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EXTERNAL THERMAL INSULATION COMPOSITE SYSTEMS (ETICS) WITH RENDERINGS

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

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD applies for External Thermal Insulation Composite Systems (ETICS) with renderings (rendering system) to be applied as external thermal insulation on the walls of buildings. The walls are made of masonry (bricks, blocks, stones...) or concrete (cast on site or as prefabricated panels) with or without rendering systems.

Depending on fixing method of thermal insulation the EAD covers the ETICS as follows:
- Purely bonded ETICS with 20 % as minimum bonded area,
- Bonded ETICS with supplementary mechanical fixings with 20 % as minimum bonded area,
- Mechanically fixed ETICS with supplementary adhesive with 20 % as minimum bonded area,
- Purely mechanically fixed ETICS with bonded area less than 20 %.

With respect to the intended use the ETICS is composed of the following components:

1. Adhesive which is applied between the substrate and the thermal insulation panels
   Factory-made thermal insulation products made of:
   - cellular plastic
   - mineral and wood wool
   - expanded cork and natural cork,
   - wood fibres
   - cellular glass
   - vegetable and animal fibres
   - mineral material
   - other thermal insulation products that can be assessed according to the methods listed in this EAD. These thermal insulation products may be covered by their harmonised technical specification (hTS),

   An indicative list of them is provided in annex H**.**

   The above thermal insulation materials shall meet the following requirements:
   - Minimum value of shear strength according to EN 12090[1]: 20 kPa (for purely bonded and bonded ETICS with supplementary mechanical fixings),
   - Minimum value of shear modulus according to EN 12090: 1 000 kPa (for purely bonded and bonded ETICS with supplementary mechanical fixings),
   - All values of water absorption after 24 hours of partial immersion according EN 1609/method A: < 1 kg/m^2
   - Maximum value λ_D (design value) according to EN 12667 (or EN 12939): 0,065 W/(m.K)
2. Mechanically fixing device if relevant:
   - Plastic anchors for mechanically fixed ETICS with characteristics assessed according to EAD 330196-01-0604 and to Annex G used to fix the ETICS on the substrate against effects of wind action (if specified), against thermal actions (if specified and/or if necessary) and/or to provide stability of outer surface of thermal insulation boards.
   - Plastic anchors for purely mechanically fixed ETICS shall be assessed with respect to their shear capacity and displacement under service load.
   - Plastic anchors are assessed for tension loads resulting from wind loads only. The dead load of the ETICS is transmitted by the adhesive of the ETICS.
   - Fixing device/anchors according to EAD 330196-01-0604 for fixing the profiles or rails to the substrate.

3. Rendering system which is composed from the following components
   - Base coat which is applied with glass fibre mesh or metal mesh
   - Glass fibre mesh or metal mesh as reinforcement embedded into base coat
   - Key coat (optionally)

1 All undated references to standards or to EAD's in this document are to be understood as references to the dated versions listed in clause 4

- Finishing coat (optionally)
- Decorative coat (optionally)

ETICS are differentiated according to the method of fixing in order to transfer the embedded load into substrate:

Bonded ETICS:

1. Purely bonded ETICS.
   The load is totally distributed by the bonding layer. ETICS may be fully bonded (over the entire surface) or partially bonded. No mechanical fixings are used.
2. Bonded ETICS with supplementary mechanical fixings.
   The load is totally distributed by the bonding layer. ETICS may be fully bonded (over the entire surface) or partially bonded. The mechanical fixings are used primarily to provide the stability and flatness of the outer face of the thermal insulation board until the adhesive has dried and has reached the final mechanical strength and act as a temporary connection to avoid the risk of detachment. Supplementary mechanical fixings can also provide the stability in case of fire.

Mechanically fixed ETICS:

3. Mechanically fixed ETICS with supplementary adhesive
   The load is distributed to the substrate by the mechanical fixings and the supplementary bonding. Mechanical fixings shall carry the horizontal load.

The adhesive is used primarily to ensure the flatness of the installed ETICS. The vertical load is distributed to the substrate by the adhesive and/or the mechanical fixings.

4. Purely mechanically fixed ETICS
   The load is totally distributed by mechanical fixings. The ETICS are secured to the wall by mechanical fixings only. ETICS with the bonded area less than 20 % are considered to be purely mechanically fixed.

The adhesive, the base coat, the key coat, the finishing coat and the decorative coat include a range of binders from pure polymeric to pure mineral (cement, lime…). These may be available in the following form:

- Powder (dry mortar) blended at the factory that requires only mixing with a quantity of water specified by the manufacturer
- Powder requiring addition of extra binder
- Paste requiring addition of cement
- Ready to use paste, supplied in workable consistency

The adhesive may be also available in the form of foam, taken directly from the bottle/can.

This EAD applies to ETICS

- with thermal insulation product of the same material according to 1.3.7 applied onto the wall
- with rendering system with the water absorption after 1 hour less than 1 kg/m^2 and if the water absorption of the reinforced base coat itself after 1 hour is less than 1 kg/m^2 (limit of water absorption) in line with 2.2.5,
- with performance on water-tightness of the ETICS: hygrothermal behaviour in line with 2.2.6
- where the performances are in range defined for bond strength between base coat and thermal insulation product in clause 2.2.11.1
- where the performances are in range defined for bond strength between adhesive and thermal insulation product in clause 2.2.11.3
- where the performances are in range defined for bond strength between adhesive and substrate in clause 2.2.11.2
- if PU adhesive is used the performance of bond strength of PU adhesive is in range defined in clause 2.2.11.4
- where the performance of tensile strength of the glass fibre mesh after ageing is min. 50% of the tensile strength in the as-delivered state in line with 2.2.21
- where the performance of the tensile strength of reinforced glass fibre mesh after ageing is min. 40% of the tensile strength in the as-delivered state in line with 2.2.21
- where the tensile strength of glass fibre meshes after ageing is min. 20 N/mm in line with 2.2.21
- to be totally applied on site,

- providing the minimum thermal resistance of 1,0 (m^2.K)/W,
- on sufficiently airtight walls.

The mechanical fixings can be anchors, vertical and/or horizontal profiles, special pieces, etc., or a combination of adhesive and mechanical fixings.

The thermal insulation product is faced with a rendering system consisting of one or more layers, one of which contains reinforcement. The rendering system is applied directly to the insulating panels, without any air gap or disconnecting layer.
The ETICS is supported with special fittings/ancillary components (e.g. base profiles, corner profiles, ...) to connect them to adjacent building structures (apertures, corners, parapets, etc.). These ancillary components are specified by the manufacturer of ETICS either by means of specific type or by performances. Ancillary components are not part of ETICS.

The ETICS comprises components which are produced by the manufacturer or purchased by the ETICS manufacturer from suppliers. The ETICS manufacturer is ultimately responsible for all components of the ETICS kit that the ETICS manufacturer manufactures or has purchased.
The product is not covered by a harmonised European standard (hEN).

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.

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.

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

1.2.1 Intended use(s)

The ETICS may be used on new or existing (retrofit) vertical building walls. They may also be used on horizontal or inclined surfaces which are not exposed to precipitation.
The ETICS gives the building wall to which it is applied additional thermal insulation and protection from effects of weathering.
ETICS are non-load-bearing construction elements. They do not contribute directly to the stability of the building wall on which they are installed.
ETICS are not intended to ensure the air tightness of the building structure.

1.2.2 Working life/Durability

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

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

[2] 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 expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Substrate

The term “substrate” refers to a wall or to a horizontal support, which in itself already meets the necessary airtightness and mechanical strength requirements (resistance to static and dynamic loads).
It may be faced with mineral or organic renders or paints or with tiles.

- Masonry walls:
  Walls constructed from units of burnt clay, concrete, calcium silicate, autoclaved aerated concrete or stone laid using mortar and/or adhesive.
- Concrete walls:
  Walls made of concrete either cast in situ or prefabricated at the factory.

1.3.2 ETICS component

Factory-made product or a group of factory-made products as a functional unit of the ETICS. List of ETICS components is defined in 1.1.

1.3.3 Adhesive

An ETICS component used for bonding the thermal insulation product to the substrate.

1.3.4 Supplementary adhesive

Adhesive used primarily to maintain thermal insulation products to the substrate before mechanical fixings.

1.3.5 Thermal insulation product

A pre-fabricated product with a high thermal resistance, which is intended to impart insulation properties to the substrate, made of thermal insulation type according to list in 1.1 under point 2.

1.3.6 Thermal insulation type

Group of thermal insulation products of the same thermal insulation material (for example MW lamella and MW board and EPS are examples for different thermal insulation types).

1.3.7 Thermal insulation material

Material used in thermal insulation type (e.g. mineral wool, polystyrene, cork...).

1.3.8 Rendering system

All the coats applied to the outer face of the thermal insulation product together with the reinforcement.

1.3.8.1 Reinforcement

Glass fibre mesh, metal mesh reinforcement (embedded)
Differentiation is made between:

- Standard mesh: embedded in the base coat all over the area and tied positively at joints, mostly by overlapping,
- Reinforced mesh: embedded in the base coat additionally to the standard mesh to improve the impact resistance, generally applied without overlapping.

1.3.8.2 Render coating

The rendering coating is applied to the thermal insulation product in one or several coats (application of a new coat on top of an existing dry coat).
Generally, multi-coat renders include the following:

- Base coat: coat applied directly onto the thermal insulation product; the reinforcement is embedded into it and provides most of the mechanical properties of the rendering,
- Key coat: very thin coat which may be applied to the base coat and is intended to act as a preparation for the application of the finishing coat. It can also be possibly used for aesthetic reasons (for example in case of “dark” ribbed finishing coats).
- Finishing coat: coat which contributes to the protection against weathering and provides a decorative finish. It is applied onto the base coat with or without a key coat.
  Type of finishing coat: where the only difference between two finishing coats is due to the size of the aggregates, they are designed as one type.
- Decorative coat: coat which generally contributes to the aesthetic finishing (to cover efflorescence ...) of the finishing coat and can also provide supplementary protection against weathering.

In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted.

1.3.9 Mechanical fixing device

Profiles, anchors, pins or any special fixing devices used to secure the ETICS kit to the substrate.

1.3.10 Plastic anchors for ETICS

Plastic anchor: a manufactured, assembled component for achieving anchorage between the base material (substrate) and the fixture.

Fixture: component to be fixed to the base material (substrate), in this case external thermal insulation composite system.

Anchorage: an assembly comprising base material (substrate), plastic anchor and fixture.

1.3.11 Anchor for profiles and rails

Fixing device/anchors for fixing the profiles or rails to the substrate.

1.3.12 Supplementary mechanical fixing device

Mechanical fixing devices (e.g. profiles, anchors, pins or any special fixing devices) used primarily to provide stability until the adhesive has dried and act as a temporary connection to avoid of risk of detachment.

1.3.13 Ancillary materials

Any supplementary component or product used addition to the kit, e.g. to form joints (mastics, corner strips, etc...) or to give specific protection (mastic, joint-covers, corner strips, corner profiles, base profiles, ...). These shall be used according to manufacturer´s instructions.

1.3.14 ETICS composition

Set of components defined by the manufacturer in European Technical Assessment specified by one base coat, one type of thermal insulation product (of the same thermal insulation type according to 1.3.6, reinforcement(s), and with adhesive(s) and/or mechanical fixing device(s), with optionally finishing coat(s) and optionally key coat(s) and decorative coat(s).

1.3.15 ETICS kit

Combination of selected products taken from a ETICS placed on the market by the manufacturer to be incorporated in the construction works.

1.3.16 Assembled kit

Kit after it has been incorporated in the construction works.

1.3.17 Reinforced base coat

Base coat with embedded reinforcement.

1.3.18 Declared thickness

Nominal thickness or range of thicknesses of a layer of an ETICS stated by the manufacturer.

1.3.19 Organic content

Total amount of organic substances as part of a component or a product related to the mass in cured and dried condition (see A.4, and A.6.5 to A.6.7).

1.3.20 Worst case

Worst configuration of ETICS components taken from the ETICS specified for testing specimen in order to reach the worst testing result/performance.

1.3.21 Mean value

Arithmetic average value.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of ETICS with renderings is assessed in relation to the essential characteristics.

Table 1 Essential characteristics of the External Thermal Insulation Composite systems (ETICS) with rendering and methods and criteria for assessing the performance of the External Thermal Insulation Composite systems (ETICS) with rendering 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	
	- reaction to fire of ETICS	2.2.1.1	class
	- reaction to fire of thermal insulation material	2.2.1.2	class
	- reaction to fire of PU foam adhesive	2.2.1.3	class
2	Facade fire performance	2.2.2	description
3	Propensity to undergo continuous smouldering of ETICS	2.2.3	description
Basic Works Requirement 3: Hygiene, health and the environment			
4	Content, emission and/or release of dangerous substances – leachable substances	2.2.4	description
5	Water absorption	2.2.5	-
	- of the base coat and the rendering system	2.2.5.1	level
	- of the thermal insulation product	2.2.5.2	level
6	Water-tightness of the ETICS: Hygrothermal behaviour	2.2.6	description
7	Water-tightness: Freeze thaw performance	2.2.7	description
8	Impact resistance	2.2.8	level

No	Essential characteristic	Assessment method	Type of expression of product performance *(level, class, description)*
9	Water vapour permeability	2.2.9	-
	- of the rendering system (equivalent air thickness s_d)	2.2.9.1	level
	- of thermal insulation product (water-vapour resistance factor)	2.2.9.2	level
Basic Works Requirement 4: Safety and accessibility in use			
10	Bond strength	2.2.11	-
	- bond strength between the base coat and the thermal insulation product (mortar or paste)	2.2.11.1	level
	- bond strength between the adhesive and the substrate	2.2.11.2	level
	- bond strength between the adhesive and the thermal insulation product	2.2.11.3	level
	- bond strength of foam adhesives	2.2.11.4	level
11	Fixing strength (transverse displacement test)	2.2.12	level
12	Wind load resistance of ETICS	2.2.13	-
	- pull-through tests of fixings	2.2.13.1	level
	- static foam block test	2.2.13.2	level
	- dynamic wind uplift test	2.2.13.3	level
13	Tensile test perpendicular to the faces of the thermal insulation product	2.2.14	-
	- in dry conditions	2.2.14.1	level
	- in wet conditions	2.2.14.2	level
14	Shear strength and shear modulus of elasticity test of ETICS	2.2.15	level
15	Pull-through resistance of fixings from profiles	2.2.16	level

No	Essential characteristic	Assessment method	Type of expression of product performance *(level, class, description)*
16	Render strip tensile test	2.2.17	level
17	Shear strength and shear modulus of foam adhesive	2.2.18	level
18	Post expansion behaviour of foam adhesives	2.2.19	level
19	Bond strength after ageing	2.2.20	-
	- bond strength after ageing of finishing coat tested on the rig	2.2.20.1	level
	- bond strength after ageing of finishing coat not tested on the rig	2.2.20.2	level
20	Mechanical and physical characteristics of the mesh	2.2.21	-
	Tensile strength of the glass fibre mesh	2.2.21.1 2.2.21.2	level
	Protection of metal mesh	2.2.21.3	level
Basic Works Requirement 5: Protection against noise			
21	Airborne sound insulation of ETICS	2.2.22.1	level
	Dynamic stiffness of the thermal insulation product	2.2.22.2	level
	Air flow resistance of the thermal insulation product	2.2.22.3	level
Basic Works Requirement 6: Energy economy and heat retention			
22	Thermal resistance and thermal transmittance of ETICS	2.2.23	level

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

Testing will be limited only to the essential characteristics which the manufacturer intends to declare. If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required except for reasonable cases given under specified clauses in 2.2.

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

2.2.1 Reaction to fire

2.2.1.1 Reaction to fire of ETICS

The ETICS shall be tested, using the test method(s) relevant for the corresponding reaction to fire class according EN 13501-1, in order to be classified according to Commission Delegated Regulation (EU) No. 2016/364.
Input data of components for test specimen to be assessed shall be considered and reported in accordance with Annex A.1 to Annex A.5.
The determination of the worst case(s) as well as the mounting and fixing provisions that are considered to be appropriate for the testing and are representative of the intended end use application are specified in Annex B.

In case of ETICS to be classified as A1 or A2 total the Q_{PCS} value of ETICS shall be calculated in accordance with EN 16724, clause 5.3.6. The provisions of Annex B shall be taken into account.
Assessment: In ETA shall be given performance - reaction to fire class for ETICS or reaction to fire for each well described ETICS configurations.

2.2.1.2 Reaction to fire of thermal insulation material

Each thermal insulation material shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to Commission Delegated Regulation (EU) No. 2016/364 and EN 13501-1. In case of existing Declaration of performance for ETICS component, reaction to fire class shall be part of it.
Input data of component for test specimen to be assessed shall be considered and reported in accordance with Annex A1 and A.2.

Assessment:
In the ETA the reaction to fire class of thermal insulation material (provisions from EN 15715 shall be taken into account) shall be given. In case of thermal insulation material to be classified as A1 or A2 the Q_{PCS} value of thermal insulation material shall be given in the ETA in accordance with EN 13501-1. The provisions of Annex B shall be taken into account.

2.2.1.3 Reaction to fire of PU-foam adhesives

Each PU foam adhesive (if relevant) shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to Commission Delegated Regulation (EU) No. 2016/364 and EN 13501-1. In case of existing Declaration of performance for ETICS component, reaction to fire class shall be part of it.

Input data of component for test specimen to be assessed shall be considered and reported in accordance with Annex A5.

Assessment:
In the ETA the reaction to fire class of PU-foam adhesives shall be given.
The provisions given in Annex A.5 shall be taken into account.

2.2.2 Facade fire performance

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

Input data of components for test specimen to be considered and assessed shall be done in accordance with Annex A.1 to Annex A.5.

Information about such situation is included in Annex C.

Assessment:

The facade fire performance shall be determined as requested at the place of application in order to demonstrate compliance with the relevant fire safety requirements and shall be stated in ETA.

2.2.3 Propensity to undergo continuous smouldering of ETICS

The characteristic “Propensity to undergo continuous smouldering of ETICS” is required in some Member States and it is only relevant for products made from mineral wool, wood based products, vegetable/animal fibres and cork (i.e. currently under standards EN 13162, EN 13168, EN 13170, EN 13171.

The performance of the relevant thermal insulation product´s propensity to undergo continuous smouldering is tested and assessed in accordance with EN 16733.

The conditions and parameters which shall be taken into account within the tests as well as the rules for the application of test results are specified in Annex E, until harmonized specifications for the thermal insulation products don’t provide such provisions.

Assessment:

In accordance with EN 16733:2016, clause 11, the ETA shall specify the following information:

Performance according to EN 16733, clause 11, of the thermal insulation product as given in its own DoP or after testing	**Description of the performance of the ETICS regarding the characteristic Propensity to undergo continuous smouldering to be stated in the ETA**
The thermal insulation product does not show propensity to undergo continuous smouldering (NoS).	The ETICS does not show propensity to undergo continuous smouldering.
The thermal insulation product shows propensity to undergo continuous smouldering (S).	The ETICS shows propensity to undergo continuous smouldering.
Assessment of the propensity for continuous smouldering combustion is not possible (ANP).	Assessment of the propensity to undergo continuous smouldering is not possible

2.2.4 Content, emission and/or release of dangerous substances - Leachable substances

The performance of the product related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[3] after

[3] 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.

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. Purely inorganic ETICS component (e.g. boards, adhesives, base coats) do not have to be tested.
The identified intended release scenarios for this product and intended use with respect to dangerous substances are:

IA3: Product with no contact to indoor air

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

S/W3: Product with no contact to soil, ground- and surface water

For the intended use covered by the release scenario S/W2 the performance of the rendering system applied on inert substrate (sandblasted glass or stainless steel) (hereafter “sub-kit”) concerning leachable substances is to be assessed. A leaching test with subsequent eluate analysis must take place, each in duplicate. Leaching tests of the test specimens are conducted according to CEN/TS 16637-2:2014. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be (80 ± 10) l/m².

The sub-kit to be tested shall be assembled according to manufacturer’s instructions. Preparation is performed using ¾ of the maximum wet film thickness for each layer. The quantity applied in each layer is verified in terms of wet weight [g/m²] by taking weight differences.

Before testing, the prepared samples are stored for at least 28 days at (23 ± 2) °C and (50 ± 5) % RH.

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

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

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

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

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

Assessment:

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

2.2.5 Water absorption

The assessment of water absorption of ETICS is carried out by means of the assessment of the water absorption of the reinforced base coat applied on the thermal insulation type (see 2.2.5.1) and the water absorption of the rendering systems applied on the thermal insulation type (see 2.2.5.1) and the water absorption of the thermal insulation product (see 2.2.5.2).

The level of water absorption is an input for a decision on: which finishing coats shall be applied on the rig to be subjected to hygrothermal testing and whether or not the freeze-thaw test is to be performed.

2.2.5.1 Water absorption of the base coat and the rendering system

The water absorption of the base coat is performed on the reinforced base coat. The water absorption of the rendering systems is performed on all types of rendering systems.
Testing is performed on samples which are prepared as follows:

Preparation of the samples:

Samples are prepared, each by taking a piece of the specified thermal insulation product, the size shall be at least 200 mm x 200 mm, and applying (in accordance with the ETICS manufacturer´s instructions related to thickness, mass per unit area and method of application) both:
- the reinforced base coat alone
and
- the configurations of complete rendering systems proposed by the manufacturer of the ETICS, i.e. the reinforced base coat covered with each type of finishing coat and (associating or not) the key coat and/or the decorative coat. If the application of the key coat and/or the decorative coat is optional, at least configurations without them shall be tested.

In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted. It means that the water absorption of the rendering system is the water absorption of the base coat.
Within a type of finishing coat, the test shall be carried out with at least the thickest layer (generally higher particle size grading with floated finishing aspect).

Three samples are prepared for each configuration. Quantities and/or thicknesses applied shall be recorded.

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

The edges of the samples, including the thermal insulation product, are sealed against water, to ensure that during subsequent testing, only the face of the reinforced base coat or the rendering system is subject to water absorption.

They are then subject to a series of 3 cycles comprising the following phases:
- 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 dependent upon surface roughness. To achieve 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.
- 24 h drying at (50 ± 5)°C.

If interruptions are necessary, e.g. at week-ends or holidays, the samples are stored at (23 ± 2)°C and (50± 5)% RH after the drying at (50 ± 5)°C.
After the cycles, the samples are stored for at least 24 h at (23 ± 2)°C and (50 ± 5)% RH.

The procedure for capillarity test is followed[4]:

To start the capillarity test the same samples which were subjected to a series of 3 cycles are again immersed in a water bath as described above.
The samples are weighed after 3 minutes immersion in the bath (reference mass) and then after 1 hour and 24 hours. Prior to the second and subsequent weighing, water adhering to the surface of the sample is removed with a damp sponge cloth.

Analysis of results and assessment:

Calculation is undertaken to determine the mean water absorption of the three samples per square metre after 1 and 24 hours.

In ETA the following values shall be given:
- the mean value of the water absorption in kg/(m^2.h) of the reinforced base coat after 1 hour and after 24 hours,
- the mean value of the water absorption in kg/(m^2.h) of the each complete rendering system after 1 hour and after 24 hours.

[4] In order to provide information about the stabilisation, the water absorption measured can be plotted on a chart as a function of $\sqrt{t}$

2.2.5.2 Water absorption of thermal insulation product

The performance of water absorption is tested for each type of thermal insulation product used in the ETICS.

Only if no test method is defined in the appropriate harmonized technical specification (Harmonized standard or European assessment document) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of performance of the product, the test shall be performed in accordance with EN 1609/Method A.

Assessment: The (maximum) value expressed in kg/m^2 after 24 hours shall be stated in the ETA.

2.2.6 Water-tightness of the ETICS: Hygrothermal behaviour

The outcome of water absorption results (clause 2.2.5.1) will determine the finishing coats to be applied on the rig for the hygrothermal behaviour.

Based on the outcome of the water absorption test, Annex D gives recommendations of the product to be tested (e.g. the number of finishing coats). Some samples are prepared at the same time as the rig in order to evaluate the following characteristics after heat/rain and heat/cold cycles (for sample size and number, see relevant test method clauses):

- Bond strength between the base coat and the thermal insulation product (only if the lower part of the rig does not only consist of the reinforced base coat alone, i.e. ETICS with only one finishing coat) (2.2.11.1)
- Tensile strength and elongation at break (Annex A, clause A.6.8.3) (for products with an application thickness up to 5 mm).

In the case of reinforced base coat with a thickness up to 5 mm, complementary samples shall also be prepared to perform the test on the hardened product according to Annex A.6.8.3.
In the case of reinforced base coat with a thickness greater than 5 mm, complementary samples shall also be prepared to perform the test on the hardened product according to Annex A.6.8.1.

Principles related to the preparation of the rig:

- As a general rule, only one reinforced base coat and at the very most four finishing coats (vertical divisions) can be applied per rig.
- If several adhesives are proposed for the ETICS, only one shall be tested on the rig.
- If more than 4 finishing coats are proposed for the ETICS, the maximum number of coats, representative of the different types proposed, shall be tested on rig(s). Furthermore, if the water absorption of the reinforced base coat after 24 h is equal to or more than 0.5 kg/m^2, each type of finishing coat containing a pure polymeric binder (non-cementitious) shall be submitted to hygrothermal cycles on rig(s). Any finishing coats not tested on the rig shall be examined according to 2.2.20.2.
- In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted.
- If different finishing coats can be used in the ETICS, the lower part of the test piece (1.5 x insulating panel height) consists of the reinforced base coat only without any finishing coat.
- If several ETICS differ only in the method of fixing (bonded or mechanically fixed) of the thermal insulation product, the test is only carried out on the ETICS applied with adhesive at the edge of the rig and with mechanical fixings devices in the centre.
- If several ETICS differ only in the type of thermal insulation product, two thermal insulation products can be applied to the rig. The thermal insulation products are divided vertically at the centre of each rig.
- The ETICS is applied, in accordance with the manufacturer's instructions, to a sufficient stabilised masonry or concrete substrate:
- The ETICS shall also be applied to the lateral faces with a uniform maximum thickness of thermal insulation product of 20 mm. If the thermal insulation product is not available in this thickness (Mineral wool Lamella for example), the lateral faces can be covered with a thickness of 20 mm expanded polystyrene.
- The dimensions of the rig shall be:
  - surface ≥ 6 m^2
  - width ≥ 2.50 m
  - height ≥ 2.00 m.

A rectangular opening (consisting of the absence of the ETICS on the substrate at this area) is included at the corner of the rig, 0.40 m wide by 0.60 m high, positioned 0.40 m from the edges (see Figure1)

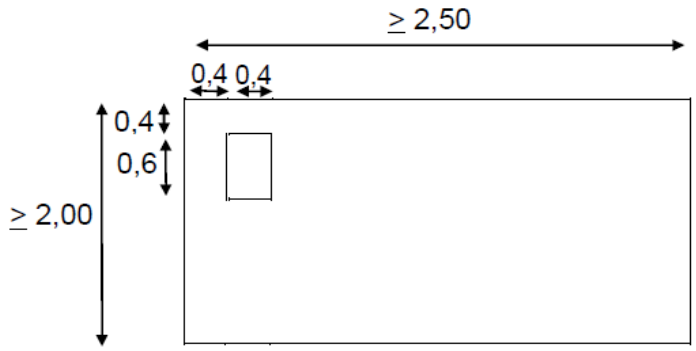


Figure 1: Dimensions of the rig (in metres) for the hygrothermal cycles

Remark: if two thermal insulation products are foreseen to be applied to the rig, two symmetrical openings shall be included at both of the upper corners of the rig. Furthermore, two openings shall be applied in order to affect all tested finishing coats.
Special methods for reinforcing corners of the opening are applied, if necessary.
Installation of the window sill and other ancillary materials is under responsibility of the manufacturer.

Preparation of the rig:
The rig preparation shall be made by the manufacturer. It shall be supervised by the laboratory in charge of the test regarding:

- checking of the respect of manufacturer prescriptions: all stages shall be in accordance with the Technical File of the manufacturer
- registering of all the stages of the installation:
  - the date and time of the various stages
  - temperature and % relative humidity during the installation (every day – at least at the beginning)
  - name and production lot (batch) of the components
  - way of fixing the thermal insulation product
  - figure describing the rig (place of the fixings and of the joints between the panels, …)
  - way of renders preparation (tool, % of mixing, possible pause time before application,…) as well as their way of application (hand tool, machines, number of layers,…)
  - quantities and/or thickness of renders applied per square metre
  - drying period between each layer
  - use and position of accessories
  - any other information

Conditioning of the rig:
The ETICS is cured indoors for a minimum of 4 weeks. During the curing time the ambient temperature shall be between 10°C and 25°C. The relative humidity shall not be less than 50%. To ensure that these conditions are met, records shall be made at regular intervals.
To prevent the ETICS from drying out too rapidly, the manufacturer may require the render to be wetted once per week by spraying for approximately 5 minutes. This wetting shall start at a time according to the prescriptions of the manufacturer.
During the curing time any deformation of the ETICS, i.e. blistering, cracking, is recorded. For a reinforced base coat with a thickness up to 5 mm, some samples are prepared according to Annex A (test for static modulus of elasticity, tensile strength and elongation at break (A.6.8.3)) and placed in the opening of the rig.

Hygrothermal cycles
The test apparatus is positioned against the front face of the rig, 0.10 to 0.30 m from the edges.
The specified temperatures during the cycles are measured at the surface of the rig. The specified temperature shall be obtained by adjustment of the air temperature.

Heat - rain cycles:
The rig is subjected to a series of 80 cycles, comprising the following phases:

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

Heat-cold cycles:
After at least 48 hours of subsequent conditioning at temperatures between 10 and 25°C and a minimum relative humidity of 50 %, the same test rig is exposed to 5 heat/cold cycles of 24 hours comprising the following phases:
1- exposure to (50 ± 5)°C (rise for 1 hour) and maximum 30% RH for 7 hours (total of 8 hours),
2- exposure to (- 20 ± 5)°C (fall for 2 hours) for 14 hours (total of 16 hours).

Observations during the test:
After every four cycles of the heat/rain and at every cycle of heat/cold, observations by naked eye relating to a change in characteristics or performance (blistering, detachment, crazing, loss of adhesion, formation of cracks, etc ...) of the entire ETICS and of the part of the rig consisting of only the reinforced base coat are recorded as follows:
- the surface finish of the ETICS is examined to establish whether any cracking has occurred; the dimensions and the position of any cracks shall be measured and recorded,
- the surface shall also be checked for any blistering or peeling and the location and extent shall again be recorded,
- the sills and the profiles shall be checked for any damage/degradation together with any associated cracking of the finish. Again, the location and extent shall be recorded.

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

Assessment:
For the assessment of the hygrothermal behaviour either for the reinforced base coat (if a part without finishing coat is required) or for the ETICS, the following defects shall neither occur during, nor at the end, the test programme:
- blistering or peeling of any finishing coat/base coat/rendering system
- failure or cracking associated with joints between thermal insulation product boards or profiles fitted with ETICS
- detachment of the finishing coat/base coat/rendering system
- width of cracks bigger than 0,2 mm allowing water penetration to the thermal insulating layer

In ETA shall be stated:
Hygrothermal cycles have been performed on a rig.
The ETICS is assessed resistant to hygrothermal cycles, it means ETICS passed the test without defects.

After the heat-rain and heat-cold cycles:
Bond strength tests according to 2.2.11.1, 2.2.20.1 and impact resistance test according to 2.2.8 shall be performed on rig, after at least 7 days drying.

2.2.7 Water tightness of the ETICS: Freeze-thaw behaviour

Freeze-thaw behaviour shall be assessed or not assessed based on analysis of results of water absorption (see 2.2.5.1 and Annex D).
The assessment of freeze-thaw shall be carried out as determined by the analysis of the capillarity test except the water absorption after 24 hours of both the reinforced base coat and the rendering system determined with each type of finishing coat is less than 0.5 kg/m^2.
However the freeze-thaw test can be performed in addition in order to show performance of freeze-thaw behaviour.
The test shall be carried out on three samples 500 mm x 500 mm consisting of a piece of the specified thermal insulation product covered by:
- reinforced base coat without finishing coat if its water absorption is equal to or higher than 0.5 kg/m^2 after 24 hours,
- all the configurations of rendering systems proposed by the manufacturer (i.e. the reinforced base coat covered with each type of finishing coat and (associating or not) key coat and/or decorative coat which lead

to a water absorption equal to or higher than 0.5 kg/m^2 after 24 hours. If the application of the key coat and/or the decorative coat is optional, at least configurations without them shall be tested).
In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted. It means that the freeze-thaw behaviour of the rendering system is the freeze-thaw behaviour of the base coat. These samples are prepared according to the manufacturer's instructions and then stored for at least 28 days at (23 ± 2)°C and (50 ± 5) % RH.

Cycles
The samples are then subjected to a series of 30 cycles (one cycle lasts for 24 hours)
comprising:
- Exposure to water for 8 hours at initial temperature of (23 ± 2)°C by immersion of the samples, render facing downwards, in a water bath, by the method described in 2.2.5.1, Capillarity test,
- Freezing to (- 20 ± 2)°C (fall for 5 hours at the sample surface and for 2 hours in the conditioned air) for respectively 11 and 14 hours (total of 16 hours).

If the test is interrupted, because the samples are handled manually and there are stops during the weekends or holidays, the samples shall always be maintained immersed in water between the cycles.
Remark: The specified temperatures are measured at the surface of the samples. The temperature is obtained by conditioned air.

Assessment:
For the assessment of the freeze-thaw behaviour either for the reinforced base coat and the rendering system, the following defects shall neither occur during, nor at the end, the test programme:
- blistering or peeling of any finishing coat/base coat/rendering system
- failure or cracking associated with joints between thermal insulation product boards or profiles fitted with ETICS
- detachment of the finishing coat/base coat/rendering system
- width of cracks bigger than 0,2 mm allowing water penetration to the insulating layer
- The assessment of the freeze-thaw behaviour is carried out as follows: *a*t the end of the test, observations relating to a change in characteristics of the surface or to the behaviour of the entire ETICS shall be stated in ETA.

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

In ETA shall be stated:
The ETICS is freeze-thaw resistant if the water absorption of both reinforced base coat and the rendering system are less than 0,5 kg/m^2 after 24 hours (see 2.2.5.1)
or
the ETICS is freeze-thaw resistant, because none of the following defects occurred during the testing on both reinforced base coat and the rendering system:
- blistering or peeling of any finishing coat/base coat/rendering system
- failure or cracking associated with joints between thermal insulation product boards or profiles fitted with ETICS
- detachment of the finishing coat/base coat/rendering system
- width of cracks bigger than 0,2 mm allowing water penetration to the thermal insulating layer

The ETICS is so assessed resistant to freeze-thaw cycles, it means ETICS passed the test without defects.

After the test:
After the test, a bond strength test shall be performed according to 2.2.11.1 and 2.2.20.2 on each sample submitted to freeze-thaw cycles. The results of bond strength shall be in line with 2.2.11.1 and 2.2.20.2 and are reported in ETA.

2.2.8 Impact resistance

The hard body impact resistance is assessed on the ETICS with each rendering system.
In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted. It means that the impact resistance of ETICS is the impact resistance of the base coat.

The hard body impact test shall be performed on the rig after the heat-rain and the heat-cold cycles. For example when the rig is composed from tested ETICS of four rendering system configurations, the hard body impact test shall be performed on four rendering system configurations.
The hard body impact tests shall be performed as described in EN ISO 7892. The points of impact are selected taking into account various modes of behaviour of walls and their cladding, varying according to whether the impact point is or is not located in an area of greater rigidity (reinforcement).
Hard body impacts (10 Joules) are carried out on 5 samples with the steel ball weighing 1.0 kg and from a height of 1.02 m.
Hard body impacts (3 Joules) are carried out on 5 samples with the steel ball weighing 0.5 kg and from a height of 0.61 m.

For finishing coats not tested on the rig or for complementary tests (double meshes, etc), these tests can also be carried out on samples aged by immersion in water for 6 to 8 days and then dried for at least 7 days at (23 ± 2)°C and (50 ± 5)% RH.

Within a type of finishing coat, the test shall be carried out with at least the thinnest layer (generally the lowest particle size grading with ribbed finishing aspect).
Within a type of glass fibre mesh, the test shall be carried out with the lowest tensile strength after ageing of the glass fibre mesh (see 2.2.21).

In case of possible optional use of key coat and/or decorative coat, at least the configurations without them shall be tested.

The diameter of the impact is measured and the result shall be indicated in ETA.
The presence of any micro cracks or cracks, at the impact point and at the circumference, shall be indicated in ETA too.

According to observations ETICS correspond to categories of impact resistance I, II, III in accordance with Table 3.
The categories of impact resistance are given in Table 2 with examples of possible uses corresponding to degrees of exposure.

Table 2 – Categories of impact resistance and examples of use

Impact resistance category	Descriptions of possible uses
I.	A zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use.
II.	A zone liable to impacts from thrown or kicked objects, but in public locations where the height of the ETICS will limit the size of the impact; or at lower levels where access to the buildings primarily to those with some incentive to exercise care.
III.	A zone not likely to be damaged by normal impacts caused by people or by thrown or kicked objects.

Table 3 – Specification of impact resistance categories

Impact energy	Impact resistance category		
	III	II	I
10 J	-	Rendering not penetrated**	No deterioration*
	and	and	and
3 J	Rendering not penetrated**	No deterioration*	No deterioration*

* Superficial damages, provided there is no cracking is considered as showing “no deterioration” for all the impacts
** The test result is assessed as being “penetrated” if circular cracking penetrating as far as the thermal insulation product is observed for at least 3 of the 5 impacts.

In ETA shall be stated:
- Level by means of Category I, II or III (evaluated according to Table 2 and 3) for rendering systems of ETICS with information if testing has been done on rig or out of rig on small samples.

2.2.9 Water vapour permeability

The characteristic is represented by equivalent air thickness of the rendering system and by resistance to water vapour diffusion of the thermal insulation product

2.2.9.1 Water vapour permeability of the rendering system (equivalent air thickness s_d)

The water vapour permeability takes place as follows: the test shall be performed on the configuration of rendering system proposed by the manufacturer of the ETICS, i.e. the reinforced base coat covered with each type of finishing coat and (associating or not) key coat and/or decorative coat. If the application of the key coat and/or the decorative coat is optional, configurations with and without shall be tested.
In case where no more layers are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing coat prescribed in test procedures shall be omitted. It means that the water vapour permeability of the rendering system is the water vapour permeability of the base coat.
Within a type, the test shall be carried out with the thickest continuous layer (generally higher particles size grading with floated finishing aspect).
The samples are prepared by applying the rendering to the thermal insulation product in accordance with the manufacturer ´s instructions and conditioned for at least 28 days at (23 ± 2)°C and (50 ± 5)% RH. Five test samples of at least 5000 mm^2 are then obtained by separating the rendering system from the thermal insulation product.
The test is carried out on the rendering system in accordance with EN ISO 7783 on 5 samples. The test shall be carried out in an enclosure at (23 ± 2)°C and (50 ± 5)% RH. The dish contains a saturated solution of ammonium dihydrogen phosphate ($NH_4H_2PO_4$). The results are expressed in metres (of air) and the resistance to water vapour diffusion is determined as the mean value and rounded to 1/10 m (one decimal).

The assessment of water vapour permeability takes place as follows:
The mean value of the resistance to water vapour diffusion rounded to 1/10 m shall be stated in the ETA, with precision on the corresponding tested rendering system(s) and thickness of rendering system, in order to enable the designer to evaluate the risk of interstitial condensation. The value (s_d) is expressed in m.

In order to fulfil function of ETICS the test results of the resistance to water vapour diffusion of the rendering systems shall not exceed

- 2.0 metres if the combination involves a cellular plastic thermal insulation product and other thermal insulation materials
- 1.0 metre if the combination involves a mineral wool thermal insulation product.

2.2.9.2 Water vapour permeability of thermal insulation product (water-vapour resistance factor)

Only if no related values accompany the CE marking and Declaration of performance of the thermal insulation product, the test shall be performed in accordance with EN 12086.
Assessment:
The μ-value (water-vapour resistance factor) of thermal insulation product accompanying the tested thickness of thermal insulation product) shall be stated in the ETA.

2.2.10 Safety in use

Whichever type of fixing is used, the bond strength between the base coat and thermal insulation product shall be tested according to 2.2.11.1, the bond strength between adhesive (mortar or paste) and substrate shall be tested according to 2.2.11.2, the bond strength between adhesive (mortar or paste) and thermal insulation product shall be tested according to 2.2.11.3, the bond strength of foam adhesives according to 2.2.11.4. Furthermore, depending on the fixing type, the stability of the ETICS on the substrate is assessed according to the tests specified in Table 4.
For mechanically fixed ETICS, the characteristic pull-out resistance of an anchor is stated in the ETA of the anchor or that determined according to EAD 330196-01-0604 (Plastic anchors made of virgin or non-virgin material for fixing of external thermal insulation composite systems with rendering).

Table 4: Tests for assessment the safety in use

		Fixing type			
		Purely bonded or bonded ETICS with supplementary mechanical fixings [1]	Mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS [2), 5)]		
			Anchors fixed through the reinforcement	Anchors fixed through the thermal insulation product only	Profiles
Thermal insulation product type	Cellular plastic Cellular glass or Mineral wool	Bond strength between base coat and thermal insulation product according to 2.2.11.1			
		Bond strength 2.2.11.2 and 2.2.11.3 or 2.2.11.4	Static foam block test 2.2.13.2 and Displacement test[4)] 2.2.12.1	Pull-through test 2.2.13.1 and/or[3)] Static foam block test 2.2.13.2 and Displacement test[4)] 2.2.12.1	Static foam block test 2.2.13.2 and Displacement test[4)] 2.2.12.1
	Wood wool, expanded cork, natural cork, wood fibre, vegetable and animal fibres, mineral materials and other	Bond strength between base coat and thermal insulation product according to 2.2.11.1			
		Bond strength 2.2.11.2 and 2.2.11.3 or 2.2.11.4 and Dynamic wind uplift test 2.2.13.3	Dynamic wind uplift test 2.2.13.3 and Displacement test[4)] 2.2.12.1	Dynamic wind uplift test 2.2.13.3 and Displacement test[4)] 2.2.12.1	Dynamic wind uplift test 2.2.13.3 and Displacement test[4)] 2.2.12.1

1) The tests on bonded ETICS with supplementary mechanical fixing devices shall be conducted without the fixings.

2) The tests on mechanically fixed ETICS with supplementary adhesive shall be conducted without the adhesive. If the bonded area is less than 20 %, the ETICS is considered to be purely mechanically fixed.

3) Decision on which test to perform is based on Figure 5.

4) For ETICS not fulfilling the criteria in 2.2.12.

5) If the mechanical fixing is intended to transfer shear load of the ETICS, supplementary adhesives shall not be tested according to 2.2.11.2 and 2.2.11.3 or 2.2.11.4

The methods introduced in 2.2.11.2 and 2.2.11.3 shall be used for the assessment of mortar- or paste adhesives. Foam adhesives shall be tested according to 2.2.11.4.

2.2.11 Bond strength

2.2.11.1 Bond strength between the base coat (mortar- or paste) and the thermal insulation product

The assessment of the bond strength between the base coat (mortar- or paste) and the thermal insulation product shall be done on each combination with each insulation material.

The following tests are used for the assessment of the bond strength between the base coat (mortar- or paste) and thermal insulation product:

- on a panel of the thermal insulation product faced with the base coat applied in accordance with the ETICS manufacturer's instructions and dried for at least 28 days under the same conditions as the rig;
- on samples taken from the rig after hygrothermal cycles (heat-rain and heat-cold cycles) or on separated samples placed in the climatic chamber (only if the lower part of the rig does not only consist of the reinforced base coat alone, i.e. without any finishing coat), the test being always performed after at least 7 days drying;
- if freeze-thaw cycles are necessary, on the samples of the reinforced base coat alone after the freeze-thaw cycles and dried for at least 7 days after the end of the cycles.

Five squares with appropriate sample size are cut through the base coat according to Figure 2 using an angle grinder. The dimensions shall be the same as the samples for testing the tensile strength perpendicular to the faces according to the respective technical specification of the thermal insulation product. If technical specification for thermal insulation product does not define the size of samples, the dimension of samples shall be 200 mm x 200 mm. Square metal plates of appropriate size are affixed to these areas with a suitable adhesive.
The pull-off test is performed at a tensioning speed of 10 ± 1 mm/minute.
The mean failure resistance is based on the results of five tests.
The individual and mean values are recorded and the results are expressed in kPa.
Pictures with failures from each test result have to be introduced in test report.

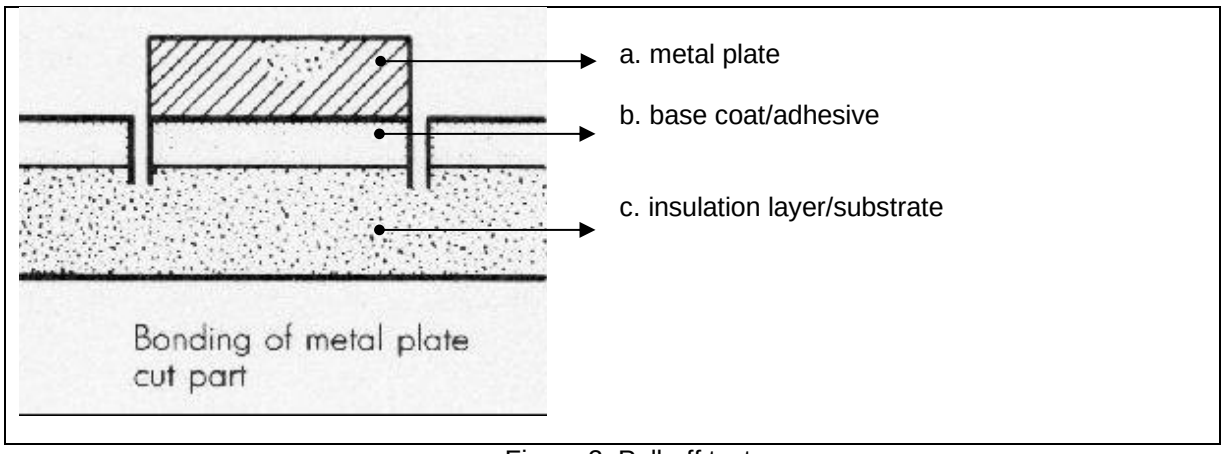


Figure 2: Pull-off test

Assessment of test results:
All the test results of the bond strength between the base coat and the thermal insulation product after each conditioning have positive results when fulfil the following provisions:

- to be at least equal to 80 kPa with cohesive or adhesive rupture. One single value lower than 80 kPa but higher than 60 kPa is admissible,

or

- the rupture occurs in the thermal insulation product (cohesive rupture) if the failure resistance is lower than 80 kPa.

In ETA shall be stated

- the minimum and mean value in kPa of the bond strength between the base coat and the thermal insulation product at the initial state drying for at least 28 days under the same conditions as the rig and the rupture type,
- the minimum and the mean value in kPa of the bond strength between the base coat and the insulation product on samples taken from the rig after hygrothermal cycles and the rupture type,
- the minimum and mean value in kPa of the bond strength between the base coat and the thermal insulation product and the type of rupture after freeze-thaw cycles if necessary.

2.2.11.2 Bond strength between the adhesive (mortar or paste) and the substrate

The tests are performed with each adhesive defined in the ETICS.
The tests are performed on the following substrate:

- A substrate consisting of a smooth concrete slab at least 40 mm thick.
  The water/cement ratio shall be of the order of 0,45 to 0,48. The tensile strength of the slab shall be at least 1.5 MPa. The moisture content of the slab prior to the test shall be a maximum of 3 % of the total mass.

Additionally:
- For cement-free adhesive the most absorbent substrate of those specified by the manufacturer of ETICS.

The adhesive is spread on the substrate. Normally, the thickness is from 3 to 5 mm, unless another value is agreed between the manufacturer of the ETICS and the Assessment Body. After allowing the adhesive to cure at (23 ± 2)°C and (50 ± 5) % RH for at least 28 days, 15 squares 15 to 25 cm^2 in area are cut through the adhesive according to Figure 2. Metal plates of appropriate size are bonded to the squares using a suitable adhesive.
The pull-off test is performed at a tensioning speed of 10 ± 1 mm/minute on the following samples (5 samples each):
- without supplementary conditioning (dry condition),
- after immersion of the adhesive in water for 2 days and 2 h drying at (23 ± 2)°C and (50 ± 5) %RH
- after immersion of the adhesive in water for 2 days and at least 7 days drying at (23 ± 2)°C and (50 ± 5) %RH.

The mean failure resistance is based on the results of five tests.

Assessment of the test results:
All the test results of the bond strength between the adhesive and the substrate after each conditioning have to be at least equal to the values indicated in the Table 5.

Table 5 – Requirements for the values of failure resistance

Mode of failure	The minimum failure resistance values after each conditioning in kPa		
	Dry condition	After effect of water	
		At 2 hours after removing the samples from the water	At 7 days after removing the samples from the water
Any	250**	80*	250**
* One single value lower than 80 kPa but higher than 60 kPa is admissible. ** One single value lower than 250 kPa but higher than 200 kPa is admissible.			

In ETA shall be stated:
- The tested thickness of adhesive
- the minimum value without supplementary conditioning (dry condition) expressed in kPa and the rupture type,
- the mean value and the minimum value after immersion of the adhesive in water for 2 days and 2 h drying at (23 ± 2)°C and (50 ± 5)% RH expressed in kPa and the rupture type,
- the mean value and the minimum value after immersion of the adhesive in water for 2 days and at least 7 days drying at (23 ± 2)°C and (50 ± 5)% RH expressed in kPa and the rupture type.

The bonded surface area S is calculated according to 2.2.11.3.1.

2.2.11.3 Bond strength between the adhesive (mortar or paste) and the thermal insulation product

The test shall be carried out for bonded ETICS only.

The test is performed on all intended combination of thermal insulation products and adhesives specified for the ETICS by the manufacturer of the ETICS.

The adhesive is spread on the thermal insulation product. Normally, the thickness is 3 to 5 mm, unless another value is agreed between the manufacturer of the ETICS and the Assessment Body. After allowing the adhesive to cure at (23 ± 2)°C and (50 ± 5) % RH at least 28 days, 15 squares, with appropriate sample size are cut through the adhesive according to Fig. 2 using an angle grinder. The dimensions shall be the same as the samples for testing the tensile strength perpendicular to the faces according to the respective

technical specification of the thermal insulation product. If technical specification for thermal insulation product does not define the size of samples, the dimension of samples shall be 200 mm x 200 mm. Square metal plates of appropriate size are affixed to these areas with a suitable adhesive.

The pull-off test is performed with the same conditions as described in 2.2.3.2 (5 samples each):
- without supplementary conditioning (dry condition),
- after immersion of the adhesive in water for 2 days and 2 h drying at (23 ± 2)°C and (50 ± 5)% RH,
- after immersion of the adhesive in water for 2 days and at least 7 days drying at (23 ± 2)°C and (50 ± 5)% RH.

Assessment of test results:
All the test results of the bond strength between the adhesive and the thermal insulation product after each conditioning have to be at least equal to the values with adhesive or cohesive rupture indicated in the Table 6.

Table 6 – Requirements for the values of failure resistance

Mode of failure	The minimum failure resistance values after each conditioning in kPa		
	Dry condition	After effect of water	
		At 2 hours after removing the samples from the water	At 7 days after removing the samples from the water
Adhesive rupture Cohesive rupture in adhesive	80*	30	80*
Cohesive rupture in insulation	30**	no requirement	no requirement
* One single value lower than 80 kPa but higher than 60 kPa is admissible. ** In order to comply with the minimal admissible bonded surface requirement as described in 2.2.11.3.1.			

In ETA shall be stated:
- The tested thickness of adhesive has to be introduced.
- the minimum value in dry condition expressed in kPa and the rupture type,
- the minimum and mean value after immersion of the adhesive in water for 2 days and 2 h drying at (23 ± 2) ºC and (50 ± 5)% RH expressed in kPa and the rupture type,
- the minimum and mean value after immersion of the adhesive in water for 2 days and at least 7 days drying at (23 ± 2) ºC and (50 ± 5)% RH expressed in kPa and the rupture type.

The bonded surface area S is calculated according to 2.2.11.3.1.

2.2.11.3.1 Minimal bonded area S for bonded ETICS

The minimal bonded area S for bonded ETICS is calculated as follows:

$$S = (0{,}03 \times 100) / B \quad \text{in \%}$$

Where:
- S minimal bonded area, expressed in %
- B minimum single failure resistance of the adhesive to the thermal insulation product in dry condition for all failure modes, expressed in kPa
- 30 bond strength between adhesive and thermal insulation product in kPa corresponding to minimal requirement on bonded ETICS (see 1.2.1)

Taking this formula into account, the minimum bond strength lower than 30 kPa would lead to as bonded surface higher than 100%. Such an ETICS shall be mechanically fixed.

2.2.11.4 Bond strength of foam adhesives

The bond strength tests shall be performed according to Annex F. This Annex specifies test methods for one component PU-foams used as adhesive for ETICS based on thermal insulation defined in Annex F.

Assessment:
All the test results of the bond strength according to Annex F have to be at least equal to the values indicated in the Table 7.

Table 7 – Requirements for the values of failure resistance

Mode of failure	The minimum failure resistance in kPa
Any	80*
* One single value lower than 80 kPa but higher than 60 kPa within one series is admissible.	

Minimal bonded surface S, which shall exceed 40 %, is calculate according to 2.2.11.3.1.

In ETA the minimum and the mean value of the bond strength of the foam adhesives in kPa shall be given.

2.2.12 Fixing strength (transverse displacement test)

The purpose of the test is to assess the longitudinal displacement of the ETICS at the edges of the wall.

The displacement test is not required for ETICS fulfilling one or more of the following criteria:
- Mechanically fixed ETICS with supplementary adhesive, where the bonded area exceeds 20 %
- E x d < 50 000 N/mm (E: modulus of elasticity of the base coat without mesh; d: thickness of the base coat)
- ETICS intended only for continuous areas of rendering with a width or height less than 10 m
- minimum insulation thickness used in ETICS is more than 120 mm,
- ETICS having a base coat where after the render strip tensile test (2.2.17) at 2 % render strain value, only cracks with a width of less than or equal to 0,2 mm are observed
- ETICS using fixing devices of which the fatigue bonding strength has been verified by testing.

Preparation of samples:
The test is performed with the thinnest and the thickest thermal insulation material for given ETICS. The worst case for tested thermal insulation product is the thermal insulation product with lowest tensile strength. A reinforced concrete slab measuring 1.0 m x 2.0 m with a thickness of 100 mm is prepared with a smooth surface. When ETICS is assessed as bonded or partially bonded, a small layer of sand is placed on top of the slab to allow the thermal insulation panel to slide. Three (2 + 2/2) thermal insulating panels are applied to the concrete slab with tight butt joints as illustrated in Figure 3.
The ETICS shall be fixed with the minimum number of mechanical fixing devices according to the ETICS manufacturer's instructions.

The reinforced base coat is then applied to the thermal insulation product according to the manufacturer. The reinforcement shall protrude on all sides of the slab by about 300 mm.
The rendering shall be cured for at least 28 days at (23 ± 2)°C and (50 ± 5) % RH.
Before testing, a foam block is bonded to the cured rendering; the protruding ends of the reinforcement are then fixed to the clamping jaws over their full length.

Execution of the test:
A simulated wind suction load of 2000 Pa is applied to the ETICS via the foam block and glued plywood or other rigid panel. Simultaneously, a normal tensile load is applied to the rendering system of the ETICS via the clamped-in reinforcement. At a tensioning speed of 1 mm/min the resulting displacement of the ETICS relative to the concrete slab and the corresponding load is measured. Preferably, the concrete slab is placed on top and the ETICS is applied under the slab.

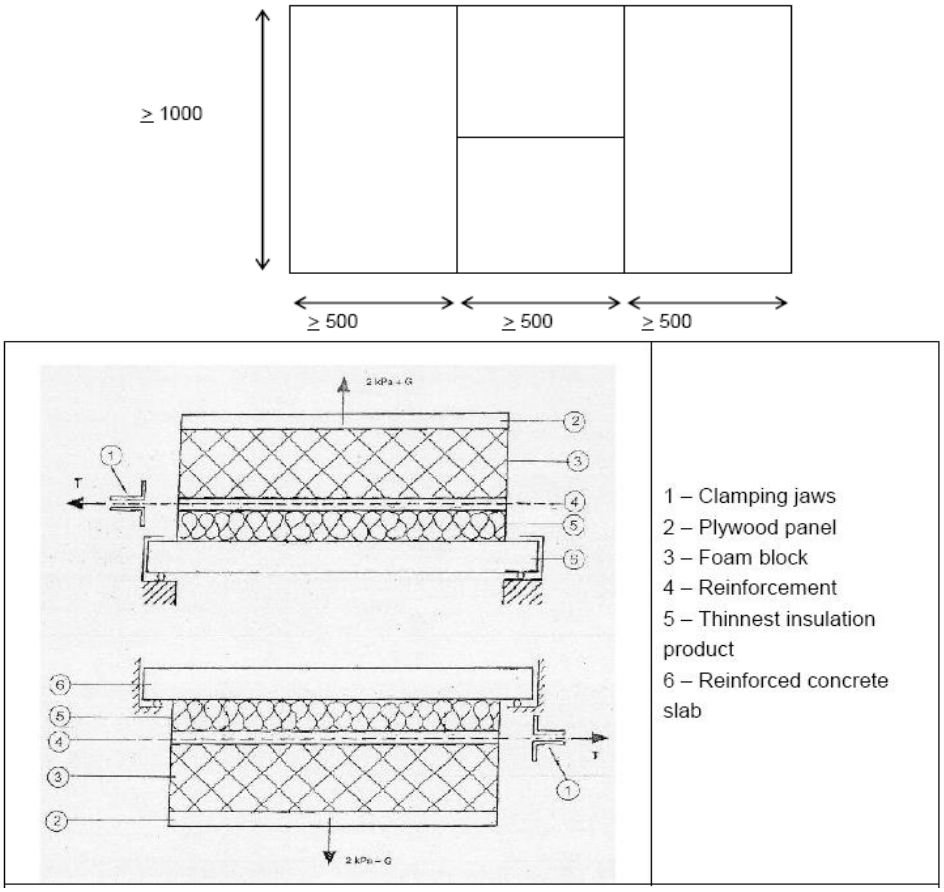


Figure 3: Dimensions in mm and principle for preparation of specimens

Assessment:
The load/displacement curve is recorded, possibly until failure occurs and the displacement U_e corresponding to the limit of elasticity is determined (see Figure 4):

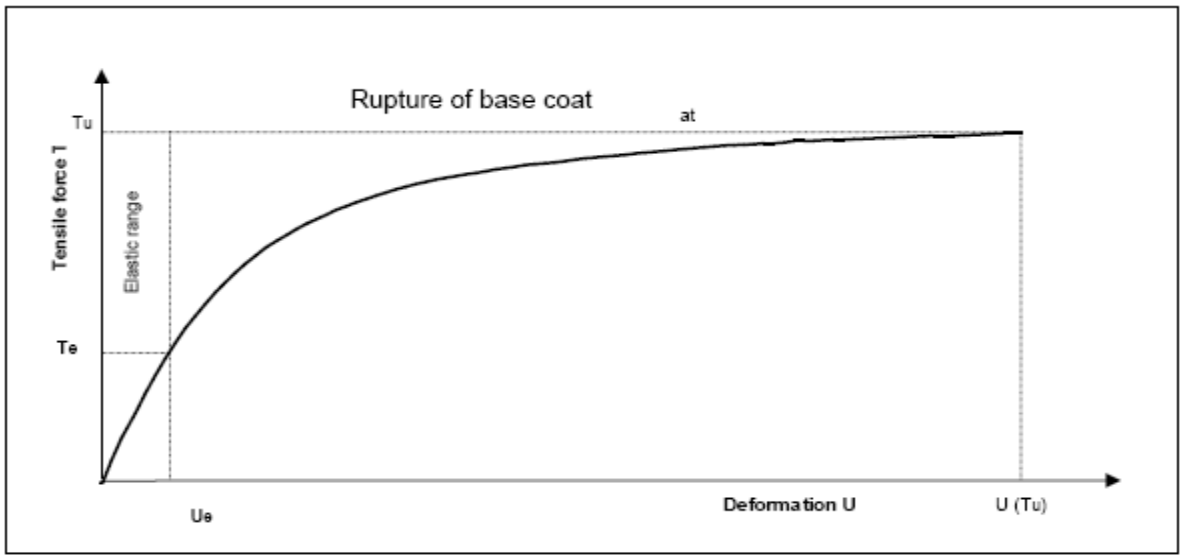


Figure 4: Load/displacement curve

The displacement U_e and equation for determining L as a function of ΔT shall be stated in the ETA. Based on these data, the length of the wall or the distance between expansion joints can be calculated using the following equation as a function of the claimed ΔT:

$$L = U_e / (\varepsilon_s + \alpha_{th} \times \Delta T) \qquad (1)$$

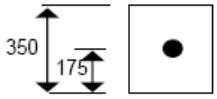
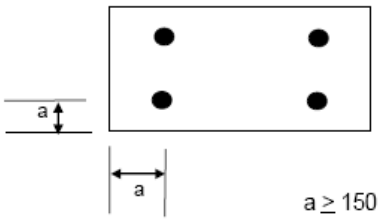
where
U_e = displacement corresponding to the elasticity limit (see load/displacement curve) in m
ε_s = shrinkage (see Annex A.6.8.2)
α_{th} = coefficient of linear thermal elongation (1 x 10^{-5}) in 1/ºC
ΔT = temperature variations in the reinforced base coat of rendering according to the manufacturer instructions in ºC.
L = length of wall or distance between expansion joints in m

The meaning of T_e in Figure 4 is:
T_e = tensile strength when occurs elasticity limit in MPa

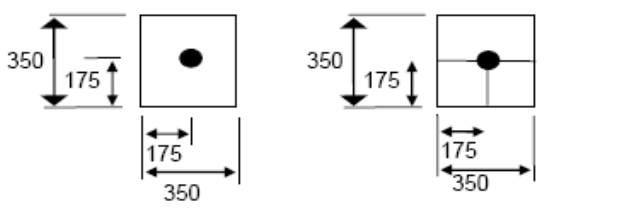
2.2.13 Wind load resistance of ETICS

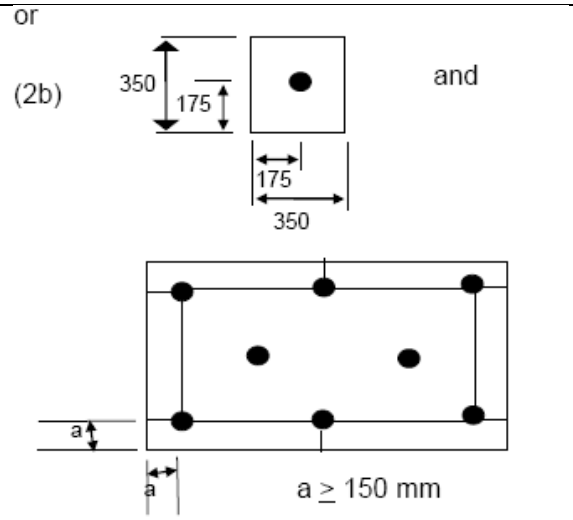
The characteristic is relevant for mechanically fixed and purely mechanically fixed ETICS.
The test samples for the pull-through test of fixings (2.2.13.1) and the static foam block test (2.2.13.2) are described in figure 5, whereas the test samples for the dynamic wind uplift test are described separately in the test description (2.2.13.3).

- (1) Pull through resistance of anchors placed at the body of the insulation product (R_{panel}).

Test samples	Test methods
(1a) 	Pull through test 2.2.13.1
or (1b) 	Static foam block test 2.2.13.2

- (2) Pull through resistance of anchors placed at the panel joint (R_{joint}).

Test samples	Test methods
(2a) 	Pull through test 2.2.13.1



	Pull through test 2.2.13.1
	Static foam block test 2.2.13.2

Figure 5: Test samples for ETICS mechanically fixed or purely mechanically fixed by anchors (dimensions in mm)

The combination of tests (scheme 2b) shall only be used if the pull-through resistance at the panel joints (R_{joint}) cannot be determined by the pull-through test due to unacceptable behaviour of the test specimens during the test.

When using the combination of tests (scheme 2b), the influence of anchors positioned at panel joints is then deduced by calculation $R_{joint} = (F - 2x\ R_{panel}) / 6$

where:

F =	maximum load by the foam block expressed as 5%-fractile
R_{panel} =	mean resistance at the body of the thermal insulation product (determined by the pull- through test)
R_{joint} =	mean resistance at the panel joint.

Assessment:

The tests are carried out at least on the thinnest thermal insulation product envisaged in ETICS to be covered by the ETA. The test is valid for the tested thermal insulation type.

In the ETA shall be stated R_{panel} and R_{joint} in kN/fixing. For further evaluation of the test, the load/displacement graph shall be recorded in the ETA.

2.2.13.1 Pull-through tests of fixings

The pull-through test of anchors is not required if the ETICS is a bonded one with anchors only used as supplementary device (see Table 4 in 2.2.11).

The test is performed in dry conditions (at (23 ± 2)°C and (50 ± 5) % RH).

However, if the tensile strength of the thermal insulation product in wet conditions tested in 2.2.14.2 is less than 80% of that tested in dry condition, the pull-through test shall be carried out in wet condition as described in 2.2.14.2 /"28 days exposure".

Insulation samples, measuring 350 mm x 350 mm, with an anchor driven through the centre of each sample (or at panel joints as described at the beginning of 2.2.13), are bonded, using a suitable adhesive, to a rigid substrate. The head of the anchor is covered previously with a self-release sheet.

When the adhesive has cured, a pulling force is exerted, at a loading rate of 20 mm/min between the rigid plate and the end of the anchor protruding through the thermal insulation product until failure.

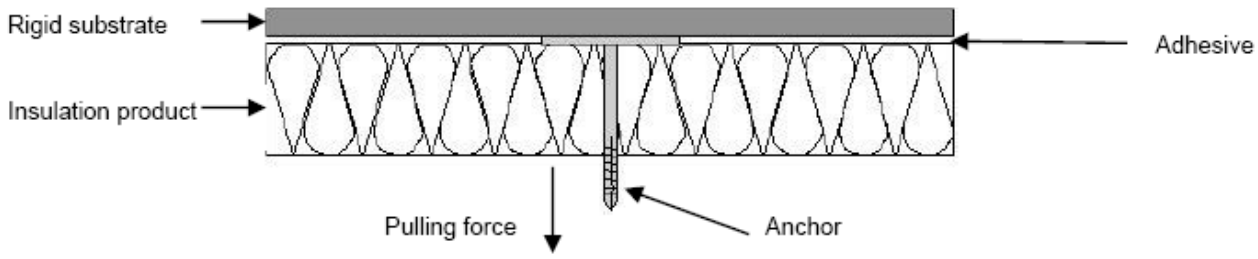


Figure 6: Pull-through test sample

5 or more tests shall be carried out.
Results are void if the rupture occurs in the edge. In such cases, the dimensions of the sample shall be increased (for example: 400 mm x 400 mm or 500 mm x 500 mm).

Assessment:
The mean and individual failure loads values R_{panel} and R_{joint} in kN/fixing of the fixings in dry conditions and, if appropriate, in wet conditions and additionally the plate diameter and plate stiffness and load resistance (according to test method described in Annex G), tensile strength perpendicular to the faces of the thermal insulation product (tested value according 2.2.14) shall be stated in ETA.

The test results are also valid for:
- thermal insulation product of the same thermal insulation type with higher thickness and/or higher tensile strength perpendicular to the faces
- anchors with the same or larger plate diameter and/or the same or higher plate stiffness/load resistance (see Annex G). In case no plate stiffness/load resistance performance are stated in the Declaration of Performance for anchors, the test of plate stiffness/load resistance are assessed according to test method described in Annex G.

2.2.13.2 Static foam block test

The static foam block test of anchors is not required if the ETICS is a bonded one with anchors only used as supplementary device (see Table 4 in 2.2.11).

The ETICS is applied on a concrete slab without any supplementary adhesive, in accordance with the ETICS manufacturer's instructions.

The dimensions shall be chosen according to the standard production size of the thermal insulation product using the minimum thickness.

For ETICS secured by anchors, test samples are prepared in accordance with the manufacturer's instructions and taking into account the influence of the anchors positioned at the panel joints as illustrated in 2.2.13 Wind load resistance.

For cellular plastic thermal insulation product, 3 or more tests (depending on the dispersion of the results) shall be carried out.

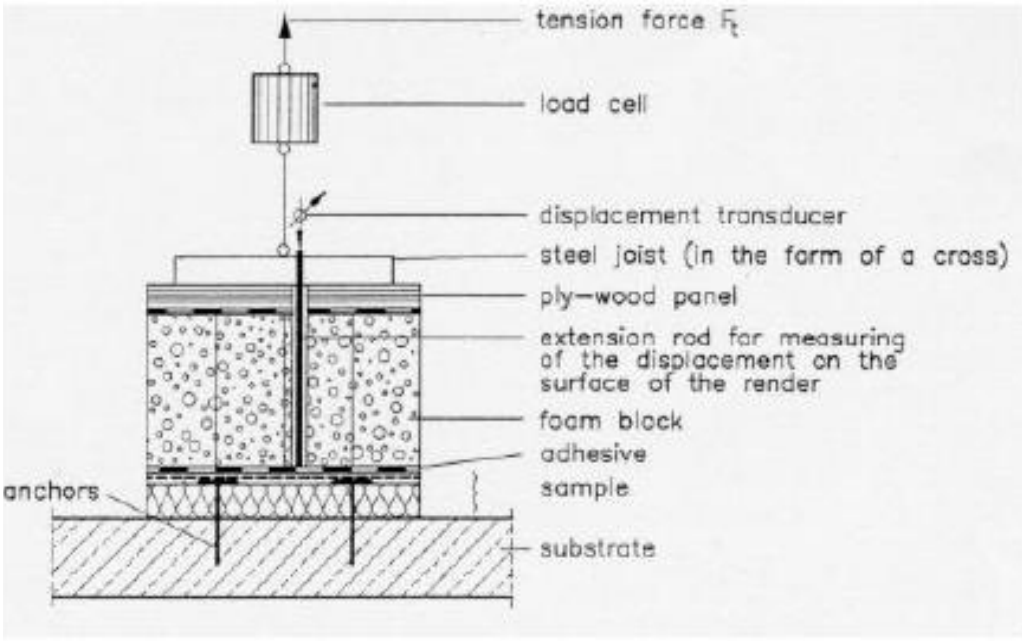
For mineral wool, wood wool, cork and other thermal insulation product, 5 or more tests (depending on the dispersion of the results) shall be carried out.

Test details are illustrated in Figure 7. The testing load F_t is generated by a hydraulic jack and transferred via a load cell to a plywood or other rigid panel. The loading speed shall be in the order of 10 ± 1 mm/minute. The joists are fixed with timber screws to a plywood panel and the timber panel is glued to the foam blocks using a two-component epoxy adhesive. As the surface of the sample is not directly accessible, the displacement of the render surface is measured via an extension rod passing through a hole in one of the foam blocks.

The foam blocks shall be weak enough to follow all displacements of the render coating without affecting the bending stiffness of the ETICS. Therefore the blocks are cut to rectangular pieces not exceeding 300 mm x 300 mm in width. The height of the blocks shall be at least 300 mm.

Comment: A suitable initial length of the block elements is 500 mm. The blocks can be cut off with a hot wire after the test is finished. They may be reused at least 20 times until the remaining length reaches about 300 mm. The tensile strength of the material shall be in the range of 80 - 150 kPa, the rupture strain shall exceed 160%. The compressive strength according to EN ISO 3386-1 or -2 shall be in the order of 1.5 – 7.0 kPa. An example of a suitable material is polyester foam.

The test is carried out to failure in dry conditions (at (23 ± 2)°C and (50 ± 5) % RH).
However, if the tensile strength of the thermal insulation product in wet conditions tested in 2.2.14.2 is less than 80% of that determined in dry conditions, this static foam block test shall be completed as follows:
For mechanically fixed or purely mechanically fixed ETICS: pull-through test carried out in wet conditions as described 2.2.14.2 /"28 days exposure".
For mechanically fixed ETICS with profiles: the static foam block test after conditioning of the thermal insulation product according to 2.2.14.2 /"28 days exposure".



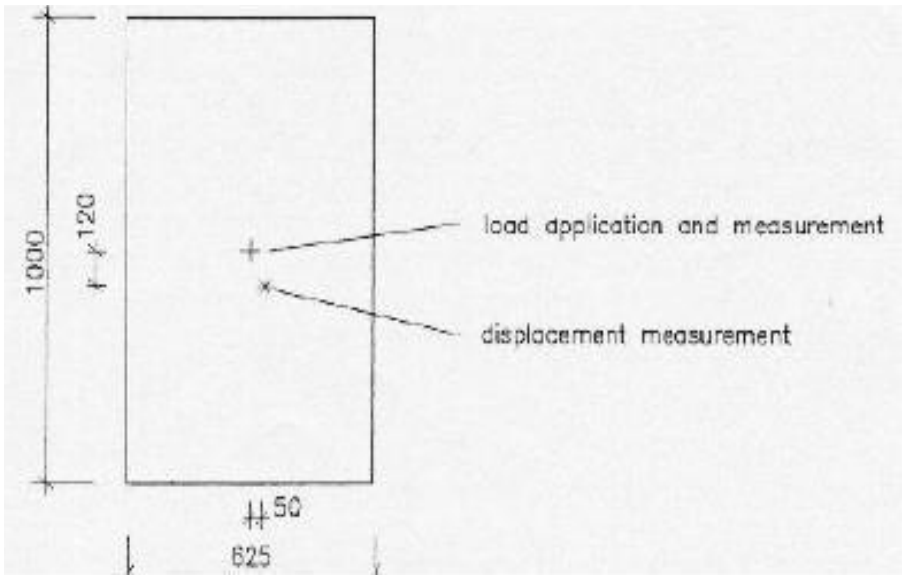


Figure 7: Test set-up according to the "foam-block-method"

Assessment:

The mean and individual failure load values R_{panel} and R_{joint} in kN/fixing of the fixings in dry conditions and, if appropriate, in wet conditions and additionally the plate diameter and plate stiffness and load resistance (according to test method described in Annex G) shall be stated in ETA.

The test results are also valid for:
- thermal insulation product of the same thermal insulation type with a higher thickness and/or a higher tensile strength perpendicular to the faces
- anchors with the same or larger plate diameter and/or the same or higher plate stiffness/load resistance (test method described in Annex G). In case no plate stiffness performance/load resistance are stated in or made for Declaration of performance for anchors, the tests of plate stiffness/load resistance are assessed according to Annex G.

2.2.13.3 Dynamic wind uplift test

Preparation of the test specimen: according to the method of attachment.

a) Mechanically fixed thermal insulation product and purely mechanically fixed thermal products:
The thinnest and thickest panels with the lowest tensile strength to be covered by the Assessment are tested.

To provide information about the resistance of the mechanical fixing devices and the bending or punching of the thermal insulation product the thinnest panel is tested with the minimum number of fixing devices in the designated pattern.

To provide information about the adhesion of the rendering to the thermal insulation product the thickest panel is tested with the maximum number of fixing devices in the designated pattern. The fixing devices of the thermal insulation product specified by the manufacturer of ETICS are tested.

The panel submitted to the test shall be of nominal dimensions.

Panels at the edge of the test box shall be secured with additional fixing devices to prevent premature failure.

b) Bonded thermal insulation product:
The test sample shall be built with the thermal insulation product thickness corresponding to the measured lowest strength according to the tensile test (2.2.14.1 Tensile strength test perpendicular to the faces in dry condition).

General
The test model comprises:
- a substrate wall made from honeycomb bricks (plastered only on the ETICS side) with a thickness greater than or equal to 250 mm with clamps for fixing to the rigid frame along the perimeter,
- the thermal insulation product secured with the specified fixing devices for the ETICS,
- the rendering.

The dimensions of the test model shall be at least 2.0 m x 2.5 m.
For a thermal insulation product fixed with profiles the minimum dimensions are:
(2a + 200 mm) x (4b + 200 mm).

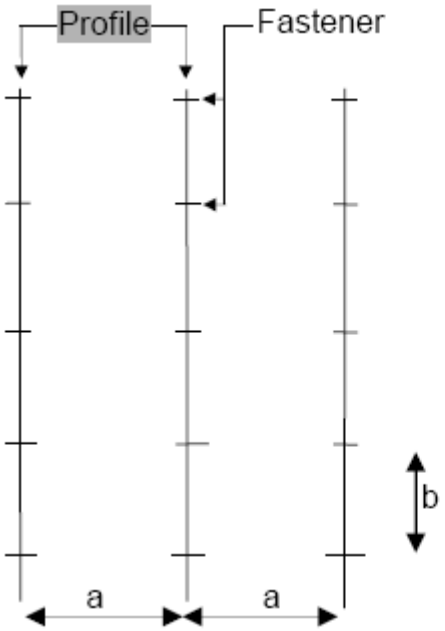


Figure 8: Dimension of specimen

Test equipment

The test equipment consists of a suction chamber which is placed over the tested ETICS. The depth of the pressure chamber shall be sufficient for a constant pressure to be exerted on the tested ETICS irrespective of its possible deformation. The pressure chamber is mounted on a rigid frame which surrounds the tested ETICS, or on the ETICS itself. The rendering system serves as the seal between the pressure chamber and the environment. The connection between the rendering system and the chamber shall be sufficient to allow a realistic deformation of the tested ETICS under the influence of simulated wind uplift.

Test procedure

The loads shown in Figure 9 are applied, each gust having the profile shown in Figure 10.
The maximum suction of each cycle is $W_{100\%}$ and is defined in the following figures and Table 8:

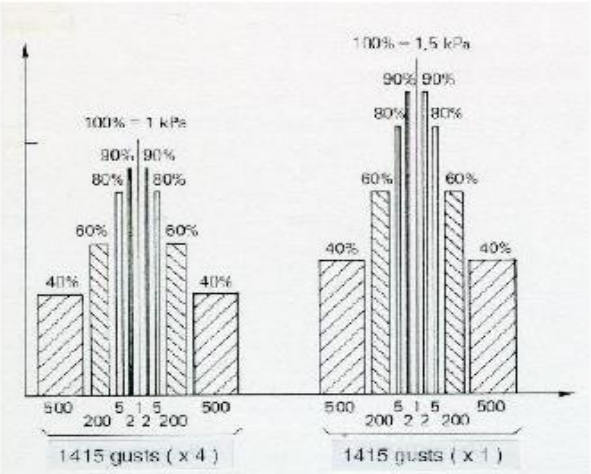


Figure 9: loads to be applied

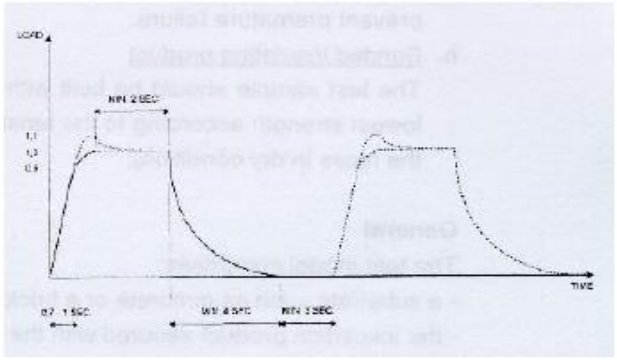


Figure 10: pressure/time profile of cyclic loads

Number of cycles	Maximum suction in kPa
4	1,0
1	1,5
1	2,0
1	2,5
1	3,0
1	3,5
1	4,0
1	etc...

Table 8 - Maximum suction of the cycles $W_{100\%}$

The sample is tested until failure:
Failure is defined by any one of the following events:
1. the thermal insulation panel(s) breaks,
2. delamination occurs in the thermal insulation product or between the thermal insulation product and its facing,
3. the rendering system detaches,
4. the thermal insulation panel is pulled off a fastener,
5. a mechanical anchor is torn out of the substrate,
6. the thermal insulation panel detaches from the supporting structure. If failure occurs between the thermal insulation panel and the substrate and the result is not satisfactory for manufacturer of ETICS, the test may be repeated with a stronger bond made between the thermal insulation panel and the substrate.

Assessment:
The test result Q_1 is the $W_{100\%}$ load in the cycle preceding that in which the test specimen fails.
The test result Q_1 is corrected on the basis of the following formula to obtain the admissible value of the characteristic resistance R_k:

$R_k = Q_1 \times Cs \times Ca$

where:
R_k = characteristic design resistance
C_a = geometric factor allowing for the difference between the deformation of the ETICS in the test and the real deformation of the ETICS on a complete wall. This factor is used in other fields for very deformable skins. In the field of ETICS Ca = 1.
C_s = statistical correction factor given in Table 9, Table 10 or below.

Bonding surface in % (S)	C_s
$50 \leq S \leq 100$	1
$20 < S < 50$	0,9

Table 9 - C_s for bonded thermal insulation product

Number of fasteners in the insulation panel	NUMBER OF PANELS IN THE TEST BOX			
	1	2	3	4
2	**	0,90	0,95	0,97
3	0,85	0,95	0,97	0,98
4	0,90	0,97	0,98	0,99

Table 10 - C_s for thermal insulation products mechanically fixed or purely mechanically fixed by anchors

** Not admissible
The test results are only valid for those fixing patterns tested.

C_s for thermal insulation products mechanically fixed with profiles
The values of C_s as a function of the dimensions of the chosen tested ETICS are given below:

For (3a + 200 mm) x (4b + 200 mm) and greater: $C_s = 0,95$
For (4a + 200 mm) x (3b + 200 mm)
and (2a + 200 mm) x (5b + 200 mm) } $C_s = 0,90$
and (2a + 200 mm) x (6b + 200 mm)
For (2a + 200 mm) x (4b + 200 mm): $C_s = 0,85$

The dimensions (2a + 200 mm) x (3b + 200 mm) are not allowed (in this case C_s will be less than 0.5).

The Q_1 value and the equation for determining the design resistance R_k shall be stated in the ETA. Additionally the tested value of tensile strength perpendicular to the face of the thermal insulation product (test result according to 2.2.14.1).

2.2.14 Tensile test perpendicular to the faces of thermal insulation product

This characteristic is relevant for performance of fixing strength and wind load resistance of ETICS and is assessed by means of testing of tensile strength perpendicular to the faces of the thermal insulation product in dry condition (see 2.2.14.1) and by means of testing of tensile strength perpendicular to the faces of the thermal insulation product in wet condition (see 2.2.14.2).

2.2.14.1 Tensile test perpendicular to the faces of thermal insulation product in dry condition.

Only if no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of Performance of the product, the assessment of tensile resistance shall be performed in accordance with EN 1607.

The dimensions shall be the same as the samples for testing the tensile strength perpendicular to the faces according to the respective technical specification of the thermal insulation product. If technical specification for thermal insulation product does not define the size of samples, the dimension of samples shall be 200 mm x 200 mm.

Test is additionally required to perform on minimal thickness of thermal insulation product stated by manufacturer to be used in testing according to 2.2.13.

Assessment:
The minimum and mean value of tensile test perpendicular to the faces of thermal insulation product in dry condition in kPa accompanying the tested thickness of thermal insulation product shall be stated in the ETA.

2.2.14.2 Tensile test perpendicular to the faces of thermal insulation product in wet condition

Only if no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of performance of the product, the assessment of tensile resistance of thermal insulation product in wet conditions shall be performed as described below.
Where the characteristics of the thermal insulation product could deteriorate by exposure to humidity, the test introduced in 2.2.14.1 shall be carried out in wet conditions.
The size of the test samples depends on the type of thermal insulation product and shall be identical to the test in dry conditions according to clause 2.2.14.1.

The test is performed as a two test series with a minimum of 8 samples exposed to heat-moisture actions at (70 ± 2)°C and (95 ± 5) % RH in a climatic chamber:
- for 7 days followed by a drying period at (23 ± 2)°C and (50 ± 5) % RH until constant mass is achieved
- for 28 days followed by a drying period at (23 ± 2)°C and (50 ± 5) % RH until constant mass is achieved.

Remark: The mass is considered constant when the mass difference between two measurements carried out at intervals of 24 hours is within 5%.

Assessment:
The tensile strength perpendicular to the face is determined after each conditioning. The mean and minimal values in kPa of each series shall be stated in the ETA.

2.2.15 Shear strength and shear modulus of elasticity test of ETICS

The characteristic of shear strength and shear modulus of elasticity of thermal insulation product is representative for shear strength and shear modulus of elasticity of the product (ETICS).

These characteristics are relevant for performance in 2.2.12 and 2.2.13.

The test is required for bonded ETICS.
Only if no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation products defined in ETICS and if no related values accompany the CE marking and Declaration of Performance of the product, the assessment of the shear strength and the shear modulus of elasticity of the thermal insulation product shall be performed in accordance with EN 12090 on a 60 mm thick sample.

The test is performed with a minimum of 5 samples exposed at (23 ± 2)°C and (50 ± 5) % RH until constant mass is achieved.

Assessment:

The minimum and mean value of shear strength in kPa and the minimum value of shear modulus in MPa shall be stated in the ETA.

2.2.16 Pull-through resistance of fixings from profiles

The assessment of pull-through resistance of fixings from profiles used as ancillary materials (base profiles, corner profiles …) is not required.
The test is carried out when ETICS is used as mechanically fixed with using profiles (see Table 4).
The pull-through resistance of a fixing (anchor) through the perforation in the profile is tested as follows: the test is carried out on 5 samples each measuring 300 mm ± 20 mm with a 6 mm perforation in the centre, obtained by drilling.
The apparatus consists of:
- a dynamometer,
- a support and metal screw as shown in Figure 11.

The samples are conditioned for at least 2 h at (23 ± 2)°C before the test.
The screw is placed perpendicular to the profile as described in Figure 11.
The tensile strength is carried out at (23 ± 2)°C.
The tensioning speed is 20 mm/min.

Assessment:

The lowest pull through resistance shall be at least equal to 500 N.
The individual and mean pull-through resistances in kN shall be stated in ETA.

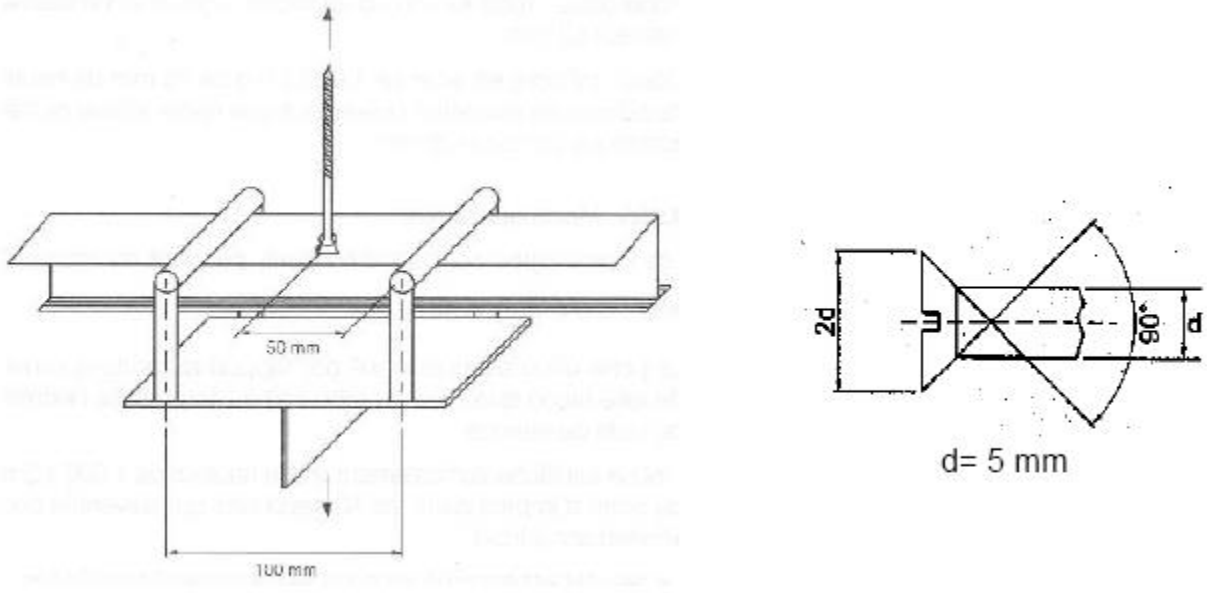


Figure 11: Profile pull-through test

2.2.17 Render strip tensile test

Purpose
The render strip tensile test of the ETICS is assessed by means of assessment of crack behaviour of the reinforced base coat by determination of the crack width distribution and the "characteristic crack width" W_{rk} at completed cracking.

Test set-up
A render strip sample has the size 600 mm x 100 mm x d_r and consists of the reinforcement and the base coat (d_r = thickness of the base coat with embedded reinforcement). The specimen is prepared on smooth substrate (for example EPS) which allows the easy detaching the specimen from the substrate after drying. The reinforcement with a length of 800 mm is arranged within the base coat according to the ETICS manufacturer's instructions. It shall protrude about 100 mm at both ends. The protruding parts of the reinforcement are placed on the rendering surfaces on which two metal plates are glued (if the reinforcement is not in the middle, two strips shall be glued to a double symmetrical specimen where the thinner parts of the strips are in the middle of the specimen).

As an alternative to bonding the specimen between two steel plates the fixing of the test sample can be done using a PVC foil (thickness 1.5 to 2 mm, Shore-A-hardness 82) and pneumatic/hydraulic clamping device (see Figure 12).

The test is performed in warp and weft direction on three render strips each. The number of threads in one direction shall be the same for all the three strips.

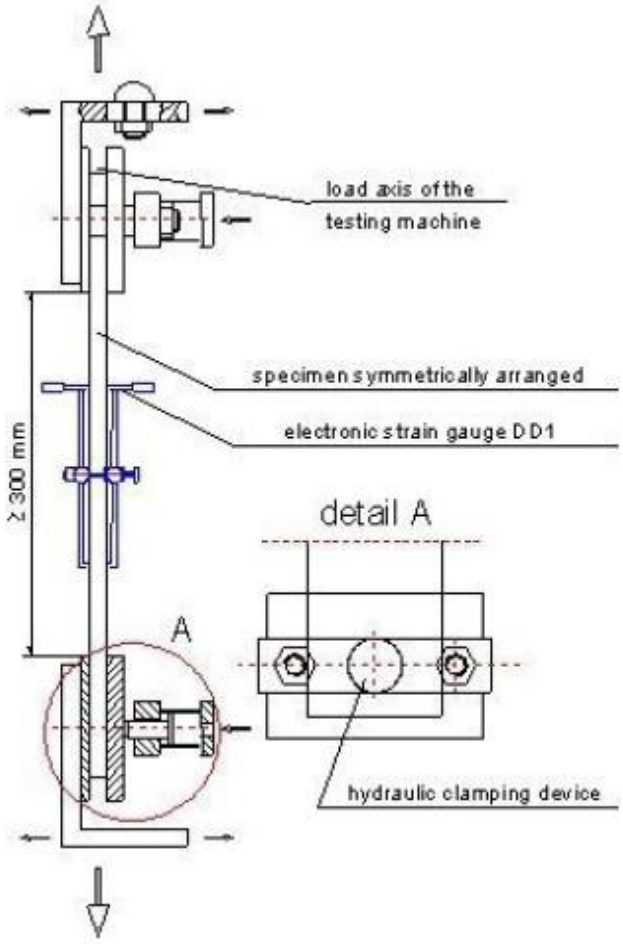


Fig. 12: Test set-up for the Render Strip Tensile Test

Execution of the test:
The tensile force is applied deformation-controlled with a rate of strain of 0.5 mm/min. The force is measured via a static uniaxial tensile testing machine (class 1). The displacements are measured by two electronic displacement gauges DD1 for ± 2.5 mm, precision class 0.1. The length of the measuring distance shall amount to at least 100 mm. The measuring points shall be arranged such that they are at least 75 mm off the outer limits of the load introducing elements. The gauge length shall be 150 mm and such that it is at least 75 mm away from the peaks of the metal plates. The two electronic displacement gauges are fixed the same way on the front and backside and/or the face sides of the specimen with the possibility of a separate analysis of the measurement results.

The render strips are loaded 10 times up to 50 % of the crack strength expected, for organic rendering systems up to a maximum of 250 N per test strip. Loading and release shall last about 1 to 2 minutes. During the 11th cycle the render strips are loaded until cracking and subsequently until failure. If no early failure occurs, the loading process is interrupted at render strain values of 0.3 %, 0.5 %, 0.8 %, 1.0 %, 1.5 %, and 2.0 %. The quantity of cracks within the metering range is counted and recorded. The crack width shall be classified with the frequency occurred in the crack developing record (see Figure 13) in categories of ≤ 0.05 mm, ≤ 0.10 mm, ≤ 0.15 mm, ≤ 0.20 mm, ≤ 0.25 mm, and > 0.25 mm. The maximum crack width W_{max} measured in each case shall be recorded with an accuracy of 1/100 mm.

It is recommended to measure the crack width with a magnifier with fiftyfold magnification; an exaggerated preciseness is not appropriate due to the irregularities of the cracks.

Sample	ε	Number of cracks on sample side A with a crack width of w[mm]								Number of cracks on sample side B with a crack width of w[mm]							
	[%]	≤ 0,05	≤ 0,10	≤ 0,15	≤ 0,20	≤ 0,25	> 0,25	max.	Σ cracks	≤ 0,05	≤ 0,10	≤ 0,15	≤ 0,20	≤ 0,25	> 0,25	max.	Σ cracks
1.0.1	0.3																
	0.5																
	0.8																
	1.0																
	1.5																
	2.0																

Fig. 13: Crack developing record for the tension test with render strip

Analysis of test results:
In the **exact procedure (I)** the related constituent equations are derived from the recorded load-strain diagram for the warp and weft direction. The render strain ε_{rk} with completed cracking can be read from that. For this state of expansion, however, at least at 0.5 % expansion the characteristic crack width w_{rk} is determined from all the test results on hand as 95 % quantile with 75% confidence level in the specified operational steps following hereinafter. In doing so intermediate values can be interpolated linearly.

- Determination of the strain ε_{rk} with "completed cracking" (constituent equations derived from the load-strain diagrams); $\varepsilon_{rk} \geq 0{,}5$ %
- Number of sample sides and measured crack widths per render tension state from the recorded crack developing record (see Figure 13).
- Determination of the mean value of the crack widths $w_{m,I}$ measured at expansion state ε_{rk} of the "completed cracking". In addition it is possibly necessary to consider the next higher and lower state and to linearly interpolate the crack widths measured.
- For the mean value w_m determined of the crack width the respective standard deviation s is determined.
- Depending on the number of tests and the confidence level of 75 % for experimental analyses on ETICS the k value for the 95 % quantile results from statistical data sheets:

n =	3	4	5	6
k =	3.15	2.68	2.46	2.34

- Calculation of the "characteristic crack width": **wrk** = wm + s ⋅ * k

In the **simplified procedure (II)** the characteristic crack width for $\varepsilon'_{rk} = 0.8$ % is determined as 95 % quantile with 75 % confidence level in the specified operational steps following hereinafter.

- Determination of the mean value of the crack width w_m at tension state $\varepsilon'_{rk} = 0.8$ %.
- For the mean value w_m determined of the crack width the respective standard deviation s is determined.
- Depending on the number of tests and the confidence level of 75 % for experimental analyses on ETICS the k value for the 95 % quantile results from statistical data sheets:

n =	3	4	5	6
k =	3.15	2.68	2.46	2.34

- Calculation of the "characteristic crack width": **wrk** = wm + s ⋅ * k

For organic rendering systems without observed crack width the elongation at rupture ε_{ru} and the respective ultimate load N_{ru} shall be determined as a mean value for each of the individual test.

Assessment:
The characteristic crack width w_{rk} in mm at completed cracking shall be given in ETA for the warp and weft direction of the rendering system (definition see clause 1.3.8) with the reference to the evaluation method applies.
For organic rendering systems without observed cracking the mean values of the elongation at rupture ε_{ru} in % and the respective ultimate load N_{ru} in kN shall be given in the ETA.

2.2.18 Shear strength and shear modulus of foam adhesive

This characteristics are assessed in case foam adhesive is part of ETICS composition.

The shear strength and shear modulus shall be determined according to Annex F.

Assessment:

The minimum and mean value of shear strength in kPa and shear modulus in MPa of foam adhesive shall be stated in ETA.

2.2.19 Post expansion behaviour of foam adhesive

This characteristic is assessed in case a foam adhesive is part of the ETICS.

The post expansion behaviour shall be determined according to Annex F.

Assessment:

The maximum and mean values in mm of post expansion behaviour of foam adhesive shall be stated in ETA.

2.2.20 Bond strength after ageing

2.2.20.1 Bond strength after ageing of finishing coat tested on the rig

The bond strength test is carried out on the rig after the hygrothermal cycles (heat-rain and heat-cold cycles) on all applied ETICS configurations and after at least 7 days drying and maximum 14 days drying.
Five squares are cut through the rendering system up to the substrate interface according to Figure 14, using an angle grinder. The dimensions shall be the same as the samples for testing the tensile strength perpendicular to the faces according to clause 2.2.14.1. Metal plates of appropriate size are bonded to it using a suitable adhesive.

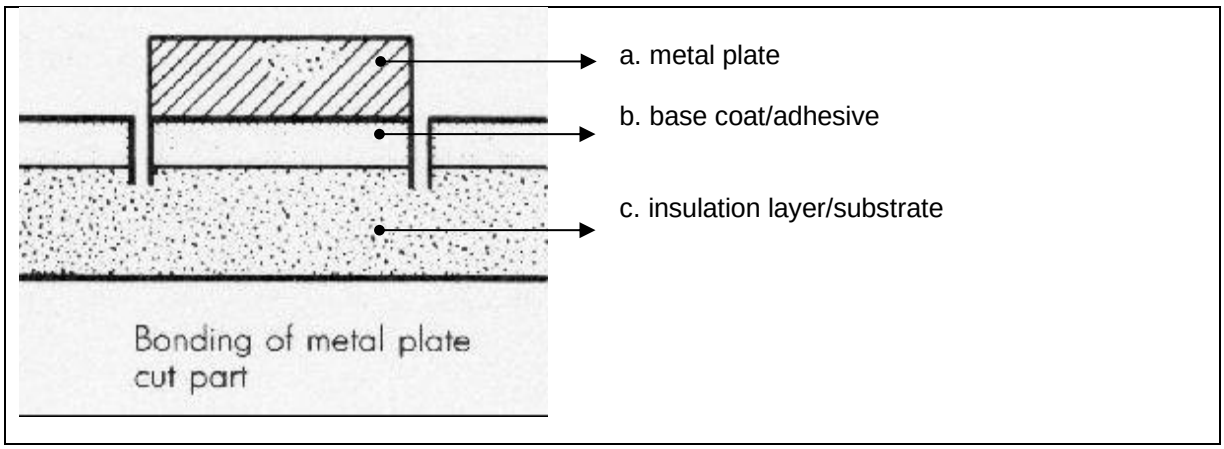


Fig. 14: Bonding of metal plate cut part

Afterwards, the failure resistance (2.2.11.1) is measured at a tensioning speed of 1 to 10 mm/minute.

Assessment:
All the test results of the bond strength between finishing coat and the thermal insulation product after each conditioning have to fulfil the following provisions:

- to be at least equal to 80 kPa with cohesive or adhesive rupture.,

or

- the rupture occurs in the thermal insulation product (100 % cohesive rupture) if the failure resistance is lower than 80 kPa.

The individual and mean values expressed in kN/m^2 with type of failure shall be stated in ETA.

2.2.20.2 Bond strength after ageing of finishing coat not tested on the rig

The test is performed additionally on small samples on other configurations which were not assessed according 2.2.20.1.
The test is performed on a thermal insulation panel faced with the rendering system applied in accordance with the ETICS manufacturer's instructions.

After allowing the samples to dry at (23 ± 2)°C and (50 ± 5) % RH for at least 28 days, five squares are cut through the rendering system up to the substrate interface according to Figure 14 using an angle grinder. The dimensions shall be the same as the samples for testing the tensile strength perpendicular to the faces according to clause 2.2.14. In case of possible optional use of a key coat and/or a decorative coat, at least the configurations without the key coat and/or the decorative coat shall be tested.
Metal plates of appropriate size are bonded to the squares using a suitable adhesive.

The test shall be performed:

- on samples aged by immersion in water for 7 days and then dried for at least 7 days at (23 ± 2)°C and (50 ± 5) % RH.

and

- if freeze-thaw cycles necessary according to 2.2.5.1: on the samples after the freeze-thaw cycles as foreseen in 2.2.7 and dried for at least 7 days and maximum 14 days after the end of the cycles.

Afterwards, the failure resistance (2.2.11.1) is measured at a tensioning speed of 10 ± 1 mm/minute.
The individual and mean values are recorded and the results expressed in kN/m^2 (kPa).

Assessment:
All the test results of the bond strength between the finishing coat and the thermal insulation product after each conditioning have to fulfil the following provisions:

- to be at least equal to 80 kPa with cohesive or adhesive rupture,

or

- the rupture occurs in the thermal insulation product (100 % cohesive rupture) if the failure resistance is lower than 80 kPa.

The individual and mean values expressed in kN/m^2 with type of failure shall be stated in ETA.

2.2.21 Mechanical and physical characteristics of the mesh

The assessment of these characteristics is relevant/representative for assessment of the impact resistance. It is assessed according to 2.2.21.1, 2.2.21.2 and 2.2.21.3.

2.2.21.1 Tensile strength and elongation of the glass fibre mesh in the as-delivered state

The characteristic shall be assessed for each type of glass fibre mesh which is the part of the ETICS in the weft and warp direction on 10 samples at least according to EAD 040016-00-0404.
If values determined according to EAD 040016-00-0404 and specified by its manufacturer in CE marking and Declaration of Performance for glass fibre mesh are available and comply with the requirements stated in 2.2.21.2, no further testing is to be performed and the mean values of the tensile strength in warp and weft directions will be taken from DoP from manufacturer of glass fibre mesh.

Assessment:

The mean value of the tensile strength expressed in N/mm and the mean value of the elongation expressed in % each in the as-delivered state of each type of glass fibre mesh in warp and weft direction shall be stated in the ETA.

2.2.21.2 Tensile strength and elongation of the glass fibre mesh after ageing

The characteristic shall be assessed for each type of glass fibre mesh which is the part of ETICS in the weft and warp directions on 10 samples at least according to EAD 040016-00-0404.
If values determined according to EAD 040016-00-0404 and specified by its manufacturer in CE marking and Declaration of Performance for glass fibre mesh are available and comply with following requirements, no further testing is to be performed.

After ageing (alkali conditioning), the mean value of residual strength of the standard mesh (see 1.3.8.1) in the weft and warp direction shall be at least:
- 50 % of the strength in the as-delivered state
- and 20 N/mm.

After ageing, the mean value of the reinforced mesh (see 1.3.8.1) in the weft and warp direction shall be at least:
- 40 % of the strength in the as-delivered state
- and 20 N/mm.

Assessment:

The mean value of the tensile strength in the as-delivered state of each type of glass fibre mesh in warp and weft direction expressed in N/mm shall be stated in ETA.

The mean value of the residual strength after ageing of each type of glass fibre mesh in warp and weft direction expressed in N/mm shall be stated in ETA.

The relative residual resistance after ageing of the strength in the as delivered state of each type of glass fibre mesh in warp and weft direction expressed in % shall be stated in ETA.

The mean value of elongation after ageing of each type of glass fibre mesh in warp and weft direction expressed in % shall be stated in ETA.

2.2.21.3 Protection against corrosion of the mesh

For galvanised steel mesh, the minimum thickness of the zinc coat required is verified using the relevant EN method.

EN ISO 1460: Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area.

EN ISO 1461: Metallic coatings - Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.

EN 10244-2: Steel wire and wire products – Non-ferrous metallic coatings on steel wire- Part 2: Zinc or zinc alloy coatings.

Metal lath or mesh reinforcement can be made of galvanised steel or austenitic stainless steel.

Assessment:

The thickness of the zinc coat and galvanizing expressed in µm shall be stated in ETA.

For galvanised mesh, the minimum thickness of the zinc coat is 20 µm ($\geq$ 275 g/m^2), and galvanising shall take place after welding the mesh.

2.2.22 Airborne sound insulation of ETICS

The airborne sound insulation of the ETICS is assessed by means of the airborne sound insulation of ETICS (see 2.2.22.1) and by means of the dynamic stiffness of the thermal insulation product (see 2.2.22.2) and by means of the air flow resistance of the thermal insulation product (see 2.2.22.3).

2.2.22.1 Airborne sound insulation of ETICS

The acoustic performance of the ETICS shall be determined on the basis of laboratory tests carried out in accordance with EN ISO 10140-1, Annex G.2 c), EN ISO 10140-2 on the relevant type of wall defined in ISO 10140-5, Annex B.
For the configuration of the ETICS to be tested, the following rules shall be taken into account:
- the thermal insulation product with a higher dynamic stiffness provides a worse performance
- the thermal insulation product with a lower air flow resistance provides a worse performance
- a higher number of fixings provides worse performance
- a higher adhesive surface coverage provides a worse performance
- a higher mass of a rendering system provides a better performance
- a greater thickness of the thermal insulation product provides a better performance
- the performance for thermal insulation product thickness between two tested ones can be linearly interpolated
- anchors with plastic screws/nails provide better performance than with metal screws/nails.

Assessment:

The direct difference of the weighted sound reduction indices of the wall with and without the ETICS, $\Delta R_{w,direct}$, $\Delta(R_w + C)_{direct}$ and $\Delta(R_w + C_{tr})_{direct}$, shall be reported as evaluated according to EN ISO 717-1 together with the description of the wall used for testing.

The tested configuration shall be stated in the ETA including the weight of the rendering system.

2.2.22.2 Dynamic stiffness of the thermal insulation product

This characteristic is assessed in order to show protection of the thermal insulation product against noise.

If no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of Performance of the product, the test shall be performed in accordance with EN ISO 9052-1 or EN 29052-1 (identical to EN ISO 9052-1) without preloading for the thinnest and thickest thickness of the foreseen thermal insulation product. The size of sample is 200 mm x 200 mm. The admissible tolerance for the surface roughness is 3 mm. The number of sample is three. It is well-known that the acoustic performance depends on dynamic stiffness. Please see clause 2.2.22.1 for example: “-the thermal insulation product with a higher dynamic stiffness provides a worse performance”.

Assessment:

The individual values of the dynamic stiffness of each type of thermal insulation product shall be stated in ETA. The value (s´) is expressed in MN/m^3 for each thickness and the tested thickness in mm shall be stated in the ETA.

2.2.22.3 Air flow resistance of the thermal insulation product

This characteristic is assessed in order to show protection of the thermal insulation product of porous insulation material against noise.

The air flow resistance shall be determined of porous insulation material (e.g. mineral wool, wood wool) only. If no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of performance of the product, the test shall be performed in accordance with EN 29053, method A for the thinnest and thickest thickness of the foreseen thermal insulation product. The number of samples is nine for type of thermal insulation. The size of samples is determined according to size of the measurement chamber of the specific device.

Assessment:

The individual values of the air flow resistance is r in $kPa \cdot s/m^2$ of each type of thermal insulation product for the thinnest and thickest thickness shall be stated in ETA.

2.2.23 Thermal resistance and thermal transmittance of ETICS

The performance of the thermal resistance of thermal insulation product according to 2.2.23.1 is representative for the assessment of the thermal resistance and the thermal transmittance of ETICS.

The additional thermal resistance provided by the ETICS (R_{ETICS}) to the substrate wall is calculated from the thermal resistance of the thermal insulation product ($R_{insulation}$), determined in accordance with 2.2.23.1, and from either the tabulated R render value of the render system (R_{render} is about 0.02 m^2K/W) or R_{render} determined by test according to EN 12667 or EN 12664 (depending on expected thermal resistance).

$$R_{ETICS} = R_{insulation} + R_{render}\ [(m^2 \cdot K)/W]$$

as described in EN ISO 10456.

The thermal bridges caused by mechanical fixing devices influence the thermal transmittance of the entire wall and shall be taken into account using the following calculation:

$$U_c = U + \Delta U\ [W/(m^2 \cdot K)]$$

With: U_c corrected thermal transmittance of the entire wall, including thermal bridges
U thermal transmittance of the entire wall, including ETICS, without thermal bridges

$$U = \frac{1}{R_{ETICS} + R_{substrate} + R_{se} + R_{si}}$$

$R_{substrate}$ thermal resistance of the substrate wall [$(m^2 \cdot K)/W$]
R_{se} external surface thermal resistance [$(m^2 \cdot K)/W$]
R_{si} internal surface thermal resistance [$(m^2 \cdot K)/W$]
ΔU correction term of the thermal transmittance for mechanical fixing devices
= χ_p * n (for anchors) + $\Sigma\psi i$ * ℓi (for profiles) (formula for U_c)
χ_p point thermal transmittance value of the anchor [W/K]. If not specified in ETA for anchors, the following values apply:
= 0.002 W/K for anchors with a plastic screw/nail, stainless steel screw/nail with the head covered by at least 15 mm plastic material, or with a minimum 15 mm air gap at the head of the screw/nail.
= 0.004 W/K for anchors with a galvanized carbon steel screw/nail with the head covered by at least 15 mm a plastic material or a minimum 15 mm air gap at the head of the screw/nail.
= 0.008 W/K for all other anchors (worst case)
n number of anchors per m^2. In case n is more than 16, the formula for U_c is not applied.
ψi linear thermal transmittance value of the profile [W/(m·K)]
ℓi length of the profile per m^2.
The influence of thermal bridges can also be calculated as described in EN ISO 10211.
It shall be calculated according to this standard if there are more than 16 anchors per m^2 foreseen. The declared χ_p -values do not apply in this case.

Assessment:

The calculated or experimentally evaluated value of thermal resistance of ETICS with minimal thickness and highest value of thermal conductivity of thermal insulation material specified by manufacturer in ETICS expressed in $(m^2 \cdot K)/W$ shall be stated in ETA.

2.2.23.1 Thermal resistance of the thermal insulation product

The characteristic is assessed according to the European standard for the relevant thermal insulation product. If no test method is defined in the appropriate harmonized technical specification (harmonized standard or European Assessment Document with accompanying ETA) for the relevant thermal insulation product and if no related values accompany the CE marking and Declaration of Performance of the product, the test shall be performed in accordance with EN 12667 or EN 12939.

Assessment:

The value of thermal resistance in $(m^2.K)/W$ of the thermal insulation product used in the ETICS shall be stated in ETA.

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 97/556/EC[5]. as amended by Decision 2001/596/EC[6].

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

For uses subject to regulations on reaction to fire the applicable AVCP systems regarding reaction to fire are 1 or 2+ depending on the conditions defined in the said Decision.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the kit in the procedure of assessment and verification of constancy of performance are laid down in Table 11a.

The actions to be undertaken by the manufacturer of the kit are laid down in Table 11b to 11e when the components are produced by the manufacturer himself and Table 11f when the components are not produced by the manufacturer himself but by his supplier under the specifications of the manufacturer.

Table 11a**:** Control plan for the manufacturer; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
1	Components produced by the manufacturer himself itself :				
	▪ Thermal insulation product	See table 11b	See table 11b	See table 11b	See table 11b
	▪ Adhesive, base coat, finishing coat, key coat, decorative coat	See table 11c	See table 11c	See table 11c	See table 11c
	▪ Reinforcement mesh	See table 11d	See table 11d	See table 11d	See table 11d
	▪ Anchors / Profiles	See table 11e	See table 11e	See table 11e	See table 11e
2	Components not produced by the manufacturer himself (*)	See table 11f	See table 11f	See table 11f	See table 11f
3	Kit	See table 11g	See table 11g	See table 11g	See table 11g
(*) Components produced by the supplier under the specifications of the manufacturer.					

5 Official Journal of the European Communities/Union L 229 of 20.08.1997, p. 14

6 Official Journal of the European Communities/Union L 209 of 2.08.2001, p. 33

Table 11b**:** Control plan when the thermal insulation product is produced by the manufacturer himself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
The kit					
Incoming materials					
1	Raw materials	Delivery ticket and/or label on the package Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component					
2	Dimensional characteristics and appearance	Acc. to relevant hEN or EN standard or specification	Acc. to the values specified in control plan	According to control plan	Acc. to Control Plan (*)
3	Density / Mass per unit	A.1			
4	Tensile strength perpendicular to the faces in dry conditions	2.2.14.1			
5	Tensile strength perpendicular to the faces in wet conditions (if relevant)	2.2.14.2			
6	Compression	Acc. to relevant hEN or EN standard or specification			
7	Shear strength and shear modulus	2.2.16			
8	Dimensional stability (not applicable for mineral wool)	Acc. to relevant hEN or EN standard or specification			
9	Thermal conductivity				At least once each 5 years
10	Heat of combustion/Q_{PCS} if relevant	A.2/EN ISO 1716			At least once each 2 years
11	Reaction to fire	Acc. to relevant hEN or EN standard or specification			
12	Propensity to continuous smouldering if relevant				
13	Water absorption				At least once each 5 years
14	Water vapour permeability				
15	Dynamic stiffness	EN 29052-1 -see product standard or specification	Acc. to the values specified in control plan	Acc. to the values specified in control plan	twice per year or acc. to relevant product standard
16	Air flow resistance	EN 29053 -see product standard or specification	Acc. to the values specified in control plan	Acc. to the values specified in control plan	twice per year or acc. to relevant product standard
(*) The frequency is determined case by case depending on the variation in the volume produced and the production process control.					

Table 11c**:** Control plan when the adhesive, base coat, finishing coat, key coat and/or decorative coat are produced by the manufacturer himself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
Adhesive, base coat, finishing coat, key coat, decorative coat					
Incoming materials					
1	Raw materials	Delivery ticket and/or label on the package Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
2	Particle size grading (7) of the adhesive	Acc. to the prescription of the manufacturer	Acc. to Control Plan	Acc. to the values specified in control plan	Acc. to the values specified in control plan
3	Bulk density of the adhevsive				
Production process					
4	Mixing process	According to the prescription of the manufacturer	According to the prescription of the manufacturer	According to the prescription of the manufacturer	According to the prescription of the manufacturer
5	Packing				
Finished component					
6	Density	A.6	Acc. to the values specified in control plan	According to control plan	Acc. to Control Plan (*)
7	Particle size grading (1) (5)	A.6.4			
8	Dry extract at 105ºC (2)	A.6.5			
9	Ash content at 450ºC	A.6.6			
10	Modulus of elasticity, tensile strength and elongation (3) (4) (5)	A.6.9			
11	Shrinkage (3) (4) (5)	A.6.9.2			
12	Viscosity (2)	Relevant EN			
13	Appearance (6)	Relevant EN			
14	Compression strength (6)	Relevant EN			
15	Dimensional stability (6)	Relevant EN			
16	Tensile strength (6)	Relevant EN			
17	Heat of combustion	EN ISO 1716			At least once each 2 years
18	Reaction to fire	Acc. to EN 13501-1 and Commission Delegated Regulation (EU) No. 2016/364, A.5 (for foam adhesives)			

(*) The frequency is determined case by case depending on the variation in the volume produced and the production process control.
(1) only for powders and pastes not for liquids
(2) only pastes and liquids
(3) on hardened mortar
(4) only for base coats without reinforcement
(5) not applicable in the case of key coat or decorative coat
(6) only for foam products
(7) only for powders

Table 11d**:** Control plan when the reinforcement mesh is produced by the manufacturer himself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
Reinforcement mesh					
Incoming materials					
1	Raw materials	Delivery ticket and/or label on the package Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component					
1	Mass per unit area (1)	A.10.2	Acc. to the values specified in control plan		At least once each 2 years
2	Ash content at 625 ºC (1)	A.10.1			
3	Mesh size and number of filaments (1)	A.10.3			
4	Mechanical resistance	2.2.21			
5	Alkali resistance (1)	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
6	Corrosion resistance (2)				
7	Heat of combustion (1)	EN ISO 1716			At least once each 2 years
(*) The frequency is determined case by case depending on the variation in the volume produced and the production process control. (1) Only for glass fibre reinforcement mesh. (2) Only for metal mesh.					

Table 11e**:** Control plan when the anchors and/or profiles are produced by the manufacturer himself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
Anchors and/or profiles					
Incoming materials					
1	Raw materials	Delivery ticket or label on the package Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component					
1	Geometry	Acc. the relevant EAD, otherwise Manufacturer's internal test or control	Acc. to the values specified by the manufacturer	According to test or control methods	Acc. to Control Plan (*)
2	Mechanical characteristics	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
3	Softening temperature (1)	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
4	Mass per unit (1)	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
5	Ash content (1)	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
6	Load resistance of anchor	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
7	Plate stiffness of anchor	Acc. the relevant EAD, otherwise Manufacturer's internal test or control			
8	Reaction to fire" (1)	EN 13501-1			At least each 5years
(*) The frequency is determined case by case depending on the variation in the volume produced and the production process control. (1) Only for PVC anchors and profiles.					

Table 11f**:** Control plan when the components are not produced by the manufacturer; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Factory production control (FPC)					
1	Components belonging to Case 1 (*)	(1)	Conformity with the order	Testing is not required	Each delivery
		(2)	Acc. to Control Plan	Testing is not required	Each delivery
2	Components belonging to Case 2 (*):	(1)	Conformity with the order	Testing is not required	Each delivery
	▪ Characteristics declared in DoP for the specific use within the kit.	(2)	Acc. to Control Plan	Testing is not required	Each delivery
	▪ Characteristics not declared in DoP for the specific use within the kit.	(3)	Acc. to Control Plan	Acc. to Control Plan	Acc. to Control Plan
3	Components belonging to Case 3 (*):	(1)	Conformity with the order	Testing is not required	Each delivery
		(3)	Acc. to Control Plan	Acc. to Control Plan	Acc. to Control Plan
(1) Checking of delivery ticket and/or label on the package. (2) Checking of technical data sheet and DoP or, when relevant: supplier certificates or supplier tests or test or control acc. to tables 11a to 11e above. (3) Checking of supplier documents and/or supplier tests and/or test or control acc. to tables 11a to 11e above" (*) Case 1: Component covered by a hEN or its own ETA for all characteristics needed for the specific use within the kit. (*) Case 2: If the component is a product covered by a hEN or its own ETA which, however, does not include all characteristics needed for the specific use within the kit or the characteristic is presented as NPD option for the component manufacturer. (*) Case 3: The component is a product not (yet) covered by a hEN or its own ETA.					

Table 11g**:** Control plan of the complete kit.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of specimens	Minimum frequency of control
Complete kit					
1	Bond strength between base coat and insulation product	2.2.11.1	2.2.11.1	According to test method	At least once a year
2	Bond strength between adhesive and substrate	2.2.11.2	2.2.11.2		
3	Bond strength between adhesive and insulation product	2.2.11.3	2.2.11.3		
4	Bond strength of foam adhesives	2.2.11.4	2.2.11.4		

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for ETICS for system 1, concerning only of performance “reaction to fire”, are laid down in Table 12.

The involvement of the notified body is required only under the conditions defined in 97/556/EC amended by 2001/596/EC – in case of reaction to fire class A1, A2, B, C of the product for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. in addition of fire retardants or a limiting of organic material) as specified in Regulation (EU) No. 2016/364 and EN 13 501-1 on the classification of the reaction to fire performance of construction products.

Table 12: Control plan for the notified body; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control *(for systems 1 and 2+)*					
1	The notified body shall verify ability of the manufacturer for a continuous and orderly manufacturing of the product. In particular, the following items shall be appropriately considered - personnel and equipment - the suitability of the factory production control established by the manufacturer - full implementation of the prescribed test plan	As defined in the control plan	As defined in the control plan	As defined in the control plan	*When starting the production, after starting a new production line or after modifications of production processes*
Continuous surveillance, assessment and evaluation of factory production control *(for systems 1 and 2+)*					
2	The notify body shall verify - the manufacturing process - the system of factory production control - the implementation of the prescribed test plan are maintained	As defined in the control plan	As defined in the control plan	As defined in the control plan	Once per year

3.4

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

Annex A establishes special test methods of components as input data for test specimen.

4 REFERENCE DOCUMENTS

EN 196-1: 2016	Methods of testing cement - Part 1: Determination of strength
EN 197-1: 2011	Cement - Part 1: Composition, specifications and conformity criteria for common cements
EN 822: 2013	Thermal insulating products for building applications - Determination of length and width
EN 823: 2013	Thermal insulating products for building applications - Determination of thickness
EN 824: 2013	Thermal insulating products for building applications - Determination of squareness
EN 825: 2013	Thermal insulating products for building applications - Determination of flatness
EN 826: 2013	Thermal insulating products for building applications - Determination of compression behaviour
EN 998-1: 2016	Specification for mortar for masonry – Part 1: Rendering and plastering mortar
EN 1602: 2013	Thermal insulating products for building applications - Determination of the apparent density
EN 1603: 2013	Thermal insulating products for building applications - Determination of dimension stability under constant normal laboratory conditions (23°C / 50% Relative Humidity).
EN 1604: 2013	Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
EN 1607: 2013	Thermal insulating products for building applications - Determination of tensile strength perpendicular to the faces
EN 1609: 2013	Thermal insulating products for building applications - Determination of short term water absorption by partial immersion
EN 12086: 2013	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN 12090: 2013	Thermal insulating products for building applications - Determination of shear behaviour
EN 12664: 2001	Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products of medium and low thermal resistance.
EN 12667: 2001	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: 2015	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 13162: 2012+A1:2015	Thermal insulation products for buildings - Factory made mineral wool (MW) products – Specification.
EN 13163: 2012+A2:2016	Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products – Specification.

EN 13164: 2012+A1:2015 Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products – Specification.

EN 13165: 2012+A2:2016 Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products – Specification.

EN 13166: 2012+A2:2016 Thermal insulation products for buildings - Factory made phenolic foam (PF) products - Specification

EN 13167: 2012+A1:2015 Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification

EN 13168: 2012+A1:2015 Thermal insulation products for buildings - Factory made wood wool (WW) products - Specification

EN 13170: 2012+A1:2015 Thermal insulation products for buildings - Factory made products of expanded cork (ICB) - Specification

EN 13171: 2012+A1:2015 Thermal insulation products for buildings - Factory made wood fibre (WF) products – Specification

EN 13238: 2010 Reaction to fire tests for building products. Conditioning procedures and general rules for selection of substrates

EN 13501-1: 2018 Fire classification of construction products and building elements: Part 1 – Classification using test data from reaction to fire tests

EN 13823: 2010+A1:2014 Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

EN 15715: 2009 Thermal insulation products – Instructions for mounting and fixing for reaction to fire testing – Factory made products

EN 16733: 2016 Reaction to fire tests for building products – Determination of a building products propensity to undergo continuous smouldering

EN 29052-1: 1992 Acoustic – Determination of dynamic stiffness – Part 1: Material used under floating floors in dwellings (idt. ISO 9052-1)

EN 29053: 1993 Acoustics - Materials for acoustical applications - Determination of airflow resistance

ISO 9053-1: 2018 Acoustics - Materials for acoustical applications - Determination of airflow resistance

EN ISO 717-1: 2013 Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

EN ISO 1460: 1994 Metallic coatings. Hot dip galvanized on ferrous materials. Gravimetric determination of the mass per unit area

EN ISO 1461: 2009 Metallic coatings. Hot dip galvanized on fabricated iron and steel articles. Specifications and test methods

EN ISO 10244-2: 2009 Steel wire and wire products. Non-ferrous metallic coatings on steel wire. Part 2: Zinc or zinc alloy coatings

EN ISO 1182: 2010 Reaction to fire tests for building products – Non combustibility test

EN ISO 1716: 2018 Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value)

EN ISO 6341: 2012 Water quality. Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea). Acute toxicity test

EN ISO 6946: 2017	Building materials and products - Thermal resistance and thermal transmittance - Calculation method
EN ISO 7783: 2011	Paints and varnishes – Determination of water-vapour transmission properties – Cup method
EN ISO 10211: 2017	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations.
EN ISO 10140-1: 2016	Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products (ISO 10140-1:2010)
EN ISO 10140-2: 2010	Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation (ISO 10140-2:2010)
EN ISO 10140-4: 2010	Acoustics - Laboratory measurement of sound insulation of building elements - Part 4: Measurement procedures and requirements (ISO 10140-4:2010)
EN ISO 10140-5: 2010	Acoustics - Laboratory measurement of sound insulation of building elements - Part 5: Requirements for test facilities and equipment (ISO 10140-5:2010)
EN ISO 10456: 2007	Building materials and products – Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN ISO 11348-1: 2008	Water quality – Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) – Part 1: Method using freshly prepared bacteria
EN ISO 11348-2: 2008/A1: 2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) – Part 2: Method using liquid-dried bacteria
EN ISO 11348-3: 2008	Water quality – Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test) – Part 2: Method using freeze-dried bacteria
EN ISO 11925-2: 2010	Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test
ISO 7892: 1988	Vertical building elements - Impact resistance tests - Impact bodies and
ISO 15799: 2019	Soil quality – Guidance on the ecotoxicological characterization of soils and soil material
EAD 040016-00-0404	Glass fibre mesh for reinforcement of cement based renderings
EAD 330196-01-0604	Plastic anchors made of virgin or non-virgin material for fixing of external thermal insulation composite systems with rendering (short form: Plastic anchors for ETICS)
EAD 040005-00-0102	Factory-made thermal and/or acoustic insulation products made of vegetable or animal fibres
EAD 040010-00-1201	Insulation product made of expanded perlite (EPB)
EAD 040012-00-1201	Thermal insulation board made of mineral material

Commission delegated regulation (EU) 2016/364 of 1 July 2015 on the classification of reaction to fire performance of construction products pursuant to Regulation (EU) No. 305/2011 of the European and of the Council

EOTA TR 034: 2015	General BWR3. Checklist for EADs/ETAs. Dangerous substances

ANNEX A – ESTABLISHING OF INPUT DATA FOR ASSESSMENT METHOD

This Annex is for testing of components where results are needed for assessment of essential characteristic for ETICS.

This annex specifies special test methods of components used for the verification of constancy of performance and, when relevant, for the description of the components.

A.1 Density of thermal insulation product

Purpose
The density of the thermal insulation product is needed in order to find the worst case for the reaction to fire testing of ETICS.
Assessment
The assessment of the density of the thermal insulation product, shall be performed in accordance with EN 1602 “Thermal insulating products for building applications. Determination of the apparent density”. Single values shall not deviate more than 15% from the apparent density.

The density range of the insulation material expressed in kg/m^3 shall be stated in the ETA.

A.2 Q_{PCS} value of thermal insulation product

Purpose
Q_{PCS} value is relevant for the classes A1 and A2 needed in order to calculate $\underline{Q_{PCS}}$ for ETICS in case of reaction to fire class A1 or A2 for ETICS.
Assessment
The assessment of Q_{PCS} value of thermal insulation product, shall be performed in accordance with EN ISO 1716.

Q_{PCS} value of insulation material is expressed in MJ/kg.

A.3 Q_{PCS} value of adhesive/base coat/glass fibre mesh/key coat/finishing coat/decorative coat

Purpose
Q_{PCS} value is relevant for the classes A1 and A2 needed in order to calculate Q_{PCS} for ETICS in case of reaction to fire class A1 or A2 for ETICS.
Assessment
The assessment of Q_{PCS} value of adhesive/base coat/glass fibre mesh/key coat/finishing coat/decorative coat, shall be performed in accordance with EN ISO 1716 and Annex B.

Q_{PCS} value of adhesive/base coat/glass fibre mesh/finishing coat/decorative coat is expressed in MJ/kg.

A.4 Ash content of adhesive/base coat/glass fibre mesh/key coat/finishing coat/decorative coat

Purpose
The ash content of the adhesive/base coat/glass fibre mesh/key coat/finishing coat/decorative coat is needed in order to find the worst case for the reaction to fire testing of ETICS.
Assessment
The assessment of the ash content of the adhesive/base coat/key coat/finishing coat/decorative coat, shall be performed in accordance with clause A.6.6.

The assessment of the ash content of the glass fibre mesh shall be performed in accordance with clause A.8.1.

The ash content of the adhesive/base coat/glass fibre mesh/finishing coat/decorative coat is expressed in %.

A.5 Reaction to fire of the PU adhesive

The assessment of reaction to fire of the PU foam adhesives shall be performed in accordance to EN ISO 11925-2 – taking into account the following parameters:

- each different composition,
- highest organic content (where relevant),
- highest thickness and
- highest coverage.

The tests shall be performed on specimens applied to an appropriate standard substrate according to EN 13238.

A.6 Input data for adhesives, base coats, key coats, finishing coats and decorative coats

A.6.1 Density of mortars - product as delivered

Pastes and liquids:
This is measured at (23 ± 2)°C in a 100 cm^3 or 1000 cm^3 cylinder.

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

Method of operation:
The results are recorded after maximum packing down on a vibrating table (manual and/or automatic) and vibration time 30 s and levelling of the surface.
The results are expressed in kg/m^3 (mean value of 3 tests).

A.6.2 Density of fresh mortars

Preparation of mortar
The mortar is prepared in the laboratory using a concrete mixer (pan type) in accordance with EN 196-1. The tests are carried out immediately after mixing unless otherwise specified by the manufacturer (possible delay time necessary prior to application).

Dry mortar
- 2 kg of powder is poured into the container and the required amount of water as specified by the manufacturer is added,
- the whisk is turned manually a few times to clear the path of the mixer,
- the material is mixed for 30 seconds at low speed,
- the walls of the container are scraped and powder gathered on the whisk is detached with a spatula, if necessary,
- the material is mixed again for 1 minute at low speed.

Paste requiring addition of cement and powder requiring addition of extra binder
- For pastes, 1 litre of paste is poured into the container and the amount of cement prescribed by the manufacturer is added.
- For powder, 2 kg of powder is poured into the container and the amount of extra binder prescribed by the manufacturer is added.
- The whisk is turned manually a few times to clear the path of the mixer,
- the material is mixed for 30 seconds at low speed,
- the walls of the container are scraped and powder gathered on the whisk is detached with a spatula, if necessary,
- the material is mixed again for 3 minutes at high speed.

Ready to use paste
Pastes have to be homogenised before use.

The apparent density is determined using a 1 litre cylindrical container, previously tared (mass M_0 in g). The container is filled with paste and after compacting down, wiped off and weighed (mass M_1 in g). The density of the paste (in $kg.m^{-3}$) is equal to $M_1 - M_0$.
The density of the paste is measured immediately after mixing.

A.6.3 Density of hardened mortar (without reinforcement)

The apparent density is determined on all the test samples by measuring mass and dimensions. The precision for weighing is 1/1000 and for the dimensions 1/100.

A.6.4 Particle size grading

Pastes:
The particle size grading is established from a sample of fillers removed from the manufactured product after washing on a sieve, mesh size 0.08 mm or after any other suitable and pertinent preparation.
The test is carried out after drying at least 105 °C.

Powders:
The particle size grading is established from a sample of fillers removed from the manufactured product.

Method of operation:
The test is performed using air streamed sieving on an about 50 g specimen for 5 minutes per sieve. The curve is traced from 0.04 (for powders) or 0.08 (for pastes) to 4 mm with at least 5 intermediate sieves.

A.6.5 Dry extract (only pastes and liquids)

Lime and polymer based products
This is determined after placing the sample in a ventilated oven set at (105 ± 5)°C until a constant mass is obtained.
The mass is regarded as constant if the difference in mass between two successive weightings, one hour apart, does not exceed 0.1 g.
Initial weighing for testing:
- 2 g for liquid products (impression, etc ...),
- 5 g for products in paste form.
The results are expressed as a percentage relative to the initial mass (mean value of 3 tests).

Silicate based products
The dry extract is determined by the following method:
A - Initial weighing of approximately 5 g (product in the as-delivered state) on an aluminium sheet, approximately 100 mm x 100 mm, 2/3 covered.
B - Pre dry for 1 hour at (125 ± 10)°C.
Dry for 2 hours at (200 ± 10)°C.
C - Final weighing.
Weighing accuracy shall be within 5 mg.
The difference in mass from the initial weighing is accounted for by volatile components including water of crystallization.
The results are expressed as a percentage relative to the initial mass (mean value of 3 tests).

A.6.6 Ash content (adhesive, base coat, key coats, finishing coats, decorative coats)

Pastes and liquids:
The ash content is determined on the same samples as those on which the dry extract has been measured.

Powders:
The ash content is determined at 450°C and 900°C on a sample of approximately 5 g pre-dried at (100 ± 5)°C or at (200 ± 5)°C for silicate based products, to constant mass. The mass is regarded as constant if the difference in mass between two successive weightings, one hour apart, does not exceed 0.1 g.
Method of operation:
- the sample is placed in a tared crucible either fitted with a lid or enclosed in a leak-tight container and the whole is weighed,
- after the lid has been removed, where necessary, the crucible is placed in the oven maintained at ambient temperature,
- the temperature of the oven is then raised to (450 ± 20)°C (ash content at 450°C) or to (900 ± 20)°C (ash content at 900°C) and maintained at that temperature for 5 hours,
- the crucible is allowed to cool down to room temperature in the desiccators before being weighed.

The results are expressed as a percentage relative to the initial mass after drying (mean value of 3 tests).
Note: The tolerances at 900°C may become larger, taking account of the products' composition.

A.6.7 Water retention capability

Water retention capability is determined for the fresh mortar, mixed as detailed in A5.2 (Preparation of mortar).
The test is performed using the apparatus described in the Standard ASTM C.91. The mortar is subjected to vacuum for 15 minutes as follows:
For the base coat and the finishing coat(s) (except coat(s) whose binder is pure polymeric), the vacuum applied is 50 mmHg (pressure difference between the exterior and the interior of the container).

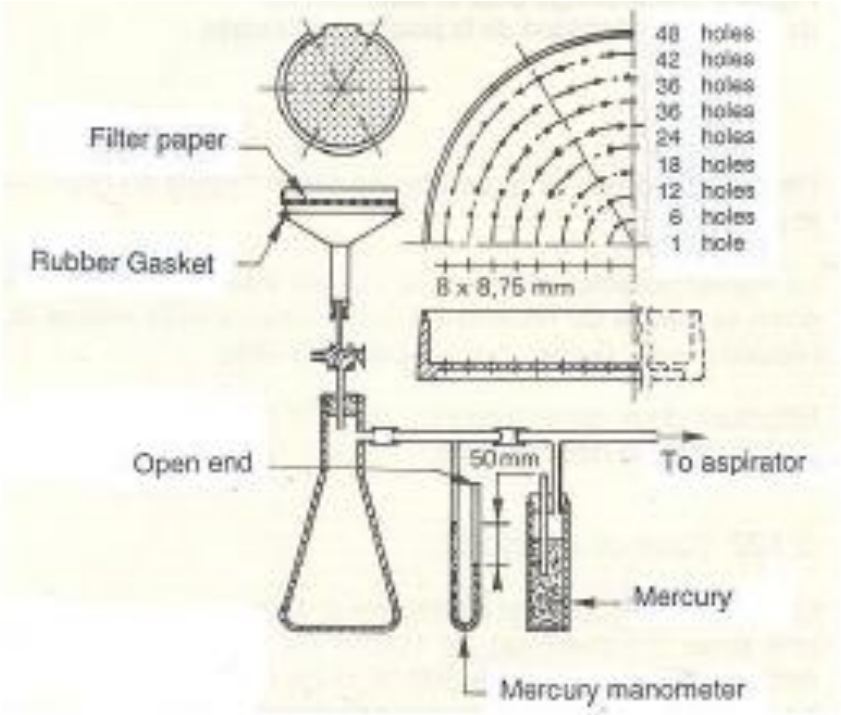


Fig. 15: Apparatus Assembly for the water retention test under 50 mmHg vacuum

For adhesives, the residual pressure is 60 mmHg (absolute pressure inside the container).

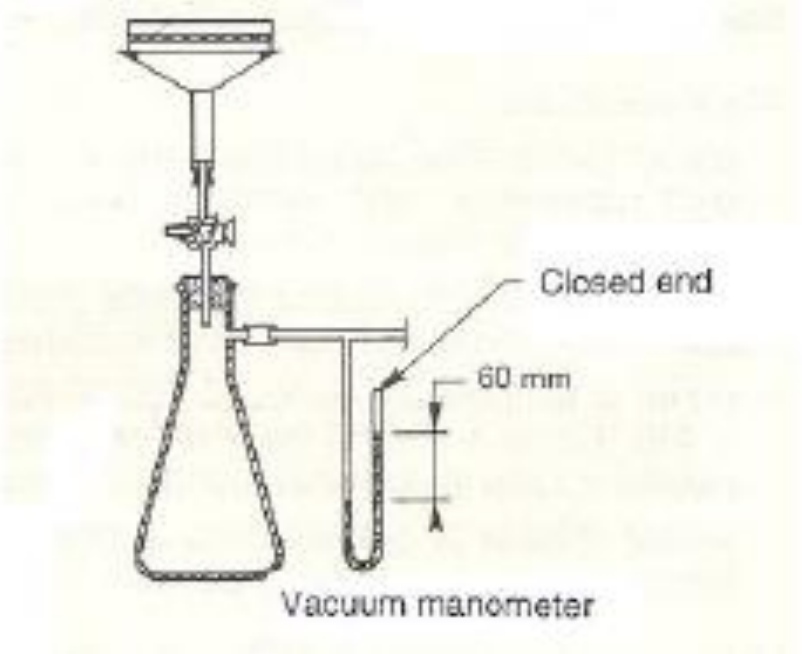


Fig. 16: Apparatus Assembly for the water retention test under 60 mmHg residual pressure

The dish is fitted with a filter paper (diameter 150 mm of 65 g/m^2), previously moistened and drained by placing on a dry filter paper, filled with paste, levelled and weighed prior to the test (as the mass of the empty dish including the moist filter paper is known, the mass of the mixed paste and the corresponding mass of the water used for mixing can be calculated in g).
These operations take place within 10 minutes of mixing. After 15 minutes (from when mixing started) the apparatus is subjected to vacuum for 15 minutes; the dish is then weighed again after wiping off the undersurface, and the loss of water (e) in g can be calculated by subtraction.
The water retention capability is expressed as a % of the initial mass of the water used for mixing (E):

$$\frac{E - e}{E} \times 100$$

A.6.8 Modulus of elasticity, tensile strength and elongation at break

A.6.8.1 Products with a thickness greater than 5 mm

Preparation and storing of test samples

The mortar is prepared by mixing as described in A.6.2.

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

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

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

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

Dynamic modulus of elasticity (Resonance frequency method)

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

The test is carried out on the following:

- 3 samples prepared as described above.
- 3 samples prepared with product taken at the time of the preparation of the rig described (see 2.2.6).

The individual values of the apparent density (in kg/m^3) and the modulus (in MPa) of the 3 test samples and the mean value of the results obtained are noted.

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

1 - Apparatus

The apparatus used for carrying out this measurement comprises:

a) A variable frequency oscillator with a frequency range of 20 kHz and a precision of 1 %.

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

c) A receiver, an electromechanical transducer and an amplifier; its mass shall be very light compared to that of the test sample.
The resonance frequencies of the vibrator and the receiver shall not fall between 0.5 kHz and 20 kHz.

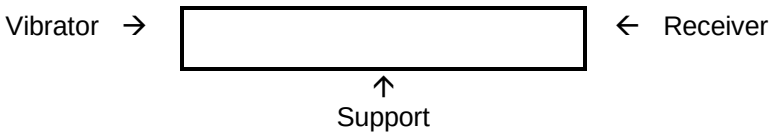
d) An amplifier.

e) An apparatus indicating the vibration amplitudes (voltmeter, milliampere-meter, oscilloscope).

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

2 - Testing

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



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

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

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

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

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

3 - Expressing the results

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

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

where:

E_d = longitudinal dynamic modulus of elasticity in MPa
L = length of test piece in meters
F = longitudinal resonance frequency in Hz
ρ = mass per unit volume in kg/m^3.

A.6.8.2 Shrinkage test

The measurement is carried out on three samples of base coat measuring 20 mm x 40 mm x 160 mm prepared and stored as described in A.6.8.1, by inserting measuring spindles in the front end (10 mm x 40 mm) of the samples. Measurements are carried out at regular intervals. The value after 28 days is recorded. In addition if there is doubt in the curve associated with stabilization, the test is continued and the value after 56 days is recorded.

A.6.8.3 Products with a thickness up to 5 mm: static modulus of elasticity, tensile strength and elongation at break

The tests are performed on test samples of the size 3 mm x 50 mm x 300 mm.

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

After the base coat, without reinforcement has dried, test samples are cut from the polystyrene with hot wire.

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

The tensioning speed is 2 mm/min.

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

A.7 Pull-out strength of the anchor

The characteristic is relevant for mechanically fixed ETICS and purely mechanically fixed ETICS only. The characteristic resistance to tension loads (pull-out from substrate) of the anchor shall be stated according to EAD 330196-01-0604 or according to another EAD used for anchors in ETICS and stated in the ETA or reference shall be made to the ETA for the anchor. The value of characteristic resistance to tension loads (pull-out from substrate) or reference to ETAs granted for anchors (ETICS components) are stated in ETA for given ETICS under description/composition of ETICS.

A.8 Glass fibre mesh

A.8.1 Ash content of glass fibre mesh

The ash content is determined at (625±20)°C on three 100 mm square samples, cut parallel to the yarn and at least 100 mm apart from the side to constant mass.

The result is expressed as a percentage relative to the initial mass.

A.8.2 Mass per unit area of reinforcement mesh

The mass per unit area is determined by measuring and weighing a one meter length of mesh. For reinforcement in roll form, the width of the sample shall be the same as the roll width.

The result is expressed in g/m².

Alternative method according to EAD 040016-00-0404 can be used.

A.8.3 Mesh size and number of filaments

The mesh size is determined by measuring the distance between 21 yarns (e.g. 20 meshes) in warp and in weft direction.

The mesh opening is calculated by subtracting the thickness of the yarn from the mesh size.

Alternative method according to EAD 040016-00-0404 can be used.

ANNEX B – REACTION TO FIRE TESTING OF ETICS WITH RENDERING

B.1 General

Principle

The determination of reaction to fire of the ETICS is based on testing of "the worst case" - the most critical configuration in the sense of reaction to fire. According to the rules described further in the text, the classification obtained on the most critical ETICS configuration is valid for all configurations having a better performance in sense of reaction to fire.

For the particular types of ETICS components the following principles apply:

- the base coat and finishing coat with the highest amount of organic content (related to the mass in dried condition as in end use application) or the highest Q_{PCS} value (according to EN ISO 1716)[7] shall be used for preparing the specimen,
- each decorative coat and key coat shall be tested unless it can be neglected according to the rules below. If there are only differences in the amount of organic content but no difference in the organic component itself, the decorative coat and the key coat with the highest organic content or the highest Q_{PCS} value (according to EN ISO 1716)[6] of this organic component shall be tested,
- the decorative coat and/or the key coat can be neglected as long as they comply with the following[8]:
  - the thickness of the decorative coat is less than 200 µm
  - and the organic content is of not more than 5% (related to the mass in dried condition as in end use application).

In addition, each coat selected for testing according to the rules above before shall have the lowest amount of flame retardants.

Product properties influencing the reaction to fire behaviour

- Type of thermal insulation product (composition, thickness, density)
- Type of base coat and finishing coats (composition, thickness, weight per unit area)
- Type of key coats and decorative coats (composition, weight per unit area)
- Type of reinforcement (composition, thickness, weight per unit area)
- Type and nature of fixings
- Type and nature of fire breaks (interruptions to the continuity of insulation or any cavity)[9]
- The organic content of the binder and of any organic additive; this can be checked by providing the formulation of the component, by performing suitable identification tests or by determining the glow loss or net calorific value.
- Type and amount of flame retardant intended to maintain or improve the reaction to fire performance of the ETICS or its components and consequently of building elements to which they are applied.
- Type and nature of substrate.

Although the rest of this annex applies the "worst case scenario" for deciding what to test, it is accepted that, where the ETA applicant produces a range of ETICS having different overall classifications, he may group these together into a number of different sub-groups (e.g. each sub-group corresponding to a different overall classification) with the 'worst case scenario' being identified for each sub-group.

Components of an ETICS, where these require separate assessment (as opposed to being tested as part of the ETICS as a whole), which are classified A1 without testing according to Decision 96/603, as amended, do not need to be tested.

B.2 Testing according to EN ISO 1182

This test method is relevant for the classes A1 and A2.

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7 If the requested information on organic content or Q_{PCS}-value of base coats and/or finishing coats are not available, the Q_{PCS}-value shall be tested to determine the worst case.

8 This rule can be reconsidered when more experience and test result are available

9 Fire breaks are important for the behaviour of the whole facade cladding system and cannot be assessed on the basis of the SBI-testing. The influence can only be observed during a large scale test. Therefore breaks are not included in the mounting and fixing rules for the SBI-test. An European fire scenario for facades has not been laid down. An additional assessment according to national provisions (e.g. on the basis of examining design solutions or a large scale test) might be necessary to comply with Member State regulations, until the existing European classification system has been completed.

Using this test method, only the 'substantial components' of the ETICS need to be tested. 'Substantial components' are defined by thickness (≥ 1 mm) and/or weight per unit area (≥ 1 kg/m²).
In the following, the thermal insulation product, the base coat and the finishing coat are identified as the most significant 'substantial components', but the adhesive, the key coat, the decorative coat and any reinforcement may also be 'substantial components'.
Parameters relevant for this test method are:
- composition
- density.

B.2.1 Thermal insulation product
For ETICS expected to be classified as A1 or A2, it is anticipated that only thermal insulation products with reaction to fire class A1 or A2 will form the insulation layer. For testing the thermal insulation product reference shall be made to the relevant product specification.

B.2.2 Render coatings
B.2.2.1 Base coats and finishing coats
Base coats and finishing coats in accordance with the provisions of EC Decision 96/603/EC (as amended) are considered to satisfy the requirements for performance Class A1 of the characteristic reaction to fire without the need for testing.
The reaction to fire behaviour of base coats and finishing coats not falling under EC Decision 96/603/EC (as amended) shall be tested according to the principle specified in § B.1 General.
The test result can be directly applied to all variants with the same base coat and finishing coat and with a lower amount of organic components. When the subject of the directly applied result contains a flame retardant, it shall be of the same type and its content must be at least that of the product tested.
Differences concerning the density shall be considered by testing the lowest and the highest density.

B.2.2.2 Key coats and decorative coats
The principles specified in clause B.1 "Principle" shall be applied.

B.2.3 Adhesive
The same rules as given in B2.2 above shall be applied. If the adhesive is identical to the tested base coat, the adhesive does not need to be tested separately.

B.2.4 Reinforcement
Each type of reinforcement that fulfils the requirements of a 'substantial component' shall be tested according to EN ISO 1182. For reinforcement that is randomly dispersed (e.g. fibres) in the render then it shall be tested as part of the render.

B.3 Testing according to EN ISO 1716

This test method is relevant for the classes A1 and A2.
This test method shall be performed to all components of the ETICS except for cases which are classified as A1 without testing, according to Decision 96/603/EC (as amended).

Parameters relevant for this test method are: composition (when performing calculation of the Q_{PCS} value, density or weight per unit area and thickness are relevant). Mechanical fixings and ancillary materials which are not continuous but discrete components of ETICS shall not to be considered for testing and for the calculation of the Q_{PCS}.

B.3.1. Thermal insulation product
For testing the thermal insulation product, reference shall be made to the relevant product specification.
It is not realistic to require that each thermal insulation product of the same type is tested within the classification of an ETICS. If the thermal insulation products come from different manufacturers and/or are of different thickness, density and formulation from those used in the testing, these may be used subject to the requirements of class A1 and A2 still being fulfilled. It shall be proved by calculation (undertaken by an Assessment Body or Notified Body) that the ETICS, together with the actual thermal insulation product (e.g. mineral wool) used in end use application, still fulfils the requirements concerning the Q_{PCS} value of the whole product. For example, it is sufficient to determine the Q_{PCS} value of the thermal insulation material (e.g. mineral wool) and if this is lower than the originally tested product then it is acceptable to use the alternative thermal insulation product (e.g. mineral wool) instead of that of used in the original test.

Note: Information relating to alternative thermal insulation products of the same type to that originally tested may be evaluated on the basis of the supplier's evidence provided within the context of its CE marking.

B.3.2. Render coating

In general, when performing calculations of the unit area referred Q_{PCS} value (related to the surface) the variant that provides the highest Q_{PCS} value shall be considered.
The test shall be performed in accordance with the principles specified in § B.1 General applied to each component of the render coating.
It is not necessary to test a finishing coat with different grain sizes if the organic content is the same as or lower than that of the tested finishing coat.
The test results can be directly applied to all variants with the same render coating but with a lower amount of organic components. When the subject of the directly applied result contains a flame retardant, it shall be of the same type and its content shall be at least that of the product tested.

B.3.3 Adhesive

For the component adhesive of the ETICS, each product with a different formulation shall be tested for reaction to fire behaviour by selecting the variant with the highest amount of organic components. The test results can be directly applied to all variants with the same composition but lower amount of organic components. For the case where one of the render coatings is used as the adhesive, the rules according to chapter B3.2 shall be applied.
If the adhesive is identical to the tested base coat, the adhesive does not need to be tested separately.

B.3.4 Reinforcement

Each type of reinforcement shall be tested according to EN ISO 1716. For reinforcement that is randomly dispersed (e.g. fibres) in the render, then it shall be tested as part of the render.

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

This test method is relevant for the classes A2, B, C and D (in some cases also for A1[10]).
In this test procedure the complete ETICS shall be tested. The ETICS is fixed to a substrate representing that on which the ETICS is fixed in the end use application (reference is made to EN 13238). The fixing shall be made using either the adhesive used in the end use application or, in the case of purely mechanical fixing, by using the means of mechanical fixing used in the end use application. When adhesives are used, the test result is valid also for mechanical fixings.
When a purely mechanical fixing with plastic anchors is used the test result is valid also for metallic anchors.
The maximum testable thickness of the test specimen, including a standard substrate according to EN 13238, is 200 mm. However, in practice, for many ETICS, the total overall thickness may be greater than 200 mm. In such cases, using a standard substrate, the thickness of the thermal insulation product must be reduced to provide for the maximum specimen thickness of 200 mm. Results obtained on an ETICS at 200 mm thickness are accepted for greater thicknesses if the thickness of insulation is provided by manufacturer.
The test specimen consists of a corner construction which shall be representative of the construction in practise. All edges are covered with the rendering system excluding the bottom edge and the top of the specimen. The floor of the test trolley beneath the test specimen can be covered by an aluminium foil. See figure B.1. It is suggested that the specimens are assembled on to an EN 13823 test trolley directly, since the completed specimens may be extremely heavy and there is the potential for cracking of the rendering system during movement. After preparation of the test specimens they shall be conditioned according to EN 13238.

Parameters which are relevant:
- amount of adhesive
- type, thickness and density of thermal insulation product
- type, binder and thickness of each coat of render coating
- amount of organic content of each coat of render coating
- amount of flame retardant of each coat of render coating
- type of reinforcement
- type and nature of substrate.

[10] In cases according to Del. Reg. (EU) 2016/364, Table 1, Footnote 2a; A1 case mentioned in EN 13501-1 does not apply to ETICS

In principle, it is desirable to find the test specimen configuration that gives the worst case concerning the reaction to fire test results. In the test procedure according to EN 13823, values for the rate of heat release, total heat release, lateral flame spread, rate of smoke release, total smoke release and burning droplets are determined. Due to the possible effects of the thermal insulation product, the following proposals are divided by considering separately the testing of ETICS with class A1 and A2 thermal insulation products and the testing of ETICS with class B, C, D and E thermal insulation products.

B.4.1 Thermal insulation product

For testing ETICS with thermal insulation products of reaction to fire class A1 or A2 the thermal insulation product with the highest (or highest testable) thickness, the highest density (tolerance ±10 %) and the highest organic content (related to the mass in dried condition) has to be used for preparing the test specimen. The reaction to fire class A1 or A2 of the thermal insulation product shall be proven separately.
For testing of ETICS with thermal insulation products with reaction to fire class B, C, D or E, each type of the thermal insulation product (PS, PU etc. plus taking into regard the reaction to fire class of the thermal insulation product) shall be tested within the system. For each type of thermal insulation product the thermal insulation product with the highest (or highest testable) thickness, the highest density (tolerance ±10 %) shall be used for preparing the test specimen.
For testing ETICS with thermal insulation products made of phenolic resin (PF) or wood fibre (WF) each thermal insulation product with the highest and lowest density shall be used for preparing the test specimens.
For testing ETICS with thermal insulation products made of expanded cork (ICB), natural cork or wood wool (WW) EN 15725 or any other animal or vegetable fibres shall be used as orientation to define all specimen configurations being relevant for testing and taking into account the intended field of application of the test results.
For testing of ETICS the following cases regarding thickness of insulation shall be considered when preparing and testing the specimens:

- the highest thickness of the thermal insulation product in cases where the adhesive has an organic content of equal to or less than 15 % (related to the mass of dried condition and in end use application) or if only mechanical fixing devices are used and
- the highest and the lowest thickness of the thermal insulation product in cases where the adhesive has an organic content of more than 15 % (related to the mass in dried condition and in end use application)

B.4.2 Render coatings

By testing one specific render coating representing a range of different coats, the following rules shall be applied to discriminate the composition, which is able to represent a range of render coatings:

- The base coat, the key coat, the finishing coat and the decorative coat to be used for preparing the specimen, taking account of the permissible combination(s) allowed by the manufacturer, shall be determined in accordance with the principles specified in A.1 General.
- For a base coat and a finishing coat having an organic content less than or equal to 5% (related to the mass in dried condition as used in the end use application), only the lowest thickness need be used for preparing the test specimen.
- For a base coat or a finishing coat having an organic content higher than 5%, both the lowest and the highest thickness of the layer of the base coat and finishing coat shall be used for preparing the test specimens.

Regardless of the organic content, only the highest thickness of a base coat and a finishing coat shall be tested on insulation material with class A1 or A2-s1, d0.

When the only difference in coatings is thickness and it is 0.5 mm or less, the coatings may be considered to be the same.

B.4.3 Adhesive

The influence of the type of adhesive having an organic content of equal or less than 15% (related to the mass in dry condition) is assumed to be negligible. Only the amount of organic content is considered important. Therefore, an adhesive with the highest amount of organic content shall be used for preparing the test specimens applied at the maximum thickness.

The influence of adhesives having an organic content of more than 15 % cannot be assumed to be negligible. Therefore, each type of adhesive with a different composition shall be tested by selecting the variant with the highest organic content.

B.4.4 Reinforcement

The specimens shall be prepared with the reinforcement that is intended to be used in end use application. If different reinforcements are intended to be used, the reinforcement with the highest Q_{PCS} value per unit area shall be used for preparing the SBI specimen. At the long wing of the SBI specimens a vertical joint of the reinforcement shall be considered at a distance of 200 mm away from the inner corner of the specimens by 100 mm overlapping of the two layers of the reinforcement (that means the joint begins at a distance of 150 mm and ends at a distance of 250 mm away from the inner corner).

B.4.5 Application of test results

The test result is valid for:

- thermal insulation products:
  - of the same type or only of the same product (cl. B.4.1),
  - with lower densities in case of thermal insulation products other than phenolic resin (PF) or wood fibre (WF)
  - with all densities between those evaluated in the tests in cases of phenolic resin (PF) or wood fibre (WF)
  - with equal or lower thickness in cases where only the highest thickness has been tested
  - with any thickness between those evaluated in cases where the highest and lowest thickness have been tested
  - with any higher thickness if 200 mm thick specimens were tested and equal and less organic content.
- base coats and finishing coats:
  - with equal or less organic content,
  - with equal or greater content of the same type of flame retardants,
  - with equal or greater thickness if the organic content is equal to or less than 5 %,
  - with thickness between those evaluated in the test, provided that the worst result of the two thicknesses tested is used for intermediate thicknesses if the organic content is higher than 5%.
- key coats:
  - with equal or less organic content,
  - with equal or greater content of the same type of flame retardants,
- decorative coats:
  - with equal or less organic content per unit area,
  - with equal or greater content of the same type of flame retardants,
- adhesives:
  - with equal or less organic content and equal or less thickness if the organic content is equal to or less than 15%,
  - of the same type, with equal or less organic content and equal or less thickness if the organic content is greater than 15%,
- reinforcements:
  - with an equal or less PCS_S-value per unit area.

B.5 Testing according to EN ISO 11925-2

This test method is relevant for the classes B, C, D and E.
In this test procedure, the ETICS is tested without a substrate. The maximum thickness of the test specimen is 60 mm. In cases where the thickness of the ETICS is larger than 60 mm, the thermal insulation product may be reduced for the purposes of testing. The results from the testing of specimens at 60 mm are applicable to greater thicknesses.

Parameters which are relevant:

- type and amount of adhesive,
- type, thickness and density of thermal insulation product
- type, binder and thickness of each coat of render coating
- amount of organic content of each coat of render coating
- amount of flame retardant of each coat of render coating
- type of reinforcement.

The specimens are prepared in such way that the edges are not covered with the rendering system (cut edges). The tests are performed with surface flaming of the front side and possibly edge flaming of the test specimen turned by 90° according to the rules of standard EN ISO 11925-2.

B.5.1 Thermal insulation product

A thermal insulation product, representative in its characterisation (type, reaction to fire classification and density) for the end use application, shall be used. The ETICS shall be evaluated incorporating the thermal insulation product at the highest possible thickness and the highest and the lowest possible densities.
For ETICS with thermal insulation products made of polystyrene or polyurethane (PUR) classified class E[11], the test results are valid only for the thermal insulation products as used in the test. ETICS manufacturer has the possibility of using thermal insulation products from different manufacturers when the following additional tests are performed and conditions are fulfilled or the manufacturer provides the necessary evidence. For thermal insulation products made of polystyrene or PU, it shall be proven separately that the product fulfils the requirements for reaction to fire class E under the following conditions. Polystyrene insulation has to be tested with the highest density and at a thickness of 10 mm for expanded polystyrene foam and at the minimum thickness produced for extruded polystyrene. The test result is valid for lower densities and higher thicknesses. PU insulation shall be tested at the density intended for the end use and at the highest thickness. The test result is valid for PU insulation with the same density and for lower thicknesses.

B.5.2 Render coatings

For testing one specific rendering system representing a range of different coatings, the rules as mentioned in B4.2 apply.

B.5.3 Adhesive

For adhesives (mortars) having an organic content of equal or lower than 15 % (related to the mass in dried condition) it can be assumed that they fulfil the requirements of the classes B within testing according to EN ISO 11925-2. Therefore, no need exists to take into account such adhesives for preparing and testing specimens of ETICS according to this standard.
For adhesives having an organic content of more than 15% (related to the mass in dried condition) it is necessary to carry out a complete set of six additional tests on specimens turned at 90 degrees on their vertical axis with edge exposure of the adhesive layer. The specimens consist of the substrate, the adhesive and the thermal insulation product. The following rules shall be applied for preparing the specimens:

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

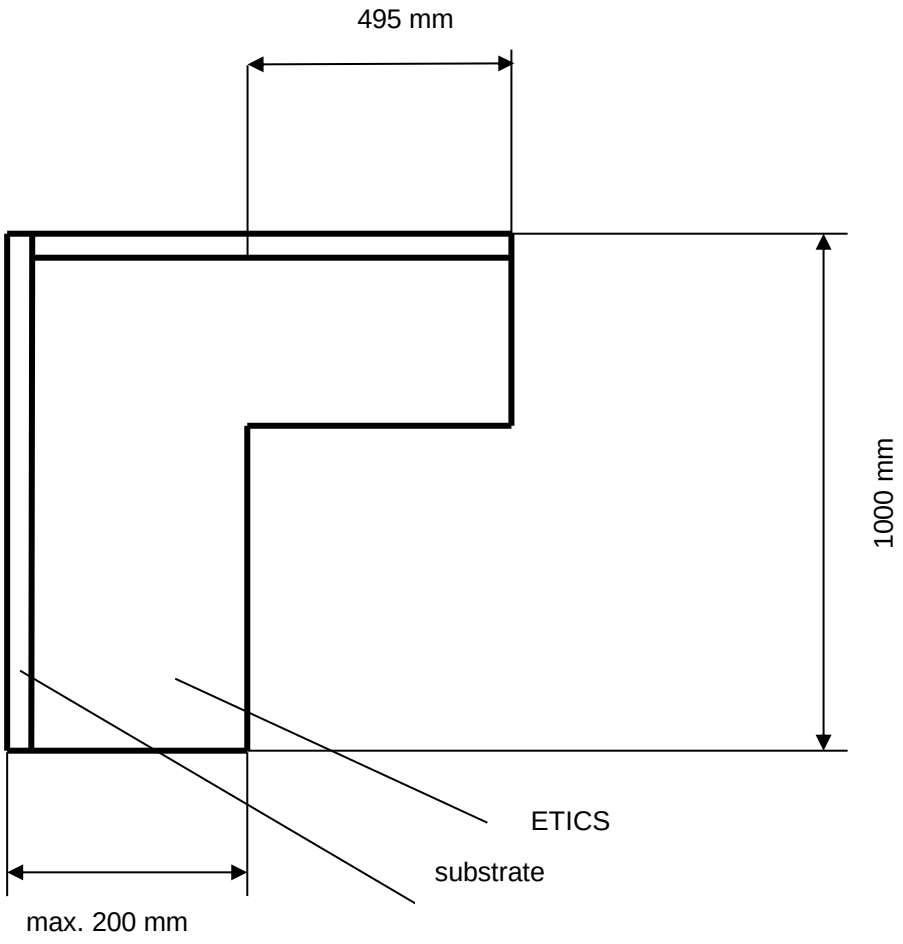
B.5.4 Reinforcement

The specimen shall be prepared with the reinforcement intended to be used in end use application. If different reinforcements are intended to be used, the reinforcement with the highest Q_{PCS} value per unit area has to be tested.

B.5.5 Application of test results

The test result covers end use application arrangements with the same type of thermal insulation product (excluding insulation made of polystyrene or PU) as used in the tests with thicknesses and densities as described in B5.1 and equal or lower organic content.
The test results from tests with thermal insulation products made of polystyrene or PU classified class E are valid for ETICS with thermal insulation products as used in the test or for ETICS with thermal insulation products as used in the test or for ETICS with any polystyrene and PU thermal insulation products classified class E when the test evidence according to B5.1 was provided.
For the direct application of test results regarding base coat, key coat, finishing coat, decorative coat, reinforcement and adhesive the same rules shall apply as given in clause B4.5.

[11] For the application of the ETICS e.g. in Germany the thermal insulation product alone must be classified at least class E



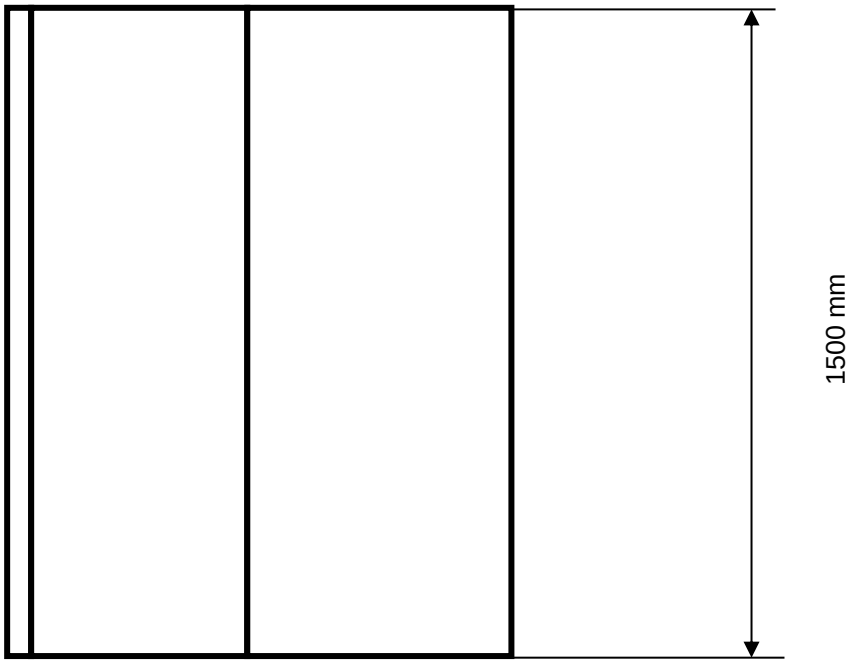
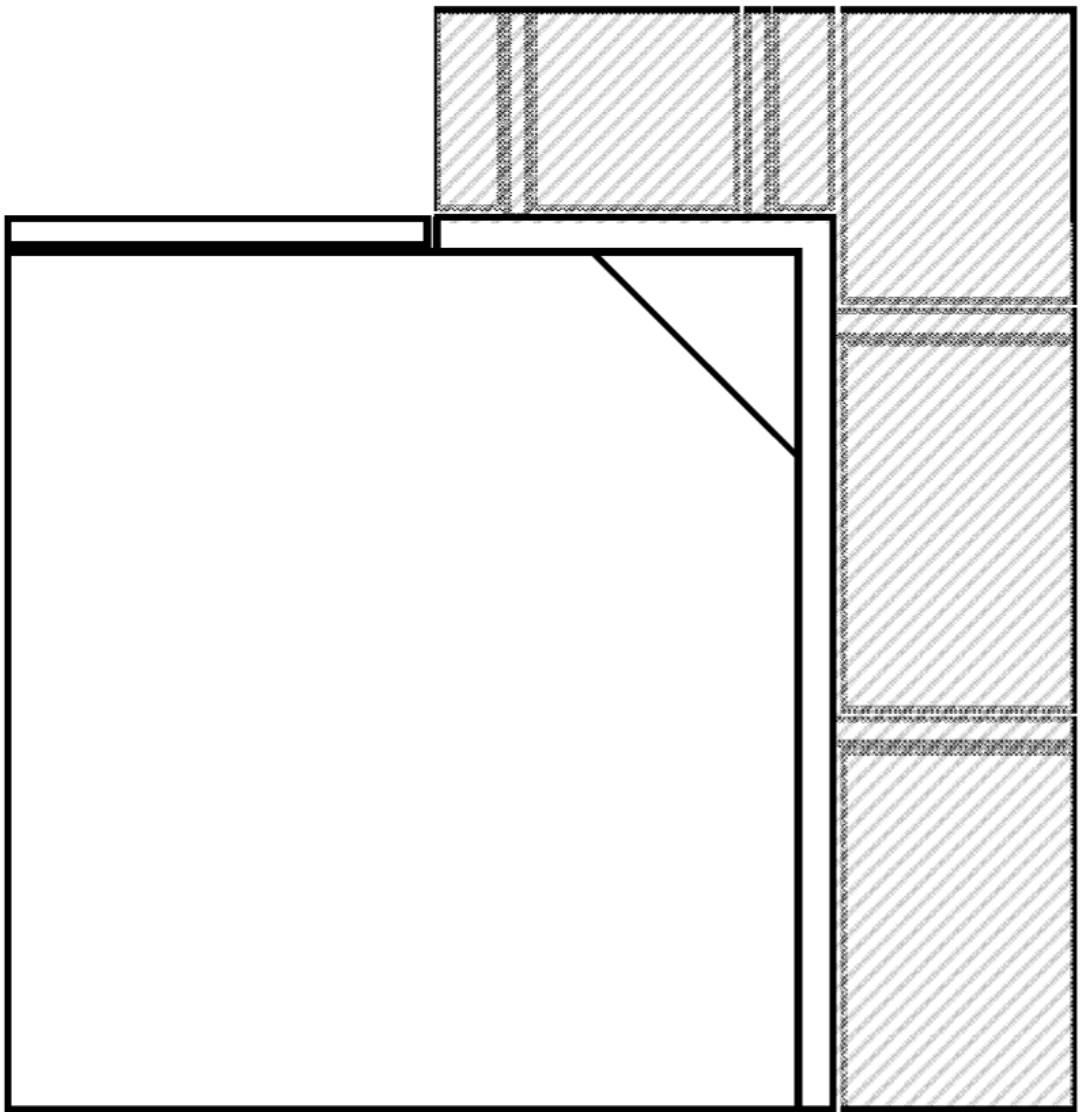


Fig. B.1: Schematic drawing of the test specimen in the SBI-test according to EN 13823

Aluminium foil covered area shown in grey hatching:

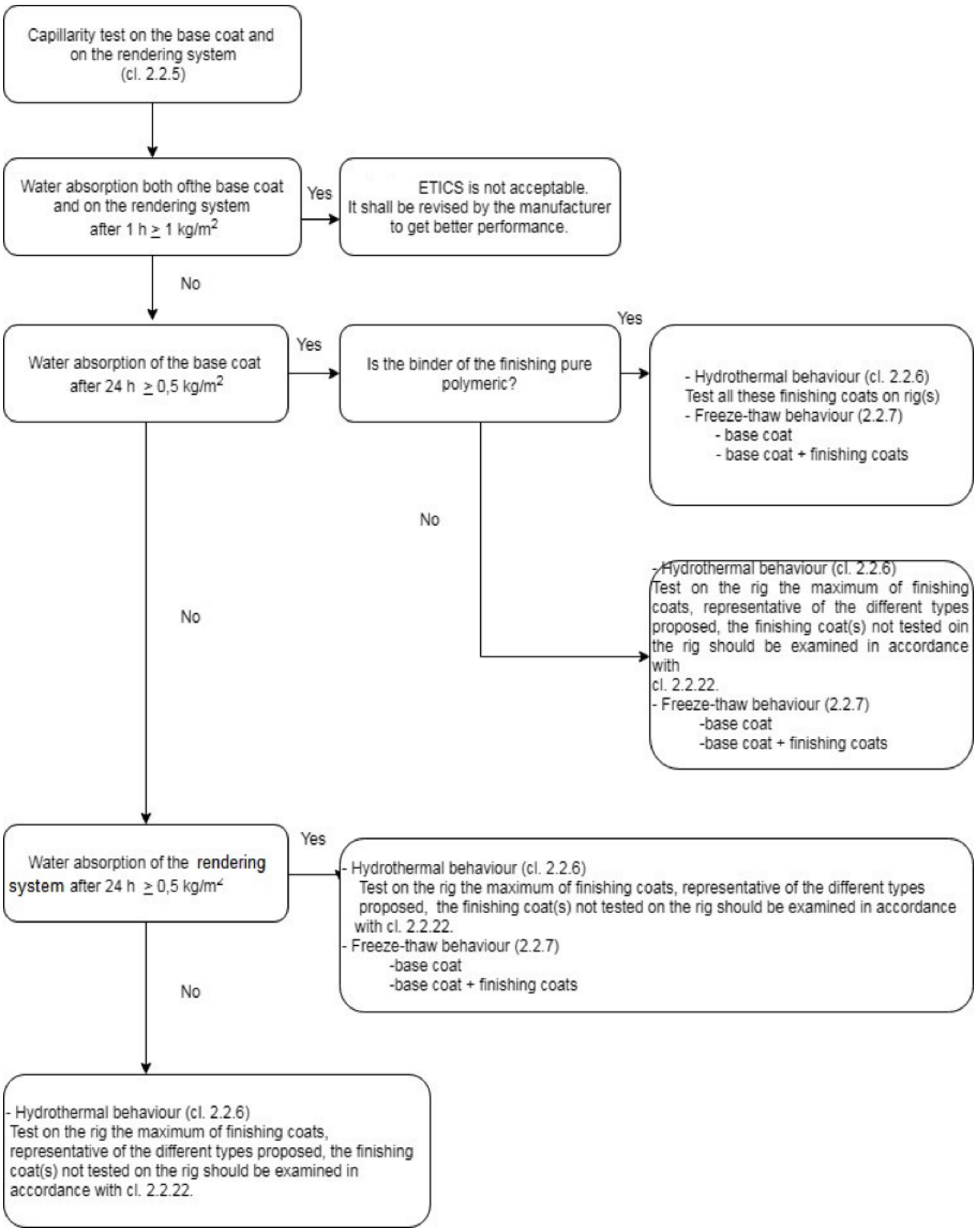


ANNEX C – FAÇADE FIRE PERFORMANCE ASSESSMENT METHOD

If the manufacturer intends to declare the facade fire performance of the product, in absence of a European assessment approach, the ETA shall state the results of the product assessment(s) according to the assessment method(s) required by the regulatory provisions, if any, of those countries, in which the manufacturer intends to make the product available on the market, according to the following Table:

Country	Assessment method
Austria	ÖNORM B 3800-5
Czech Republic	ČSN ISO 13785-1
Denmark, Sweden, Norway	SP Fire 105
Finland	• SP Fire 105 • BS 8414
France	LEPIR 2
Germany	• DIN 4102-20 Complementary reaction-to-fire test for claddings of exterior walls, • Technical building regulation A 2.2.1.5
Hungary	MSZ 14800-6:2009 Fire resistance tests. Part 6: Fire propagation test for building facades
Ireland	BS 8414 (BR 135)
Poland	PN-B-02867:2013
Switzerland, Liechtenstein	• DIN 4102-20 • ÖNORM B 3800-5 • Prüfbestimmung für Aussenwandbekleidungssysteme
UK	BS 8414 -1:2015 and BS 8414-2:2015

ANNEX D – RECOMMENDATIONS FOR CHOOSING THE TEST TO BE PERFORMED IN ORDER TO ASSESS THE WATER TIGHTNESS OF ETICS



ANNEX E

ADDITIONAL PROVISIONS FOR DETERMINATION THE PROPENSITY TO UNDERGO CONTINUOUS SMOULDERING OF THERMAL INSULATION MATERIAL MADE OF MINERAL WOOL, WOOD WOOL, CORK, WOOD FIBRES OR ANY OTHER VEGETABLE OR ANIMAL FIBRES

E.1 Provisions for products made of mineral wool

E.1.1 Sample input data

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

- the product-type[12],;
- the product or product variant with the highest organic content (in percentage per mass), determined according to EN 13820;
- the product or product variant with the highest density as well as a density of about 100 kg/m³ (± 15 %); if this range is lower than 115 kg/m³, then only the product or product variant with the highest density. The density shall be determined in accordance with EN 1602);
- the product or product variant with the highest thickness. If the highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the backside to the maximum testable thickness of about 100 mm. The thickness shall be determined on accordance with EN 823 on at least three specimens.
- each different produced fibre orientation, i.e. lengthwise and crosswise to the length direction of the specimen as well as perpendicular to the surface of the specimen front side;
- without any facings, coatings (or similar) – existing facings or coatings shall be removed when preparing the test specimens.

E.1.2 Preparation of test specimen

The tests shall be done on free-hanging specimens without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions, and without any joints (see further).

If the product is only available in lengths lower than 800 mm, the test specimens shall be prepared by using two (or more) smaller pieces of the mineral wool, which shall put together with a butt joint. This joint shall be positioned in the highest possible distance to the bottom edge of the test specimens. Connection of the pieces of the test specimens shall be carried out in such a manner that a permanent and close contact is ensured between both pieces at the joint for the entire testing and monitoring time.

E.1.3 Extended application of test results

The test results considering the aforementioned parameters are also valid for products:

- of the same product-type,
- with lower organic content,
- with all lower densities,
- with lower thickness and also with higher thickness when 100 mm thick specimens were tested,
- with all fibre orientations,
- with any facings or coatings and
- for any end-use conditions.

E.2 Provisions for products made of wood wool or wood chips

E.2.1 Sample input data

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

12 To permit the TAB to draft EXAP-rules, the manufacturer should provide sufficient information (e. g. on the basis of the composition of the products in question), allowing the TAB to determine which products or product variants should be submitted to testing.

a) Homogeneous products

- product-type[12] (e.g. the type of wood, binder and additives),
- the product or product variant with the highest organic content (in percentage per mass), determined according to EN 13820;
- the product or product variant with the highest density as well as the lowest density, determined by tests according to EN 1602;
- the product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined according to EN 823 on at least three specimens;
- each different produced orientation of the wood wool / wood chips (i. e. lengthwise and crosswise to the length direction of the specimen),
- without any facings, coatings or suchlike – existing facings or coatings shall be removed when preparing the test specimens

b) Non-homogeneous products (composite boards)

- product-type[12] (e.g. the type of wood, binder and additives, any possible combination of wood wool / wood chips and other possible layer materials),
- the product or product variant with the highest as well as lowest density of the wood wool / wood chip layer;
- the product or product variant with the highest thickness of the wood wool / wood chip layer
- each different produced orientation of the wood wool / wood chips and the fibres of the second layer in case of materials made of mineral wool, wood fibres, cork or any other animal or vegetable fibres (i. e. lengthwise and crosswise to the length direction of the specimen);
- the product or product variant with the highest organic content (in percentage per mass), determined by tests according to EN 13820;
- the product or product variant with the highest as well as lowest density of the second layer material, in case of combination with material which may also show propensity to undergo continuous smouldering (wood fibre, cork or materials made of any other vegetable or animals fibres);
- the product or product variant with the highest density as well as a density of about 100 kg/m³ (± 15 %) of the second layer in case the material is made of mineral wool; if the highest density of the range is equal or lower than 115 kg/m³, then only the product or product variant with the highest density. The density shall be determined in accordance with EN 1602);
- the product or product variant with the highest density of the second layer material, in case of combination with any other products which do not show propensity to undergo continuous smouldering;
- the product or product variant with the highest thickness of the second layer material, in case of combination with material which may also show propensity to undergo continuous smouldering (wood fibre, cork, mineral wool or materials made of any other vegetable or animals fibres) or
- the product or product variant with the lowest thickness of the second layer material, in case of combination with any other material which do not show propensity to undergo continuous smouldering.

E.2.2 Preparation of tests specimens

The tests shall be done on specimens taken from 2-layer-composite boards (with one external wood wool / wood chip layer), which also cover 3-layer composite boards (with two external wood wool / wood chip layers).

In case of composite boards made of wood wool / wood chips and second layer material which may also show propensity to undergo continuous smouldering (wood fibre, cork, mineral wool or materials made of any other vegetable or animals fibres), both layers shall be exposed by the ignition source within the tests.

In case of composite boards made of wood wool / wood chips and any other second layer material, which do not show propensity to undergo continuous smouldering, only the wood wool / wood chip layer shall be exposed by the ignition source within the tests.

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions. If the paragraph 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

E.2.3 Extended application of test results

The determined performance of the tested product shall be expressed in accordance with clause 11 of EN 16733. The results of tests considering the aforementioned parameters in fully are also valid for products:

- of the same product-type (e.g. type of wood, binder and additives),
- with lower organic content of the wood wool / wood chip layer,
- with all densities of the wood wool / wood chip layers between those evaluated,
- with lower densities in case of mineral wool as second layer material or in case of layer material which do not show propensity to undergo continuous smouldering,
- with all densities between those evaluated in case of wood fibre, cork or any other materials made of vegetable or animal fibres as second layer,
- with lower thickness of the wood wool / wood chip layer as well as of the second layer and also with higher thickness of the layers when the layer thickness of the tested specimen was of about 100 mm,
- with all orientations of the wood wool / wood chips and the second layer material in case of materials made of mineral wool, wood fibre, cork or any other animal or vegetable fibres,
- with any facings or coatings or suchlike and
- for any end-use conditions.

E.3 Provisions for products made of cork

E.3.1 Sample input data

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

- product-type[12], (type of binder and additives etc.);
- the product or product variant with the highest and lowest density, determined by tests according to EN 1602;
- the product or product variant with the highest thickness, determined by tests according to EN 823 on at least three specimens;
- each different produced orientation, if relevant (i. e. lengthwise and crosswise to the length direction of the product),
- without any facings, coatings or suchlike – existing facings or coatings shall be removed when preparing the test specimens.

E.3.2 Preparation of tests specimens

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions. If the paragraph 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

E.3.3 Extended application of test results

The results of tests considering the aforementioned parameters in fully are also valid for products:

- of the same product-type,
- with all densities between those evaluated,
- with lower thickness and also with higher thickness when 100 mm thick specimens were tested,
- with all orientations, if all relevant orientations (lengthwise and crosswise) had been tested,
- with any facings or coatings or suchlike and
- for any end-use conditions.

E.4 Provisions for products made of wood fibre

E.4.1 Sample input data

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

- product-type[12], (e.g. type of binder and additives),
- wood type of the wood fibres,
- type of production process,

- the product or product variant with the highest and lowest density, determined by tests according to EN 1602;
- the product or product variant with the highest thickness, determined by tests according to EN 823 on at least three specimens;
- each different produced fibre orientation (i. e. lengthwise and crosswise to the length direction of the product),
- without any facings, coatings or suchlike – existing facings or coatings shall be removed when preparing the test specimens.

E.4.2 Preparation of tests specimens

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions. If the paragraph 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

E.4.3 Extended application of test results

The results of tests considering the aforementioned parameters in fully are also valid for products:

- of same product-type (e.g. binder type and additives, wood type of the fibres, including the production process),
- with all densities between those evaluated,
- with lower thickness and also with higher thickness when 100 mm thick specimens were tested,
- with all fibre orientations, if all relevant orientations had been tested,
- with any facings or coatings or suchlike,
- for any end-use conditions.

E.5 Provisions for products made of vegetable or animal fibre

E.5.1 Sample input data

In addition to EN 16733, the following conditions and parameters shall be considered when performing sampling and preparing test samples:

- product-type[12], (type of fibres, type of binder and additives / treatment, including the type of production process),
- the product or product variant with the highest and lowest density, determined by tests according to EN 1602;
- the product or product variant with the highest thickness, determined by tests according to EN 823 on at least three specimens;
- each different produced fibre orientation (i. e. lengthwise and crosswise to the length direction of the specimen),
- without any facings, coatings or suchlike – existing facings or coatings shall be removed when preparing the test specimens

E.5.2 Preparation of tests specimens

The tests shall be done without consideration of the intended end-use conditions, because propensity to undergo continuous smouldering is hardly affected by end-use conditions. If the paragraph 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

E.5.3 Extended application of test results

The results of tests considering the aforementioned parameters in fully are also valid for products:

- of the same product-type, including production process,
- with all densities between those evaluated,
- with lower thickness and also with higher thickness when 100 mm thick specimens were tested,
- with all fibre orientations, if all relevant orientations had been tested,
- with any facings or coatings or suchlike and
- for any end-use conditions.

ANNEX F – TEST METHODS FOR FOAM ADHESIVES FOR ETICS

F.1 General

This Annex specifies methods of identification and test methods for one component PUR foams used as adhesive for ETICS based on Expanded Polystyrene (EPS) for the use on masonry or concrete. Other foams, insulation products or substrates are not covered by this Annex.

F.2 General test conditions

If not determined otherwise, the test procedures shall be performed at (23 ± 2) °C and (50 ± 5) % RH (standard conditions). Any material (bottle/can, PE-foil, substrate, EPS board,…) used for testing shall be stored under the climate conditions for at least 3 days to ensure that it is fully acclimatized.

The bottle/can shall be shaken at least 20 times before application. The first approximately 100 g of foam is discarded by spraying.

The technique of application (straw/gun) shall be as given in the manufacturer's application instructions and recorded in the test report.

If not determined otherwise (either in the test procedure description or manufacturer's instructions), the spray speed is from 100 to 200 mm/s.

For the purpose of identification the time between production date and testing has to be taken into account.

F.3 Establishing of input data for assessment methods

F.3.1 Density

Required tools:

- PE-foil
- Sharp and clean knife (cutting knife)
- Balance with an accuracy of 0,1 g
- Measuring cylinder with an increment of 10 ml
- Water

Preparation of test specimens:

A full bottle/can shall be used for preparation of test samples.

The bottle/can is shaken at least 20 times before application. The first approximately 100 g of foam is discarded by spraying.

Cylindrically shaped beads with diameter of 20 to 30 mm and about 200 mm length are sprayed on a PE-foil from a distance of approximately 10 mm and left to harden.

After 24 hours minimum, the beads shall be cut on both sides to a length of 100 to 150 mm.

Test procedure:

The mass of the samples is measured in grams (**m**) with an accuracy of 0,1 g.

A measuring cylinder having an increment of 10 ml is filled with water and a reference volume ($\mathbf{V_0}$) is set.

By pressing a cutting knife into one end of the bead, the sample is submerged into the measuring cylinder. The increased volume ($\mathbf{V_1}$) is read off immediately.

Calculation:

The density of the PUR-Foam is determined by using the following formula:

$$\rho = \frac{m}{\mathrm{V1} - \mathrm{V0}} * 1000$$

The results shall be expressed in kg/m³.

The test result shall be calculated as the mean of at least 5 single values.

F.3.2 Tack free time

Background and purpose:

The tack free time is the time after which a bead of foam has formed a skin, so that adhesion on the surface has stopped.

The tack free time is susceptible to temperature and humidity conditions. It is usually prolonged by lower temperature and / or lower humidity.

Required tools:

- Paper or cardboard
- Small rod or tube made of PE (e.g. straw)
- Clock or stopwatch

Test procedure:

Cylindrically shaped beads (3 samples) with diameter of 20 to 30 mm are sprayed on the cardboard and the time is noted ($\mathbf{t_0}$) or the stopwatch is started. The surface of the bead is touched gently with the small rod/tube (without penetrating the skin) several times after applying the foam, e.g. every 30 sec (see Figure F.3.2). For every touch a clean part of the rod/tube and a new spot on the bead shall be used. The time when no foam adheres to the rod is noted ($\mathbf{t_1}$).

Calculation:

$t_{tack\ free} = t_1 - t_0$

No calculation is needed when using a stopwatch.

The minimum value is expressed in minutes (min).

Figure F.3.2 – Touching the bead with the rod/tube

F.3.3 Cutting time

Background and purpose:

The cutting time is the time after which cut surface of a cylindrically shaped bead of (not entirely hardened) foam, 30 mm in diameter, is not sticky anymore, the knife remains clean without pre-polymer residues and the cells are not squeezed. It is a time after which the foam is not entirely hardened, but it can be processed. The foam hardening process is usually prolonged by lower temperature and/or lower humidity.

Required tools:

- Sharp and clean knife (cutting knife)
- Paper or cardboard
- Clock or stopwatch
- Template with a window of 30 mm height and approximately 60 mm width. See Figure F3.3.1.

Test procedure:

Cylindrically shaped beads (3 samples) with diameter of 20 to 30 mm are sprayed on the cardboard (see Figure F.3.3.2) and the time is noted ($\mathbf{t_0}$) or the stopwatch is started. Measurements shall be started 10 minutes before the anticipated cutting time.

To check the bead diameter the template according to Figure F.3.3.1 used.

The bead is cut in a place with 30 mm diameter, found by template (see Figure F.3.3.3). The bead shall not be "sawn", but cut in one or two steps at a fast pace.

If fresh polymer remains on the knife, the foam cells are crushed or the cut surface is still sticky, the foam is still not cured. Another bead or part of bead is cut in the same way after 3 minutes. It shall be ensured that no impact on the foam due to a previous cut surface occurs.

This procedure is repeated every 3 minutes (respectively 1 minute when being close to the anticipated cutting time) until the foam cells are not squeezed by the knife and the cut surface is not sticky. Also the bead shall stay in shape.

The time is noted ($\mathbf{t_1}$).

Calculation:

$t_{cutting} = t_1 - t_0$

No calculation is needed when using a stopwatch.

The minimal value (result) is expressed in minutes (min).

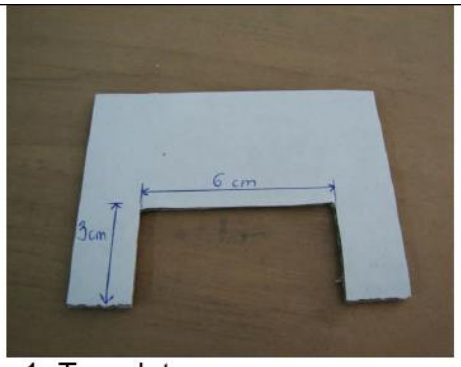


Figure 1: Template

Figure 2: Beads on the cardboard

Figure 3: How to find 3 cm diameter bead

Note: Figure 1 is identical to F3.3.1, Figure 2 is identical to F3.3.2, Figure 3 is identical to F.3.3.

F.4 Test method for bond strength of foam adhesives

Required tools:

- Substrate *(concrete slab according to this EAD, clause 2.2.11.2, thickness: 40-80 mm)*
- Insulation product *(EPS with tensile strength TR150, dimensions*: 50 mm × 50 mm × 30-100 mm)*
- Spacers (any non-sticking material, used to ensure a consistent gap between the specimens of insulation product)
- Weights or clamps, if substrate material is not heavy enough to ensure stability of test sample
- Cutting knife

- Tie anchors to connect the insulation product to a testing machine (e.g. made of square metal plates)
- Calliper (accuracy ≤ 0,1 mm) for measuring sample surface area
- tensile testing machine

**Note: if the laboratory is equipped, one can also use a bigger EPS plate (max. 120 mm x 200 mm x 30-100 mm) and cut test samples afterwards*

Preparation of test samples:

The bottle/can is shaken at least 20 times before application. The first approximately 100 g of foam is discarded by spraying away.

After this, the foam is sprayed without interruption from a distance of approximately 10 mm onto the surface of the insulation product which shall be affixed to the substrate. The diameter of the beads shall be from 20 mm to 30 mm without space between them. The foam shall be applied in longitudinal strips or in serpentine pattern (Figure F.4.1). It is very important that, while spraying the next bead(s), the foam is not sprayed into the already applied foam bead(s). The surface shall be fully covered with foam.

If not determined differently (see Test conditions, 'Modification of processing time'), the sample components shall be assembled together after 180±10 seconds from finishing the foam application by firmly pressing the concrete slab onto the foam. If not determined differently (see Test conditions, Modification of foam thickness) the thickness of foam shall be (8 ± 1) mm. The foam has to be able to expand to the lateral sides.

If not determined differently (see Test conditions) the samples are stored for at least 1 day (24 h) at the standard conditions. The required thickness is controlled by clamping the samples or using weights.

After one day curing, tie anchors may be affixed to the insulation product by using a suitable adhesive (see Figure F.4.6), the adhesive may need one day for curing.

Samples shall be cut to the specified dimensions (50 mm x 50 mm) after curing in case larger EPS plates are used.

Figures on the bond strength test - specimen preparation

Figure F.4.1: Spray pattern

Figure F.4.2: Set-up with spacers (ex. 1)

Figure F.4.3: Set-up with spacers (ex. 2)

Figure F.4.4: Set-up with spacers (ex. 3)

Figure F.4.5: Test sample during curing (48hrs)

Figure F.4.6: Tie anchors

Figure F.4.7: Cutting of the surplus

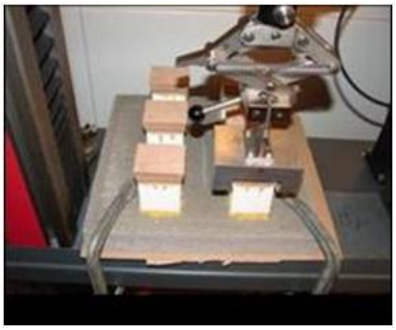


Figure F.4.8: Test set-up in test machine

Test procedure:

The surplus foam shall be carefully cut off (see Figure F.4.7).

The tensile test (pull-off test) is performed on at least five test samples at a tension speed of (10 ± 1) mm/min.

After testing the sample surface (s) shall be measured in mm², and the test results β_i are calculated by the formula

$$\beta_i = F_i/s_i$$

The test results (individual and mean values) are expressed in N/mm² (MPa) along with description of the failure mode. The way of application (straw/gun, application pattern) shall be given in the test report.

Test conditions

F.4.1 Standard application conditions

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with standard application conditions:

- Completion of test samples within 180±10 seconds
- Thickness of foam: (8 ± 1) mm

F.4.2 Modification of application conditions

F.4.2.1 Modification of foam thickness

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with a thickness of foam of (15 ± 1) mm by using appropriate spacers.

F.4.2.2 Modification of processing time (open time)

The tensile test is carried out at standard conditions (23 ± 2) °C / (50 ± 5) % RH with the standard thickness of foam of (8 ± 1). The time between spraying the beads and completion of test samples shall be in accordance with the maximum open time declared by the manufacturer.

F.4.2.3 Modification of temperature

Two tensile tests are carried out with the standard thickness of foam of (8 ± 1) mm. For preparation of test samples the following conditioning for substrate, insulation product, application, foam and curing is taken into account:

F.4.2.3.1 Low temperature: (5 ± 2) °C, no RH is required if not declared differently by the manufacturer

F.4.2.3.2 High temperature: (35 ± 2) °C, (30 ± 5) % RH if not declared differently by the manufacturer

The duration of storage must ensure the required temperature of all components.

After preparation and curing for 24 hours under the defined conditions, the samples are tested without delay at standard conditions (23 ± 2) °C / (50 ± 5) % RH.

F.5 Test method for post expansion behaviour of foam adhesives

Background and purpose:

The post expansion behaviour is a process of increase of foam volume after application until finished hardening. The post expansion behaviour is a relevant characteristic for the determination of application instructions. Depending on the post expansion behaviour, it may be reasonable to use temporary fixings for bonding the insulation product in ETICS to avoid undesirable movements.

The post expansion behaviour is subject to temperature and humidity conditions.

Required tools:

- board with flat surface (Chipboard or cement bonded particle board or cement bonded fibre board), dimensions: ≥ 500 mm x ≥ 500 mm, minimum thickness: 12 mm
- EPS-board with determined density (15 ± 5) kg/m³
  dimension: 500 mm x 500 mm, thickness: 40 mm
- Weights (only if total weight of EPS-board is less than 200 g)
- caliper
- four spacers, dimension: 20 mm x 20 mm, thickness 8 mm, fixed on each corner of the chipboard
- clock or stopwatch

Preparation of test samples:

The bottle/can is shaken at least 20 times before application. Then, the foam is applied in a square-shaped (40x40cm) bead according to Figure 1.

The foam is sprayed from a distance of circa 1 cm to the EPS-board's surface and form beads of 20 to 30 mm diameter. The spray speed shall be from 100 to 200 mm/sec.

Without delay, the so prepared EPS-board is firmly pressed onto the chipboard until it touches the spacers. A total weight of 200 g shall be ensured by the EPS-board and additional weights, if necessary.

Test procedure:

The distance in millimeters between the base board and the EPS-board is measured by the caliper (see Figure F.5.2). Measurements are taken in the following intervals:

M1	after	5	minutes
M2	after	10	minutes
M3	after	20	minutes
M4	after	40	minutes
M5	after	60	minutes
M6	after 24 hours		

Note: In case of significant differences in the measurements within one interval, the test should be discarded and repeated.

The mean value of each measurement is calculated from the four single values measured at the corners of the EPS-board.

All the M1-M6 values shall be reported. The final result is the highest value out of the six measurements.

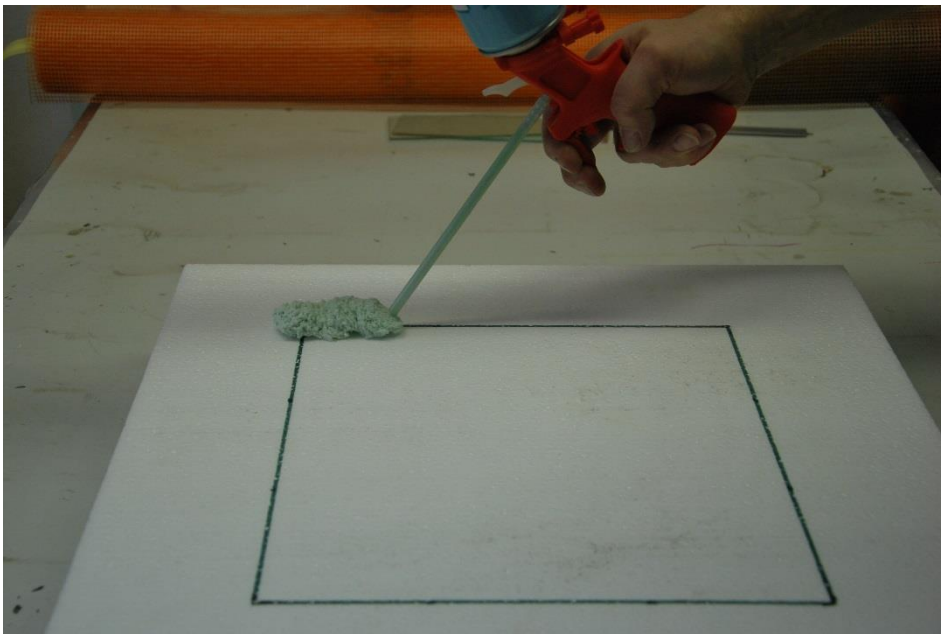


Fig. F.5.1: Preparation of the sample

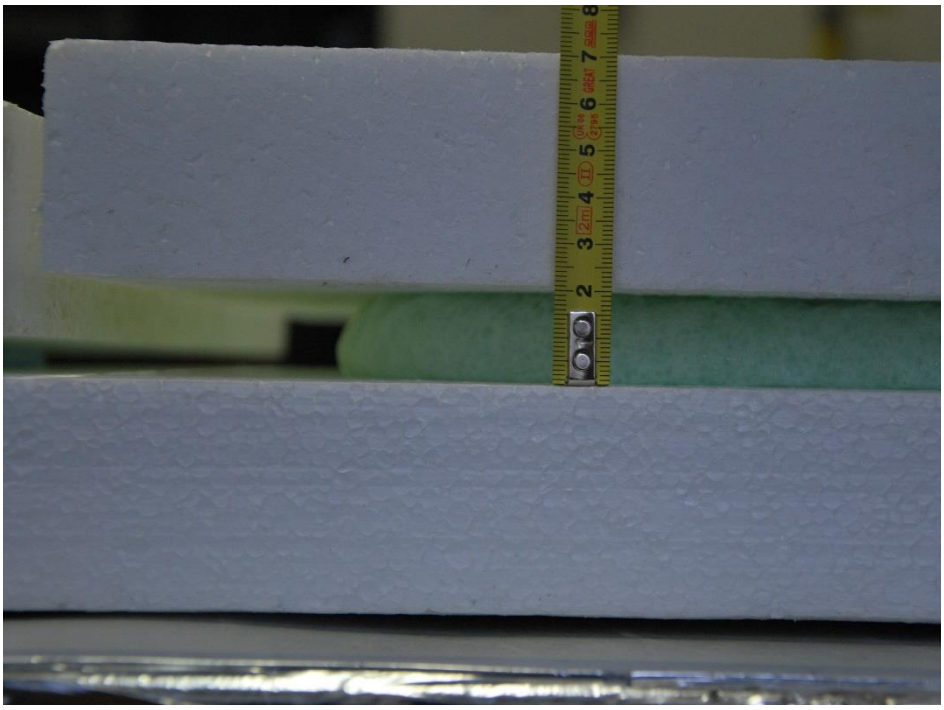


Fig. F.5.2: Measurement by a caliper

F.6 Test method for shear strength and shear modulus of foam adhesives

Background and purpose:

The shear behaviour (shear strength and shear modulus) of a foam is a relevant characteristic when used for bonding the insulation product in ETICS with thick insulation boards, heavy rendering systems of ETICS.

Required tools:

- Two chipboard plates (P5 according to EN 312), dimensions: 140 mm x 100 mm x min. 10 mm
- two spacers with the dimensions of 20 mm x 100 mm, thickness 8 ± 1 mm, fixed on each end of the test sample on one chipboard
- screw clamps or weights

Preparation of test samples

The foam is sprayed without interruption from a distance of approximately 10 mm onto the surface of the chipboard, onto which the spacers are temporarily fixed. The diameter of the beads shall be 20 to 30 mm without space between them. The foam shall be applied in longitudinal strips or in serpentine pattern. The surface (100 mm x 100 mm) shall be fully covered with foam.

The test sample shall be completed within 180±10 seconds by pressing the second chipboard firmly onto the first chipboard until it touches the spacers.

During curing of at least 2 days at standard conditions, the required thickness (8 ± 1 mm) is controlled by clamping the samples or using weights.

Before testing, the spacers shall be removed and the overlapping foam shall be cut off.

Test procedure:

The test is carried out according to EN 12090 on at least 3 samples at the speed of (3 ± 0,5) mm/min.

The test results (individual and mean values) shall be expressed in kPa according to EN 12090 (chapter 8).

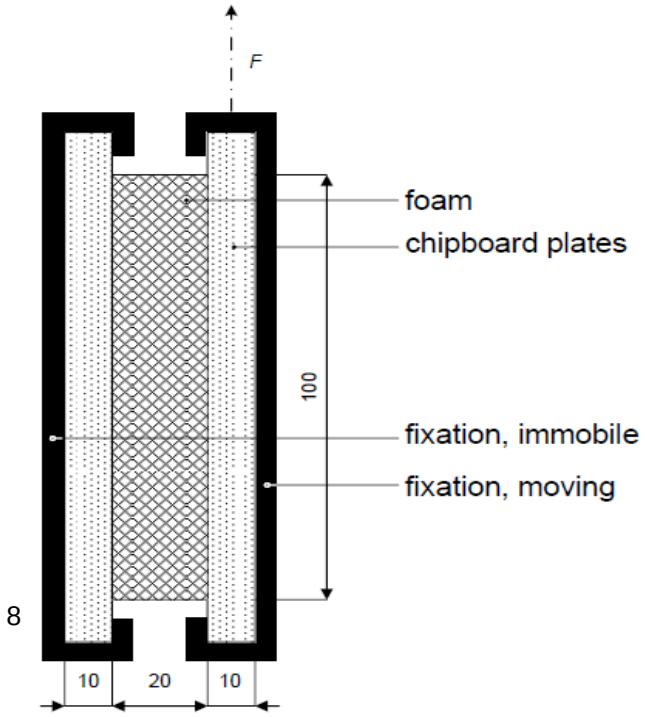


Figure F.6: test sample ready for test

ANNEX G – TEST OF PLATE STIFFNESS OF PLASTIC ANCHORS FOR ETICS

G.1 General

The load resistance of the ETICS fixed by anchors is particularly linked to the mechanical properties of the anchor plate and the insulation material. The minimum requirements to the properties of the anchor plate are relevant for ETA for ETICS.

These properties are
• the load resistance and
• the plate stiffness.
of the anchor plate

This Annex covers pull-through tests to evaluate the pull-through resistance of the anchor plate and the plate stiffness of plastic anchors for fixing of ETICS with rendering. The pull-through test shall be carried out according to following clauses.

G.2 Details of method and criteria for assessment

The failure load of the anchor plate shall be determined from at least 5 tests using the product type to be assessed only. During the tests the anchor plate shall rest on a solid support ring with a clear inside diameter of 30 mm. A preload can be applied for determination of the stiffness for curved anchor plates in a way, that the tension load is be transmitted at the inside edge of the support ring. If the anchor plate is stiffened by ribs, recesses, which prevent a contact between the ribs and the supporting ring and the load transmission is not effected by the ribs, shall be designed in the steel ring.

A principle test setup is shown in Figure G2.

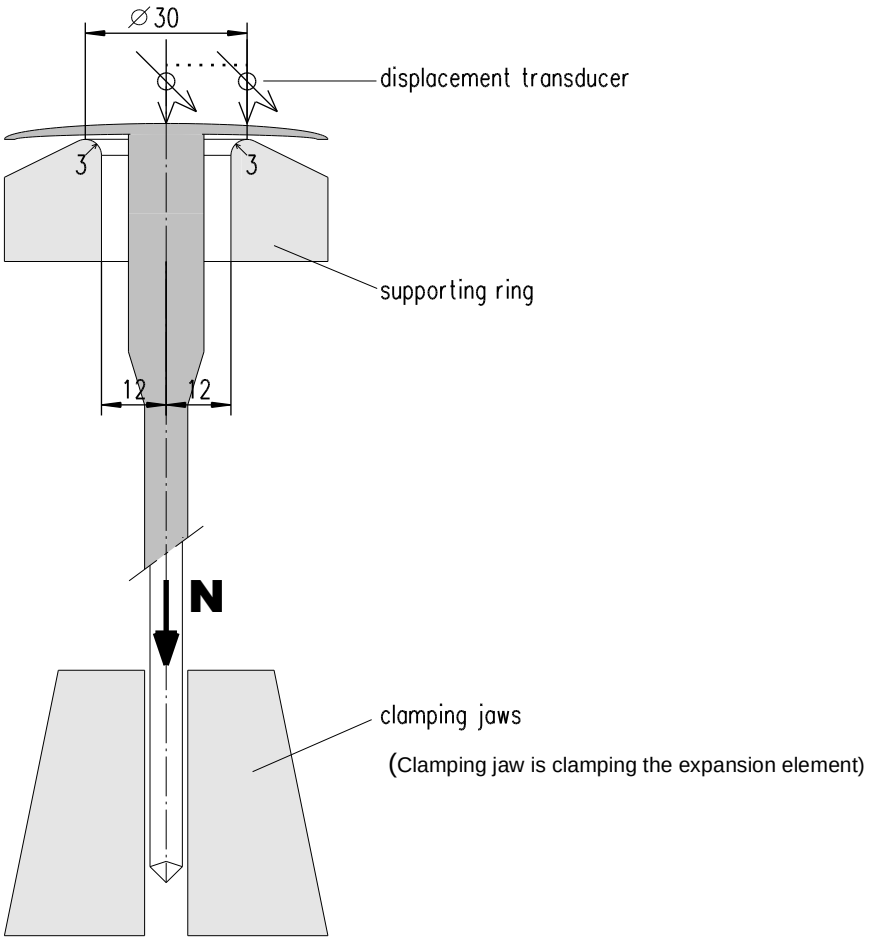


Figure G.2 Principle description of the test for determination of the plate stiffness

For plastic anchor plates, which change their mechanical properties under influence of humidity, the tests shall be carried out using air-humid conditioned anchors but always in ambient temperature (standard conditions: equilibrium water content at T = +23 °C and 50 % relative humidity). The tension load is transmitted over the anchor shaft with a loading rate of 1 kN/min ± 20 %.

G.3 Assessing of method and criteria for assessment

G.3.1 Load resistance

The characteristic resistance has to be determined from the 5%-quantile of the ultimate loads for a confidence level of 90 %. This value has to be stated in the ETA. The characteristic resistance shall at least comply with the characteristic resistance in the ETICS according to this EAD. If the characteristic resistance amounts at least 1,0 kN, the universal application mentioned above can be ensured. The reduction of the resistance of the anchor plate caused by increased temperature is included in this value.

G.3.2 Plate stiffness

For getting a comparable dimension for the plate stiffness, the tangent stiffness (c) has to be determined for every test. This tangent stiffness states the gradient of an idealised straight line between the points s_u (displacement in mm) with the appropriate tension force N_u = 0 kN and s_o = 1 mm (displacement) with the appropriate tension force N_o in the load-displacement-diagram (see Figure G3.2).

The plate stiffness and the diameter of the anchor plate shall be stated in the ETA.

Tangents stiffness (in kN/mm):

$$\mathbf{c} = \frac{\mathbf{N_o} - \mathbf{N_u}}{\mathbf{s_o} - \mathbf{s_u}} = \frac{\mathbf{N_o}}{\mathbf{1mm} - \mathbf{s_u}} \qquad \text{(G.3.2)}$$

with $s_u \leq 0{,}3\ s_o$

The evaluated values should be rounded upward expediently to $^1/_{10}$ kN and be stated related to 1 mm deformation (e.g. 0,3 kN/mm / 0,4 kN/mm / 0,5 kN/mm / 0,6 kN/mm / 0,7 kN/mm).

For characterising the plate stiffness the mean value has to be stated in ETA. The coefficient of variation shall not exceed 20 %.

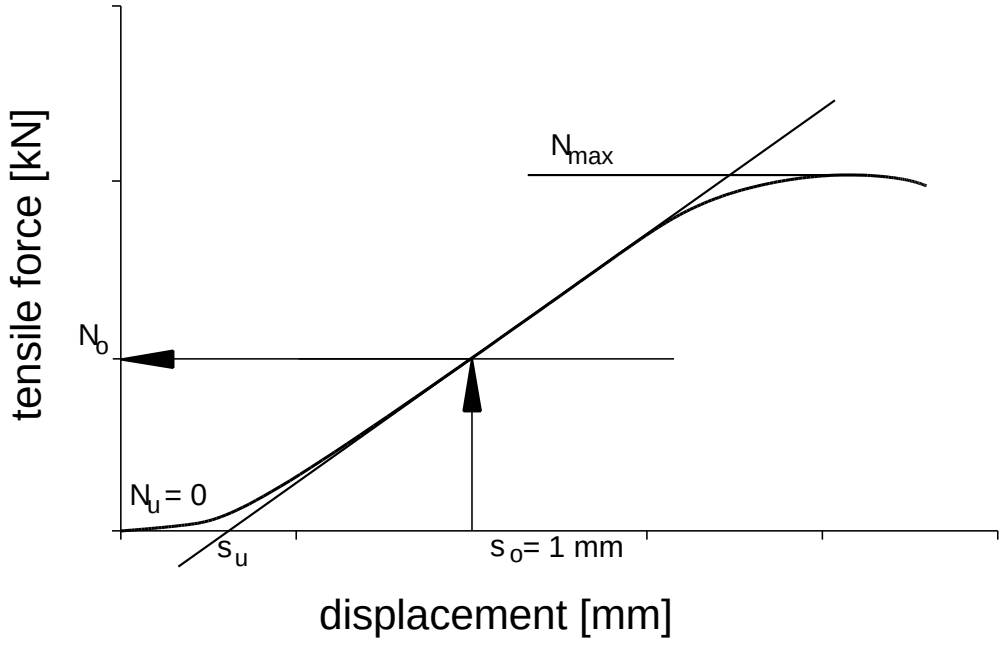


Figure G.3.2 Load-displacement-diagram with the idealized straight line

ANNEX H – INDICATIVE LIST OF THERMAL INSULATION PRODUCTS

The thermal insulation products may be covered by their harmonised technical specification (hTS), an indicative list of them is provided in the table below

Thermal insulation product type	**Harmonised technical specification**	**Other references**
Cellular plastic: EPS, XPS, PU, PF	EN 13163, EN 13164, EN 13165, EN 13166	Not relevant
Cellular glass	EN 13167	
Mineral and wood wool	EN 13162, EN 13168	
Expanded cork	EN 13170	
Wood fibres	EN 13171	
Vegetable and animal fibres	EAD 040005-00-0102	
Mineral materials	EAD 040012-00-1201 EAD 040010-00-1201	
Other (i.e natural cork, ecc) thermal insulation products that can be assessed according to the methods listed in this EAD.		