

## EUROPEAN ASSESSMENT DOCUMENT

EAD 090062-00-0404

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### KITS FOR EXTERNAL WALL CLADDINGS MECHANICALLY FIXED

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

## Contents

<b>1</b>	<b>Scope of the EAD.....</b>	<b>5</b>
1.1	Description of the construction product .....	5
1.2	Information on the intended use(s) of the construction product .....	9
1.2.1	Intended use(s).....	9
1.2.2	Working life/Durability .....	9
1.3	Specific terms used in this EAD (if necessary in addition to the definitions in CPR, Art 2) .....	10
1.3.1	Cladding kit.....	10
1.3.2	Substrate .....	10
1.3.3	Subframe .....	10
1.3.4	Cladding element .....	10
1.3.5	Cladding fixing .....	10
1.3.6	Subframe fixing.....	10
1.3.7	Ancillary materials .....	10
1.3.8	Breather membrane .....	10
1.3.9	Cavity barrier (compartmentation of air space) .....	10
1.3.10	Air space.....	11
1.3.11	Ventilated air space .....	11
<b>2</b>	<b>Essential characteristics and relevant assessment methods and criteria.....</b>	<b>11</b>
2.1	Essential characteristics of the product .....	11
2.2	Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product .....	14
2.2.1	Reaction to fire .....	14
2.2.2	Façade fire performance .....	14
2.2.3	Propensity to undergo continuous smouldering .....	14
2.2.4	Watertightness of joints (protection against driving rain) .....	15
2.2.5	Water absorption .....	15
2.2.6	Water vapour permeability .....	15
2.2.7	Drainability .....	16
2.2.8	Content, emission and/or release of dangerous substances .....	16
2.2.9	Wind load resistance .....	17
2.2.10	Resistance to horizontal point loads.....	18
2.2.11	Impact resistance .....	18
2.2.12	Mechanical resistance .....	18
2.2.13	Airborne sound insulation.....	23
2.2.14	Thermal resistance .....	23
2.2.15	Durability.....	24
<b>3</b>	<b>Assessment and verification of constancy of performance .....</b>	<b>29</b>
3.1	System(s) of assessment and verification of constancy of performance to be applied .....	29
3.2	Tasks of the manufacturer .....	29
3.3	Tasks of the notified body .....	32
<b>4</b>	<b>Reference documents .....</b>	<b>34</b>
<b>ANNEX A –</b>	<b>CLADDING ELEMENT TEST METHODS BY MATERIAL .....</b>	<b>40</b>
<b>ANNEX B –</b>	<b>REACTION TO FIRE .....</b>	<b>41</b>
<b>ANNEX C –</b>	<b>MOUNTING AND FIXING PROVISIONS FOR THE SBI TEST .....</b>	<b>43</b>
<b>ANNEX D –</b>	<b>ADDITIONAL CRITERIA FOR WATERTIGHTNESS TESTS.....</b>	<b>49</b>

<b>ANNEX E – WIND SUCTION AND PRESSURE LOAD TESTS .....</b>	<b>51</b>
<b>ANNEX F – RESISTANCE TO HORIZONTAL POINT LOAD .....</b>	<b>55</b>
<b>ANNEX G – IMPACT RESISTANCE TEST .....</b>	<b>56</b>
<b>ANNEX H – RESISTANCE TO GROOVED CLADDING ELEMENT .....</b>	<b>59</b>
<b>ANNEX I – MECHANICAL RESISTANCE OF THE CONNECTION BETWEEN THE CLADDING ELEMENT AND THE CLADDING FIXING .....</b>	<b>60</b>
<b>ANNEX J – MECHANICAL RESISTANCE OF THE CLADDING FIXING .....</b>	<b>66</b>
<b>ANNEX K – MECHANICAL RESISTANCE OF SUBFRAME FIXINGS .....</b>	<b>69</b>
<b>ANNEX L – RESISTANCE OF BRACKETS (HORIZONTAL AND VERTICAL LOAD).....</b>	<b>71</b>
<b>ANNEX M – DURABILITY .....</b>	<b>77</b>
<b>ANNEX N – TEST RESULTS STATISTICAL DESCRIPTION .....</b>	<b>80</b>
<b>ANNEX O - FAÇADE FIRE PERFORMANCE ASSESSMENT METHODS.....</b>	<b>81</b>

# 1 SCOPE OF THE EAD

## 1.1 Description of the construction product

The EAD covers the assessment of kits<sup>1</sup> for external wall claddings mechanically fixed.

The EAD is applicable to the cladding kits belonging to the families indicated in table 1.1. They consist of the following components:

### 1. Cladding elements made of the materials indicated in table 1.2.

The cladding element may include grooves, dowel holes, drill or undercut holes, or may be in form of metal cassette depending on the kit family (see figures 1.1).

Cladding elements are specified by the type of material (in the case of natural stone also name and petrographic description), dimensions (when relevant also grooves and dowel holes dimensions) and density or weight per square meter.

### 2. Cladding fixings made of metal materials (steel or aluminum alloys).

Cladding fixings are specified by geometric and physical parameters (such as form and dimensions, weight, cross section, distance between two cladding fixings, distance to the cladding element borders) and material parameters (such as type of material, specific gravity, mechanical material properties).

### 3. Subframe components (optional):

- Vertical and/or horizontal profiles made of metal materials (steel or aluminium alloy) or wood.
- Brackets made of metal materials (steel or aluminium alloy) for fastening the profiles to the substrate (e.g. external wall).

Profiles and brackets are specified by geometric and physical parameters (such as form and dimensions, weight, cross section, distance between profiles and between brackets) and material parameters (such as type of material, specific gravity, mechanical material properties).

- Screws or rivets between the brackets and the profiles and between the cladding fixings and the profiles.
- Metal anchors between the subframe and the substrate (optional).

Screws, rivets and anchors are specified by geometric parameters (such as form and dimensions) and material parameters (such as type of material, mechanical properties).

### 4. Thermal insulation products (optional). Factory made or in-situ formed thermal insulation products for buildings covered by a harmonized technical specification (hEN or EAD) as an individual product.

Thermal insulation products are specified by the type of material, dimensions, density or weight per square meter and water absorption.

### 5. Other ancillary components (optional):

- Breather membrane.
- Cavity barrier.
- Any other component used in the kit (e.g. to form joints such as sealant, corner strips, etc.; or to achieve continuity such as mastic, joint-covers, gaskets, trims, etc.; or to keep the position of the cladding element such as springs, groove protectors, etc.; or to improve performance at joints to control rain penetration such as baffles and flashings, etc.).

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<sup>1</sup> Definition of "Kit" according to Art. 2 n° 2 of CPR. The components are assembled on site, and thus, become an "assembled cladding kit" when installed in the construction works.

Ancillary components are specified by geometric parameters (such as form and dimensions) and material parameters (such as type of material, mechanical properties).

The manufacturer can provide:

- a complete kit (cladding element, cladding fixings, subframe components and optionally, thermal insulation product and other ancillary components),
- a minimum kit (cladding element and cladding fixings) or,
- the cladding element alone (without cladding fixings or subframe), in this case, an ETA can be issued in accordance with this EAD only if the other components of the kit (at least the cladding fixings) are available on the market and specified in the ETA by the description of dimensions, material and performance of components. The manufacturer and trading reference of fixings may be indicated. In this case: the assessment shall be done with the specified cladding fixings, and the performance of the kit stated in the ETA applies only for configuration as used in ETA process.

The cladding kits covered by this EAD always include the cladding element. When the cladding element is not provided by the manufacturer this EAD does not apply and, then, the kit may be covered by a specific EAD (e.g. EAD 090034-00-0404).

Between the cladding elements and the thermal insulation layer or the external wall respectively, there is an air space which shall always be drained and may be ventilated or not.

The claddings are non load-bearing construction elements. They do not contribute to the stability of the wall on which they are installed. The claddings will normally contribute to durability of the works by providing enhanced protection from the effect of weathering. They are not intended to ensure airtightness of the building.

The product is not fully covered by the harmonized technical standards (hEN) given in table 1.2 because they do not cover kits, they only cover cladding elements alone.

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

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

The cladding elements are usually assembled according to a specific technical design for fixings, joints and construction discontinuities, which forms part of the product description.

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

**Table 1.1 Description of the cladding kit families and the associated cladding fixings**

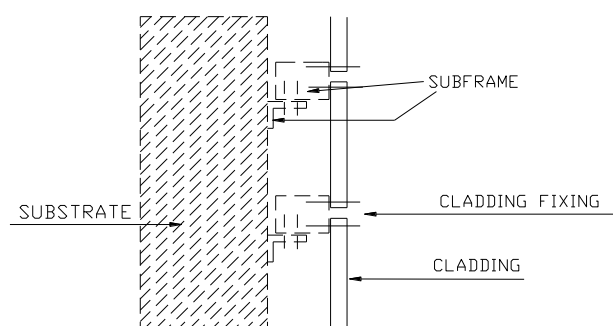
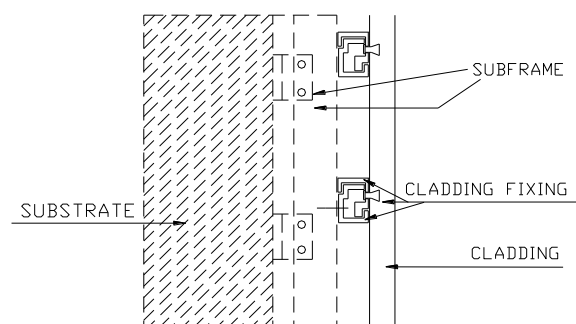
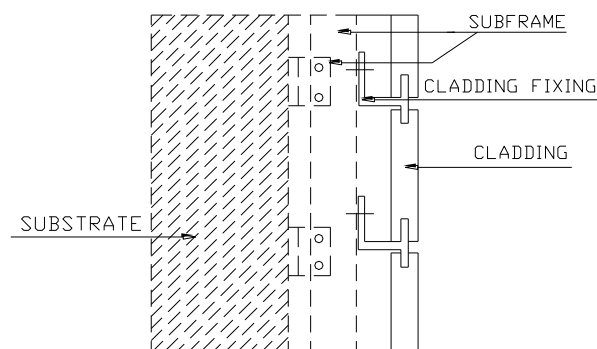
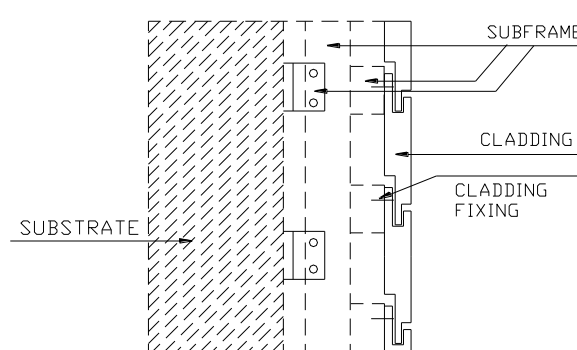
Family of cladding kits	Description of the cladding kit	Type of cladding fixings
Family A (see figure 1.1a)	The cladding elements are mechanically fastened to the subframe by through visible punctual fixings.	Nails, screws rivets or other similar punctual fixings.
Family B (see figure 1.1b)	The cladding elements are mechanically fastened to the subframe by a special anchor placed in a drilled hole or in an undercut hole and anchored by mechanical interlock (at least 4 anchors).	Group of components <sup>2</sup> : <ul style="list-style-type: none"> <li>- undercut anchor<sup>3</sup></li> <li>- horizontal hook-rail</li> <li>- horizontal support rail</li> </ul>

<sup>2</sup> The minimum component to be defined as cladding fixing for family B kit is the undercut anchor.

<sup>3</sup> Undercut anchors may have their own CE marking according to an ETA via e.g. EAD 330030-00-0601.

**Table 1.1 Description of the cladding kit families and the associated cladding fixings**

Family of cladding kits	Description of the cladding kit	Type of cladding fixings
Family C (see figure 1.1c)	The cladding elements are mechanically fastened to the subframe by punctual or linear fixings placed in the grooves or dowel holes of the cladding element.	Rail profiles, small rails, clips, clamps pins or other similar punctual or linear fixings.
Family D (see figure 1.1d)	The cladding elements, integrated with adjacent elements by interlocking together at top and bottom with an overlap, are fixed to the subframe by mechanical punctual fixings positioned on the top edge and masked by the edge of the upper elements.	Nails, screws rivets or other similar punctual fixings.
Family E (see figure 1.1e)	The cladding elements are fixed to the subframe by mechanical fixings positioned on the top edge and masked by the edge of the upper plank.	Nails, screws rivets or other similar punctual fixing.
Family F (see figure 1.1f)	The cladding elements are mechanically fastened to the subframe by at least 4 metal punctual fixings.	Small rails, clips clamps or other similar punctual fixings.
Family G (see figure 1.1g)	The cladding elements are suspended on the subframe by means of a hook-on arrangement with slotted fixings.	Hook/slot profile and rails or other similar fixings.
Family H (see figure 1.1h)	The cladding elements are mechanically fastened to the subframe by vertical hanging from fixings (Tile-hung cladding kit).	Screws fixed support rails or other similar fixings.

**Figure 1.1a: Cladding kit family A.****Figure 1.1b: Cladding kit family B.****Figure 1.1c: Cladding kit family C.****Figure 1.1d: Cladding kit family D.**

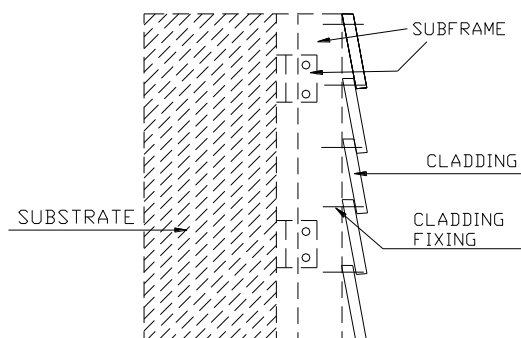


Figure 1.1e: Cladding kit family E.

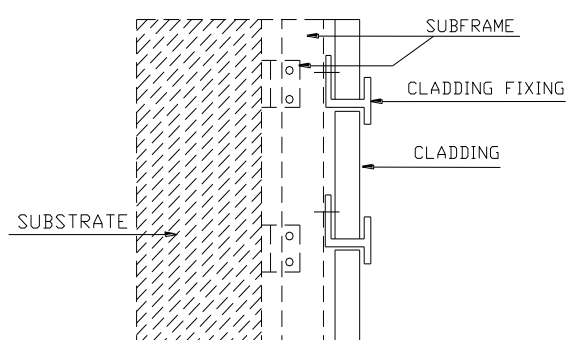


Figure 1.1f: Cladding kit family F.

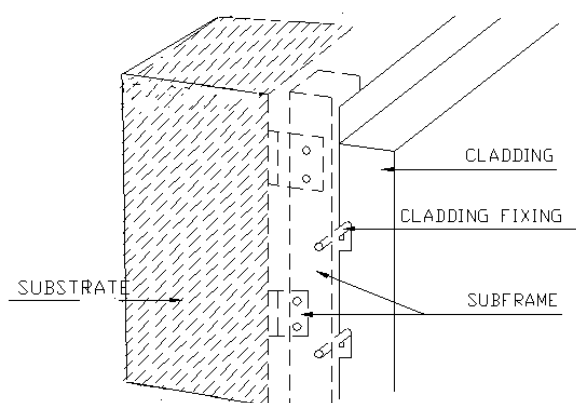


Figure 1.1g: Cladding kit family G.

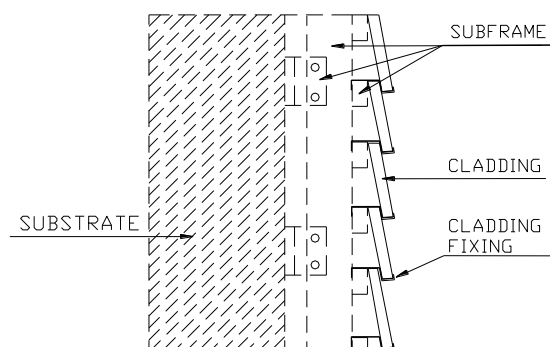


Figure 1.1h: Cladding kit family H.

Table 1.2 Cladding elements materials and associated product technical specifications

Cladding element material	Possible associated product technical specifications (*)	
	Harmonized standard (hEN)	Other references
Wood based	EN 13986; EN 14915	---
Metal	EN 14782; EN 14783	---
Stone	EN 1469; EN 12057; EN 12326-1	---
HPL Laminates	EN 438-7	---
Fibre-cement Fibre reinforced cement	EN 12467; EN 492; EN 494; EN 14992	EN 15191
Concrete	EN 490; EN 14992	---
Terra cotta or ceramic	EN 1304; EN 14411	---
Plastic	EN 16153; EN 1013; EN 13245-2	---
Resin mortar	---	---
Cement bonded particle board	---	EN 634-1; EN 634-2
Thin Metallic Composite Panels (TMCP)	---	EOTA TR 038
(*) Other harmonized specifications applicable to these materials may be used.		

This EAD does not cover cladding kits or cladding elements made of:

- Self-supporting double skin metal faced insulating panels according to EN 14509.
- Composite panels except the Thin Metallic Composite Panels (TMCP) as described in EOTA TR 038.



- A render sprayed in situ on metal mesh.
- Panels covered by a render applied in situ.
- Glass.
- Agglomerated stone according to EN 15286.

And does not cover either cladding kits with:

- Cladding elements glued to the subframe.
- Curtain wall products according to EN 13830.
- Window and door products.
- Cladding elements in contact with ground.
- External suspended ceilings kits or kits including non-vertical parts.

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

### **1.2.1 Intended use(s)**

This EAD covers the intended use of external wall claddings (rainscreens) as external finishes of walls:

- in ventilated façades, and/or
- in non-ventilated façades;

Cladding kits are fixed to external vertical walls made of masonry (clay, concrete or stone), concrete (cast on site or as prefabricated panels), timber or metal frame in new or existing buildings (retrofit).

This EAD does not cover the assessment of the cladding kits under the effects of seismic actions.

### **1.2.2 Working life/Durability**

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the cladding kit for the intended use of 25 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works<sup>4</sup>.

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

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<sup>4</sup> The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

### **1.3 Specific terms used in this EAD (if necessary in addition to the definitions in CPR, Art 2)**

#### **1.3.1 Cladding kit**

A cladding kit is a specific kit<sup>1</sup> composed by a cladding element, its cladding fixings and optionally a subframe, thermal insulation product and other ancillary components, which is to be used as external wall claddings.

#### **1.3.2 Substrate**

The term "substrate" refers to a wall, which in itself already meets the necessary airtightness and mechanical strength requirements (resistance to static and dynamic loads), as well as a relevant watertightness and water vapour resistance. The substrate walls can be made of masonry (clay, any kind of concrete or stone), concrete (cast on site or as prefabricated panels), timber or metal frame.

#### **1.3.3 Subframe**

An intermediate assembly of vertical and/or horizontal wood or metal profiles and metal brackets (including the fixings between the brackets and the profiles) located between the cladding element and the substrate.

#### **1.3.4 Cladding element**

Sheet, plank, tile, brick slip, board, panel or cassette made of durable materials (see table 1.2) applied to the external face of an external wall such as: wood based panels, fibre cement, concrete, stone, slate, ceramics, metal, plastics and HPL laminates.

#### **1.3.5 Cladding fixing**

Profiles, brackets, screws/anchors, nails, rivets or any special fixing devices used to secure the cladding element to the subframe.

#### **1.3.6 Subframe fixing**

Screws/anchors, nails, rivets or any special fixing devices used to fasten the subframe components.

#### **1.3.7 Ancillary materials**

Breather membrane, cavity barrier or any supplementary component used in the kit (e.g. to form joints such as sealant, corner strips, etc.; or to achieve continuity such as mastic, joint-covers, gaskets, trims, etc.; or to keep the position of the cladding element such as springs, groove protectors, etc.; or to improve performance at joints to control rain penetration such as baffles and flashings, etc.).

#### **1.3.8 Breather membrane**

Membrane placed in the cladding kit which contributes to the watertightness of the wall.

#### **1.3.9 Cavity barrier (compartmentation of air space)**

Element placed in the air space to separate horizontally or vertically two compartments of air space (for fire or wind pressure purposes).

### 1.3.10 Air space

It is the space between the cladding element and the insulation layer or the substrate respectively.

### 1.3.11 Ventilated air space

A layer of air between the substrate or insulation layer and cladding elements connected to the external environment permitting the dry-out of the water that may be found in this space due to condensations or rain penetration and the water vapour diffusion from the internal side of the wall.

External wall claddings are considered as ventilated when the following criteria are fulfilled:

- The distance between the cladding elements and the insulation layer or the substrate accordingly (ventilation air space) amounts to at least 20 mm. This air space may be reduced locally to 5 to 10 mm depending on the cladding and the subframe, provided that it is verified that it does not affect the draining and/or ventilation function,
- Ventilation openings are envisaged, as a minimum, at the building base point and at the roof edge with cross-sections of at least 50 cm<sup>2</sup> per linear metre.

## 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

### 2.1 Essential characteristics of the product

Table 2.1 shows how the performance of cladding kit is assessed in relation to the essential characteristics.

**Table 2.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics**

No	Essential characteristic	Assessment method	Type of expression of product performance	
Basic Works Requirement 2: Safety in case of fire				
1	Reaction to fire	2.2.1	Class	
2	Façade fire performance	2.2.2	Description or Level	
3	Propensity to undergo continuous smouldering	2.2.3	Description	
Basic Works Requirement 3: Hygiene, health and the environment				
4	Watertightness of joints (protection against driving rain)	2.2.4	Description (for open joints) Level (for closed joints)	
5	Water absorption (for non-ventilated façades) (*)	2.2.5	Level	
6	Water vapour permeability (for non-ventilated façades) (*)	2.2.6	Level	
7	Drainability	2.2.7	Description	
8	Content, emission and/or release of dangerous substances	2.2.8	Description	
Basic Works Requirement 4: Safety and accessibility in use				
9	Wind load resistance	2.2.9	Level	
10	Resistance to horizontal point loads	2.2.10	Description	
11	Impact resistance	2.2.11	Description	
12 to 14	Mechanical resistance (**)	Cladding element (see table 2.2)	2.2.12.1 to 2.2.12.3	Level
15 to 20		Connection between the cladding element and its fixings (see table 2.2)	2.2.12.4 to 2.2.12.9	Level

**Table 2.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics**

No	Essential characteristic		Assessment method	Type of expression of product performance	
21 to 23		Cladding fixing (see table 2.2)		2.2.12.10 to 2.2.12.12	Level
24		Resistance of profiles		2.2.12.13	Description
25		Subframe fixings	Tension/pull-out resistance (*)	2.2.12.14	Level
26			Shear load resistance (*)	2.2.12.5	Level
27		Bracket resistance (horizontal and vertical load)		2.2.12.6	Level
Basic Works Requirement 5: Protection against noise					
28	Airborne sound insulation		2.2.13	Level	
Basic Works Requirement 6: Energy economy and heat retention					
29	Thermal resistance		2.2.14	Level	
Durability (***)					
30	Hygrothermal behaviour		2.2.15.1	Description	
31	Behaviour after pulsating load		2.2.15.2	Level	
32	Freeze-thaw resistance (*)		2.2.15.3	Level	
33	Behaviour after immersion in water (*)		2.2.15.4	Level	
34	Dimensional stability (*):	by humidity	2.2.15.5	Level	
		by temperature			
35	Chemical and biological resistance (*)		2.2.15.6	Level	
36	UV radiation resistance (*)		2.2.15.7	Level	
37	Corrosion		2.2.15.8	Description	
38 to 55	Accelerated ageing behaviour of kits when the cladding element is made of thin metallic composite panels (TMCP) (see table 2.3)		2.2.15.9	Level	
(*) When available, performance included in the DoP for the CE marking as individual component should be used as far as possible to avoid retesting or reassessment.					
(**) Mechanical resistance of the kit is assessed by means of the mechanical characteristics of the relevant kit components. See section 2.2.12.					
(***) Durability of the kit is assessed by means of relevant component durability, when relevant. See section 2.2.15.					

**Table 2.2 Mechanical resistance of the components in relation with the applicable kit family**

No	Essential characteristic		Assessment method	Applicable to kit family (it is marked with X when is applicable)							
				A	B	C	D	E	F	G	H
12	Mechanical resistance of cladding element	Bending strength (*)	2.2.12.1	X	X	X	X	X	X	X	X
13		Resistance of grooved cladding element	2.2.12.2	---	---	X	X	---	---	---	---
14		Resistance at dowel hole (*)	2.2.12.3	---	---	X	---	---	---	---	---
15		Pull-through resistance	2.2.12.4	X	---	---	X	X	---	---	X
16		Pull-through resistance under shear loads	2.2.12.5	X	---	---	X	X	---	---	X

**Table 2.2 Mechanical resistance of the components in relation with the applicable kit family**

No	Essential characteristic		Assessment method	Applicable to kit family <i>(it is marked with X when is applicable)</i>							
				A	B	C	D	E	F	G	H
17	Mechanical resistance of connection between the cladding element and the cladding fixing	Axial tension resistance	2.2.12.6	---	X	---	---	---	---	---	---
18		Shear load resistance	2.2.12.7	---	X	---	---	---	---	---	---
19		Combined tension and shear load resistance	2.2.12.8	---	X	---	---	---	---	---	---
20		Resistance of slot	2.2.12.9	---	---	---	---	---	---	X	---
21	Mechanical resistance of cladding fixing	Resistance to vertical load	2.2.12.10	---	---	X	---	---	X	---	---
22		Pull-through resistance of fixings from profile	2.2.12.11	---	---	X	---	---	---	---	---
23		Resistance of metal clip	2.2.12.12	---	---	X	---	---	X	---	X
(*) When available, performance included in the DoP for the CE marking as individual component should be used as far as possible to avoid retesting or reassessment.											

**Table 2.3 Accelerated ageing behaviour of cladding elements made of thin metallic composite panels (TMCP)**

No	Essential characteristic		Assessment method	Type of expression of product performance
38	Decay of delamination resistance	After hygrothermal cycles	2.2.15.9	Level
39		After immersion 6 h in boiling water at 90 °C		Level
40		After immersion in water 500 h at 20 °C		Level
41		After freeze-thaw cycles		Level
42		After long term exposure to heat (2500 h at hot dry air 80 °C)		Level
43	Decay of flexural resistance	After hygrothermal cycles		Level
44		After immersion 6 h in boiling water at 90 °C		Level
45		After immersion in water 500 h at 20 °C		Level
46		After freeze-thaw cycles		Level
47		After long term exposure to heat (2500 h at hot dry air 80 °C)		Level
48	Decay of flexural stiffness after short term exposure (1 h. +80 °C)			Level
49	Decay of resistance of routed and returned edge after TPB test, flexural pulsating loads			Level
50	Decay of resistance of slot and its fixing device after pulsating loads			Level
51	Corrosion infiltration after exposure to spray SALT (only relevant for TMCP with coated aluminium sheets)			Level
52	Degree of blistering after exposure to humidity (only relevant for TMCP with coated aluminium sheets)			Level
53	Retention of colour and gloss (only relevant for TMCP with coated aluminium sheets)	After humidity		Level
54		After UV-and water condensation		Level
55		After accelerated ageing by heat		Level

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

### **2.2.1 Reaction to fire**

Reaction to fire of the whole kit shall be assessed by considering the reaction to fire of the components (cladding element, cladding fixings, subframe components, thermal insulation products, etc.), in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

When relevant (e.g. asymmetrically composed cladding elements, or relevant surfaces of the kit components of the back side), reaction to fire of the rear side of the cladding kit shall also be assessed in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

The whole kit shall be classified based on the worst class of any component obtained according to a CWFT Decisions or according to the relevant tests method(s) according to EN 13501-1.

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

Criteria indicated in Annex B shall be taken into account. Associated mounting and fixing rules for the SBI test shall be in accordance with Annex C.

When tested rear side cladding kit to SBI test (EN 13823), the test shall involve a free-hanging arrangement (taking into account the intended use as foreseen by the manufacturer) with the flame impingement to the rear side in accordance with EN 13823 (test arrangement without open joints between the cladding elements and without insulation layer on A1 or A2 substrate, so that the distance between the substrate and the cladding elements amounts to at least 80 mm).

### **2.2.2 Façade fire performance**

If the manufacturer intends to declare the façade fire performance of the product, in absence of a European assessment approach, the ETA shall be issued taking into account the situation in Member States where the manufacturer intends his product to be made available on the market.

Information on such situation is included in Annex O.

The assessment method(s) used shall be indicated in the ETA.

### **2.2.3 Propensity to undergo continuous smouldering**

This characteristic is only applicable for cladding kits which include the thermal insulation product (see section 1.1) made of mineral wool (MW), wood wool (WW), cork, wood fibres (WF) or made of any other vegetal or animal fibres.

The assessment of the kit's propensity to undergo continuous smouldering is carried out by means of the assessment of the propensity to undergo continuous smouldering of the thermal insulation product. It is considered representative of this essential characteristic for cladding kits.

Propensity to undergo continuous smouldering of thermal insulation product shall be assessed according to the EN 16733.

*Note: When available, performance included in the DoP regarding the thermal insulation component should be used as far as possible to avoid retesting or reassessment.*

Description of propensity to undergo continuous smouldering shall be given in the ETA according to section 11 of EN 16733.

## 2.2.4 Watertightness of joints (protection against driving rain)

The assessment of watertightness of joints is intended to determine two requirements of the cladding kit:

- Water running down the outside face of the cladding kit shall not reach the inside face of the substrate.
- Materials likely to be adversely affected by water (fixings subject to corrosion, thermal insulations, etc.) shall not become damp.

Cladding kits with open joints shall be described as “not watertight”<sup>5</sup>.

Cladding kits with close joints contribute to the watertightness of the wall. In this case, the watertightness of the cladding kit shall be determined by testing according to EN 12865 Procedure A (see also Annex D). At least the worst case shall be tested (e.g. maximum number of joints).

The limit level of pressure (e.g. just before water penetration) shall be given.

## 2.2.5 Water absorption

This characteristic is only relevant when the cladding kit is used in non-ventilated façades.

The assessment of the kit water absorption is carried out by means of the assessment of the cladding element water absorption representative of this essential characteristic for cladding kits.

Water absorption of the cladding element shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the cladding element component should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the water absorption of the cladding element shall be assessed according to the test standards indicated in table A.1 of Annex A.

The mean<sup>6</sup> value and the maximum value shall be indicated.

The values shall cover the range of density of the cladding element.

## 2.2.6 Water vapour permeability

This characteristic is only relevant when the cladding kit is used in non-ventilated façades.

The assessment of the kit water vapour permeability is carried out by means of the assessment of the water vapour permeability of the relevant kit components (cladding element, thermal insulation product and breather membrane) representative of this essential characteristic for cladding kits.

Water vapour permeability of the following kit components:

- Cladding element;
- Thermal insulation product (when it is part of the kit);
- Breather membrane (when it is part of the kit);

Shall be assessed according to the relevant hEN (see table 1.2) or EAD.

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<sup>5</sup> When the joints are not watertight, the first layer behind ventilated air space (e.g. insulation layer) should be composed by materials with low water absorption (e.g. insulation products made of MW acc. to EN 13162, EPS acc. to EN 13163, XPS acc. to EN 13164, PUR acc. to EN 13165 and PF acc. to EN 13166), according to the national regulations in force.

<sup>6</sup> The mean value is the arithmetic average value.

*Note: When available, performance included in the DoP regarding the relevant kit components should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the water vapour permeability of the cladding element shall be tested according to the method indicated in EN ISO 12572, if no tabulated values according to EN ISO 10456 are available.

The values shall be indicated according to the relevant technical specification.

### 2.2.7 Drainability

The assessment of drainability is intended to determine whether water which penetrates in the air space or condensation water is drained out of the installed cladding kit without accumulation or moisture damage or leakage into the substrate or the cladding kit.

This assessment shall be carried out by means of the analysis of the relevant design details provided by the manufacturer, regarding the cladding fixings geometry and the connections of the cladding kit with the base edge, openings (windows or doors) to detect potential accumulation of water behind cladding kit. These design details should be included in the ETA.

### 2.2.8 Content, emission and/or release of dangerous substances

The performance of the kit related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer<sup>7</sup> after identifying the release scenarios (in accordance with EOTA TR 034) taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified intended release scenario for this product and intended use with respect to dangerous substances is:

S/W2: Product with indirect contact to soil, ground- and surface water.

#### 2.2.8.1 Leachable substances

For the intended use covered by the release scenario S/W2, the performance of the kit concerning leachable substances has to be assessed.

The dangerous substances assessment of the kit is carried out by means of the assessment of the most relevant kit component material, which is the cladding element material.

#### For cladding elements made of concrete and cement-based cladding elements

A leaching test with subsequent eluate analysis must take place, each in duplicate. Leaching tests of the cladding element conducted according to CEN/TS 16637-2:2014, but considering the steps below indicated for the leachant renewal. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area must be  $(80 \pm 10) \text{ l/m}^2$ .

Samples shall be prepared according to clause 8.2 of CEN/TS 16637-2:2014.

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<sup>7</sup> The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged:

- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.
- Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.



The eluate is produced by a tank test according to CEN/TS 16637-2. The eluates taken after 6 hours, 1 day, 2 days and 6 hours, 4 days, 9 days, 16 days, 36 days and 64 days shall be analysed for following environmentally relevant parameters:

- aluminium, antimony, arsenic, barium, lead, cadmium, chromium (total), chromate (Cr VI), cyanide (total), cobalt, copper, molybdenum, nickel, mercury, thallium, vanadium, zinc,
- chloride (Cl<sup>-</sup>), sulphate (SO<sub>4</sub><sup>2-</sup>), fluoride (F<sup>-</sup>)
- TOC,
- pH-value, electrical conductivity, odour, colour, turbidity, and tendency to produce foam

The parameters shall be analysed using an appropriate equipment with a measurement range allowing the measurement of the substance concentration.

Measured concentration of the leaching test according to CEN/TS 16637-2 of these cladding elements must be expressed per step for each parameter in µg/L and mg/m<sup>2</sup>. Additionally, the cumulatively released quantities must be expressed for each parameter in mg/m<sup>2</sup>.

The used test methods for the analysis of the parameters shall be documented, including the equipment and its measurement range.

For cladding elements materials other than concrete or cement-based cladding elements covered by CEN/TS 16637-2

A leaching test with subsequent eluate analysis must take place, each in duplicate. Leaching tests of the cladding element conducted according to CEN/TS 16637-2:2014. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area must be (80 ± 10) l/m<sup>2</sup>.

Samples shall be prepared according to clause 8.2 of CEN/TS 16637-2:2014.

In eluates of "6 hours" and "64 days", the following biological tests shall be conducted:

- Acute toxicity test with *Daphnia magna* Straus according to EN ISO 6341.
- Toxicity test with algae according to ISO 15799.
- Luminescent bacteria test according to EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3.

For each biological test, EC20-values shall be determined for dilution ratios 1:2, 1:4, 1:6, 1:8 and 1:16.

If the parameter TOC is higher than 10 mg/l, the following biological tests shall be conducted with the eluates of "6 hours" and/or "64 days" eluates:

- Biological degradation according to OECD Test Guideline 301 part A, B or E.

Determined toxicity in biological tests must be expressed as EC20-values for each dilution ratio. Maximum determined biological degradability must be expressed as "...% within ...hours/days". The respective test methods for analysis must be specified.

## **2.2.9 Wind load resistance**

The wind load resistance (suction and/or pressure) of assembled cladding kit shall be tested according to the method indicated in Annex E.

The number of tests depends on the combination of parameters presented for the kit to be assessed.

At least the worst case (the mechanically weakest case) of the assembled cladding kit shall be tested.

*Note: The manufacturer together with TAB will decide the relevant test (suction, pressure or both) to be carried out to assess at least the mechanically weakest case (worst case) taking into account the kit mechanical resistance (see section 2.2.12) and the specific design of the cladding kit specimen. In case of doubt, it is recommended to carry out both tests, suction and pressure.*

One test specimen for each chosen geometry shall be assessed. If the test result does not confirm the results obtained by mechanical tests in accordance with sections 2.2.12, at least two other test specimen have to be tested.

The assessment shall be based on data from the wind suction and/or wind pressure tests (see Annex E) and the calculation taking into account the mechanical resistances of the kit components (cladding elements, cladding fixings and subframe components) obtained from sections 2.2.12.

Relevant elasticity and resistance equations and relevant standards (e.g. EN 1999 for aluminium or EN 1993 for steel) should be considered for the calculation (at ultimate and serviceability limit state).

The maximum wind load resistance “Q” for assembled cladding kit shall be indicated.

#### **2.2.10 Resistance to horizontal point loads**

This characteristic is only relevant for cladding kits that are known to be or suspected of being sensitive to horizontal point loads (ladder bearing against it).

The resistance to horizontal points loads (e.g. one person standing on a ladder leaning against the cladding element) shall be tested according to the method indicated in Annex F.

At least the worst case (the mechanically weakest case) of the assembled cladding kit shall be tested.

The cladding kit shall be capable of accommodating the horizontally applied loads acting on its surface due to maintenance works without any reduction in its performance.

There shall be no permanent deformation (no visible deformation) on any component.

#### **2.2.11 Impact resistance**

The impact resistance shall be tested according to the method indicated in Annex G.

At least the worst case (the mechanically weakest case) of the assembled cladding kit shall be tested.

The degree of exposure according to the use categories defined in the table G.2 in section G.3 of Annex G shall be indicated.

Additionally, the hard body and soft body impact resistance may be indicated.

#### **2.2.12 Mechanical resistance**

The assessment of the kit mechanical resistance is carried out by means of the assessment of the mechanical resistance of the relevant kit components (cladding element, cladding fixings and subframe components) and the connections between them, which are representative of this essential characteristic for cladding kits.

The assessment depends on the applicable kit family (see table 2.2) and the kit to be provided by the manufacturer (complete kit, minimum kit or cladding element alone assessed as kit), see section 1.1.

Mechanical essential characteristics are divided in four groups:

a) Mechanical resistance of the cladding element:

- Bending strength of the cladding element. See section 2.2.12.1.
- Resistance of the grooved cladding element. See section 2.2.12.2.
- Resistance of the cladding element at dowel hole. See section 2.2.12.3.

b) Mechanical resistance of connection between the cladding element and the cladding fixing:

- Pull-through resistance. See section 2.2.12.4.
- Pull-through resistance under shear loads. See section 2.2.12.5.

- Axial tension resistance. See section 2.2.12.6.
- Shear load resistance. See section 2.2.12.7.
- Combined tension and shear load resistance. See section 2.2.12.8.
- Resistance of slot. See section 2.2.12.9.

c) Mechanical resistance of cladding fixing:

- Resistance to vertical load. See section 2.2.12.10.
- Pull-through resistance of fixings form profile. See section 2.2.12.11.
- Resistance of metal clip. See section 2.2.12.12.

d) Mechanical resistance of subframe components:

- Resistance of profiles. See section 2.2.12.13.
- Tension/pull-out resistance of subframe fixings. See section 2.2.12.14.
- Shear load resistance of subframe fixings. See section 2.2.12.15.
- Bracket resistance (horizontal and vertical load). See section 2.2.12.16.

### **2.2.12.1 Bending strength of cladding element**

The bending strength of the cladding element shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the cladding element component should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the bending strength of the cladding element shall be assessed according to the test standards indicated in table A.1 of Annex A.

For materials which are sensitive to temperature variations (e.g. plastics), the bending strength of the cladding element should also be tested after conditioning to high and low temperatures (max +80 °C; min -20 °C). For cladding elements made of TMCP section 2.2.15.9 applies.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The values shall cover the range of density and thickness of the cladding element.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

### **2.2.12.2 Resistance of grooved cladding element**

This characteristic is only relevant for kits family C & D (cladding elements with groove).

The grooved cladding element resistance shall be tested according to the method indicated in Annex H.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

### **2.2.12.3 Resistance of the cladding element at dowel hole**

This characteristic is only relevant for kits family C (cladding elements with dowel hole).

The resistance of the cladding element at dowel hole shall be tested according to the method indicated in EN 13364.

*Note: In the case of cladding elements made of natural stone according to EN 1469, when available, performance included in the DoP regarding the natural stone cladding element component should be used as far as possible to avoid retesting or reassessment.*

The mean<sup>6</sup> value and the characteristic value according to EN 13364 shall be given.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

### **2.2.12.4 Pull-through resistance**

This characteristic is only relevant for kits family A, D, E & H (cladding elements which are pierced by punctual cladding fixings such as screws, rivets or nails).

For kit family A, E & H, the pull-through resistance shall be tested according to the method indicated in section I.1.1 of Annex I.

For kit family D, the pull-through resistance shall be tested according to the method indicated in section I.1.2 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Behaviour after pulsating load. See section 2.2.15.2.
- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

### **2.2.12.5 Pull-through resistance under shear loads**

This characteristic is only relevant for kits family A, D, E & H (cladding elements which are pierced by punctual cladding fixings such as screws, rivets or nails).

The pull-through resistance under shear loads shall be tested according to the method indicated in section I.2 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

### **2.2.12.6 Axial tension resistance**

This characteristic is only relevant for kits family B (cladding elements which are fixed by a special anchor placed in a drill hole or in an undercut hole and anchored by mechanical interlock).

Axial tension resistance shall be tested according to the method indicated in section I.3 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Behaviour after pulsating load. See section 2.2.15.2.
- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

#### **2.2.12.7 Shear load resistance**

This characteristic is only relevant for kits family B (cladding elements which are fixed by a special anchor placed in a drill hole or in an undercut hole and anchored by mechanical interlock).

Shear resistance shall be tested according to the method indicated in section I.4 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

#### **2.2.12.8 Combined tension and shear load resistance**

This characteristic is only relevant for kits family B (cladding elements which are fixed by a special anchor placed in a drill hole or in an undercut hole and anchored by mechanical interlock).

Combined tension and shear load resistance shall be tested according to the method indicated in section I.5 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

#### **2.2.12.9 Resistance of slot**

This characteristic is only relevant for kits family G (cladding elements which are fixed by means of slots).

The resistance of slot shall be tested according to the method indicated in section I.6 of Annex I.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The value and the assessment method of this characteristic is also to be used for the following durability characteristics:

- Behaviour after pulsating load. See section 2.2.15.2.
- Freeze-thaw resistance. See section 2.2.15.3.
- Behaviour after immersion in water. See section 2.2.15.4.

#### **2.2.12.10 Resistance to vertical load**

This characteristic is only relevant for kits family C & F when the cladding fixings are punctual fixings.

Resistance to vertical load shall be tested according to section J.1 of Annex J. At least the worst case (the mechanically weakest case) shall be tested.

Maximum deflection according to section J.1 of Annex J shall be given.

#### **2.2.12.11 Pull-through resistance of fixings from profile**

This characteristic is only relevant for kits family C when the cladding fixings are rail profiles.

Fixing pull-through resistance shall be tested according to the method indicated in section J.2 of Annex J.  
At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

#### **2.2.12.12 Resistance of metal clip**

This characteristic is only relevant for kits family F & H (punctual cladding fixings such as clips, small rails, pins, clamps, hungs and hooks).

Resistance of metal clip shall be tested according to the method indicated in section J.3 of Annex J.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

The value and the assessment method of this characteristic is also to be used for the following durability characteristic:

- Behaviour after pulsating load. See section 2.2.15.2.

#### **2.2.12.13 Resistance of profiles**

This characteristic is only relevant when the manufacturer provides a complete kit (see section 1.1).

The following characteristics shall be described:

- Form and dimensions of the profile/stud section according to relevant standards (e.g. EN 755-9 for aluminium).
- Effective moment of area (inertia of the profile/stud section) according to the relevant standards (e.g. EN 1999-1-1 for aluminium).
- Minimum mechanical properties of the profile/stud material. E.g. elastic limit and modulus of elasticity in the case of metal profiles according to the relevant standards (e.g. EN 755-2 for aluminium).
- Maximum deflection admitted by the manufacturer (e.g. L/200).

#### **2.2.12.14 Tension/pull-out resistance of subframe fixings**

This characteristic is only relevant when the manufacturer provides a complete kit (see section 1.1).

For fixings between subframe components, the tension/pull-out resistance on the relevant subframe component (e.g. vertical profile or wood stud) shall be assessed according to the relevant hEN, EAD or Eurocode (e.g. EN 14592, EAD 330046-01-0602, §3 of EN 1993-1-8, §3.3 of EN 1999-1-1, etc.).

*Note: When available, performance included in the DoP regarding the relevant subframe component should be used as far as possible to avoid retesting or reassessment.*

When the hEN, EAD or Eurocode does not give an assessment method or when there is no relevant hEN EAD or Eurocode applicable, the tension load/pull-out resistance of the fixing shall be tested according to the method indicated in section K.1 of Annex K.

At least the worst case (the mechanically weakest case) shall be considered.

For fixings connecting the subframe to the wall (anchors), tension / pull-out resistance shall be assessed according to the relevant EAD (e.g. EAD 330747-00-0601 and EAD 330284-00-0604, EAD 330076-00-0604, etc.).

Test results shall be given according to the relevant EAD or section K.1 of Annex K.

#### **2.2.12.15 Shear load resistance of subframe fixings**

This characteristic is only relevant when the manufacturer provides a complete kit (see section 1.1).

For fixings between subframe components, the shear strength of the fixings between subframe components (e.g. between the vertical profile and the bracket) shall be assessed according to the relevant hEN, EAD or Eurocode (e.g. EN 14592, EAD 330046-01-0602, §3 of EN 1993-1-8, §3.3 of EN 1999-1-1, etc.).

*Note: When available, performance included in the DoP regarding the subframe fixing component should be used as far as possible to avoid retesting or reassessment.*

When the hEN, EAD or Eurocode does not give an assessment method or when there is no relevant hEN, EAD or Eurocode applicable, the shear load resistance of the fixing shall be tested according to the method indicated in section K.2 of Annex K.

At least the worst case (the mechanically weakest case) shall be considered.

For fixings connecting the subframe to the wall (anchors), shear resistance shall be assessed according to the relevant EAD (e.g. EAD 330747-00-0601 and EAD 330284-00-0604, EAD 330076-00-0604, etc.).

Test results shall be given according to the relevant EAD or section K.2 of Annex K.

#### **2.2.12.16 Bracket resistance (horizontal and vertical load)**

This characteristic is only relevant when the manufacturer provides a complete kit (see section 1.1).

The bracket load bearing capacity and deformation under loading (horizontal and vertical load) shall be tested according to the method indicated in Annex L.

At least the worst case (the mechanically weakest case) shall be tested.

The mean<sup>6</sup> value and the characteristic value according to Annex N shall be indicated.

When possible, calculation according to relevant standards (e.g. EN 1999-1-1 for aluminium) can be carried out provided that this calculation is compared by testing according to the method indicated in Annex L. In this case no additional testing will be required.

#### **2.2.13 Airborne sound insulation**

The improvement of airborne sound insulation shall be tested according to EN ISO 10140-1 Annex G.

At least the worst or more representative assembled cladding kit shall be tested. For the determination of the influence of the cladding kit on the sound insulation of the external wall, parameters such as the dynamic stiffness of the insulation product, the mass/m<sup>2</sup> of the cladding element and the type of fixings in the substrate have to be known.

The ratings of airborne sound insulation shall be undertaken according to EN ISO 717-1.

The weighted improvement  $\Delta R_w$ , the sound reduction index  $R_w$  with and without the assembled cladding kit and the spectrum adaptation terms  $C$  and  $C_{tr}$ , shall be given.

#### **2.2.14 Thermal resistance**

##### In the case of non-ventilated façades:

Thermal resistance (R-value) of the assembled cladding kit shall be calculated according to EN ISO 6946, using the thermal resistance of the kit components obtained from EN ISO 10456, the relevant European product standards (see table 1.2), or tested according to EN 12667, EN 12939 or EN 12664. Alternatively, the thermal resistance may be tested according to EN ISO 8990.

The assembled cladding kit thermal bridges shall be calculated according to EN ISO 10211.

At least the worst or more representative assembled cladding kit shall be assessed.

Thermal resistance values for the assembled cladding kit shall be given.

##### In the case of ventilated façades when the cladding kit includes the thermal insulation product:

Thermal resistance (R-value) of the kit is associated to the resistance of the thermal insulation product and it shall be assessed according to the relevant hEN or EAD.

*Note: When available, performance included in the DoP regarding the thermal insulation component should be used as far as possible to avoid retesting or reassessment.*

When there is no relevant hEN or EAD applicable, the thermal resistance of the thermal insulation product shall be tested according to EN 12667, EN 12939 or EN 12664.

Thermal resistance values for the thermal insulation product shall be given.

In the case of ventilated façades when the cladding kit does not include the thermal insulation product:

This characteristic is not relevant.

## **2.2.15 Durability**

The assessment of the durability of the kit is carried out by means of the assessment of the following characteristics which are representative of this essential characteristic for cladding kits:

- Hygrothermal behaviour of the kit, when relevant. See section 2.2.15.1.
- Behaviour of the kit after pulsating loads, when relevant. See section 2.2.15.2.
- Durability of kit components, when relevant. See sections 2.2.15.3 to 2.2.15.8. In particular, in the case of kits when the cladding element is made of TMCP, section 2.2.15.9 applies.

*Note: The manufacturer together with TAB shall decide the relevant durability characteristics to be assessed considering the types and materials of kit components.*

### **2.2.15.1 Hygrothermal behaviour**

This characteristic is only relevant for cladding kits that are known to be or suspected of being sensitive to hygrothermal variation.

For cladding elements made of TMCP section 2.2.15.9 applies.

Hygrothermal behaviour of the cladding kit shall be tested according to the method indicated in section M.1 of Annex M.

Description on if any of the following defects occur during or at the end of the test programme shall be indicated:

- deterioration such as cracking or delamination of the cladding element that allows water penetration to the insulation;
- detachment of the cladding element;
- irreversible deformation.

### **2.2.15.2 Behaviour after pulsating load**

This characteristic is only relevant for cladding kits that are known to be or suspected of being sensitive to pulsating loads.

For cladding elements made of TMCP section 2.2.15.9 applies.

Cladding kit behaviour after pulsating loads shall be assessed by means of the following relevant mechanical resistance tests before and after cycles, considering the relevant family kit:

- Mechanical resistance of connections between the cladding element and the cladding fixing:
  - Pull-through resistance. See section 2.2.12.4.
  - Axial tension resistance. See section 2.2.12.6.



- Resistance of slot. See section 2.2.12.9.
- Mechanical resistance of cladding fixings:
  - Resistance of metal clip. See section 2.2.12.12.

Pulsating load cycles shall be carried out according to the method indicated in section M.2 of Annex M.

*Note: the number of test specimens shall be the same as those of the mechanical tests.*

Test results shall be given according to the relevant mechanical tests.

Ratio (division between the results after cycles and before cycles) may also be indicated.

### **2.2.15.3 Freeze-thaw resistance**

This characteristic is only relevant for cladding kits with components that are known to be or suspected of being sensitive to freeze-thaw.

For cladding elements made of TMCP section 2.2.15.9 applies.

Cladding kit behaviour after freeze-thaw cycles shall be assessed by means of bending strength tests (see section 2.2.12.1) before and after cycles.

*Note: When available, performance included in the DoP regarding the cladding element component should be used as far as possible to avoid retesting or reassessment.*

Additionally, depending on the kit family (see table 2.2), the behaviour after freeze-thaw cycles may also be assessed by means of the following relevant mechanical resistance tests before and after the freeze-thaw cycles:

- Mechanical resistance of connections between the cladding element and the cladding fixing:
  - Pull-through resistance. See section 2.2.12.4.
  - Axial tension resistance. See section 2.2.12.6.
  - Resistance of slot. See section 2.2.12.9.
- Mechanical resistance of the cladding element:
  - Resistance of grooved cladding element. See section 2.2.12.2.
  - Resistance of the cladding element at dowel hole. See section 2.2.12.3.

Freeze-thaw cycles shall be carried out according to the relevant hEN (see table 1.2) or EAD. When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the freeze-thaw cycles shall be carried out according to the method indicated in section M.3 of Annex M.

*Note: the number of test specimens shall be the same as those of the mechanical tests.*

Test results shall be given according to the relevant mechanical tests.

Ratio (division between the results after and before cycles) may also be indicated.

The values shall cover the range of density of the cladding element.

### **2.2.15.4 Behaviour after immersion in water**

This characteristic is only relevant for cladding kits with components that are known to be or suspected of being sensitive to water penetration.

For cladding elements made of TMCP section 2.2.15.9 applies.

Cladding kit behaviour after immersion in water shall be assessed by means of bending strength tests (see section 2.2.12.1) before and after immersion in water.

*Note: When available, performance included in the DoP regarding the cladding element component should be used as far as possible to avoid retesting or reassessment.*

Additionally, depending on the kit family (see table 2.2), the behaviour after immersion in water may also be assessed by means of the following relevant mechanical tests before and after immersion in water:

- Mechanical resistance of connections between the cladding element and the cladding fixing:
  - Pull-through resistance. See section 2.2.12.4.
  - Axial tension resistance. See section 2.2.12.6.
  - Resistance of slot. See section 2.2.12.9.
- Mechanical resistance of the cladding element:
  - Resistance of grooved cladding element. See section 2.2.12.2.
  - Resistance of the cladding element at dowel hole. See section 2.2.12.3.

Immersion in water shall be carried out according to the relevant hEN (see table 1.2) or EAD. When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the immersion in water shall be carried out by full immersion in water of the specimen until about 100% saturation is achieved.

*Note: the number of test specimens shall be the same as those of the mechanical tests.*

Test results shall be given according to the relevant mechanical tests.

Ratio (division between the results after immersion and before immersion) may also be indicated.

The values shall cover the range of density of the cladding element.

### **2.2.15.5 Dimensional stability**

This characteristic is only relevant for cladding kits with components that are known to be or suspected of being sensitive to changes in environmental relative humidity and/or temperature.

For cladding elements made of TMCP section 2.2.15.9 applies.

#### Dimensional stability by humidity

The dimensional stability of the kit components associated with changes in relative humidity shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the relevant kit components should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the dimensional variation by humidity of the cladding element shall be assessed according to EN 318 or EN 1170-7.

The maximum values shall be indicated.

The values shall cover the range of density of the kit components.

#### Linear thermal expansion

The dimensional stability of the kit components associated with changes in temperature shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the relevant kit components should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the linear thermal expansion coefficient of the cladding element shall be assessed according to §3.2.6 of EN 1993-1-1, §3.2.5 of EN 1999-1-1 or EN 14617-11.

The maximum values shall be indicated.

The values shall cover the range of density of the kit components.

#### **2.2.15.6 Chemical and biological resistance**

This characteristic is only relevant for cladding kits with components that are known to be or suspected of being sensitive to chemical and biological attack such as wood based panels, wood subframe components, plastics, stones and HPL laminates.

For cladding elements made of TMCP section 2.2.15.9 applies.

Chemical and biological resistance of the kit components shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the relevant kit components should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the following standards shall be taken into account: EN 321, EN 335, EN 350, EN 351-1, EN 460, EN 599-1, EN 599-2, EN ISO 846 or EN 14147.

Test results shall be given according to the relevant hEN, EAD or standard listed above.

#### **2.2.15.7 UV radiation resistance**

This characteristic is only relevant for cladding kits with components that are known to be or suspected of being sensitive to UV radiation such as polyester or other plastics.

For cladding elements made of TMCP section 2.2.15.9 applies. Kit components behaviour after UV radiation ageing shall be assessed according to the relevant hEN (see table 1.2) or EAD.

*Note: When available, performance included in the DoP regarding the relevant kit components should be used as far as possible to avoid retesting or reassessment.*

When the hEN or EAD does not give an assessment method or when there is no relevant hEN or EAD applicable, the following standards shall be taken into account: EN ISO 877-1, EN ISO 877-3, EN ISO 4892-1, EN ISO 4892-2, EN ISO 4892-3, EN 927-2, EN 13245-2 or EN 10169.

Test results shall be given according to the relevant hEN, EAD or standard listed above.

#### **2.2.15.8 Corrosion**

The assessment of the kit corrosion is carried out by means of the assessment of the metal kit components corrosion representative of this essential characteristic for cladding kits.

The corrosion protection of the metal components of the cladding kits shall be described according to the appropriate EN standard (e.g. EN 10346 for continuously hot-dip coated steels).

The choice of steel, aluminium and stainless steel grade shall be described according to the appropriate EN standards (e.g. EN 10346 for continuously hot-dip coated steel, EN 755-1 and EN 1999-1-1 for aluminium alloys, EN 10088-4 for stainless steels).

The steel or aluminium grade and the respective corrosion protection shall be described in function of the field of application and the corrosivity of atmospheres defined in EN ISO 9223 (e.g. marine atmosphere, industrial atmosphere, etc.). In particularly aggressive atmospheres with extreme chemical pollution (e.g. desulphurization plants, chloride atmosphere), special measures of corrosion protection shall be foreseen.

If necessary, the performance deterioration caused by corrosion should also be described.

In addition, any electrochemical compatibility between the different metal components in contact should be also described.

For cladding elements made of TMCP section 2.2.15.9 applies.

#### **2.2.15.9 Accelerated ageing behaviour of kits when the cladding element is made of thin metallic composite panels (TMCP)**

These characteristics are only relevant for kits when the cladding elements is made of TMCP according to it is defined in EOTA TR 038.

The following durability characteristics of the TMCP shall be assessed and given in the ETA according to the EOTA TR 038.

- Decay of delamination resistance:
  - o After hygrothermal cycles.
  - o After immersion 6 h in boiling water at 90 °C.
  - o After immersion in water 500 h at 20 °C.
  - o After freeze-thaw cycles.
  - o After long term exposure to heat (2500 h at hot dry air 80 °C).
- Decay of flexural resistance (only relevant for TMCP with core made of post-consumption LDPE, with or without mineral compounds):
  - o After hygrothermal cycles
  - o After immersion 6 h in boiling water at 90 °C
  - o After immersion in water 500 h at 20 °C
  - o After freeze-thaw cycles
  - o After long term exposure to heat (2500 h at hot dry air 80 °C).
- Decay of flexural stiffness after short term exposure (1h +80°C).
- Decay of resistance of routed and returned edge after TPB test, flexural pulsating loads.
- Decay of resistance of slot and its fixing device after pull-out pulsating loads.
- Corrosion infiltration after exposure to spray SALT (only relevant for TMCP with coated aluminium sheets).
- Resistance to humidity of coil coated aluminium (only relevant for TMCP with coated aluminium sheets).
- Retention of colour and gloss (only relevant for TMCP with coated aluminium sheets):
  - o After humidity.
  - o After UV-and water condensation
  - o After accelerated ageing by heat.

### 3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products covered by this EAD the applicable European legal act is Decision 2003/640/EC.

The applicable AVCP system is 2+ for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire<sup>8</sup> the applicable AVCP systems regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision.

#### 3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in table 3.1a.

The actions to be undertaken by the manufacturer of the product for the different components of the kit are laid down in table 3.1b & 3.1c when the components are produced by the manufacturer himself and table 3.1d when the components are not produced by the manufacturer himself but by its supplier under the specifications of the manufacturer.

**Table 3.1a: Control plan for the manufacturer; cornerstones**

No	Subject/type of control	Test or control method (*)	Criteria, if any	Minimum number of specimens	Minimum frequency of control
<b>Factory production control (FPC)</b>					
1	Components <u>produced by the manufacturer himself</u> :				
	▪ Cladding elements	See table 3.1b	Acc. to the Control Plan	See table 3.1b	See table 3.1b
	▪ Cladding fixings and subframe components	See table 3.1c	Acc. to the Control Plan	See table 3.1c	See table 3.1c
	▪ Thermal insulation product	Acc. to the relevant hEN standard or EAD	Acc. to the Control Plan	Acc. to Control Plan	Acc. to the relevant hEN standard or EAD
	▪ Ancillary components	Acc. to the Control Plan	Acc. to the Control Plan	Acc. to the Control Plan	Acc. to the Control Plan
2	Components <u>not produced by the manufacturer himself</u> (**)	See table 3.1d	See table 3.1d	See table 3.1d	See table 3.1d
(*) In all cases, the TAB and the manufacturer may agree to alternative tests or control methods or, where none exist, these parties may agree on the method.					
(**) Components produced by the supplier under the specifications of the manufacturer.					

<sup>8</sup> Including propensity to undergo continuous smouldering, where relevant.

**Table 3.1b: Control plan when the cladding element is produced by the manufacturer himself; cornerstones**

No	Subject/type of control	Test or control method (*)	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Supplier certificates or supplier tests			
Finished component					
1	Geometry (form and dimensions)	When apply, acc. to the relevant hEN or EAD Otherwise measuring, visual check or table A.1 of Annex A	Acc. to the Control Plan	According to tests or control methods	Acc. to the Control Plan (**)
2	Density or mass per unit area or per unit	When apply, acc. to the relevant hEN or EAD Otherwise table A.1 of Annex A			
3	Mechanical characteristics	Test or control based on relevant section 2.2.12			
		Test acc. to 2.2.12			At least once each 5 years
(*) In all cases, the TAB and the manufacturer may agree to alternative tests or control methods or, where none exist, these parties may agree on the method.					
(**) The frequency is determined case by case depending on the type of production process, the variation in the volume produced and the production process control.					

**Table 3.1c: Control plan when the cladding fixings and/or subframe components are produced by the manufacturer himself; cornerstones**

No	Subject/type of control	Test or control method (*)	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Supplier certificates or supplier tests			
Finished component					
1	Geometry (form and dimensions)	Measuring and visual check	Acc. to the Control Plan	According to tests or control methods	Acc. to the Control Plan (**)
2	Mechanical characteristics	Test or control based on relevant section 2.2.12.4 to 2.2.12.16			
		Test acc. to 2.2.12.4 to 2.2.12.16			At least once each 5 years
(*) In all cases, the TAB and the manufacturer may agree to alternative tests or control methods or, where none exist, these parties may agree on the method.					
(**) The frequency is determined case by case depending on the type of production process, the variation in the volume produced and the production process control.					

**Table 3.1d: Control plan when the components are not produced by the manufacturer;  
cornerstones**

No	Subject/type of control	Test or control method (**)	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
1	Components belonging to Case 1 (*)	(1)	Conformity with the order	Testing is not required	Each delivery
		(2)	Acc. to the Control Plan	Testing is not required	Each delivery
2	Components belonging to Case 2 (*):	(1)	Conformity with the order	Testing is not required	Each delivery
	▪ Characteristics declared in DoP for the specific use within the kit.	(2)	Acc. to the Control Plan	Testing is not required	Each delivery
	▪ Characteristics not declared in DoP for the specific use within the kit.	(3)	Acc. to the Control Plan	Acc. to Control Plan	Acc. to Control Plan
3	Components belonging to Case 3 (*):	(1)	Conformity with the order	Testing is not required	Each delivery
		(3)	Acc. to the Control Plan	Acc. to Control Plan	Acc. to Control Plan
<div>(1) Checking of delivery ticket and/or label on the package.</div> <div>(2) Checking of technical data sheet and DoP or, when relevant: supplier certificates or supplier tests or test or control acc. to tables 3.1a to 3.1c above.</div> <div>(3) Supplier certificates or supplier tests or Test or control acc. to tables 3.1a to 3.1c above.</div>					
<div>(*) Case 1: Component covered by a hEN or its own ETA for all characteristics needed for the specific use within the kit.</div> <div>Case 2: If the component is a product covered by a hEN or its own ETA which, however, does not include all characteristics needed for the specific use within the kit or the characteristic is presented as NPD option for the component manufacturer.</div> <div>Case 3: The component is a product not (yet) covered by a hEN or its own ETA.</div> <div>(**) In all cases, the TAB and the manufacturer may agree to alternative tests or control methods or, where none exist, these parties may agree on the method.</div>					

### 3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for cladding kit are laid down in table 3.2.

**Table 3.2 Tasks of the notified body under AVCP system 2+**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Initial inspection of the manufacturing plant and of factory production control</b>					
1	Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer considering the constancy of performances of kit components defined in the Control Plan (except reaction to fire).	As defined in the control plan	As defined in the control plan	As defined in the control plan	When starting the production
<b>Continuous surveillance, assessment and evaluation of factory production control</b>					
2	Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer considering the constancy of performances of kit components defined in the Control Plan (except reaction to fire).	As defined in the control plan	As defined in the control plan	As defined in the control plan	Once per year

Regarding reaction to fire<sup>8</sup>, the intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

In this case the cornerstones of the tasks to be undertaken by the notified body under AVCP system 1 are laid down in table 3.3

**Table 3.3 Tasks of the notified body under AVCP system 1**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Initial inspection of the manufacturing plant and of factory production control</b>					
1	Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer limited to the constancy of performances of reaction to fire and taking into account the limit of organic material and/or the addition of fire retardants.	As defined in the control plan	As defined in the control plan	As defined in the control plan	When starting the production



**Table 3.3 Tasks of the notified body under AVCP system 1**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Continuous surveillance, assessment and evaluation of factory production control</b>					
2	Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer limited to the constancy of performances of reaction to fire and taking into account the limit of organic material and/or the addition of fire retardants.	As defined in the control plan	As defined in the control plan	As defined in the control plan	Once per year

## 4 REFERENCE DOCUMENTS

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

EN 10088-1	Stainless steels - Part 1: List of stainless steels.
EN 10088-2	Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.
EN 10088-4	Stainless steels - Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes.
EN 1013	Light transmitting single skin profiled plastics sheets for internal and external roofs, walls and ceilings - Requirements and test methods.
EN 10143	Continuously hot-dip coated steel sheet and strip - Tolerances on dimensions and shape.
EN 10169	Continuously organic coated (coil coated) steel flat products - Technical delivery condition.
EN 10346	Continuously hot-dip coated steel flat products for cold forming - Technical delivery conditions.
EN 10545-2	Ceramic tiles. Part 2: Determination of dimensions and surface quality.
EN 10545-3	Ceramic tiles. Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density.
EN 10545-4	Ceramic tiles - Part 4: Determination of modulus of rupture and breaking strength.
EN 1170-4	Precast concrete products. Test method for glass-fibre reinforced cement. Part 4: Measuring bending strength, "simplified bending test" method.
EN 1170-6	Precast concrete products. Test method for glass-fibre reinforced cement. Part 6: Determination of the absorption of water by immersion and determination of the dry density.
EN 1170-7	Precast concrete products. Test method for glass-fibre reinforced cement. Part 7: Measurement of extremes of dimensional variations due to moisture content.
EN 12020-1	Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 - Part 1: Technical conditions for inspection and delivery.
EN 12020-2	Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 - Part 2: Tolerances on dimensions and form.
EN 12057	Natural stone products - Modular tiles – Requirements.
EN 12086	Thermal insulating products for building applications - Determination of water vapour transmission properties.
EN 12087	Thermal insulating products for building applications - Determination of long term water absorption by immersion.
EN 12088	Thermal insulating products for building applications - Determination of long term water absorption by diffusion.
EN 12326-1	Slate and stone for discontinuous roofing and external cladding - Part 1: Specifications for slate and carbonate slate.
EN 12372	Natural stone test methods - Determination of flexural strength under concentrated load.
EN 12467	Fibre-cement flat sheets - Product specification and test methods.
EN 12664	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance.

EN 12667	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance.
EN 12865	Hygrothermal performance of building components and building elements - Determination of the resistance of external wall systems to driving rain under pulsating air pressure.
EN 12939	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance.
EN 1304	Clay roofing tiles and fittings - Product definitions and specifications.
EN 1309-1	Round and sawn timber. Method of measurement of dimensions. Part 1: Sawn timber.
EN 13162	Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification
EN 13163	Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products – Specification.
EN 13164	Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products – Specification.
EN 13165	Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products – Specification.
EN 13166	Thermal insulation products for buildings - Factory made phenolic foam (PF) products – Specification.
EN 13238	Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates.
EN 13245-2	Plastics - Unplasticized poly (vinyl chloride) (PVC-U) profiles for building applications - Part 2: PVC-U profiles and PVC-UE profiles for internal and external wall and ceiling finishes.
EN 13364	Natural stone test methods. Determination of the breaking load at dowel hole.
EN 13369	Common rules for precast concrete products.
EN 13373	Natural stone test methods - Determination of geometric characteristics on units.
EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.
EN 13823	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item.
EN 13830	Curtain walling - Product standard.
EN 13859-2	Flexible sheets for waterproofing - Definitions and characteristics of underlays - Part 2: Underlays for walls.
EN 1396	Aluminium and aluminium alloys - Coil coated sheet and strip for general applications – Specifications.
EN 13986	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.
EN 14081-1	Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.
EN 14147	Natural stone test methods - Determination of resistance to ageing by salt mist
EN 14411	Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking.
EN 14509	Self-supporting double skin metal faced insulating panels - Factory made products – Specifications.
EN 14592	Timber structures - Dowel-type fasteners – Requirements.

EN 14617-11	Agglomerated stone - Test methods - Part 11: Determination of linear thermal expansion coefficient.
EN 1469	Natural stone products - Slabs for cladding – Requirements.
EN 14782	Self-supporting metal sheet for roofing, external cladding and internal lining - Product specification and requirements.
EN 14783	Fully supported metal sheet and strip for roofing, external cladding and internal lining - Product specification and requirements.
EN 14915	Solid wood panelling and cladding - Characteristics, evaluation of conformity and marking.
EN 14992	Precast concrete products - Wall elements.
EN 15191	Precast concrete products - Classification of glass-fibre reinforced concrete performance.
EN 15286	Agglomerated stone - Slabs and tiles for wall finishes (internal and external).
EN 1602	Thermal insulating products for building applications - Determination of the apparent density.
EN 1609	Thermal insulating products for building applications - Determination of short term water absorption by partial immersion.
EN 16153	Light transmitting flat multiwall polycarbonate (PC) sheets for internal and external use in roofs, walls and ceilings - Requirements and test methods.
EN 16733	Reaction to fire tests for building products - Determination of a building product's propensity to undergo continuous smouldering.
EN 1925	Natural stone test methods. Determination of water absorption coefficient by capillarity.
EN 1936	Natural stone test methods - Determination of real density and apparent density, and of total and open porosity.
EN 1990	Eurocode - Basis of structural design.
EN 1993-1-1	Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings.
EN 1993-1-8	Eurocode 3: Design of steel structures - Part 1-8: Design of joints.
EN 1999-1-1	Eurocode 9: Design of aluminium structures - Part 1-1: General structural rules.
EN 310	Wood-based panels. Determination of modulus of elasticity in bending and of bending strength.
EN 318	Wood based panels - Determination of dimensional changes associated with changes in relative humidity.
EN 321	Wood-based panels - Determination of moisture resistance under cyclic test conditions.
EN 323	Wood-based panels. Determination of density.
EN 325	Wood-based panels - Determination of dimensions of test pieces.
EN 335	Durability of wood and wood-based products - Use classes: definitions, application to solid wood and wood-based products.
EN 350	Durability of wood and wood-based products - Testing and classification of the durability to biological agents of wood and wood-based materials.
EN 351-1	Durabilidad de la madera y de los productos derivados de la madera. Madera maciza tratada con productos protectores. Parte 1: Clasificación de las penetraciones y retenciones de los productos protectores.
EN 438-6	High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (Usually called Laminates) - Part 6: Classification and specifications for Exterior-grade Compact laminates of thickness 2 mm and greater.

EN 438-7	High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (Usually called Laminates) - Part 7: Compact laminate and HPL composite panels for internal and external wall and ceiling finishes.
EN 460	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 485-2	Aluminium and aluminium alloys - Sheet, strip and plate - Part 2: Mechanical properties.
EN 485-3	Aluminium and aluminium alloys - Sheet, strip and plate - Part 3: Tolerances on dimensions and form for hot-rolled products.
EN 485-4	Aluminium and aluminium alloys. Sheets, strip and plate. Part 4: Tolerances on shape and dimensions for cold-rolled products.
EN 490	Concrete roofing tiles and fittings for roof covering and wall cladding - Product specifications.
EN 491	Concrete roofing tiles and fittings for roof covering and wall cladding - Test methods.
EN 492	Fibre-cement slates and fittings - Product specification and test methods.
EN 494	Fibre-cement profiled sheets and fittings - Product specification and test methods.
EN 538	Clay roofing tiles for discontinuous laying - Flexural strength test.
EN 599-1	Durability of wood and wood-based products - Efficacy of preventive wood preservatives as determined by biological tests - Part 1: Specification according to use class.
EN 599-2	Durability of wood and wood-based products. Performance of preventive wood preservatives as determined by biological tests. Part 2: Classification and labelling.
EN 634-1	Cement-bonded particleboards. Specification. Part 1: General requirements
EN 634-2	Cement-bonded particleboards - Specifications - Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions.
EN 755-1	Aluminium and aluminium alloys- Extruded rod/bar, tube and profiles - Part 1: Technical conditions for inspection and delivery.
EN 755-2	Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 2: Mechanical properties.
EN 755-9	Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 9: Profiles, tolerances on dimensions and form.
EN 822	Thermal insulating products for building applications - Determination of length and width.
EN 823	Thermal insulating products for building applications - Determination of thickness.
EN 927-2	Paints and varnishes - Coating materials and coating systems for exterior wood - Part 2: Performance specification.
EN ISO 10140-1	Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products.
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations.
EN ISO 10352	Fibre-reinforced plastics - Moulding compounds and prepregs - Determination of mass per unit area.
EN ISO 10456	Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values.
EN ISO 10666	Drilling screws with tapping screw thread - Mechanical and functional properties.

EN ISO 11348-1	Water quality. Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test). Part 1: Method using freshly prepared bacteria.
EN ISO 11348-2	Water quality. Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test). Part 2: Method using liquid-dried bacteria.
EN ISO 11348-3	Water quality. Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test). Part 3: Method using freeze-dried bacteria.
EN ISO 1182	Reaction to fire tests for products - Non-combustibility test.
EN ISO 1183-1	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method.
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test.
EN ISO 12572	Hygrothermal performance of building materials and products - Determination of water vapour transmission properties.
EN ISO 14588	Blind rivets - Terminology and definitions.
EN ISO 14589	Blind rivets - Mechanical testing.
EN ISO 15148	Hygrothermal performance of building materials and products - Determination of water absorption coefficient by partial immersion.
EN ISO 1716	Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value).
EN ISO 178	Plastics - Determination of flexural properties.
EN ISO 1923	Cellular plastics and rubbers. Determination of linear dimensions.
EN ISO 4892-1	Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance.
EN ISO 4892-2	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps.
EN ISO 4892-3	Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps.
EN ISO 6341	Water quality. Determination of the inhibition of the mobility of <i>Daphnia magna</i> Straus (Cladocera, Crustacea). Acute toxicity test.
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method.
EN ISO 717-1	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation.
EN ISO 7500-1	Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system.
EN ISO 845	Cellular plastics and rubbers - Determination of apparent density.
EN ISO 846	Plastics. Evaluation of the action of microorganisms.
EN ISO 877-1	Plastics - Methods of exposure to solar radiation - Part 1: General guidance.
EN ISO 877-3	Plásticos. Métodos de exposición a la radiación solar. Parte 3: Exposición intensificada por radiación solar concentrada.
EN ISO 8990	Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box.
EN ISO 9223	Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation.

ISO 15799	Soil quality. Guidance on the ecotoxicological characterization of soils and soil materials.
EAD 090034-00-0404	Kit composed by subframe and fixings for fastening cladding and external wall elements.
EAD 330046-01-0602	Fastening screws for metal members and sheeting.
EAD 330076-00-0604	Metal injection anchors for use in masonry.
EAD 330284-00-0604	Plastic anchors for redundant non-structural systems in concrete and masonry (former ETAG 020)
EAD 330474-00-0601	Fasteners for use in concrete for redundant non-structural systems (former ETAG 001-6)
ETAG 001-6	Metal Anchors for Use in Concrete. Part 6 : Anchors for multiple use for non-structural applications.
ETAG 020	Plastic Anchors. Part 1: General. Part 2: for use in normal weight concrete. Part 3: for use in solid masonry materials. Part 4: for use in hollow or perforated masonry. Part 5: for use in autoclaved aerated concrete.
EOTA TR 001	Determination of impact resistance of panels and panels assemblies.
EOTA TR 034	General BWR3 Checklist for EADs/ETAs - Content and/or release of dangerous substances in construction products.
EOTA TR 038	Assessment procedure for durability of thin metallic composite panels.
CEN/TS 16637-2	Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test.
Commission Delegated Regulation (EU) 2016/364	Commission Delegated Regulation (EU) 2016/364 of 1 July 2015 on the classification of the reaction to fire performance of construction products pursuant to Regulation (EU) No 305/2011 of the European Parliament and of the Council.
Decision 96/603/EC	Commission Decision of 4 October 1996 establishing the list of products belonging to Classes A 'No contribution to fire' provided for in Decision 94/611/EC implementing Article 20 of Council Directive 89/106/EEC on construction products.
Commission Regulation (EC) No 1451/2007	Commission Regulation (EC) No 1451/2007 of 4 December 2007 on the second phase of the 10-year work programme referred to in Article 16(2) of Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market (Text with EEA relevance).
Decision 2003/640/EC	Commission Decision 2003/640/EC of 4 September 2003 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards kits for exterior wall claddings (Text with EEA relevance) (notified under document number C(2003) 3160).
Regulation (EC) No 1272/2008	Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.
OECD Test Guideline 301, part A	OECD Guideline 301 for Testing of Chemicals. Part A: DOC Die-Away. <i>Standard related with EN ISO 7827. Water quality. Evaluation of the "ready", "ultimate" aerobic biodegradability of organic compounds in an aqueous medium. Method by analysis of dissolved organic carbon (DOC).</i>
OECD Test Guideline 301, part B	OECD Guideline 301 for Testing of Chemicals. Part B: CO <sub>2</sub> Evolution (Modified Sturm Test).
OECD Test Guideline 301, part E	OECD Guideline 301 for Testing of Chemicals. Part E: Modified OECD Screening.

## ANNEX A – CLADDING ELEMENT TEST METHODS BY MATERIAL

**Table A.1 Cladding element main test methods by materials**

Cladding element material	Test methods			
	Water absorption	Bending strength, Modulus of elasticity or Modulus of rupture	Dimensions	Specific mass or density
Wood based	EN ISO 15148	EN 310	EN 325; EN 1309-1	EN 323
Metal	EN 14782; EN 14783; EN ISO 15148	EN 10346; EN 485-2	EN 10143; EN 485-4; EN 14782; EN 14783	EN 10346; EN 1396
Stone	EN 1925; EN ISO 15148	EN 12372	EN 13373	EN 1936
HPL laminates	EN ISO 15148	EN ISO 178	EN 438-6	Method A EN ISO 1183-1
Fibre-cement Fibre reinforced cement	EN 12467; EN 492; EN 494; EN 1170-6; EN ISO 15148	EN 12467; EN 492; EN 494; EN 1170-4	EN 12467; EN 492; EN 494; EN 13369	EN 12467; EN 492; EN 494; EN 1170-6
Concrete	EN 491; EN ISO 15148	EN 491	EN 491; EN 13369	EN 491
Terra cotta or ceramic	EN 10545-3; EN ISO 15148	EN 10545-4; EN 538	EN 10545-2	EN 10545-3
Plastic	EN ISO 15148	EN ISO 178	EN 16153; EN 1013	Method A EN ISO 1183-1; EN ISO 10352
Resin mortar	EN 12467; EN 1170-6; EN ISO 15148	EN 12467; EN ISO 178; EN 1170-4	EN 12467; EN 1013	EN 12467; Method A EN ISO 1183-1; EN ISO 10352; EN 1170-6
Cement bonded particle board	EN ISO 15148	EN 310	EN 325; EN 1309-1	EN 323
Thin Metallic Composite Panels (TMCP)	EN 14782; EN 14783; EN ISO 15148	FPB test acc. to EOTA TR 038 without ageing	EN 485-3; EN 485-4; EN ISO 1923	Calculation based on dimension and mass; EN ISO 845; EN 1602



## ANNEX B – REACTION TO FIRE

### B.1 General

#### B.1.1 Principle

The determination of reaction to fire of the cladding kits is based on testing of “the worst case” - the most critical configuration in sense of reaction to fire. According to the rules described further in the text, the classification obtained on the most critical configuration of the cladding kit components is valid for all configurations of cladding kit components having better performance in sense of reaction to fire.

For the particular parts of the cladding kit components, the following principles apply:

- The kit components material with the highest amount of organic content<sup>9</sup> (if there are only differences in the amount of organic content but no difference in the organic component itself) or the highest PCS value (according to EN ISO 1716) shall be tested.
- In addition, each kit components material selected for testing according to the previous point shall have the lowest amount of flame retardants.

#### B.1.2 Physical properties influencing the reaction to fire behaviour

- Type of cladding element (composition, thickness, density).
- When apply (e.g. cladding elements made of resin mortar, fibre-cement, concrete, cement bonded particle, etc.), the organic content of the binder and of any organic additive; can be checked by providing the formulation of the component, by performing suitable characterization tests or by determining the glow loss or net calorific value.
- Type and amount of flame retardant.
- Type and nature of cladding fixings and subframe components.

*Note: Fire breaks are important for the behaviour of the whole facade cladding system and cannot be assessed on the basis of SBI-testing. The influence can only be observed during a large scale test. Therefore breaks are not included in the mounting and fixing rules for the SBI-test.*

Although the rest of this annex applies the “worst case scenario” for deciding what to test, it is accepted that, where the manufacturer produces a range of cladding elements having different overall classifications, it may group these together into a number of different sub-groups (e.g. each sub-group corresponding to a different overall classification) with the ‘worst case scenario’ being identified for each sub-group.

Components of a cladding kit which are classified A1 without testing according to Decision 96/603/EC (as amended) do not need to be tested.

### B.2 Testing according to EN ISO 1182

This test method is relevant for classes A1 and A2.

Using this test method, only the substantial components of the cladding kit need to be tested. ‘Substantial components’ are defined by thickness ( $\geq 1$  mm) and/or mass per unit area ( $\geq 1$  kg/m<sup>2</sup>).

Parameters relevant indicated in clause B.1.2 shall be applied.

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<sup>9</sup> When relevant, the manufacturer is responsible for the information on organic content per unit area. If the information is not available, the PCS value shall be tested to decide about the worst case.

### **B.3 Testing according to EN ISO 1716 (PCS value)**

This test method is relevant for classes A1 and A2.

This test method shall be performed to all components of the cladding kit except for cases which are classified as A1 without testing.

Parameters relevant for this test method are: composition (when performing calculation of the PCS<sub>S</sub>-value), density or mass per unit area and thickness. Mechanical fixings and ancillary materials which are not continuous but discrete components of cladding kit do not need to be considered for testing and for the calculation of the PCS<sub>S</sub>.

It is not necessary to test a cladding element with different grain sizes if the organic content is the same as or lower than that of the tested cladding element.

### **B.4 Testing according to EN 13823 (SBI-test)**

This test method is relevant for classes A2, B, C and D (in some cases also for A1).

Mounting and fixing provisions for the SBI-test for cladding kits are indicated in Annex C.

Parameters which are relevant for this test method:

- Type of kit components (composition, dimensions, density).
- Amount of organic content of the kit components.
- Amount of flame retardant, if any.

In principle, it is desirable to find the test specimen configuration that gives the worst case concerning the reaction to fire test results. In the test procedure according to EN 13823, values for the rate of heat release, total heat release, lateral flame spread, rate of smoke release, total smoke release and burning droplets are determined.

The test specimen shall be prepared with the kit components with the highest organic content or PCS<sub>S</sub>-value per unit area.

#### **B.4.1 Direct application rules of test results**

See section C.3 of Annex C.

### **B.5 Testing according to EN ISO 11925-2**

This test method is relevant for classes B, C, D and E.

Parameters which are relevant:

- Type of kit components (composition, dimensions, density).
- Amount of organic content of the kit components.
- Amount of flame retardant, if any.

For cladding elements with covered edges, the specimens shall be prepared both with covered edges and edges without covering (cut edges).

The tests are performed with surface flaming of the front side and possibly edge flaming of the test specimen turned 90° according to the rules of standard EN ISO 11925-2.

Besides, the principles specified in clause B.1 shall be applied.

## ANNEX C – MOUNTING AND FIXING PROVISIONS FOR THE SBI TEST

Considerations for cladding kits included in section B.4 of Annex B shall also be considered for SBI test.

The reaction to fire testing shall be given for the whole kit, in simulating its end-use conditions.

The testing standard EN 13823 gives a general description of the arrangement of the test specimen for SBI test, applicable to classes A2, B, C and D (in some cases also to A1).

This Annex describes specific provisions for cladding kits.

### C.1 General information

As a function of the use of the kit, the specimen shall be installed on a substrate in accordance with standard EN 13238:

- Calcium silicate or fibre-cement board simulates a wall made of masonry or concrete,
- Non FR particle board simulates a wall made of timber frame,
- Steel sheet simulates a wall made of metal frame.

The frame is made from non fire-retardant treated timber, aluminium or steel.

All ancillary components which form part of the kit (e.g. breather membranes and cavity barriers) shall be included in a representative fashion in the test specimen.

An air space is always provided behind the cladding element in accordance with the manufacturer's instructions (minimum of 20 mm). The bottom and top edges of the specimen shall also remain opened. For ventilated cladding systems there may be a gap of 10 mm between the bottom of the specimen and top level of U-profile of the SBI-test device.

If mineral wool insulation layer is planned in end-use situation of the kit, a 50 mm thick insulation product made of mineral wool according to EN 13162, with a density of 30 to 70 kg/m<sup>3</sup>, shall be installed between frame and substrate.

For other insulation materials, different conditions can be used for testing (e.g. maximum and/or minimum thicknesses, maximum and/or minimum density, unless proven otherwise).

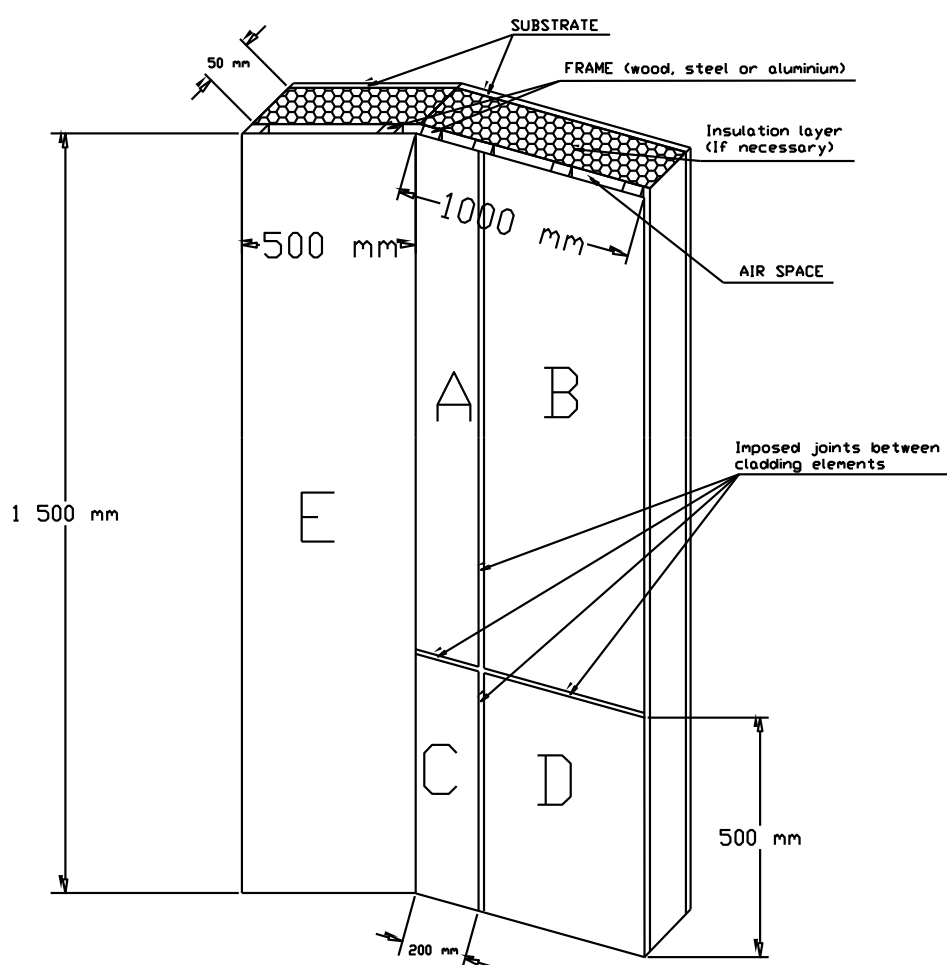
If non insulation layer is considered in the test specimen the test result is applicable provided that the insulation layer placed behind the cladding element is made of materials of class A1 or A2-s1,d0 (e.g. mineral wool).

The cladding kit is fixed to the frame. The cladding kit shall be installed with the cladding fixing density defined by the manufacturer as specified in the ETA.

When the kit presents a horizontal joint, it shall be tested with a horizontal joint in the long wing at a height of 500 mm from the bottom edge of the specimen and when the kit tested presents a vertical joint, it shall be tested with a vertical joint in the long wing at a distance of 200 mm from the corner line, in accordance with the figure C.1. In the areas A, B, C, D and E, it is possible to have other vertical and/or horizontal joints between cladding elements, if their size is not big enough.

In the internal vertical angle, no profile shall be used and the cladding elements create a vertical closed joint.

*Note: Asymmetrically composed cladding products shall be tested in such a way that the rear of the product is exposed to the flame.*



**Figure C.1:** Example of SBI test installation.

*Note: The two wings are perpendicular.*

## C.2 Specific information

The kits are tested in a limited number of configurations to cover the influence of the parameters indicated in section B.4 of Annex B.

The cladding elements can be cut to size as shown in figures C.2.

The cladding fixing and subframe shall be fixed to the substrate through fixings adapted to the type and material of the substrate.

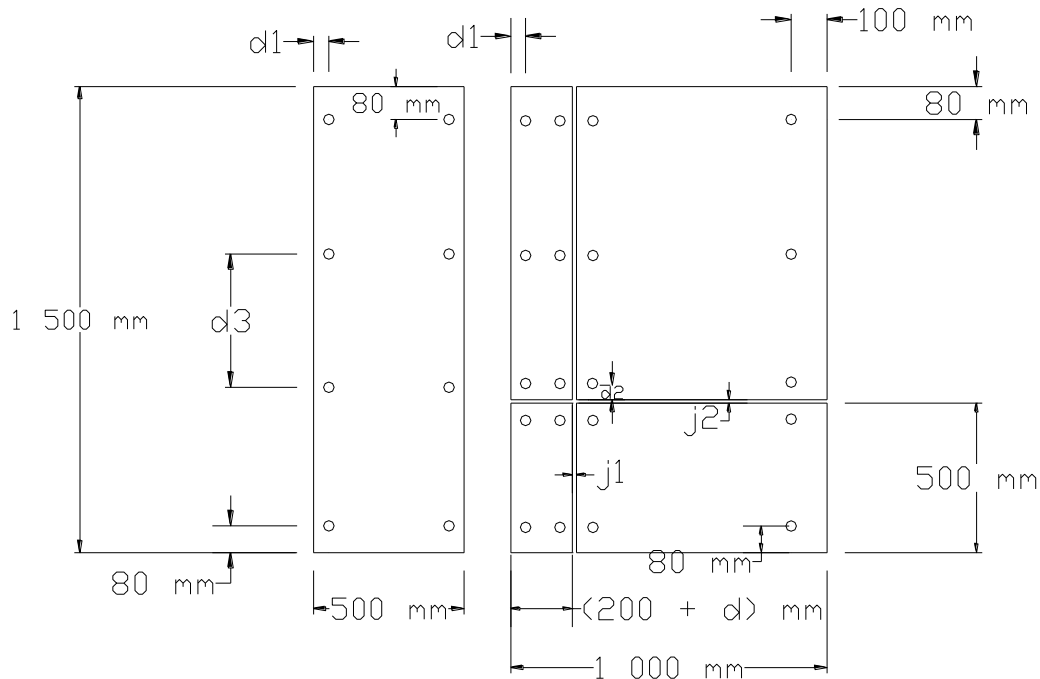
## C.3 Extension of results

The test result (classification) shall remain valid, without test:

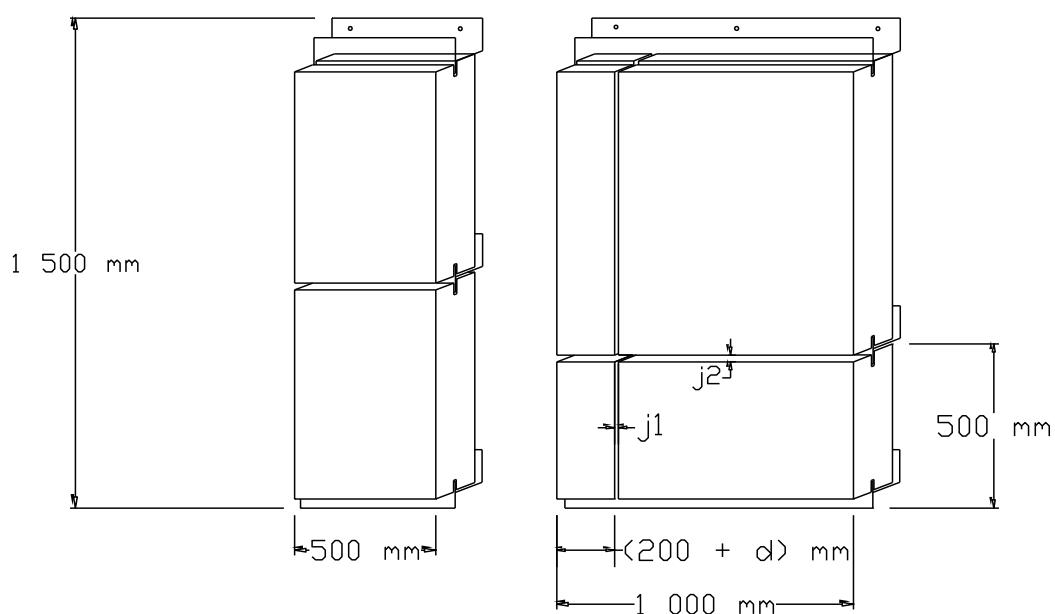
- For greater dimensions (height and width) of cladding elements.
- For other higher density of cladding fixings.
- For the same type of cladding element (for family A to G) used in applications with open vertical joint  $\leq j_1$  (tested value) and open horizontal joint  $\leq j_2$  (tested value), up to 15 mm (see figures C.2 to C.6).
- For other higher thickness of air space.

- When the test is carried out without insulation layer, the test result is applicable provided that the insulation layer placed behind the cladding element in the end-use situation is made of materials of class A1 or A2-s1,d0 (e.g. mineral wool).
- When the test is carried out with mineral wool insulation shall be valid for:
  - all other greater thickness of mineral wool insulation layer with the same density and the same or better reaction to fire classification;
  - the same type of panel used without insulation, if the substrate chosen according to EN 13238 is made of panel with Euro-class A1 or A2 (e.g. fibres-cement panel).
- The results of reaction to fire tests, where a combustible insulation material was used as substrate, are also valid for end-use applications of the tested product without insulation on solid mineral substrates of class A1 or A2-s1,d0 like masonry or concrete.
- The test result of a test with non fire-treated timber frame shall be valid, without test, for the same type of cladding element used with aluminium or steel frame.
- The test result of a test with screws shall be valid, without test, for the same type of cladding element fixed by rivets made of the same material as the screws (steel screws for steel rivets and aluminium screws for aluminium rivets) and vice versa.
- The test result of the lowest and highest thickness of the cladding element shall be valid, without test, for all the thickness in between.
- The result from a test with an open horizontal joint shall be valid, without test, for the same type of cladding element used in applications with horizontal joints closed by steel or aluminium profiles.

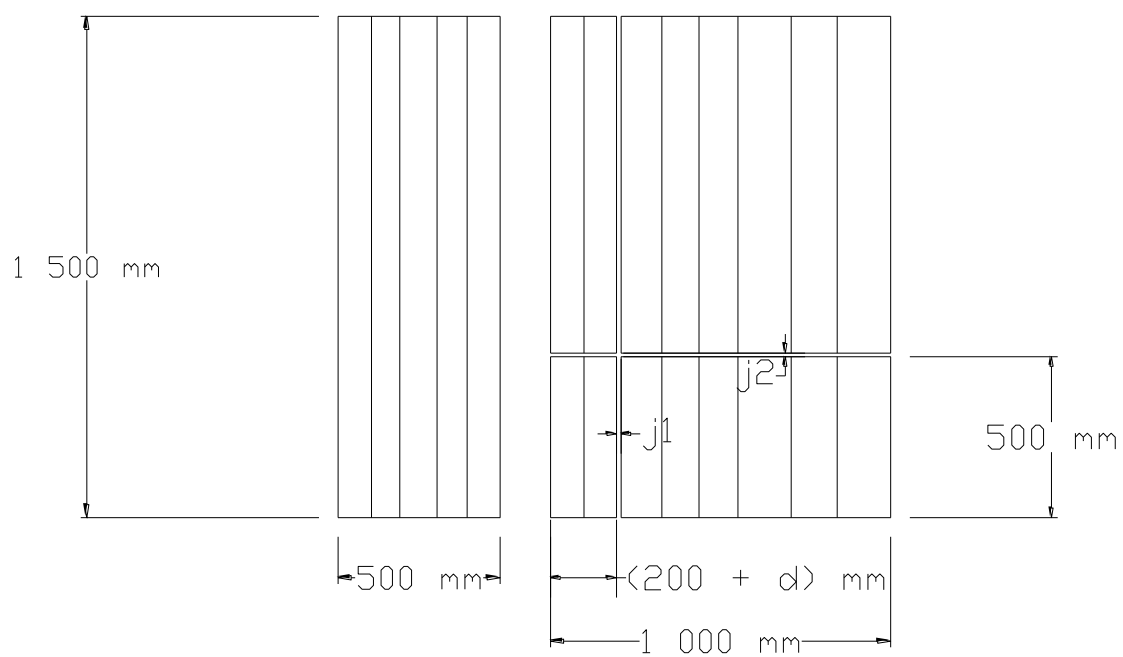
*Note: other aspects indicated in the relevant hEN standards or EAD for the cladding element material should be also taken into account.*



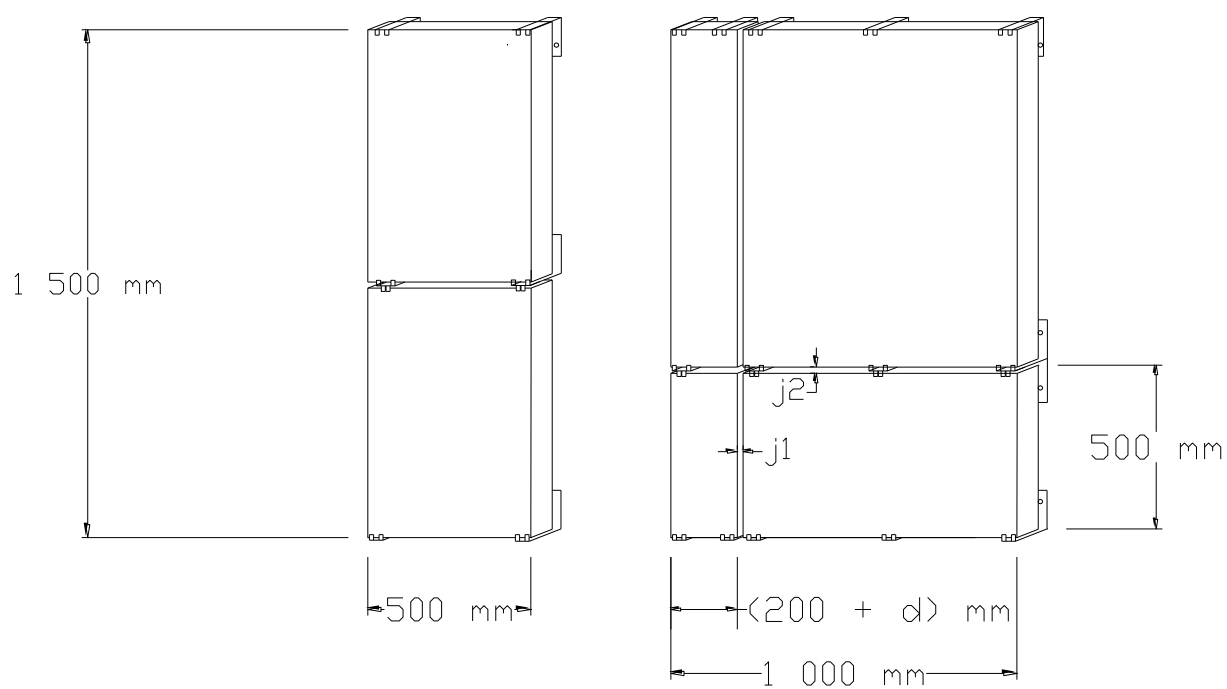
**Figure C.2:** Example of installation for kits family A or B.



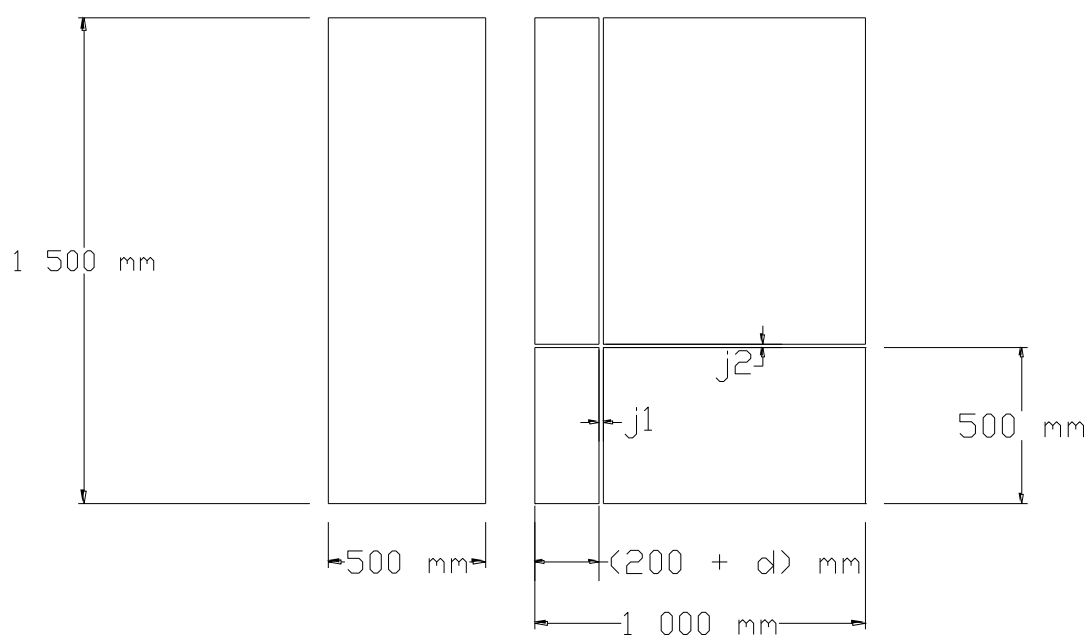
**Figure C.2:** Example of installation for kits family C or D.



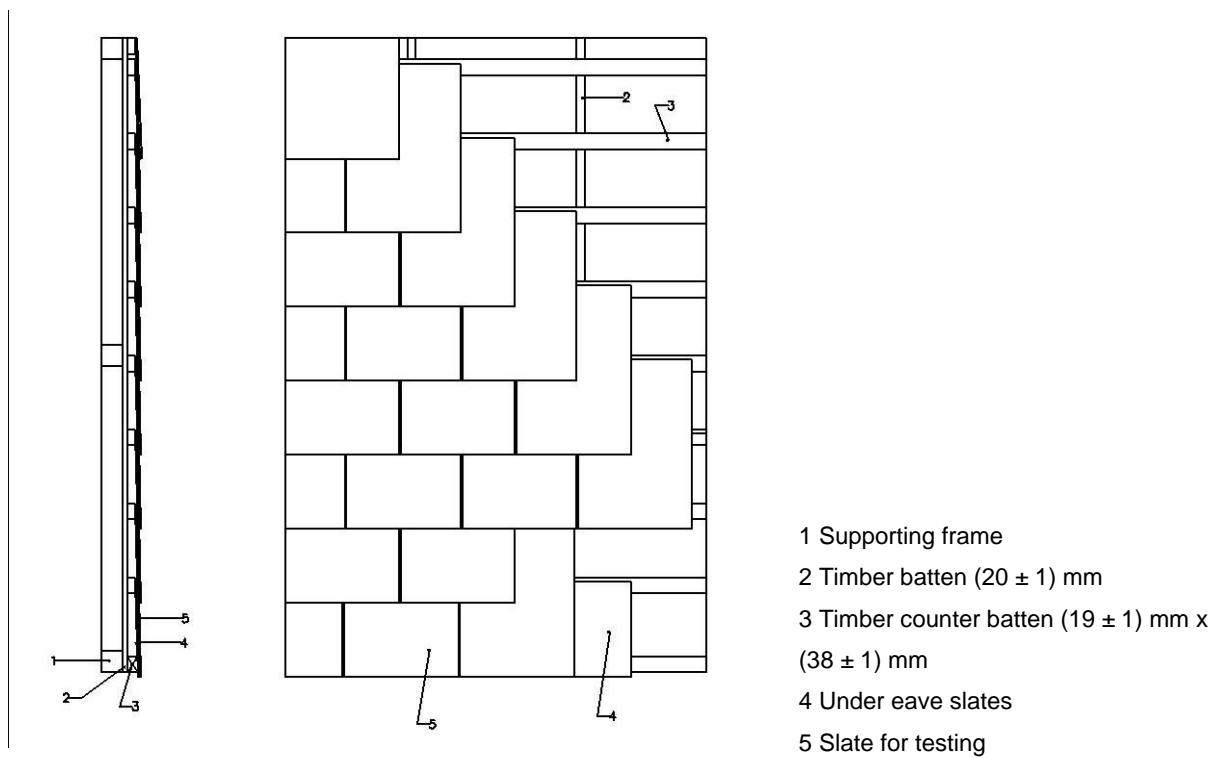
**Figure C.3:** Example of installation for kits family E.



**Figure C.4:** Example of installation for kits family F.



**Figure C.5:** Example of installation for kits family G.



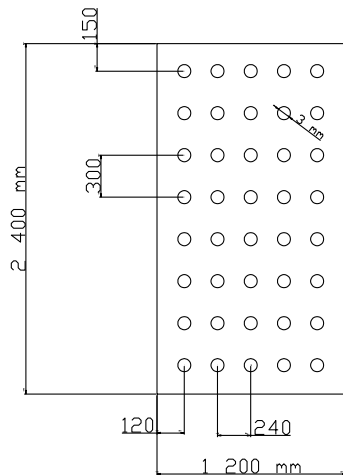
**Figure C.6:** Example of installation for kits family H.



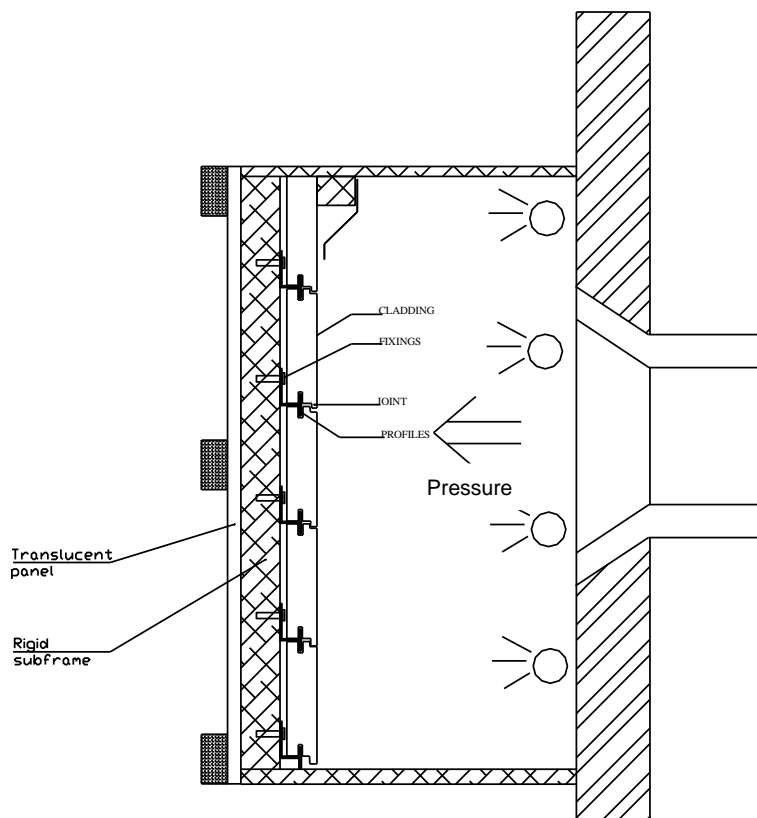
## ANNEX D – ADDITIONAL CRITERIA FOR WATERTIGHTNESS TESTS

A transparent material panel (PMMA thickness 8 mm) with 3 mm diameter holes (0,01 % holes) could be placed behind the cladding (see figure D.2 and figure D.3).

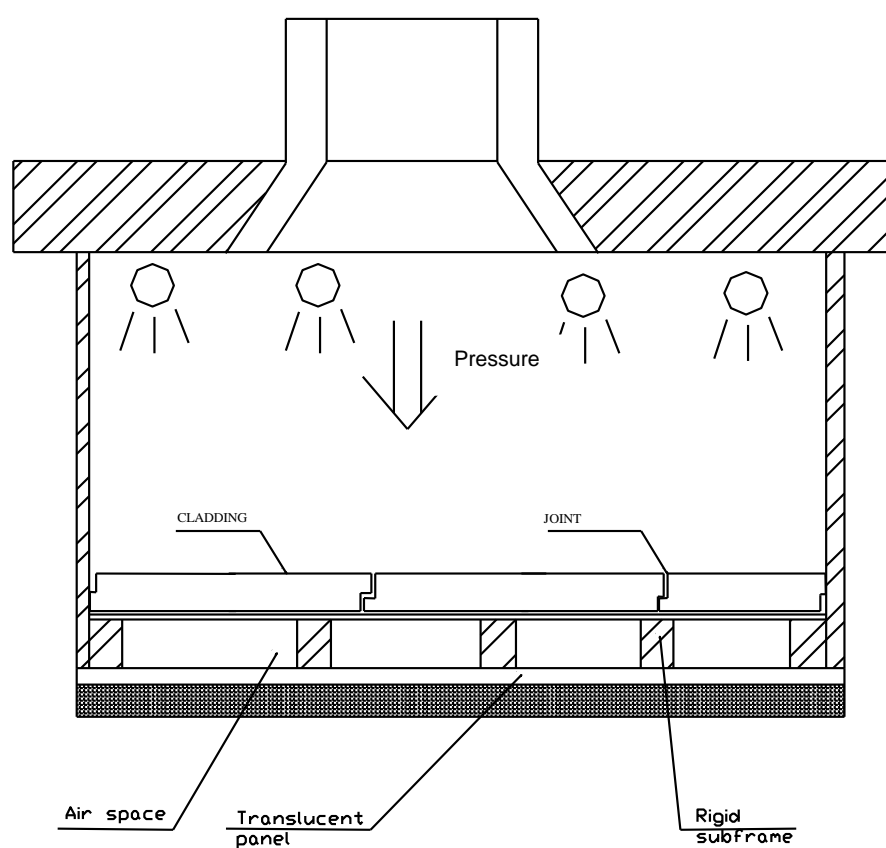
E.g., if the size of sample is 2400 x 1200 mm, the display of holes could be made according to figure D.1.



**Figure D.1:** Example of distances between holes.



**Figure D.2:** Example of test device – vertical section.



**Figure D.3:** Example of test device – horizontal section.

## **ANNEX E – WIND SUCTION AND PRESSURE LOAD TESTS**

The principle is to establish the effects of suction and pressure loads on the assembled cladding kit.

The number of tests depends on the combination of parameters presented for the assembled cladding kit.

As a minimum, the mechanically weakest design shall be tested.

### **E.1 Wind suction test**

#### **E.1.1 Preparation of the test specimen**

The test specimen shall be mounted in the test equipment in accordance with the manufacturer instructions.

The test specimen is defined as follows:

- A non-airtight substrate (test rig) such as wood or steel rigid frame. Masonry or concrete wall may also be used as substrate; however, they have to include at least one hole per square metre with a minimum diameter of at least 150 mm.
- The assembled cladding kit must be fixed to the test rig.
- The dimensions of the test specimen depend on the size of external cladding element and the specified cladding fixings:
  - for cladding elements which are mechanically fixed independent of each other, a minimum surface cladding of 1,5 m<sup>2</sup> shall be tested.
  - If they depend on each other vertically and horizontally, at least 3 x 3 elements shall be tested.
  - If they depend on each other vertically or horizontally, at least 4 elements shall be tested.
- To define the mechanically weakest design the following aspects shall be taken into account:
  - The mechanically weakest cladding element (e.g. minimum thickness, minimum bending strength, minimum grooved cladding element resistance, etc.)
  - Density of cladding fixings (e.g. minimum density).
  - Span between profiles (e.g. maximum span).
  - Span between brackets (e.g. maximum span).

The tolerances due to manufacturing and/or installation and deformations due to temperature and humidity variations have to be taken into account.

The mechanical properties of the components used for the test are to be known.

#### **E.1.2 Test equipment**

The test equipment consists of a pressure or suction chamber (see figure E.1) against which is placed the assembled cladding kit. The depth of chamber shall be sufficient for a constant pressure or suction to be exerted on the test specimen applied to the external surface of the assembled cladding kit irrespective of its possible deformation. The chamber is mounted on a rigid frame. The assembled cladding kit acts as the seal between the chamber and the environment. The connection between the assembled cladding kit and the chamber shall be sufficient to allow a realistic deformation of the test specimen under the influence of simulated wind suction.

### Alternative test equipment

The alternative test may be used, provided that the geometric shape allows the foil bags to be placed in the air space and be blown out so that a uniformly distributed pressure load at the rear face of the cladding is possible.

The test rig consists of a rigid frame (steel construction) made of vertical longitudinal girder and horizontal profiles (anchor channel) and rigid boards or a massive wall such as masonry or concrete.

The subframe of the cladding kit has to be fixed on the rig and the cladding elements have to be fixed on the subframe according to the indications given by the manufacturer.

The vertical profiles of the rig can be movable (sliding) so that they can be placed in the axis of the fixings of the cladding.

Foil bags which are placed in the air space at the rear side of the cladding are blown out and they exert a uniformly distributed pressure load on the rear face of the cladding which corresponds to the wind suction load.

### **E.1.3 Test procedure**

The uniformly distributed loads are exerted on the surface of the assembled cladding kit.

The test is performed in successive steps (two steps of 300 Pa, one step of 500 Pa and one step of 1000 Pa, then steps of +200 Pa thereafter, at each step the load is maintained constant for at least 10 seconds and returned to zero after each step; see figure E.2) until significant irreversible deformation (deformation which affects serviceability) or failure occurs.

The test is then continued until failure occurs.

The deflection shall be measured, at the relevant points (e.g. central point of the cladding element, border or corner of the cladding element, cladding fixing, profiles, etc.), as a function of the load and reported in tabular or graphic form.

With the differential pressure reduced to zero, the permanent deflection shall be noted after 1 minute recovery. The pressure at which defect or damage occur shall be noted.

Additionally, if relevant, the permanent deflection 1 hour after failure occurs shall be noted.

The fixings between the assembled cladding kit and the test equipment shall not constitute weak points and shall therefore be chosen accordingly.

### **E.1.4 Observations during the test**

Failure is defined by any one of the following events:

- Any cladding element, cladding fixing, profile or bracket breaks.
- Any cladding element, cladding fixing, profile or bracket presents a significant permanent deflection.
- Falling of detached components.
- Failure or detachment of the kit subframe.

### **E.1.5 Test results**

The test result is:

- The failure load  $Q$ .
- The type of failure.

- The value of maximum permanent deflection (after 1 minute recovery), the maximum deflection of the test specimen and the load and sensor position for this maximum permanent deflection and maximum deflection.

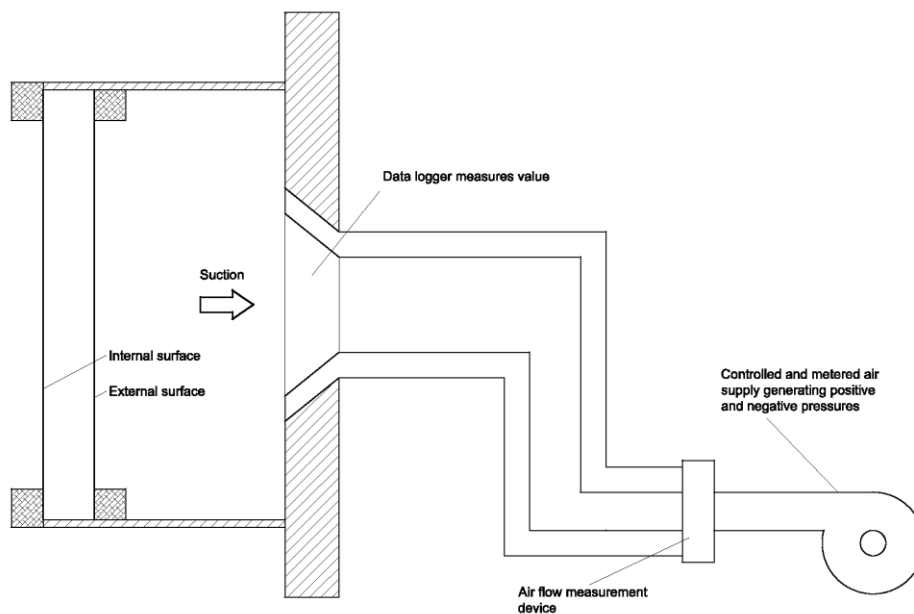
### E.1.6 Test specimen description

It is necessary to describe the test specimen by giving details about:

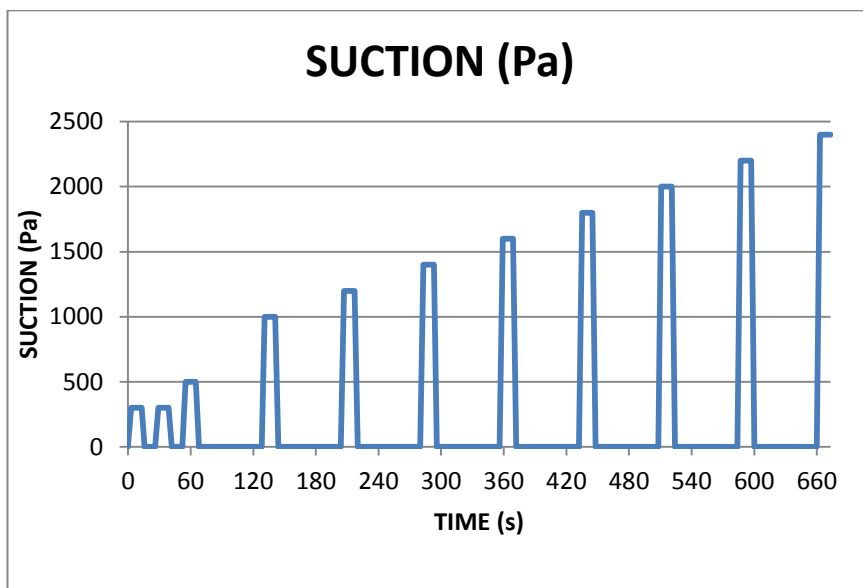
- Brackets (material, geometry, distance between two brackets and number and disposition of fixings).
- Profiles (material, geometry and distance between two profiles).
- Cladding element (material and geometry).
- Cladding fixing (material and geometry and number and disposition of fixings).
- Fixings between the test equipment and the assembled cladding kit (position, generic type, material and geometry).

## E.2 Wind pressure test

The test procedure is similar to E.1, the only difference being that the wind action is reversed.



**Figure E.1:** Example of wind pressure and suction apparatus.



**Figure E.2:** Example of wind load steps.

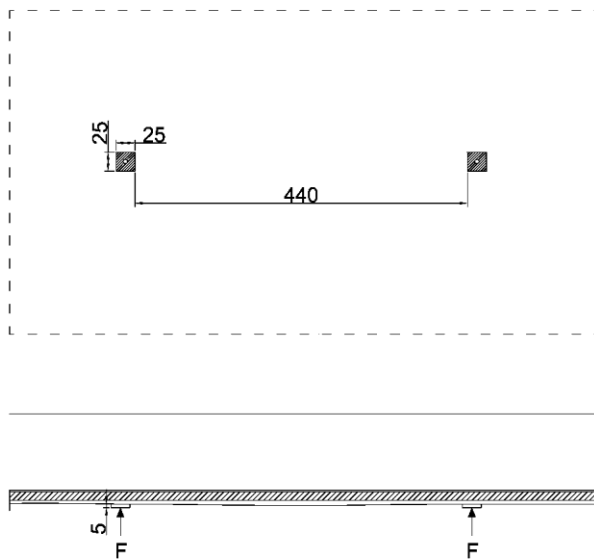
## ANNEX F – RESISTANCE TO HORIZONTAL POINT LOAD

The cladding kit shall be tested under a static load 500 N applied for one minute horizontally through two squares of 25 x 25 x 5 mm space apart (distance 440 mm) on any part of the cladding element (representing one person standing on a ladder leaning against the external surface) at room temperature and according to figure F.1.

To define the mechanically weakest case of the assembled cladding kit the following aspects should be taken into account:

- The mechanically weakest cladding element (e.g. minimum thickness, minimum bending strength, minimum grooved cladding element resistance, etc.).
- The mechanically weakest cladding fixings (e.g. minimum thickness, minimum mechanical material characteristics, etc.).
- Minimum density of cladding fixings.
- The mechanically weakest subframe components (e.g. minimum thickness, minimum mechanical material characteristics, etc.).
- Maximum span between profiles.
- Maximum span between brackets.

The mechanical properties of the components used for the test is to be known.



**Figure F.1:** Resistance to horizontal load test (dimensions in mm).

## ANNEX G – IMPACT RESISTANCE TEST

### G.1 General

The principle is to establish the impact resistance of the cladding kit considering hard body and soft body impacts. Besides, it is established the impact use categories to correspond to the degree of exposure to impacts in use.

The bodies to impact and the test equipment are indicated in EOTA TR 001. The points of impact shall be selected taking into account the behaviour of the cladding element and the substrate, varying according to whether the impact point is or is not located in an area of greater rigidity (at less than 50 mm from the edge of cladding element).

Hard body impacts are:

- H1 and H2 (1 J and 3 J respectively), carried out with the steel ball weighing 0,5 kg and from a height of 0,20 m and 0,61 m respectively (at least in three locations).
- H3 (10 J), carried out with the steel ball weighing 1,0 kg and from a height of 1,02 m (at least in three locations).

Soft body impacts are:

- Small soft body S1 and S2 (10 J and 60 J respectively), carried out with the soft ball weighing 3,0 kg and from a height of 0,34 m and 2,04 m respectively (at least in three locations).
- Large soft body S3 and S4 (100 J and 400 J respectively), carried out with the spherical bag weighing 50,0 kg and from a height of 0,61 and 0,82 m respectively (at least in the space between two profiles).

*Note: National building regulations in some member states may have specific requirements. The manufacturer may consider other energy values for the hard and soft body impacts. Any change shall be indicated in the ETA.*

At least, the mechanically weakest design shall be tested.

The size of the test specimen shall be chosen to carry out all the impacts indicated in table G.1.

The dimensions of any indentation shall be reported. Noted shall be made of any damage caused.

The mechanical properties of the components used for the test is to be known.

### G.2 Test procedure

Test procedure can be carried out using one of following options:

1. When the impact resistance is chosen by the manufacturer or it is known, using the impact tests indicated in table G.1 for this impact resistance chosen or known.
2. When the impact resistance is not known, starting with lowest impact bodies and continue increasing the impacts, with the aim of obtaining the maximum impact resistance.



**Table G.1 - Hard and soft body impact tests**

External impacts and assessment						
			Category IV	Category III	Category II	Category I
Hard body impact	H1	<ul style="list-style-type: none"> <li>Weight: 0,5 kg</li> <li>Impact: 1 J (height 0,20 m)</li> <li>No. impacts: 3</li> <li>Position of impacts: three different locations</li> </ul>	No penetrated (2) No perforated (3)	---	---	---
	H2	<ul style="list-style-type: none"> <li>Weight: 0,5 kg</li> <li>Impact: 3 J (height 0,61 m)</li> <li>No. impacts: 3</li> <li>Position of impacts: three different locations</li> </ul>	---	No penetrated (2) No perforated (3)	No deterioration (1)	No deterioration (1)
	H3	<ul style="list-style-type: none"> <li>Weight: 1 kg</li> <li>Impact: 10 J (height 1,02 m)</li> <li>No. impacts: 3</li> <li>Position of impacts: three different locations</li> </ul>	---	---	No penetrated (2) No perforated (3)	No deterioration (1)
Soft body impact	S1	<ul style="list-style-type: none"> <li>Weight: 3 kg</li> <li>Impact: 10 J (height 0,34 m)</li> <li>No. impacts: 3</li> <li>Position of impacts: three different locations</li> </ul>	No deterioration (1)	No deterioration (1)	---	---
	S2	<ul style="list-style-type: none"> <li>Weight: 3 kg</li> <li>Impact: 60 J (height 2,04 m)</li> <li>No. impacts: 3</li> <li>Position of impacts: three different locations</li> </ul>	---	---	No deterioration (1)	No deterioration (1)
	S3	<ul style="list-style-type: none"> <li>Weight: 50 kg</li> <li>Impact: 300 J (height 0,61 m)</li> <li>No. impacts: 1</li> <li>Position of impacts: At least in the centre point of a cladding element</li> </ul>	---	---	No deterioration (1)	---
	S4	<ul style="list-style-type: none"> <li>Weight: 50 kg</li> <li>Impact: 400 J (height 0,82 m)</li> <li>No. impacts: 1</li> <li>Position of impacts: At least in the centre point of a cladding element</li> </ul>	---	---	---	No deterioration (1)
<p>(1) Superficial damage, provided there is no cracking, is considered as showing "no deterioration" for all the impacts. Collapse or any other dangerous failure is not allowed.</p> <p>(2) The test result is assessed as being "penetrated" if there is any cracking penetrating to be observed in the cladding element (to be also observed by the rear side). Superficial cracking (no penetrating) is allowed. Collapse or any other dangerous failure is not allowed.</p> <p>(3) The test result is assessed as being "perforated" if there is a destruction of the cladding element (to be also observed by the rear side). Collapse or any other dangerous failure is not allowed.</p>						

### G.3 Definition of the impact use categories (informative)

The categories given in table G.2 correspond to the degrees of exposure in use. They do not include an allowance for acts of vandalism.

**Table G.2 - Impact use categories**

Category	Use
I	A zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use. (e.g.: Façade bases in buildings sited in public locations, such as squares, schoolyards or parks. Cleaning gondolas may be used on the façade).
II	A zone liable to impacts from thrown or kicked objects, but in public locations where the height of the kit will limit the size of the impact; or at lower levels where access to the building is primarily to those with some incentive to exercise care (e.g.: Façade bases in buildings not sited in public locations (e.g. squares, schoolyards, parks) or upper façade levels in buildings sited in public locations that occasionally can be hit by a thrown object (e.g. ball, stone, etc.). Cleaning gondolas may be used on the façade).
III	A zone not likely to be damaged by normal impacts caused by people or by thrown or kicked objects (e.g.: Upper façade levels in buildings (not including base) not sited in public locations, that occasionally can be hit by a thrown object (e.g. ball, stone, etc.). Cleaning gondolas should not be used on the façade).
IV	A zone out of reach from ground level (e.g. High façade levels that cannot be hit by a thrown object. Cleaning gondolas should not be used on the façade).

## ANNEX H – RESISTANCE TO GROOVED CLADDING ELEMENT

The principle is to establish the mechanical resistance of the grooved cladding element.

A minimum of 5 specimens shall be tested.

Samples with a fitting are applied to a rigid substrate as shown in figure H.2.1.

The force shall be exerted at a rate of 5 mm/min on the profile.

The force is applied by pulling the head of the profile. If other cladding fixings are used (instead of profile), then the length (L) of the cladding fixings may be < 100 mm.

The dimensions “a” and “b” depend on the cladding kit and also on the material, geometry and fabrication tolerances of the cladding element.

The mechanical properties of the components used for the test is to be known.

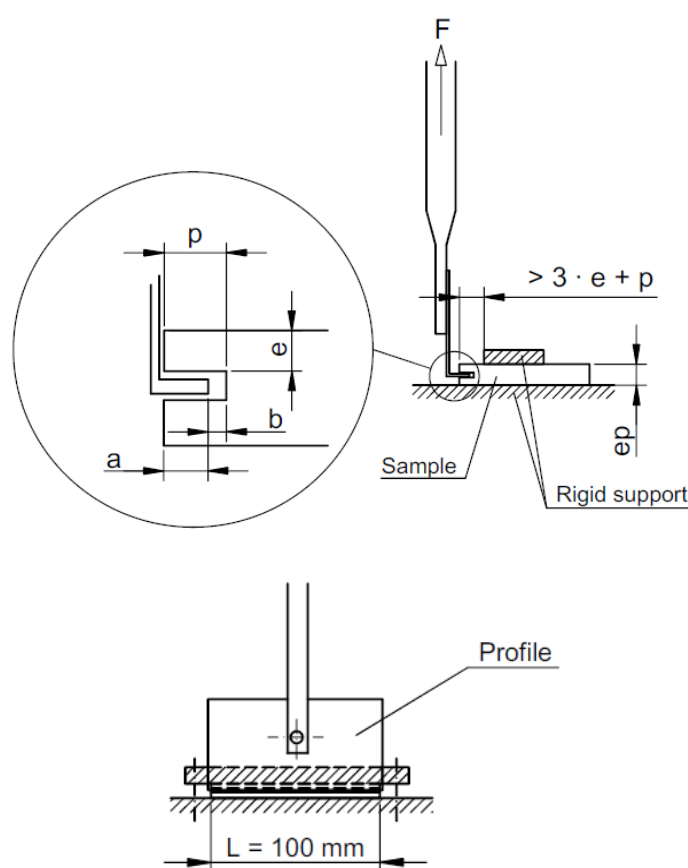


Figure H.2.1: Example of test specimen fixing.

Test report should include:

- Type and geometry of the test specimen (values of “e”, “p”, “a”, “b” and “ep” indicated in figure H.2.1).
- Type, material and geometry of the profile or cladding fixing used to exert the force.
- Each individual force value,  $F_i$  (expressed in N), and the description of the failure of the test specimen (breakage of the cladding element, significant permanent deflection of the profile or cladding fixing, etc.).
- The mean<sup>6</sup> value,  $F_m$ , and the characteristic value,  $F_C$ , in accordance with Annex N.

## ANNEX I – MECHANICAL RESISTANCE OF THE CONNECTION BETWEEN THE CLADDING ELEMENT AND THE CLADDING FIXING

### I.1 - PULL-THROUGH RESISTANCE (for kits family A, D, E & H)

The mechanical properties of the components used for the test is to be known.

#### I.1.1 Test for kits family A, E & H

Test shall be carried out on samples with a cladding fixing driven through cladding element position (centre, middle and corner) taking into account the configuration of the assembled kit defined by the manufacturer.

It is recommended to carry out test series for each position (centre, middle and corner) or, at least, for the mechanically weakest sample (e.g. minimum thickness of the cladding element, minimum diameter of cladding fixing, corner or border position, minimum distances to the borders, etc.).

The cladding fixing shall be installed on the cladding element as specified by the manufacturer.

The test series shall be carried out separately on 3 rings, minimum, medium and large diameter (e.g. between 50 and 350 mm; or 180, 270 and 350 mm for fibre cement and HPL laminated panels) for each position.

For each series, at least 5 test specimens shall be carried out.

An axial tension load is exerted on the fixing. The speed rate shall be adjusted to 5 mm/min. The force can be applied either by pushing on the head of the anchor or pulling the end of the fixing.

The force is applied as show in figures I.1.1 and I.1.2 until failure by pulling through.

Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

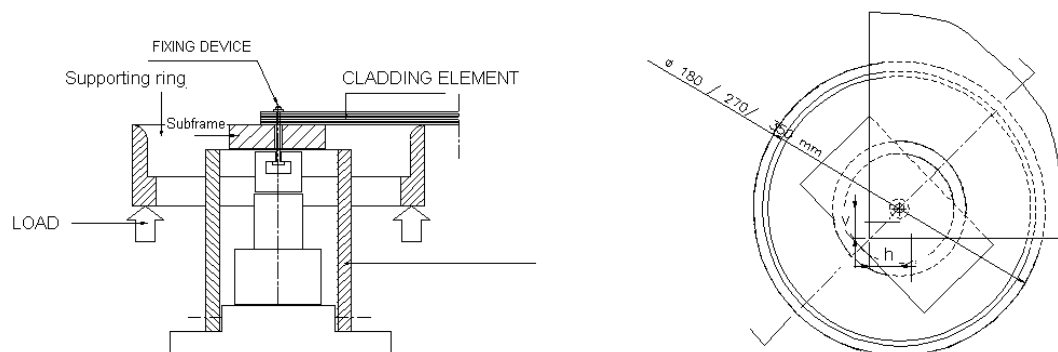


Figure I.1.1: Example of pull-through test in corner.

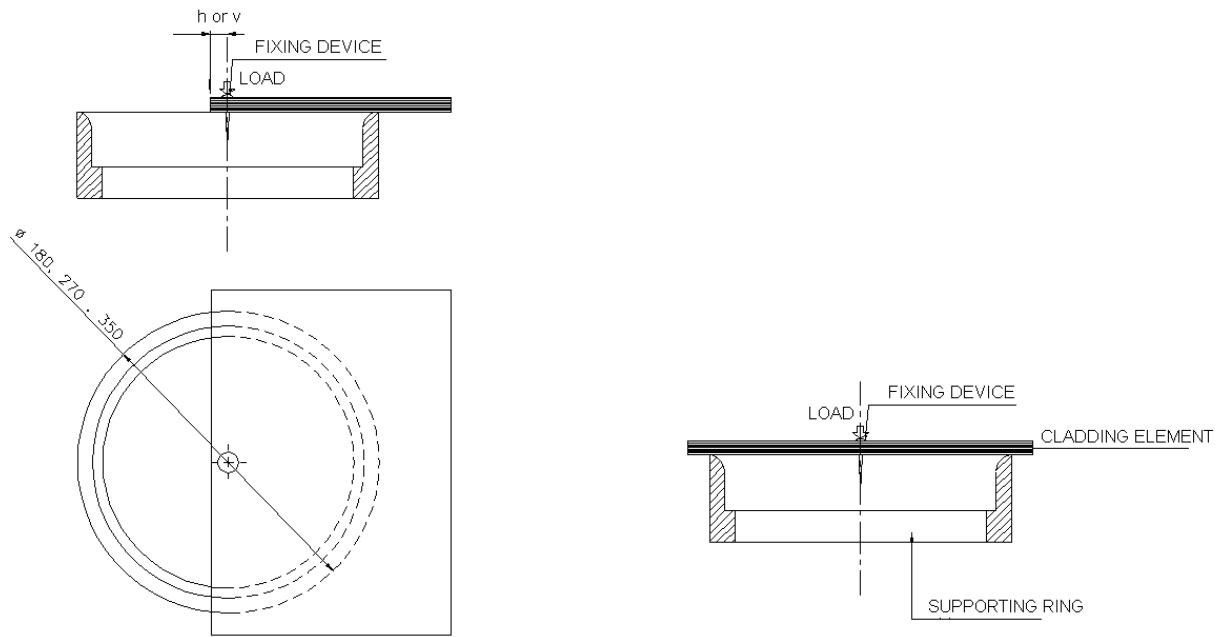


Figure I.1.2: Example of pull-through test in edge and centre.

### I.1.2 Test for kits family D

At least 5 tests shall be carried out.

The tests shall be carried out on samples length 200 mm at least with a fixing. Samples are applied to a supporting ring as show in figure I.1.3 The diameter depends on the material of the sample. It shall be about 50 mm.

A force is exerted, at a speed rate of 10 mm/min on the fixing through the cladding element until failure. The force can be applied either by pushing on the head of the anchor or pulling the end of the fixing.

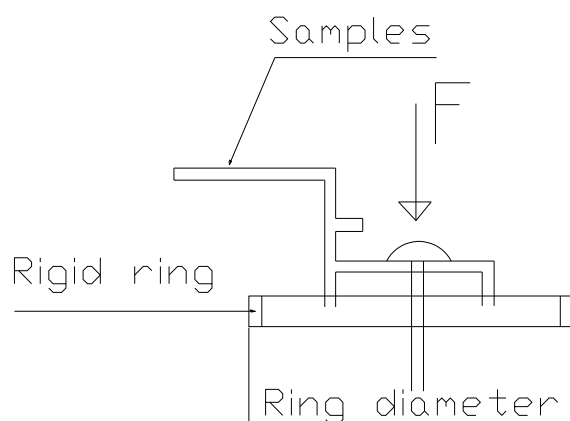


Figure I.1.3: Example of pull-through test for claddings family D.

Test report should include:

- Type, material and geometry of the cladding fixing.

- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

## I.2 - PULL-THROUGH RESISTANCE UNDER SHEAR LOADS (for kits family A, D, E & H)

The tests shall be carried out on sample strips mechanically fixed to a wooden batten or a metal profile with one fixing.

At least 5 tests shall be carried out. On the test specimens with the lowest ultimate loads the number of tests shall be supplemented so that for a statistical evaluation at least 7 test results are available.

When testing, the edge distances  $a_{min}$  and  $b_{min}$  (according to figures I.2.1 to I.2.4) shall be confirm to the smallest edge distances intended to be used for the cladding kit.

For fixings of parts of the exterior wall cladding which have nearly the same stiffness, the tests shall be performed according to figure I.2.3.

If a part is almost rigid in comparison with the other, the tests shall be performed according to figure I.2.4.

If the relative stiffnesses are between those requiring tests to figure I.2.3 and I.2.4, then both tests shall be carried out.

The speed rate shall be adjusted to 5 mm/min.

The mechanical properties of the components used for the test is to be known.

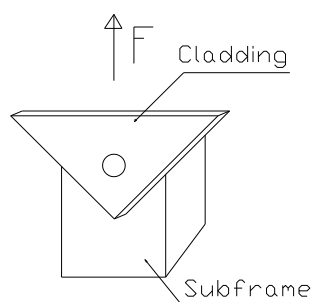


Figure I.2.1: Example of pull-through under shear load (corner).

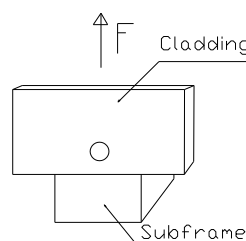


Figure I.2.2: Example of pull-through under shear load (border).

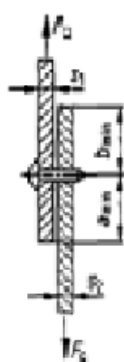


Figure I.2.3: Example of pull-through under shear load (corner).

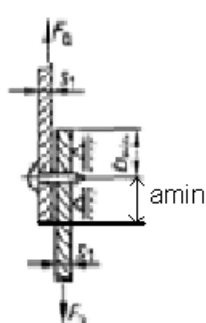


Figure I.2.4: Example of pull-through under shear load (border).

$F_Q$ : shear force

$a_{min}$ : smallest intended edge distance of the cladding

$b_{min}$ : smallest intended edge distance of the subframe

$s_1$ : thickness of the cladding

$s_2$ : thickness of the subframe

### I.3 - AXIAL TENSION RESISTANCE (for kits family B)

The tests shall be carried out on cladding element sections with single cladding fixings without edge and spacing effects.

The cladding fixing shall be installed on the cladding element as specified by the manufacturer. The force shall be exerted as follow in the figure I.3.1 of relevant sections until failure.

The loading speed shall be adjusted so that the failure occurs in 1 minute +/- 30 seconds.

The diameter of the supporting ring shall be changed (e.g. between Ø 50 and 350 mm) in order to find out the diameter  $d_{ref}$  where the failure mode changes from pull-out of the cladding fixing or cone failure to bending failure of the test specimen.

For each diameter at least 5 tests shall be carried out.

The mechanical properties of the components used for the test is to be known.

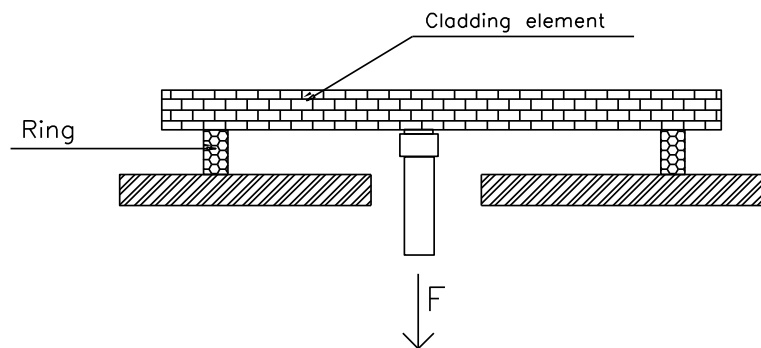


Figure I.3.1: Example of axial tension test.

Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

### I.4 - SHEAR LOAD RESISTANCE (for kits family B)

At least 5 tests shall be carried out.

The tests shall be carried out on cladding element sections with single cladding fixings without edge and spacing effects.

The cladding fixing shall be installed on the cladding element as specified by the manufacturer. The shear load shall be applied on the cladding fixing without eccentricity and without exposure to moments (see figure I.4.1) until failure.

The loading speed shall be adjusted so that the failure occurs in 1 minute +/- 30 seconds.

The mechanical properties of the components used for the test is to be known.

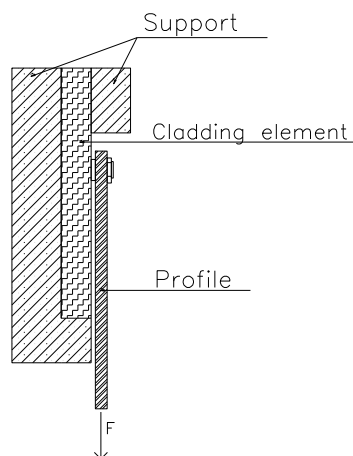


Figure I.4.1: Example of shear load test.

Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_C$ , in accordance with Annex N.

## I.5 - COMBINED TENSION AND SHEAR LOAD RESISTANCE (for kits family B)

At least 5 tests shall be carried out.

The tests shall be carried out on cladding element sections with single cladding fixings without edge and spacing effects.

The cladding fixing shall be installed on the cladding element as specified by the manufacturer. The force shall be exerted as follow in the figure I.5.1 until failure. The direction of load shall correspond to an angle of 30° and 60° relative to the plane of the panel.

The loading speed shall be adjusted so that the failure occurs in 1 minute +/- 30 seconds.

The diameter of the supporting ring shall be changed (e.g. between Ø 50 and 350 mm) in order to find out the diameter  $d_{ref}$  where the failure mode changes from pull-out of the cladding fixing or cone failure to bending failure of the test specimen.

The mechanical properties of the components used for the test is to be known.

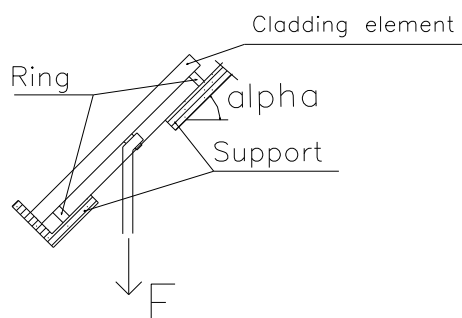


Figure I.5.1: Example of combined axial and shear load test.



Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

## I.6 - RESISTANCE OF SLOT (for kits family G)

At least 5 tests shall be carried out (for TMCP, the final number of test specimens may depend on the durability tests indicated in section 2.2.15.9).

At least, the mechanically weakest connection (cladding element and cladding fixing) shall be tested.

The tests shall be carried out on samples (e.g. 200 x 125 mm) with notch that are applied to a rigid substrate as show in figure I.6.1.

A force is exerted, at a speed rate of 5 mm/min on the cladding element's fixing until failure.

Additionally, when relevant, a test in the vertical direction of the cassette (resistance of dead load or anti-lift up) may be performed.

The mechanical properties of the components used for the test is to be known.

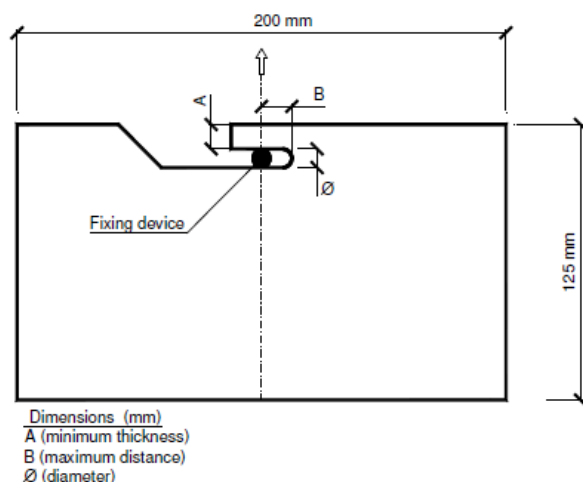


Figure I.6.1: Example of resistance of slot test.

Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure of the test specimen (pull-out of the anchor, cone failure, etc.).
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

## ANNEX J – MECHANICAL RESISTANCE OF THE CLADDING FIXING

### J.1 - RESISTANCE TO VERTICAL LOAD (for punctual fixings of kits family C & F)

The principle is to establish the effect of an additional dead load equivalent to two cladding elements on the assembled cladding kit.

At least, the mechanically weakest cladding fixings and subframe brackets shall be tested.

One cladding element is installed on the cladding fixings and the subframe and an additional dead load equivalent to two cladding elements is added on top of the first one. The subframe brackets shall be fixed to a test rigid substrate in accordance with the instructions of the manufacturer.

The displacements of the first cladding element shall be measured.

The test can be stopped when the deflection, after adding the dead load, is less than 0,1 mm after 1 hour.

The test result is a deflection curve as a function of time and the maximum deflection.

The mechanical properties of the components used for the test is to be known.

### J.2 - PULL-THROUGH RESISTANCE OF FIXINGS FROM PROFILE (for profiles of kits family C)

A minimum of 3 specimens shall be tested.

The test specimens must be mounted in accordance with the manufacturer instructions.

Each test specimen will be composed of one profile and the fixing defined for its connection with the subframe.

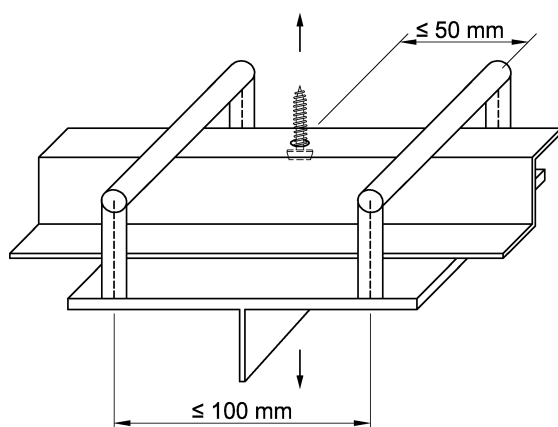
The length of the subframe profile should be 300 mm approximately, however, depending on the cladding kit, other dimensions may be chosen.

Test specimens shall be conditioned for at least 2 hours at  $(23 \pm 2) ^\circ\text{C}$  before the test.

The mechanical properties of the components used for the test is to be known.

The apparatus must consist of:

- A dynamometer,
- A test support as shown in the following figures, depending on the type of test indicated above.



**Figure J.2.1:** Example of pull-through test.

The test shall be carried out using a tensioning speed of 20 mm/min. When relevant, lower speed may be considered.

The fixing must be placed perpendicular to the profile as described in figure J.2.1, and the force must be applied either through the support or by the fixing until failure.

Failure must be defined by any one of the following events:

- Profile breaks.
- Fixing breaks.

Test report should include:

- Type, material and geometry of the components.
- Each individual failure value,  $F_{iu}$  (expressed in N).
- The mode of failure description of the test specimen.
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_c$ , in accordance with Annex N.

### J.3 - RESISTANCE TO METAL CLIP (for kits family F & H)

A minimum of 5 specimens shall be tested.

The cladding fixing shall be installed as specified by the manufacturer.

The force must be exerted at a rate of 5 mm/min on the cladding fixing.

The test is performed in successive steps with a return to zero at each level, until 1 mm irreversible deformation occurs.

*Note: To obtain the forces with accuracy, it is recommended to make the control by displacement of the growth between cycles. This type of control is the best to avoid big gaps between the residual distortions that occur after each consecutive cycle.*

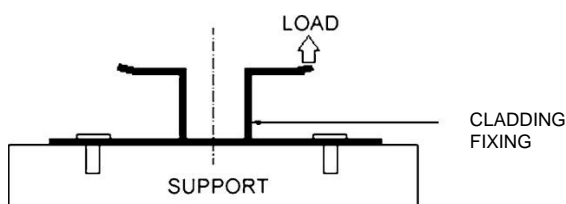
The test is then continued until failure occurs.

The displacements and forces shall be measured and reported in tabular or graphic form.

The test specimen consists of one cladding fixing applied to a rigid substrate as shown in figure J.3.1.

The force must be exerted as shown in figure J.3.1.

The mechanical properties of the components used for the test is to be known.



**Figure J.3.1:** Examples of test lay-out for horizontal load resistance test.

Test report should include:

- Type, material and geometry of the cladding fixing.
- Each individual displacement and force value,  $F_i$  (expressed in N), for 1 mm irreversible deformation.
- Each individual failure value,  $F_{iu}$  (expressed in N), and the mode of failure description of the test specimen (breakage, significant permanent deflection, etc.).
- The displacements and forces shall be measured and reported in tabular or graphic form.
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_C$ , in accordance with Annex N.

## ANNEX K – MECHANICAL RESISTANCE OF SUBFRAME FIXINGS

### K.1 - TENSION / PULL-OUT RESISTANCE

A minimum of 5 specimens shall be tested.

The test specimens must be mounted in accordance with the manufacturer instructions.

Each test specimen will be composed of one subframe profile/stud and the fixing defined for its connection with the cladding fixing.

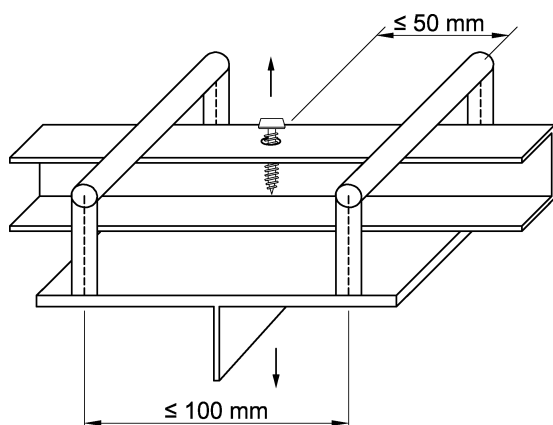
The length of the subframe profile/stud should be 300 mm approximately, however, depending on the cladding kit configuration, other dimensions may be chosen.

Test specimens shall be conditioned for at least 2 hours at  $(23 \pm 2)$  °C before the test.

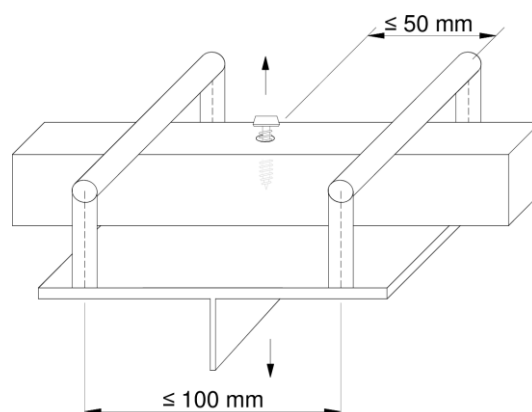
The mechanical properties of the components used for the test is to be known.

The test apparatus must consist of:

- A dynamometer,
- A test support as shown in the following figures, depending on the type of test indicated above.



**Figure K.1.1:** Example of pull-out test on metal profile.



**Figure K.1.2:** Example of pull-out test on wood stud.

The test shall be carried out using a tensioning speed of 20 mm/min. When relevant, lower speed may be considered.

The fixing must be placed perpendicular to the subframe profile/stud as described in figure K.1.1 and K.1.2, and the force must be applied either through the support or by the fixing until failure.

Failure must be defined by any one of the following events:

1. Profile/stud breaks.
2. Fixing breaks.

Test report should include:

- Type, material and geometry of the components (profile/stud and fixings).
- Each individual failure value,  $F_{iu}$  (expressed in N).
- The mode of failure description of the test specimen.
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_C$ , in accordance with Annex N.

## K.2 - SHEAR LOAD RESISTANCE

A minimum of 5 specimens shall be tested.

The test specimens must be mounted in accordance with the manufacturer instructions.

Each test specimen will be composed of two sheets or one stud and one sheet of the same materials and thickness than those of the subframe components to be connected and the fixing defined for this connection.

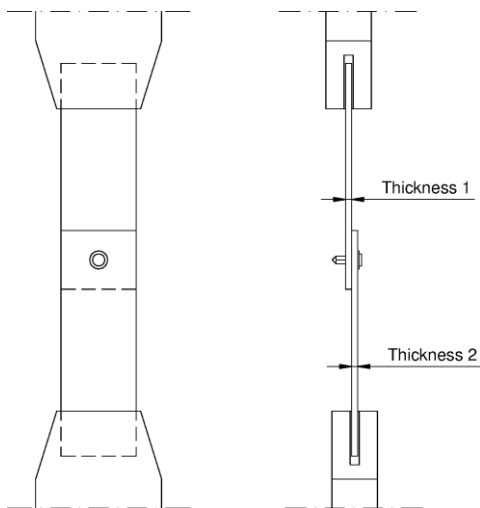
The dimensions of the sheets should be 150 x 50 mm approximately, however, other dimensions may be chosen.

Test specimens shall be conditioned for at least 2 hours at  $(23 \pm 2) ^\circ\text{C}$  before the test.

The mechanical properties of the components used for the test is to be known.

The test apparatus must consist of:

- A dynamometer,
- A test support as shown in the figure K.2.1.



**Figure K.2.1:** Example of shear test.

The test shall be carried out using a tensioning speed of 20 mm/min. When relevant, lower speed may be considered.

The fixing must be placed as described in figure K.2.1, and the force must be applied through the two sheets or through the timber stud and the sheet until failure.

Failure must be defined by any one of the following events:

1. Metal sheet or timber stud breaks.
2. Fixing breaks.

Test report should include:

- Type, material and geometry of the components.
- Each individual failure value,  $F_{iu}$  (expressed in N).
- The mode of failure description of the test specimen.
- The mean<sup>6</sup> values,  $F_m$ , and the characteristic values,  $F_C$ , in accordance with Annex N.

## **ANNEX L – RESISTANCE OF BRACKETS (HORIZONTAL AND VERTICAL LOAD)**

### **L.1 General**

The aim of the test is to determine the load bearing capacity and wind resistance of the brackets and their fixings to the subframe under shear and tension loads respectively.

Resistance of brackets shall be tested under:

- Vertical load (weight), see section L.4.1.
- Horizontal load (wind), see section L.4.2.

Test and measuring equipment shall be in accordance with section L.2.

Test specimens shall be tested in accordance with section L.3.

The mechanical properties of the components used for the test is to be known.

### **L.2 Test equipment**

The equipment is made of a traction machine of class 1 in accordance with EN ISO 7500-1, minimum capacity of 1000 daN, in the vertical axis, whose main elements are the following:

- a lower part allowing fixing of the brackets to the profile
- an upper mobile part allowing fixing to the profile.

These parts must be placed in the same axis.

Additionally, a load-displacement measurement device shall be used.

The lower part of the support is made of a rigid substrate (e.g. a horizontal basis and a vertical perpendicular surface, see figure L.2).

This substrate shall:

- be rigidly fixed on the lower tray of the machine,
- be rigid enough to allow the correct execution of the test.

Whenever the substrate is not made of steel, steel plates shall be used to provide a support surface under the brackets (minimum thickness 5 mm and with a surface area at least equal to the surface of the bracket wing, incorporating a hole of diameter equal to that of fixing).

The upper part consists of a traction device appropriate to the section of the profile.

The upper mobile part and the attached profile shall be vertically aligned with the substrate.

Displacements under load can be taken equal to displacements of the mobile crosspiece but it is preferable to have sensors of displacement:

- either in the axis of the profile
- or on the head of each bracket

Displacement sensors are linked up with a graphic recorder allowing to draw the curve strength-displacement (see figure L.1).

### **L.3 Mounting provisions of test specimens**

#### **L.3.1 Fixings of brackets to substrate**

Brackets shall be fixed to the substrate according to the following:

- Vertical load test shall be in accordance with figure L.2.
- Horizontal load test shall be in accordance with figure L.3.
- The worst position of the fixings (the weakest design) considering the use shall be tested.
- The type of anchor between the bracket and the substrate must be chosen according to the type of substrate and the manufacturer specifications. Whenever no fixings to substrate are defined by the manufacturer, bolts of suitable diameter adapted to predrilling ( $\varnothing$  6 mm minimum) by using washers shall be used.
- The fixing bolt (anchor) on the support shall be positioned in the oblong hole at the maximum specified distance from the profile.

*Note: The anchors (fixing between the bracket and the substrate) shall not represent a weak point of the test specimen.*

#### **L.3.2 Brackets**

Each test specimen shall consist of one (asymmetrical) or two brackets mounted in accordance with the specifications of the manufacturer.

Nevertheless, an asymmetrical bracket may be tested by means of two brackets in opposition on both sides of the profile. The test may be done on a single bracket as well (asymmetric layout).

Whenever several lengths of wings are available, at least the weakest mechanically bracket configuration shall be tested.

#### **L.3.3 Fixings profile-bracket**

Profile shall be fixed to brackets according to the following:

- The type of bracket fixing on the profile must correspond to the fixing to be used in the system.
- Fixings shall be installed in accordance with the specifications of the manufacturer.
- The worst position of the fixings (the weakest design) considering the use shall be tested.

#### **L.3.4 Profile**

Whenever it is possible the profile defined for the system shall be used in the test.

The metal profile can also be simulated by a square or rectangular section steel tube of 1,5 mm minimum thickness.

### **L.4 General test procedure (vertical and horizontal loads)**

A minimum of 5 specimens shall be tested

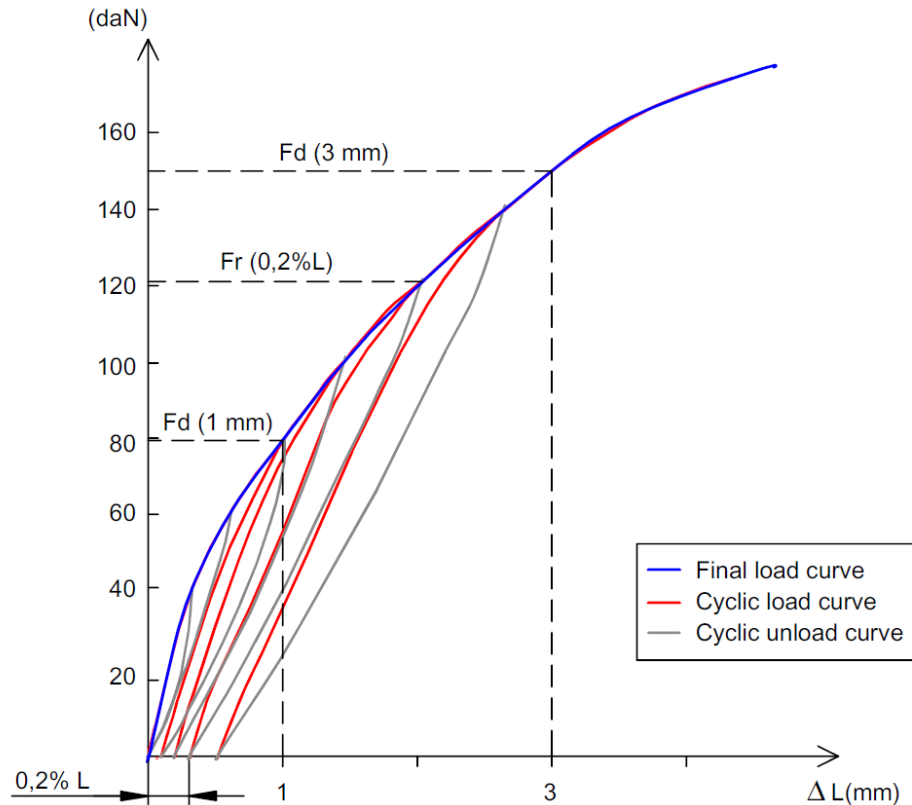
Brackets are subjected to a succession of cycles during the test. In each cycle a growing load is applied and then returned to zero.

Figure L.1 shows an example of test procedure.

Load shall be applied in constant speed to the profile in order to avoid a dynamic failure of the test specimen.



*Note: The term “displacement” refers to the measured distance at the head of wing during the application of the load. The term “Residual distortion” refers to the measured distance at the head of wing after the application of the load.*



**Figure L.1:** Example of curve strength-displacement.

According to the typology of bracket, the manufacturer shall decide if cycles are defined either by means of load growths or by means of displacement growths under load.

*Note: The manufacturer shall appraise the necessity for previous tests in order to define the most appropriate growth (load or displacement) for each bracket.*

If the cycle succession is defined according to load growths, it shall be carried out in steps of 10 daN in vertical load resistance tests and in steps of 20 daN in horizontal load resistance tests. The load shall be applied in order to meet the condition: constant speed of load < 500 daN/min.

If the cycle succession is defined according to displacement growths, it shall be carried out in steps of 0,25 mm, 0,5 mm, or 1,0 mm depending on the behaviour of the bracket under load. The load shall be applied in order to meet the condition: constant speed of load ≤ 5 mm/min.

Mean<sup>6</sup> and characteristic resistance shall be obtained for each test result series from the test specimens (“i” specimens) e.g.  $F_{r1}$  to  $F_{ri}$ ;  $F_{1d1}$  to  $F_{1di}$ ;  $F_{3d1}$  to  $F_{3di}$  and  $F_{s1}$  to  $F_{si}$ .

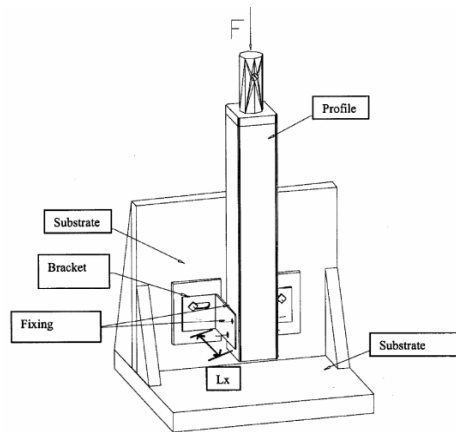
The characteristic resistance ( $R_{cr}$ ,  $R_{cd1}$ ,  $R_{cd2}$  and  $R_s$ ) of the bracket is obtained according to Annex N.

#### L.4.1 Vertical load resistance test

Vertical load test shall be carried out considering the following:

- The test specimen shall be in accordance with figure L.2.

- The test shall be carried out in accordance with section L.3.
- Test results shall be in accordance with section L.4.



**Figure L.2:** Vertical load test. Example of test device.

Following results shall be recorded during the tests:

### **1<sup>st</sup> Criterion: $F_r$ load**

$F_r$  is the load that causes a residual distortion on the bracket measured at the head of wing (after returning to zero) equal to:

$$\Delta L = \frac{0,2 \cdot L_x}{100} \quad \text{where } L_x \text{ is the length of the perpendicular wing to the substrate.}$$

*Note: To obtain  $F_r$  with accuracy, growths between cycles (load or displacement) shall be appropriate in order to avoid big gaps between the residual distortions obtained after consecutive cycles.*

### **2<sup>nd</sup> Criterion: $F_{1d}$ and $F_{3d}$ loads**

$F_{1d}$  and  $F_{3d}$  are the loads that cause a displacement under load of 1 and 3 mm respectively measured at the head of wing.

*Note: Due to the fact that  $F_{1d}$  and  $F_{3d}$  are related to displacement values instead of residual distortion values, it is possible that loads  $F_{1d}$  and/or  $F_{3d}$  can be attained before  $F_r$  load is reached.*

### **3<sup>rd</sup> Criterion: $F_s$ Load**

$F_s$  is the load that corresponds to the failure.

Failure is defined by any one of the following events:

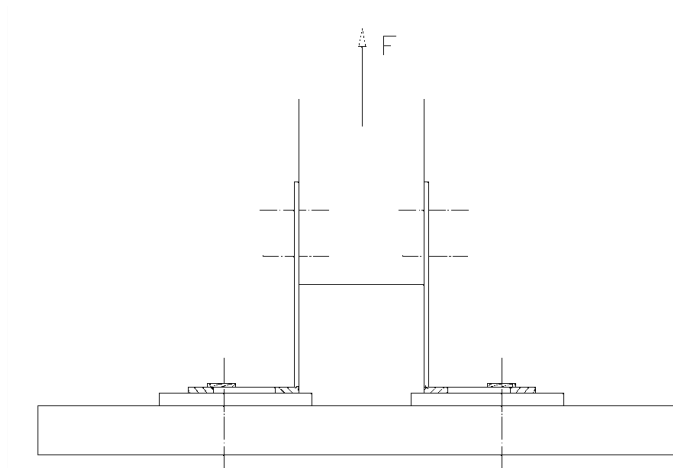
1. Any bracket breaks.
2. Any bracket presents a significant permanent deflection.
3. Any fixing breaks.

*Note: When a failure is defined by a significant permanent deflection, a unified failure criterion (e.g. 10 mm displacement) shall be followed for all test specimens belonging to the same test group.*

#### L.4.2 Horizontal load resistance test

Horizontal load test shall be carried out considering the following:

- The test specimen shall be in accordance with figure L.3. Brackets are fixed to the horizontal substrate.
- The test shall be carried out in accordance with section L.3.
- Test results shall be in accordance with section L.4.



**Figure L.3:** Horizontal load test. Example of test device.

Following results shall be recorded during the tests:

##### **1<sup>st</sup> Criterion: $F_m$ Load**

$F_m$  is the load that causes a residual distortion on the bracket measured at the head of wing (after returning to zero) equal to 1 mm.

*Note: To obtain  $F_m$  with accuracy, growths between cycles (load or displacement) shall be appropriate in order to avoid big gaps between the residual distortions obtained after consecutive cycles.*

##### **2<sup>nd</sup> Criterion: $F_t$ Load**

$F_t$  is the load that corresponds to the failure.

Failure is defined by any one of the following events:

1. Any bracket breaks.
2. Any bracket presents a significant permanent deflection.
3. Any fixing breaks.

*Note: When a failure is defined by a significant permanent deflection, a unified failure criterion (e.g. 10 mm displacement) shall be followed for all test specimens belonging to the same test group.*

## L.5 Test report

Test report shall include:

- Material and geometric characteristics of the brackets, including drawings of the brackets.
- Description of the failure of the test specimens (break, significant permanent deflection, failure of system fixings), including the failure criterion in case of failure due to significant permanent deflections.
- Figure including position and number of fixings between components for each test group.
- The number of brackets corresponding to the test results, including a reference to the use of symmetrical or asymmetrical brackets. Whenever a test has been carried out by means of two symmetrical brackets, test results shall clearly refer to the corresponding configuration.
- The curve strength-displacement for each test specimen.
- Identification of fixings (between the brackets and the substrate or between the brackets and the profile):
  - Description or generic type.
  - Dimensions (diameter, length, etc.).
  - Material.
  - Fixing method to the substrate.
  - Washers and nuts (if they are used):
    - Description or generic type.
    - Dimensions (diameter, length, etc.)
    - Material.

## ANNEX M – DURABILITY

### M.1 - HYGROTHERMAL BEHAVIOUR TEST

#### M.1.1 Principles related to the preparation of the specimen

The cladding kit must be applied, in accordance with the manufacturer's instructions, to a sufficiently stabilised masonry or concrete substrate (minimum 28 days).

Depending on the test equipment, the cladding kit may be applied to the lateral faces of the supporting wall and in its corners.

The installation details of the kit components, position of the joints between cladding elements, cladding fixings, etc. have to be checked and registered by the laboratory.

The dimension of the weather surface of the test wall shall be:

- Surface:  $\geq 6,00 \text{ m}^2$
- width:  $\geq 2,50 \text{ m}$
- height  $\geq 2,00 \text{ m}$

#### M.1.2 Hygrothermal cycles

The test apparatus is positioned against the front face of the specimen, 0,10 m to 0,30 m from the edges.

The specified temperatures during the cycles are measured at the surface of the specimen. The regulation shall be obtained by adjustment of the air temperature.

##### Heat - rain cycles:

The specimen is subjected to a series of 80 cycles (6 hours each cycle), comprising the following phases:

1. Heating to  $70^\circ\text{C}$  (rise for 1 hour) and maintaining at  $(70 \pm 5)^\circ\text{C}$  and 10% to 30% RH for 2 hours (total of 3 hours).
2. Spraying for 1 hour, water temperature  $(15 \pm 5)^\circ\text{C}$ , amount of water  $1,0 \text{ l/m}^2 \text{ min}$ .
3. Leave for 2 hours (drainage).

##### Heat-cold cycles:

After at least 48 hours of subsequent conditioning at temperature  $(20 \pm 10)^\circ\text{C}$  and a minimum relative humidity of 50%, the same test specimen is exposed to 5 heat/cold cycles of 24 hours comprising the following phases:

1. Exposure to  $(50 \pm 5)^\circ\text{C}$  (rise for 1 hour) and maximum 30% RH for 7 hours (total of 8 hours).
2. Exposure to  $(-20 \pm 5)^\circ\text{C}$  (fall for 2 hours) for 14 hours (total of 16 hours).

#### M.1.3 Observations during the tests

At periods of every four cycles during the heat/rain cycles and at every cycle during the heat/cold cycles, observations relating to a change in characteristics or performance (blistering, detachment, crazing, loss of adhesion, formation of cracks, etc.) are recorded as follows:

- the surface of the cladding element must be examined to establish whether any cracking has occurred. The dimensions and position of any cracks should be measured and recorded,
- the surface should also be checked for any blistering or peeling and the location and extent should again be recorded,

- the other specimen components should be checked for any damage/degradation together with any associated cracking of the cladding element. Again, the location and extent should be recorded.

Following the completion of the test, a further investigation is conducted involving removal of sections containing cracks to observe any water penetration.

#### **M.1.4 Test report**

The test report shall detail the following:

- Observations recorded during the test (see section M.1.3).
- Photos to detail the damages occurred on each specimen after the cycles and, if necessary, after each visual inspection.

### **M.2 - PULSATING LOAD CYCLES**

The cladding fixings shall be exposed to 10.000 load cycles at a frequency of 2 to 6 Hz.

The upper load  $F_{max}$  and the lower load  $F_{min}$  shall be chosen accordingly. In general, the following loads can be considered as appropriate:

- For kit family A, D, E & H: upper load  $F_{max} = 50\% \times F_C$ ; lower load  $F_{min} = 20\% \times F_C$  ( $F_C$  = characteristic value of the pull-through resistance (see section 2.2.12.4) determined according to Annex N).
- For kit family B: upper load  $F_{max} = 50\% \times F_C$ ; lower load  $F_{min} = 20\% \times F_C$  ( $F_C$  = characteristic value of the axial tension resistance (see section 2.2.12.6) determined according to Annex N).
- For kit family G: upper load  $F_{max} = 50\% \times F_C$ ; lower load  $F_{min} = 20\% \times F_C$  ( $F_C$  = characteristic value of the resistance of slot (see section 2.2.12.9) determined according to Annex N).
- For kit family F and, when relevant, family H: upper load  $F_{max} = 50\% \times F_C$ ; lower load  $F_{min} = 20\% \times F_C$  ( $F_C$  = characteristic value of the resistance of metal clip (see section 2.2.12.12) determined according to Annex N).

During each cycle the load shall vary like a sine curve between  $F_{max}$  and  $F_{min}$ . The displacement shall be measured during the first loading up to  $F_{max}$  and either continuously or at least after 1, 10, 100, 1.000 and 10.000 load cycles.

After completion of the load cycles the specimen shall be unloaded, the displacement measured and the relevant mechanical tests indicated in the points above shall be carried out.

Test report should include:

- type, material and geometry of the test specimen;
- results of displacement measured after 1, 10, 100, 1.000 and 10.000 cycles;
- test results shall be given according the relevant mechanical tests indicated in the points above.

### **M.3 - FREEZE-THAW CYCLES**

The number of cycles required on the geographical zones the manufacturer wants to be covered by the ETA. The following options may be used:

- Option 1: 25 freeze-thaw cycles.
- Option 2: 50 freeze-thaw cycles.

The cladding element shall be immersed in water and then subjected to freeze-thaw cycles according to section 7.4.1.3 of EN 12467.

After completion of the freeze-thaw cycles the cladding element shall be submitted to bending strength test according to section 2.2.12.1.

Additionally, the mechanical tests according to 2.2.12.4, 2.2.12.6, 2.2.12.9, 2.2.12.2 and 2.2.12.3 may be carried out after the freeze-thaw cycles.

The test results shall be given according to the relevant mechanical tests.

## ANNEX N – TEST RESULTS STATISTICAL DESCRIPTION

$$F_{u,5} = F_{\text{mean}} - k_n \cdot S$$

Where:

$F_{u,5}$  = the characteristic breaking force giving 75 % confidence that 95 % of the test results will be higher than this value

$F_{\text{mean}}$  = the mean<sup>6</sup> breaking force, either under tension or shear

$k_n$  = the variable as a function of the number of test specimens for 5 % ( $p = 0,95$ ) with 75 % confidence level when the population standard deviation is unknown (see table N.1)

$S$  = the standard deviation of series under consideration

**Table N.1** – The variable  $k_n$  as a function of the number of test specimens (see EN 1990 Eurocode: *Basis of structural design*, table D1,  $V_x$ , unknown).

Number of specimens	3	4	5	6	7	8	10	20	30	$\infty$
Variable $k_n$	3,37	2,63	2,33	2,18	2,10	2,00	1,92	1,76	1,73	1,64



**ANNEX O - FAÇADE FIRE PERFORMANCE ASSESSMENT METHODS**

<b>Country</b>	<b>Assessment method</b>
Austria	ÖNORM B 3800-5
Czech Republic	ČSN ISO 13785-1
Denmark, Sweden, Norway	SP Fire 105
Finland	<ul style="list-style-type: none"> <li>• SP Fire 105</li> <li>• BS 8414</li> </ul>
France	LEPIR 2
Germany	<ul style="list-style-type: none"> <li>• DIN 4102-20 Complementary reaction-to-fire test for claddings of exterior walls,</li> <li>• Technical regulation A 2.2.1.5</li> </ul>
Hungary	MSZ 14800-6:2009 Fire resistance tests. Part 6: Fire propagation test for building façades
Ireland	BS 8414 (BR 135)
Poland	PN-B-02867:2013
Slovak Republic	ISO 13785-2
Switzerland, Lichtenstein	<ul style="list-style-type: none"> <li>• DIN 4102-20</li> <li>• ÖNorm B 3800-5</li> <li>• Prüfbestimmung für Aussenwandbekleidungssysteme</li> </ul>
UK	BS 8414 -1:2015 and BS 8414-2:2015