EAD **090019-01-0404**

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European Assessment Document for

Kits for external wall claddings of expanded glass granulated boards, magnesium oxide boards or other mineral boards with rendering applied on site

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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) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The EAD covers the assessment of kits for external wall claddings mechanically fixed where the cladding element is made of boards where a rendering system is applied on site (from now on “cladding kit with rendering” or “kit”).

The EAD is applicable to the cladding kits with renderings belonging to the Family 1 to Family 3 indicated in Table 1.1.1 or a combination of these families. They consist of the following components[1]:

1. Cladding elements composed of boards (see clause 1.1.1) and a reinforced rendering system (see clause 1.1.2) applied on site on the external surface (from now on the term “cladding element” is used when it is referred to the group of board and reinforced rendering system).

2. Board-fixings (see clause 1.1.3) for mechanical (not glued) fastening the boards to the subframe by means of screws, nails or rivets. Board-fixings are related to cladding fixings belonging to Family A according to Table 1.1.1 of EAD 090062-01-0404 or to Type 6 according to Table 1.1.1 of EAD 090034-01-0404, however, the head of the board-fixings are covered by the rendering system applied on site.

3. Subframe, see clause 1.1.3 of EAD 090062-01-0404.

4. Thermal insulation layer (optional), see clause 1.1.4 of EAD 090062-01-0404.

5. Breather membrane (optional) and other ancillary components (optional), see clause 1.1.5 of EAD 090062-01-0404.

The cladding kits with renderings covered by this EAD always include the cladding elements (boards and rendering systems). When the cladding elements are not provided by the manufacturer this EAD does not apply.

The cladding kits with renderings are non-load bearing construction elements. They do not contribute to the stability of the substrate on which they are installed. The cladding kits with renderings 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. They may have influence in the annual balance of water vapour resistance of the complete composition of the external wall including the cladding kit (mainly in the case of Use 2 according to clause 1.2.1).

Cladding kits with renderings do not contain windows or door products.

This EAD is applicable to the following compositions of the kits:

- Complete kits (rendering systems, boards, board-fixings, subframe components and optionally, breather membranes, thermal insulation products and other ancillary components).

- Minimum kits (rendering systems, boards, board-fixings), the other components of the external wall cladding systems (at least the subframe components) shall be available on the market and described in the ETA according to clauses 1.1.3 to 1.1.5 of EAD 090062-01-0404 as part of the intended use of the kit, therefore, these components are part of the product assembly and are necessarily used within the product assessment process. This also applies for intermediate composition kits with components between minimum kits and complete kits.

Between the cladding elements and the thermal insulation layer or the substrate, there is an air space which is always drained and may be ventilated or not (see clause 1.3.10 of EAD 090062-01-0404).

There are no open joints between cladding elements, open joints for the ventilated air space are included at the building base points and at the roof edges (see clause 1.3.11 of EAD 090062-01-0404).

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1 Any kit component may be produced (manufactured) or not produced (purchased on the market or from a specific supplier) by the kit manufacturer.

Table 1.1.1 Description of the cladding kit with rendering families

Family of cladding kits with renderings	**Description of the cladding kits with renderings**
Family 1 (see Figure 1.1.1)	The boards of the cladding elements are mechanically fastened to the subframe made of vertical metal profiles.
Family 2 (see Figure 1.1.2)	The boards of the cladding elements are mechanically fastened to the subframe made of horizontal metal profiles.
Family 3 (see Figure 1.1.3)	The boards of the cladding elements are mechanically fastened to the subframe made of vertical and / or horizontal wood/timber studs.

Figures 1.1.1 to 1.1.3 are schematic representations of the families of cladding kits with renderings described in Table 1.1.1 (with different types of substrates, with thermal insulation and indicating by means of arrows the air flow in case of ventilated cladding kits with renderings).

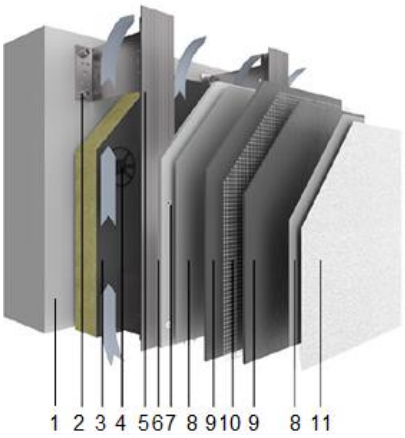

Figure 1.1.1: Example of cladding kits with renderings Family 1 with vertical metal profiles.

Legend (for Figures 1.1.1 to 1.1.3):

1. Substrate.
2. Subframe brackets.
3. Thermal insulation panel.
4. Thermal insulation mechanical fixing.
5. Subframe profiles.
6. Board.
7. Board-fixing.
8. Key coat (primer).
9. Base-coat.
10. Reinforcement mesh.
11. Finishing-coat.

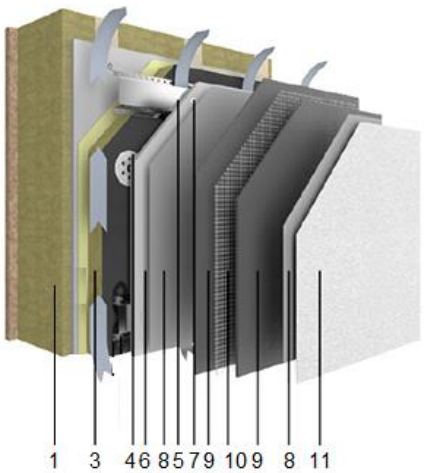

Figure 1.1.2: Example of cladding kits with renderings Family 2 with horizontal metal profiles.

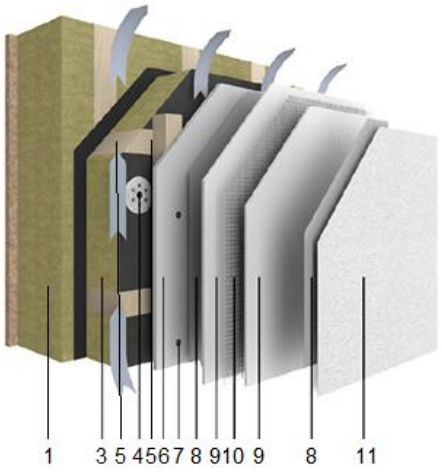

Figure 1.1.3: Example of cladding kits with renderings Family 3 with vertical and / or horizontal wood/timber studs.

The product is not fully covered by the following harmonised technical specification:

- Boards' harmonised technical standards (hEN) (see Table 1.1.1.1) because they do not cover kits, they only cover cladding elements alone and more generic intended uses (not the specific use for ventilated and non-ventilated façades).

- EAD 090062-01-0404 because it covers cladding kits where the cladding elements are made of one fully body material (except TMCS[2]) without rendering applied on site.

- EAD 090058-00-0404 because it covers cladding kits where the cladding elements are made of composite metallic honeycomb panels and the cladding fixings and the subframe have a very specific composition different to the kit families given in Table 1.1.1. This EAD does not cover this type of composite cladding elements nor the specific cladding fixing and subframe.

- EAD 090097-00-0404 because it covers claddings kits where the cladding elements are glued to the subframe by means of an adhesive system and where the cladding elements are made of one fully body material (except TMCS) without rendering applied on site. Mechanical cladding fixings may be considered as supplementary components. This EAD does not cover this way for fastening the cladding elements.

- EAD 090125-00-0404 because it covers cladding kits where the cladding element is a composite panel made of multilayer rigid materials without rendering applied on site. This EAD does not cover this type of composite cladding elements.

- EAD 090034-01-0404 because it only covers kits that do not contain the cladding elements. Kits covered by this EAD always include the cladding element.

- EN 1090-1[3] because this harmonised standard does not apply to non-structural products (see FAQ number 31 on European Commission website https://ec.europa.eu/growth/sectors/construction/construction-products-regulation-cpr/frequently-asked-questions_en). Besides, the cladding elements are not included in this standard.

- EN 13830 because this harmonised standard covers curtain walling kits which are very different products intended to form external walls, and not intended as coverings of external walls.

Compared to the previous version of the EAD, the following changes are introduced:

- Extension of the scope by considering:

  - New boards materials: magnesium oxide boards and other mineral boards included in EAD 090119-00-0404 for considering the merging of both EADs, (see Table 1.1.1.1).

  - New finishing-coat for the rendering system made of thin elastic strips bonded by organic adhesive on the basecoat (see clause 1.1.2).

- Reworking of the document for its alignment with the EAD 090062-01-0404 and improving the descriptions in the document.

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

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

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA as long as the details of the assessment methods as laid down in this EAD are respected.

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2 TMCS = Thin Metal Composite Sheet.

3 All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

1.1.1 Boards

Boards covered by this EAD are made of the materials given in Table 1.1.1.1 for exterior use, that are installed by means of board-fixings (see clause 1.1.3) to the subframe profiles.

Minimum data for describing the boards are the type of material, dimensions, density or weight per square meter and those properties indicated in clause 3.2.

Joints between boards are treated by means of joint fillers (including mortars) and / or joint tapes (reinforcement mesh strips).

Table 1.1.1.1 Board materials and associated product technical specifications

Board materials	Associated product technical specifications	
	Harmonised technical specifications	Others
Expanded glass granulates	---	See clause 1.1.1.1
Magnesium oxide	---	See clause 1.1.1.2
Fibre-cement	EN 12467	---
Gypsum boards with fibrous reinforcement	EN 15283-1; EN 15283-2	---
Cement bonded board Cement bonded particle board	EAD 210024-00-0504	EN 634-1; EN 634-2

1.1.1.1 Expanded glass granulate boards

Lightweight boards made of expanded glass granulated and reactive resins with glass-fibre mesh reinforcement on both sides. From now on EGG boards.

1.1.1.2 Magnesium oxide boards

Mineral boards based on MgO (magnesium oxide or magnesia) / $MgSO_4$ (magnesium sulphate) binders, filled by filler as for example SiO_2 (silicon dioxide or silica) or sawdust, and with glass-fibre mesh reinforcement on both sides. From now on MgO boards.

1.1.2 Rendering systems

Rendering systems are composed of the following components:

1. Base-coat: cement- or organic- based mortar applied directly onto the board with or without a key coat; e.g., cement-based mortars according to EN 998-1, organic based mortars according to EN 15824 or cement-based adhesives according to EN 12004.

2. Reinforcement mesh: glass-fibre mesh according to EAD 040016-01-0404 embedded into the base-coat to provide most of the mechanical properties of the rendering system.

3. Key-coat (optional): organic- or organic/silicate- based very thin coat that is applied on the board and/or on the base-coat and acts as a preparation for the application of the base-coat and finishing-coat respectively. In specific cases it may be used also for aesthetic reasons. Key-coat is also called primer or impregnation.

4. Finishing-coat: coat which contributes to the protection against weathering and may provide a decorative finishing. It is applied onto the base-coat with or without a key coat. This EAD covers the following types of finishing-coats:

    a. Cement- or organic- based mortar; e.g., cement-based mortars according to EN 998-1 and organic based mortars according to EN 15824.

    b. Paints; e.g., paints classified according to EN 1062-1.

c. Thin elastic resin strips of dimensions up to 200 mm x 500 mm and of thickness up to 5 mm. They are pre-made of mixture of aggregate of specified grain, elastic resin, admixtures, additives and pigments. Thin elastic resin strips are bonded separately to the base-coat by means of an elastic organic resin adhesive.

Type of finishing-coats is specified by used type and quantity of binder, type of used aggregate, mass and type of admixtures (for example of fibres) and mass and type of additives: Where the only difference between two finishing-coats is due to the size of the aggregate, they are considered as one type.

5. Decorative-coat (optional): acrylic or acrylic- / siloxane-based coat which generally contributes to the aesthetic finishing (e.g., for covering efflorescence) of the finishing-coat and may also provide supplementary protection against weathering.

Minimum data for describing these components are the type of material, thickness range, density or weight per square meter and those properties indicated in clause 3.2.

1.1.3 Board-fixings

Board-fixings are screws, nails or rivets used for fastening the boards to the subframe.

Board-fixings are made of metal materials (stainless steel, hot-dipped zinc steel, zinc galvanized steel, aluminium alloy, or copper).

Minimum data for describing the board-fixings are the geometric and physical parameters (such as cross-section shape and dimensions, weight, distance range between two board-fixings, distance range to the board borders) and material parameters (such as type of material, specific gravity, mechanical material properties). Exceptionally when justified for avoiding ambiguities, these data may be accompanied by adding the trade name of the component.

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

1.2.1 Intended use(s)

This EAD covers the following intended use s:

- Use 1: Ventilated cladding systems (rain-screens) for external walls (for Family 1, for Family 2 with metal profiles when the horizontal profiles are perforated and for Family 3 with vertical wood/timber studs and for Family 3 with horizontal studs on vertical studs that allows the air space).

- Use 2: Non-ventilated cladding systems for external walls (all families).

Besides, this EAD covers cladding kits where the cladding element is intended to be in vertical or inclined (slopped) with a maximum inclination (positive or negative) from vertical up to 30º. The substrate may be vertical or inclined with maximum inclination (positive or negative) from vertical up to 45° (see Clause 3.1.2 of EN 508-1).

Cladding kits with renderings are mechanically fixed to external walls (from now on “substrate”) 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).

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 with rendering 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[4].

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

1.3 Specific terms used in this EAD

Specific terms and symbols included in clauses 1.3.1 to 1.3.3, 1.3.6 to 1.3.14 of EAD 090062-01-0404 apply.

1.3.1 Cladding element

Cladding element is composed of a board for exterior use (see clause 1.1.1) and of a continuous reinforced rendering system applied on site (see clause 1.1.2). The boards are installed by means of the board-fixings (see clause 1.1.3) through a subframe to the external surface of the external walls. Cladding element may also be called “skin element”.

[4] 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.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of cladding kit with rendering is assessed in relation to the essential characteristics.

Table 2.1.1 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	EAD 090062-01-0404, clause 2.2.2	Description / Class / Level (as relevant)
3	Propensity to undergo continuous smouldering	EAD 090062-01-0404, clause 2.2.3	Description
4	Adhesion of core at high temperature (only for kits with MgO boards)	2.2.2	Description
Basic Works Requirement 3: Hygiene, health and the environment			
5	Watertightness (protection against driving rain)	EAD 090062-01-0404, clause 2.2.4	Level
6	Water absorption	2.2.3	Level
7	Water vapour permeability	2.2.4	Level
8	Drainability	EAD 090062-01-0404, clause 2.2.7	Description
9	Content, emission and/or release of dangerous substances	EAD 090062-01-0404, clause 2.2.8	Description
Basic Works Requirement 4: Safety and accessibility in use			
10	Wind load resistance	EAD 090062-01-0404, clause 2.2.9	Level
11	Resistance to horizontal point loads	EAD 090062-01-0404, clause 2.2.10	Description
12	Impact resistance	2.2.5	Description
13	Bond strength (*)	2.2.6.1	Level
14	Bending strength (*)	2.2.6.2	Level
15	Pull-through resistance (*)	EAD 090062-01-0404, clause 2.2.12.5	Level
16	Pull-through resistance under shear loads (*)	EAD 090062-01-0404, clause 2.2.12.6	Level
17	Combined tension and shear load resistance (**)	EAD 090062-01-0404, clause 2.2.12.9	Level
18	Resistance of profiles (*)	EAD 090062-01-0404, clause 2.2.12.14	Description

No	Essential characteristic	Assessment method	Type of expression of product performance
19	Pull-through resistance of fixings from profile (only for kits Family 2)	EAD 090062-01-0404, clause 2.2.12.12	Level
20	Tension/pull-out resistance of subframe fixings (*)	EAD 090062-01-0404, clause 2.2.12.15	Level
21	Shear load resistance of subframe fixings (*)	EAD 090062-01-0404, clause 2.2.12.16	Level
22	Brackets resistance (horizontal and vertical load) (*)	EAD 090062-01-0404, clause 2.2.12.17	Level
23	Resistance to seismic loads. Out-of-plane fundamental vibration period	EAD 090062-01-0404, clause 2.2.13.1	Level
24	Resistance to seismic loads. Out-of-plane acceleration	EAD 090062-01-0404, clause 2.2.13.2	Level
25	Resistance to seismic loads. In-plane displacement	EAD 090062-01-0404, clause 2.2.13.3	Level
Basic Works Requirement 5: Protection against noise			
26	Airborne sound insulation	EAD 090062-01-0404, clause 2.2.14	Level
Basic Works Requirement 6: Energy economy and heat retention			
27	Thermal resistance	EAD 090062-01-0404, clause 2.2.15	Level
Aspects of durability (***)			
28	Hygrothermal behaviour	2.2.7.1	Level
29	Freeze-thaw resistance	2.2.7.2	Level
30	Behaviour after immersion in water	EAD 090062-01-0404, clause 2.2.16.4	Level
31	Dimensional stability by humidity	2.2.7.3	Level
32	Flatness stability by humidity	2.2.7.4	Level
33	Linear thermal expansion	2.2.7.5	Level
34	Chemical and biological resistance	EAD 090062-01-0404, clause 2.2.16.6	Level
35	UV radiation resistance	EAD 090062-01-0404, clause 2.2.16.7	Level
36	Corrosion	EAD 090062-01-0404, clause 2.2.16.8	Description

(*) Mechanical resistance of the kit is assessed by means of the mechanical characteristics of the relevant kit components and their connexions. See clause 2.2.6 and relevant clauses 2.2.12 in EAD 090062-01-0404.

(**) Only relevant for cladding kits which contain inclined (sloped) surfaces.

(***) Durability of the kit is assessed by means of relevant component durability, where relevant. See clause 2.2.7 and relevant clauses 2.2.16 in EAD 090062-01-0404.

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

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer, and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant essential characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

All test results of mechanical characteristics shall be rounded downwards according to EN ISO 80000-1 for three valid places.

2.2.1 Reaction to fire

Reaction to fire of the kits shall be assessed by considering the reaction to fire of the components (cladding elements (rendering system and boards), board-fixings, subframe components, thermal insulation products, etc.), in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

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

For the assessment of reaction to fire of the kits, one of the following options shall apply:

a) The kits shall be assessed based on the worst reaction to fire class of the kit components obtained according to a CWFT[5] Decision or tested using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1.

   Note: if option a) is followed, the field of application of the individual reaction to fire class of every kit component (i.e., the product and installation conditions for which the reaction to fire of the individual component is valid) shall completely match the end-use conditions of such a component when assembled into the kit.

b) If the option (a) leads to too onerous classification of the kits, or if classification for one or several components are missing, then the kits shall be tested, using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1 (reference method in case of dispute).

Criteria indicated in Annex B shall be taken into account. Associated mounting and fixing rules for the SBI test as well as for tests according to EN ISO 11925-2 shall be in accordance with Annex C.

The kits shall be classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

When the thermal insulation products are part of the kits, the individual reaction to fire of the thermal insulation products shall be assessed, depending on the material, according to the thermal insulation product standards given in clause 1.1.4 of EAD 090062-01-0404. The thermal insulation products shall be classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

When subframe stud made of wood/timber are part of the kits, the individual reaction to fire of these subframe studs shall be assessed according to a CWFT Decision or tested using the method(s) relevant

5 CWFT = Classified without Further Testing.

for the corresponding reaction to fire class according to EN 13501-1. The subframe studs made of wood/timber shall be classified according to the Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Components fulfilling the conditions as stated in clause B.6 of EAD 090062-01-0404 shall be considered as small components without the need for testing and assessment of their reaction to fire performance, except where it is explicitly prescribed in Annexes B and C.

2.2.2 Adhesion of core at high temperature

This characteristic is only applicable for cladding kits with renderings where the boards of the cladding element are MgO boards (see clause 1.1.1.2).

The adhesion of core at high temperature shall be assessed by testing according to the method given in clause 5.10 of EN 520, on at least six test specimens. Test specimens shall be prepared according to clause 5.10.3 of EN 520.

If some test specimen breaks during test (for example crumbled into more parts), the test shall be repeated with new set of test specimens. The test series shall be stopped after the second set of test specimens.

Any break during the test of each specimen (for example crumbled into more parts) shall be noted.

The description of appearance of test specimen after the test (if test specimen is crumbled or not) and the number of broken test specimens shall be stated in the ETA.

2.2.3 Water absorption

The assessment of the kits' water absorption is carried out by means of the assessment of the water absorption of the relevant kit components (cladding elements (boards and rendering systems) and thermal insulation products) that are representative of this essential characteristic for cladding kits with renderings.

Water absorption of the following kit components shall be assessed:

- Rendering systems on the board, see clause 2.2.3.1.
- Boards alone, see clause 2.2.3.2.
- Thermal insulation products (when it is part of the kit): according to EN ISO 29767 for short-term water absorption by partial immersion, EN ISO 16535 for long-term water absorption by immersion or EN ISO 16536 for long-term water absorption by diffusion depending on the material of thermal insulation products (see clause 1.1.4 of EAD 090062-01-0404).

The arithmetic average value and the maximum value shall be stated in the ETA according to the procedures and standards given above.

The values shall cover the range of density of the kit component material.

2.2.3.1 Water absorption by capillarity

Water absorption by capillarity shall be tested according to Annex D.

Testing shall be carried out:

- for the whole rendering system (base-coat with the reinforcement mesh, finishing-coat and where relevant, key-coat and decorative coat) to be considered in the kit assessment, and
- for the reinforced base-coat alone.

The test specimens shall be prepared with the actual board as the substrate. The edges of test specimens shall be protected to ensure that only the rendering system or the reinforced base-coat is subject to water absorption.

Only the rendering system or reinforced base-coat of the test specimens shall be submerged in a water bath.

When relevant, the test specimens shall be prepared at the same time as:

- the rig for the hygrothermal behaviour test (see clause 2.2.7.1), and
- the specimens for freeze-thaw resistance test (see clause 2.2.7.2).

The arithmetic average values and the maximum values of water absorption [in kg/m^2] after 3 minutes, 1 hour and 24 hours (for the whole rendering system and for the reinforced base-coat alone) shall be stated in the ETA.

The values of this characteristic are also to be used for the following durability characteristics:

- Hygrothermal behaviour. See clause 2.2.7.1. For deciding the finishing-coats to be applied in the hygrothermal test specimen.
- Freeze-thaw resistance. See clause 2.2.7.2. For deciding whether the freeze/thaw resistance testing shall be carried out.

2.2.3.2 Water absorption of the boards

Water absorption of the boards shall be assessed according to the test standards indicated in Table A.1 depending on the type of board material.

At least, two test specimens shall be tested. Test specimens shall be prepared according to the corresponding standards given in Table A.1.

The arithmetic average value and the maximum value shall be stated in the ETA according to the standards given in Table A.1.

The values shall cover the range of density of the board material.

2.2.4 Water vapour permeability

Clause 2.2.6 of EAD 090062-01-0404 applies considering that the so-called “cladding element” in the EAD 090062-01-0404 is the set of the board and the rendering system (see clause 1.3.1), therefore the values to be stated in the ETA shall be referred to this set of components.

2.2.5 Impact resistance

Impact resistance of cladding kit with rendering shall be assessed according to clause 2.2.11 of EAD 090062-01-0404 by considering the following adjustments:

- The so-called “cladding element” in the EAD 090062-01-0404 is the set of board and rendering system (also called cladding element, see clause 1.3.1) according to this EAD.
- Hard body impacts shall be assessed for each combination of rendering system to be considered in the assessment.
- The diameter of the hard body impacts on the rendering systems shall be measured and recorded.

Hard body impacts are also to be used for the assessment of the following durability characteristics:

- Hygrothermal behaviour. See clause 2.2.7.1.
- Freeze-thaw resistance. See clause 2.2.7.2.

2.2.6 Mechanical resistance

The assessment of the kits mechanical resistance is carried out by means of the assessment of the mechanical resistance of the relevant kit components (rendering systems, boards, board-fixings and subframe components) and the connexions between them (see clauses 2.2.6.1 and 2.2.6.2 and Table 2.1.1, rows 15 to 21), which are representative of this essential characteristic for cladding kits with renderings.

2.2.6.1 Bond strength

The assessment of the kit bond strength is carried out by means of the assessment of the rendering system bond strength on the board, which is representative of this essential characteristic for the kit.

Bond strength or adhesion between the rendering system and the board (in dry and other conditions) shall be tested according to the method given in Annex E.

Tests shall be carried out for the connections and the conditionings given in Table E.1.1.

The test specimens shall be prepared with the actual board as the substrate.

Test shall be carried out for each combination of board material with the reinforced base-coat alone or the rendering system (including different finishing-coats).

When a finishing-coat includes a range of different aggregate sizes, for reducing the tests, the worst finishing-coat (i.e., the one with minimum bond strength resistance value) may be defined by considering one indicative test specimen for each aggregate size. Once the worst case has been defined, the assessment may be carried out for this worst case and the obtained values shall be considered for the other finishing-coats.

When relevant, the test specimens shall be prepared at the same time that:

- the rig for the hygrothermal behaviour test (see clause 2.2.7.1), and
- the specimens for freeze-thaw resistance test (see clause 2.2.7.2).

The arithmetic average value and minimum value of bond strength and the rate (in %) of rupture types (cohesive rupture and/or adhesive rupture) shall be stated in the ETA.

The values of this characteristic are also to be used for the assessment of the following durability characteristics:

- Hygrothermal behaviour. See clause 2.2.7.1.
- Freeze-thaw resistance. See clause 2.2.7.2.

2.2.6.2 Bending strength

The assessment of the kit bending strength is carried out by means of the assessment of the board (see clause 1.1.1), which is representative of this essential characteristic for the kit.

The bending strength (including the modulus of elasticity where relevant) of the boards shall be assessed according to the test standards indicated in Table A.1 depending on the board materials. At least 5 test specimens shall be considered unless the test procedure given in Table A.1 indicates otherwise.

At least the worst case (the mechanically weakest case, i.e., weakest material and minimum thickness) shall be tested.

The arithmetic average value R_m [in N/mm^2] and the characteristic value R_C in [N/mm^2] according to equation (N.1) of EAD 090062-01-0404 shall be stated in the ETA.

The values shall cover the range of density and thickness of the boards.

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

- Behaviour after immersion in water. See row 30 in Table 2.1.1.

2.2.7 Durability aspects

2.2.7.1 Hygrothermal behaviour

Hygrothermal behaviour of the kit shall be assessed by means of bond strength test (see clause 2.2.6.1) and hard body impact test (see clause 2.2.5) of specimens taken from the assembled kit submitted to:

- The hygrothermal cycles given in clause F.1 (reference method).
- The combined test with hygrothermal and freeze-thaw cycles given in clause F.2 for more severe climatic conditions (e.g., climatic conditions in the Middle Europe).

At least the worst case shall be considered (i.e., minimum bond strength, maximum water absorption by capillarity, minimum thickness of kit components, without the breather membrane, etc.). See also clause F.1.2.

It is possible to carry out the test only with the external layers of the kit (rendering system and board).

The number of hygrothermal testing rigs shall be decided by considering the statements given in clause F.1.1.

After the test of hygrothermal behaviour, the following additional tests shall be carried out on the rig (or separate test specimens after hygrothermal cycles):

- Bond strength according to clause 2.2.6.1 for all the whole rendering systems and reinforced base-coats alone considered in the test rig.
- Hard body impact resistance according to clause 2.2.5 for all the whole rendering systems considered in the test rig.

The following values shall be stated in the ETA:

- Minimum value and arithmetic average value of bond strength tests (see clause 2.2.6.1) after hygrothermal cycles [in kPa].
- Ratio (division between the results after and before cycles) [in %] between the bond strength arithmetic average value after hygrothermal cycles test and the arithmetic average value in the bond strength tests without hygrothermal cycles (at initial state indicated in point a) of Table E.1.1).
- Hard body impact resistance [in J] of each tested rendering system configuration.
- Description of any of the following defects if they occur during or at the end of the hygrothermal cycles programme:
  - Deterioration such as cracking or delamination of the rendering system or the boards that allows water penetration to the board.
  - Deterioration or cracking associated with joints between the boards.
  - Detachment of the rendering system or the board.
  - Visual permanent deformation.

2.2.7.2 Freeze-thaw resistance

Freeze-thaw resistance behaviour of the kit shall be assessed by means of bond strength test (see clause 2.2.6.1) and hoard body impact test (see clause 2.2.5) of specimens taken from the assembled kit submitted to the freeze-thaw cycles given in Annex G.

The freeze-thaw resistance test shall only be carried out when the water absorption by capillarity of the whole rendering system (see clause 2.2.3.1) is greater or equal than 0,5 kg/m² after 24 hours.

At least the worst case shall be considered (i.e., minimum bond strength, maximum water absorption by capillarity, minimum thickness of kit components, without the breather membrane, etc.). See also clause F.1.2.

It is possible to carry out the test only with the external layers of the kit (rendering system and board).

After the test of freeze-thaw cycles, the following additional tests shall be carried out:

- Bond strength according to clause 2.2.6.1 for all the whole rendering systems and reinforced base-coats alone considered in the test rig.

- Hard body impact resistance according to clause 2.2.5 for all the whole rendering systems considered for freeze-thaw cycles.

The following data shall be stated in the ETA:

- Minimum value and arithmetic average value of bond strength tests (see clause 2.2.6.1) after freeze-thaw cycles [in kPa].

- Ratio (division between the results after and before cycles) [in %] between the bond strength arithmetic average value after freeze-thaw cycles test and the arithmetic average value in the bond strength tests without freeze-thaw cycles (at initial state indicated in point a) of Table E.1.1).

- Hard body impact resistance [in J] of each tested rendering system configuration.

- Description of any of the following defects if they occur during or at the end of the freeze-thaw cycles programme:

  - Deterioration such as cracking or delamination of the rendering system or the boards that allows water penetration to the board.

  - Deterioration or cracking associated with joints between the boards.

  - Detachment of the rendering system or the board.

  - Visual permanent deformation.

2.2.7.3 Dimensional stability by humidity

The assessment of the dimensional stability by humidity of the kit is carried out by means of the assessment of the relevant kit components (i.e., boards and subframe wood studs) which are representative of this essential characteristic for the kit.

The dimensional variations of the kit components associated with changes in relative humidity shall be assessed according to the following technical specifications:

- EN 12467 clause 5.4.3 for fibre-cement boards, expanded glass granulates boards and MgO boards.

- EN 318 for subframe studs made of wood materials, cement bonded boards, cement bonded particle boards and gypsum boards with fibrous reinforcement.

  In the case of subframe studs, the following adaptation of the standard shall be considered:

- Test pieces shall be stud pieces with length (300 ± 2) mm and the actual cross-section of the stud that replaces the dimensions (50 ± 2) mm and “panel thickness” defined in the clause 5 of the EN 318. Thickness shall be considered as the smallest dimension of the cross-section stud.

The maximum values in [mm/m] shall be stated in the ETA.

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

2.2.7.4 Flatness stability by humidity

The assessment of the flatness stability by humidity of the kit is carried out by means of the assessment of the boards which are representative of this essential characteristic for the kit.

The flatness variations of the boards associated with changes in relative humidity shall be assessed according to EN 14617-12. Before the test, the test specimens shall be covered by the reinforced base-coat on front face, opposite to rear side covered by wet felt. Differently from Clause 7 of EN 14617-12, deformation shall be measured after 48 hours of exposition.

The maximum values in [mm] shall be stated in the ETA.

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

2.2.7.5 Linear thermal expansion

The assessment of the linear thermal expansion of the kit is carried out by means of the assessment of the relevant kit components (i.e., boards and subframe profiles) which are representative of this essential characteristic for the kit.

The dimensional variations of the kit components associated with changes in temperature shall be assessed according to the following technical specifications:

- EN 14617-11 for all the boards materials given in Table 1.1.1.1. Clause 6 of EN 14617-11 shall be replaced by: “The shape and dimensions of the test specimen shall be selected according to the dimensions of the dilatation sample holders. A length of the specimen not smaller than 10 mm shall be considered. The measurement shall be repeated on at least three different samples”.

For subframe components made of steel and aluminium materials, values given in clause 3.2.6 of EN 1993-1-1 and clause 5.2.5 of EN 1999-1-1 shall be stated in the ETA.

The maximum values in [mm/m] shall be stated in the ETA.

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

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 Commission 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[6] the applicable AVCP systems regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision.

6 Including propensity to undergo continuous smouldering, where relevant.

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 3.2.1.

The manufacturer (regarding the components he buys from the market with DoP) shall take into account the Declaration of Performance issued by the manufacturer of that component. No retesting is necessary.

Table 3.2.1: Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Reaction to fire (i)				
	▪ Reaction to fire (for any classification)	Indirect tests as specified in Table 3.2.2, Table 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.3.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.3.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.3.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404
	▪ Reaction to fire (for class A1)	Direct test according to EN ISO 1182	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class A1 or A2)	Direct test according to EN ISO 1716	According to Control Plan	According to test method and Control Plan (v)	At least once each two years
	▪ Reaction to fire (for class A2 to D)	Direct test according to EN 13823 (ii)	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class B to F)	Direct test according to EN ISO 11925-2	According to Control Plan	According to test method and Control Plan (v)	(iv)
2	When applicable, Propensity to undergo continuous smouldering	Direct control method based on relevant clause 2.2.3 of EAD 090062-01-0404	According to Control Plan	One (v)	At least once each two years
		Indirect tests as specified in Table 3.2.2, Table 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404	See Table 3.2.2, Table 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404
3	Components produced by the manufacturer himself:				
	▪ Boards	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2
	▪ Base-coat, key-coat, finishing-coat and decorative coat	See Table 3.2.3	See Table 3.2.3	See Table 3.2.3	See Table 3.2.3
	▪ Glass fibre reinforcement mesh	See clause 3.2 of EAD 040016-01-0404	See clause 3.2 of EAD 040016-01-0404	See clause 3.2 of EAD 040016-01-0404	See clause 3.2 of EAD 040016-01-0404
	▪ Board-fixings and subframe components	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404	See Table 3.2.3 of EAD 090062-01-0404

Table 3.2.1: Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
	▪ Thermal insulation products	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404	See Table 3.2.4 of EAD 090062-01-0404
	▪ Ancillary components	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
4	▪ Components not produced by the manufacturer himself (iii)	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404	See Table 3.2.5 of EAD 090062-01-0404

(i) Indirect tests shall be applied to all components independent from the source of their classification (Testing, Decision 96/603/EC as amended or any other applicable CWFT decision). Direct tests within the FPC shall only apply to those components where the classification is based on the prescribed tests for the corresponding class(es) according to Commission Delegated Regulation (EU) 2016/364 and EN 13501-1.

(ii) If it is necessary to perform SBI tests within the FPC, the test set-up that was classified as the worst case within the ETA procedure shall be tested.

(iii) Components produced by the supplier under the specifications of the manufacturer.

(iv) The tests shall always be carried out whenever the performance is not verified by means of indirect tests (see Tables 3.2.2 and 3.2.3 and Tables 3.2.3 to 3.2.5 of EAD 090062-01-0404) or, at least, once each five years when the indirect tests verify the performance. For this minimum frequency, the sufficient correlation between the foreseen system of indirect FPC measures and the direct tests shall be stated in the Control Plan. Otherwise, the minimum frequency of direct tests within the FPC shall be at least once per two years.

(v) The necessary number of specimens shall be detailed in the Control Plan depending on the test method and the class to be verified within the FPC. The tests shall be performed on randomly taken specimens from the production process.

Table 3.2.2: Control plan when the board 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) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Checking of supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Process					
2	When relevant, fire-retardant quantity (i)	Quantity measurement	According to Control Plan	---	Each batch
Finished component					
3	Geometry (form and dimensions) (i)	Depending on the material, according to the technical specifications defined in Table 1.1.1.1. Otherwise, measuring, visual check or clause 3.4.1	According to Control Plan	According to Control Plan	Daily(ii)
4	Dimensional stability by humidity	Test based on clause 2.2.7.3	According to Control Plan	According to Control Plan	According to Control Plan (ii)
5	Flatness stability by humidity	Test based on clause 2.2.7.4	According to Control Plan	According to Control Plan	According to Control Plan (ii)
6	Density or mass per unit area or per unit (i)	Depending on the material, according to the technical specifications defined in Table 1.1.1.1. Otherwise, clause 3.4.1	According to Control Plan	According to Control Plan	Daily (ii)
7	Bending strength	Test based on clause 2.2.6.2	According to Control Plan	According to Control Plan	According to Control Plan (ii)
8	Q_{PCS}-value (for class B to D) (i)	Test according to EN ISO 1716	According to Control Plan	According to Control Plan	Monthly (ii)
9	Organic content (i)	Ash content / loss on ignition according to clause 3.4.2. Otherwise, Thermogravimetry test based on EN ISO 11358-1	According to Control Plan	According to Control Plan	Once per batch (ii)
10	Adhesion of core at high temperature (only for MgO boards) (i)	Test based on clause 2.2.2	According to Control Plan	According to Control Plan	Once per year (ii)

(i) Indirect characteristic related to reaction to fire and, when applicable, propensity to undergo continuous smouldering.

(ii) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.

Table 3.2.3: Control plan when the base-coat, key-coat, finishing-coat, decorative coat 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) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package and Checking of supplier certificates or supplier tests	Conformity with the order	---	Each delivery
2	Particle size grading	EN 1015-1	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan
3	Bulk density	EN 1015-1	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan
Production process					
4	Mixing process	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan
5	Packing	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan
6	When relevant, fire-retardant quantity (i)	Quantity measurement	As defined in the Control Plan	---	Each batch
Finished component					
7	Density (for hardened mortar) (i)	Clause 3.4.3	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
8	Particle size grading (for mortars delivered in paste and powder mortars)	Clause 3.4.4	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
9	Dry extract at 105 ºC (for mortars delivered in paste) (i)	Clause 3.4.5	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
10	Ash content at 450 ºC (for powder mortar) (i)	Clause 3.4.6.1	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
11	Viscosity	EN 1015-4	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
11	Modulus of elasticity, tensile strength and elongation (applicable for hardened mortars)	Clause 3.4.7	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
12	Shrinkage (applicable for hardened mortars)	Clause 3.4.8	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
13	Crack bridging resistance (for paints)	As defined in the Control Plan, method based on EN ISO 4628-4	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)
14	Bond strength (for hardened mortar) (applicable for the whole rendering system)	Test based on clause 2.2.6.1	As defined in the Control Plan	As defined in the Control Plan	At least once each 5 years
15	Q_{PCS}-value (for class B to D) (i)	Test according to EN ISO 1716	As defined in the Control Plan	As defined in the Control Plan	As defined in the Control Plan (ii)

(i) Indirect characteristic related to reaction to fire.
(ii) Deviations from the given cornerstones (higher or lower frequencies) may be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.

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 the cladding kit with rendering are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the cladding kit with rendering.	Verification of the complete FPC as described in the Control Plan agreed between the TAB and the manufacturer	According to Control Plan	According to Control Plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control					
2	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the Control Plan.	Verification of the controls carried out by the manufacturer as described in the Control Plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	According to Control Plan	According to Control Plan	Once per year

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire[7] 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 actions to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.2.

7 Including propensity to undergo continuous smouldering, where relevant.

Table 3.3.2 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire-retardants					
1	Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 are fulfilled for reaction to fire, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire-retardants or a limiting of organic material).	Verification of the complete FPC as described in the Control Plan agreed between the TAB and the manufacturer	As defined in the Control Plan agreed between the TAB and the manufacturer	As defined in the Control Plan agreed between the TAB and the manufacturer	When starting the production, after starting a new production line or after modifications of the production process
Continuous surveillance, assessment and evaluation of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire-retardants					
2	Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 in the Decisions regarding reaction to fire are fulfilled, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire-retardants or a limiting of organic material)	Verification of the controls carried out by the manufacturer as described in the Control Plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	As defined in the Control Plan agreed between the TAB and the manufacturer	As defined in the Control Plan agreed between the TAB and the manufacturer	Once per year

3.4 Special methods of control and testing used for the assessment and verification of constancy of performance

3.4.1 Dimension and density of the boards

Table 3.4.1.1 Boards special methods of testing by materials

Board material	Test methods	
	Dimensions	**Specific mass or density**
Expanded glass granulates	EN 12467, clause 5.3.	EN 12467, clause 5.4.2.
Magnesium oxide	EN 12467, clause 5.3.	EN 12467, clause 5.4.2.
Fibre-cement	EN 12467, clause 5.3.	EN 12467, clause 5.4.2.
Gypsum boards with fibrous reinforcement	EN 15283-1, clauses 4.7 EN 15283-2, clauses 4.7	EN 15283-2, clauses 5.10
Cement bonded board Cement bonded particle board	EN 325; EN 1309-1	EN 323

3.4.2 Ash content or Loss on ignition of boards, subframe components and thermal insulation products

For products which are inorganic, i.e., products containing a low percentage of organic compounds and for thermal insulation products as well, the test method shall be based on EN 13820.

For products which are organic, the test method shall be based on EN ISO 3451-1.

3.4.3 Density of mortars

3.4.3.1 Product as delivered

Pastes and liquids

This is measured at (23 ± 2) °C in a 1000 cm^3 cylinder.

Powders

This is measured at (23 ± 2) °C in a 500 cm^3 cylinder.

Method of operation

The results are recorded after maximum packing down on a vibrating table and levelling of the surface. The results are expressed in kg/m^3 (arithmetic average value of 3 tests).

3.4.3.2 Fresh mortar

Preparation of mortar

The mortar is prepared in the laboratory according to MPII.

In most cases, both spray (large surfaces) and trowel (small surfaces) applied mortar are specified. Therefore, unless the one of both method is specified, the method of application, or the most onerous application method shall be assessed, tests shall be conducted with both spray and trowel applied material and the density of both shall be measured. Both densities and their tolerances for trowel and spray applied renderings shall be included in the Control Plan.

Method of operation

The apparent density is determined using one litre cylindrical container, previously tared (mass M_0 [in g]). The container is filled with paste and after compacting down, wiped off and weighed (mass M_1 [in g]). The density of the paste [in kg/m^3] is equal to M_1 - M_0. The density of the paste is measured immediately after mixing.

Alternative method according to EN 1015-6 may be used.

3.4.3.3 Hardened mortar

The specimens shall be prepared according to clause 3.4.3.2 using a formwork or mould with known geometry.

Apparent density of hardened mortar shall be determined by measuring mass and dimensions. The accuracy for weighing is 1/1000 and for the dimensions is 1/100.

Alternative method according to EN 1015-10 may be used.

3.4.4 Particle size grading

Pastes

Particle size grading is established from a specimen of fillers removed from the manufactured product after washing on a sieve, mesh size 0,08 mm or after any other suitable and pertinent preparation. The test is carried out after drying at least 105 °C.

Powders

Particles size grading is established from a specimen of fillers removed from the manufactured product.

Method of operation

The test is performed using air streamed sieving on an about 50 g specimen for 5 minutes per sieve. The curve is traced from 0,04 (for powders) or 0,08 (for pastes) to 4 mm with at least 5 intermediate sieves.

3.4.5 Dry extract (only pastes and liquids)

3.4.5.1 Lime and polymer based products

This is determined after placing the specimen in a ventilated oven set at (105 $\pm$ 5) °C until a constant mass is obtained.

The mass is regarded as constant if the difference in mass between two successive weighing, one hour apart, does not exceed 0,1 g.

Initial weighing for testing:

- 2 g for liquid products (impression, etc.),
- 5 g for products in paste form.

The results are expressed as a percentage relative to the initial mass (arithmetic average value of 3 tests).

Alternative method according to EN 480-8 may be used.

3.4.5.2 Silicate based products

The dry extract is determined by the following method:

A - Initial weighing of approximately 5 g (product in the as-delivered state) on an aluminium sheet, approximately 100 mm x 100 mm, 2/3 covered.

B - Pre dry for 1 hour at (125 ± 10) °C. Dry for 2 hours at (200 ± 10) °C.

C - Final weighing.

Weighing accuracy shall be within 5 mg.

The difference in mass from the initial weighing is accounted for by volatile components including water of crystallization.

The results are expressed as a percentage relative to the initial mass (arithmetic average value of 3 tests).

Alternative method according to EN 480-8 may be used.

3.4.6 Ash content

3.4.6.1 Base-coat and finishing coats

Pastes and liquids

The ash content is determined on the same specimens as those on which the dry extract has been measured.

Powders

The ash content is determined at 450 °C and 900 °C on a specimen of approximately 5 g pre-dried at (100 ± 5) °C or at (200 ± 5) °C for silicate-based products, to constant mass. The mass is regarded as constant if the difference in mass between two successive weightings, one hour apart, does not exceed 0,1 g.

Method of operation

- The specimen is placed in a tared crucible either fitted with a lid or enclosed in a leak-tight container and the whole is weighed,
- After the lid has been removed, where necessary, the crucible is placed in the oven maintained at ambient temperature,
- The temperature of the oven is then raised to (450 ± 20) °C (ash content at 450 °C) or to (900 ± 20)°C (ash content at 900 °C) and maintained at that temperature for 5 hours,
- The crucible is allowed to cool down to room temperature in the desiccators before being weighed.

The results are expressed as a percentage relative to the initial mass after drying (arithmetic average value of 3 tests).

Note: the tolerances at 900 °C may become larger, taking account of the products' composition.

3.4.7 Modulus of elasticity, tensile strength and elongation

3.4.7.1 Products with a thickness greater than 5 mm

Preparation and storing of test specimens

The mortar is prepared by mixing as described in clause 3.4.3.2.

Test specimens, conforming to the dimensions defined in the paragraphs below, are prepared in metal moulds in two layers.

Each layer is compacted into position by dropping alternately each side of the mould from a height of 5 mm approximately ten times. The test specimens are then levelled with a metal ruler.

The test specimens are removed from the mould after 24 h.

They are then stored for at least 28 days at (23 ± 2) °C and (50 ± 5) % relative humidity.

Dynamic modulus of elasticity (Resonance frequency method)

The dynamic modulus of elasticity is determined on prismatic test specimens measuring 25 mm x 25 mm x 285 mm.

The test is carried out on 3 specimens prepared as described above.

The individual values of the apparent density [in kg/m^3] and the modulus [in MPa] of the 3 test specimens and the arithmetic average value of the results obtained are noted.

The principle of the measurement consists of measuring the basic resonance frequency of a test specimen under longitudinal vibration.

1 – Apparatus:

The apparatus used for carrying out this measurement comprises:

a) A variable frequency oscillator, with a frequency range of 20 kHz and an accuracy of 1%.

b) An electromagnetic vibrator which may or may not be in mechanical contact with the test specimen; its mass shall be very light compared to that of the test specimen.

c) A receiver, an electromechanical transducer and an amplifier; its mass shall be very light compared to that of the test specimen.

The resonance frequencies of the vibrator and the receiver shall not fall between 0,5 kHz and 20 kHz.

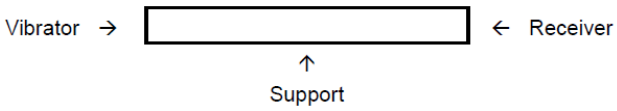
d) An amplifier.

e) An apparatus indicating the vibration amplitudes (voltmeter, milliammeter, oscilloscope).

f) A very narrow support on which the test specimen rests during the measurement, which shall not hinder the longitudinal vibration of the test specimen and which shall be in the nodal plane.

2 - Testing

The specimen is centred on the support. The vibrator and the receiver are placed as shown in the figure below:



It is important that the ends of the test piece are free to vibrate in an axial direction. The vibration generator and the receiver, if they are in contact with the test piece, shall exert an equal very weak stress on the two ends. In this case, it is recommended to weakly bond the mobile part of the vibrator to the specimen using a coupling product (mastic). The same applies for the receiver.

The variable frequency oscillator supplies the vibrator and the test piece vibrates longitudinally. The vibrations are collected by the receiver and after amplification their amplitude is shown on a dial (voltmeter, milliammeter, oscilloscope). For most frequency ranges, the vibration amplitude is quite small. But for certain frequencies, the displacement becomes appreciable. The resonance conditions are created when maximum amplitude is obtained on the indicating dial.

The frequency of the basic longitudinal resonance corresponds to the lowest frequency for which a maximum amplitude is obtained (for the higher harmonic frequencies a resonance is also produced).

Two measurements are carried out: the vibration is produced successively at the two ends of the test piece. The arithmetic average value is recorded. If the difference between the two values is higher than 5 % the vibrations are restarted.

The measurements of the mass and dimensions of the test piece are needed to calculate the modulus. The accuracy for weighing is 1/1000 and for the dimensions 1/100.

3 - Expressing the results:

As the basic longitudinal resonance frequency, the mass and the dimensions of the test piece are known the dynamic modulus of elasticity is determined using the following formula:

$E_d = 4 \cdot L^2 \cdot F^2 \cdot \rho \cdot 10^{-6}$

E_d = longitudinal dynamic modulus of elasticity [in N/mm^2].

L = length of test piece [in m].

F = longitudinal resonance frequency [in Hz].

ρ = density or mass per unit volume [in kg/m^3].

3.4.7.2 Products with a thickness up to 5 mm

Preparation and storing of test specimens

The mortar is prepared by mixing as described in clause 3.4.3.2.

The tests are performed on test specimens measuring 3 mm x 50 mm x 300 mm.

Moulds for the specimens are made using appropriately positioned 3 mm thick strips of extruded polystyrene adhered to expanded polystyrene boards.

After the mortar (without reinforcement) has dried, test specimens are cut from the polystyrene with hot wire.

The test specimen is subjected to a tensile test until it breaks using a suitable machine which records the tensile stress and elongation. The distance between the jaws of the machine is 200 mm. The specimen is held between the jaws with the interposition of pads.

The tensioning speed is 2 mm/minute.

The tests are carried out on five specimens stored for at least 28 days at (23 $\pm$ 2) °C and (50 $\pm$ 5) % RH and on five specimens which have undergone the hygrothermal test (placed in the window of the specimen).

3.4.8 Shrinkage

The measurement is carried out on three specimens of product measuring 20 mm x 40 mm x 160 mm prepared and stored as described in clause 3.4.3.2, by inserting measuring spindles in the front end (10 mm x 40 mm) of the specimens.

Measurements are carried out at regular intervals. The value after 28 days is recorded. In addition, if there is doubt in the curve associated with stabilisation, the test is continued, and the value after 56 days is recorded.

Alternative method according to EN 12617-4 or EN 13888-2 may be used.

4 REFERENCE DOCUMENTS

EAD 040016-01-0404	Glass fibre mesh for reinforcement of cementitious or cement-based renderings.
EAD 040083-00-0404	External thermal insulation composite systems (ETICS) with renderings.
EAD 090058-00-0404	Ventilated external wall cladding kit comprising a metallic honeycomb panel and its associated fixings.
EAD 090062-01-0404	Kits for external wall claddings mechanically fixed.
EAD 090097-00-0404	Kits for external wall claddings glued to the subframe.
EAD 090125-00-0404	Kits for external wall claddings with multilayer composite rigid cladding elements.
EAD 090034-01-0404	Kit composed by subframe and fixings for fastening cladding and external wall elements.
EAD 210024-00-0504:2017-07	Cement-bonded boards.
EN 1015-1:1999 EN 1015-1:1999/A1:2006	Methods of test for mortar for masonry - Part 1: Determination of particle size distribution (by sieve analysis).
EN 1015-4:1998	Methods of test for mortar for masonry - Part 4: Determination of consistence of fresh mortar (by plunger penetration).
EN 1015-6:1998 EN 1015-6:1998/A1:2006	Methods of test for mortar for masonry - Part 6: Determination of bulk density of fresh mortar.
EN 1015-10:1999 EN 1015-10:1999/A1:2006	Methods of test for mortar for masonry - Part 10: Determination of dry bulk density of hardened mortar.
EN 1062-1:2004	Paints and varnishes - Coating materials and coating systems for exterior masonry and concrete - Part 1: Classification.
EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components.
EN 12004:2007+A1:2012	Adhesives for tiles - Requirements, evaluation of conformity, classification and designation.
EN 12467:2012+A2:2018	Fibre-cement flat sheets – Product specification and test methods.
EN 12617-4:2002	Products and systems for the protection and repair of concrete structures - Test methods - Part 4: Determination of shrinkage and expansion.
EN 1309-1:1997	Round and sawn timber - Method of measurement of dimensions - Part 1: Sawn timber.
EN 13888-2:2022	Grouts for ceramic tiles - Part 2: Test methods.
EN 13238:2010	Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates.
EN 13494:2019	Thermal insulation products for building applications - Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material.
EN 13501-1:2018	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests.
EN 13820:2003	Thermal insulating materials for building applications - Determination of organic content.
EN 13823:2020+A1:2022	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item.
EN 13830: 2003	Curtain walling – Product standard.
EN 14617-11:2005	Agglomerated stone – Test methods – Part 11: Determination of linear thermal expansion coefficient.
EN 14617-12:2012	Agglomerated stone - Test methods - Part 12: Determination of dimensional stability.
EN 15283-1:2008+A1:2009	Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 1: Gypsum boards with mat reinforcement.
EN 15283-2:2008+A1:2009	Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards.
EN 15715:2019	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products.

EN 15824:2017	Specifications for external renders and internal plasters based on organic binders.
EN 16383:2016	Thermal insulation products for building applications - Determination of the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS).
EN 1991-1-4:2005 EN 1991-1-4:2005/A1:2010 EN 1991-1-4:2005/AC:2010	Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions.
EN 1993-1-1:2022	Eurocode 3 - Design of steel structures – Part 1-1: General rules and rules for buildings.
EN 1999-1-1:2023	Eurocode 9: Design of aluminium structures – Part 1-1: General structural rules.
EN 310:1993	Wood-based panels. Determination of modulus of elasticity in bending and of bending strength.
EN 318:2002	Wood based panels – Determination of dimensional changes associated with changes in relative humidity.
EN 323:1993	Wood-based panels - Determination of density.
EN 325:2012	Wood-based panels - Determination of dimensions of test pieces.
EN 480-8:2012	Admixtures for concrete, mortar and grout - Test methods - Part 8: Determination of the conventional dry material content.
EN 508-1:2021	Roofing and cladding products from metal sheet - Specification for self-supporting products of steel, aluminium or stainless steel sheet - Part 1: Steel.
EN 520:2004+A1:2009	Gypsum plasterboards - Definitions, requirements and test methods.
EN 634-1:1995	Cement-bonded particleboards. Specification. Part 1: General requirements.
EN 634-2:2007	Cement-bonded particleboards – Specifications – Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions.
EN 998-1:2016	Specification for mortar for masonry - Part 1: Rendering and plastering mortar.
EN ISO 80000-1:2022	Quantities and units - Part 1: General.
EN ISO 11358-1:2022	Plastics – Thermogravimetry (TG) of polymers – Part 1: General principles.
EN ISO 1182:2020	Reaction to fire tests for products – Non-combustibility test.
EN ISO 11925-2:2020	Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test.
EN ISO 15148:2002 EN ISO 15148:2002/A1:2016	Hygrothermal performance of building materials and products – Determination of water absorption coefficient by partial immersion.
EN ISO 16535:2019	Thermal insulating products for building applications - Determination of long-term water absorption by immersion.
EN ISO 16536:2019	Thermal insulating products for building applications - Determination of long-term water absorption by diffusion.
EN ISO 1716:2018	Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value).
EN ISO 29767:2019	Thermal insulating products for building applications - Determination of short-term water absorption by partial immersion.
EN ISO 3451-1:2019	Plastics – Determination of ash – Part 1: General methods.
EN ISO 4628-4:2016	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 4: Assessment of degree of cracking.

ANNEX A: WATER ABSORPTION AND BENDING STRENGTH TEST METHODS BY BOARD MATERIALS

Table A.1 summarizes the board test methods to be applied for the cladding kit with rendering assessment according to clauses 2.2.3.2 and 2.2.6.2.

Table A.1 Board test methods by materials

Board material	**Test methods**	
	Water absorption	**Bending strength, Modulus of elasticity or Modulus of rupture**
Expanded glass granulates	EN ISO 15148	EN 12467, clause 7.3.2 (conditioning for “type test” according to table 10 of EN 12467 is applicable).
Magnesium oxide	Surface water absorption: EN 520, clause 5.9.1. Total water absorption: EN 520, clause 5.9.2.	EN 12467, clause 7.3.2 (conditioning for “type test” according to table 10 of EN 12467 is applicable).
Fibre-cement	EN 12467, clause 5.4.5	EN 12467, clause 5.4.4 (conditioning for “type test” according to table 10 of EN 12467 is applicable).
Gypsum boards with fibrous reinforcement	Surface water absorption: EN 15283-2, clause 5.8. Total water absorption: EN 15283-1, clause 5.8 or EN 15283-2, clause 5.9.	EN 15283-1, clause 5.6 or EN 15283-2, clause 5.6.
Cement bonded board Cement bonded particle board	EN ISO 15148	EN 310

ANNEX B: REACTION TO FIRE

B.1 – GENERAL

B.1.1 – Principle

The determination of reaction to fire of the cladding kits with renderings 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 kit components is valid for all configurations of kit components having better performance in sense of reaction to fire.

For testing of the cladding kit with rendering, the following principles shall apply regarding the selection of the relevant kit components:

- The kit components’ materials with the highest amount of organic content[8] (if there are only differences in the amount of organic content but no difference in the organic component itself) or with the highest gross heat of combustion - Q_{PCS} [MJ/kg] according to EN ISO 1716 (from now on called “Q_{PCS}-value”) shall be tested.

- The influences of different colours shall be considered by performing tests on a light, on a dark and on a colour in the middle of the range (e.g., CIELAB 40.51, 59.28, 47.98; RGB 184, 29, 19; Munsell ref. 7.5R 4/13; RAL 3020; or BS04E56).

- In addition, each kit components material selected for testing according to the previous point shall have the smallest amount of fire-retardants.

Components of a kit which are classified A1 without testing according to Decision 96/603/EC (as amended by Commission Decision 2000/605/EC and Commission Decision 2003/424/EC) do not need to be tested for an assessment according to option "a)" of clause 2.2.1. They also do not need to be tested for an assessment according to option "b)" of clause 2.2.1 if applying those test methods where each component shall be tested separately (e.g., EN ISO 1182, EN ISO 1716). In case of further calculation to determine to total Q_{PCS}-value of a composite product or a kit, these components do not contribute to the total Q_{PCS}-value, therefore, their individual Q_{PCS}-value shall be set as zero.

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

- Type of rendering system components (e.g., material composition, thickness, density, weight per unit area).

- Type of boards (e.g., material composition, thickness, density, weight per unit area).

- Organic content (binder and any other additives) of kit components, where applicable.

- Type and amount of fire-retardant[9].

- Type and nature of board-fixings and subframe components.

Note: Fire breaks and cavity barriers 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 (see Annex Q of EAD 090062-01-0404). Therefore, breaks shall not be included in the mounting and fixing rules for the SBI-test.

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8 The organic content can be checked by providing the formulation or, by performing suitable characterization tests or by determining the glow loss (loss on ignition or ash content). When information on organic content per unit area is not available, the Q_{PCS}-value shall be tested to decide about the worst case.

9 The term “fire-retardant” refers both to chemicals incorporated into a product composition during the manufacturing process (sometimes known as flame-retardant) and to coatings applied onto a finished product, in both cases with the purpose of improving the product’s reaction to fire.

Although the rest of this annex applies the “worst case scenario” for deciding what to test, it is accepted that, where the manufacturer wants to assess a range of cladding kit with rendering configurations 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.

B.2 - TESTING ACCORDING TO EN ISO 1182

This test method is relevant for classes A1 and A2 according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Using this test method, only the substantial components of the cladding kit with rendering shall be tested. ‘Substantial components’ are defined by thickness (≥ 1 mm) and/or mass per unit area (≥ 1 kg/m^2). In the following, the boards, the thermal insulation products, the base-coat and the finishing-coat shall be considered as the most significant “substantial components”, however, the key-coat, the decorative coat, breather membrane and any reinforcement mesh may also be considered as “substantial components”.

Physical properties as given in clause B.1.2 (in particular product type, density, organic content, fire-retardants) and the principles given in clause B.1.1 for the determination of the probable worst case shall be considered for selection of the specimens and the testing purposes.

B.3 - TESTING ACCORDING TO EN ISO 1716 (Q_{PCS}-VALUE)

This test method is relevant for classes A1 and A2 according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

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

Parameters relevant for this test method are composition (when performing calculation of the Q_{PCS}-values, density or mass per unit area and thickness are relevant). Discrete and non-continuous mechanical fixings and ancillary components which fulfil the conditions for small components according to clause B.6 shall not be considered for testing and for the calculation of the Q_{PCS}-values.

It is not necessary to test kit components (mainly boards and rendering system components) with different grain sizes if the organic content is the same as or lower than that of the tested kit component.

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) according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

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

Parameters which are relevant for this test method:

- Type of kit components (e.g., material composition, dimensions, density, weight per unit area).
- Amount of organic content of the kit components.
- Amount of fire-retardant, if any.
- Colour according to the principles as in B.1.1.

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 shall be determined.

The test specimen shall be prepared with the kit components with the highest organic content or Q_{PCS}-values per unit area.

B.4.1 - Direct application rules of test results

See clause B.1.3.

B.5 - TESTING ACCORDING TO EN ISO 11925-2

This test method is relevant for classes B, C, D, E and F according to Commission Delegated Regulation (EU) 2016/364 in connection with EN 13501-1.

Mounting and fixing provisions for the tests are indicated in Annex B.

Parameters which are relevant:

- Type of kit components (e.g., material composition, dimensions, density, weight per unit area).
- Amount of organic content of the kit components.
- Amount of fire-retardant, if any.
- Colour according to the principles as in B.1.1.

For boards with covered edges by the rendering system, the specimens shall be prepared both with covered edges and edges without covering (cut edges).

The tests shall be performed with surface exposure of the front side, edge exposure and possibly edge exposure of multi-layered specimen turned 90° on their vertical axis according to the rules of standard EN ISO 11925-2.

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

B.5.1 - Application rules of test results

See clause B.1.3.

B.6 - SMALL COMPONENTS

Clause B.6 of EAD 090062-01-0404 applies.

ANNEX C: MOUNTING AND FIXING PROVISIONS FOR SBI TEST (EN 13823) AND SINGLE-FLAME SOURCE TEST (EN ISO 11925-2)

C.1 - TESTING OF THE REACTION TO FIRE ACCORDING TO EN 13823 (SBI TEST)

Considerations for cladding kits with renderings included in clause C.4 shall also be considered for SBI test.

The reaction to fire testing shall be given for the whole assembled 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 with renderings.

C.1.1 - 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 or laminated gypsum board simulates a wall made of masonry or concrete,
- Non-fire-retardant-treated particle board or plywood board simulate a frame wall made with an outer planking of wood or wood-based boards.
- Steel sheet simulates a frame wall made with an outer planking of metal sheets with a melting point of at least 1000 °C.
- Aluminium sheet simulates a frame wall made with an outer planking of metal sheets with a melting point of minimum 500 ºC.
- Additional substrates not covered by EN 13238 for specific uses. In such cases, test results are only applicable for the tested configuration.

  A necessary subframe shall be formed by vertically directed beams or profiles made of non-fire-retardant-treated timber (spruce recommended, saw-cut, density not less than 350 kg/m³), aluminium or steel.

  A non-fire-retardant-treated timber subframe also covers metal subframes. Aluminium profiles cover subframes made of metal with a melting point of at least 500 °C. Steel profiles in the tests cover metal subframes with a melting point of at least 1000 °C.

All ancillary components which form part of the kit (e.g., breather membranes, thermos-stop pads, gaskets, seals, adhesive strips or double-sided tapes) shall be included in a representative manner in the test specimen unless they may be considered as small components according to clause B.6.

An air space shall always be provided behind the boards in accordance with the MPII (minimum of 20 mm). The bottom and top edges of the specimen shall also remain opened.

For ventilated cladding kits with renderings, a continuous airflow (without any interruption) in the air space shall be ensured. To that end, the provisions to allow a lateral airflow given in EN 13823 shall be considered as a first option. Only when the subframe profiles or studs (or any other kit component) do not allow this continuous airflow from the outer lateral edges of the test specimen wings, there shall be a gap of 10 mm between the bottom of the specimen and top level of U-profile of the SBI-test device.

For cladding kits with renderings without thermal insulation products applied to the substrate (supporting wall), two cases regarding the depth of an air gap shall be considered within the tests:

- the minimum air gap depth (between rear surface of the boards and the substrate) as stated according to the MPII and allowed by the subframe dimensions and geometry (but not less than 20 mm) and,

- a 40 mm air gap depth between rear surface of the boards and the substrate.

First, an indicative test shall be performed for each of both air gap depths. The depth showing the worst results shall be completed (at least two additional tests) in order to obtain the worst classification.

If both indicative tests point to the same classification, any greater depth of the air gap than the tested minimum one shall be classified based on this result, without additional testing.

If the indicative tests point to different classifications, additionally, the case (air gap depth) showing the best results in the indicative test can also be fully tested for classification (two additional SBI test specimens to complete the required three test results) to determine if a better classification is obtained. If so, this better classification will apply only to the best-case air gap depth and the rest of the range will have the classification obtained with the worst-case air gap depth, unless additional intermediate depths are tested to determine the point (air gap depth) where classification changes.

For cladding kits with renderings with thermal insulation products applied to the substrate (supporting wall), two cases regarding the depth of an air gap shall be considered within the tests:

- the minimum air gap depth (between rear surface of the boards and front surface of the thermal insulation product) as stated according to the MPII and allowed by the subframe dimensions and geometry (but not less than 20 mm) and,

- a 40 mm air gap depth between rear surface of the boards and front surface of the thermal insulation product.

First, an indicative test shall be performed for each of both air gap depths. The depth showing the worst results shall be completed (at least two additional tests) in order to obtain the worst classification.

If both indicative tests point to the same classification, any greater depth of the air gap than the tested minimum one could be classified based on this worst result, without additional testing.

If the indicative tests point to different classifications, additionally, the case (air gap depth) showing the best results in the indicative test can also be fully tested for classification (two additional SBI test specimens to complete the required three test results) to determine if a better classification is obtained. If so, this better classification will apply only to the best-case air gap depth and the rest of the range will have the classification obtained with the worst-case air gap depth, unless additional intermediate depths are tested to determine the point (air gap depth) where classification changes.

If the kit includes the thermal insulation products, for insulation materials class A1 or A2 as part of the kit, a standard mineral wool insulation according to EN 13238, but with a thickness of 50 mm, shall be installed between subframe and substrate.

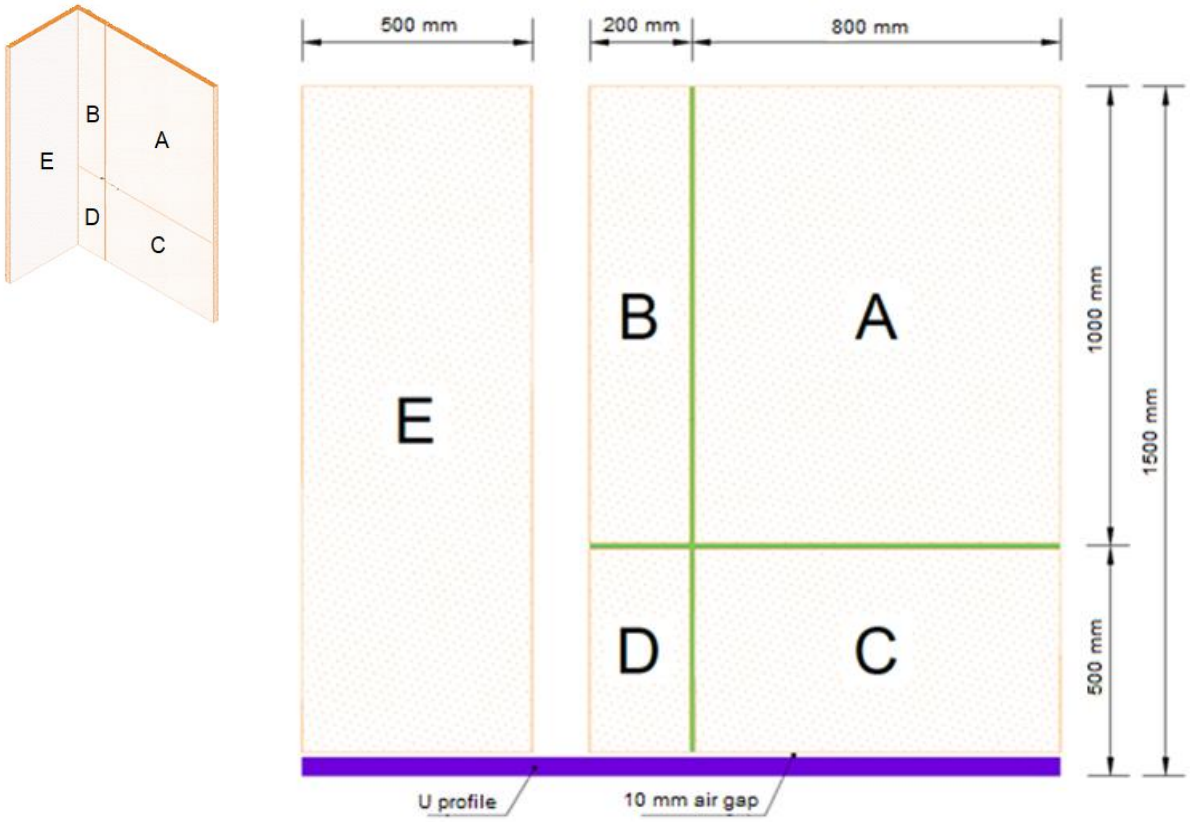
For other insulation materials, different conditions can be used for testing (e.g., maximum and/or minimum thicknesses, maximum and/or minimum density, unless proven otherwise). In absence of representative insulation materials, the test results shall only be valid for those applications as tested.

Tests on specimen with a total thickness of at least 200 mm (maximum testable thickness according to EN 13823, including cladding element (board and rendering system), airgap, subframe, thermal insulation product and substrate) shall be valid for cladding kit with rendering with greater thickness.

The cladding kit with rendering is fixed to the subframe. The cladding kit with rendering shall be installed with the number of board-fixings according to the MPII. If no information is available from the manufacturer regarding the number of board-fixings, each board being part of the specimen shall be fixed with one board-fixing at each corner of the board.

When the kit presents horizontal joints, it shall be tested with, at least, a horizontal joint in the long wing at a height of 500 mm from the bottom edge of the specimen to the centre axis of the joint and when the kit tested presents vertical joints, it shall be tested with, at least, a vertical joint in the long wing at a distance of 200 mm from the corner line to the centre axis of the joint, in accordance with the Figures C.1.1.1 to C.1.1.3. In the areas A, B, C, D and E, it is possible to have other vertical and/or horizontal joints between boards.

When tested rear side cladding kit with rendering (in case of asymmetrically composed cladding elements, which is usually the case of the cladding elements (boards and rendering systems) covered by this EAD), the test shall involve a free-hanging arrangement with the flame impingement to the rear side in accordance with EN 13823 (test arrangement without open joints between the boards and without thermal insulation layer on A1 or A2 substrate, so that the distance between the backing substrate-board and the boards amounts to at least 80 mm – see Figure C.1.2.2).



Note: 10 mm air gap is only to be included when necessary to ensure continuous airflow (see clause C.1.1).

Figure C.1.1.1: Schematic representation of SBI test installation (front view).

Legend for Figures C.1.1.2 to C.1.1.3:

1. Cladding element.
2. Cladding fixing.
3. Substrate.
4. Air space.
5. Subframe.
6. Thermal insulation product.

d = short wing cladding element thickness.

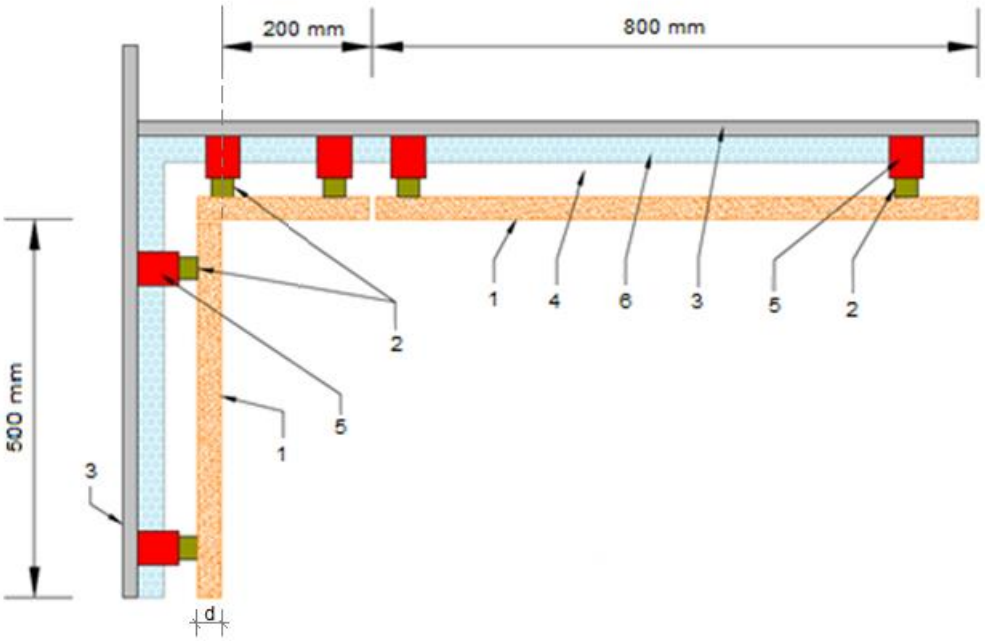


Figure C.1.1.2: Schematic representation of SBI test installation (top view – test specimen with subframe and thermal insulation product).

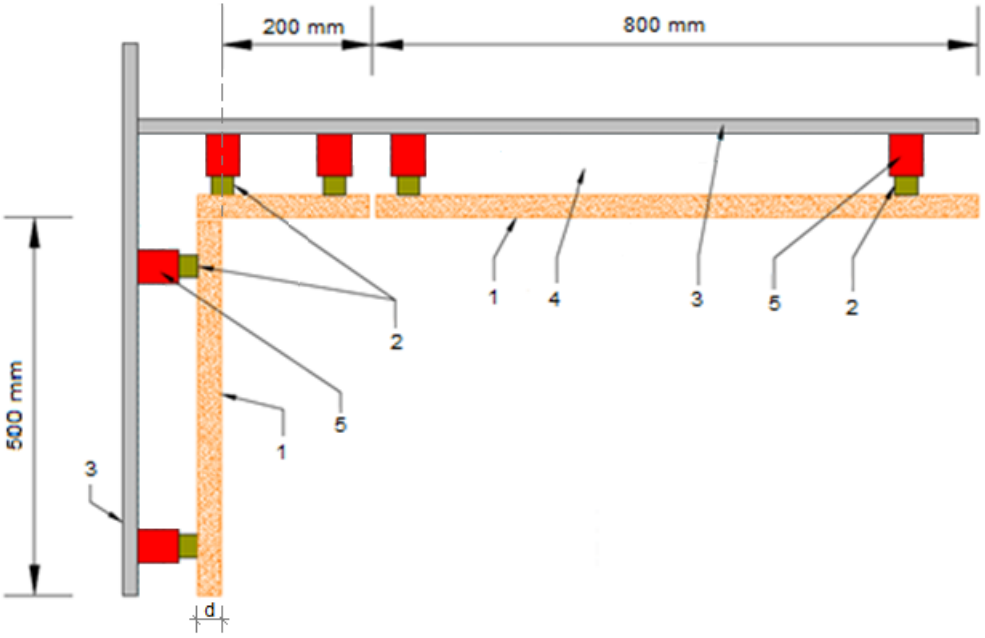


Figure C.1.1.3: Schematic representation of SBI test installation (top view – test specimen with subframe and without thermal insulation product).

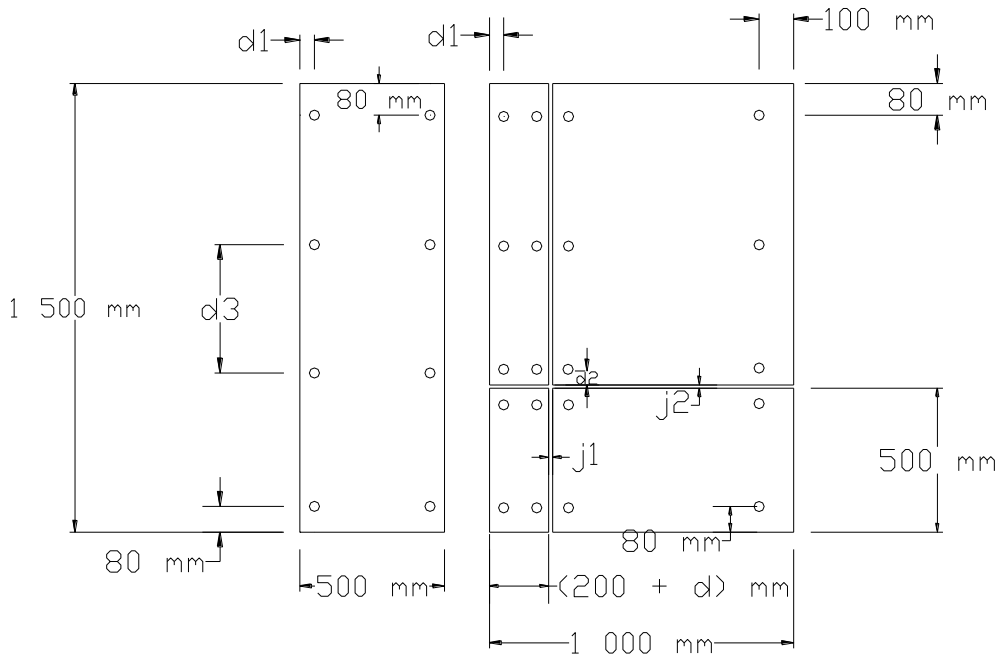
C.1.2 - Specific information

The kits are tested in a limited number of configurations to cover the influence of the parameters indicated in clause C.4.

The boards can be cut to size as shown in Figures C.1.2.1 and C.1.2.2.

The rending system and joints between boards shall be applied on the boards according to the MPII.

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



Legend:
j1 = width of vertical joint
j2 = width of horizontal joint
d1, d2 = distance of the axis of cladding fixing to the edges of the cladding element.
d3 = distance between two consecutive cladding fixings.
d = short wing cladding element thickness (board and rendering system).

Figure C.1.2.1: Example of installation for cladding kits with renderings.

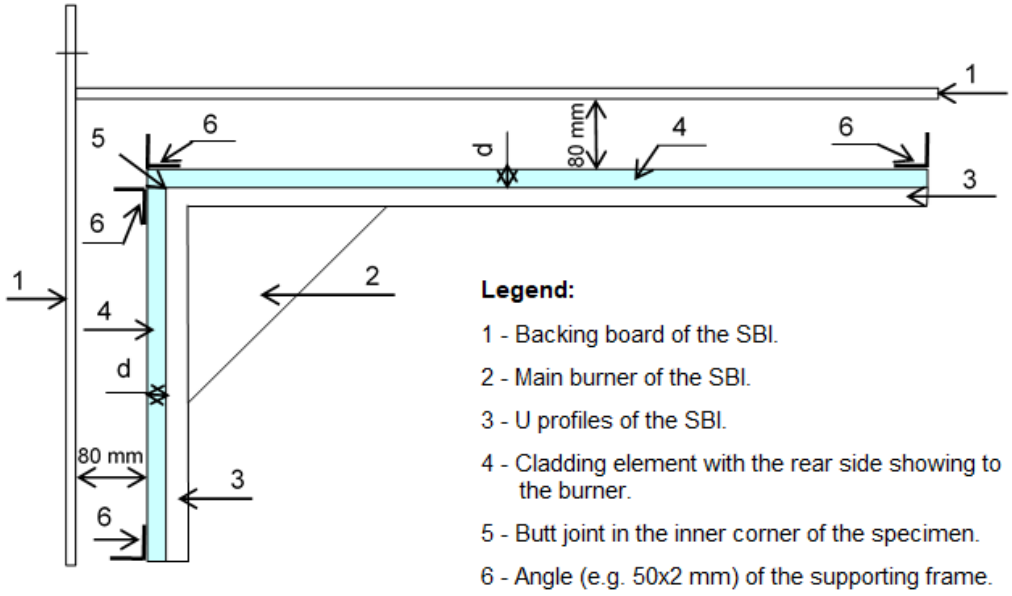


Figure C.1.2.2: Principle of testing the rear side.

C.1.3 - Extension of results

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

- For greater dimensions (height and width) of boards.
- For other metal mechanical fixings with the same or higher number of board-fixings, if metal fixings were used for testing.
- For the same density of joints or the range between the minimum and maximum density as tested.
- For other greater depth of air gap.
- When the test is carried out without thermal insulation layer, the test result is only applicable to end-use applications without thermal insulation layers.
- When the test is carried out with mineral wool thermal insulation panels the test results shall be valid for:
  - all other greater thickness of mineral wool insulation layer with the same or greater density and the same or better reaction to fire classification;
  - the same type of substrate-board used without thermal insulation, if the substrate chosen according to EN 13238 is made of substrate-board with class A1 or A2 (e.g., fibres-cement substrate-boards).
- The results of reaction to fire tests, where a combustible thermal insulation material was used, are also valid for end-use applications of the tested product without thermal insulation product on solid mineral substrates of class A1 or A2-s1,d0 like masonry or concrete.
- The test result of a test with non-fire-retardant-treated timber subframe shall be valid, without test, for the same type of cladding element (board and rendering system) used with aluminium or steel subframe. The test result of a test with an aluminium frame shall be valid, without test, for the same type of cladding element (board and rendering system) used with aluminium or steel frame. Result of tests with a steel frame are only valid for the same type of cladding elements (boards and rendering systems) used with metal frames with a melting point higher than 1000 °C.

- If the classification is the same, the test result of the lowest and highest thickness of the cladding element (board and rendering system) shall be valid, without test, for all the thickness in between. In other case the worst classification applies to the other thicknesses of the range.

- The test results are valid for cladding elements (board and rendering system) with the same composition and same assembly (or alternatively: all product types of the same defined product family) than used in the tests. In addition, the provisions of clause C.1.1 regarding organic content and content of fire-retardants shall be considered.

- The test results are valid for the same density / weight per unit area (if only one value was tested) or the range between those values evaluated in the tests.

- The test results are valid for the same organic coating/finish or any other coatings/finishes with the same or lower Q_{PCS}-value (related to the mass in dried condition), each with the same or lower applied quantity (in dried condition) than tested.

- The test results are valid for the same inorganic coating or facing and other inorganic coatings / facings with the same or higher applied quantity per unit area.

- The test results are valid for the same colour of cladding elements (board and rendering system) than tested or for the entire range of colours, if colours as prescribed in clause C.1.1. were tested.

C.2 - TESTING OF THE REACTION TO FIRE ACCORDING TO EN ISO 11925-2 (SINGLE FLAME SOURCE TEST)

C.2.1 - General

Due to the very limited size of the specimens as prescribed by the test standard, it is widely impossible to test the cladding kit with rendering as whole. Therefore, all essential components of the kit shall be tested separately except in cases prescribed below.

For the relevant flame exposure types to be applied within testing, see clause C.5.

C.2.2 - Thermal insulation

When the cladding kit with rendering contains the thermal insulation product, the following cases shall be considered:

Case 1:

According to the second paragraph of clause 2.2, thermal insulation products shall not be tested if reaction to fire is declared in their DoP and the given class according to EN 13501-1 is equal to or better than the intended class for the cladding kit with rendering (e.g., cladding kits with renderings class B or C, then the thermal insulation product shall be classified as class C).

Case 2:

When the reaction to fire class according to EN 13501-1 of the thermal insulation product is not declared in the DoP, or the declared class is worse than the intended class for the cladding kit with rendering, testing of the thermal insulation product shall be carried out, the test shall be performed according to the provisions of the test standard and taking into consideration the specific mounting and fixing provisions of the thermal insulation product standards (see clause 1.1.4 of EAD 090062-01-0404) in connection with EN 15715.

Results and classification according to cases 1 and 2 are valid for the application of the thermal insulation product on any substrate covered by standard substrates according to EN 13238 using mechanical fixing means or adhesives (mortars) with an organic content equal to or lower than 15% (related to the mass in dried condition; see clause C.2.3).

If an adhesive with an organic content higher than 15% (related to the mass in dried condition) is used for fixing the thermal insulation product to the substrate, separate testing is required as prescribed in C.2.3.

C.2.3 - Fixing means

Case 1:

Metal linear mechanical fixings or punctual mechanical fixings of the cladding kit with rendering (board-fixings, subframe fixings, anchors or thermal insulation product mechanical fixings) do not need to be tested according to EN ISO 11925-2 within the assessment of the kit, because their contribution to fire spread and fire growth is zero (in case of metal fixings) or low (in case of discrete plastic fixings) due to their limited dimensions and the distance to each other.

Case 2:

When the cladding kit with rendering contains the thermal insulation product fixed by means of an adhesive (mortar) with an organic content of equal or lower than 15 % (related to the mass in dried condition), such an adhesive does not need to be part of the thermal insulation test specimen tested according to EN ISO 11925-2 (see clause C.2.2).

Case 3:

When the cladding kit with rendering contains the thermal insulation product fixed by means of an adhesive (mortar) with an organic content of more than 15% (related to the mass in dried condition) used for fixing the thermal insulation product to the substrate, it is necessary to carry out a complete set of six tests on specimens turned at 90 degrees on their vertical axis with edge exposure of the adhesive layer. The specimens consist of the substrate, the adhesive and the thermal insulation product. The following rules shall be applied for preparing the specimens:

- each type of adhesive with a different composition shall be used by selecting the variant with the highest amount of organic content and with the highest thickness,
- the thermal insulation product shall be used with the lowest thickness applied for the assessment,
- the substrate shall be the same as the one used for SBI testing of the external cladding kit with rendering as a whole.

When the cladding kit with renderings contains ancillary adhesives (see clause 1.1.5 of EAD 090062-01-0404) that are not considered as small components (see clause B.6) with an organic content of more than 15% (related to the mass in dried condition) see provisions given in clause C.2.7.

C.2.4 - Breather membranes

Case 1:

Products covered by a harmonised product specification do not need to be tested, if reaction to fire is declared in their Declaration of performance (DoP), the given class according to EN 13501-1 of the breather membrane is equal to or higher than the intended class for the external cladding kit with rendering (e.g., class B or C shall be determined for the kit, than at least the breather membrane shall be classified as class C too) and the field of application of the classification given in the DoP (product parameters and end-use conditions as stated in the MPII) is valid when using the membrane as part of the cladding kit with rendering.

Case 2:

If testing of the breather membrane is required, the test shall be performed according to the provisions of the test standard and taking into consideration the following mounting and fixing provisions:

- free-hanging arrangement of the specimens without any substrate behind, it covers all end use applications with or without any material behind,

- arrangement of the specimens directly mechanically fixed onto a representative standard substrate according to EN 13238 covering the specific application of the membrane as part of the kit.

The following product parameters are relevant for testing:

- variations of a product family (as defined by a certain combination of raw materials and a certain type of production process)
- organic content - where relevant, the product with the highest organic content shall be tested,
- thickness – where relevant, the highest and lowest thickness shall be tested,
- density / weight per unit area – where relevant, the highest and lowest density as well as the highest and lowest weight per unit area shall be tested.

Breather membranes glued to a thermal insulation product shall be tested and assessed together with the thermal insulation product.

C.2.5 - Subframe

Case 1:

Metal subframe profiles classified as A1 according to Decision 96/603/EC (as amended by Commission Decision 2000/605/EC and Commission Decision 2003/424/EC), as well as subframe profiles made of wood / wood-based materials which are covered by an applicable CWFT Decision, do not need to be tested.

Case 2:

Subframe components used for mechanically fixed cladding elements and not covered by case 1 shall be tested separately according to the provisions of the test standard and using a free-hanging test arrangement.

C.2.6 - Cladding elements

Mechanically fixed cladding elements (board and rendering system) shall be tested in a free-hanging test arrangement without any substrate or subframe profile behind.

If the cladding elements (board and rendering system) are built-in with a specific type of joints between neighbouring elements, this type of joint shall be considered at the lengthwise centre axis of at least two specimens of both flame exposure types (edge flaming and surface flaming).

C.2.7 - Other ancillary components

Each different ancillary component of the kit (except small components as defined in clause B.6) shall be tested separately according to the provisions of the test standard and their own harmonised product specification, if available.

Otherwise, the component shall be tested using a free-hanging test arrangement. If these tests fail, a test set-up with an appropriate standard substrate according to EN 13238 can be used representing the end-use application of the component in the kit.

ANNEX D: WATER ABSORPTION BY CAPILLARITY TEST

D.1 - Preparation of the test specimen

Test shall be carried out on at least three specimens for each combination of board material, reinforced base-coat alone and rendering system (including different finishing-coats).

When a finishing-coat includes a range of different aggregate sizes, for reducing the tests, the worst finishing-coat (i.e., the one with maximum water absorption by capillarity value) may be defined by considering one indicative test specimen for each aggregate size. Once the worst case has been defined, the assessment may be carried out for this worst case and the obtained values shall be considered for the other finishing-coats.

Specimens shall be prepared considering boards with a surface area of at least 200 mm x 200 mm on which the reinforced base-coat alone or the whole rendering system is applied according to the MPII (Manufacturer Product Installation Instructions).

At least, the following aspects shall be recorded in the test report:

- Thickness of each layer of the specimen.
- Weigh of the whole specimen (board and rendering system or base-coat alone).
- Summary of the MPII used for the specimen installation.

As given in clause 2.2.3.1, tests shall be carried out for:

- the whole rendering system (base-coat with the reinforcement mesh, finishing-coat and where relevant, key-coat and decorative coat) to be considered in the kit assessment, and
- for the reinforced base-coat alone.

The edges of the specimens (including the board) shall be sealed against water, to ensure that during subsequent testing, only the front face of the specimen is subject to water absorption.

D.2 - Conditioning of the specimens

The prepared specimens shall be conditioned for 7 days at (23 ± 2) °C and (50 ± 5) % RH.

They shall be then subject to a series of 3 cycles comprising the following phases:

- Phase 1: 24 h partial immersion in a water bath (tap water) at (23 ± 2) °C

  The specimens shall be immersed face downwards, to a depth of 2 to 10 mm, the depth of immersion depends upon surface roughness. To achieve complete wetting of rough surfaces, the specimens shall be tilted as they are introduced into the water. The depth of immersion may be regulated in the water tank by means of a height-adjustable slat.

- Phase 2: 24 h drying at (50 ± 5) °C

If interruptions are necessary, e.g., at weekends or holidays, the specimens shall be stored at (23 ± 2) °C and (50 ± 5) % RH after the drying at (50 ± 5) °C.

After the cycles, the specimens shall be stored for at least 24 h at (23 ± 2) °C and (50 ± 5) % RH.

D.3 - Test procedure

To start the capillarity test, the specimens shall again be immersed in a water bath as described above.

The specimens shall be weighed after 3 minutes immersion in the bath (reference weight) and then after 1 hour and 24 hours. Prior to the second and subsequent weighing, water adhering to the surface of the specimen shall be removed with a damp sponge cloth.

D.4 - Test results

Calculation shall be undertaken to determine the arithmetic average value of water absorption per square metre after 3 min, 1 hour and 24 hours of the three specimens.

ANNEX E: BOND STRENGTH TEST

E.1 - General

The test procedure given below is considered equivalent to the procedure described in EN 13494 for External Thermal Insulation Composite System where the board acts as the thermal insulation panel.

Tests shall be carried out for the connections and conditionings given in Table E.1.1.

Bond strength connexion	**Specimen conditioning (i)**	**Bond strength minimum value**[10] **(kPa)**
Whole rendering system and the board	a) initial state	≥ 80 (iv) or ≥ 30 if cohesive rupture in the board
	b) after hygrothermal cycles (ii)	≥ 60 (v) or ≥ 30 if cohesive rupture in the board
	c) after freeze-thaw cycles (iii)	
	d) 2 d. H_2O + 2 h. drying	test for selecting the worst case to be tested to hygrothermal and freeze-thaw cycles (see clause F.1.2)
	e) 2 d. H_2O + 7 d. drying	
	f) 7 d. H_2O + 7 d. drying only for finishing-coats not tested to hygrothermal cycles	≥ 80 (iv) or ≥ 30 if cohesive rupture in the board
Reinforced base-coat and the board	a) dry conditions	≥ 80 (iv) or ≥ 30 if cohesive rupture in the board
	b) after hygrothermal cycles (ii)	≥ 60 (v) or ≥ 30 if cohesive rupture in the board
	c) after freeze-thaw cycles (iii)	
	d) 2 d. H_2O + 2 h. drying	test for selecting the worst case to be tested to hygrothermal and freeze-thaw cycles (see clause F.1.2)
	e) 2 d. H_2O + 7 d. drying	
	f) 7 d. H_2O + 7 d. drying only for reinforced base-coats on MgO boards	

(i) The different conditionings are defined as:
- a) After at least 28 days curing at (23 ± 2) ºC and (50 ± 5) % RH, i.e., without any supplementary conditioning (at initial state).
- b) After hygrothermal cycles (see clause F.1) or after the test combined hygrothermal and freeze-thaw cycles (see clause F.2).
- c) After freeze-thaw cycles (see Annex G).
- d) After immersion in water at (21 ± 2) °C for 2 days and 2 hours drying at (23 ± 2) ºC and (50 ± 5) % RH after removing the specimens from the water.
- e) After immersion in water at (21 ± 2) °C for 2 days and 7 days drying at (23 ± 2) ºC and (50 ± 5) % RH after removing the specimens from the water.
- f) After immersion in water at (21 ± 2) °C for 7 days and 7 days drying at (23 ± 2) ºC and (50 ± 5) % RH after removing the specimens from the water.

(ii) On specimens taken from the specimen of the hygrothermal test or combined hygrothermal and freeze-thaw test.

(iii) On specimens taken from the specimen of the freeze-thaw test.

(iv) The minimum value of the test results shall be greater or equal than this value with adhesive rupture. One single test result lower than 80 kPa but higher than 60 kPa is admissible.

(v) The arithmetic average value of the test results shall be greater or equal than this value with cohesive or adhesive rupture.

Table E.1.1: Bond strength. Conditioning and minimum values.

10 The limit values are those considered in EAD 040083-00-0404 (former ETAG 004) that are fully applicable here because the composition of the rendering system is equivalent.

E.2 - Preparation of the test specimen

The whole rendering system or the reinforced base-coat alone shall be applied in boards with the appropriate size, e.g., at least 350 mm x 350 mm (large specimen), to obtain the measurements by cutting square areas 50 mm x 50 mm (small specimens). Several cuttings and measurements may be obtained from one board specimen with the corresponding rendering system or reinforced base-coat.

Rendering system and reinforced base-coat shall be applied according to the MPII (Manufacturer Product Installation Instructions). Components used, thickness, weight and method of application shall be recorded.

Test shall be carried out for each combination of board material, reinforced base-coat alone and rendering system (including different finishing-coats).

When a finishing-coat includes a range of different aggregate sizes, for reducing the tests, the worst finishing-coat (i.e., the one with minimum bond strength resistance value) may be defined by considering one indicative test specimen for each aggregate size. Once the worst case has been defined, the assessment may be carried out for this worst case and the obtained values shall be considered for the other finishing-coats.

For each conditioning given in Table E.1.1 the large specimens shall be prepared together with the corresponding large specimens at initial state. When possible, it is recommended to prepare the large specimens for the complete set of conditionings all together.

Large specimens shall be cured at least 28 days at (23 $\pm$ 2) ºC and (50 $\pm$ 5) % RH before starting the conditionings given in Table E.1.1.

Rear surface and edges of the large specimens to be used in conditionings given in points c) to f) indicated in Table E.1.1 (by freeze-thaw and by immersion in water) shall be completely protected against water penetration by appropriate organic coating.

Test shall be carried out on at least five cutting areas as given above (small specimens), for each rendering combination and conditioning, obtained by cutting on the large specimen size area.

The small specimens shall be cut through the layers according to Figure E.3.1 (the depth of the cut shall be at least 3 mm below the upper surface of board) using an adequate tool (e.g., a saw). At least 50 mm of distance is necessary between each small specimen and with the edges of the large specimen. Metal plates of appropriate size shall be affixed to these cut areas with a suitable adhesive.

All large test specimens aged and conditioned as given in Table E.1.1 shall be dried for at least 7 days in laboratory conditions (23 ± 2) °C and (50 ± 5) % RH and then the small specimens shall be cut.

E.3 - Test procedure

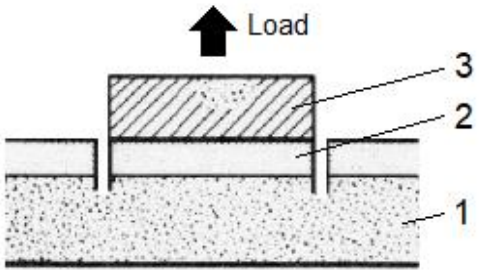
Dried large specimens shall be positioned on rigid substrate, pull-off machine shall be attached to test metal plate and pull-off test shall be performed at a tensioning speed of (10 ± 1) mm/min for each small specimen (cut area).

For each individual measurement, the following information shall be noted and recorded:

- Area of small specimen (square area) [in mm].
- Breaking load [in kN].
- Mode of failure (adhesion between any layer or cohesion in any layer) in % of small specimen area.

The bond strength of each tested specimen shall be calculated, and the result shall be expressed in kPa with accuracy as integer.

The arithmetic average value of the bond strength shall be calculated from at least five test results.



Legend:

1. Board substrate.
2. Whole rendering system or reinforced base-coat alone.
3. Bonded metal plate.

Figure E.3.1: Bond strength test specimen.

E.4 - Test report

Each individual value of bond strength and the rupture type (cohesive rupture and/or adhesive rupture) shall be recorded.

Test report shall include at least the following information:

- Registered data of the stages of the installation:
  - The date and time of the different stages of application.
  - Name and production lot of the components.
  - Way of component preparation (tool, % of mixing, possible pause time before application, etc.) as well as their way of application (hand tool, machines, number of layers, etc.).
  - Quantity and/or thickness of component layers applied per square metre.
  - Drying period between each layer.
  - Any other information meaningful for the test and its result.
- Registered values of dimensions, breaking loading and type of braking of each measurement.
- Calculated bond strength of each measurement.
- Calculated arithmetic average value of bond strength for the set of at least five measurements.

ANNEX F: HYGROTHERMAL BEHAVIOUR TEST

This annex describes the following hygrothermal behaviour tests:

1. Hygrothermal behaviour test (see clause F.1), which include:
    - Heat-rain cycles
    - Heat-cold cycles
2. Combined hygrothermal and freeze-thaw cycles (see clause F.2), in case of severe climatic conditions when it is required in national regulation. It includes:
    - Heat-rain cycles
    - Heat-cold cycles
    - Freeze-thaw cycles.

The purpose is to determine the effects of accelerated ageing by hygrothermal procedures on the kit.

After the hygrothermal cycles, bond strength tests (see clause 2.2.6.1) and hard body impacts (see clause 2.2.5) shall be carried out on cutting specimens taken of the test wall (test rig specimen).

The specimens for bond strength at initial state indicated in point a) of Table E.1.1 (without hygrothermal cycles) shall be prepared at the same time that hydrothermal test rig specimens.

F.1 - HYGROTHERMAL BEHAVIOUR TEST

F.1.1 - Principles related to the preparation of the specimen

The assembled cladding kit with rendering (including the profiles and brackets) shall be installed, in accordance with the MPII, on a rigid substrate, preferably on a steel frame or timber frame that allows to observe the rear side of the boards. A sufficiently stabilised masonry or concrete substrate (minimum 28 days) may also be used.

The test wall (test rig specimen) shall have one or two openings (depending on the number of rendering system configurations that shall be tested) positioned as given in the Figures F.1.1.1 and F.1.1.2. The dimension of the weather surface area (of at least 6 m^2) of the test wall shall be:

- Width: ≥ 2,50 m (for one opening) or ≥ 3,00 m (for two openings).
- Height ≥ 2,00 m.

The openings shall be at the upper part of the test wall positioned at a distance ≥ 0,40 m from the edges (preferably positioned as shown in Figures F.1.1.1 and F.1.1.2, for one and two openings respectively). The openings shall have a width and a height of (0,5 ± 0,1) m.

The configuration of the specimen shall be decided according to the following rules:

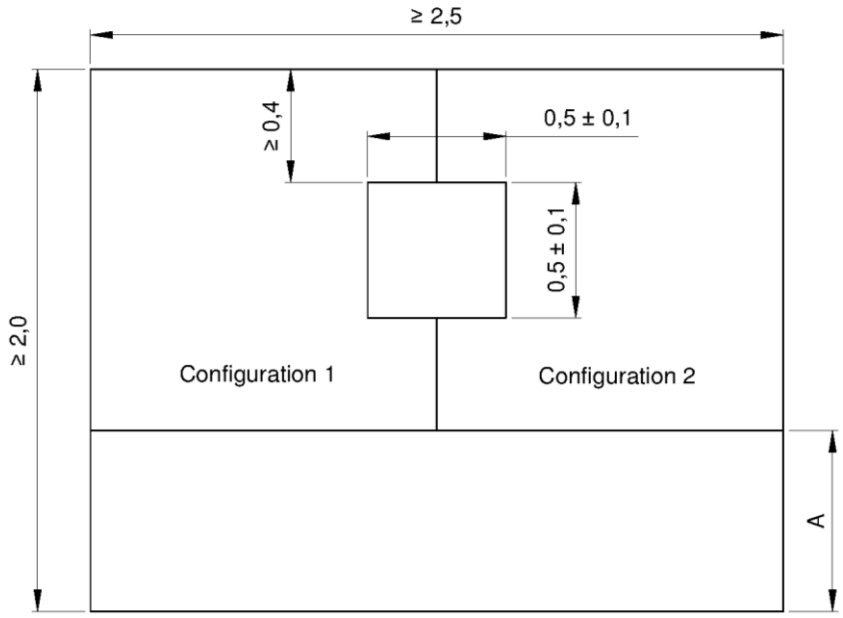
- At least the worst case shall be considered (i.e., maximum water absorption of the rendering systems and boards, minimum bond strength, minimum thickness of the rendering system components, etc.). Additional tests given in clause F.1.2 may also be considered for selecting the worst case.
- If more than 4 finishing-coats are considered, the maximum number of finishing-coats, representative of the different types proposed, shall be tested. Furthermore, if the water absorption

of the reinforced base-coat after 24 hours is equal to or more than 0,5 kg/m^2 (see clause 2.2.3.1), each type of finishing-coats containing a pure polymeric binder (no cementations) shall be submitted to hygrothermal cycles.

- As general rule, for each opening, only one board and only one reinforced base-coat shall be used for the test wall specimen. If more renderings are tested, reinforced base-coat shall be without dilatation joints in contact lines of renderings.
- At the very most two rendering systems (different nature of finishing) shall be applied per opening in the test wall (vertical divisions). Maximum two configurations in the case of one opening (see Figure F.1.1.1) and maximum four configurations in the case of two openings (see Figure F.1.1.2).
- If different finishing-coats are used, the lower part of the test wall area (A = 1/3 of the total height) shall consist of the reinforced base-coat alone (without any finishing-coat).
- Where relevant, on vertical sides of test rig specimen the reinforced base coat shall be implemented continuously from front side on lateral sides of the rig.

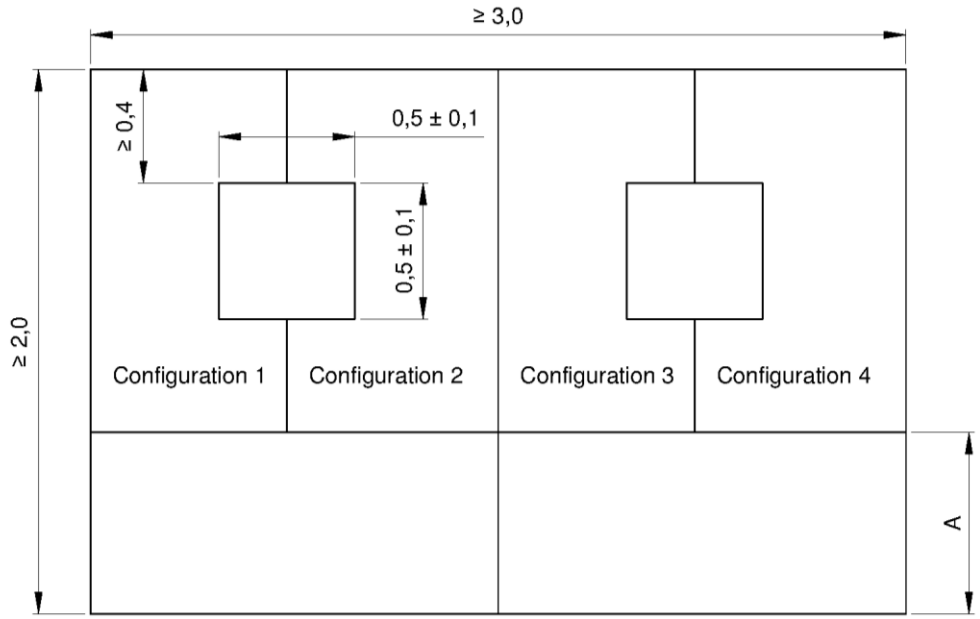
Any other finishing-coat not tested on the hygrothermal test rig specimen shall be assessed by means of bond strength tests according to clause 2.2.6.1 after immersion in water for 7 days and 7 days drying at (23 ± 2) ºC and (50 ± 5) % RH after removing the specimens from the water (conditioning indicated in point f) of Table E.1.1).

Special methods for reinforcing corners of the opening, as well as the installation of the windowsill and other ancillary materials shall follow the MPII.



Where: A = 1/3 of the total height.

Figure F.1.1.1: Example of hygrothermal behaviour test rig specimen (test wall) with one opening (dimensions in metres).



Where: A = 1/3 of the total height.

Figure F.1.1.2: Example of hygrothermal behaviour test rig specimen (test wall) with two openings (dimensions in metres).

F.1.2 - Tests for selecting the worst case

When the assessment covers a range of different finishing-coats, it is possible to select the worst case to be included in the hygrothermal cycle test rig by means of bond strength tests according to clause 2.2.6.1 after:

- immersion in water for 2 days and 2 hours drying at (23 ± 2) ºC and (50 ± 5) %RH after removing the specimens from the water (conditioning indicated in point d) of Table E.1.1).
- immersion in water for 2 days and 7 days drying at (23 ± 2) ºC and (50 ± 5) % RH after removing the specimens from the water (conditioning indicated in point e) of Table E.1.1).

Bond strength lower values shall be considered as the worst case.

F.1.3 - Preparation of the specimen

The preparation of the test rig specimen (test wall) shall be carried out according to MPII. The following data shall be recorded:

- Registering of all the stages of the installation:
  - The date and time of the different installation stages.
  - Environmental temperature [in ºC] and relative humidity [% RH] during the installation (every day – at least at the beginning).
  - Name and production lot of the components.
  - Figure describing the test wall (given the kit components dimensions and position of the components and board joints).
  - Way of base-coat and finishing-coat preparation (tool, % of mixing, possible pause time before application, etc.) as well as their way of application (hand tool, machines, number of layers, etc.),

- Quantities and/or thickness of base-coat and finishing-coat applied per square meter.
- Drying period between each layer.
- Use and position of accessories or ancillary components.
- Any other relevant information.

Quantities and/or thicknesses applied shall be recorded.

F.1.4 - Conditioning of the specimen

Each layer shall be cured inside for the time defined in the MPII (if no information is given, the whole specimen shall be cured at least for 28 days). During the curing time the ambient temperature shall be (20 ± 10) °C. The relative humidity shall not be less than 50 % RH. To ensure that these conditions are met, records shall be made at regular intervals.

To prevent the layers are dried out too rapidly the layers may be wetted once per week by spraying for approximately 5 minutes. This shall start according to the prescriptions given in the MPII.

During the curing time any deformations of the layers, i.e., blistering, cracking, shall be recorded.

F.1.5 - Hygrothermal cycles

The test devices (according to clause 5 of EN 16383) shall be positioned against the front surface of the specimen, 0,10 m to 0,30 m from the rendering surface.

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

Heat - rain cycles:

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

1. Heating to 70°C (rise for 1 hour) and maintaining at (70 + 5) °C and 10% to 30% RH for 2 hours (total of 3 hours).
2. Spraying for 1 hour, water temperature (15 ± 5) °C, amount of water (1,5 ± 0,5) l/m² min.
3. Leave for 2 hours (drainage) at (20 ± 5) °C.

Heat-cold cycles:

After at least 48 hours of subsequent conditioning at temperatures (20 ± 10) °C and a minimum relative humidity of 50 %, the same test specimen shall be exposed to 5 heat/cold cycles of 24 hours comprising the following phases:

1. Exposure to (50 ± 5) °C (rise for 1 hour) and maximum 30% RH for 7 hours (total of 8 hours).
2. Exposure to (- 20 ± 5) °C (fall for 2 hours) for 14 hours (total of 16 hours).

F.1.6 - 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.) of the whole rendering system and of the part of the specimen consisting of only the reinforced base-coat shall be recorded as follows:

- The surface finish (base-coat or whole rendering system) of the kit shall be examined to establish whether any cracking has occurred. The dimensions and position of any cracks shall be measured and recorded.
- The surface shall also be checked for any blistering or peeling, and the location and extent shall again be recorded.
- The windowsills and profiles shall be checked for any damage/degradation together with any associated cracking of the finishing. The location and extent shall also be recorded.

Following the completion of the test, a further investigation shall be conducted involving removal of components containing cracks to observe any water penetration within the kit (e.g., rear side of the board).

F.1.7 - After the cycles

After the heat-rain and heat-cold cycles, bond strength tests (see clause 2.2.6.1) shall be carried out on small specimens taken from the test specimens.

These tests shall be performed after at least 7 days drying at ambient temperature (20 ± 10) °C.

F.1.8 - Test report

At least, the test report shall detail the following:

- Observations recorded during the test (see clause F.1.6).
- Photos to detail the damages occurred on each specimen after the cycles and, if necessary, after each visual inspection.

F.2 - COMBINED HYGROTHERMAL AND FREEZE-THAW CYCLES TEST

The test procedure given below is considered equivalent to the procedure described in EN 16383 for External Thermal Insulation Composite System where the board acts as the thermal insulation panel.

F.2.1 - Principles related to the preparation of the specimens

See clause F.1.1.

F.2.2 - Preparation of the specimen

See clause F.1.2 and F.1.3.

F.2.3 - Conditioning of the specimen

See clause F.1.4.

F.2.4 - Combined cycles

The test devices (according to clause 5 of EN 16383) shall be positioned against the front surface of the specimen, 0,10 m to 0,30 m from the rendering surface.

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

Heat - rain cycles:

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

3. Heating to 70°C (rise for 1 hour) and maintaining at (70 ± 5) °C and 10% to 30% RH for 2 hours (total of 3 hours).
4. Spraying for 1 hour, water temperature (15 ± 5) °C, amount of water (1,5 ± 0,5) l/m² min.
5. Leave for 2 hours (drainage) at (20 ± 5) °C.

Heat-cold cycles:

After at least 48 hours of subsequent conditioning at temperature (20 ± 10) °C and a minimum relative humidity of 50 %, the same test specimen shall be exposed to 5 heat/cold cycles of 24 hours comprising the following phases:

1. Exposure to (50 ± 5) °C (rise for 1 hour) and maximum 30% RH for 7 hours (total of 8 hours).
2. Exposure to (- 20 ± 5) °C (fall for 2 hours) for 14 hours (total of 16 hours).

Freeze-thaw cycles:

After at least 48 hours of subsequent conditioning at temperature (20 ± 10) °C and a minimum relative humidity of 50 %, the same test specimen shall be exposed to:

- Conditioning the test specimen spraying for 8 hours, water temperature (15 ± 5) °C, amount of water (1,5 ± 0,5) l/m²·min.
- 30 freeze/thaw cycles of 8 hours comprising the following phases:
  - Freeze the surface of the specimen at least 2 hours to (- 20 ± 5) °C and maintain it for 4 hours (in total 6 hours).
  - Thaw the specimen for 1 hour at temperature of (20 ± 5) °C.
  - Spraying for 8 hours, water temperature (15 ± 5) °C, amount of water (1,5 ± 0,5) l/m²·min.

After the 30 cycles condition specimen at ambient temperature (20 ± 10) °C.

F.2.5 - Observations during the tests

At periods of every four cycles during the heat/rain cycles and at every cycle during the heat/cold cycles and freeze-thaw cycles, observations given in clause F.1.6 shall be considered.

F.2.6 - After the cycles

See clause F.1.7.

F.2.7 - Test report

See clause F.1.8.

ANNEX G: FREEZE-THAW RESISTANCE TEST

The freeze-thaw test shall be carried out as determined by the analysis of the water absorption by capillarity test (see clause 2.2.3.1), i.e., this test shall be carried out except when the water absorption after 24 hours of both, the reinforced base-coat (without finishing-coat) and the whole rendering system (with finishing-coat) determined for each type of finishing-coat is less than 0,5 kg/m².

G.1 - Test specimen preparation

The test shall be carried out on at least three specimens with dimensions 500 mm x 500 mm.

These specimens shall be prepared according to the MPII and then stored for at least 28 days at (23 ± 2) °C and (50 ± 5) % RH.

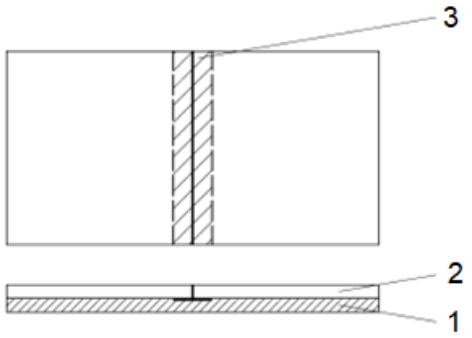
The test specimens shall be prepared with the actual board as substrate. At least three specimens shall be tested for each case (set of board material and rendering system combination or reinforced base-coat).

Each test specimen shall be made of:

- Substrate made of two board pieces connected by an intermediate joint (with the respective joint treatment), see Figure G.1.1 minimum area for each board piece shall be 900 cm² (e.g., 300 mm x 300 mm or 200 mm x 500 mm).
- Each rendering system or reinforced base-coat to be assessed (see also Table E.1.1).

The edges of the specimens (including the board) shall be sealed against water.

Quantities and/or thicknesses applied shall be recorded.



Legend:

1. Whole rendering system or reinforced base-coat alone.
2. Board substrate.
3. Board joint treatment.

Figure G.1.1: Example of freeze-thaw behaviour test specimen

G.2 - Freeze-thaw cycles

The specimens shall be subjected to a series of 30 cycles comprising:

1. Exposure to water for 8 hours at (23 ± 4) °C by immersion of the specimens, with the rendering system submerged in a water bath, according to the method described in clause 2.2.3.1.
2. Freezing to (- 20 ± 2) °C (fall for 2 hours) for 14 hours (total of 16 hours).

If the test is interrupted, because the specimens are handled manually and there are stops during weekends or holidays the specimens shall always be stored at a temperature of (- 20 ± 2) °C between the cycles.

The specified temperatures shall be measured at the surface of the specimens (surface of the rendering). The regulation is obtained by conditioned air.

G.3 - Observations

At the end of the test, observations relating to a change in characteristics of the surface or to the behaviour of the kit shall be recorded according to clause F.1.6.

Any distortion at the edges of the specimens shall also be reported.

G.4 - After the cycles

After the freeze-thaw cycles, bond strength tests (see clause 2.2.6.1) shall be carried out on each specimen submitted to freeze-thaw cycles.

These tests shall be performed after at least 7 days drying at ambient temperature (20 ± 10) °C.

G.5 - Test report

See clause F.1.8.