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FIRE PROTECTIVE PRODUCTS

RENDERINGS AND RENDERING KITS INTENDED FOR FIRE RESISTING APPLICATIONS

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

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The construction product is a fire protective rendering or rendering kit¹, put on the market as the dry mix in bags and, in case of kits, combined with other components as fixings, primers, top coatings, etc.

The product assessed on the basis of this EAD is applicable to the following substrate materials:

- Steel²,
- Concrete,
- Masonry,
- Timber (including wood based board products)³
- Boards (including plasterboard and calcium silicate types).

The EAD does not deal with prefabricated shells or elements for curtain walls.

The product is not covered by a harmonised European standard (hEN).

1.1.1 Dry mix and the assessed product

The dry mix is the basic product excluding fixings, reinforcement or other components incorporated on site.

The dry mix is a dry mortar basing at least on a mineral binder and mineral aggregates. Recycled material as a constituent of the dry mix is acceptable, as long as the recycled constituent is clearly described and is part of the assessment in accordance with this EAD.

The addition of a small amount of additives to improve the application and the product's performance is possible. These additives are not part of the dry mix but, if used in the product assessed, they should be specified in the ETA.

The dry mix is mixed with pure water using, an appropriate equipment according to the manufacturer's instruction. The fresh mortar may be spray-applied or manually applied by trowel to the substrate pre-treated according to the manufacturer's instruction.

The applied fresh mortar hardens and forms the final product, a continuous fire resistant rendering completely bonded to the substrates (steel, concrete, masonry). The assessment of the product is therefore to be done in end-use conditions.

The thickness of the applied rendering depends on the intended fire resistance class of the protected element and shall be calculated according to the standards applied according to this EAD.

1.1.2 Technical description of the rendering or rendering kit

The materials and components of the fire protective rendering shall be specified through their properties which have an influence on the ability of the rendering to fulfil the basic requirements of the works (BWR). To that purpose, see clause 2.3.2 except for confidential aspects.

1.1.3 Options of product assessment

- Option 1

The ETA only covers the fire protective rendering product (dry mix) evaluated in its end use application directly applied to the specific substrate without the use of additional components such as a bonding agent, reinforcing mesh, fixings, top coat/sealing coat or additives.

- Option 2

The ETA covers a real kit comprising the rendering product (dry mix) plus one or more specified additional components such as bonding agent/s, reinforcing mesh, fixings, top coat/sealing coat or additives evaluated in the end use application as a rendering and being supplied by the producer as a rendering kit. All components need to be described and subjected to the assessment and to factory production control (FPC)

¹ "Kit" means a construction product placed on the market by a single manufacturer as a set of at least two separate components that need to be put together to be incorporated in the construction works.

² For other metals a separate EAD may be necessary.

³ For the application of the product on timber or timber products a separate EAD might be necessary to define the methods to test fire resistance and to demonstrate proper adhesion (the bond on the substrate).

requirements. The rendering kit shall comprise at least two components.

- **Option 3**

The ETA is issued for a possible “final assembly” defined by the ETA holder. The ETA only covers the rendering product (dry mix), but one or more specified additional components such as primer/s, bonding agent/s, reinforcing mesh, fixings, top coat/s, sealing coat/s or additives will be added on site to form the system. These are evaluated in the end use application as a rendering but with all additional components being placed on the market by other than the producer of the rendering product. The technical description of the additional components may be specific (e.g. by trade name or type) or generic (e.g. family of primers or by minimum properties and/or performance). All components of the “final assembly” are subjected to the assessment, but only the rendering product (dry mix) is subjected to the FPC requirements and CE-marking.

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.

Specific provisions are defined in Annex G.

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

1.2.1 Intended use(s)

The product is intended to be used to protect construction elements in case of fire or to up-grade the resistance to fire of construction elements e.g. of steel columns, beams or other load-bearing elements for internal or external use.

1.2.2 Types of elements to be protected

To facilitate the expression of different performance (e.g. concerning fire resistance test) of the fire protective rendering with regard to the element(s) intended to be protected and the resistance to fire referred to in Table 1, BWR 2, a distinction is made between the following types of use related to the element(s) intended to be protected:

- Type 1 Fire Protective Products as a horizontal membrane protection
- Type 2 Fire Protective Products as a vertical membrane protection
- Type 3 Fire Protective Products to protect load-bearing concrete elements
- Type 4 Fire Protective Products to protect load-bearing steel elements
- Type 5 Fire Protective Products to protect load-bearing flat concrete profiled sheet composite elements
- Type 6 Fire Protective Products to protect load-bearing concrete filled hollow steel columns
- Type 7 Fire Protective Products to protect load-bearing timber elements³
- Type 8 Fire Protective Products that contribute to the fire resistance of fire separating assemblies with no load bearing requirements
- Type 9 Fire Protective Products that contribute to the fire resistance of technical services assemblies in buildings
- Type 10 Other intended uses, related to fire compartmentation or to protection of fire performance, not covered by types 1 to 9.

1.2.3 Type of use related to environmental conditions

The type of environmental conditions for the intended use base on the general fact that temperature,

freeze/thaw, humidity (water vapour, liquid water, rain), UV exposure, pollution⁴ (e.g. for industrial regions: high SO₂, H₂S, NO_x; for coastal regions: high chloride levels), biological attack⁴ etc. may influence essentially the performance of the product considered.

The product shall be assessed for the following use scenario when applied:

- **Type X** Renderings and rendering kits intended for all climatic conditions (internal, semi-exposed and exposed to weather),
- **Type Y** Renderings and rendering kits intended for internal and semi-exposed conditions. "Semi-exposed" includes temperatures below 0 °C, but no exposure to rain and limited or casual exposure to UV (but the effect of UV exposure is not assessed),
- **Type Z₁** Renderings and rendering kits intended for internal conditions with humidity equal to or higher than 85 % RH, excluding temperatures below 0 °C⁵,
- **Type Z₂** Renderings and rendering kits intended for internal conditions with humidity lower than 85 % RH excluding temperatures below 0 °C.

NOTE 1: *Products that meet the requirements for type X, meet the requirements for all other types. Products that meet the requirements for type Y also meet the requirements for types Z₁ and Z₂. Products that meet the requirements for type Z₁ also meet the requirements for type Z₂.*

It is acceptable for a rendering to be intended for internal applications only, however, the construction process may result in a rendering being subjected to outdoor conditions for an extended period before the building envelope is closed. In this case the conditions during the construction process could be more severe than intended for the final end use. The following possibilities shall be taken into consideration to avoid disadvantages and a loss in performance:

1. Special provisions shall be made to protect temporarily the exposed rendering according to the instructions of the producer included or referenced in the ETA, or
2. the rendering shall be evaluated as if it were intended to be used for exposed applications (Type X), or
3. for established products only, the evaluation of the rendering for use conditions of type Y or type Z applications (as appropriate) and acceptance by the TAB of the possibility of short term exposure based on long term experience and evidence of such exposure.

The use of sealing coats or top coats for exposed and semi-exposed applications may be required for the rendering to assist the resistance to weathering. In the case that resistance to fire tests are carried out without the sealing coat/top coat, insulation efficiency test on coated renderings shall be performed in accordance with Annex E.

1.2.4 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 rendering/ rendering kit for the intended use of 25 years when installed in the works provided that the rendering/rendering kit is subject to appropriate installation (see 1.1), use and maintenance (see Annex G). These provisions are based upon the current state of the art and the available knowledge and experience.

If a satisfactory performance of the product is not established in the durability tests then an estimated working life of 10 years may be attributed based on a favourable assessment of serviceability tests (e.g. flexural and compressive strength and where possible adhesion/bond strength) but only for use conditions of type Z₂. Additional evidence of the product in actual service may also be taken into account.

Therefore, when an assessment following these EAD provisions is made, the assessment methods are appropriate with regard to the assumed working life. 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 works⁶.

⁴ The influence of pollution and/or biological attack on the fire performance may be very complex and specific. If specific test methods and assessment procedures may be required, a separate EAD is needed.

⁵ These conditions apply for internal humidity class 5 in accordance with EN ISO 13788.

⁶ 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.

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 choosing the appropriate products in relation to the expected economically reasonable working life of the works. They are also not appropriate to serve as a basis to derive performance of the product for essential characteristics related to the basic requirement 7 for construction works.

1.3 Specific terms used in this EAD in addition to the definitions in CPR, Art 2

1.3.1 Rendering (spray or trowel applied fire protective material)

The applied product for fire protection comprises only:

1. Spray-applied gypsum or cement binder mixed with one or more aggregates and/or fibres. The product is mixed with water to produce a slurry and sprayed wet;
2. Spray-applied mineral wool mixed with a mineral binder, filler and/or aggregates. The product is sprayed dry and mixed with water at the nozzle. The binder may be included as part of the dry mix in the bag or may be added with the water at the nozzle;
3. Trowel applied gypsum or cement binder mixed with one or more aggregates and/or fibres mixed as a slurry at a consistency which enables it to be trowel-applied to conform with the profile of the substrate;
4. The same materials as in 1, 2 and 3 above but trowel applied and mixed at a consistency which allows the "patch repair" of "small areas" of the finally applied products described in 1, 2 and 3.

The term 'rendering' refers to the applied, dried and hardened product.

1.3.2 Mechanical fixings

Mechanical fixings are components to key or to reinforce the rendering to the substrate.

- Keying mesh: mesh of metal or other material of relatively small aperture size, typically 10 mm to 25 mm which allows some penetration of spray to produce a good key and applied in close proximity or fixed to the substrate. Typical types: expanded metal lath, ribbed expanded lath, welded mesh, woven hexagonal mesh.
- Reinforcing mesh: mesh of metal or other material of relatively large aperture size, typically 25 mm which allows full penetration of the rendering and hence provides reinforcement. Typical types: welded mesh, woven hexagonal mesh. A reinforcing mesh is typically positioned in the middle third of the rendering thickness.
- Discontinuous metal fixings: pins welded, shot-fired or screwed to the substrate and bent, split or fixed with large diameter washers or spring clips to key the rendering or used to support keying or reinforcing mesh.

Mechanical fixings shall be specified and assessed in accordance with the relevant product and test standards.

1.3.3 Primer

Primers are components used for:

- corrosion protection, a coating applied directly to a suitably prepared steel surface to provide corrosion protection, or
- bonding agent, a liquid component not part of the dry mix and not mentioned in its formulation, applied to the substrate separately or mixed with the rendering and applied as a thin first layer to ensure or to improve the adhesion (bond strength) of the rendering on the substrate, especially if no mechanical fixing is used.

1.3.4 Additives:

Additives are components not part of the dry mix and not mentioned in its formulation; added to the water or to the fresh mixed slurry before spraying to ensure or to improve the adhesion (bond strength) of the rendering, to accelerate or retard the setting process or to influence the porosity.

1.3.5 Rendering kit:

The rendering kit comprises the dry mix (usually delivered in bags) and one or more other components such as bonding agent/s, reinforcing mesh, fixings, top coat/s, sealing coat/s or additives provided by the ETA holder.

1.3.6 Top coats / Sealing coats:

These materials are generally components of an “external grade” rendering kit where the rendering requires additional weathering resistance. They may also be used to protect the rendering from mechanical damage, or be provided purely for decorative purposes without any claimed contribution to performance.

These materials may be:

- coatings of low viscosity intended to soak into the surface of the rendering,
- coatings of high viscosity which are either spray or brush applied as a surface sealing coat over the rendering.

1.3.7 Shelf life:

The shelf life describes the maximum time for which the dry mix shall be stored under the specified storage conditions.

1.3.8 Pot life:

This term describes the maximum time within which the dry mix, once mixed with water and any other additives, shall be used and finally applied.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the fire protective rendering /rendering kits is assessed in relation to the essential characteristics.

Table 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 (level, class, description)
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	class
2	Resistance to fire	2.2.2	class
3	Durability	2.2.12	description
Basic Works Requirement 3: Hygiene, health and the environment			
4	Content, emission and/or release of dangerous substances	2.2.3	description
5	Water vapour permeability	2.2.4	description
Basic Works Requirement 4: Safety and accessibility in use			
6	Mechanical resistance and stability	2.2.5	description
7	Resistance to impact/movement	2.2.6	description
8	Adhesion ¹⁾	2.2.7	level
Basic Works Requirement 5: Protection against noise			
9	Airborne sound insulation	2.2.8	level
10	Sound absorption	2.2.9	level
11	Impact sound insulation	2.2.10	level
Basic Works Requirement 6: Energy economy and heat retention			
12	Thermal insulation	2.2.11	level
13	Water vapour permeability	2.2.4	level

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

Characterisation of products to be assessed shall be done in accordance with available specifications, notably with the basic material properties which are relating to intended fire protective performance.

2.2.1 Reaction to fire

The rendering/rendering kit shall be tested according to the relevant test method referred to in EN 13501 -1 (EN ISO 1182; EN ISO 1716; EN ISO 11925-2; EN 13823) in order to be classified according to EN 13501-1..

If the rendering is intended to be used with and without a top coat, both situations shall be tested.

If relevant, the test configuration should take into account the intended installation situation (wall, ceiling, roof pitch etc.). Guidance on mounting and fixing arrangements for the relevant tests is given in Annex A of this document.

If the rendering/rendering kit is considered to satisfy the requirements for performance class A 1 of the characteristic reaction to fire in accordance with the EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that Decision and its intended use being covered by that Decision.

The rendering/rendering kit shall be classified in accordance with EN 13501-1⁷.

2.2.2 Resistance to fire

The rendering/rendering kit shall be tested according to the relevant test method referred to in the relevant part of EN 13501, according to the type of element intended to be protected (see 1.2.3).

For use Type 4, the rendering/rendering kit shall be tested for various thicknesses according to EN 13381-4, unless the technical assessment body well-foundedly accepts another test method (e.g. for the use of historical data).

The fire resistance shall be classified in accordance with EN 13501 and shall specify the elements (substrate) to be protected, e.g. the steel section.

Because a rendering does not possess fire resistance in its own right, the classification applies to the protected element, including the rendering, and not to the protection itself.

NOTE 2: *European Technical Assessments (ETAs) issued before publication of the EAD in the OJEU on the basis of the corresponding ETAG 018, Part 3 according to Art 66 (3) of Regulation (EU) 305/2011 are deemed to have been issued on the basis of this EAD.*

2.2.3 Content, emission and/or release of dangerous substances

The performance of the rendering/rendering kit related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer⁸ after identifying the release scenarios (in accordance with EOTA TR 034) taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified intended release scenarios for this product and intended use with respect to dangerous substances for this product are:

IA1: Product with direct contact to indoor air.

IA2: Product with indirect contact to indoor air (e.g. covered products) but possible impact on indoor air.

SW 2: Product with indirect contact to soil, ground- and surface water.

2.2.3.1 SVOC and VOC

For the intended use covered by the release scenarios IA1 and IA2 semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) are to be determined in accordance with EN 16516.

⁷ In this text "classification according to EN 13501-1" means classification according to EN 13501-1 or classification "class A1" according to Decision 96/603/EEC as amended or according to a relevant CWFT decision.

⁸ The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged:

- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

The respective loading factor [m^2/m^3] used for emission testing can be taken from the following table:

Table 2 Loading factor L, depending on the product type (in accordance with EN 16516)

Intended use	Loading factor [m^2/m^3]
Walls	1,0
Floor, ceiling	0,4
Small surfaces, small surfaces, e.g. door, window, heating system	0,05
Very small surfaces, e.g. sealants	0,007

The preparation of the test specimen is performed as follows:

- a) For the rendering the application is carried out as specified in the manufacturer's instructions for the product using a substrate made of stainless steel or (in absence of such instructions) the usual practice for installation.
- b) For the rendering kit all possible materials and components of the kit are to be installed in accordance with the manufacturer's product installation instructions or (in absence of such instructions) the usual practice of installation.

Once the test specimen has been produced, as described above, it should immediately be placed in the emission test chamber. This time is considered the starting time of the emission test.

The test results have to be reported for the relevant parameters (e.g. chamber size, temperature and relative humidity, air exchange rate, loading factor, size of test specimen, conditioning, production date, arrival date, test period, test result) after 3 and 28 days testing.

The relevant test results shall be expressed in [mg/m^3] and stated in the ETA.

2.2.4 The relevant test results shall be expressed in [mg/m^3] and stated in the ETA. Water vapour permeability

Water vapour transmission coefficient shall be determined in accordance with EN ISO 12572, EN 12086 or similar European standards which are based on the same principle. EN 1015-19 may also be used, if appropriate.

The water vapour transmission coefficient shall be stated for performance description in the ETA together with a reference to the test method applied.

2.2.5 Safety and accessibility in use – mechanical resistance and stability

2.2.5.1 Pull off resistance of discontinuous fixings (into timber, masonry and concrete)

This test method shall be carried out for mechanically fixed systems only and establishes the pull-off resistance of a fixing system. This test shall be conducted on each substrate (including different types of concrete, softwood and hardwood, and masonry) for which the rendering is intended to be used and for each type of fixing.

For each substrate and fixing type, 5 samples are tested. The minimum sample size shall be 300 mm x 300 mm.

The apparatus consists of a dynamometer.

The fixing system is installed in accordance with the ETA-applicant's specifications.

The tensile strength for pulling out the fixing shall be measured with a dynamometer. The tensioning speed is (20 ± 2) mm/min.

The pull-off resistance of each test is recorded.

The test results for each substrate, the mode of failure and mean value are recorded in the test report.

2.2.5.2 Bending resistance of discontinuous fixings (for steel)

These tests shall be carried out to confirm the bending resistance of fixings on each type of steel substrate to which the rendering kit is to be applied.

For “Straight fixing welded pins”, a purpose made tool (100 mm in length) shall be provided to sleeve over the fixing “pin”, leaving a gap of 15-20 mm between the end of the tool and the surface of the steel. The tool shall be bent to an angle of 45 ° and back to vertical without any failure of the pin or weld, see Figure 1. This shall be repeated on no less than 10 fixings without failure.

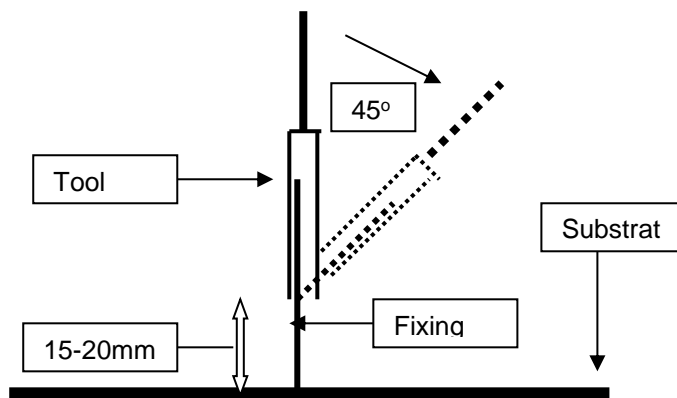


Figure 1 – Schematic of bending test for fixing pins

For “Helical welded pins”, a purpose made tool shall be used to twist the fixing through 90 ° and back without any failure of the pin or weld. This shall be repeated on no less than 10 fixings without failure. The tool is required to engage the top portion of the fixing in such a way as to allow the twisting motion required.

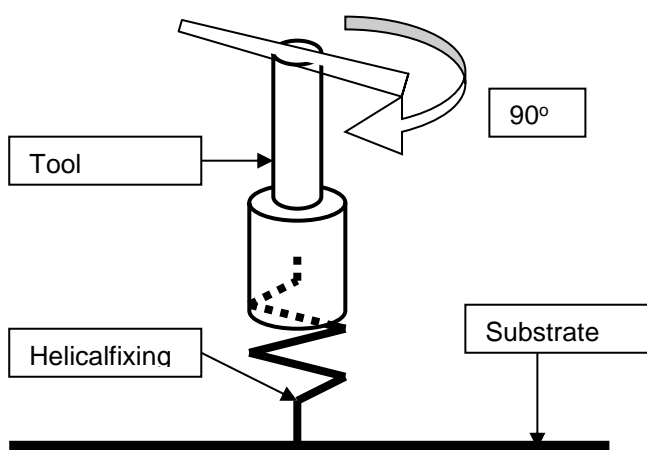


Figure 2 – Schematic of bending test for fixing pins

Fixings different from the types described above shall be tested following the principles of the two methods above. The applied load will be measured and recorded.

2.2.5.3 Pull off resistance of keying mesh

This test is to be carried out to test the weld strength (pull off resistance) of expanded metallic meshes where these are resistance welded to the substrate.

A “T-shaped” tool shall be inserted under the mesh adjacent to the welded strands so as to straddle two strands of the mesh aperture. A load is applied normal to the plane of the mesh and is measured with a simple spring balance. If the spring balance is not suitable, a dynamometer may be used.

The applied load is recorded.

2.2.6 Resistance to impact/movement

2.2.6.1 Resistance to functional failure from hard body impact load – 0,5 kg steel ball

The need to evaluate the resistance to hard body impact is restricted to products intended to be used in applications where hard body impact to the rendering is likely to occur and for which impact resistance is claimed. Tests are not required where the rendering is protected by independent mechanical means.

Tests are not required to be conducted on structural steel sections provided that the material is continuously bonded to the steelwork, unless a top coat is used to improve impact resistance.

If the conditions above do not apply, the test shall be conducted in accordance with the test method as specified in EOTA Technical Report TR 001, with the following modifications:

- a) For flat or essentially flat large surfaces the test sample shall be a section of substrate of minimum dimensions 1 m × 1 m.
- b) For flat, or essentially flat, large surfaces the impact resistance shall be measured both at fixing points, if any, and between fixings.
- c) For evaluation on structural steelwork the test sample shall be a section of a rectangular hollow section steel column of nominal size 1m long of section size 200 mm × 200 mm. The rendering shall be mixed and sprayed in accordance with the ETA-applicant's specification and incorporating the appropriate mechanical fixings, if any, as specified. The test shall be repeated at the minimum thickness of rendering for each intended type of substrate, variation of fixings, including no mechanical fixings if appropriate, and for each fixing pattern. If the worst case fixings and fixing pattern can be described, only the worst case need be tested.
- d) For structural steelwork the impact resistance shall be measured at three points determined to be the weakest points, e.g. at corners and ends of flanges.

The height of the ball before the release shall depend on the claims made by the ETA-applicant.

After testing the sample shall be inspected for visible signs of damage (cracking, spalling or delamination from the substrate) and the dimensions of any detached pieces measured.

The test report shall show the impact resistance (energy in Nm) that the system resisted without visible damage. The test report shall record all visible damage sustained at higher impact levels.

2.2.6.2 Resistance to functional failure from soft body impact load – 50 kg bag

The need to evaluate the resistance to soft body impact is restricted to products intended to be used in applications on large flat vertical surfaces (greater than 1 m by 1 m) in zones where soft body impact is likely to occur. Tests are not required to be conducted on structural steel sections provided that the material is continuously bonded to the steelwork.

Separate tests shall be conducted on each type of substrate for which the rendering is intended to be used, except that the results of tests conducted on rendering applied to sheet steel may be applied to all other substrates defined in this EAD. The steel sheet shall be of the minimum thickness for which the rendering is suitable and the steel shall be supported as it would be in practice.

The test method is specified in EOTA TR 001. The following modifications shall be considered:

The test sample shall be a section of substrate of minimum dimensions 1 m × 1 m. The rendering shall be mixed and sprayed in accordance with the ETA-applicant's specification and incorporating the appropriate mechanical fixings, if any, as specified. The test shall be repeated for each intended type of substrate, maximum and minimum thickness of rendering, variation of fixings, including no mechanical fixings if appropriate, and for each fixing pattern. If the worst case fixings and fixing pattern can be specified, only the worst case need be tested.

The bag is suspended at a specified height above the impact point and released. The point of impact shall be the centre of the sample.

The height of the bag before the release shall depend on the claims made by the ETA-applicant. To prevent progressive damage from influencing the test results, the impact resistance test shall always be conducted on new assemblies.

NOTE 3: *If the resistance to impact/movement for vertical elements is relevant, ISO 7892 may apply.*

After testing the sample shall be inspected for visible signs of damage (cracking, spalling or delamination from the substrate) and the dimensions of any detached pieces measured.

The test report shall show the impact resistance (energy in Nm) that the system resisted without damage. The test report shall record all visible damage sustained at higher impact levels.

2.2.7 Adhesion (bond strength)

The following tests are designed to establish the minimum adhesion required for the rendering to achieve the requested fire performance. See clause 2.3 regarding sample preparation for tests which in the case of adhesion (bond strength) may alternatively be conducted on the fire test sample itself. The least adhesion (bond strength) shall be determined at the minimum and maximum intended rendering thickness. Most timber structures require supplementary fixing but, if no fixings are used, the adhesion (bond strength) shall be tested as for other substrates.

The adhesion (bond strength) of renderings which do not incorporate either a keying or reinforcing mesh shall be determined. Examples of suitable test methods are EGOLF method EA 5 or EN 1015-12 and particularly for low adhesion products, ASTM E 736.

For renderings which incorporate a continuous keying or reinforcement mesh there is no requirement for testing since it is assumed that the reinforcement is independently fixed to the substrate and the fixings are evaluated separately.

NOTE 4: Fire resistance performance is related to a minimum of bond strength on every substrate.

When conducting adhesion (bond strength) tests, the following points shall be observed:

- a) Minimum and maximum rendering thicknesses shall be measured.
- b) Specimens of renderings based on mineral wool fibres are very sensitive to cutting but it is possible, if done with special care and adequate tools (e.g. automatically controlled slitting saw).
- c) The bonding shall ensure that the whole surface of the rendering is fixed to the circular steel plate. Usually, fire protective renderings based on mineral wool show irregular surfaces, which can lead to an inefficient bonding of the circular steel plate. Therefore, in order to ensure a good bonding, the necessary amount of adhesive (in accordance with the ETA-applicant's specification) shall be spread over the rendering surface to fill all the irregularities. Next, the steel plate shall be put on the test specimen and shall be pressed slightly to avoid damage on the test specimen.

Before performing the test, it is necessary to check that no adhesive has penetrated inside the cut between the test piece and the surrounding material.

- d) Load rate. In accordance with the test method, tensile force shall be applied to the test piece, manually or automatically, at a steady rate according to the performance rating of the load cell (capacity 1 kN to 10 kN), or by a steady application of increasing dead weights. The load applying device (tensiometer or dead weights system) shall be able to apply loads from almost 0 kN. The load rate shall be adequate for the tested material. It shall be recorded and specified in the test report.
- e) Test specimen dimensions may need to be smaller than specified in the test method, for example because of the specimen profile (re-entrant or trapezoidal profiles, see figure 3), because of weight considerations or to fit test apparatus at laboratories.

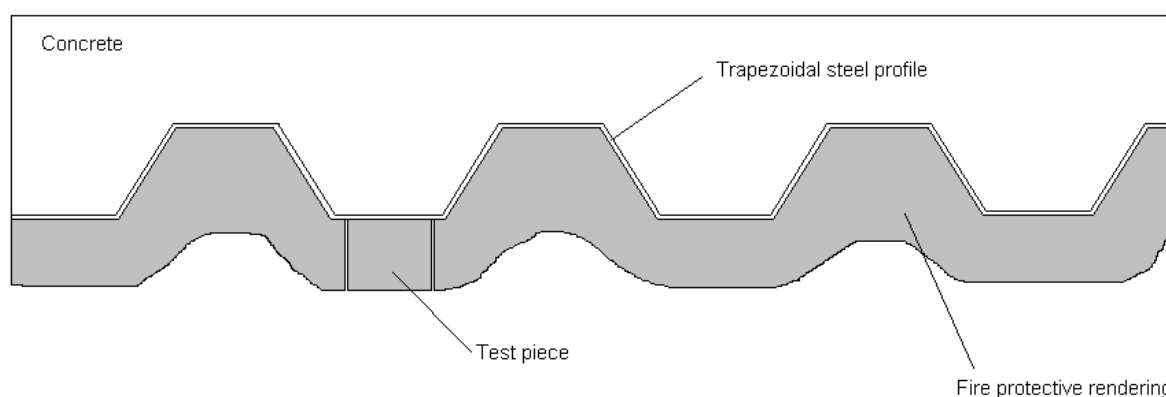


Figure 3 -Sampling for trapezoidal steel profiles

NOTE 5: Failure in the test will be either adhesive or cohesive, depending on which is weaker. It is not possible to predetermine the mode of failure and accordingly not possible to measure bonding between different layers by design.

The measured load in N is recorded; calculated bond strength is recorded in N/mm².

2.2.8 Airborne sound insulation

The airborne sound insulation shall be specified in accordance with EN 10140-2.

The measured airborne sound insulation is expressed as a single number rating R_w in accordance with EN ISO 717-1.

2.2.9 Sound absorption

The sound absorption coefficient shall be determined in accordance with EN ISO 354.

The measured sound absorption is expressed as a single number rating α_w in accordance with EN ISO 11654.

2.2.10 Impact sound insulation

Impact sound insulation shall be determined in accordance with EN 10140-3.

The measured impact sound insulation is expressed as a single number rating $L_{n,w}$ in accordance with EN ISO 717-2.

2.2.11 Thermal insulation

Where the applicant defines the specific thermal conductivity, these either shall be tested in accordance with EN 12664, EN 12667 or EN 12939, as appropriate.

Alternatively, the thermal resistance and thermal transmittance (U-value) may be determined by testing according to EN ISO 8990.

If necessary, the thermal resistance shall be calculated on the basis of EN ISO 6946.

In principle, thermal bridges should be prevented. However, if such bridges occur, their effect on the overall thermal performance shall be incorporated in the above mentioned thermal resistance calculations, taking into account results of thermal bridges calculation methods as described in EN ISO 14683 or EN ISO 10211, as appropriate.

The following methods may be used to determine "thermal insulation".

2.2.11.1 Method for mineral wool based renderings (Annex D)

a) Lambda fractile value at 10 °C, at dry conditions

The lambda fractile value at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$), representing at least 90 % of the production with a confidence limit of 90 % shall be stated in the product assessment (ETA).

b) Moisture conversion factor ($f_{u,1}$)

The moisture conversion factor ($f_{u,1}$) for the conversion of $\lambda_{10,dry}$ to $\lambda_{23,50}$ shall be stated in the ETA.

c) Lambda stated at 23 °C and 50 % relative humidity $\lambda_{D(23,50)}$

The calculated value of the lambda stated at 23 °C and 50 % relative humidity shall be stated in the ETA.

d) Conversion factor to high moisture content ($f_{u,2}$)

The conversion factor to high moisture content ($f_{u,2}$), and the moisture content mass by mass (m/m) at 23 °C and 50 % relative humidity and 23 °C and 80 % relative humidity shall be given in the ETA.

It shall be stated in the ETA that in the value of the lambda stated at 23°C and 50% relative humidity the influence of moisture has been taken into account.

2.2.11.2 Method for renderings other than those based on mineral wool

The determination of the thermal conductivity of these renderings shall be determined in accordance with one of the two following methods:

Method 1: EN 1745:2002, clause 4.2.2

The design value shall be determined in accordance with EN 1745:2002, clause 4.3.

It shall be stated in the ETA that the intended use of the product is restricted to places not exposed to wetting or weathering.

NOTE 6: However, in certain cases it may be necessary to know the influence of high moisture content in relation to the stated lambda value at 23 °C and 50 % relative humidity ($\lambda_{D(23,50)}$). This conversion factor to high the moisture content ($f_{u,2}$) then should only be seen as an information.

Method 2: the same method as for mineral wool based renderings according to 2.2.11.1

The measured or calculated value of the thermal resistance or thermal transmittance shall be stated for performance description in the ETA with the reference to the method of determination.

2.2.12 General aspects relating to the assessed performance of the construction product

2.2.12.1 Durability tests

The following methods of testing shall be applied to the rendering, including if used, any mechanical fixings which are intended to be used as a part of a kit or assembled system, unless similar tests have been performed on the basis of European product standards. The need to conduct each of the following tests is determined by the claimed exposure and environmental conditions for the product or system as given in Table 2.

The appropriate tests for the exposure type/s for the intended use conditions are given in Table 2. The references are to the detailed test requirements given in Annex E. The TAB has to select the relevant characteristic for appropriate assessment.

The test indicated in E.9 of Annex E shall also be used to compare the insulation efficiency of the rendering with different top coats, if relevant.

Table 2: Test requirements for different exposure types

Use conditions (see 1.2.4)	UV	Moisture		Temperature (high/low)	Freeze/thaw
		Rain	High humidity		
Type X	Yes*, E.3	Yes, E.4	Yes, E.5	Yes, E.6	Yes, E.7a
Type Y	No	No	Yes, E.5	Yes, E.6	Yes E.7b
Type Z ₁	No	No	Yes, E.5	No	No
Type Z ₂	No	No	No	No	No

* only necessary for renderings with top coats of organic composition or such with organic binder or aggregates.

Resistance to UV exposure

This exposure condition is a requirement for renderings claimed for use at climatic conditions of type X. The test method is given in Annex E, E.3.

Resistance to deterioration caused by heat and rain

This exposure condition is a requirement for renderings claimed for use at climatic conditions of type X. The test method is given in Annex E, E.4.

Resistance to deterioration caused by high humidity

This exposure condition is a requirement for renderings claimed for use at climatic conditions of type Y and type Z₁. The test method is given in Annex E, E.5.

Resistance to deterioration caused by heat and cold

This exposure condition is a requirement for renderings claimed for use at climatic conditions of type X and type Y. The test method is given in Annex E, E.6.

Resistance to deterioration caused by freezing and thawing

This exposure condition is a requirement for renderings claimed for use at climatic conditions of type X and type Y. The test method for type X is given in Annex E, E.7a. The test method for type Y is given in Annex E, E.7b.

The durability is demonstrated by comparing the performance of unexposed specimens with specimens subjected to artificial ageing (see annex E).

- working life of 25 years:

This shall be the favourable assessment for the relevant complete durability assessment of the rendering. The relevancy depends on the intended use based on the environmental conditions and will be possible for new products if:

- a satisfactory performance for the defined type of use conditions is available or
- the intended use is restricted to use conditions of type Z₂

- working life of 10 years:

If a satisfactory performance of the product is not established in the durability tests then an estimated working life of 10 years may be attributed based on the applicant's demonstration of the satisfactory use of the rendering system for a period of 10 years in the environmental conditions claimed.

2.2.12.2 Demonstration of experience of 10 years favourable performance

If the ETA-applicant uses the option of providing documented proof that the product has been used satisfactorily for at least 10 years under the intended use conditions, the ETA shall specify which evidence was presented to the TAB. If the TAB considers the evidence provided as sufficient, the working life as specified in the ETA shall be 10 years. The evidence provided becomes part of the TAB's confidential file.

2.2.12.3 Assessment criteria for the durability tests

Resistance to UV exposure

Relevant for use conditions of type X.

After the exposure test the samples shall be tested for adhesion according to E.8 and for thermal efficiency according to E.9. The adhesion (bond strength) and the thermal efficiency shall be not less than 80 % of that achieved by unexposed samples. Where the result falls outside this criterion, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

Resistance to deterioration caused by heat and rain

Relevant for use conditions of type X.

After exposure to the prescribed test the adhesion (bond strength) shall be not less than 80 % of that achieved by unexposed samples nor shall the insulation efficiency be less than 85 % of the mean value of the unexposed samples. Where the result falls outside these criteria, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

Resistance to deterioration caused by high humidity

Relevant for use conditions types Y and Z₁.

After exposure to the prescribed test the adhesion (bond strength) shall not be less than 80 % of that achieved by the unexposed samples nor shall the insulation efficiency be less than 85 % of the mean value of the unexposed samples. Where the result falls outside these criteria, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

Resistance to deterioration caused by heat and cold

Relevant for use conditions type X and type Y.

After exposure to the prescribed test the adhesion (bond strength) shall be not less than 80 % of that achieved by the unexposed samples nor shall the insulation efficiency be less than 85 % of the mean value of the unexposed samples. Where the result falls outside these criteria, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

Resistance to deterioration caused by freezing and thawing

Relevant for use conditions of type X and type Y.

After exposure to the prescribed test the adhesion (bond strength) shall be not less than 80 % of that achieved by the unexposed samples nor shall the insulation efficiency be less than 85 % of the mean value of the unexposed samples. Where the result falls outside these criteria, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

2.2.14.4 Serviceability

Additional primers

When different primers are to be specified and assessed, test indicated in E.9 of Annex E shall be used to compare the insulation efficiency of the rendering with the additional primers against the rendering with the primer used in fire test.

For renderings applied with additional primers, the prescribed test the adhesion (bond strength) shall be not less than 80 % of that achieved by the system fire tested nor shall the insulation efficiency be less than 85 % of the mean value of the system fire tested. Where the result falls outside these criteria, four additional specimens with the additional primers may be tested and assessed. All four specimens shall fulfil the pass criteria.

Resistance to corrosion of a steel substrate induced by the rendering

If the rendering is claimed by the ETA applicant to be suitable for direct application to un-primed steel, an assessment of the compatibility with and protective ability to the steel shall be made using the test method given in Annex B. The loss of mass shall be recorded.

If a primer is part of the rendering kit, and it is claimed to provide corrosion protection, then the performance of the primer shall be proven by tests according to EN ISO 12944-6.

Resistance to corrosion of the fixings induced by the rendering

Any fixing shall be contained entirely within the thickness of the rendering and therefore it will not be exposed to environmental conditions after installation. The fixings shall, however, be shown to be compatible with the rendering and not exhibit any adverse reaction. Since the suitability of fixings will depend on the chemical nature of the rendering, no specific test method can be prescribed. The TAB shall determine what is required to establish compatibility.

For galvanised steel reinforcement, the minimum thickness of zinc coating required is determined using the relevant EN method: EN ISO 1460 or EN ISO 1461.

Compatibility of the fixings and the rendering is established by the particular test for the specific fixing/rendering combination.

For galvanized fixings/reinforcement the thickness of zinc coating shall be recorded.

Water absorption (capillarity test)

This test needs only be performed for renderings intended for out-door use (use conditions of type X) or for in-door use at temperatures below 0°C and if the intended use involves conditions, such as contact with the ground, which would make capillarity actions relevant.

In that case the method given in Annex F shall be used.

The assessment shall be done according to Annex F.4.

2.3 Criteria for the application of the test methods

This clause refers to methods used to determine the various aspects of performance of the product in relation to the requirements for the works (calculation, tests, engineering knowledge, site experience, etc.), bearing in mind that the performance of the product is determined in relation to its end-use conditions as specified by the manufacturer.

2.3.1 Sampling and testing specimens

Where possible, samples of the product for all tests shall be taken at the manufacturing site (production, storage) and shall be representative of the rendering or rendering kit.

All samples for test specimens for the product shall be taken at the same time, and from the same lot, ensuring the comparability of the results. If sampling at the same time is impossible for practical reasons, measures shall be taken to ensure that all samples taken have identical constituents and composition. In the latter case the TAB needs to provide relevant evidence of measures taken to those responsible for AVPC.

The specimens for assessment tests shall as far as possible be prepared at the same time and in accordance with the ETA-applicant's application method in order to minimize differences caused by variations in specimen preparation. Simultaneously, samples for density determination shall be prepared. This is in order to relate the characteristics of the material to the fire performance achieved.

Alternatively density may be determined by measurement of actual test specimens.

The surface of the substrate for the specimens shall reflect the surface conditions claimed by the ETA-applicant, as specified in the application instructions for the product.

Unless specified differently for a particular test the following standard substrates shall be used for the tests:

- a) Steel as specified according to EN 10025 grade S, except S185, of size between 300 mm x 300 mm up to 500 mm x 500 mm and of thickness not less than 5 mm.
Where galvanized steel is used as substrate, EN ISO 1460 or EN ISO 1461 applies.
- b) Concrete as specified in EN 1323 of minimum size 300 mm x 400 mm and of nominal thickness 40 mm.
- c) Wood based panels (also covering solid timber) and particle boards as specified in EN 312:2010, of density $700 \text{ kg/m}^3 \pm 10 \%$, nominal size 500 mm x 500 mm and (20 ± 2) mm thick.
- d) For boards other than those in c), the specific board type shall be used.

2.3.2 Technical definition of the rendering or rendering kit

The materials and components of the fire protective rendering shall be defined as to their properties which have an influence on the ability of the rendering to fulfil the basic requirements of the works (BWR).

It is necessary to recognise practical tolerances of the characteristics of the rendering or rendering kit in relation to results/data collected in tests.

The fire protective product shall be clearly described. Regardless of which option (see 1.1.3) is chosen for the rendering or the rendering kit product, components and materials used in fire protective rendering shall be described, either through methods specified in a European product standard or in a European Technical Assessment.

At least the amount of all components of the dry mix shall be specified either by mass or volume percentage, with appropriate tolerances and trade names of raw materials as far as they represent their chemical and physical properties.

The ETA is issued for the fire protective product/kit on the basis of agreed data/information, deposited with the TAB which issued the ETA, which describes the product/kit that has been assessed.

Changes in composition or production process may cause the assessed performance in the ETA being not met.

Changes to additional components of the system may cause the assessed performances in the ETA being not met for those characteristics relating to the assembled system (e.g. resistance to fire).

Table 3 presents examples of methods which may be used to describe the rendering product technically. Methods adopted shall be appropriate to the type of rendering being evaluated and agreed with the TAB.

Additional components, including additives, shall be identified by reference to trade name, reference codes, formulation, and compliance with the relevant EN, corrosion protection, dimensions or other appropriate means.

Table 3 Examples for the individually technical definition of the rendering/rendering kit

property	dry mix	fresh mortar	rendering	bonding agent/s, primer/s, top coat/s	reinforcement/s	fixing/s
Description (verbal)	X		X	X	X	X
Formulation (e.g. chemical constitution, recipes, composition of raw materials, amounts, components specified by characteristics, compliance with other specifications e.g. European standards or by mass, volume, percentage) <u>or</u> fingerprint, providing the following information: binder and pigment content, infrared spectra, non-volatile matter by mass	X			X		

Fingerprint ⁹	X			X		
Manufacturing process parameters (e.g. temperature, pressure, time; product/production codes)	X			X		
Mixing ratio (if applicable)		X		X		
Colour (visual specification)	X		X	X		
Particle size (grading) ¹⁰ ,	X					
Fibre type length and aspect ratio (e.g. mineral wool)	X					
Density: - bulk density (dry mix) - mean density (fresh mortar) - density (hardened mortar)	X	X		X		
Density (relevant part of EN ISO 2811, determined at (23 ± 2) °C and (50 ± 5) % RH)				X		
pH-value		X		X		
Dry extract (105 °C)	X			X		
Ash content (450 °C or 900 °C)				X		
Flexural and compressive strength of hardened mortar (e.g. EN 1015-11)			X			
Volatile organic components (VOC) (ISO 3233, determined at (23 ± 2) °C and (50 ± 5) % RH)				X		
Nominal film thickness				X		
Description of the component (incl. corrosion resistance)					X	X
Geometry					X	X
Tensile strength					X	X

2.3.3 Density of the applied rendering

In most cases, ETA-applicants shall specify both spray (large surfaces) and trowel (small surfaces) applied rendering. Therefore, unless the ETA-applicant specifies the method of application, or the more onerous application method can be determined, tests shall be conducted with both spray and trowel applied material and the density of both shall be measured. The ETA shall specify the densities and their tolerances for trowel and spray applied¹¹ renderings.

The density shall be determined by appropriate methods relating to the type of rendering under evaluation.¹² For the assessment of the density the method given in EN 13381, part 4 should be used, as far as possible.

The density of all test specimens is required to be within ± 15 % of the mean value of the fire test specimens. If measured densities are outside of the prescribed tolerance, additional tests shall be conducted to evaluate a wider density range to be stated in the ETA.

⁹ If "Fingerprinting" is used, for most products FTIR (Fourier Transform Infra-Red Spectroscopy), gas chromatography, TGA (Thermo-Gravimetric Analysis) or DTA (Differential Thermal Analysis) will be appropriate. X-ray diffraction may also be considered.

¹⁰ For fibrous materials: fibre-diameter/length/aspect ratio e.g. for mineral wool.

¹¹ The application method shall be specified in the ETA.

¹² If appropriate, EN 1015-6, EN 1015-10 or other methods can be used to determine the stated density. In this case the mean value shall be determined on the basis of at least 10 measurements.

The stated density of the applied rendering with its tolerance is deemed to relate to the performance given in the ETA including fire resistance.

In addition, a stated level of density with its tolerance may be specified in the ETA according to other suitable methods¹².

The method agreed to be used to state the density shall also be used for AVCP purposes. The stated density may also serve as benchmarks for site tests.

2.3.4 Thickness

The thickness of the hardened rendering of all test specimens shall be measured using a 1 mm diameter probe or drill, which shall be inserted into the material at each measurement position until the tip of the probe or drill touches the surface of the test specimen substrate. The probe or drill shall carry a circular steel plate of approximate diameter 50 mm but at least 30 mm upon it, for accurate determination of the surface level.

For fire resistance tests, the thickness of the test specimen shall be measured in the proximity, between 50 mm and 100 mm away from each of the thermocouples fixed to the substrate, beneath the applied fire protection system.

For all other test specimens, the measurements shall be geometrically uniformly distributed over the surface of the test specimen, but shall include measurement of any visibly smaller thicknesses. The minimum number of measurements per test specimen is 10.

The thickness of the test specimen shall not deviate by more than 20 % of the mean value over the whole of its surface. In this case, the mean value shall be used in the assessment of the results and the limits of applicability of the assessment. If it deviates by more than 20 %, the maximum thickness recorded shall be used in the assessment.

2.3.5 Effects of drying

The applied rendering is required to harden and cure with minimal shrinkage or cracking and to maintain dimensional stability and not crack during its working life. The samples prepared for the durability tests and those for fire testing can be used to evaluate the effects of drying of the rendering.

Hairline cracks that develop as a result of drying may be accepted providing the desired results are achieved in the fire tests with the presence of cracking. Observations shall be made on the effect of drying and hardening with respect to shrinkage and cracking.

Cracks up to the size and density of those exhibited by the fire test specimens prior to test are acceptable. This shall be expressed in the ETA as maximum width of crack and total length of cracks per square metre of rendering.

2.3.6 Conditioning of test specimens and test conditions

The rendering test specimens shall be applied and fully cured according to the ETA-applicant's instructions.

Except where conditioning is specified in a referenced test method, the prepared test specimens shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 28 days or until constant mass, i.e. until two subsequent mass measurements differ less than 1 % over a 24 h period.

The laboratory conditions shall be (20 ± 10) °C and (50 ± 20) % relative humidity.

2.3.7 Assessment approach for kits or final assemblies

2.3.7.1 General

In many cases the TAB will be confronted with a kit or an intended assembly, consisting of the dry mix and one or more primers and/or one or more top coats or with an assessment that includes other products (fixings, reinforcement etc.). Primers, topcoats, reinforcements, mechanical fixings and additives may be referred to specifically (by trade name and type) or generically, e.g. by generic product family in the case of primers. The components of a kit shall be always referred specifically. All others components, specific or generic, shall be specified in the ETA according to the available technical specifications (e.g. EN or ETA) or, when this is not possible, by reference to proprietary items, physical dimensions and material performance.

In the case of primers, when they are not specific, reference to the generic families shall be made.

Some rendering systems, with or without top coat, may be applied directly on the substrate. In the case of steel substrates, this is either due to the steel substrate not requiring additional protection, taking into account the intended use (e.g. weathering steels complying with EN 10025-2 or stainless steels complying

with EN 10088, Part 2 or Part 3) or because the steel substrate has been protected by metallic coatings, using hot-dip galvanizing (see EN 10326 or EN 10327) or thermal zinc or aluminium spraying.

If the rendering can be applied without primer, tests shall be performed accordingly.

If the rendering may be applied with and without primer(s), both situations shall be assessed.

2.3.7.2 Primer evaluation

a) Bonding agents provided for the purpose of providing a 'key' for the rendering

If the rendering system is intended to be used with one or more specifically referenced bonding agents, all system tests, i.e. all tests not performed on the individual components, foreseen in this chapter shall be carried out using the specifically referenced bonding agent(s). The specifically referenced bonding agent(s) shall be specified in the ETA and be subjected to FPC as specified in this EAD, if they are kit components.

b) Corrosion protection primers, specific or generic

There are two options for assessing primers and covering primers in the ETA: generic types or specific primers.

The most commonly used generic types of primer and their nominal thickness range are given in Table 4. Only one primer from a primer family is subjected to testing and primer types not covered by the generic types listed in table 4 shall be the subject of a separate evaluation in accordance with Annex E.9. If a primer is tested on uncoated steel but is intended to be used on galvanised steel as well, a separate evaluation on galvanised steel shall be made. In this case the maximum thickness shall not be more than 50% of the tested thickness.

Each generic primer group shall be evaluated separately; where the ETA-applicant specifies that water borne and solvent borne materials may be used, both shall be tested. Solvent free materials shall be classed in the same generic group as the solvent borne equivalent.

Table 4: Generic primer types

Generic primer type	Maximum assessed thickness - permitted extension from the tested thickness (%) ¹³
Acrylic	+ 50
Short/medium oil alkyd	+ 50
Two component epoxy	+ 50
Zinc rich epoxy (containing about 80% by mass of metallic zinc powder)	+ 50
Zinc silicate	+ 50

In all cases the dry thickness of the primer shall not exceed the maximum dry thickness for each product as recommended by the ETA-applicant.

Where the primer contains zinc metal there may be a requirement to include a further tie coat or pre-treatment, in which case this shall be included in the system to be tested.

When a primer from any generic group is tested, the generic assessment will be limited to other primers in the group provided the maximum thickness is lower than the permitted extension given in Table 4. Any thicknesses below that tested shall be acceptable provided the lower thickness is not less than that recommended by the ETA-applicant.

If no primer is used, the surface preparation shall be specified and tested in accordance with Annex E.9.

Compatibility testing carried out on steel panels will be acceptable for other ferrous substrates except stainless steel, which shall be evaluated separately in accordance with Annex E.9.

Primers not covered by the families described above may be grouped in other families of primers based on the binder (e.g. oil alkyd or epoxy), carrier (organic, solvent/water) and pigment (e.g. inhibitive or non-inhibitive) type.

¹³ No (-) tolerance is permitted.

Durability testing with a primer from the generic type of zinc rich epoxy primer does not cover galvanized steel, for instance hot dip galvanized steel. Galvanized steel is treated as another form of “primer” and has to be tested separately.

All tests/assessments to specify the intended performance shall be carried out with a primer chosen by the applicant. However, where the rendering is intended to be used with more than one primer family or with no primer, an insulation efficiency test (as specified in Annex E.9) is necessary for the additional primer(s). When fire tests are carried out without a primer, the efficiency test can be also used to assess the use of primers. Only one primer from every intended primer family shall be subjected to testing.

That means:

- 1) If the initial test was performed on bare steel, a fire test is required (EN 13381-4 including loaded element and its reference section at least for maximum thickness of rendering) for at least one primer in order to determine a new correction factor for stickability when using a primer and the other primers may be assessed with an insulation efficiency test.
- 2) If the initial test was performed with a primer, an insulation efficiency test is required to assess other primers and bare steel

The tests are valid for primers with the same carrier (water borne or solvent borne) and for related similar thicknesses (a range of validity for tested dry film thickness shall be given).

It is assumed that the result “pass” within the insulation efficiency test is a basis for the assessment of a comparable behaviour in all other tests (e. g. fire resistance tests, durability test).

It is recognized that in the majority of cases the steel elements will arrive on site already primed. In that case, it is necessary for the rendering applicator to ensure that the primer is compatible with the rendering. For this case provisions are given in Annex G “End-use conditions relating to product performance”.

However, where the primer is found to be a type not covered by the ETA, the ETA does not cover the use of the rendering intended to be applied and an additional assessment shall be done.

b) Existing data

For existing products, in some circumstances, it might be possible to assess the performance in fire of systems with alternative primers using existing data from tests other than to the specified EN standard (for example to equivalent national test standards).

If the alternative data is from a fire resistance test which is substantially similar to the specified EN test, this data may be used in conjunction with the EN test data, corresponding to one specific primer, to support an assessment for an alternative primer. In particular, if the alternative test is substantially similar to the specified EN test in terms of thermal exposure, mechanical stress, scale of deformation and deflection etc., the “stickability” (bond to the substrate) and overall performance of the rendering system might be assessed.

It is likely that existing test data may be from fire resistance tests where the furnace heating regime was not exactly the same as that in the specified EN test. For example, the plate thermometer may not have been used for measuring furnace temperatures. Nevertheless, the existing data may still be used if it provides a comparison of performance between the alternative primers in the same heating regime and was conducted at an accredited, independent laboratory.

2.3.7.3 Top coat evaluation

All assessment tests shall be conducted without a top coat unless the top coat is necessary to provide the required performance under the particular exposure conditions. In this case the rendering shall be tested with the specified top coat.

The TAB shall decide which characteristics are dependent on the top coat for their performance, (e.g. adhesion may be independent of the top coat).

If the rendering is claimed to be equally suitable with and without top coat for environmental conditions types Z_1 and type Z_2 , the initial tests shall be performed with panels with and without top coat to show that the top coat has no influence on the insulation efficiency. For determining the insulation efficiency after exposure, it is sufficient to perform the tests without top coat. The top coat shall be specified in the ETA. The colour of the top coat has no influence on the result of the durability assessment for types Z_1 and Z_2 . Therefore there is no need to test different colours of the top coat. The use conditions tested or described in the ETA is valid for all top coat colours then.

For environmental use conditions type Y and type X the test results could be influenced by the various top coat types and their colours. No generic approach is possible in relation to the type of top coat, so the applicant has to test all top coats. However, in order to cover all colours of a particular top coat, a colour

having an index $L < 50$ on the CIELAB¹⁴ scale shall be selected for test. The decision to choose the colour of the top coat used in durability assessment is taken by the TAB and the ETA-applicant. The test results are valid for the tested top coat and all its different colours.

2.3.7.4 Reinforcements and mechanical fixings

All assessment tests shall be conducted without reinforcement or mechanical fixings unless the reinforcement or mechanical fixings are necessary to provide the required performance under the particular exposure conditions. In this case the rendering shall be tested with the specified reinforcement or mechanical fixings which shall be specified in the ETA.

NOTE 7: *Determining the reinforcement(s) and/or mechanical fixing(s) that lead(s) to worst performance within each family of primers is a decision taken by the TAB and the ETA-applicant, on a case-by-case basis, until European consensus can be achieved.*

¹⁴ "Commission International de l'Eclairage" (CIE) system of colour space defines lightness/darkness (L) scale in CIELAB units. White is defined as $L = 100$ and black as $L = 0$. For measuring the parameters for determining the L-index see ISO 7724 or EN ISO 787-25.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products covered by this EAD the applicable European legal act is: Decision 1999/454/EC

The system(s) is: 1

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 5.

Table 5 Control plan for the manufacturer; cornerstones

No	Subject/type of control (<i>product, raw material, constituent, component - indicating characteristic concerned</i>)	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					
dry mix and/or top coat and/or primer					
1	Raw materials, constituents	Statement on conformity	manufacturer's specification		Every lot supplied
dry mix (dry mortar)					
2	Apparent density of aggregates	manufacturer's established method or ISO 697	Value \pm tolerance	3	Once per incoming lot
3	Apparent density of dry mix	manufacturer's established method or ISO 697	Value \pm tolerance	3	Once per mixing lot or five times per day (24 h) at regular intervals
Fresh mortar					
4	Bulk density	as established in product tests or EN 1015-6	Value \pm tolerance	3	Once per lot or five times per day (24 h) at regular intervals
5	Setting time, workability (pot life)	manufacturer's specification	Value \pm tolerance	3	Once per lot or five times per day (24 h) at regular intervals
Rendering (hardened mortar)					
6	Bulk density	as established in product tests or EN 1015-10	Value \pm tolerance	3	Once per month
7	Adhesion (bond strength) on substrate	EGOLF method EA 5 or EN 1015-12	Value \pm tolerance	3	Once per month
8	Insulation efficiency or any alternative test designed to ensure consistency of fire performance (to be agreed between the TAB, the NB and the ETA holder)	Annex E.9	time to reach the critical temperature of 500 °C	2	Once per month

Additional components/accessories of the kit					
9	Bonding agent and top coat (manufactured by others)	Agreed specification based on e.g. description, type of material, viscosity, pH value, colour, volatile content	ETA holder's specification	9	Bonding agent and top coat (manufactured by others)
10	Fixings, lath and reinforcement	Agreed specification based on e.g. description, type of material, coating, dimensions, geometry, design	ETA holder's specification	10	Fixings, lath and reinforcement

3.3 Tasks of the notified body

The corner stones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the rendering or the rendering kit are laid down in Table 6.

The notified body checks the documentation as deemed necessary for issuing the ETA.

Table 6 Control plan for the Notified Product Certification Body

N ^o	Subject/type of control (product, raw material, constituent, component - indicating characteristic concerned)	Test or control method	Criteria, if any	min. number of samples
Initial inspection of the manufacturing plant and of factory production control (for systems 1)				
1	Raw materials/ constituents	Statement on conformity	manufacturer's specification	6
2	Apparent density of aggregates	manufacturer's established method or ISO 697	value ± tolerance	6
3	Apparent density of dry mix	manufacturer's established method or ISO 697	value ± tolerance	3
4	Bulk density of fresh mortar	as established in product tests or EN 1015-6	value ± tolerance	6
5	Setting time/ workability (pot life) of fresh mortar	manufacturer's specification	value ± tolerance	
6	Bulk density of hardened mortar	as established in product tests or EN 1015-10	value ± tolerance	3
7	Adhesion (bond strength) on substrate	EGOLF method EA 5 or EN 1015-12	value ± tolerance	6
8	Insulation efficiency or any alternative test designed to ensure consistency of fire performance (to be agreed between the TAB, the NB and the ETA holder)	Annex E.9	time to reach the critical temperature of 500 °C	

9	bonding agent/s	agreed specification based on e.g. description, type of material, viscosity, pH value, colour, volatile content	manufacturer's specification	
10	top coat/s	agreed specification based on e.g. description, type of material, coating, dimensions, geometry, design	manufacturer's specification	
11	Fixings, lath and reinforcement	Agreed specification based on e.g. description, type of material, viscosity, pH value, colour, volatile content	ETA holder's specification	
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1)</i>				
N°	Subject/type of control	Test/control method	Criteria, if any	min. frequency of control
1	results of FPC	as established	as defined for ETA	2/a for continuous production once/a for fractional production
dry mix (dry mortar)				
2	Apparent density of aggregates	manufacturer's established method or ISO 697	value \pm tolerance	twice a year
3	Apparent density of dry mix	manufacturer's established method or ISO 697	value \pm tolerance	twice a year
Additional components/accessories of the kit				
4	bonding agent/s	agreed specification based on e.g. description, type of material, viscosity, pH value, colour, volatile content	manufacturer's specification	twice a year
5	top coat/s	agreed specification based on e.g. description, type of material, coating, dimensions, geometry, design	manufacturer's specification	twice a year
6	Fixings, lath and reinforcement	Agreed specification based on e.g. description, type of material, viscosity, pH value, colour, volatile content	ETA holder's specification	twice a year

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

3.4.1 Inspection and testing

The ETA holder remains responsible for the product and any components supplied as part of a kit although the ETA holder may not manufacture all or any of them. The ETA holder's AVCP system shall ensure consistency of production and equivalent confidence in all components together with the information who is responsible (e.g. supplier or ETA holder) for conducting the evaluation.

If the product or kit components are supplied to the ETA-holder, the supplier shall meet the requirements in Table 5 and the ETA-holder shall ensure conformity with the supplier's statement of conformity, by sample inspection of the incoming product or incoming components.

Supplier's statement of conformity shall correspond with the principles of EN ISO 17050, Part 1 and Part 2.

Inspection and testing of kit components

Where the ETA holder offers a rendering kit the AVCP shall address appropriate conformity testing or inspection of all items in the kit to ensure consistency of performance of the rendering¹⁵. Lot sampling of components may be appropriate dependent on the volume of production of such items.

In circumstances where the kit components are manufactured on the ETA holder's behalf, the AVCP shall address sample inspection of incoming components. Where the material from which the components are made is critical to the component's end use or a corrosion resistant coating may be required on the component in order for it not to create a detrimental effect on the primary product with which it is used, these criteria shall be addressed in the AVCP. Where such criteria are critical to the overall performance of the kit, the ETA holder shall require parameters for checking the conformity of externally manufactured components.

Where incoming material is released for urgent production purposes it shall be specified and recorded in order to facilitate immediate recall in the event of non-conformity.

Product testing

On-going semi-manufactured and finished product testing shall be carried out in accordance with the ETA holder's documented AVCP in order to verify continued conformity with the product specification. All materials, semi manufactured and finished products subject to testing and inspection shall be traceable through batch numbers or other ETA holder production references.

This production related testing shall be carried out by suitably trained / qualified personnel either directly employed by the ETA holder or by an external body acting on behalf of the ETA holder.

Records of all semi-manufacturing / finished product inspection and testing shall be traceable to raw material/ admix constituent conformity testing records.

Inspection and test status

The ETA holder's FPC shall detail the methods employed to demonstrate the inspection and test status of raw materials / admix constituents, semi manufactured product and finished product.

¹⁵ The constancy of the products' performance also could be checked by other means, e.g. by checking the constancy of the formulation/composition ("Fingerprint") of the product and of its production process.

4 REFERENCE DOCUMENTS

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

EN 312	Particle Boards; Specification
EN ISO 354	Acoustics - Measurement of sound absorption in a reverberation room
EN ISO 717	Acoustics - Rating of sound insulation in buildings and of building elements Part 1:2006 Airborne sound insulation Part 2:2013 Impact sound insulation
EN ISO 787-25	General methods of test for pigments and extenders; Part 25: Comparison of the colour, in full-shade systems, of white, black and coloured pigments; Colorimetric method
EN 1015	Methods of test for mortar for masonry; Part 6 Determination of bulk density of fresh mortar Part 10 Determination of dry bulk density of hardened mortar Part 11 Determination of flexural and compressive strength of hardened mortar Part 12 Determination of adhesive strength of hardened rendering and plastering mortars on substrates Part 18 Determination of water absorption coefficient due to capillary action of hardened mortar Part 19 Determination of water vapour permeability of hardened rendering and plastering mortar
EN ISO 1182	Reaction to fire tests for building products; Non-combustibility test
EN 1323	Adhesives for tiles - Concrete slab for test
EN 1363-1	Fire resistance tests; Part 1: General requirements
EN 1365	Fire resistance tests for loadbearing elements; Part 2 Floors and roofs
EN ISO 1460	Metallic coatings; Hot dip galvanized coatings on ferrous materials; Gravimetric determination of the mass per unit area
EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles; Specifications and test methods
EN ISO 1716	Reaction to fire tests for building products - Determination of the heat of combustion
EN 1745	Masonry and masonry products - Methods for determining design thermal values
EN ISO 1182	Reaction to fire tests for products - Non-combustibility test
EN ISO 2811	Paints and varnishes
EN ISO 3506-1	Mechanical properties of corrosion-resistant stainless-steel fasteners; Part 1: Bolts, screws and studs
EN ISO 4892-3	Plastics - Methods of exposure to laboratory light sources; Part 3: Fluorescent UV lamps
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
EN ISO 8990	Thermal insulation; Determination of steady-state thermal transmission properties; Calibrated and guarded hot box
EN 10025	Hot rolled products of non-alloy structural steels; Part 1: General delivery conditions Part 2: Technical delivery conditions for flat products
EN 10088	Stainless steels; Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections and bright products of corrosion resisting steels for general purposes
EN ISO 10140	Acoustics Laboratory measurement of sound insulation of building elements; Part 2 Measurement of airborne sound insulation Part 3 Measurement of impact sound insulation
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations
EN 10326	Continuously hot-dip coated strip and sheet of structural steels – Technical delivery conditions
EN 10327	Continuously hot-dip coated strip and sheet of low carbon steels for cold forming – Technical delivery conditions
EN ISO 11925-2	Reaction to fire tests; Ignitability of building products subjected to direct impingement of flame; Part 2: Single-flame source test

EN 12086	Thermal insulating materials for building application - Determination of water vapour transmission properties
EN 12467	Fibre-cement flat sheets; Product specification and test methods
EN ISO 12572	Hygrothermal performance of building materials and products - Determination of water vapour transmission properties
EN 12664	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products with medium and low thermal resistance
EN 12667	Thermal performance of building materials and products; Determination of thermal resistance by means of guarded hot plate and heat flow meter methods; Products of high and medium thermal resistance
EN 12939	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance
EN ISO 12944-6	Paints and varnishes - Corrosion protection of structures by protective paint systems, Part 6: Laboratory performance test
EN 13162	Thermal insulation products for buildings - Factory made mineral wool products – Specification
EN 13169	Thermal insulation products for buildings - Factory made products of expanded perlite (EPB) – Specification
EN 13238	Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates
EN 13381	Test methods for determining the contribution to the fire resistance of structural members Part 1 Horizontal protective members Part 2 Vertical protective members Part 3 Applied protection to concrete members Part 4 Applied passive protection products to steel members Part 5 Applied protection to concrete/profiled sheet steel composite members Part 6 Applied protection to concrete filled hollow steel columns Part 7 Applied protection to timber members
EN 13501	Fire classification of construction products and building elements; Part 1: Classification using test data from reaction to fire tests Part 2: Classification using data from fire resistance tests, excluding ventilation services Part 3: Classification using data from fire resistance tests systems and services
EN 13658-2	Metal lath and beads - Definitions, requirements and test methods; Part 2: External rendering
EN ISO 13788	Hygrothermal performance of building components and building elements; Internal surface temperature to avoid critical surface humidity and interstitial condensation; Calculation methods
EN 13823	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item
EN 16516	Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air
EN ISO 17050	Conformity assessment; Supplier's declaration; Part 1: General requirements Part 2: Supporting documentation
ISO 697	Surface active agents; Washing powders; Determination of apparent density; Method by measuring the mass of a given volume
ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel; Part 1: Bolts, screws and studs
ISO 3233	Paints and varnishes - Determination of percentage volume of non-volatile matter by measuring the density of a dried coating
ISO 7724	Paints and varnishes – Colourimetry Part 1: Principles Part 2: Colour measurement
ISO 7892	Vertical building elements - Impact resistance tests - Impact bodies and general test procedures
ISO 10456	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EOTA TR 001	Determination of impact resistance of panels and panel assemblies; version February 2003
EOTA TR 034	EOTA Technical Report TR 034: General checklist for EADs/ETAs – Content and/or release of dangerous substances in construction products

EGOLF EA 5	Fire Testing; Method for the measurement of bonding properties of fire protection materials applied to steel, concrete and steel/concrete composite structures
ASTM E 736	Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

ANNEX A REACTION TO FIRE TESTS FOR BUILDING PRODUCTS – MOUNTING AND FIXING ARRANGEMENTS FOR RENDERINGS

A.1 Testing according to EN 13823 (SBI)

Rendering and rendering kits intended for fire resisting applications shall be tested when applied in a laminar fashion to the substrate. The test shall be configured as the product will be used in practice e.g. with reinforcing fabric enclosed in the rendering and with any surface coating.

Specimens for each wing are to be produced separately. Specimens shall be prepared according to clause 2.3.1 and conditioned according to clause 2.3.6. The assembly of both wings shall be performed on the sample trolley of the SBI testing device.

A standard substrate according to EN 13238 shall be used, which is to be set up at a distance of ≥ 80 mm to the backing board. The result applies to all substrates used in practice which are represented in this standard. If a non-standard substrate is used for testing the result applies only to that substrate.

On substrates of classes A1 or A2 the renderings and rendering kits shall be tested with the maximum applied dry thickness. The result applies to all application thicknesses up to the thickness tested.

For substrates of classes B, C, D, or E the renderings and rendering kits shall be tested with the maximum and minimum applied dry thickness. Three specimens shall be tested at each thickness. The result¹⁶ applies to all thicknesses between and including the thicknesses tested.

If the renderings and rendering kits have surface coatings, the test shall be carried out with that coating which from experience based on formulation, existing experience or testing could cause the worst result.

In case of combustible substrates (i.e. those classified as other than A1) the joint between the wings shall be protected by A1 classified mineral wool or similar material to prevent a contribution to the energy release from the substrate that would never happen in practice (see figure 4).

Wire mesh may need to be fixed to the substrate to ensure that the rendering adheres to the wings.

A.2 Testing according to EN ISO 11925-2 (small burner test)

If used, the production of the test specimens and execution of the test shall be carried out in accordance with the requirements of EN ISO 11925-2.

A.3 Testing according to EN ISO 1716 and EN ISO 1182

The production of test specimens and execution of the tests shall be carried out in accordance with the requirements of EN ISO 1716 and EN ISO 1182.

The tests shall be carried out with that coating which from experience based on formulation, existing experience or testing could cause the worst result.

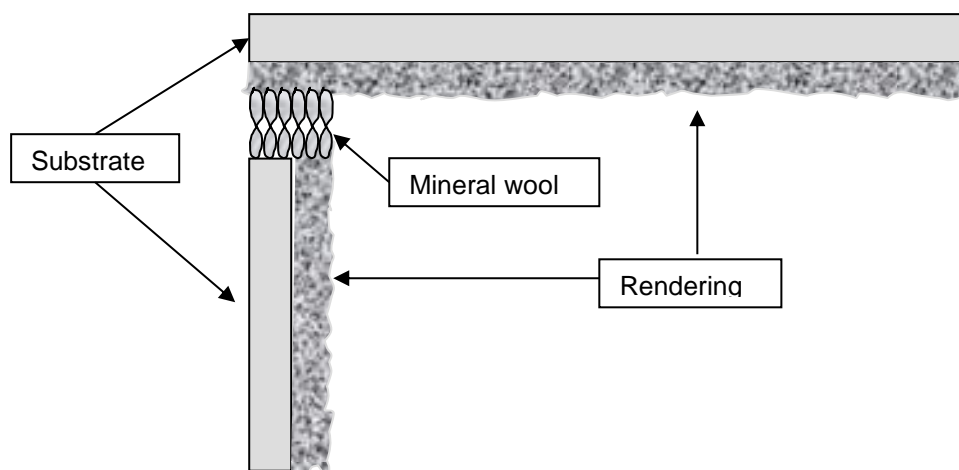


Figure 4
Configuration of the vertical joint for testing a rendering system

¹⁶ If the test results lead to two different classifications, the worst result will be considered or further tests could be carried out if requested by the ETA-applicant.

ANNEX B TEST METHOD FOR EVALUATING CORROSION OF STEEL SUBSTRATES INDUCED BY THE RENDERING

B.1 Scope

This test method covers a procedure for measuring corrosion to steel induced by renderings.

B.2 Summary of test method

In this test method panels of bare, primed and galvanized steel are sprayed with rendering and subjected to room temperature and humidity conditions for 240 h in a temperature and humidity controlled chamber. Corrosion is determined by the loss of mass of the sheets.

Only steel with the finishes claimed by the ETA holder to be suitable for use with the rendering are required to be tested.

B.3 Significance and use

It is the intent of this test method to determine the relative corrosive properties of renderings to provide an indication of serviceability. Satisfactory performance of a rendering applied to structural members and assemblies depends upon its ability to withstand the various influences that occur during the life of the structure, as well as upon its satisfactory performance under fire conditions.

This test method evaluates the relative corrosion of steel induced by rendering and determines whether the presence of rendering increases or has no effect on the corrosion characteristics of steel.

B.4 Apparatus

- Standard Temperature Humidity Cabinet, equipped to maintain a temperature of (35 ± 2) °C and (95 ± 5) % relative humidity. The cabinet and all accessories shall be of a material that does not affect the corrosiveness of the atmosphere in the cabinet. Additionally, all parts that come into contact with the test samples shall be made of a material that does not cause electrolytic corrosion. Adequate circulation of the atmosphere over the samples shall be provided.
- Weighing Scales, having a capacity of 5 kg and a sensitivity of $\pm 0,1$ g.
- Wire Brush, with brass wire bristles approximately 25 mm long mounted in a handle. The bristle section shall be 127 mm long by 19 mm wide.

B.5 Materials

This test method requires the application of rendering in accordance with the ETA-applicant's instructions. The apparatus, materials, and procedures used to apply the rendering shall be representative of application for the fire test and in practice.

The density of the prepared sample shall be the same as the density fire tested within ± 15 % of the given tolerance.

Steel sheets shall be 200 mm \times 200 mm \times 5 mm and shall be:

- bare steel to EN 10025 grade S, except S185
- primed to EN 10025 grade S, except S185, steel coated with iron oxide alkyd primer, or other specified by the ETA-applicant
- galvanized steel to EN 10025 grade S, except S185 galvanised in accordance with EN 10326

B.6 Laboratory test samples

There shall be four steel sheets of each type to be evaluated, e.g. bare, primed, galvanised steel.

The sheets in each set shall be designated a, b, c and d.

The steel sheets shall be free of all surface rust.

B.7 Procedure

Wash the steel sheets with alcohol or acetone to remove any oil or grease. Dry at room temperature.

Weigh each sheet to the nearest 0,1 g and record its mass.

Protect the edges of the sheets and apply a suitable coating to one face. This coating shall be stable under the conditions of this test method and shall not promote corrosion; paraffin wax is suggested.

Apply the rendering at a minimum thickness for which the ETA-applicant has a fire resisting classification.

Determine the density and thickness of each laboratory prepared sample.

Samples a and b of each set:

- Condition the samples for (240 ± 2) h at room temperature (23 ± 2) °C and relative humidity not greater than 60%.
- Remove the rendering, as well as the protective wax coating, from the steel sheets.
- Remove all surface rust from the sheets with the wire brush described in clause C.4 and clean with solvent (alcohol or acetone).
- Weigh the sheets to the nearest 0,1 g, and record their mass.

Samples c and d of each set:

- Place the sheets into the temperature humidity cabinet and keep at (35 ± 2) °C and (95 ± 5) % relative humidity for a duration of (240 ± 2) h.
- At the completion of the 240 h period, remove the samples from the cabinet.
- Remove the rendering and the protective wax coating, from the sheets.
- Remove all surface rust from the sheets with the wire brush described in clause C.4 and clean with solvent (alcohol or acetone).
- Weigh the sheets to the nearest 0,1 g, and record its mass.

B.8 Calculation

Calculate the mean loss of mass at the end of the initial ageing period of samples a and b and the loss of mass at the end of the 240 h humidity test of samples c and d as follows:

For each sample:
$$\text{loss of mass (g/mm}^2\text{)} = \frac{\text{mass before (g)} - \text{mass after (g)}}{\text{Area of sheet (mm}^2\text{)}}$$

Calculate the mean loss of mass at the end of the initial ageing period (a and b), and the mean loss of mass at the end of the 240 h humidity test (c and d) as follows:

$$\text{mean loss of mass}_1 = \frac{\text{loss of mass of sample a} + \text{loss of mass of sample b}}{2}$$

$$\text{mean loss of mass}_2 = \frac{\text{loss of mass of sample c} + \text{loss mass of sample d}}{2}$$

B.9 Report

Report the thickness of the rendering in millimetres, the density of the rendering in kg/m³ and the individual and mean loss of mass in g/mm² of each sample and set.

Report all information on the steel including the grade; the nature of the primer, including the product name and manufacturer, the measured dry film thickness and the elapsed time (number of days or hours) between application of primer and application of rendering.

ANNEX C TEST METHOD FOR AIR EROSION OF RENDERINGS

C.1 Scope

This test method covers a procedure for determining the effect of an air stream upon renderings.

C.2 Terminology

Definitions:

denier, n:	the number of grams per 9 000 m.
end (fabric), n:	an individual warp yarn (single or ply) cord.
pick, n:	an individual filling yarn.
air erosion:	the action or process of being eroded by an air stream.

C.3 Summary of test method

This test method covers a procedure for determining the effect of an air stream upon renderings in plenums. The rendering is subjected to a tangential air stream for a minimum of 24 h. Collection filters downstream from the sample are weighed at frequent intervals to determine the amount of material removed from the sample.

C.4 Significance and use

It is the intent of this test method to determine properties of renderings that may be used to provide an indication of serviceability. Satisfactory performance of a rendering depends upon its ability to withstand the various influences that may occur during construction and during the life of the system, as well as upon its performance under fire conditions.

Air erosion tests on renderings are conducted to evaluate the behaviour of the rendering when subjected to plenum air streams during normal service conditions. Such tests evaluate the resistance to dusting, flaking, spalling and delamination of the rendering.

C.5 Apparatus

- Duct System, made of galvanized steel, horizontally positioned, with one rectangular opening of minimum size 0,36 m² in the centre of the top of the duct and 50 mm from each vertical side.
- Pitot Tube, used in conjunction with a suitable manometer to measure air velocities in the duct.
- Blower, capable of moving air at a temperature of (20± 10) °C and (50 ± 20) % RH through the entire cross section of the duct at a velocity sufficient to handle the test requirement.
- Filters, upstream from the test sample (at the blower end) and located downstream of the test sample. These filters shall be made of 30-denier nylon. The nominal construction of the fabric shall be 37 ends per 10 mm and 32 picks per 10 mm, or finer.
- Scale, having a capacity of 100 g and a sensitivity of ± 0,001 g.

C.6 Materials

This test method requires the application of rendering in accordance with the ETA-applicant's normal method and representative of application on site.

The density of the prepared sample shall be similar to that of the fire tested sample(s)¹⁷.

C.7 Test sample

The test sample shall consist of rendering applied to the substrate. A separate test shall be conducted for each substrate intended to be used.

The substrate shall be of minimum area 0,36 m² with the rendering being applied at the thickness recommended by the ETA-applicant.

Prepare duplicate samples and allow to dry and to harden at a temperature of (20 ± 10) °C and an RH not greater than 60 % until successive mass reading, taken at 24 h intervals, differ by less than 1%.

C.8 Procedure

Test one sample to determine thickness and density.

Dry the collecting filter at (50 ± 2) °C for 1 h, weigh and place in the apparatus.

Place the second sample into the duct opening so that the face of the sample and the inside face of the duct are positioned flush and in the same plane. All edges shall extend at least 50 mm beyond the duct opening.

¹⁷ Tolerances of density as indicated in clause 2.3.2.1

Place the pitot tube (100 ± 2) mm from the upstream edge of the sample at the centreline of the duct and 50 mm below the top side of the duct.

With both filters and the sample in position, maintain the blower at the velocity of ($6 \pm 0,25$) m/s.

At elapsed times of 1 h, 6 h and 24 h, stop the blower and carefully remove, fold, dry at (50 ± 2) °C and then reweigh the collecting filter. If the collecting filter continues to show a mass gain at 24 h, continue the test, making measurements every 24 h until a constant mass is reached.

C.9 Report

Report the mass of the collecting filter in grams before and after each test interval. After each interval, record the net mass gain both individually and cumulatively. Also report the total net mass gain.

Report the thickness in mm and the density in kg/m^3 of the sample.

Indicate the techniques such as tamping, trowelling, surface sealing, or similar finishing operations and the extent that they are made.

ANNEX D DETERMINATION OF THE THERMAL CONDUCTIVITY AND THE CONVERSION FACTOR TO HIGH MOISTURE CONTENT FOR MINERAL WOOL BASED RENDERINGS

D.1 Determination of the λ -fractile value at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$)

D.1.1 Measurement of the λ_{dry} at 10 °C

D.1.1.1

Test specimens for the determination of the thermal conductivity λ at 10 °C shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 28 days or until constant mass, i.e. until two subsequent mass measurements differ less than 1 % over a 24 h period.

The laboratory conditions shall be (20 ± 10) °C and (50 ± 20) % relative humidity.

D.1.1.2

The thermal conductivity of the test specimens conditioned according to D.1.1.1 shall be measured according to EN 12667 or EN 12939 for thick products at a mean temperature of $(10 \pm 0,3)$ °C.

During the measurement, precaution shall be taken to avoid moisture absorption by the specimen. It is acceptable, for instance, to put the test specimen into a thin plastic bag.

D.1.2 Calculation of the λ -fractile value at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$)

D.1.2.1

The λ -fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$) as a limit value representing at least 90 % of the production with a confidence limit of 90 % shall be calculated using the procedures as detailed in EN 13162:2009 Annex A. It shall be noted that the λ_D shall be calculated in accordance with clause D.3.

D.2 Determination of the moisture conversion factor ($f_{u,1}$)

For the determination of the moisture conversion factor $f_{u,1}$, two sets of measurements are needed.

Set 1

Two measurements on dry test specimens, to determine $\lambda_{10,dry}$ and u_{dry} (moisture content mass by mass).

Set 2

Two measurements on test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity, to determine $\lambda_{10,(23,50)}$ and $u_{23,50}$ (moisture content mass by mass).

D.2.1 Procedure

D.2.1.1 Set 1

Dry the two test specimens following the procedure in D.1.1.1.

Determine for each test specimen the mass in dry condition. Take the mean of the two values to determine the m_{dry} . The u_{dry} , being the moisture content in dry condition, is by definition set to 0.

Determine for each test specimen the λ -value at 10 °C following the procedure in D.1.1.2. Take the mean of the two values to determine the $\lambda_{10,dry}$.

D.2.1.2 Set 2

D.2.1.2.1

Condition the two test specimens at (23 ± 2) °C and (50 ± 5) % relative humidity following the procedures detailed in EN 13169:2008, 5.2, step 2.

D.2.1.2.2

Determine for each test specimen the mass at (23 ± 2) °C and (50 ± 5) % relative humidity.

Take the mean of the two values to determine the mass at 23 °C and 50 % relative humidity as $m_{23,50}$.

D.2.1.2.3

Calculate $u_{23,50}$ by the following formula:

$$u_{23,50} = \frac{m_{23,50} - m_{dry}}{m_{dry}}$$

Where:

$m_{23,50}$ is the mass at 23 °C and 50 % relative humidity according to D.2.1.2.2,

m_{dry} is the mass according to D.2.1.1.

D.2.1.2.4

Determine for each test specimen conditioned according to D.2.1.2.1 the λ -value in accordance with EN 2667 or EN 12939 for thick products at a mean temperature of $(10 \pm 0,3)$ °C.

Take the mean of the two values to determine $\lambda_{10,(23,50)}$.

D.2.1.3 Calculation of the moisture conversion factor ($f_{u,1}$)

The moisture conversion factor $f_{u,1}$ shall be calculated by the following formula (derived from ISO 10456:2010, formula 4):

$$f_{u,1} = \frac{\ln \frac{\lambda_{10,(23,50)}}{\lambda_{10,dry}}}{u_{23,50} - u_{dry}}$$

Where:

$\lambda_{10,(23,50)}$ is determined according to D.2.1.2.4,

$\lambda_{10,dry}$ is determined according to D.2.1.1,

$u_{23,50}$ is determined according to D.2.1.2.3,

u_{dry} is determined according to D.2.1.1 and is defined to be 0.

D.3 Calculation of the stated thermal conductivity λ_D

The stated thermal conductivity λ_D shall be calculated using the following formula:

$$\lambda_{(23,50)} = \lambda_{10,dry,90/90} * e^{f_{u,1}(u_{23,50} - u_{dry})}$$

Where:

$\lambda_{10,dry,90/90}$ is determined according to D.1.2,

$f_{u,1}$ is determined according to D.2.1.3,

$u_{23,50}$ is determined according to D.2.1.2.3,

u_{dry} is determined according to D.2.1.1 and is defined to be 0.

The calculated value $\lambda_{(23/50)}$ shall be rounded upwards to the nearest 0,001 W/(m.K) and stated as $\lambda_{D(23,50)}$.

D.4 Determination of the conversion factor ($f_{u,2}$) to high moisture content

For the determination of the conversion factor to high moisture content $f_{u,2}$, two sets of measurements are needed.

Set 1

Two measurements on test specimens conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity, to determine $\lambda_{10,(23,50)}$ and $u_{23,50}$ (moisture content mass by mass).

Set 2

Two measurements on test specimens conditioned at (23 ± 2) °C and (80 ± 5) % relative humidity, to determine $\lambda_{10,(23,80)}$ and $u_{23,80}$ (moisture content mass by mass).

D.4.1 Procedure

D.4.1.1 Set 1

Determine the $\lambda_{10,(23,50)}$ and $u_{23,50}$ in accordance with D.2.1.2.

D.4.1.2 Set 2

D.4.1.2.1

Condition the two test specimens at (23 ± 2) °C and (80 ± 5) % relative humidity following the procedures detailed in EN 13169:2008, clause 5.2, step 2.

D.4.1.2.2

Determine for each test specimen the mass at (23 ± 2) °C and (80 ± 5) % relative humidity.

Take the mean of the two values to determine the mass at 23 °C and 80 % relative humidity as $m_{23,80}$.

D.4.1.2.3

Calculate $u_{23,80}$ by the following formula:

$$u_{23,80} = \frac{m_{23,80} - m_{dry}}{m_{dry}}$$

Where:

$m_{23,80}$ is the mass at 23 °C and 80 % relative humidity according to D.4.1.2.2,

m_{dry} is the mass according to D.2.1.1.

D.4.1.2.4

Determine for each test specimen conditioned according D.4.1.2.1 the λ value in accordance with EN 12667 or EN 12939 for thick products at a mean temperature of $(10 \pm 0,3)$ °C.

Take the mean of the two values to determine $\lambda_{10,(23,80)}$.

D.4.1.3 Calculation of the conversion factor to high moisture content ($f_{u,2}$)

The conversion factor to high moisture content $f_{u,2}$ shall be calculated by the following formula (derived from ISO 10456:2010, formula 4):

$$f_{u,2} = \frac{\ln \frac{\lambda_{10,(23,80)}}{\lambda_{10,(23,50)}}}{u_{23,80} - u_{23,50}}$$

Where:

$\lambda_{10,(23,80)}$ is determined according to D.4.1.2.4,

$\lambda_{10,(23,50)}$ is determined according to D.2.1.2,

$u_{23,80}$ is determined according to D.4.1.2.3,

$u_{23,50}$ is determined according to D.2.1.2.

For the determination of the moisture conversion factor $f_{u,1}$ and the conversion factor to high moisture content $f_{u,2}$, the test specimens shall be taken from the same production run.

NOTE 8: Thermal conductivity may also be measured at mean temperatures other than 10 °C, providing that the accuracy of the relationship between the temperature and thermal properties is well documented.

ANNEX E DURABILITY TESTING OF RENDERING

E.1 Introduction

The durability of renderings is based on comparative data between samples subjected to artificial exposure conditions and control samples.

The parameters used are:

- adhesion (bond strength),
- insulation efficiency,
- visual observations.

NOTE 9: *In the following tests adhesion (bond strength) is used as a characteristic to determine changes before and after the test. Adhesion (bond strength) is, therefore, required to be measured in these tests even though in practice reinforcement or mechanical fixings may be used.*

NOTE 10: *The insulation efficiency test is conducted only on a steel substrate since the durability characteristics of the rendering are considered to be independent of the substrate. Adhesion (bond strength) and visual observations are relevant to all substrates.*

E.2 Specimens

The surface of the substrate for the specimens shall reflect the surface conditions claimed by the ETA-applicant, as specified in the application instructions for the product.

Unless specified differently for a particular test the following standard substrates shall be used for the tests:

- a) Steel as specified according to EN 10025 grade S, except S185, of nominal size 500 mm x 500 mm and of thickness not less than 5 mm.
Where galvanized steel is used as substrate, EN ISO 1460 or EN ISO 1461 applies.
- b) Concrete as specified in EN 1323 of minimum size 300 mm x 400 mm and of nominal thickness 40 mm.
- c) Wood based panels (also covering solid timber) and particle boards as specified in EN 312:2010, of density $700 \text{ kg/m}^3 \pm 10 \%$, nominal size 500 mm x 500 mm and (20 ± 2) mm thick.
- d) For boards other than those in c), the specific board type shall be used.

If the rendering system requires the steel to be primed, the steel shall be primed.

If the rendering is able to be used without a top coat it shall be tested without a top coat.

The rendering shall be applied at a nominal thickness of 25 mm or at the minimum thickness if greater than 25 mm or the maximum thickness if less than 25 mm. The rendering thickness shall be measured and recorded at ≥ 10 uniformly distributed points prior to testing.

The edges of the specimens shall be sealed in order to prevent the joint between rendering and substrate being subjected to the exposure conditions.

For panels, used for durability testing, a protective coating (primer) shall be applied to the back and edges (including all control panels), to prevent rust contamination of the cabinet.

For each exposure condition to be tested, four specimens shall be prepared: two for adhesion testing and two for insulation efficiency testing. In addition, four specimens shall be prepared as controls (reference): two to establish a set value for adhesion (bond strength) and two to establish a set value for insulation efficiency.

The specimens shall be prepared and conditioned in accordance with the ETA-applicant's instructions for the rendering system.

Except where conditioning is specified in a referenced test method, the prepared test specimens shall be conditioned at $(23 \pm 2) \text{ }^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity for at least 28 days or until constant mass, i.e. until two subsequent mass measurements differ less than 1 % over a 24 h period.

The laboratory conditions shall be $(20 \pm 10) \text{ }^\circ\text{C}$ and $(50 \pm 20) \%$ relative humidity.

Control specimens shall then be stored under conditions and for a period of time as specified by the ETA-applicant. After exposure to the specified durability tests the specimens shall be stored in the conditions specified in clause 2.3.4 until constant mass is attained before either the adhesion (bond strength) or insulation efficiency test is conducted.

It is recommended that photographs be taken before and after the durability tests.

E.3 UV exposure

Two specimens shall be tested in accordance with EN ISO 4892-3:2006 for 112 cycles (equivalent to 28 days).

Exposure mode 2 with combined lamps shall be used.

E.4 Heat – rain

Four specimens to the specification in annex E.2 shall be subjected to the exposure conditions specified in EN 12467:2006, clause 7.4.2 for 50 cycles.

E.5 High humidity

Four specimens to the specification in annex E.2 shall be exposed for four weeks to (35 ± 2) °C and (95 ± 5) % relative humidity.

E.6 Heat – cold

Four specimens to the specification in annex E.2 shall be subjected to the following exposure conditions, which shall be repeated five times. The test shall be conducted at ambient humidity.

Period/duration (hours)	Temperature
2	1 st cycle - increase from ambient temperature to (60 ± 2) °C Subsequent cycles – increase from (-15 ± 2) °C to (60 ± 2) °C
4	Hold at (60 ± 2) °C
2	Decrease from (60 ± 2) °C to (-15 ± 2) °C
16	Hold at (-15 ± 2) °C

If higher maximum temperatures or lower minimum temperatures are expected the expected maximum/minimum temperature shall be tested.

E.7 Freeze-thaw

- a) For use conditions of type X: Four specimens to the specification in annex E.2 shall be subjected to the following exposure conditions (Table 7a), which shall be repeated twenty five times. The test shall be conducted at ambient humidity.

Table 7a Procedure to test the product for use condition type X

Period/duration (hours)	Condition, temperature and water immersion
4	Immersion in water at (23 ± 2) °C
2	Remove from water, reduce temperature to (-5 ± 2) °C for 2 h
16	Hold at (-5 ± 2) °C (out of water)
2	Increase temperature from (-5 ± 2) °C to (23 ± 2) °C (out of water)

- b) For use conditions of type Y: Four specimens to the specification in annex E.2 shall be subjected to the following exposure conditions (Table 7b), which shall be repeated twenty-five times.

Table 7b Procedure to test the product for use condition type Y

Period/duration (hours)	Temperature	Relative humidity
4	(23 ± 2) °C	95 ± 5 %
2	Reduce from (23 ± 2) °C to (-10 ± 2) °C	n/a
16	Hold at (-10 ± 2) °C	n/a
2	Increase from (-10 ± 2) °C to (23 ± 2) °C	95 ± 5 %

E.8 Adhesion (bond strength) – test procedure

Two control specimens (unexposed specimens) as specified in annex E.2 and two specimens after being exposed to the testing regimes in the annexes E.3 to E.7 (as appropriate) shall be tested in accordance with method EGOLF EA 5. Four tensile bond tests shall be conducted on each panel (e.g. four on each panel). For each pair of specimens the highest and lowest adhesion shall be discarded and the remaining six averaged, as specified in EGOLF EA 5.

- Test results

The mean value of the tensile bond after durability testing shall be not less than 80 % of the control value. If the test has been performed for steel bars, galvanized substrates etc., the results are also valid for steel and concrete slabs.

E.9 Insulation efficiency – Test procedure

General

The small scale furnace fire test shall be carried out under the condition of the standard time – temperature curve as defined in EN 1363-1.

The specimens shall be prepared, conditioned and measured as specified in E.2 at a defined 23/50-climate for 28 days.

After exposure to environment conditions, if any, the specimens shall again be stored in the conditions specified in E.2 at 20°C and 50 % RH for a minimum of one week before fire testing.

Specimens

Two control specimens (unexposed specimens) as specified in annex E.2 and two specimens after being exposed to the testing regimes in the annexes E.3 to E.7 (as appropriate) are required to be tested.

Test procedure

The specimens may be tested individually or in one test. The specimen(s) shall be placed in the furnace in a vertical or in a horizontal position such that the side with the rendering system is exposed to the fire. The specimen(s) shall be mounted in a frame which forms part of one side (wall or ceiling) of the furnace. The non-fire side shall be covered using vermiculite or calcium silicate board with a minimum thickness of 5 mm with a bulk density of $(475 \pm 25) \text{ kg/m}^3$ or mineral wool (stone wool) with a bulk density of $(110 / 120 \pm 10) \text{ kg/m}^3$ ¹⁸.

Two thermocouples shall be attached to the non-fire side of the steel panels. These thermocouples shall be located close to the centre 20 mm apart. The thermocouples shall be of the K type according to EN 1363-1 but without a copper disc and without insulation pad. The thermocouples shall be fixed to the back of the steel panels by welding (resistance spot welding).

The time for the non-fire side of the steel to reach a mean temperature of 500 °C shall be recorded.

Test results

The time for the non-fire side of the steel to reach a mean temperature of 500 °C shall be recorded. For information purposes furthermore, observation shall be made of the rendering, noting any detachment, delamination or cracking and be reported. The mean time for the non-fire side of the steel of the specimens exposed to the durability tests shall be not less than 85 % of the time for the non-fire side of the steel of the control specimens to reach a mean of 500 °C. No single result shall be less than 80 % of the mean time to 500 °C of the initial test.

Where the result falls outside these criteria, four additional specimens may be exposed, tested and assessed. All four specimens shall fulfil the pass criteria.

Interpretation of test results

When evaluating primers/primer families:

- if the result is better than or equal to that of the reference primer, the primer is considered acceptable,
- if the result obtained with an alternative primer is worse, the same criteria to assess durability samples shall be applied.

E.10 Visual observations

The condition of all specimens after testing shall be visually inspected and changes from the pre-test condition shall be recorded. This shall include a record of all cracking and fissuring including the size and depth of such cracks and fissures. This shall be expressed in the ETA as maximum width of crack and total length of cracks per square metre of rendering.

¹⁸ As the Insulating efficiency test is an indirect testing for comparison (durability, different primers, different top coats) all tests of one assessment shall be carried out under identical conditions/parameters.

ANNEX F WATER ABSORPTION – CAPILLARITY TEST

F.1 Introduction

The water absorption (capillarity test) enables to decide whether the freeze-thaw testing is necessary and whether the intended top-coat or sealing coat works.

F.2 Preparation of the samples

Take a piece of at least 200 mm x 200 mm of the hardened product, in accordance with the ETA-applicant's instructions concerning thickness, mass per unit area, method of application etc.

Take a sample for all the configurations of complete rendering systems as intended by the ETA-applicant for use conditions of type X and for use at temperatures below 0°C,

Three samples shall be prepared for each configuration. Quantities and/or thicknesses applied shall be recorded as well as the composition of the tested rendering kit.

The prepared samples are conditioned for at least 7 days at (23 ± 2) °C and (50 ± 5) % RH.

The edges of the samples shall be sealed against water, to ensure that during the test only the face of the rendering system is subjected to water absorption.

The samples shall be subjected then to 3 cycles comprising the following 2 steps:

1. 24 h immersion in a water bath (tap water) at (23 ± 2) °C.
The samples are immersed rendered face downwards, to a depth of 2 to 10 mm. The depth of immersion depends on the surface roughness. To achieve a complete wetting of rough surfaces, the samples shall be tilted as they are introduced into the water. The depth of immersion can be regulated in the water tank by means of a height-adjustable slat.
2. 24 h drying at (50 ± 5) °C. If interruptions are necessary, e.g. at week-ends or holidays, the samples shall be stored at (23 ± 2) °C and (50 ± 5) % RH after the drying at (50 ± 5) °C.

After the 3rd cycle, the samples shall be stored for at least 24 h at (23 ± 2) °C and (50 ± 5) % RH.

F.3 Capillarity test procedure

To start the capillarity test the samples shall be immersed again in a water bath as described above (F.2 step 1).

The samples shall be weighed after 3 minutes immersion (reference mass) and then after 1 hour and 24 hours. Prior to the second and subsequent weighing, water adhering at the surface of the sample shall be removed with a damp sponge cloth.

F.4 Analysis of results

Calculation shall be done to determine the mean water absorption of the three samples per square metre after 1 and 24 hours (in g/m²).

If the water absorption after 1 hour of each sample tested is less than 1 kg/m², the rendering could be used at temperatures below 0°C for covered application (no exposure to rain)

The freeze/thaw test is inevitably necessary if the water absorption of the rendering (with or without sealing coating) is equal to or higher than 0,5 kg/m² after 24 hours.

ANNEX G END USE CONDITIONS RELATING TO PRODUCT PERFORMANCE

G.1 Design of works

Fire protective renderings and kits shall be assessed under the presumption that the element being protected, the substrate, is suitable for the rendering to be used in the way intended and in full compliance with the ETA such that when installed in the prescribed manner the works will comply with all relevant Essential Requirements.

The TAB shall assess the risks involved and, if deemed necessary, carry out relevant tests from those described in this EAD or foresee limitations in order for the rendering or rendering kit to be fit for the intended use.

An ETA holder may place on the market bags of dry mix only, for use without any additional components such as fixings or reinforcement (this is 'Option 1' as defined in clause 1.1.3). Any other components required to be used but supplied by others, e.g. fixings, mesh, additives, shall be specified in the ETA according to the available technical specifications (e.g. EN or ETA), and when it is not possible by reference to proprietary items, physical dimensions and material performance or by compliance with relevant product specifications (this is 'Option 3' as defined in clause 1.1.3). It is therefore assumed that in designing the works the correct components will be used.

Alternatively an ETA applicant may place on the market bags of dry mix plus one or more other components such as bonding agent, reinforcing mesh, fixings and additives. This constitutes a 'kit' and in this case the ETA covers the 'kit' and the ETA applicant is responsible for both the specification and compliance with specification of all the components he supplies as part of the kit (this is 'Option 2' as defined in clause 1.1.3). It is assumed that the design of the works will accommodate the kit as supplied and that the kit will be installed as specified.

It is assumed that the possible effect of other fire protection measures, such as sprinklers, on the rendering will be taken into account in the design of the building.

It is assumed that where the works may be subject to say, vibration either during the construction or during use that precautions will be specified, for example the use of a keying or reinforcement mesh.

G.2 Execution of works

It is assumed the site environmental conditions of exposure, temperature and humidity will be within the parameters prescribed for the application of the rendering (see 1.2.4).

Rendering systems intended for indoor applications may be temporarily exposed before the building envelope is closed. If the rendering is able to sustain short term exposure this shall be stated in the ETA and recommendations shall be given as to how to deal with this situation. This shall include, for example, how to dry the material if it has become wet; details of inspection required for cracks, delamination and mould growth; details of measurement of thickness and adhesion (bond strength) and a procedure for patch repair of damaged areas.

It is also assumed that the elements (substrates) to be protected are suitably prepared to the requirements specified in the ETA and, where appropriate, a suitable primer applied.

The primer used in the product tests shall be specified in the ETA. The ETA may also include generic/primer families for which the compatibility and adhesion (bond strength) have been proved by testing.

Where rendering is to be applied on steel that is already primed, the compatibility of the primer shall be established. If its trade name or generic type is not known the adhesion between the primer and rendering with a bonding agent, if used, shall be tested.

For cement-rich primers the pH-value of the primer to be used shall be tested and be within the limits prescribed for the rendering.

This EAD is not designed to cover the application of rendering over any existing coating (e.g. 'old' existing paint) or rendering. It is therefore assumed that:

- a) any existing coating or rendering is completely removed, or;
- b) if it is not removed, that the compatibility and adhesion (bond strength) between the new rendering and the existing coating or rendering is not less than 80 % of that which would exist between the new rendering and the substrate, or;
- c) mechanical fixing is employed e.g. a keying mesh secured independently of the existing coating or rendering direct to the substrate.

It is assumed that there is no contribution to performance from the existing substrate.

It is assumed that special attention will be paid to any additives required to be used with the rendering. In particular their specification, quantity, ratio and conditions of use as specified in the ETA and in the ETA applicant's instructions shall be considered.

Preparation of the product and its application is critical to the performance of renderings and their ability to fulfil the Essential Requirements. The ETA holder shall provide comprehensive installation instructions which shall clearly specify the installation criteria for the rendering or rendering kit together with training requirements for operatives.

G.3 Installation of the rendering product

The specification of components of the kit, e.g. fixings and reinforcement, shall be given together with a description of how they are used.

The installation / application instructions shall define the minimum requirements for satisfactory installation of the product in respect of training, competence and / or experience.

Where the sale of the product is restricted by the ETA holder to specialist fire protection industry contractors this shall be clearly explained on the packaging in addition to inclusion in the installation instructions.

The instructions shall clearly describe the correct tools and equipment for application of the rendering or rendering kit in all of the various forms (clearly described equipment for certain types of application).

The ETA shall state if a rendering intended for indoor or semi-exposed applications is tested to be temporarily exposed to outdoor conditions before the building envelope is closed. Instructions shall specify any special provisions such as; to temporarily protect the rendering or, for example, drying, adhesion testing and inspection requirements in the event of exposure.

The installation instructions shall clearly describe the method of installation of the product or kit including but not restricted to:

- storage conditions for the products, including the shelf life of the bagged product, and other components where relevant; the 'pot life', or 'workability' of prepared material and the time to full cure,
any substrate preparations required before application (including levels of substrate cleanliness, compatibility of the rendering with different substrates),
- any substrate key-coat / barrier coat which may be required in certain circumstances including the detailed instructions for mixing (as applicable), environmental conditions required for application and requirements for correct application,
- details of the requirements for primers on substrates and for the checking of compatibility with the rendering (by reference to pH, for example) and solution if not compatible (see below),
- the circumstances under which the product requires additional support / reinforcement for example when the substrate is coated with an unsuitable or unknown product where compatibility with the rendering, and hence the degree of adhesion (bond strength), cannot be established,
- details on the type / size of fixing required to reinforce or retain reinforcement to the substrate to be coated. The frequency, fixing pattern and method of installing the fixings (where required),
- the test methods to be used on site to determine adequacy of fixings and of primer coats,
- the test methods to be used on site to determine adhesion (bond strength) of the rendering together with the minimum adhesion given in the ETA,
- the required fixing strength and adhesion (bond strength) shall be 80 % of the achieved in the product tests,
- the specification for the reinforcement media (which may be fixed to the pre-installed fixings) for the particular scenario,
- the installation instructions for the location and retention of the reinforcement media (including its intended end position within the rendering thickness),
- the environmental conditions under which the rendering product may be mixed (as applicable) and applied,
- the instructions for mixing (as applicable) including product to water quantity ratios; the quality of water, e.g. 'potable'; any additives, their specification, ratio and conditions of use; the type of equipment required to effect correct mixing of the product and the mixing cycle time,
- the pressure settings and recommended spray tip sizes for correct application of the rendering using the specified type of equipment (where rendering is sprayed),
- if not sprayed, the method of application of the product,

- details of rendering thicknesses (with tolerances) required for different periods of fire resistance and substrate type and section size,
- instructions on overcoat times and restrictions (if any) on re-coating,
- guidance on trowelling, tamping or any other form of truing the surface of the rendering to produce a more regular finish than that achievable by initial application (if required),
- details of the maximum amount of cracking permitted expressed in the ETA as a maximum width of crack and total length of cracks per square metre of rendering,
- details on over-coating the rendering with either proprietary coatings of another manufacture or those made by the rendering ETA holder as part of the kit (if necessary) e.g. for better weather protection,
- guidance on masking work locations during the application of such products.

The mean density quoted in the ETA is that at which the products tests were conducted and for which the performance characteristics are valid. A tolerance of $\pm 15\%$ on the quoted mean is accepted as the field of 'direct application' for which the quoted performance characteristics are deemed valid.

It is recognized that in practice it is difficult to control the density of the sprayed mix. However, the density of the sprayed rendering shall not fall outside the lower tolerance. If the density exceeds the upper tolerance it will be necessary to evaluate other parameters. This constitutes a field of extended application. Although performance characteristics are unlikely to be compromised at higher densities the effect of additional mass needs to be considered. Consequently, adhesion/bond strength (if the rendering is not reinforced or mechanically fixed), the thickness of the rendering and the substrate type, for example flat or with re-entrant angles, need to be examined in order to establish the acceptability or otherwise of the higher density. As a guide a density of the mean plus 20 % might be acceptable except possibly at the upper limit of thickness (e.g. a high fire resistance period combined with a slender steel profile with high Area/Volume-ratio), where the additional mass of the rendering may give rise for concern.

Similarly, if sprayed at thicknesses greater than those specified whilst not detracting from performance the additional mass shall be considered, particularly if combined with a higher density.

The installation information shall also clearly specify any limitations for the product's use such as the product's incompatibility with certain environments or fire protection scenarios.

If the product cannot withstand mechanical damage without additional cladding of a specified type, this shall be described clearly.

Recommendations shall be given on the sequencing of works such that rendering is not applied until adjacent works, which might cause damage to it, are completed.

A recommendation to provide ventilation around completed works to avoid biological attack such as mould growth shall be included.

If the works are, for example, likely to be subject to vibration, special provisions such as the use of keying or reinforcing mesh may need to be specified.

Where the product assessed is not compatible with another fire protective product and could influence the protected structure, this shall be described.

Information shall be included on how to deal with junctions between elements and between old and new areas of rendering.

Guidance shall be given by the manufacturer on how to deal with over-spraying existing rendering (if that is a recommended practice).

G.4 Site tests

Where fixings are required to be used, the evaluation tests of pins and keying mesh being non-destructive, are appropriate to use as quality control tests on site to check the efficacy of fixings and are recommended to ensure that the same performance is achieved in practice as was type tested.

Where the rendering is self-bonded to the substrate without fixings, the method described in 2.2.7 is appropriate to ensure that at least 80 % of the bonding is achieved in practice as was type tested.

The thickness shall be measured at a frequency sufficient to determine the mean and minimum thickness. A suitable method for thickness measurement is given in 2.3.4 (for non-fire tests).

The density of the rendering shall be measured by a method recommended by the ETA holder. It shall be within the tolerances specified in the ETA. Suitable methods to measure the density are given in 2.3.3.

If EN 1015-6 and EN 1015-10 will be used, the number of samples may be reduced to an appropriate level. Other methods may be applied.

When some renderings dry and cure, a certain amount of shrinkage of the material inevitably occurs with resultant cracking. Within limits this behaviour is acceptable. Hairline cracks are acceptable up to the size and number of those recorded in the fire test samples before testing. The maximum degree of cracking permitted for a rendering shall be included in the ETA.

G.5 Maintenance and repair

General remarks

Renderings can generally be repaired, when there are small areas of damage caused by accident or disruption by other trades. The requirements for the repair: shape and maximum size of repair, preparation, the material, fixings, reinforcement and the method of application shall be specified in the instructions. Particular attention shall be paid to the difficulties in bonding the repair to old rendering.

The ETA holder shall specify in the installation instructions for the application/installation of the rendering specific instructions relating to the maintenance and repair of the rendering.

This shall include routine inspections of the rendering to check for damage, cleaning, re-application of the top coat / sealing coat (as applicable).

The repair procedure shall describe the controls to be imposed on the repair activity relating to:

- preparation of the damaged rendering for repair including the removal of damaged material and “dressing” of the surrounding rendering to achieve a sound perimeter bond surface,
- cleaning of the substrate and remaining original rendering,
- instructions on the replacement of reinforcing media (as applicable),
- specifying whether a special repair rendering product is required or whether the original product can be used effectively,
- mixing (as applicable) of the repair material,
- application of the repair material,
- re-application of top coat / sealing coat (as applicable).

Biological attack

In rare cases, deterioration of these products may occur due to biological attack, i.e. mould growth on the products and/or the products being subject to deterioration due to insects or mammals infestation. This EAD does not foresee product assessment for resistance to biological attack, but where Assessment Bodies expect biological attack to be of particular importance for specific products, additional, case-by-case assessment shall take place.

Moulds and other fungi that may damage products require warm (10 °C to 35 °C), humid conditions (relative humidity > 70 %), and a suitable food source. Mould growth is encouraged by dark conditions and lack of air movement. Design solutions shall prevent the possibility of mould growth by ensuring that areas where these products are used can be ventilated sufficiently. Users shall ensure that adequate ventilation is provided to discourage mould and fungal growth.

Proper water tightness of the building envelope, using appropriate design principles and details are essential. During the exposed and partially enclosed phases of construction, to minimize the potential for mould growth, it is important to minimize the risk of water damage and wet surfaces due to external factors such as rain, snow, flooding, and high relative humidity. During construction, the following shall be considered to minimize the potential for mould growth: minimizing the exposure of interior building products to exterior conditions; protecting stored materials from moisture; minimizing moisture accumulation within the building; preventing spillage of water within the building; maintaining the integrity of the building envelope components through ongoing monitoring and inspections; achieving balance control of thermal comfort and relative humidity in the building; checking all material deliveries to validate that components are dry and clean; rejecting wet or mouldy materials, and monitoring installations to ensure they remain clean and dry (including heating, ventilation and air conditioning systems).

In addition, where animals (insects or mammals) might attack these products, design solutions shall prevent animal access to places where the products have been used and habitable voids that might harbour animals shall be either avoided or sealed.