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European Assessment Document for

External thermal insulation composite systems with rendering system



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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD applies to kits for External Thermal Insulation Composite Systems with rendering system (hereinafter referred to as ETICS) to be applied on site onto external walls.

The ETICS is composed of the following components¹:

1. Adhesive, see Clause 1.1.1, if relevant depending on the fixing methods defined below.
2. Factory-made thermal insulation product, see Clause 1.1.2.
3. Mechanical fixing device, see Clause 1.1.3, if relevant depending on the fixing methods defined below.
4. Rendering system, see Clause 1.1.4.

Kits covered by this EAD are composed of all the ETICS components.

The ETICS may include ancillary components (see Clause 1.3.1.22) defined in the Manufacturer's Product Installation Instructions (MPII).

ETICS are non-load-bearing construction products. They do not contribute directly to the stability of the building wall on which they are installed.

The EAD covers kits for ETICS with different fixing methods of thermal insulation product, as follows:

1. Bonded ETICS.

ETICS where the acting loads (both, vertical load due to self-weight and horizontal load due to wind) are distributed to the substrate only by the bonding layer (layer between adhesive and substrate and between adhesive and thermal insulation product). These ETICS shall have either purely bonded (over the entire surface) or partially bonded with 40% as minimum bonded area depending on the bond strength values between ETICS layers.

There are two types of bonded ETICS:

- 1.1 Purely bonded ETICS. No mechanical fixing devices are used. The thermal insulation product is fully bonded to the substrate with adhesive.
- 1.2 Bonded ETICS with supplementary mechanical fixing devices². The fixings are installed while the adhesive is drying, and are used to provide stability and flatness of the outer face of the thermal insulation product until the adhesive has dried and has reached its final mechanical strength. These fixings act as a temporary connection to avoid the risk of detachment. In this type of ETICS, the load capacity of the supplementary fixings is disregarded in the load resistance performance of the ETICS otherwise, the system shall be considered mechanically fixed ETICS with supplementary adhesive.

2 Mechanically fixed ETICS with supplementary adhesive.

ETICS where the horizontal acting load due to wind is distributed to the substrate by the mechanical fixing devices. In this configuration, a supplementary adhesive is applied with a minimum bonded area of 20%. The supplementary adhesive is used to level the substrate ensuring tight contact between the

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

² These mechanical fixing devices may not be different than the mechanical fixing devices for mechanically fixed ETICS.

wall and the thermal insulation board and to possibly distribute vertical load due to the self-weight to the substrate.

3 Purely mechanically fixed ETICS.

ETICS where the acting loads (both, vertical load due to self-weight and horizontal load due to wind) are distributed to the substrate only by the mechanical fixing devices.

Supplementary adhesive (layer between thermal insulation and substrate) may be used with a maximum bonded area of 20% to level the substrate.

This EAD applies to ETICS with:

- Thickness of thermal insulation product between 15 mm and 400 mm for bonded ETICS and between 20 mm and 400 mm for mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS.
- Mean value of water absorption of the base coat or the rendering system after 1h < 1kg/m² in accordance with the test method described in Annex E.
- Maximum values of water absorption of thermal insulation product after 24 hours of partial immersion in accordance with EN ISO 29767³ method A: 1 kg/m².
- Minimum value of shear strength of thermal insulation product in accordance with EN 12090: 20 kPa (not relevant for mechanically fixed ETICS with supplementary adhesive and for purely mechanically fixed ETICS).
- Minimum value of shear modulus of thermal insulation product in accordance with EN 12090: 1000 kPa (not relevant for mechanically fixed ETICS with supplementary adhesive and for purely mechanically fixed ETICS).
- Glass-fibre mesh with tensile strength after alkali conditioning of at least 20 N/mm and at least 50% of the initial value in accordance with EAD 040016-01-0404 Clause 2.2.7.

The product is not fully covered by EAD 040083-00-0404. Compared to the previous version of the EAD, the following changes are introduced:

- The title of the EAD has been amended using the terminology “rendering system” instead of renderings.
- Extension of the scope by considering:
 - A new alternative of rendering system consisting of thin prefabricated strips (see Clause 1.1.4).
 - New mechanical fixing devices to be used with different installation methods (see Clause 1.1.3).
- Clarification of the scope such as:
 - The minimum bonded area for “Purely bonded ETICS” and “Bonded ETICS with supplementary mechanical fixing devices” has been increased from 20% to 40%.
 - The minimum and the maximum thicknesses of the thermal insulation product have been introduced for determining the applicability of test methods.

³ 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.

- Improvement of the definition of the intended use for ETICS applied on inclined vertical surfaces ($\pm 5^\circ$ with respect to the vertical plane); horizontal surfaces are not covered by this EAD (see Clause 1.2.1).
- Improvements in the following assessment methods:
 - Water absorption of thermal insulation product (see Clause 2.2.5.2).
 - Watertightness of the ETICS: Hygrothermal behaviour (see Clause 2.2.6).
 - Fixing strength (transverse displacement test) (see Clause 2.2.11).
 - Impact resistance (see Clause 2.2.8).
 - Bond strength expression of results and definition of cohesive failure (see Clause 2.2.10).
 - Limits for water vapour permeability of the rendering system have been deleted because they are not relevant.
 - Pull-through test of fixings (in partial deviation from EN 16382 to perform a less onerous test) (see Clause 2.2.12.1) and static foam block resistance (see Clause 2.2.12.2).
 - Shear strength and shear modulus of elasticity of thermal insulation (new definition of specimens' size, (see Clause 2.2.14).
 - Bond strength, shear strength, shear modulus and post expansion behaviour of PU-foam adhesive (2.2.17).
 - Pull-through resistance of fixings from profiles (see Clause 2.2.15).
 - Thermal resistance of ETICS (see Clause 2.2.20).
 - Extended application rules have been introduced.
- Improvement and clarification of several definitions, and technical descriptions:
 - Mechanically fixed ETICS with supplementary adhesive.
 - Purely mechanically fixed ETICS.
 - Rendering system with prefabricated strips.
 - Thermal insulation type.
 - Finishing coat type.
 - Finishing coat layer.
 - Extended application rules.
- Improvement, clarification and modification of Factory Production Control (FPC) for:
 - Prefabricated strips.
 - Anchors and profiles.
 - Purely bonded ETICS, Bonded ETICS with supplementary mechanical fixing devices, mechanically fixed ETICS with supplementary adhesive and purely mechanically fixed ETICS.
 - Dynamic modulus of elasticity; water retention capability for adhesive; density of fresh mortar, particle size grading for paste and liquid, static modulus of elasticity, tensile strength and elongation at break for base coat have been deleted.

- Flexural and compressive strength have been introduced for hardened products delivered as powder.
- Annex A of EAD 040083-00-0404 has been relocated in Clause 3.4.
- New numbering of essential characteristics.

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

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

Relevant manufacturer's stipulations, e.g., with regard to the intended end use conditions, having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA as long as the details of the assessment methods as laid down in this EAD are respected

1.1.1 Adhesive

An adhesive forms a layer applied between the substrate and the thermal insulation products to bond them to the substrate and, to a certain extent, level the substrate.

The adhesive plays different role depending on ETICS with different fixing methods:

- For purely bonded ETICS and bonded ETICS with supplementary mechanical fixing devices, the adhesive distributes to the substrate vertical load due to self-weight and horizontal load due to wind (see point 1.1 and 1.2 of Clause 1.1).
- For mechanically fixed ETICS with supplementary adhesive (see Clause 1.3.1.5), the supplementary adhesive is used to level the substrate and may also contribute to transferring the vertical load due to self-weight to the substrate (see point 2 of Clause 1.1).
- For purely mechanically fixed ETICS supplementary adhesive (see Clause 1.3.1.5) might be used only to level the substrate, without contributing to load transfer (see point 3 of Clause 1.1).

The adhesive includes a range of binders from pure polymeric to pure mineral (cement, lime, etc.). These may be available in the following form:

- Powder (dry mortar) blended at the factory that requires only mixing with a quantity of water according to MPII.
- Powder requiring addition of extra binder.
- Paste requiring addition of cement.
- Ready to use paste, supplied in workable consistency.
- The adhesive may also be available in the form of foam (polyurethane foam, hereinafter referred to as, PU-foam), applied directly from the bottle or can. The PU-foam is only used with expanded polystyrene thermal insulation product (hereinafter referred to as EPS) or extruded polystyrene (hereinafter referred to as, XPS).

Minimum data for describing the adhesive are: chemical nature of the product, maximum grain size, weight per square meter, density and, if relevant, the percentage of dilution and when the reaction to fire of the ETICS is assessed, also ash content and, if relevant, heat of combustion.

Minimum data for describing PU-foam adhesive are: chemical nature of the product, density, coverage, tack free time and cutting time, and when the reaction to fire of the ETICS is assessed, also ash content and, if relevant, heat of combustion.

1.1.2 Factory-made thermal insulation product

In ETICS the thermal insulation product shall be of the same material⁴, and faced with a rendering system.

Thermal insulation products are installed on the substrate by means of the method of fixing described in Clause 1.1.

They are made of the materials given in Table 1.1.2.1.

Table 1.1.2.1 Thermal insulation materials and the relevant associated product technical specifications

Thermal insulation materials		Relevant associated product technical specifications
Cellular plastic	Expanded polystyrene (EPS)	EN 13163
	Extruded polystyrene (XPS)	EN 13164
	Polyurethane foam (PU)	EN 13165
	Phenolic foam (PF)	EN 13166
Cellular glass (CG)		EN 13167
Mineral wool board (MW), mineral wool lamella		EN 13162
Wood wool (WW)		EN 13168
Expanded cork (ICB)		EN 13170
Wood fibres (WF)		EN 13171
Vegetable and animal fibres		EAD 040005-00-1201
Mineral materials		EAD 040012-00-1201
Expanded perlite		EAD 040010-00-1201
Expanded perlite		EN 13169
Agglomerated natural cork		EAD 041389-00-1201
Factory-made vacuum insulation panels (VIP).		EN 17140; EAD 040011-01-1201

Minimum data for describing the thermal insulation products are: thermal insulation type (see Clause 1.3.1.7), range of nominal or classes of dimension tolerances in accordance with the relevant product technical specification (see Table 1.1.2.1), compressive strength and, when the reaction to fire of the ETICS is assessed, also reaction to fire, maximum density and, if relevant, heat of combustion. Besides, if the thermal insulation product is sensitive to relative humidity and/or temperature (see Clause 2.2.13.2), also dimensional stability.

1.1.3 Mechanical fixing devices

Anchors, fasteners, vertical and/or horizontal profiles, rails, pins or any fixing device used to fix the ETICS to the substrate, such as the mechanical fixing devices listed in Table 1.1.3.1.

Table 1.1.3.1 Mechanical fixing devices and the relevant associated product technical specifications

Mechanical fixing devices	Relevant associated product technical specifications
Plastic anchors made of virgin or non-virgin material for fixing of external thermal insulation composite systems with rendering	EAD 330196-01-0604
Plastic anchors for redundant non-structural systems in concrete and masonry	EAD 330284-00-0604
Injected anchors for thermal insulation board	EAD 331433-00-0601
Powder-actuated fastener for the fixing of ETICS in concrete	EAD 330965-00-0601

⁴ Any type of fire protection measure with the function of a fire barrier in the façade is excluded from the assessments of this EAD.

The different mechanical fixing devices are used depending on the ETICS methods of fixing the thermal insulation product, described in Clause 1.1. Mechanical fixing devices (anchors or fasteners) can be applied using various installation methods, such as:

- Flush installation (see Clause 1.3.1.18).
- Countersunk installation (see Clause 1.3.1.19).
- Countersunk installation of spiral anchors (see Clause 1.3.1.20).
- Injected installation (see Clause 1.3.1.21).
- Fixed through the reinforcement layer (through glass fibre mesh).

Minimum data for describing mechanical devices are: material, shape, dimensions, mechanical characteristics (plate stiffness and load resistance of the anchor plate), type of installation method and setting position. Besides, when ETICS is mechanically fixed with supplementary adhesive or purely mechanically fixed (see Clause 1.1), also pull-out from substrate.

ETICS may also be mechanically fixed by means of profiles and rails.

Minimum data for describing profiles and rails are: material, shape, dimensions, number of fixings per unit area, distance range between two fixing devices.

1.1.4 Rendering system

The rendering system is applied on the external surface of the thermal insulation in one layer (i.e., the reinforced base coat alone) or several layers.

The rendering system is composed of the following components:

- Base coat applied directly onto the thermal insulation product without any air gap or separating layer; the reinforcement mesh is embedded into it.
- Standard glass fibre mesh as reinforcement embedded into base coat.
- Reinforced glass fibre mesh (optional) as reinforcement embedded into base coat in addition to the first layer of the standard glass fibre reinforcement.
- Key coat (optional): very thin coat which may be applied to the base coat and is intended to act as a preparatory layer for the application of the finishing coat. It can also be used for aesthetic reasons (for example, in case of “dark” ribbed finishing coats). Key coats may also be used under decorative coats.
- Finishing layer (optional). This EAD covers two different finishing layers:
 - 1) 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.
 - 2) Finishing layer with prefabricated strips made of material based on polymeric binder which may be bound with a mineral content; and composed of:
 - Specific adhesive to glue prefabricated strips on the base coat.
 - Prefabricated strips with a maximum weight 7,5 kg/m² and maximum thickness 7 mm, excluding the adhesive.
 - Grout (optional) to fill the joints between prefabricated strips.

Prefabricated strips themselves can be made of the same material as grout and/or adhesive.

- Decorative coat (optional): coat which generally contributes to the aesthetic finishing (to cover efflorescence, etc.) of the finishing layer and can also provide supplementary protection against weathering.

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

- Powder (dry mortar) blended at the factory that requires only mixing with a quantity of water according to MPII.
- Powder requiring addition of extra binder.
- Powder requiring addition of filler (e.g., “pebble dash”).
- Paste requiring addition of cement.
- Ready to use paste, supplied in workable consistency.

Minimum data for describing the base coat are: chemical nature of the product, maximum grain size, density, thickness of application and coverage, if relevant, the percentage of dilution (mixing rate). Besides, when the reaction to fire of the ETICS is assessed, also ash content and, if relevant, heat of combustion.

Minimum data for describing the glass fibre mesh (standard and reinforced) are: dimensions, mesh size, mass per unit area and, coverage rate, when the reaction to fire of the ETICS is assessed, also ash content and, if relevant, heat of combustion.

Minimum data for describing the finishing coat are: chemical nature of the product, maximum grain size, density, if relevant, the percentage of dilution, thickness of application and coverage. Besides, when it is relevant for reaction to fire of the ETICS, also ash content and, if relevant, heat of combustion.

Minimum data for describing the adhesive, prefabricated strips and grout are: chemical nature of prefabricated strips, maximum grain size, thickness of application, dimension parameters, mass per unit area. Besides, when the reaction to fire of the ETICS is assessed, also ash content and, if relevant, heat of combustion.

Minimum data for describing the key coat and the decorative coat are: type of material and coverage. Besides, when the reaction to fire of the ETICS is assessed, also thickness, ash content and, if relevant, heat of combustion.

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

1.2.1 Intended use(s)

This EAD covers the intended use of ETICS on new or existing (retrofit) vertical building external walls ($\pm 5^\circ$ with respect to the vertical plane).

The walls are made of masonry (bricks, blocks or stones) or concrete (cast in situ or as prefabricated panels) with or without rendering systems.

The ETICS gives the building wall to which it is applied, additional thermal insulation and protection from effects of weathering.

ETICS are not intended to ensure the airtightness of the building.

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 with MW, EPS, as thermal insulation product materials for the intended use of 50 years, and a working life of the ETICS with other thermal insulation product materials (as given in Table 1.1.2.1) 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 works⁵.

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 Specific terms

1.3.1.1 Substrate

The term "substrate" refers to a wall or to a 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 rendering systems, paints, tiles or prefabricated strips.

- Masonry walls:

Walls constructed from units of burnt clay, concrete, calcium silicate, autoclaved aerated concrete or stone, laid using mortar, adhesive or both.

- Concrete walls:

Walls made of concrete, either cast in situ or prefabricated at the factory.

1.3.1.2 ETICS composition

Product specified by the comprising components: adhesive (see Clause 1.1.1), factory-made thermal insulation product, (see Clause 1.1.2), mechanical fixing devices (if relevant, depending on the fixing methods (see Clause 1.1.3), and rendering system (see Clause 1.1.4).

1.3.1.3 ETICS

A system of adjacent layers consisting of the components listed in Clause 1.3.1.2. The system is fixed to the substrate using adhesive (see Clause 1.3.1.4) or mechanical fixing devices (see Clause 1.3.1.16) with or without an adhesive bed, in such way that no air ventilation occurs between the substrate and the thermal insulation layer. The continuous thermal insulation layer is faced with a rendering system consisting of two or more layers, one of which contains a reinforcement (see Clause 1.3.1.10). The rendering system (see

⁵ 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.

Clause 1.3.1.8) is applied directly to the thermal insulation boards, without any air gap or a disconnecting layer. Ancillary components can be used as optional components (see Clause 1.3.1.22).

1.3.1.4 Adhesive

See Clause 1.1.1.

1.3.1.5 Supplementary adhesive

The adhesive (see Clause 1.1.1) used in mechanically fixed ETICS with supplementary adhesive may serve to level the substrate and possibly distributing vertical load due to self-weight of ETICS to the substrate. The adhesive may also be used in purely mechanically fixed ETICS as an adhesive bed to level the substrate.

1.3.1.6 Thermal insulation product

A product with a significantly low thermal conductivity which is used to provide improved thermal resistance to the substrate.

1.3.1.7 Thermal insulation type

Thermal insulation products are considered of the same type when they are made from the same material (e.g., expanded polystyrene (EPS) or mineral wool (MW)) and share general structural characteristics, like fibre orientation, surface treatment (faced, unfaced) and structure (multi-layered, composite).

Examples of different thermal insulation product types are: mineral wool board, mineral wool lamella; natural cork and expanded cork; expanded polystyrene, and extruded polystyrene foam, EPS cut from big blocks and EPS spumed in moulds (e.g., “perimeter”), double density mineral wool, etc.

Note: When the assessment of an essential characteristic is affected by the thermal insulation type, the relevant clause defines the one to be used.

1.3.1.8 Rendering system

See Clause 1.1.4.

1.3.1.9 Reinforced base coat

Base coat with embedded reinforcement.

1.3.1.10 Reinforcement

Glass fibre mesh embedded in base coat which can differ in:

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

1.3.1.11 Prefabricated strips

See Clause 1.1.4, point 2.

1.3.1.12 Finishing layer

Finishing layer is an optional component consisting in the options described in Clause 1.1.4 point 1 and point 2.

1.3.1.13 Finishing coat

See Clause 1.1.4, point 1.

1.3.1.14 Finishing coat type

Finishing coats are considered of the same type when the only relevant difference between them is due to the size of aggregates.

Note: When the assessment of an essential characteristic is affected by the different superficial structure of finishing coats (floated or ribbed, etc.) the relevant clause defines the one to be used.

1.3.1.15 Key coat and decorative coat

See Clause 1.1.4.

1.3.1.16 Mechanical fixing devices

Mechanical fixing device is a general term used to identify any fixing device of ETICS such as plate anchor, spiral anchor, injection and powder-actuated fasteners but also profiles, pins or any special fixing device. See Clause 1.1.3.

1.3.1.17 Supplementary mechanical fixing devices

Mechanical fixing devices (e.g., profiles, anchors/fasteners, 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.

1.3.1.18 Flush installation

Flush (surface) installation is when the position of plate anchors is flush with the thermal insulation.

1.3.1.19 Countersunk installation

Countersunk installation is when the position of the plate of the anchor is set deeper than flush, together with a thermal insulation plug or PU-foam on top of the plate part.

1.3.1.20 Countersunk installation of spiral anchors

Deep countersunk installation with a thermal insulation plug on top to be used for spiral anchors (no plate included).

1.3.1.21 Injected installation

Injected installation (flush (surface) or countersunk installation) of the anchor body (with plate or without plate) to be injected by the filling/expanded material, filling /expanded material is on top of the body of anchor.

1.3.1.22 Ancillary components

Ancillary components are ETICS complementary products according to the MPII that are used to treat specific building details such as connections, transitions, endings, etc. e.g., to form joints (i.e., mastics, corner strips, etc.); to give specific protection (i.e., mastic, joint-covers) or to connect them to adjacent building structures (i.e., apertures, corners, parapets, corner profiles, base profiles, etc.).

These ancillary components are not part of ETICS covered by this EAD.

1.3.1.23 Organic content

Total amount of organic substances as part of a component or a product related to the mass in cured and dried condition measured at 450 °C (see Clause A.6.2) or at 625 °C (only for glass fibre mesh, see EAD 040016-01-0404 Clause 2.2.2).

1.3.1.24 Amount

Quantity of a product or coverage expressed in g/cm² or in l/m² relation to the surface area. The amount is relevant to assess product with a thickness < 1 mm such as glass fibre mesh, key coat and decorative coat.

1.3.1.25 Extended application rules

Rules established to extend the validity of test results from various worst configurations to better ones.

1.3.2 Symbols

Symbols / Acronyms	Description	Unit
A	Surface of the specimen.	m ²
ANP	Assessment of the propensity for continuous smouldering combustion is not possible.	---
B	Minimum value of failure resistance of the adhesive to the thermal insulation product.	kPa
B _s	Bonded surface area of ETICS.	%
c	Tangent stiffness.	kN/mm
C and C _{tr}	Spectrum adaptation in terms of airborne sound insulation.	dB
C _a	Geometric factor.	---
CG	Cellular glass.	---
d	Deformation.	mm
C _s	Statistical correction factor.	---
d _{mean,position,condition}	Mean (arithmetic average value) of displacement in pull-through test at a position of anchor in the centre“ or “joint, at a tested condition of the thermal insulation.	mm
d _{Fmax,position,condition}	Displacement value corresponding to the maximum load at a position of the anchor at the “centre“ or “joint” at the tested condition of the thermal insulation.	mm
dr	Thickness of the base coat with embedded reinforcement.	mm
EPS	Expanded polystyrene.	---
EXAP-rules	Extended application rules.	---
F	Measured value of the load determined by different tests (e.g., static foam block test, pull-through or render strip tensile strength).	kN
F _{min}	Minimum value of the load determined by different tests (e.g., static foam block test, pull-through or render strip tensile strength).	kN
F _{mean}	Mean value (arithmetic average value) of the load determined by different tests.	kN

Symbols / Acronyms	Description	Unit
$F_{B-I,min,condition}$	Minimum value of bond strength between base coat and insulation product under different conditions.	kPa
$F_{A-S,min,condition}$	Minimum value of bond strength between adhesive and insulation product under different conditions.	kPa
$F_{A-I,min,condition}$	Minimum value of bond strength between adhesive and insulation product under different conditions.	kPa
$F_{B-I,mean,condition}$	Mean value (arithmetic average value) of bond strength between base coat and insulation product under different conditions.	kPa
$F_{A-S,mean,condition}$	Mean value (arithmetic average value) of bond strength between adhesive and insulation product under different conditions.	kPa
$F_{A-I,mean,condition}$	Mean value (arithmetic average value) of bond strength between adhesive and insulation product under different conditions.	kPa
$F_{min,HWC}$	Minimum value of bond strength of finishing layers tested on the rig after HWC test conditioning.	kPa
$F_{mean,HWC}$	Mean value (arithmetic average value) of bond strength of finishing layers tested on the rig after HWC test conditioning.	kPa
$F_{min,HWCFT}$	Minimum value of bond strength of base coat, tested on the rig after HWCFT test conditioning.	kPa
$F_{mean,HWCFT}$	Mean value (arithmetic average value) of bond strength of base coat, tested on the rig after HWCFT test conditioning.	kPa
$F_{min}F_{B-I,F-T}$	Minimum value of bond strength of base coat, tested after freeze thaw test conditioning	kPa
$F_{mean}F_{B-I,F-T}$	Mean value (arithmetic average value) of bond strength of base coat, tested after HWCFT test conditioning.	kPa
$F_{5\%}$	Characteristic value of loads.	kN
$F_{5\%}F_{centre,condition}$	Characteristic value of maximum load for each fixing device placed in the centre of thermal insulation in configuration 1c, at the tested condition.	kN
$F_{5\%}F_{joint,condition}$	Characteristic value of maximum load for each mechanical fixing device placed through the reinforcement layer in the joint of thermal insulation, at the tested condition.	kN
$F_{5\%position,5mm,condition}$	Characteristic value of loads of pull-through measured within a test series of at least 5 specimens, with the same preconditioning and mechanical fixing position at displacement of 5 mm.	kN
$F_{5\%position,10mm,condition}$	Characteristic value of loads of pull-through measured within a test series of at least 5 specimens, with the same preconditioning and anchor position at displacement of 10 mm.	kN
$F_{max,i,position,condition}$	Maximum value of load of pull-through test with the same preconditioning and anchor position, calculated for each specimen.	kN
$F_{mean,postion,5mm,condition}$	Mean value (arithmetic average value) of load at 5 mm displacement of pull-through test with the same preconditioning and anchor position, calculated for one anchor.	kN
$F_{mean,position,10mm,condition}$	Mean value (arithmetic average value) of load at 10 mm displacement of pull-through test with the same preconditioning and anchor position, calculated for one anchor.	kN
$F_{centre,condition}$	Testing load in static foam test when the fixing device is placed in the centre of the thermal insulation	kN
$F_{foam block,condition}$	Mean value (arithmetic average value) of the maximum load of the three specimens in static foam test, at the tested condition.	kN

Symbols / Acronyms	Description	Unit
$F_{\text{joint,condition}}$	Maximum load for each mechanical fixing device placed through the reinforcement layer in the joint of thermal insulation, at the tested condition.	kN
$F_{\text{max,i,position,condition}}$	Maximum value of the loads of each specimen at position of the anchor at “centre” or “joint” at the tested condition of the thermal insulation.	kN
$F_{\text{render,aged}}$	Bond strength after ageing of finishing layer not tested on the rig	kN
$F_{\text{render,min,aged}}$	Minimum value of bond strength after ageing of finishing layer not tested on the rig	kN
$F_{\text{render,mean,aged}}$	Mean value (arithmetic average value) of bond strength after ageing of finishing layer not tested on the rig	kN
$F_{\text{render,F-T}}$	Bond strength after Freeze-thaw of finishing layer	kN
$F_{\text{render,min,F-T}}$	Minimum value of bond strength after freeze-thaw of finishing layer	kN
$F_{\text{render,mean,F-T}}$	Mean value (arithmetic average value) of bond strength after Freeze thaw of finishing layer	kN
G_{min}	Minimum value of shear modulus.	kPa
G_{mean}	Mean value (arithmetic average value) of shear modulus.	kPa
HC	Heating – Cooling conditioning.	---
HW	Heating – Wetting conditioning.	---
HWC	Heating – Wetting – Cooling test conditioning /cycles.	---
HWCFT	Heating – Wetting – Cooling – Freezing – Thawing test conditioning/cycles.	---
ICB	Expanded cork.	---
k	Statistic coefficient.	---
L_{crack}	Crack load.	kN
L_{ref}	Extensometer reference length.	mm
L_{spec}	Specimen free length.	mm
M	The highest value of mean values (arithmetic average value) in post expansion behaviour of PU-foam adhesive.	mm
m_{1h}	Mass of the specimen after water absorption after 1 hour.	kg
m_{24h}	Mass of the specimen after water absorption after 24 hours.	kg
m_{3min}	Mass of the specimen after water absorption after 3 minutes.	kg
MPII	Manufacturer's Product Installation Instructions.	---
MW	Mineral wool.	---
n	Number.	---
N_0	Tension force.	kN
N_{ru}	Ultimate load.	kN
N_u	Tension force $N_u = 0$ kN.	kN
NoS	The thermal insulation product does not show propensity to undergo continuous smouldering.	---
P5	Type of load-bearing boards for use in humid conditions in accordance with EN 312.	---
PE	Polyethylene.	---
PF	Phenolic foam.	---
PU or PUR	Polyurethane.	---
$PU_{f-a,mean}$	Mean value (arithmetic average value) of bond strength of PU-foam.	kPa
$PU_{f-a,min}$	Minimum value of bond strength of PU-foam.	kPa
Pt_{1mm}	Plate stiffness	kN/mm
Q_1	Maximum load at $W_{100\%}$ in the cycle preceding that in which the test specimen fails.	kPa
Q_{PCS}	Gross heat of combustion.	MJ/kg
R	Individual value of the air flow resistance.	kPa·s/m ²
R_{adhesive}	Value of thermal resistance of adhesive.	(m ² .K)/W

Symbols / Acronyms	Description	Unit
R _{ETICS}	Value of thermal resistance of ETICS.	(m ² .K)/W
RH	Relative humidity.	%
R _{insulation}	Value of thermal resistance of insulation.	(m ² .K)/W
R _k	Characteristic wind uplift resistance.	kPa
R _{render}	Value of thermal resistance of render.	(m ² .K)/W
R _{se}	External surface thermal resistance.	(m ² .K)/W
R _{si}	Internal surface thermal resistance.	(m ² .K)/W
R-value	Thermal resistance of the kit without the substrate.	(m ² .K)/W
R _w	Sound reduction index of the airborne sound insulation.	dB
R _{50,m,min}	Tensile strength within the width of mm at initial state.	N/50 mm
R _{50,m,alk}	Tensile strength within the width of mm after alkali ageing.	N/50 mm
T _{max,in}	Tensile strength within the width of 1 meter at initial state.	kN/m
T _{max,alk}	Tensile strength within the width of 1 meter mm after alkali ageing.	kN/m
S	The thermal insulation product shows propensity to undergo continuous smouldering.	---
s	Standard deviation.	---
s'	Individual values of the dynamic stiffness.	MN/m ³
SBI	Single Burning Item.	---
s _d	Equivalent air thickness.	m
s _o	Larger displacement of plate stiffness.	mm
s _u	Smaller displacement of plate stiffness.	mm
U	Thermal transmittance of the undisturbed wall, without anchors or profile penetrating in the thermal insulation layer.	W/(m ² .K)
U _c	Thermal transmittance of the disturbed wall, with anchors or profile penetrating in the thermal insulation layer.	W/(m ² .K)
VIP	Vacuum insulation panels.	---
w	Immersion in water and then drying conditioning.	---
W _{100%}	Maximum suction load of the cycles.	kPa
WF	Wood fibres.	---
WFT	Wetting – Freezing – Thawing.	---
W _i	Suction load of the cycles	kPa
W _m	Mean value (arithmetic average value) of the crack width.	mm
W _{mx}	Mean value (arithmetic average value) of the cracks width of the specimen x.	mm
W _{p,1h}	Mean value (arithmetic average value) of water absorption after 1 hour.	kg/m ²
W _{p,24h}	Mean value (arithmetic average value) of water absorption after 24 hours.	kg/m ²
W _{pi,24h}	Maximum value of water absorption after 24 hours of thermal insulation.	kg/m ²
W _{rkd}	Characteristic crack width at a determined deformation.	mm
WW	Wood wool.	---
W _{x,i}	Crack width.	mm
XPS	Extruded polystyrene.	---
ΔL	Value of the measured displacement.	mm
ΔR _{W,direct}	Weighted sound reduction indices of the basic element.	dB
ε _{m,in}	Mean value (arithmetic average value) of elongation at tensile failure at initial state.	%
ε _{m,alk}	Mean value of (arithmetic average value) elongation at tensile failure after alkali ageing.	%
ε _r	Strain obtained from measured values.	%
μ-value	Water-vapour resistance factor.	---
ψ-value	Linear thermal transmittance value of the profile.	W/(m.K)

Symbols / Acronyms	Description	Unit
$\psi(h_{\min})$	The linear thermal transmittance for the minimum thickness ($h_{\min}$) of the thermal insulation layer range intended to be used.	W/(m·K)
$\psi(h_{150})$	The linear thermal transmittance for the intermediate thickness (h_{150}) for the reference thickness of the thermal insulation layer $h = 150$ mm.	W/(m·K)
$\psi(h_{\max})$	The linear thermal transmittance for the maximum thickness ($h_{\max}$) of the thermal insulation layer range intended to be used.	W/(m·K)
λ_D	Thermal conductivity (declared value) of thermal insulation product.	W/(m·K)
χ - value	Point thermal transmittance of one anchor.	W/K
$\chi(h_{\min})$	Point thermal transmittance for the minimum thermal insulating layer thickness according to the manufacturers specification.	W/K
$\chi(h_{150})$	Point thermal transmittance for thermal insulating layer thickness of 150 mm.	W/K
$\chi(h_{\max})$	Point thermal transmittance for the maximum thermal insulating layer thickness according to the manufacturers specification.	W/K
θ_{se}	Temperature of external surface.	°C
θ_{si}	Temperature of internal surface.	°C
$\sigma_{m,\min}$	Compressive strength of thermal insulation product (minimum value).	kPa
$\sigma_{mt,dry}$	Measured value of tensile strength perpendicular to the faces of thermal insulation product in dry condition.	kPa
$\sigma_{mt,wet}$	Measured value of tensile strength perpendicular to the faces of thermal insulation product in wet condition.	kPa
$\sigma_{mt,\min,dry}$	Minimum value of tensile strength of thermal insulation product perpendicular to faces in dry condition.	kPa
$\sigma_{mt,\min,wet}$	Minimum value of tensile strength of thermal insulation product perpendicular to faces in wet condition.	kPa
$\sigma_{mt,mean,wet}$	Mean value (arithmetic average value) of tensile strength of thermal insulation product perpendicular to faces in wet condition.	kPa
$T_{\min}$	Minimum value of shear strength.	kPa
T_{mean}	Mean value (arithmetic average value) of shear strength.	kPa

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire of ETICS	2.2.1.1	Class and description ¹
2	Reaction to fire of the thermal insulation product (*)	2.2.1.2	Class
3	Reaction to fire performance of the PU-foam adhesives (*)	2.2.1.3	Class
4	Façade fire performance	2.2.2	Level/Class/Description (as relevant)
5	Propensity to undergo continuous smouldering	2.2.3	Description
Basic Works Requirement 3: Hygiene, health and the environment			
6	Content, emission and/or release of dangerous substances. Leachable substances	2.2.4.1	Description and level EC20-values for each dilution ratio [% within ... hours/days]
7	Water absorption of the base coat and the rendering system (*)	2.2.5.1	Level $W_{p,1h}$ [kg/m ²], $W_{p,24h}$ [kg/m ²].
8	Water absorption of the thermal insulation product (*)	2.2.5.2	Level $W_{pi,24h}$ [kg/m ²].
9	Watertightness. Hygrothermal behaviour (**)	2.2.6	Description
10	Watertightness. Freeze – thaw resistance	2.2.7	Description
11	Impact resistance	2.2.8	Level, Description.
12	Water vapour permeability of the rendering system (equivalent air thickness) (*)	2.2.9.1	Level s_d [m] ² .
13	Water vapour permeability of the thermal insulation product (Water-vapour resistance factor) (*)	2.2.9.2	Level μ -value [-].

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 4: Safety and accessibility in use			
14	Bond strength between the base coat and the thermal insulation product (*)	2.2.10.1	Level and description of failure mode $F_{B-I,min,dry}$ [kPa], $F_{B-I,mean,dry}$ [kPa], $F_{B-I,min,HWC}$ [kPa], $F_{B-I,mean,HWC}$ [kPa], Or³ $F_{B-I,min,HWCFT}$ [kPa], $F_{B-I,mean,HWCFT}$ [kPa], $F_{B-I,min,F-T}$ [kPa]⁴, $F_{B-I,mean,F-T}$ [kPa]⁴.
15	Bond strength between the adhesive and the substrate (*)	2.2.10.2	Level and description of failure mode $F_{A-S,min,dry}$ [kPa]⁵, $F_{A-S,mean,dry}$ [kPa]⁵, $F_{A-S,min,2d,2h}$ [kPa]⁵, $F_{A-S,mean,2d,2h}$ [kPa]⁵, $F_{A-S,min,2d,7d}$ [kPa]⁵, $F_{A-S,mean,2d,2h}$ [kPa]⁵.
16	Bond strength between the adhesive and the thermal insulation product (*)	2.2.10.3	Level and description of failure mode $F_{A-I,min,dry}$ [kPa]⁵, $F_{A-I,mean,dry}$ [kPa]⁵, $F_{A-I,min,2d,2h}$ [kPa]⁵, $F_{A-I,mean,2d,2h}$ [kPa]⁵, $F_{A-I,min,2d,7d}$ [kPa]⁵, $F_{A-I,mean,2d,7d}$ [kPa]⁵.
17	Bond strength of the PU-foam adhesives (*)	2.2.10.4	Level and description of failure mode $PU_{f-a,min}$ [kPa], $PU_{f-a,mean}$ [kPa].
18	Fixing strength transverse displacement test with tension load (*)	2.2.11.1	Level and description $F_{5\%}$ [kN]⁶ $\sigma_{mt,min,dry}$ [kPa]⁷, T_{min} [kPa]⁷, G_{min} [kPa]⁷, $\sigma_{m,min}$ [kPa]⁷.
19	Fixing strength transverse displacement test without tension load (*)	2.2.11.2	Level $F_{5\%}$ [kN]⁶ $\sigma_{mt,min,dry}$ [kPa]⁷, T_{min} [kPa]⁷, G_{min} [kPa]⁷ $\sigma_{m,min}$ [kPa]⁷.

No	Essential characteristic	Assessment method	Type of expression of product performance
20	Wind load resistance. Pull-through resistance	2.2.12.1	Level $F_{5\% \text{ position, 5mm, condition}}$ [kN] ⁸ , $F_{5\% \text{ position, 10mm, condition}}$ [kN] ⁸ , $F_{\text{mean, position, condition}}$ [kN] ⁹ , $d_{\text{mean, position, condition}}$ [mm] ⁹ , $\sigma_{\text{mt, min, dry}}$ [kPa] ⁷ , $\sigma_{\text{m, min}}$ [kPa] ⁷ , $Pt_{1\text{mm}}$ [kN/mm], F [kN/mm] ¹⁰
21	Wind load resistance. Static foam block resistance	2.2.12.2	Level $F_{5\%}$ $F_{\text{centre, condition}}$ [kPa] ¹¹ , $F_{5\%}$ $F_{\text{joint, condition}}$ [kPa] ¹¹ , $\sigma_{\text{mt, min, dry}}$ [kPa] ⁷ , $\sigma_{\text{m, min}}$ [kPa] ⁷ , $Pt_{1\text{mm}}$ [kN/mm], F [kN/mm] ¹⁰ $F_{5\%}$ $F_{\text{foam block, condition}}$ [kN] ¹² $F_{\text{foam block, condition}}$ [kN] ¹²
22	Wind load resistance. Dynamic wind uplift resistance	2.2.12.3	Level Q_1 [kPa] R_k [kPa] C_s [-] $\sigma_{\text{mt, min, dry}}$ [kPa] ¹³ , $\sigma_{\text{m, min}}$ [kPa] ¹³ .
23	Tensile strength perpendicular to the faces of the thermal insulation product in dry conditions (*)	2.2.13.1	Level $\sigma_{\text{mt, mean, dry}}$ [kPa]
24	Tensile strength perpendicular to the faces of the thermal insulation product in wet conditions (*)	2.2.13.2	Level $\sigma_{\text{mt, min, wet}}$ [kPa] ¹⁴ , $\sigma_{\text{mt, mean, wet}}$ [kPa] ¹⁴ .
25	Shear strength and shear modulus of elasticity of the thermal insulation product (*)	2.2.14	Level T_{min} [kPa] ¹³ , T_{mean} [kPa] ¹³ , G_{min} [kPa] ¹³ , G_{mean} [kPa] ¹³ .
26	Pull-through resistance of mechanical fixing devices from profiles (*)	2.2.15	Level and description F_{min} [kN], F_{mean} [kN].
27	Render strip tensile strength (*)	2.2.16	Level w_{rkd} [mm]
28	Shear strength and shear modulus of the PU-foam adhesives (*)	2.2.17	Level T_{mean} [kPa]; G_{mean} [kPa].
29	Post expansion behaviour of the PU-foam adhesives (*)	2.2.18	Level M [mm].

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 5: Protection against noise			
30	Airborne sound insulation	2.2.19	Level description $\Delta R_{W,direct}$ [dB] ¹⁵ .
31	Dynamic stiffness of the thermal insulation product (*)	2.2.19.1	Level s' [MN/m ³] ¹³ .
32	Air flow resistance of the thermal insulation product (*)	2.2.19.2	Level R [kPa·s/m ³]
Basic Works Requirement 6: Energy economy and heat retention			
33	Thermal resistance of ETICS without influence of mechanical fixing devices	2.2.20.1	Level R -value [m ² ·K)/W]
34	Thermal conductivity and thermal resistance of the thermal insulation product (*)	2.2.20.2	Level λ_D [W/(m·K)]. $R_{insulation}$ [(m ² ·K)/W] ¹⁶ .
35	Thermal transmittance of fixing devices (*)	2.2.20.3	Level χ -value [W/K] ¹⁷ ψ -value [W/(m·K)] ¹⁸
Aspects of durability			
36	Bond strength (*) after ageing of finishing layers tested on the rig	2.2.21.1	Level $F_{min,HWC}$ [kPa], $F_{mean,HWC}$ [kPa], Or ³ $F_{min,HWCFT}$ [kPa], $F_{mean,HWCFT}$ [kPa].
37	Bond strength (*) after ageing of finishing layers not tested on the rig	2.2.21.2	Level $F_{render,min,aged}$ [kPa], $F_{render,mean,aged}$ [kPa], Or ⁴ $F_{render,min,F-T}$ [kPa], $F_{render,mean,F-T}$ [kPa].

No	Essential characteristic	Assessment method	Type of expression of product performance
38	Tensile strength and elongation (*) of the glass fibre mesh at initial state and after ageing in alkali conditions	EAD 040016-01-0404 Clause 2.2.7	Level At initial state: $R_{50,m,min}$ [N/50 mm] and /or $T_{max,in}$ [kN/m]; Elongation $\varepsilon_{m,in}$ [%]; After ageing in alkali condition warp / weft: $R_{50,m,alk}$ [N/50 mm] and /or $T_{max,m,alk}$ [kN/m]¹⁹; Elongation $\varepsilon_{m,alk}$ [%]²⁰.
(*) This essential characteristic of the ETICS is assessed by means of the relevant kit components and their connections. (**) This essential characteristic of the ETICS is linked to aspects of durability. (1) Accompanied by the combination of components covered by the achieved class and by relevant data of components in accordance with Annex A (see Clause 2.2.1.1). (2) Accompanied by the measured thickness of rendering system [mm] and the conditioning applied (see Clause 2.2.9.1). (3) Depending on the performed conditioning according to Clause 2.2.6. (4) If relevant according to Clause 2.2.7. (5) Accompanied by the measured thickness of adhesive [mm] (see Clause 2.2.10.2 or Clause 2.2.10.3). (6) Accompanied by graph, by description of the configuration with number, position of fixings and by the percentage of bonded area of adhesive (see Clause 2.2.11.1/2). (7) Measured value of thermal insulation product. (8) Accompanied by graph and the tested thickness of the specimen. (9) The value shall be stated only if the maximum load is reached before 5 mm of displacement. (10) Values related to the mechanical fixing device (see Clause L.2.3). (11) According to the configuration see Clause 2.2.12.2. (12) The value applies only for ETICS fixed by profiles (see Clause 2.2.12.2). (13) Measured value of thermal insulation product, accompanied by the tested thickness. (14) Accompanied by obtained ratio between tested values of tensile strength after wet condition and tensile strength after dry condition (Clause 2.2.13.1). (15) Accompanied by description of tested configuration and the weight of the rendering system. (16) The thermal resistance of thermal insulation for each nominal thickness, or at least the minimum thermal resistance for the minimum thickness of thermal insulation (Clause 2.2.20.2). (17) The value shall be expressed for punctual fixings (anchors). (18) The value shall be expressed for linear fixings (profiles). (19) The value shall be expressed in both warp and weft directions including the type of glass fibre mesh (see Clause 2.2.16). (20) The value shall be expressed with value of residual tensile strength within the width of 1 meter after alkali ageing.			

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

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

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

The ETICS shall be described in the ETA in accordance with the minimum data for each component, as indicated in Clause 1.1.

2.2.1 Reaction to fire

2.2.1.1 Reaction to fire of the ETICS

Purpose of the assessment

The purpose of this assessment is to provide the reaction to fire of the ETICS.

Assessment method

At least the worst-case scenario shall be taken into account for the relevant reaction to fire tests. Provisions for its definition as well as mounting and fixing rules for the relevant reaction to fire tests are given in Annex A. The ETICS shall be tested using the method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The ETICS shall be classified in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.

In addition, reaction to fire of the thermal insulation products (see Clause 2.2.1.2) and reaction to fire of the PU-foam adhesives (see Clause 2.2.1.3) shall also be assessed.

Expression of results

The following data shall be stated in the ETA:

- The reaction to fire class of the ETICS (either for the worst-case for all variants or for each worst-case for defined sub-groups) in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.
- The combination of components of the ETICS covered by the achieved reaction to fire classification, according to the extended application rules given in Clauses A1 to A.5.
- Relevant data of components in accordance with Annex A considered in the reaction to fire assessment.

2.2.1.2 Reaction to fire of thermal insulation product

Purpose of the assessment

The purpose of the test method herein included is the assessment of reaction to fire of the thermal insulation product, which is decisive for reaction to fire of the ETICS.

Assessment method

The thermal insulation products shall be tested, using the method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The thermal insulation products shall be classified in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.

Mounting and fixing provisions shall be in accordance with the technical specifications given in Table 1.1.2.1 depending on the thermal insulation material. If the technical specification does not give information regarding the mounting and fixings provisions, standard EN 15715 shall be followed.

Expression of results

The following data shall be stated in the ETA:

- the reaction to fire class of thermal insulation product in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.

For the non-tested configurations, results shall apply according to the extended application rules given in Clauses A.1 to A.5.

2.2.1.3 Reaction to fire of PU-foam adhesives

Purpose of the assessment

This characteristic is only applicable when the ETICS contain PU-foam adhesive. The purpose of the test method herein included is the assessment of reaction to fire of PU-foam adhesive which is decisive for reaction to fire of ETICS.

Assessment method

At least, the worst-case scenario selected according to the following parameters shall be tested:

- Each different composition of PU-foam.
- The highest organic content (where relevant).
- The highest thickness, and
- The highest coverage (amount).

The PU-foam adhesive shall be tested, using the method(s) relevant for the corresponding reaction to fire class in accordance with EN 13501-1. The PU-foam adhesive shall be classified in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.

The tests shall be performed on specimens applied on a standard substrate in accordance with EN 13238.

Expression of results

The following data shall be stated in the ETA:

- The reaction to fire class of PU-foam adhesives in accordance with the Commission Delegated Regulation (EU) No 2016/364 in conjunction with EN 13501-1.

For the non-tested PU-foams, results shall apply according to the extended application rules given below:

- The same PU-foam composition only.
- The equal or lower organic content (where relevant).
- The equal or lower thickness and the equal or lower coverage.

- The equal or lower nominal apparent density.

2.2.2 Façade fire performance

If the manufacturer intends to declare the façade fire performance of the product, in the absence of a European assessment approach, the ETA shall state the results of the product assessment(s) together with the assessment method(s) required by the regulatory provisions of those countries, in which the manufacturer intends to make the product available on the market, according to the Table given in Annex B.

2.2.3 Propensity to undergo continuous smouldering

Purpose of the assessment

The purpose of the assessment is to provide the propensity to undergo continuous smouldering of ETICS by means of the propensity to undergo continuous smouldering of the thermal insulation product which is decisive for this ETICS' characteristic.

Assessment method

At least, the worst-case scenario selected according to the extension of the test results given in Annex C. shall be tested.

The propensity to undergo continuous smouldering of the thermal insulation product shall be 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 C.

Expression of results

In ETA shall be stated the propensity to undergo continuous smouldering in accordance with EN 16733, Clause 11, specifying the information of Table 2.2.3.1.

Table 2.2.3.1: Propensity to undergo continuous smouldering in accordance with EN 16733

Performance in accordance with 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

For the non-tested configurations, results shall apply according to the indication given in Clause C.

2.2.4 Content, emission and/or release of dangerous substances

The performance of the product regarding 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 manufacturer⁶ after identifying the release scenarios taking into account the intended use(s) 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 with indoor air.

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

2.2.4.1 Leachable substances

For the intended use covered by the release scenario S/W2 the performance of the ETICS concerned leachable substances shall be assessed.

The leachable substances assessment of the ETICS is carried out by means of the assessment of the most relevant components materials, which are the materials of the rendering systems.

The rendering system shall be applied on inert substrate (sandblasted glass or stainless steel) (hereafter "specimen").

A leaching test with subsequent eluate analysis take place, each in duplicate. Leaching tests of the test specimens are conducted in accordance with EN 16637-2. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be (80 ± 10) l/m².

The specimen to be tested shall be assembled according to MPII. Preparation is performed using $\frac{3}{4}$ 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 specimens 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 in accordance with EN ISO 6341.
- Toxicity test with algae in accordance with EN ISO 15799.
- Luminescent bacteria test in accordance with EN ISO 11348-1/A1, EN ISO 11348-2/A1 or EN ISO 11348-3/A1.

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

⁶ The manufacturer may be asked to provide to the TAB the REACH related information which shall accompany the DoP (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
- provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS, taking into account the installation conditions of the construction product and the release scenarios resulting from there.

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

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 in accordance with OECD Test Guideline 301 part A, B or E.

Expression of results

In the ETA shall be stated the determined toxicity in biological tests and expressed as EC20-values for each dilution ratio. The 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

Water absorption of the ETICS shall be assessed by means of the water absorption of the reinforced base coat and the rendering system on the thermal insulation product, and the water absorption of the thermal insulation product, both of which are representative of the ETICS.

2.2.5.1 Water absorption of the base coat and the rendering system

Purpose of the assessment

The purpose of the assessment is to provide water absorption of the reinforced base coat and the rendering system, which are decisive for water absorption of the ETICS.

The level of water absorption is also an input for a selection of finishing coats which shall be applied on the specimen to be subjected to hygrothermal testing and also for the decision whether or not the freeze-thaw test is to be performed (see Clause D.1, which provides decision making flow-chart serving for minimizing the number of tests).

Assessment method

At least, the worst-case scenario selected according to the extension of the test results given in Clause E.4 shall be tested.

Water absorption of the reinforced base coat and the rendering system applied on the thermal insulation product shall be tested according to the method described in Annex E.

Tests shall be carried out for the configurations defined in Clause E.1.1.

The mean value of water absorption of the reinforced base coat or of the rendering system after one hour shall be less than 1 kg/m².

Expression of results

The following data shall be stated in the ETA:

- The mean⁷ value of water absorption after 1 hour ($W_{p,1h}$) and after 24 hours ($W_{p,24h}$) in kg/m², rounded to the nearest 0,1 kg/m².

For the non-tested configurations, results shall apply according to the extended application rules given in Clause E.4.

2.2.5.2 Water absorption of thermal insulation product

Purpose of the assessment

⁷ The mean value is the arithmetic average value.

The purpose of the assessment is to provide the water absorption of the thermal insulation product, which is relevant for all thermal insulation products.

Assessment method

The water absorption of the thermal insulation product shall be assessed for each relevant thermal insulation type used in the ETICS by means of the short-term water absorption by partial immersion tested in accordance with Method A of EN ISO 29767.

The maximum value of water absorption after 24 hours of the thermal insulation product shall not be greater than 1 kg/m².

Expression of results

The following data shall be stated in the ETA:

- The maximum value of water absorption expressed in kg/m² after 24 hours ($W_{pi,24h}$).

2.2.6 Watertightness. Hygrothermal behaviour

Purpose of the assessment

The purpose of the assessment is to determine the behaviour of the ETICS when it is submitted to hygrothermal test conditionings for detecting possible defects that may affect its watertightness.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause F.4 shall be tested.

The following test conditionings shall be considered depending on the environmental climatic conditions (defined in the MPII) where the ETICS is intended to be used:

Test conditioning HWC (reference test conditioning where no definition is provided in the MPII):

- HWC: heating and wetting (HW) + heating and cooling (HC).

Test conditioning HWCFT:

- HWCFT: heating and wetting (HW) + heating and cooling (HC) + wetting, freezing and thawing (WFT).

Note: HWCFT test conditioning does not replace the freeze-thaw resistance test described in Clause 2.2.7.

The hygrothermal behaviour shall be assessed in accordance with:

- 1) EN 16383 Clause 7, parts a) and b), for hygrothermal cycles under test conditioning HWC.
- 2) EN 16383 Clause 7, parts a), b) and c), for hygrothermal cycles under test Conditioning HWCFT.

Test specimen shall be prepared in accordance with EN 16383 Clause 6. The outcome of water absorption results of the rendering system (Clause 2.2.5.1) determines the finishing coats to be considered in the test specimen. Additional information related to preparation of specimen are reported in Clauses F.1 and F.2.

Based on the outcome of the water absorption test, Clause D.1 and extended application rules in Clause F.4 give information of the products (e.g., the number of finishing coats) to be tested on the rig in order to minimize the number of tests.

Testing devices shall be in accordance with EN 16383 Clause 5 and the principles related to the preparation of the rig, described in Clause F.2, shall be followed.

Expression of results

The following data shall be stated in the ETA:

- Hygrothermal test conditioning performed (Test condition HWC or Test condition HWCFT).
- The statement “ETICS is hygrothermal cycles (HWC or HWCFT) resistant” applies if no defects defined in Clauses F.2.2 and F.3 are observed or “ETICS is not hygrothermal cycles (HWC or HWCFT) resistant” applies if any defect as defined in Clauses F.2.2 and F.3 is observed.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause F.4.

2.2.7 Watertightness. Freeze-thaw resistance

Purpose of the assessment

The purpose of the assessment is to determine the behaviour of the ETICS when it is submitted to freeze-thaw test conditioning for detecting possible defects that may affect its watertightness.

The relevance of this behaviour is based on the analysis of results of water absorption (see Clauses 2.2.5 and D.1). Therefore, freeze-thaw resistance shall be tested when the mean value of water absorption of the base coat or the rendering system after 24 hours is equal or higher than 0,5 kg/m² for:

- The reinforced base coat;

or

- All types of rendering systems (base coat with finishing layers).

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause G.4 shall be tested.

Freeze–thaw resistance shall be tested in accordance with the method described in Annex G.

Tests shall be carried out for the configurations defined in Clause G.1.

After the freeze-thaw cycles test, the bond strength test shall be performed in accordance with Clause I.1.1 and to Clause 2.2.21.2 on each specimen submitted to freeze-thaw cycles.

Expression of results

The following data shall be stated in the ETA:

- The statement “ETICS is freeze-thaw resistant” applies if either the water absorption of both reinforced base coat and the rendering system after 24 hours is less than 0,5 kg/m² (see Clause 2.2.5.1), or no defects in accordance with Clause G.3 are observed after freeze-thaw cycles. If any defect in accordance with Clause G.3 is observed after freeze-thaw cycles, the statement “ETICS is not freeze-thaw resistant” applies.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause G.4.

2.2.8 Impact resistance

Purpose of the assessment

The purpose of the assessment is to provide the hard body impact resistance of ETICS after the test conditionings, taking into account the environmental climatic conditions defined in the MPII, (see

Clause 2.2.6) with respect to the impact energy in accordance with the intended use conditions defined in the MPII.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause H.4 shall be tested.

Depending on the impact energy, one of the following methods shall be used:

To assess up to 10 Joule impact energies (3 and/or 10 Joules) two alternative and equivalent methods are possible:

- In accordance with Annex H;
- or
- In accordance with EN 13497⁸.

To assess more than 10 Joule impact energy (15 J, 20 J, 30 J, 40 J, 60 J, 80 J, 100 J, 125 J, 150 J, 175 J, 200 J) the method shall be in accordance with EN 13497.

Tests shall be carried out on the configurations defined in Clause H.1.1.

Expression of results

The results coming from different alternative methods described in Annex H are considered equivalent provided that they are expressed in accordance with criteria described in Clause H.3⁹.

The following data shall be stated in the ETA regardless the assessment method used:

- The level of damage A, B, C and D (see Clause H.3) for rendering systems of ETICS, the information if testing has been done on rig or out of rig on small specimens (HWC, HWCFT or w) and the energy level of the test in Joules. The result shall be expressed as follows:
 - Level of damage (A, B, C, D) with two subscripts; the first subscript identifies the energy level of the test (3 J, 10 J or above 15 J to 200 J) and the second subscript identifies the preconditioning before the test and the impact test.
 - “HWC” – if the test was performed on the rig subjected to hygrothermal cycles (heating-wetting-cooling),
 - “HWCFT” - if the test was performed on the rig subjected to hygrothermal cycles (heating-wetting-cooling-freezing and thawing),
 - “w” – if the specimen was conditioned by immersion in water and then dried.

Example:

C_{3,HWC} means that the level of damage C was identified, energy level of the test was 3 J and the test specimen was preconditioned by HWC cycles on the rig;

or

⁸ The two test methods for assessing impact resistance at 3 J and/or 10 J (ISO 7892 and EN 13497) mainly differ in the test equipment, which uses slightly different balls dropping by a slightly different drop height. These differences are considered negligible because both setups deliver the same impact energy to the test surface.

⁹ The results of impact resistance obtained according to previous version of this EAD (EAD 040083-00-0404) may be used, as an option to avoid retesting, provided that the results (level of damage) are expressed according to the new criteria given in Annex H .3.

$B_{100,HWCFT}$ means that the level of damage B was identified, energy level of the test was 100 J and specimen was preconditioned by HWCFT cycles on the rig.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Annex H.4.

2.2.9 Water vapour permeability

Water permeability of the ETICS shall be assessed by means of the determination of the equivalent air thickness of the rendering system and of the resistance to water vapour diffusion of the thermal insulation product.

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

Purpose of the assessment

The purpose of the assessment is to provide the equivalent air thickness of the rendering system, which is relevant for water vapour permeability of the ETICS.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results indicated below shall be tested.

Water vapour permeability of the rendering system shall be tested in accordance with the method described in EN ISO 7783, conditioning Method B Clause 6.2.3 which is the reference conditioning. Conditioning by Method A Clause 6.2.3 may also be used because it provides reliable results of the water permeability even though they are obtained with different conditioning.

The specimens are prepared by applying the rendering to the thermal insulation product in accordance with the MPII. After curing for 28 days at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity, the rendering system is separated from the thermal insulation product by cutting the thickness of the insulation so as to leave a thin layer of thermal insulation (about 1mm) to be removed with a trowel without damaging the rendering system. Each reinforced base coat shall be covered with each type of finishing layer.

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 layer 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). In case of finishing coats with different structure (ribbed or floated/smooth aspect) the results on the floated structure apply to the ribbed finishing coats.

Expression of results

The following data shall be stated in the ETA:

- The mean value of the resistance to water vapour diffusion (s_d) rounded to 1/10 m, with precision on the corresponding tested rendering system(s) and measured thickness of rendering system expressed in mm. The value (s_d) is expressed in m.
- Reference to test method applied EN ISO 7783, method A of clause 6.2.3 or EN ISO 7783, method B of clause 6.2.3.

For the non-tested configurations, results shall apply according to the following extended application rules:

- Base coat: the same base as the one tested and applied with the same or lower thickness.
- Standard mesh: any.

- Reinforced mesh: any.
- Key coat: test results obtained with a key coat apply only to the same key coat as the one tested with the same or lower amount applied; test results obtained with a key coat apply to the use without a key coat.
- Finishing coat: any finishing coat of the same type (see Clause 1.3.1.14) applied with the same or lower thickness as the one tested. In case of finishing coats with different structure (ribbed or floated/smooth) the results on the floated structure apply to the ribbed finishing coats.
- Decorative coat: test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or lower amount applied; test results obtained with a decorative coat apply to the use without a decorative coat.
- When evaluating ETICS with prefabricated strips, the test results are valid only for the same render strip as the one tested with equal or lower thickness and with equal or lower weight and, if used, the tested grout. The assessment is valid only for configurations where surface area of joints is higher as the one tested.

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

Purpose of the assessment

The purpose of the assessment is to provide the water-vapour resistance factor of the thermal insulation product, which is relevant for the water vapour permeability of ETICS.

Assessment method

The test is not relevant for factory-made vacuum insulation panels (VIP).

The assessment shall be performed in accordance with the applicable provisions for water vapour permeability of thermal insulation product, as given in the harmonized technical specification for the thermal insulation product (Table 1.1.2.1). When such provisions are not given, the assessment shall be done in accordance with EN 12086.

Expression of results

The following data shall be stated in the ETA:

- The μ -value (water-vapour resistance factor) of thermal insulation type. In alternative, s_d value (in m) may also be reported together with the tested thickness of thermal insulation product in mm.

2.2.10 Bond strength

Purpose of the assessment

The purpose of the assessment is to provide the bond strength of ETICS represented by the bond strength between its various layers.

Bond strength of ETICS shall be assessed by means of testing the connections among the relevant ETICS components (adhesive, thermal insulation product, base coat), and the substrate, which are representative of this characteristic of ETICS.

Table D.2.1 defines relevant bond strength tests based on the system configuration and type of fixing method.

The assessment of bond strength is summarised in Table 2.2.10.1:

Table 2.2.10.1 Bond strength tests in relation to the test configurations and test conditionings

Bond strength on the following connections	Test conditions and symbols			Reference clause
Between the base coat and the thermal insulation product	Dry F _{B-I,dry}	On the rig after HWC or HWCT (2.2.6). F _{B-I,HWC} or F _{B-I,HWCFT}	After freeze thaw cycles if relevant (2.2.7) F _{B-I,F-T}	2.2.10.1
Between the adhesive and substrate	Dry F _{A-S,dry}	After immersion of the adhesive in water for 2 days and 2 h drying F _{A-S,2d,2h}	After immersion of the adhesive in water for 2 days and at least 7 days drying F _{A-S,2d,7d}	2.2.10.2
Between the adhesive and thermal insulation product	Dry F _{A-I,dry}	After immersion of the adhesive in water for 2 days and 2 h drying F _{A-I,2d,2h}	After immersion of the adhesive in water for 2 days and at least 7 days drying F _{A-I,2d,7d}	2.2.10.3
Between the PU-foam adhesive and thermal insulation product	Dry PU _{f-a}	-	-	2.2.10.4

2.2.10.1 Bond strength between the base coat and the thermal insulation productAssessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause I.1.5 shall be tested.

Bond strength between the base coat and the thermal insulation product shall be tested in accordance with EN 13494.

Additional information for the configurations to be tested given in Clause I.1.1 shall be considered.

Tests shall be carried out for the specimens defined in Clause I.1.2.

Test results of bond strength between base coat and thermal insulation product shall be equal or greater than the value indicated in Clause I.1.4. Otherwise, mechanically fixed ETICS with fixing devices fixed through the reinforcement layer (through glass fibre mesh) shall be considered for the assessment (see Table D.2.1).

Expression of results

The following data shall be stated in the ETA:

- The minimum and the mean values of bond strength, $F_{B-I,min,condition}$ and $F_{B-I,mean,condition}$ expressed in kPa, rounded to the nearest 1 kPa, and if needed, corrected as described in Table I.1.3.1, of :
 - The bond strength between the base coat and the thermal insulation product at the initial state (F_{B-I,dry}) drying for at least 28 days and the failure mode (see Clause I.1.4).
 - The bond strength between the base coat and the insulation product on specimens taken from the rig after hygrothermal cycles used HWC (F_{B-I,HWC}) or HWCFT (F_{B-I,HWCFT}) and the failure mode (see Clause I.1.4).

- The bond strength between the base coat and the thermal insulation product and the failure mode (see Clause I.1.4) after freeze-thaw cycles ($F_{B-I,F-T}$), if relevant in accordance with Clause 2.2.7.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause I.1.5.

2.2.10.2 Bond strength between the adhesive and the substrate

Assessment method

Bond strength between the adhesive and the substrate shall be tested in accordance with the method described in Clause I.2.

Tests shall be carried out for the specimens defined in Clauses I.2.1.

For bonded ETICS, test results of bond strength between adhesive and the substrate shall be equal or greater than the value indicated in Table I.2.2.1.

Expression of results

The following data shall be stated in the ETA:

- The tested thickness of adhesive in mm.
- The minimum and the mean values of bond strength $F_{A-S,min,condition}$ and $F_{A-S,mean,condition}$ expressed in kPa rounded to the nearest 1 kPa of the following:
 - o The bond strength without supplementary conditioning in dry condition ($F_{A-S,dry}$) (see Clause I.2.1), and the failure mode (percentage of adhesive or cohesive rupture).
 - o The bond strength after immersion of the adhesive in water for 2 days and 2 h drying at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ ($F_{A-S,2d,2h}$) (see Clause I.2.1) and the failure mode (percentage of adhesive or cohesive rupture).
 - o The bond strength after immersion of the adhesive in water for 2 days and at least 7 days drying at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ ($F_{A-S,2d,7d}$) (see Clause I.2.1) and the failure mode (percentage of adhesive or cohesive rupture).

For mechanically fixed ETICS with supplementary adhesive, the bond strength shall be indicated independently of the limit values given in Table I.2.2.1.

2.2.10.3 Bond strength between the adhesive and the thermal insulation product

Assessment method

Bond strength between the adhesive and the thermal insulation product shall be tested in accordance with EN 13494.

Additional information for preparation of test specimen is given in Annex I.3.

Tests shall be carried out for the specimens defined in Clause I.3.1.

For bonded ETICS test results of bond strength between adhesive and thermal insulation product shall be equal or greater than the values given in the Table I.3.3.1.

Expression of results

The following data shall be stated in the ETA (for all combinations of thermal insulation types (see Clause I.3.1.7) and adhesives according to MP11).

- The tested thickness of adhesive in mm.

- The minimum and mean values of bond strength $F_{A-I,min,condition}$ and $F_{A-I,mean,condition}$, expressed in kPa, rounded to the nearest 1 kPa and corrected, if needed, as described in Table I.1.3.1 of:
 - The bond strength between the adhesive and the thermal insulation product in dry condition ($F_{A-I,dry}$) and the failure mode (percentage of adhesive or cohesive rupture) (see Clause I.1.4).
 - The bond strength between the adhesive and the thermal insulation product on specimens after immersion of the adhesive in water for 2 days and 2h drying at the $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ ($F_{A-I,2d,2h}$) expressed in kPa and the failure mode (percentage of adhesive or cohesive rupture) (see Clause I.1.4).
 - The bond strength between the adhesive and the thermal insulation product after immersion of the adhesive in water for 2 days and at least 7 days drying at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ ($F_{A-I,2d,7d}$) expressed in kPa and the failure mode (percentage of adhesive or cohesive rupture) (see Clause I.1.4).
- For mechanically fixed ETICS with supplementary adhesive, the bond strength shall be indicated independently of the limit values given in Table I.3.3.1.
- For bonded ETICS, the minimum bonded area B_s expressed in % linked to the minimum value of tested bond strength in dry conditioning ($F_{A-I,dry}$), obtained according to Clause I.4.

2.2.10.4 Bond strength of PU-foam adhesives

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause J.2. shall be tested.

Bond strength of PU-foam adhesives shall be only applicable when the adhesive is PU-foam (see Clause 1.1.1.) and thermal insulation product is made of expanded or extruded polystyrene (EPS and XPS). Bond strength of foam adhesives shall be tested in accordance with the method described in Clause 5.7 of EN 17101 (cohesion strength) regardless the methods of fixing of thermal insulation product (see Clause 1.1).

Input data of PU-foam shall be taken into account in accordance with the indication given in Clauses 5.3, 5.4 and 5.5 of EN 17101.

Test results of bond strength of PU-foam adhesive shall be equal or greater than the values indicated in Table J.1.1.

In case the individual bond strength test results are greater than the nominal tensile strength perpendicular to the faces (TR) of the thermal insulation product, each value shall be corrected to the nominal TR value of the insulation product in kPa as described in Clause I.1.3 and are expressed in kPa.

Expression of results

The following data shall be stated in the ETA:

- Minimum ($PU_{f-a,min}$), and mean ($PU_{f-a,mean}$) values of bond strength of PU-foam adhesive expressed in kPa, rounded to the nearest 1 kPa and corrected, if needed, as described in Table I.1.3.1.
- The failure mode (see Clause I.1.4).
- For mechanically fixed ETICS with supplementary adhesive, the bond strength shall be indicated independently of the limit value given in Table J.1.1.
- For bonded ETICS, the minimum bonded area B_s expressed in % linked to the minimum value of tested bond strength of PU-adhesive ($PU_{f-a,min}$), obtained according to Clause I.4.
- For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause J.2.

2.2.11 Fixing strength transverse displacement test

This characteristic is only relevant for mechanically fixed ETICS with supplementary adhesive and for purely mechanically fixed ETICS, as given in Table D.2.1.

Depending on the combination of tension and lateral shear loads, one of the following methods shall be used:

- Fixing strength transverse displacement test with tension load, in accordance with Clause 2.2.11.1.
- Fixing strength transverse displacement test without tension load, in accordance with Clause 2.2.11.2.

2.2.11.1 Fixing strength transverse displacement test with tension load

Purpose of the assessment

The purpose of the test method herein included is to assess lateral shear loading in the plane of the base coat reinforcement with a constant tension load.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause K.2 shall be tested.

The test shall be performed in accordance with the Method D and Figure 2 of EN 13495 where a constant tension load 2,0 kPa shall be applied.

Clauses 5 to 10 of EN 13495 shall be applied with the additional information and amendments given in Clause K.1.

Expression of test results

The following data shall be stated in the ETA:

- The load-bearing capability ($F_{5\%}$), expressed in kN, in accordance with EN 13495 Clause 9.2.
- The graph of lateral shear load (kN) versus lateral displacement (mm).
- The description of the tested configuration including the number and the position of fixing devices and the percentage of bonded area of adhesive.
- Minimum measured values of the following characteristics; tensile strength perpendicular to the faces ($\sigma_{mt,min,dry}$), shear strength (T_{min}), shear modulus (G_{min}), and compressive strength at 10% of compression ($\sigma_{m,min}$), expressed in kPa, of the thermal insulation product used for the test specimen with the same thickness.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause K.2.

2.2.11.2 Fixing strength transverse displacement test without tension load

Purpose of the assessment

The purpose of the test method herein included is to assess lateral shear loading in the plane of the base coat reinforcement without a constant tension load.

Assessment method

The test shall be performed in accordance with Method E and Figure 3 of EN 13495.

Clauses 5 to 10 of EN 13495 shall be applied, together with the additional information and amendments given in Clause K.1.

Expression of test results

The following data shall be stated in the ETA:

- The load-bearing capability ($F_{5\%}$), expressed in kN, in accordance with EN 13495 Clause 9.2.
- The graph of lateral shear load (kN) versus lateral displacement (mm).
- The description of the tested configuration including the number and the position of fixing devices and the percentage of bonded area of adhesive.
- Minimum measured values of the following characteristics: tensile strength perpendicular to the faces ($\sigma_{mt,min,dry}$), shear strength (τ_{min}), shear modulus strength (G_{min}), and compressive strength at 10% of compression ($\sigma_{m,min}$), expressed in kPa, of the thermal insulation product used for the test specimen with the same thickness.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause K.2.

2.2.12 Wind load resistance

The wind load resistance of the ETICS is assessed by means of different test methods depending on the method of fixing the thermal insulation product and the configurations of ETICS in accordance with Table D.2.1. Further information on both pull-through resistance and static foam block resistance is given in Annex L.

2.2.12.1 Wind load resistance. Pull-through resistancePurpose of the assessment

The purpose of this assessment is to provide the pull-through resistance of the connection between the thermal insulation product and the mechanical fixing devices, which is decisive for the stability of mechanically fixed ETICS.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause L.3 shall be tested.

Tests shall be carried out for the configurations defined in Figure L.1.1.1.

Pull-through resistance shall be tested in accordance with one of the following alternative methods:

- Method 1 (reference method) in accordance with EN 16382 with additional information reported in Clause L.1.3.
- Method 2: in accordance with EN 16382 with additional information and amendments reported in Clause L.1.3 and L.1.4.

Expression of results

The following data shall be stated in the ETA:

- The characteristic value of $F_{5\%position,5mm,condition}$ pull-through resistance, expressed in kN calculated in accordance with EN 16382 (by Equation 4 of Clause 8.2) given for 5 mm displacement (if reached) where subscripts define conditions under which the values were tested in accordance with Clause L 1.5.
- The thickness of the tested specimen.

- The characteristic value of $F_{5\%position,10mm,condition}$ pull-through resistance calculated in accordance with EN 16382 (by equation 4 of Clause 8.2) given for 10 mm (if reached) where subscripts define conditions under which the values were displacement in accordance with Clause L.1.5.
- $F_{mean,position,condition}$ and $d_{mean,position,condition}$ shall be stated only in case the maximum load is reached before 5 mm of displacement.
- The load/displacement graph.
- Minimum measured values, as defined in Clause L.3, of the following characteristics: tensile strength perpendicular to the faces ($\sigma_{mt,min,dry}$), and compressive strength at 10% of compression ($\sigma_{m,min}$), expressed in kPa, of the thermal insulation product used for the test specimen and relevant data of mechanical fixing devices in accordance with Clauses L.2.3: plate stiffness (Pt_{1mm}), expressed in kN/mm and the maximum load resistance (F) expressed in kN.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause L.3.

2.2.12.2 Wind load resistance. Static foam block resistance

Purpose of the assessment

The purpose of the test method herein included is the assessment of the tensile resistance between the thermal insulation product and the mechanical fixing devices which is decisive for the stability of the ETICS.

Static foam block test shall be performed when ETICS is mechanically fixed with supplementary adhesive or purely mechanically fixed ETICS, and mechanical fixing devices are placed through the reinforcement layer (through glass fibre mesh), or for ETICS fixed by profiles (see Clause D.2).

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause L.3 shall be tested.

Tests shall be carried out for the configurations defined in Figure M.1.1.

The static foam block shall be tested in accordance with Method A of EN 13495 and considering the additional information for the preparation of specimens and for the calculation of test results provided in Annex M.

In case the thermal insulation products are sensitive to humidity (see Clause 2.2.13.2) the conditioning described in Clause M.1.1 shall apply.

Additional assessments of relevant performances for components are given in Clauses L.2 and L.3.

Expression of results

For ETICS mechanically fixed with supplementary adhesive, for purely mechanically fixed ETICS, when mechanical fixing devices are placed through the reinforcement layer (through glass fibre mesh), the following data shall be stated in the ETA:

For test configuration (1c):

- The characteristic value of $F_{5\% F_{centre,condition}}$ obtained in accordance with Clause M.2.

For test assembly (2c):

- The characteristic value of $F_{5\% F_{joint,condition}}$ obtained in accordance with Clause M.2.
- Minimum measured values, as defined in Clause L.3, of the following characteristics: tensile strength perpendicular to the faces ($\sigma_{mt,min,dry}$), and compressive strength at 10% of compression ($\sigma_{m,min}$), expressed in kPa, of the thermal insulation product used for the test specimen and relevant data of

mechanical fixing devices in accordance with Clauses L.2.3: plate stiffness (P_{t1mm}) expressed in kN/mm and the maximum load resistance (F) expressed in kN.

For ETICS mechanically fixed by profiles:

- Characteristic value ($F_{5\%} F_{\text{foam block,condition}}$) and mean value $F_{\text{foam block,condition}}$ (in the profile or in the thermal insulation product) along with the type and geometry of the used profiles, obtained in accordance with Clause M.2.

2.2.12.3 Wind load resistance. Dynamic wind uplift resistance

Purpose of the assessment

The purpose of the assessment is to provide the uplift resistance of the thermal insulation product and the mechanical fixing devices, which is decisive for the stability of ETICS for the configurations indicated in Table D.2.1.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause N.5 shall be tested.

Uplift resistance shall be tested in accordance with the method described in Annex N.

Expression of results

The following data shall be stated in the ETA:

- The characteristic wind uplift value (Q_1) (kPa), the characteristic resistance R_k (kPa) in accordance with Clause N.4, and the factors C_s and C_a used for determining the resistance R_k .
- Minimum measured values, as defined in Clause N.1, of the following characteristics: tensile strength perpendicular to the faces ($\sigma_{mt,min,dry}$), and compressive strength at 10% of compression ($\sigma_{m,min}$), expressed in kPa, of the thermal insulation product with the test thickness.

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause N.5.

2.2.13 Tensile strength perpendicular to the faces of thermal insulation product

Purpose of the assessment

The purpose of the test method herein included is the assessment of the tensile strength of the thermal insulation product considered relevant for assessing bond strength between the adhesive and the base coat with the thermal insulation product as well as wind load resistance and fixing strength transverse displacement test of ETICS.

The tensile strength shall be tested (measured value) to perform displacement test, pull-through, static foam block test and dynamic uplift test as specified in Clauses 2.2.11, 2.2.12.1, 2.2.12.2, and 2.2.12.3 respectively.

2.2.13.1 Tensile strength perpendicular to the faces of thermal insulation product in dry condition

Assessment method

Tensile strength perpendicular to the faces of the thermal insulation product shall be tested for each thermal insulation type used in the ETICS, in accordance with EN 1607.

Expression of result

The following data shall be stated in the ETA:

- The mean value of tensile test strength (in kPa) perpendicular to the faces ($\sigma_{mt,mean,dry}$) of each thermal insulation type in dry condition.

2.2.13.2 Tensile strength perpendicular to the faces of thermal insulation product in wet condition

Purpose of the assessment

This characteristic is relevant only for thermal insulation materials which could be deteriorated by exposure to humidity, consisting of mineral wool (MW), wood wool (WW), expanded cork (ICB), wood fibres (WF), expanded cork (ICB), vegetable and animal fibres, and agglomerated natural cork. All other thermal insulation materials according to the Table 1.1.2.1 shall be assessed in accordance with Clause 2.2.13.1.

Assessment method

Tensile test strength perpendicular to the faces of thermal insulation product in wet condition shall be tested in accordance with the method described in EN 1607. In order to assess the deterioration of thermal insulation products sensitive to humidity described above the tests shall be carried out in both dry condition (see Clause 2.2.13.1) and in wet conditions.

The size of the test specimens depends on the type of thermal insulation product and shall be identical to the test in dry conditions in accordance with Clause 2.2.13.1.

The test shall be performed as a two-test series with a minimum of eight specimens (four specimens for each series) exposed to heat-moisture actions at $(70 \pm 2)^\circ\text{C}$ and $(95 \pm 5)\%$ RH in a climatic chamber:

- for 7 days followed by a drying period at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ RH until constant mass is achieved.
- for 28 days followed by a drying period at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ RH until constant mass is achieved.

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

Expression of results

The following data shall be stated in the ETA:

- The minimum and the mean values of tensile strength perpendicular to the faces ($\sigma_{mt,min,wet}$, $\sigma_{mt,mean,wet}$) expressed in kPa, of thermal insulation type in wet condition of each series (after 7 days and after 28 days) together with the obtained ratio between tested values of tensile strength after wet condition and tensile strength after dry condition (Clause 2.2.13.1).

2.2.14 Shear strength and shear modulus of elasticity of thermal insulation product

Purpose of the assessment

The purpose of this assessment is to provide the shear strength and shear modulus of elasticity of the thermal insulation product which are decisive for shear strength and shear modulus of elasticity of the whole ETICS.

These characteristics are relevant for bonded and mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS and to perform the displacement test as specified in Clause 2.2.11.

Assessment method

Irrespective of the types of fixing for ETICS used, tests of shear strength and shear modulus of elasticity of thermal insulation products shall be performed in accordance with EN 12090. The shear strength shall be tested in the effective direction of the dead load of the ETICS for isotropic materials. In case of anisotropic thermal insulation product, the shear strength and shear modulus shall be performed in both directions.

The size of the specimens depends on the range of thickness of the thermal insulation products to be assessed, therefore, the following adaptations of the EN 12090 shall be considered in the tests.

1. For thermal insulation thicknesses lower than 100 mm:
 - The shear strength and the shear modulus of elasticity shall be assessed in accordance with the single specimen test assembly given in EN 12090, Figure 1. The test specimen shall be 250 mm in length, 50 mm in width and 60 mm in thickness.
 - If the thickness of 60 mm is not available, the tests shall be performed on both the maximum and minimum available thickness of the product.
 - For thicknesses below 60 mm, the single specimen test assembly in accordance with EN 12090, Figure 1 applies.
 - For thicknesses above 60 mm, the double specimen test assembly in accordance with EN 12090, Figure 2 applies.
2. For thermal insulation thicknesses equal to or greater than 100 mm:
 - The shear strength and the shear modulus of elasticity shall be assessed in accordance with the double specimen test assembly given in EN 12090, Figure 2. The test specimen shall be 400 mm in length, 200 mm in width, and 200 mm in thickness.
 - If the thickness of 200 mm is not available, the test shall be carried out on the maximum thickness below 200 mm and on the minimum thickness above 200 mm (if applicable), in accordance with the double specimen test assembly given in EN 12090, Figure 2. The test specimen shall be 400 mm in length, 200 mm in width.

The results obtained with thermal insulation products 200 mm thick cover for thicknesses greater than 200 mm.

Test results of shear strength of thermal insulation product in accordance with EN 12090 shall be equal or greater than 20 kPa for purely bonded and bonded ETICS with supplementary mechanical fixing devices. Otherwise, mechanically fixed ETICS with supplementary adhesive shall be considered for the assessment (see Table D.2.1).

Test results of shear modulus of thermal insulation product in accordance with EN 12090 shall be equal or greater than 1000 kPa for purely bonded and bonded ETICS with supplementary mechanical fixing devices.

Expression of results

The following data shall be stated in the ETA:

- For all tested thicknesses the minimum and mean values of shear strength (T_{min} ; T_{mean}) expressed in kPa, and the minimum and mean value of shear modulus (G_{min} ; G_{mean}) expressed in kPa, with reference to tested thickness of thermal insulation product¹⁰. In case of anisotropic thermal insulation product, the shear strength and shear modulus in kPa shall be expressed in both tested directions.

¹⁰ The indication of the thickness of thermal insulation product is relevant because the shear performance decreases when the thickness of the insulation product increases.

2.2.15 Pull-through resistance of fixings from profiles

Purpose of the assessment

The purpose of the test method herein included is the assessment of pull-through resistance of fixings from profiles when ETICS is mechanically fixed using profiles in accordance with indications of Clause D.2.

Assessment method

Pull-through resistance of mechanical fixing devices through the perforation in the profile shall be tested in accordance with the method described in Annex O.

Each different profile cross-section shall be tested together with the fixing with the smallest head or body diameter according to MPII. In addition, extended application rules given in Clause O.4 may be used for deciding the worst-case scenario.

Expression of results

The following data shall be stated in the ETA:

- The minimum and mean values of pull-through resistance (F_{min} , F_{mean}), expressed in kN together with the size of the diameter of the head and the body in mm and the resistance of material of the tested fixing device in kN.

2.2.16 Render strip tensile strength

Purpose of the assessment

The purpose of the test method herein included is the assessment of the crack behaviour of the reinforced base coat, by determination of the crack width distribution and the "characteristic crack width" w_{rkd} where w_{rkd} is the characteristic crack width at a determined deformation, usually selected at 0,8% of strain or according to Clause P.2.

Assessment method

Render strip tensile strength shall be performed in accordance with the method described in Annex P.

Expression of results

The following data shall be stated in the ETA:

- The characteristic crack width w_{rkd} , at a determined deformation (d) expressed in mm (see Clause P.3), for the warp and weft direction of the reinforced base coat with reference to type of the glass fibre mesh (see Clause 1.3.1.9).

2.2.17 Shear strength and shear modulus of the PU-foam adhesives

Purpose of the assessment

The purpose of this assessment is to provide shear strength and shear modulus of elasticity of the PU-foam adhesive which are decisive for shear strength and shear modulus of elasticity of the whole ETICS.

Shear strength and shear modulus of PU-foam adhesive is only applicable when the adhesive is PU-foam (see Clause 1.1.1.) and thermal insulation product is made of expanded or extruded polystyrene (EPS and XPS).

Assessment method

Shear strength of PU-foam adhesive shall be tested in accordance with clause 5.8 of EN 17101. Shear modulus shall be calculated in accordance with clause 8.3 of EN 12090.

Expression of results

The following data shall be stated in the ETA:

- Mean value of shear strength, T_{mean} expressed in kPa, in accordance with clause 5.8 of EN 17101.
- Mean value of shear modulus, G_{mean} expressed in kPa in accordance with EN 12090.

2.2.18 Post expansion behaviour of the PU-foam adhesives

Purpose of the assessment

The purpose of this assessment is to provide post expansion behaviour of the PU-foam adhesives which are decisive for the post expansion behaviour of the whole ETICS.

Post expansion behaviour of PU-foam adhesive is only applicable when the adhesive is PU-foam (see Clause 1.1.1.) and thermal insulation product is made of expanded or extruded polystyrene (EPS and XPS).

Assessment method

Post expansion behaviour of PU-foam adhesive shall be tested in accordance with clause 5.6 of EN 17101.

Expression of results

The following data shall be stated in the ETA:

- The highest value (M) in mm of the six mean values recorded in accordance with clause 5.6 of EN 17101.

2.2.19 Airborne sound insulation

Purpose of the assessment

The purpose of this assessment is to provide the increment of airborne sound insulation that an ETICS can provide to wall where an ETICS is installed.

Assessment method

At least, the worst-case scenario selected in accordance with the extension of the test results given below shall be tested.

The worst-case scenario is defined with the configurations of the following relevant components:

- Adhesive: with higher adhesive surface coverage.
- Thermal insulation product: with a lower dynamic stiffness or with higher air flow resistance, or with a higher thickness. The performance for an insulation product thickness between two tested ones can be linearly interpolated.
- Rendering system: with higher mass of rendering system.
- Mechanical fixing device: with the highest number of fixings. Results obtained with mechanical fixing device with metal screws/nails can be applied to mechanical fixing device with plastic screws/nails.

The acoustic performance of the ETICS shall be determined on the basis of laboratory tests carried out in accordance with EN ISO 10140-1, Clause G.2 c), EN ISO 10140-2 on the relevant type of wall defined in EN ISO 10140-5/B.2, Annex B.

Expression of results

The following data shall be stated in the ETA:

- The direct difference of the weighted sound reduction indices of the wall with and without the ETICS, $\Delta R_{W, \text{direct}}$, $\Delta(R_W + C)_{\text{direct}}$ and $\Delta(R_W + C_{tr})_{\text{direct}}$, as evaluated in accordance with EN ISO 717-1 together with the description of the wall used for testing.
- The tested configuration including the weight of the rendering system.

For the non-tested configurations, results shall apply according to rules for the worst-case scenario.

2.2.19.1 Dynamic stiffness of the thermal insulation product

Purpose of the assessment

The purpose of this assessment is to provide the dynamic stiffness of the thermal insulation product, which is relevant to assess the sound insulation of the ETICS.

Assessment method

The test shall be performed in accordance with EN 29052-1 (identical to ISO 9052-1). The excitation shall be applied in accordance with the method shown in Figure 1 or 2 or 3 of Clause 5 of EN 29052-1.

Tests shall be carried out on the thinnest and thickest thickness of thermal insulation type.

Expression of results

The following data shall be stated in the ETA:

- The individual values of the dynamic stiffness of each type of thermal insulation type, the value (s') is expressed in MN/m^3 for each thickness and the tested thickness in mm.

2.2.19.2 Air flow resistance of the thermal insulation product

Purpose of the assessment

The purpose of this assessment is to provide the air flow resistance of the thermal insulation product, which is relevant to assess the sound insulation of the ETICS.

Assessment method

The air flow resistance shall be determined in accordance with EN ISO 9053-1, and it is relevant only of porous and fibrous thermal insulation material (e.g., mineral wool, wood wool). Tests shall be carried out on the thinnest and thickest thickness of thermal insulation type.

Expression of results

The following data shall be stated in the ETA:

- The individual value of the air flow resistance (R) expressed in $\text{kPa}\cdot\text{s}/\text{m}^3$ of each type of thermal insulation product for the thinnest and thickest thickness following the clause 7.5 of EN ISO 9053-1.

2.2.20 Thermal resistance

Purpose of the assessment

The assessment of the thermal resistance of ETICS is based on the assessment of its most relevant components (i.e., thermal insulation product and, if any, mechanical fixing devices). The thermal resistance of the ETICS depends primarily on the thermal conductivity and thickness of the thermal insulation product, as well as the influence of thermal bridges introduced by mechanical fixing devices such as anchors or profiles.

Therefore, the purpose of the assessment is to determine:

- The thermal resistance of the ETICS without thermal bridges in accordance with Clause 2.2.20.1;
- The thermal conductivity and thermal resistance of the thermal insulation product in accordance with Clause 2.2.20.2 and,
- Where applicable, the point thermal transmittance of anchors or the linear thermal transmittance of profile fixings, or both, in accordance with Clause 2.2.20.3 in order to quantify the additional heat losses caused by mechanical fixing devices (anchors or profiles) which act as thermal bridges.

2.2.20.1 Thermal resistance of ETICS without the influence of mechanical fixing devices

Assessment method

The thermal resistance of the ETICS without thermal bridges (R_{ETICS}) shall be calculated in accordance with Clause Q.1. Where more than one type or thickness or both of thermal insulation product is used in the ETICS, the thermal resistance shall be calculated for each combination of insulation type and thickness.

The R_{ETICS} value is based on:

- The thermal resistance of the thermal insulation product (see Clause 2.2.20.2).
- The thermal resistance of the rendering system.

Expression of results

The following data shall be stated in the ETA:

- The thermal resistance (R-value) of the ETICS without thermal bridge expressed in $(m^2 \cdot K)/W$ for each assessed insulation type and thickness.

2.2.20.2 Thermal conductivity and thermal resistance of the thermal insulation product

Assessment method

The thermal conductivity and thermal resistance of the thermal insulation product shall be tested in accordance with the relevant product technical specification (see Table 1.1.2.1) depending on the material of the thermal insulation product.

The maximum value of nominal thermal conductivity of thermal insulation product λ_D , determined in accordance with the relevant product standard (see Table 1.1.2.1), shall be equal or lower than 0,065 $W/(m \cdot K)$.

Expression of results

The following data shall be stated in the ETA:

- The thermal conductivity of the thermal insulation product, (λ_D) expressed in $W/(m \cdot K)$.
- The thermal resistance of the thermal insulation product for each nominal thickness, ($R_{insulation}$) expressed in $(m^2 \cdot K)/W$.
- The thermal resistance for each nominal thickness, ($R_{insulation}$) expressed in $(m^2 \cdot K)/W$;
or at least:
- The minimum thermal resistance for the minimum thickness, ($R_{insulation}$) expressed in $(m^2 \cdot K)/W$.

2.2.20.3 Thermal transmittance of fixing devices

Assessment method

Depending on the type of fixing devices (anchors or profiles), the point thermal transmittance of anchors and linear thermal transmittance of profiles shall be determined in accordance with Clause Q.2 for punctual fixings (anchors) and Clause Q.3 for linear fixings (profiles).

Expression of results

The following data shall be stated in the ETA:

For punctual fixings (anchors):

- The point thermal transmittance (χ -value), expressed in W/K.

For linear fixings (profiles):

- The linear thermal transmittance (ψ -value), expressed in W/(m·K).

2.2.21 Aspects of durability

Purpose of the assessment

The purpose of this assessment is to provide data regarding durability of the ETICS carried out by means of the assessment of the following characteristics which are representative of this essential characteristic ETICS:

- Bond strength after ageing of finishing layers tested on the rig (see Clause 2.2.21.1).
- Bond strength after ageing of finishing layers not tested on the rig (see Clause 2.2.21.2).

Note: The principle related to the preparation of the rig allows maximum four finishing coats to be tested on the rig, therefore in case information according to MPII provides more than four finishing coats, the Clause 2.2.21.2 apply (see Clause F.2.2 and Clause D1).

- Tensile strength and elongation of the glass fibre mesh in the initial state and after ageing in accordance with EAD 040016-01-0404 Clause 2.2.7.

2.2.21.1 Bond strength after ageing of finishing layer tested on the rig

Assessment method

This test method is relevant only for finishing layers tested on the rig after the hygrothermal cycles test conditioning HWC and if performed, test conditioning HWCFT, on all applied ETICS configurations and after at least 7 days drying and maximum 14 days drying (see Clause 2.2.6).

Bond strength after ageing of finishing layers tested on the rig shall be tested in accordance with EN 13494.

For the preparation of specimens see Clause I.1.2; for the calculation of test results see Clause I.1.3.

Test results shall fulfil the following limit values:

- Minimum 80 kPa with cohesive or adhesive failure (see Clause I.1.4);
or
- The failure shall occur in the thermal insulation product (cohesive failure) if the failure resistance is lower than 80 kPa (see Clause I.1.4).

Expression of results

The following data shall be stated in the ETA:

- Test conditioning applied in accordance with Clause 2.2.6 (HWC or HWCFT).
- The minimum and the mean values of bond strength after ageing ($F_{\min, \text{HWC}}$; $F_{\text{mean, HWC}}$; or $F_{\min, \text{HWCFT}}$; $F_{\text{mean, HWCFT}}$); expressed in kPa, rounded to the nearest 1 kPa and, if needed, corrected as described in Table I.1.3.1, with the failure mode (see Clause I.1.4).

For the non-tested configurations, results shall apply according to the following extended application rules:

- Base coat: the same base coat as the one tested.
- Thermal insulation product: any thermal insulation product of the same type (definition in Clause 1.3.1.7) as the one tested with the same or higher nominal tensile strength (TR) perpendicular to the faces.
- Key coat: test results obtained without a key coat apply to the use of any key coat. Test results obtained with a key coat apply only to the same key coat as the one tested with the same or higher amount applied.
- Finishing coat: test results apply to the same finishing coat type as the one tested. If the tested finishing coat thickness is up to 3 mm, the results are valid for the tested finishing coat type in any thickness up to 3 mm. If the tested thickness is more than 3 mm the test results are applicable to the tested thickness ± 1 mm. In case of finishing coats with different structure (ribbed or floated/smooth) the results of the floated structure apply to the ribbed finishing coats.
- Decorative coat: test results obtained without a decorative coat apply to the use of any decorative coat. Test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or higher amount applied.
- In case of ETICS with prefabricated strips, the test results are valid only for the same render strip as the one tested with configurations.

2.2.21.2 Bond strength after ageing of finishing layer not tested on the rig

Assessment method

Bond strength after ageing of finishing layers not tested on the rig shall be tested in accordance with EN 13494.

At least, the worst-case scenario selected in accordance with the extension of the test results given in Clause 2.2.21.1 shall be tested.

The test shall be performed on a thermal insulation product faced with the rendering system which was not assessed in accordance with Clause 2.2.6 and applied according to MPII.

In case of ETICS with prefabricated strips, two test arrangements shall be used. One with minimum and one with maximum area of joints.

For the preparation of specimens see Clause I.1.2.

The tests shall be performed:

- On specimens faced with the rendering system, aged by immersion in water for 7 days and then dried for at least 7 days at $(23 \pm 2)^\circ \text{C}$ and $(50 \pm 5) \% \text{RH}$.

And

- If freeze-thaw cycles are relevant in accordance with 2.2.5.1: on the specimens 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

For the calculation of test results see Clause I.1.3.

Expression of results

The following data shall be stated in the ETA:

In case of bond strength after ageing of finishing layers not tested on the rig:

The minimum and the mean values of bond strength after ageing ($F_{\text{render,min,aged}}$; $F_{\text{render,mean,aged}}$), expressed in kPa, rounded to the nearest 1 kPa and, if needed, corrected as described in Table I.1.3.1, with the failure mode (see Clause I.1.4).

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause 2.2.21.1.

In case freeze-thaw cycles are relevant in accordance with 2.2.5.1:

- The minimum and the mean values of bond strength after ageing ($F_{\text{render,min,F-T}}$; $F_{\text{render,mean,F-T}}$), expressed in kPa, rounded to the nearest 1 kPa and, if needed, corrected as described in Table I.1.3.1, with the failure mode (see Clause I.1.4).

For the non-tested configurations, results shall apply in accordance with the extended application rules given in Clause 2.2.21.1.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

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

For the products covered by this EAD the applicable European legal act is Commission Decision 97/556/EC, as amended by Decision 2001/596/EC.

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

For uses subject to regulations on reaction to fire¹¹ the applicable AVCP systems regarding reaction to fire are 1 or 2+ depending on the conditions defined in the said Decision.

¹¹ Including propensity to undergo continuous smouldering, where relevant

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

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

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Reaction to fire (i)				
	▪ Reaction to fire (for any classification)	Indirect tests as specified in Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5
	▪ Reaction to fire (for class A1)	Direct test in accordance with EN ISO 1182	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class A1 or A2)	Direct test in accordance with EN ISO 1716	According to Control Plan	According to test method and Control Plan (v)	At least once each two years
	▪ Reaction to fire (for class A2 to D)	Direct test in accordance with EN 13823 (ii)	According to Control Plan	According to test method and Control Plan (v)	(iv)
	▪ Reaction to fire (for class B to F)	Direct test in accordance with EN ISO 11925-2	According to Control Plan	According to test method and Control Plan (v)	(iv)
2	When applicable, Propensity to undergo continuous smouldering	Direct control method based on relevant Clause 2.2.3	According to Control Plan	One (v)	At least once each two years
		Indirect tests as specified in Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5	See Tables 3.2.2 to 3.2.5
3	Bond strength between base coat and insulation product (vi) (vii)	Clause I.1.1 Only at the initial state	Clause I.1.4 Only in dry condition	According to test method	At least once a year (viii)
4	Bond strength between adhesive and substrate (vi)	Clause I.2.1 Only in dry condition	Clause I.2.2 Only in dry condition	According to test method	At least once a year (viii)
5	Bond strength between adhesive and insulation product (vi)	Clause I.3.1 Only in dry condition	Clause I.3.3 Only in dry condition	According to test method	At least once a year (viii)
6	Bond strength of foam adhesives (vi)	EN 17101 Clause 5.7	According to Control Plan	According to test method	At least once a year (viii)
7	<u>Components produced by the manufacturer himself:</u>				
	▪ Thermal insulation product	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2	See Table 3.2.2
	▪ Adhesive, base coat, finishing coat, key coat, decorative coat	See Table 3.2.3	See Table 3.2.3	See Table 3.2.3	See Table 3.2.3
	▪ Prefabricated strips (specific adhesive, prefabricated strips, grout)	See Table 3.2.4	See Table 3.2.4	See Table 3.2.4	See Table 3.2.4

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
	▪ Reinforcement mesh	See Table 3.2.5	See Table 3.2.5	See Table 3.2.5	See Table 3.2.5
	▪ Anchors	See Table 3.2.6	See Table 3.2.6	See Table 3.2.6	See Table 3.2.6
	▪ Profiles	See Table 3.2.7	See Table 3.2.7	See Table 3.2.7	See Table 3.2.7
8	Components not produced by the manufacturer himself (iii)	See Table 3.2.8	See Table 3.2.8	See Table 3.2.8	See Table 3.2.8
(i) Indirect tests shall be applied to all components independent of the source of their classification (testing, Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) or any other applicable CWFT decision). Direct tests within the FPC shall only apply to those components where the classification is based on the prescribed tests for the corresponding class(es) in accordance with Commission Delegated Regulation (EU) 2016/364 and EN 13501-1. (ii) If it is necessary to perform SBI tests within the FPC, the test set-up that was classified as the worst-case within the ETA procedure shall be tested. (iii) Components produced by the supplier under the specifications of the manufacturer (iv) The tests shall always be carried out whenever the performance is not verified by means of indirect tests (see Tables 3.2.2 to Table 3.2.5) or, at least, once each five years when the indirect tests verify the performance. For this minimum frequency, the sufficient correlation between the foreseen system of indirect FPC measures and the direct tests shall be stated in the Control Plan. Otherwise, the minimum frequency of direct tests within the FPC shall be at least once per two years. (v) The necessary number of specimens shall be detailed in the Control Plan depending on the test method and the class to be verified within the FPC. The tests shall be performed on randomly taken specimens from the production process. (vi) For bonded ETICS and mechanically fixed ETICS with supplementary adhesive, (in case the adhesive and the base coat are the same product, at least the bond strength between the base coat and the thermal insulation product shall be performed). (vii) For purely mechanically fixed ETICS. (viii) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.					

Table 3.2.2: 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 samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt materials	Delivery ticket and/or label on the package Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Production process					
2	When relevant, flame retardant quantity (i)	Quantity measurement	According to Control Plan	---	Each batch
Finished component					
3	Dimensional characteristics and appearance	In accordance with relevant product technical specification as indicated in Table 1.1.2.1.	According to Control Plan	According to Control Plan	Once per year (i)
4	Reaction to fire	2.2.1.2	According to Control Plan	According to Control Plan	Once each 2 years
5	Density / Mass per unit (ii)	EN ISO 29470	According to Control Plan	According to Control Plan	Once per year (i)
6	Q _{PCS} value/heat of combustion (if reaction to fire is declared) (iii)	EN ISO 1716 A.3.1	According to Control Plan	According to Control Plan	Once each 2 years (i)
7	Propensity to continuous smouldering	2.2.3	According to Control Plan	According to Control Plan	Once each 2 years (i)
8	Water absorption	2.2.5.2	According to Control Plan	According to Control Plan	Once per year (i)
9	Water vapour permeability	EN 12086	According to Control Plan	According to Control Plan	Once per year (i)
10	Tensile strength perpendicular to the faces in dry conditions	EN 1607	According to Control Plan	According to Control Plan	Once per year (i)
11	Shear strength and shear modulus	2.2.14	According to Control Plan	According to Control Plan	Once per year (i)
12	Dynamic stiffness	2.2.19.1	According to Control Plan	According to Control Plan	Once per year (i)
13	Air flow resistance	2.2.19.2	According to Control Plan	According to Control Plan	Once per year (i)
14	Thermal conductivity	2.2.20.1	According to Control Plan	According to Control Plan	Once per year (i)
15	Dimensional stability (if product is sensitive to relative humidity and/or temperature (iv))	In accordance with relevant product technical specification as indicated in Table 1.1.2.1.	According to Control Plan	According to Control Plan	Once per year (i)
16	Compressive strength	In accordance with relevant product technical specification as indicated in Table 1.1.2.1.	According to Control Plan	According to Control Plan	Once per year (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control. (ii) Relevant when the reaction to fire of ETICS is declared. (iii) Relevant for the classes A1 and A2 of reaction to fire of ETICS. (iv) To check thermal insulation products sensitive to relative humidity and/or temperature see Clause 2.2.13.2.					

Table 3.2.3: 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 samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt material	Delivery ticket and/or label on the package	According to Control Plan	According to Control Plan	According to Control Plan
		Supplier certificates or supplier tests	According to Control Plan	According to Control Plan	According to Control Plan
2	Particle size grading (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
3	Bulk density (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
Production process					
4	Mixing process	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
5	Packing	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
Finished component					
6	Density of mortar product at initial state (for paste/liquid and powder)	3.4.1.1	According to Control Plan	According to Control Plan	One per PW (i)
7	Density of hardened mortar ((ii), vii)	3.4.1.2	According to Control Plan	According to Control Plan	Once per year (i)
8	Particle size grading (ii, iv)	3.4.1.3	According to Control Plan	According to Control Plan	Once per PW (i)
9	Dry extract (v)	A.6.1	According to Control Plan	According to Control Plan	Once per 4 PW (i)
10	Ash content at 450°C (vi)	A.6.2	According to Control Plan	According to Control Plan	Once per 4 PW (i)
11	Flexural and compressive strength (only for hardened base coat delivered in powder)	EN 1015-11	According to Control Plan	According to Control Plan	Once each 2 years (i)
12	Viscosity (v)	When applicable, as defined in the relevant technical specification	According to Control Plan	According to Control Plan	Once per PW (i)
13	Compressive strength (viii)	EN 17333-4	According to Control Plan	According to Control Plan	Once per year (i)
14	Dimensional stability(viii)	EN 17333-2	According to Control Plan	According to Control Plan	According to Control Plan
15	Tensile strength (viii)	EN 17333-4	According to Control Plan	According to Control Plan	According to Control Plan
16	QPCS value/heat of combustion (if reaction to fire is declared) (ix)	EN ISO 1716	According to Control Plan	According to Control Plan	Once each 2 years (i)

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
17	Reaction to fire (for PU-foam adhesives, if declared)	EN ISO 11925-2	According to Control Plan	According to Control Plan	Once each 2 years (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control. (ii) Relevant only for powders. (iii) Relevant for powders and pastes not for liquids. (iv) Not relevant for key coat and decorative coat. (v) Relevant for pastes and liquids. (vi) Relevant when the reaction to fire of ETICS is declared. (vii) Relevant for base coats without reinforcement (viii) Relevant only for PU-foam products. (ix) Relevant for the classes A1 and A2 of reaction to fire of ETICS. Not relevant for adhesives, base coats, key coats and decorative coats and finishing coats meeting criteria of class A1 in accordance with Commission Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) without testing. Only the worst-case product among adhesives, base coats, key coats, decorative coats and finishing coats can be selected for testing based on Clause A.1.1.					
PW: Frequency specified as “per PW” refers to the production week definition. Production week is defined as the time period of maximum 5 production days where the first and the last day are not more than 31 days apart					

Table 3.2.4: Control plan when prefabricated strips are produced by the manufacturer himself; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt material	Delivery ticket and/or label on the package	According to Control Plan	According to Control Plan	According to Control Plan
		Supplier certificates or supplier tests	According to Control Plan	According to Control Plan	According to Control Plan
2	Particle size grading (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
3	Bulk density of the powder (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
Production process					
4	Mixing process (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
5	Packing (ii)	According to Control Plan	According to Control Plan	According to Control Plan	According to Control Plan
Finished component					
6	Ash content at 450 °C (iii)	A.6.2	According to Control Plan	According to Control Plan	Once each 2 years (i)
7	Q _{PCS} value/Heat of combustion if reaction to fire is declared (iv)	EN ISO 1716	According to Control Plan	According to Control Plan	Once each 2 years (i)
8	Dimension tolerances	EN ISO 10545-2	According to Control Plan	According to Control Plan	Once per year (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control. (ii) Relevant only for adhesive (iii) Relevant when the reaction to fire of ETICS is declared. (iv) Relevant for the classes A1 and A2 of reaction to fire of ETICS.					

Table 3.2.5: 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 samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Incoming materials					
1	Receipt material	Delivery ticket and/or label on the package	Conformity with the order	---	Each delivery
		Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component					
2	Mass per unit area	Annex A of EAD 040016-01-0404	According to Control Plan	According to Control Plan	Once per year (i)
3	Ash content at 625 °C (ii)	EAD 040016-01-0404, Clause 2.2.2	According to Control Plan	According to Control Plan	Once each 2 years (i)
4	Mesh size and number of filaments	Annex A of EAD 040016-01-0404.	---	---	Once per year (i)
5	Durability of the mesh	EAD 040016-01-0404 Clause 2.2.7	---	---	Once per year (i)
6	Alkali resistance: Tensile strength and elongation after alkalis conditioning	EAD 040016-01-0404 Clause 2.2.7	≥ 20 N/mm and 50%	---	Once per year (i)
7	Q _{PCS} value/Heat of combustion if reaction to fire is declared (iii)	EN ISO 1716	---	---	Once each 2 years (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control					
(ii) Relevant when the reaction to fire of ETICS is declared.					
(iii) Relevant for the classes A1 and A2 of reaction to fire of ETICS.					

Table 3.2.6: Control plan when the anchors are produced by the manufacturer itself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Anchors for mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Supplier certificates or supplier tests			
Finished component					
2	Geometry	Depending on the material, in accordance with the technical specifications defined in Clause 1.1.3.	According to Control Plan	According to Control Plan	Once per year (i)

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
3	Mechanical characteristics - Load resistance of anchor - Plate stiffness of anchor	In accordance with the relevant EAD and Clauses L.2.2 and L.2.3.	According to Control Plan	According to Control Plan	Once per year (i)
4	Density of expanding filling material (ii)	In accordance with EAD 331433-00-0601 Annex C	According to Control Plan	According to Control Plan	Once per year (i)
5	Bond strength of expanding filling materials to substrate (ii)	In accordance with EAD 331433-00-0601 Annex C	According to Control Plan	According to Control Plan	Once per year (i)
6	Shear strength of expanding filling materials (ii)	In accordance with EAD 331433-00-0601 Annex C	According to Control Plan	According to Control Plan	Once per year (i)
7	Characteristic resistance under tensile load of individual anchor, anchor with and without the effect of expansion zone (ii)	Clause 2.2.3 of EAD 331433-00-0601	According to Control Plan	According to Control Plan	Once per year (i)
8	Pull out of anchor	EAD 330196-01-0604(iii)	According to Control Plan	According to Control Plan	Once per year (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.					
(ii) Only for injected anchors.					
(iii) Indirect tests as specified in Clause 3.2 of EAD 330196-01-0604.					

Table 3.2.7: Control plan when the profiles are produced by the manufacturer himself; cornerstones.

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
Profiles for mechanically fixed ETICS by profiles					
Incoming materials					
1	Receipt materials	Delivery ticket or label on the package	Conformity with the order	---	Each delivery
		Supplier certificates or supplier tests	Conformity with the order	---	Each delivery
Finished component					
2	Geometry	Depending on the material, according to the technical specifications defined in Clause 1.1.3	According to Control Plan	According to Control Plan	Once per year (i)
(i) Deviations from the given cornerstones (higher or lower frequencies) shall be agreed between manufacturer and TAB and laid down in the Control Plan case by case depending on the type of production process, the variation in the volume produced and the production process control.					

Table 3.2.8: Control plan when the components are not produced by the manufacturer; cornerstones

No	Subject/type of control (ii)	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Components belonging to <u>Case A</u> (i)	(1)	Conformity with the order	Testing is not required	Each delivery
		(2)	According to Control Plan	Testing is not required	Each delivery
2	Components belonging to <u>Case B</u> (i):	(1)	Conformity with the order	Testing is not required	(1)
	▪ Characteristics declared in the Declaration of Performance (DoP) for the specific use within the kit.	(2)	According to Control Plan	Testing is not required	(2)
	▪ Characteristics not declared in DoP for the specific use within the kit.	(3)	According to Control Plan	According to Control Plan	(3)
3	Components belonging to <u>Case C</u> (i):	(1)	Conformity with the order	Testing is not required	Each delivery
		(3)	According to Control Plan	According to Control Plan	(3)
(1) Checking of delivery ticket and/or label on the package. (2) Checking of technical data sheet and DoP or, when relevant: checking of supplier certificates or supplier tests or test or control according to Tables 3.2.2 to 3.2.7 above. (3) Checking of supplier certificates or supplier tests or test or control according to Tables 3.2.2 to 3.2.7 above.					
(i) Case A: Component covered by a DoP for all characteristics needed for the specific use within the kit. Case B: If the component is a product covered by a DoP 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 C: The component is not covered by a DoP. (ii) Component characteristics are those defined in Tables 3.2.2 to 3.2.7 above.					

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 are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

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

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire¹² for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material).

In this case the cornerstones of the actions to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.2.

Table 3.3.2 Control plan for the notified body; cornerstones

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

¹² Including propensity to undergo continuous smouldering, where relevant.

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

3.4.1 Special methods of control for adhesives, base coats, key coats, finishing coats, decorative coats and prefabricated strips, grout

3.4.1.1 Density of mortar- product initial state

- Pastes and liquids:

This test shall be carried out at $(23 \pm 2) ^\circ\text{C}$ in a 100 cm³ or 1000 cm³ cylinder.

- Powders:

- This test shall be carried out in a 500 cm³ cylinder.

Method of operation:

The results shall be 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 shall be expressed in kg/m³ (mean value of three tests) and given in the test report.

3.4.1.2 Density of hardened mortar

Relevant only for base coat without reinforcement and for product in powder. The apparent density shall be determined on all the test specimens by measuring mass and dimensions. The precision for weighing is 1/1000 (0,01 g) and for the dimensions 1/100 (0,01 mm).

3.4.1.3 Particle size grading

Relevant only powders.

The particle size grading shall be established from a specimen removed from the manufactured product.

Method of operation:

The test shall be performed using air stream sieving on about 50 g specimen for 5 minutes per sieve. The curve shall be traced from 0,04 to 4 mm with at least five intermediate sieves without removing the fine fraction and measuring the passing fraction at 0.04.

3.4.2 Other special tests of control of base coat without reinforcement

For all base coats indicated in MPII:

- Flexural and compressive strength (relevant only for hardened products delivered as powder) in accordance with EN 1015-11.

3.4.3 Special methods of control for reinforcement mesh

3.4.3.1 Mass per unit area of reinforcement mesh

The mass per unit area is determined in accordance with EAD 040016-01-0404.

3.4.3.2 Mesh size and number of filaments

The mesh size is determined in accordance with Annex A of EAD 040016-01-0404.

4 REFERENCE DOCUMENTS

EAD 040005-00-1201	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 040011-01-1201	Vacuum insulation panel (VIP) with factory applied protection layers.
EAD 040012-00-1201	Thermal insulation board made of mineral material.
EAD 040016-01-0404	Glass fibre mesh for reinforcement of cement based renderings.
EAD 041389-00-1201	Boards made of agglomerated natural cork for thermal and acoustic insulation.
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 330284-00-0604	Plastic anchors for redundant non-structural systems in concrete and masonry.
EAD 330965-00-0601	Powder-actuated fastener for the fixing of ETICS in concrete.
EAD 331433-00-0601	Injected anchor for thermal insulation boards.
EN 1015-11:2019	Methods of test for mortar for masonry - Part 11: Determination of flexural and compressive strength of hardened mortar.
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 12939:2000	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 13169:2012+A1:2015	Thermal insulation products for buildings- Factory made expanded perlite board (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 13494:2019	Thermal insulation products for building applications - Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material.
EN 13495:2019	Thermal insulation products for building applications – Determination of pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test).
EN 13497:2018 + A1:2021	Thermal insulation products for building applications – Determination of resistance to impact of external thermal insulation composite systems (ETICS).
EN 13501-1:2018	Fire classification of construction products and building elements: Part 1 – Classification using test data from reaction to fire tests.
EN 13820:2003	Thermal insulation products for building applications- Determination of organic content.
EN 13823:2020+A1:2022	Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item.
EN 15715:2009	Thermal insulation products – Instructions for mounting and fixing for reaction to fire testing – Factory made products.
EN 15725:2023	Extended application reports on the fire performance of construction products and building elements.
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 16382: 2016	Thermal insulation products for building applications – Determination of pull-through resistance of plate anchors through thermal insulation products.
EN 16383:2016	Thermal insulation products for building applications - Determination of the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS).
EN 16637-2:2023	Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test.
EN 16733:2016	Reaction to fire tests for building products – Determination of a building products propensity to undergo continuous smouldering.
EN 17101:2018	Thermal insulation products for buildings - Methods of identification and test methods for one-component PU adhesive foam for External Thermal Insulation Composite Systems (ETICS)
EN 17140:2020	Thermal insulation product for building- Factory-made vacuum insulation panels (VIP). Specification.
EN 17333-2:2020 EN 17333-2:2020 + AC:2020	Characterisation of one component foam – part 2: Expansion characteristics.
EN 17333-4:2020	Characterisation of one component foam – part 4: Mechanical strength.
EN 1934:2000	Thermal performance building. Determination of thermal resistance by hot box method using heat flow meter.
EN 196-1:2016	Methods of testing cement - Part 1: Determination of strength.
EN 1990:2023	Eurocode - Basis of structural and geotechnical design.
EN 29052-1:1992	Acoustic – Determination of dynamic stiffness – Part 1: Material used under floating floors in dwellings

EN 312:2010	Particleboards – Specifications.
EN 998-1:2016	Specification for mortar for masonry – Part 1: Rendering and plastering mortar.
EN ISO 10140-1:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products (ISO 10140-1:2021).
EN ISO 10140-2:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation (ISO 10140-2:2010).
EN ISO 10140-4:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 4: Measurement procedures and requirements (ISO 10140-4:2010).
EN ISO 10140-5:2021	Acoustics - Laboratory measurement of sound insulation of building elements - Part 5: Requirements for test facilities and equipment (ISO 10140-5:2010).
EN ISO 10211:2017	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations.
EN ISO 10456:2007 EN ISO 10456:2007/AC:2009	Building materials and products – Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values.
EN ISO 10545-2:2018	Ceramic tiles - Part 2: Determination of dimensions and surface quality (ISO 10545-2:2018)
EN ISO 11348-1:2008 EN ISO 11348-1:2008 / A1:2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) – Part 1: Method using freshly prepared bacteria.
EN ISO 11348-2:2008 EN ISO 11348-2:2008 /A1:2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) – Part 2: Method using liquid-dried bacteria.
EN ISO 11348-3:2008 EN ISO 11348-3:2008 /A1:2018	Water quality - Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) - Part 3: Method using freeze-dried bacteria.
EN ISO 1182:2020	Reaction to fire tests for building products – Non combustibility test.
EN ISO 11925-2:2020	Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test.
EN ISO 15799:2022	Soil quality – Guidance on the ecotoxicological characterization of soils and soil material.
EN ISO 1716:2018	Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value).
EN ISO 29466:2022	Thermal insulating products for building applications - Determination of thickness.
EN ISO 29469:2022	Thermal insulating products for building applications - Determination of compression behaviour.
EN ISO 29470:2020	Thermal insulating products for building applications - Determination of the apparent density.
EN ISO 29767:2019	Thermal insulating products for building applications -- Determination of short-term water absorption by partial immersion.
EN ISO 6341:2012	Water quality. Determination of the inhibition of the mobility of <i>Daphnia magna</i> Straus (Cladocera, Crustacea). Acute toxicity test.
EN ISO 6946:2017	Building materials and products - Thermal resistance and thermal transmittance - Calculation method.
EN ISO 717-1:2020	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation.
EN ISO 7500 -2:2006	Metallic materials – Verification of static uniaxial testing machines. Part 2: Tension creep testing machine – Verification of the applied force.
EN ISO 7783:2018	Paints and varnishes – Determination of water-vapour transmission properties – Cup method
EN ISO 8990: 1999	Thermal insulation. Determination of steady state thermal transmission properties. Calibrated and guarded hot box.

EN ISO 9053-1:2018	Acoustics - Materials for acoustical applications - Determination of airflow resistance.
EN ISO 9513: 2013	Metallic materials. Calibration of extensometer systems used in uniaxial testing.
ISO 7892:1988	Vertical building elements - Impact resistance tests - Impact bodies and general test procedures.
ISO 9052-1:1989	Acoustics - Determination of dynamic stiffness. Part 1 Materials used under floating floors in dwellings.
CEN/TS 15117:2005	Fire-resistance of building materials and elements. Guidance on direct and extended application.
OECD Test Guideline 301, part A	OECD Guideline 301 for Testing of Chemicals. Part A: DOC Die-Away. Standard related with EN ISO 7827.
OECD Test Guideline 301, part B	OECD Guideline 301 for Testing of Chemicals. Part B: CO2 Evolution (Modified Sturm Test).
OECD Test Guideline 301, part E	OECD Guideline 301 for Testing of Chemicals. Part E: Modified OECD Screening.

ANNEX A: REACTION TO FIRE TESTING OF ETICS

A.1 General

A.1.1 Principle

The determination of reaction to fire of the ETICS is based on testing of the worst-case scenario, 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 testing of ETICS components the following principles apply:

- The base coat, specific adhesive, prefabricated strips, grout and finishing coat with the highest amount of organic content¹³ (related to the mass in dried condition as in end use application in accordance with the method indicate in Clause A.6.1) or the highest Q_{PCS} value (in accordance with EN ISO 1716)¹⁴ 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. For decorative / key coats with the same type of organic content and the only differences in the amount, only the decorative coat and the key coat with the highest organic content (related to dried condition) shall be tested with its highest application quantity per unit area. For decorative coats and key coats with different types of organic content, the decorative coat and key coat with the highest Q_{PCS} value per unit area [MJ/m^2] – based on the Q_{PCS} value [MJ/kg] (in accordance with EN ISO 1716) and the highest application quantity per unit area - shall be tested;
- The decorative coat and/or the key coat can be neglected in the following cases:
 - the thickness of the decorative coat is less than 200 μm ;
 - the organic content is not more than 5 % (related to the mass in dried condition as in end use application).
- In addition, each component material selected for testing according to the previous point, shall have the lowest amount of flame retardants.

The test results can be directly applied to all variants with the same rendering system coating but with a lower amount of organic components of each relevant coat. 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.

Although the rest of this annex applies the “worst-case scenario” for deciding what to test, it is accepted that, where the manufacturer wants to assess a range of 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 which are classified A1 without testing in accordance with Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) do not need to be tested, if separate testing and assessment is required for the components of the ETICS in the following clauses (as opposed to being tested as part of the ETICS as a whole),

¹³ The organic content can be checked by providing the formulation or, by performing suitable characterization tests or by determining the glow loss (loss on ignition or ash content). When information on organic content per unit area is not available, the Q_{PCS} -value shall be tested to decide about the worst-case.

¹⁴ If the requested information on organic content or Q_{PCS} -value of base coats specific adhesive, prefabricated strips, grout and/or finishing coats are not available, the Q_{PCS} -value shall be tested to determine the worst-case.

A.1.2 Physical properties influencing the reaction to fire behaviour

- Type of thermal insulation product (composition, thickness, density).
- Type of base coat specific adhesive, prefabricated strips, grout and finishing coats (composition, thickness, weight per unit area).
- Type of key coats and decorative coats (composition, weight per unit area).
- Type of specific adhesive.
- Type of reinforcement (composition, thickness, weight per unit area).
- Type and nature of mechanical fixing device.
- Type and nature of fire breaks (interruptions to the continuity of insulation or any cavity)¹⁵.
- 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 manufacturer wants to assess 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 in accordance with Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) do not need to be tested.

A.2 Testing in accordance with EN ISO 1182

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

Using this test method, only the ‘substantial components’ of the ETICS need to be tested. ‘Substantial components’ are defined by thickness (≥ 1 mm) or mass per unit area (≥ 1 kg/m²).

***Note:** 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:

¹⁵ Fire breaks are important for the behaviour of the whole facade ETICS 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.

- Composition,
- density.

A.2.1 Thermal insulation product

For testing the thermal insulation product reference shall be made to the relevant product specification according to Table 1.1.2.1.

A.2.2 Render coatings

A.2.2.1 Base coats and finishing coats (including prefabricated strips)

Base coats, specific adhesive, prefabricated strips, grout and finishing coats in accordance with the provisions of EC Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) 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 Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC) shall be tested in accordance with the principle specified in Clause A.1.

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 shall be at least that of the product tested.

Differences concerning the density shall be considered by testing the lowest and the highest density.

A.2.2.2 Key coats and decorative coats

The principles specified in Clause A.1 “Principle” shall be applied.

A.2.3 Adhesive

The same rules as given in A.2.2 above shall be applied. If the adhesive is identical to the tested base coat, the adhesive does not need to be tested separately.

A.2.4 Reinforcement

Each type of reinforcement that fulfils the requirements of a ‘substantial component’ shall be tested in accordance with EN ISO 1182. ‘Substantial components’ are defined by thickness (≥ 1 mm) or by mass per unit area (≥ 1 kg/m²). For reinforcement that is randomly dispersed (e.g., fibres) in the rendering system then it shall be tested as part of the rendering system.

A.3 Testing in accordance with EN ISO 1716

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

This test method shall be performed to all components of the ETICS except for cases which are classified as A1 without testing in accordance with Decision 96/603/EC (as amended by Decision 2000/605/EC and Decision 2003/424/EC).

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 fixing device and ancillary materials

which are not continuous but discrete components of ETICS shall not be considered for testing and for the calculation of the Q_{PCS} .

A.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.

A.3.2. Rendering system coating (including prefabricated strips)

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 Clause A.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.

For the application of test results the provisions in Clause A.1.1 shall apply.

A.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 rendering system coatings is used as the adhesive, the rules in accordance with Clause A.3.2 shall be applied.

If the adhesive is identical to the tested base coat, the adhesive does not need to be tested separately.

A.3.4 Reinforcement

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

A.4 Testing in accordance with EN 13823 (SBI-TEST)

This test method is relevant for the classes A2, B, C and D (in some cases also for A1¹⁶) in accordance with Commission Delegated Regulation (EU) 2016/364 in conjunction with EN 13501-1.

¹⁶ In cases in accordance with Delegated Regulation (EU) 2016/364, Table 1, Footnote 2a; A1 case mentioned in EN 13501-1 does not apply to ETICS.

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 mechanically fixing ETICS, by using the means of mechanical fixing device used in the end use application. When adhesives are used, the test result is valid also for mechanical fixing device.

When a purely mechanically fixing ETICS 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 in accordance with 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 shall 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 practice see Figures A.4.1 and A.4.2. 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 A.4.3.

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 in accordance with 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 system coating,
- amount of organic content of each coat of render system coating,
- amount of flame retardant of each coat of render system coating,
- type of reinforcement,
- type and nature of substrate.

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 in accordance with 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 provisions in Clause A.4.1 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.

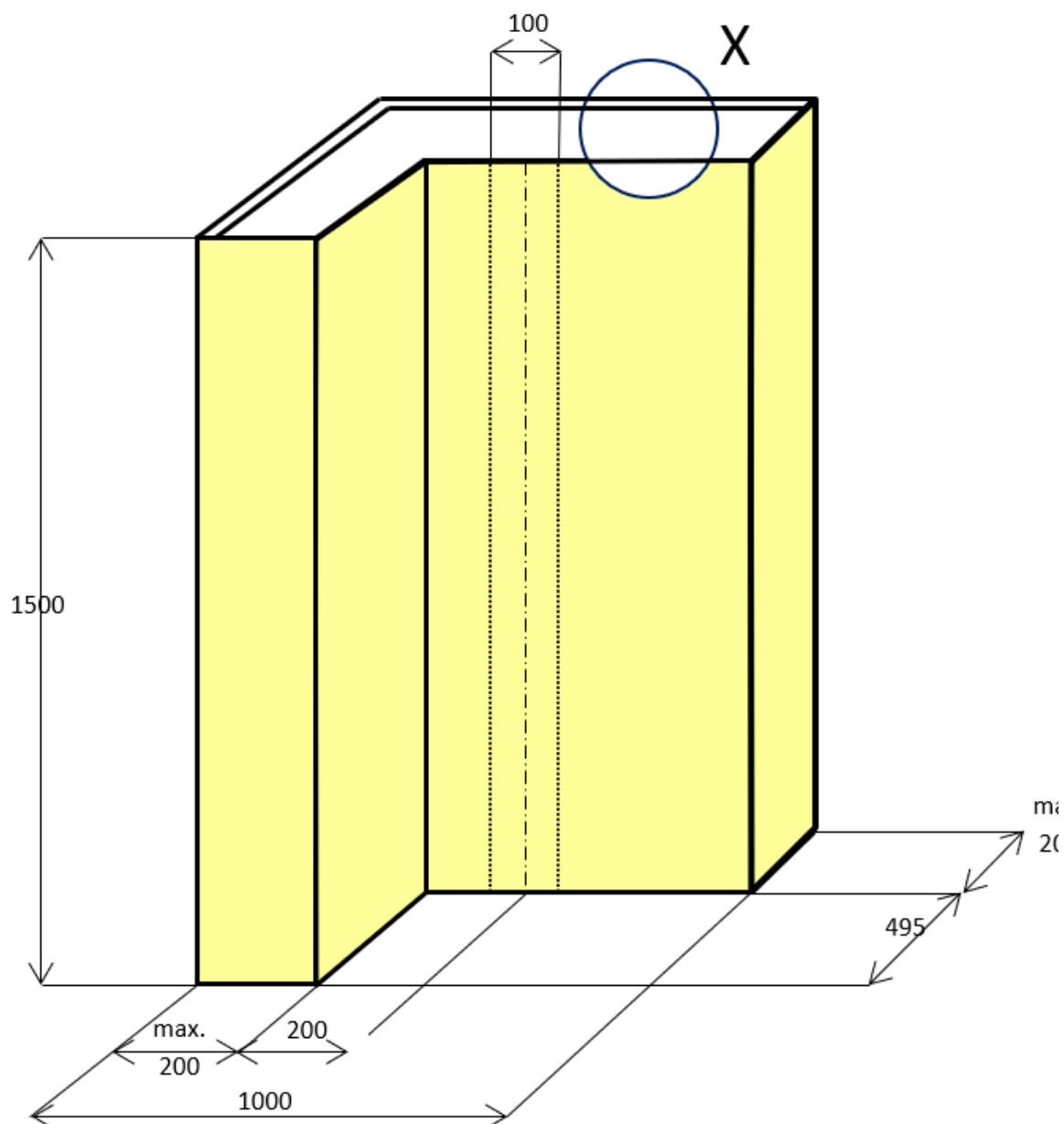


Figure A.4.1: Schematic drawing of the test specimen in the SBI-test in accordance with EN 13823 together with details of Figure A.4.4.

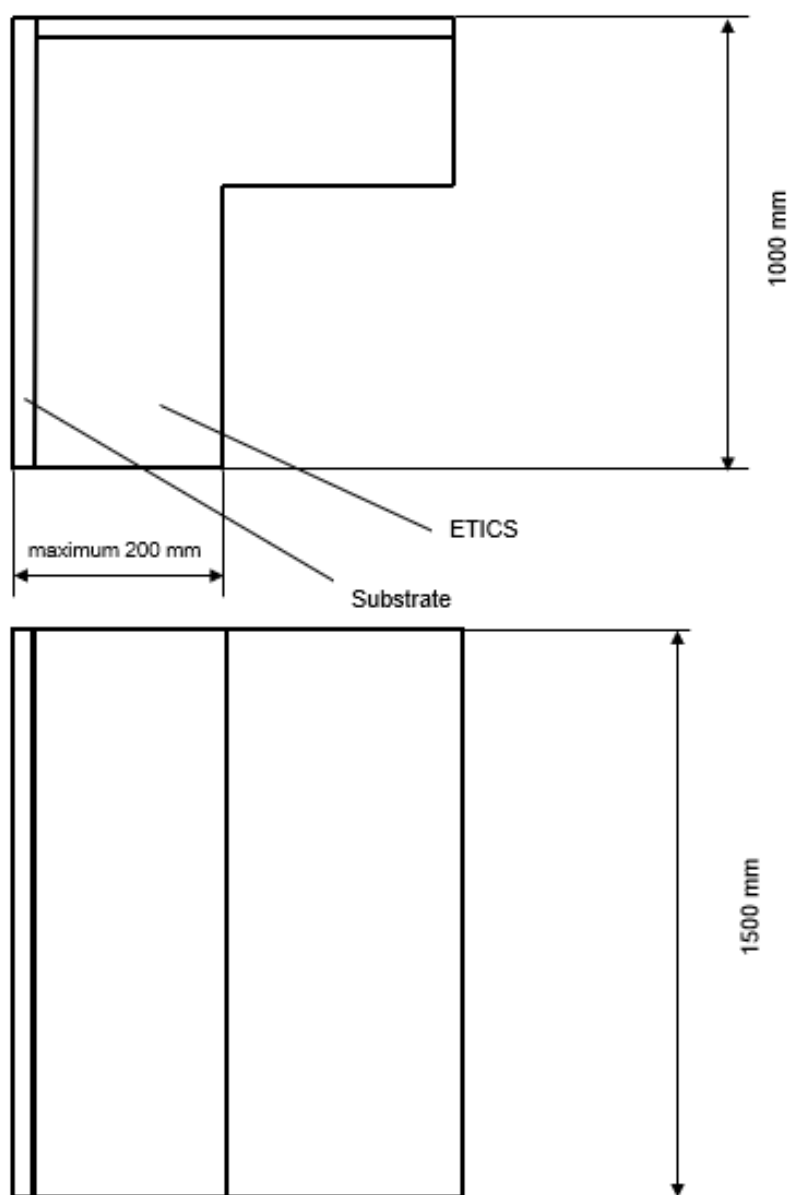
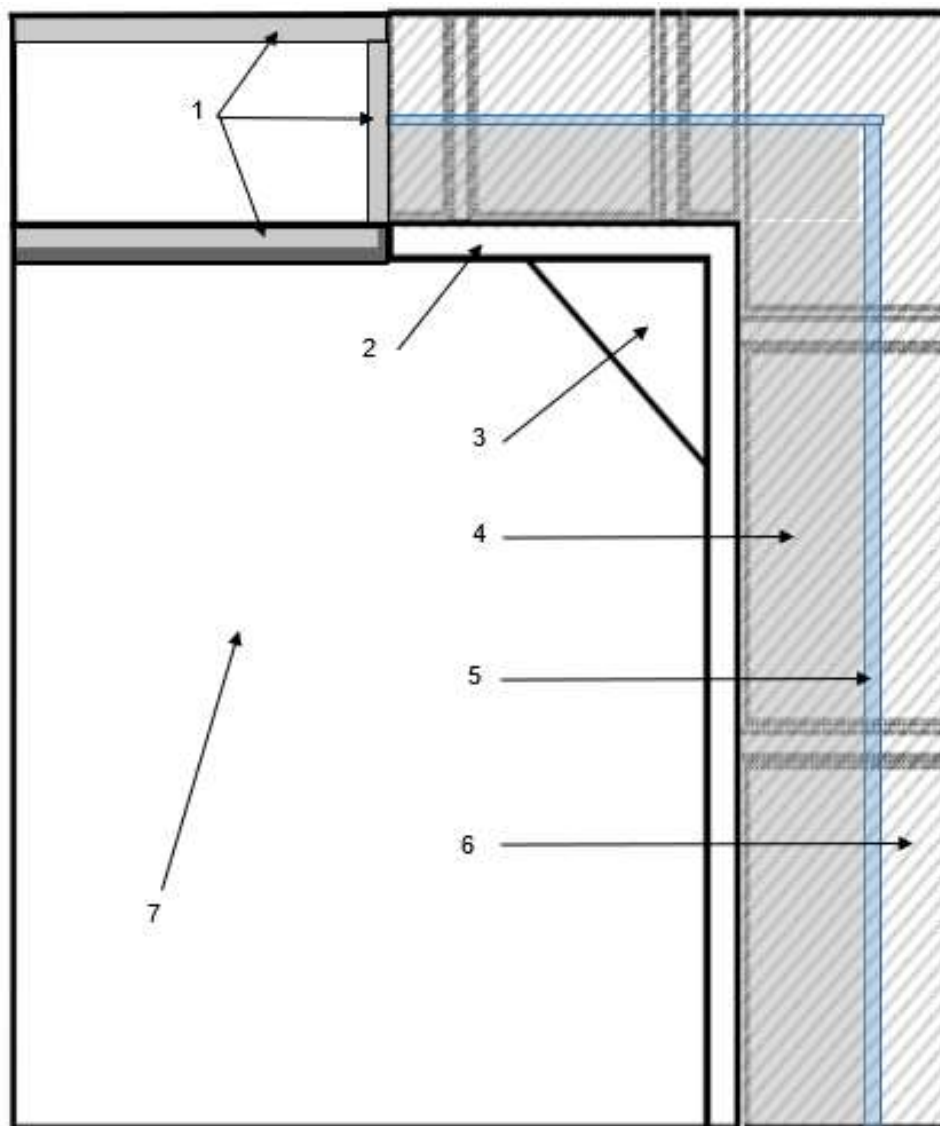


Figure A.4.2: Schematic drawing of the test specimen in the SBI-test in accordance with EN 13823



- 1 – Calcium-silicate boards of the SBI apparatus
- 2 – U-profile of the SBI apparatus
- 3 – main burner
- 4 – ETICS specimen (including substrate)
- 5 – backing board of the SBI apparatus
- 6 – area below the specimen covered by aluminium foil (entire hatched area)
- 7 – floor of the specimen trolley

Figure A.4.3: Ground view on the specimen trolley with the areas covered by an aluminium foil (Aluminium foil covered area shown in grey hatching)

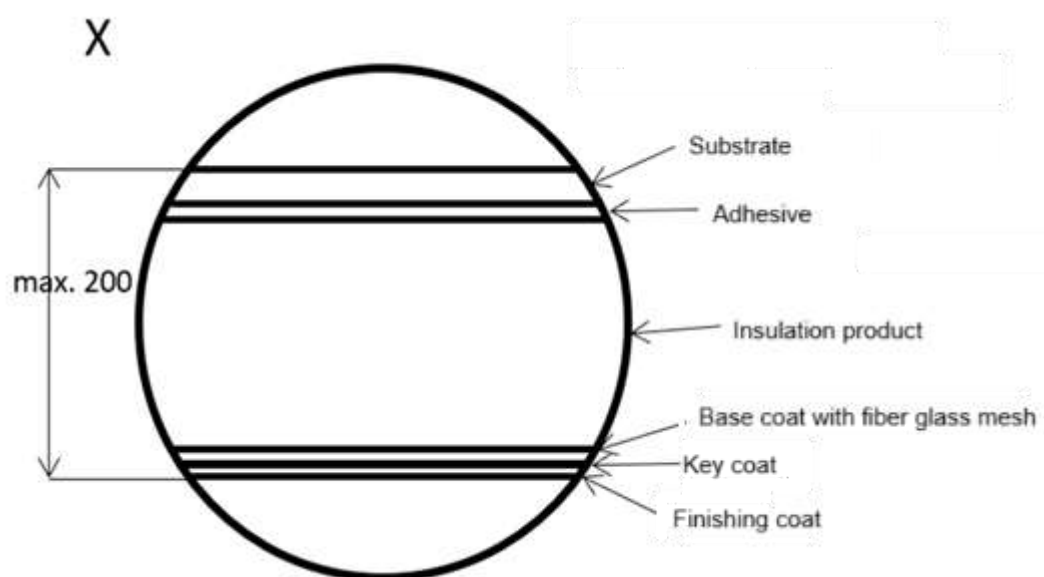


Figure A.4.4: Detail of the specimen for SBI test

A.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 $\pm 10\%$), in accordance with EN ISO 29470, and the highest organic content (related to the mass in dried condition), in accordance with EN 13820, 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 (see Table 1.1.2.1 taking into regard the reaction to fire class 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 $\pm 15\%$) 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) or any other animal or vegetable fibres or VIP, the provisions of EN 15725 in combination with CEN/TS 15117 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 (e.g., in relation to type/composition, density thickness or other parameters as given in A 4.1).

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).

A.4.2 Rendering system coatings (including prefabricated strips)

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 rendering system coatings:

- The base coat, the key coat, the finishing coat, the decorative coat and the specific adhesive, the prefabricated strips, the grout 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 Clause A.1 General.
- In addition to the above rule, each relevant combination of organic bound base coat and finishing coat (each with an organic content higher than 5 %) shall be tested, if class A2-s1, d0 shall be determined for the entire ETICS. One indicative test (one test specimen) shall be performed with each relevant combination and then the test shall be repeated at least twice with the most critical combination.
- For a base coat, a specific adhesive, a prefabricated strips, a grout 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 or a specific adhesive, a prefabricated strips, a grout 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, a specific adhesive, prefabricated strips, a grout and a finishing coat, shall be tested on insulation material with class A1 or A2-s1, d0.

In case of ETICS with prefabricated strips, the organic content of components of render strip are required for class other than A1 or A2. The heat combustion of components of render strips are required for class A1 or A2.

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.

A.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.

A.4.4 Reinforcement

The specimens shall be prepared with the reinforcement that is intended to be used in end use application. If different reinforcements of glass fibre mesh 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).

A.4.5 Extended application rules

The test result is valid for, in addition to rules aforementioned in A.4.1 to A.4.4:

- Thermal insulation products:

- of the same thermal insulation material (Table 1.1.2.1) or only of the same product (Clause A.4.1);
 - of the same reaction to fire class by EN 13501-1;
 - with lower densities and also with a maximum of 15% higher density than that tested one in case of thermal insulation products other than phenolic resin (PF) or wood fibre, (WF) or VIP;
 - with all densities between those evaluated in the tests in cases of phenolic resin (PF) or wood fibre (WF);
 - with density / weight per unit area as tested in case of VIP products;
 - 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;
 - with equal and less organic content, where relevant (see Clause A 4.1).
- Base coats and finishing coats, (including prefabricated strips (specific adhesive, prefabricated strips, grout)):
 - 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 QPCS-value per unit area.

A.5 Testing in accordance with EN ISO 11925-2

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

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 shall apply 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 rendering system coating;
- amount of organic content of each coat of rendering system coating;
- amount of flame retardant of each coat of rendering system 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° in accordance with the rules of standard EN ISO 11925-2.

A.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 (or highest testable thickness) and the densities as specified in the following provisions.

In addition, the lowest thickness of the thermal insulation shall be considered in cases as described in Clause A 5.3.

Depending on the type of the thermal insulation, the following provisions shall apply:

a) ETICS with thermal insulations of classes A1 and A2.

Each different type of the thermal insulation shall be considered for the tests of the ETICS. The specimen of the ETICS shall be prepared with that thermal insulation product having the highest organic content or the highest Q_{PCS} value (related to the mass) in accordance with EN ISO 1716 and the highest density.

b) ETICS with thermal insulations of classes B, C, D, E or F

- Each different type of the thermal insulation shall be considered for the tests of the ETICS with polystyrene (EPS, XPS). The specimens of these ETICS shall be prepared with that thermal insulation product having the highest density.
- 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.
- The specimens of ETICS with thermal insulations made of polyurethane (PU) shall be prepared with that density of the thermal insulation that is intended for the end-use.
- For testing ETICS with thermal insulation products made of vacuum insulation panels (VIP), each thermal insulation product with the highest and lowest weight per unit area (related to the relevant thickness for testing) shall be used for preparing the test specimens.
- For testing ETICS with thermal insulation products not covered by the rules above (e.g., made of cork, wood wool or any other animal or vegetable fibres), the provisions of EN 15725 in combination with CEN/TS 15117 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 (e.g., in relation to type/composition, density thickness or other parameters as given in A 5.1).

A.5.2 Rendering system coatings (including specific adhesive for prefabricated strips)

For testing one specific rendering system representing a range of different coatings, the rules as mentioned in A.4.2 apply.

A.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 in accordance with 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.

A.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.

A.5.5 Extended application rules

The test results for an ETICS tested are valid regarding the thermal insulation for:

- the same type of the thermal insulation material (Table 1.1.2.1) or only for the same product (see Clause A.5.1);
- of the same or better reaction to fire class by EN 13501-1;
- with equal or lower organic content or equal or lower Q_{PCS} value (related to the mass) in accordance with EN ISO 1716, where relevant (see Clause A 5.1),
- with equal or lower densities in cases where the highest density has been tested (see Clause A 5.1),
- with all densities between those evaluated in the tests in cases where highest and lowest density has been tested (see Clause A 5.1),
- with that density tested (including ± 15 % tolerance) in case of thermal insulations made of polyurethane (PU; see Clause A 5.1),
- with any weight per unit area between those evaluated in the tests (related to the thickness tested) in case of VIP products.
- 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 60 mm thick specimens were tested.

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 A.4.5.

A.6 Dry extract and ash content of adhesive/base coat, key coat, finishing coat, decorative coat, prefabricated strips (specific adhesive, prefabricated render strip, grout)

Dry extract and ash content of the adhesive/base coat, key coat, finishing coat, decorative coat, and prefabricated strips (specific adhesive, prefabricated strip, grout) are relevant in order to select the worst-case for the reaction to fire testing ETICS.

A.6.1 Dry extract (only pastes and liquids)

Relevant only for pastes and liquids.

- Lime and polymer-based products.

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

The mass shall be 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 shall be expressed as a percentage relative to the initial mass (mean value of three tests) and given in the test report.

- Silicate-based products.

The dry extract shall be determined by the following method:

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

B - Pre dry for 1 hour at $(125 \pm 10) ^\circ\text{C}$.

Dry for 2 hours at $(200 \pm 10) ^\circ\text{C}$.

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 shall be expressed as a percentage relative to the initial mass (mean value of three tests) and given in test report.

A.6.2 Ash content

- Pastes and liquids:

The ash content shall be determined on the same specimens as those on which the dry extract has been measured in accordance with Clause A.6.1.

- Powders:

The ash content shall be determined at 450°C and 900°C on a specimen of approximately 5 g pre-dried at $(100 \pm 5) ^\circ\text{C}$ or at $(200 \pm 5) ^\circ\text{C}$ for silicate-based products, to constant mass. The mass is regarded as

constant if the difference in mass between two successive weightings, one hour apart, does not exceed 0,1 g.

Method of operation:

- the specimen shall be 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 shall be placed in the oven maintained at ambient temperature,
- the temperature of the oven shall be then raised to $(450 \pm 20) ^\circ\text{C}$ (ash content at 450°C) or to $(900 \pm 20) ^\circ\text{C}$ (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 shall be expressed as a percentage relative to the initial mass after drying (mean value of three tests) and given in test report.

The maximum ash content of the adhesive/base coat, finishing coat, decorative coat, prefabricated strips (prefabricated strip, grout), at 450°C shall be expressed in % and given in the test report.

ANNEX B: ASSESSMENT METHODS APPLIED IN EU/EFTA MEMBER STATES FOR ASSESSING THE FIRE PERFORMANCE OF FAÇADES

Country	Assessment method
Austria	ÖNORM B 3800-5
Belgium	• BS 8414-1 • BS 8414-2 • DIN 4102-20 • LEPIR 2
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 regulation A 2.2.1.5
Hungary	MSZ 14800-6:2020 Fire resistance tests. Part 6: Fire propagation test for building façades
Ireland	BS 8414 (BR 135)
Poland	PN-B-02867:2013
Switzerland, Liechtenstein	• DIN 4102-20 • ÖNorm B 3800-5 • Prüfbestimmung für Aussenwandbekleidungssysteme

ANNEX C: ADDITIONAL PROVISIONS FOR DETERMINATION THE PROPENSITY TO UNDERGO CONTINUOUS SMOULDERING

This annex specifies the additional provisions for specific insulation materials for determination the characteristic *Propensity to undergo continuous smouldering* of the ETICS's thermal insulation products. For other insulation materials the Clause 2.2.3 applies directly.

C.1 Provisions for products made of mineral wool¹⁷

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

- The product variations of a product family (as defined by a certain combination of raw materials and other additives and produced in a certain production process)¹⁸.
- 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 ($\pm 15\%$); 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 ISO 29470.
- The product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm; (thickness determined in accordance with EN ISO 29466 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.
- Specimens without any non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm), otherwise Clause C.1.2 applies.

C.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 below).

If the highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

- Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm), shall be removed when preparing the test specimens.

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.

¹⁷ For products made of mineral wool fibres and aerogel the same provisions shall apply as given in clause C.1 for factory-made products made of mineral wool.

¹⁸ To permit the TAB to apply EXAP-rules for test results within the assessment, it is recommended that the manufacturer should provide (but he is not obliged to do it) sufficient information (e. g. on the basis of the composition of the product in question), allowing the TAB to determine which products or product variants shall be submitted to testing and to reduce the number of tests required

C.1.3 Extended application of test results

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

- of the same product-family;
- 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 external non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, otherwise Clause C.1.2 applies.
- for any end-use conditions.

C.2 Provisions for products made of wood wool

C.2.1 Specimen input data

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

a) Homogeneous products:

- product-variations of a product family (as defined by a certain combination of raw materials, e.g., the type of wood, binder and other additives, and produced in a certain production process)¹⁷.
- the product or product variant with the highest organic content (in percentage per mass), determined by tests in accordance with EN 13820;
- the product or product variant with the highest density as well as the lowest density, determined by tests in accordance with EN ISO 29470;
- the product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined in accordance with EN ISO 29466 on at least three specimens;
- each different produced material orientation of the wood wool / wood chips (i.e., lengthwise and crosswise to the length direction of the specimen);
- specimens without any non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm), otherwise Clause C.1.2 applies.

b) Non-homogeneous products (composite boards):

- product-variations of a product family (as defined by a certain combination of raw materials, e.g., the type of wood, binder and additives, possible combinations of wood wool and other possible layer materials, and produced in a certain production process);
- the product or product variant with the highest as well as lowest density of the wood wool layer;
- the product or product variant with the highest thickness of the wood wool layer;
- each different produced orientation of the wood wool 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 in accordance with 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 animal fibres), density determined by tests in accordance with EN ISO 29470;
- the product or product variant with the highest density as well as a density of about 100 kg/m³ ($\pm 15\%$) 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 ISO 29470);
- 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 animal 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;
- each different produced main and second layer material 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 non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) – existing facings or coatings shall be removed when preparing the test specimens.

C.2.2 Preparation of tests specimens

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

If the highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

In case of composite boards made of wood wool 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 animal fibres), both layers shall be exposed by the ignition source within the tests.

In case of composite boards made of wood wool and any other second layer material, which do not show propensity to undergo continuous smouldering, only the wood wool 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 clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.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 defined product-family (as defined by e.g., type of wood, binder and additives).
- With lower organic content of the wood wool layer.
- With all densities of the wood wool layers between those evaluated.
- With lower densities in case of mineral wool as second layer material or in case of layer material which does 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 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 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 external non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, and
- for any end-use conditions.

C.3 Provisions for products made of cork

C.3.1 Specimen input data

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

- Product-variations of a product family (as defined by a certain combination of raw materials, e. g. type of binder and additives etc., and produced in a certain production process¹⁷).
- The product or product variant with the highest and lowest density, determined by tests according to EN ISO 29470.
- The product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined by tests in accordance with EN ISO 29466 on at least three specimens.
- Each different produced orientation, if relevant (i. e. lengthwise and crosswise to the length direction of the product).
- Specimens without any non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm), otherwise, Clause C.3.2 applies.

C.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 highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

If clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.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-family.
- 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 external non-substantial facings or coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, and
- for any end-use conditions.

C.4 Provisions for products made of wood fibre

C.4.1 Specimen input data

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

- Product-variations of a product family (as defined by a certain combination of raw materials, e.g., type of binder and additives, and produced in a certain production process)¹⁷.
- 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 ISO 29470.
- The product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined by tests according to EN ISO 29466 on at least three specimens.
- Each different produced fibre orientation (i. e. lengthwise and crosswise to the length direction of the product).
- Specimens without any non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) – otherwise, Clause C.4.2 applies.

C.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 highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

If clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.4.3 Extended application of test results

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

- Of the same defined product-family (as defined by 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 external non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, and
- for any end-use conditions.

C.5 Provisions for products made of other vegetable fibre (than wood fibre) or animal fibre

C.5.1 Specimen input data

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

- Product-variations of a product family (as defined by a certain combination of raw materials, e.g., type of fibres, type of binder and additives / treatment, and produced in a certain type of production process)¹⁷.
- The product or product variant with the highest and lowest density, determined by tests in accordance with EN ISO 29470.

The product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined by tests in accordance with EN ISO 29466 on at least three specimens.

- Each different produced fibre orientation (i. e. lengthwise and crosswise to the length direction of the specimen).
- Specimens without any non-substantial facings, coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm), otherwise, clause C.5.2 applies.

C.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 highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

If clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.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-family, 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 external non-substantial facings, coatings or suchlike as defined by EN 13501-1, clause 3.1.5, (mass < 1 kg/m², and thickness < 1 mm) and
- for any end-use conditions.

C.6 Provisions for products made of phenolic foam

C.6.1 Sample input data

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

- product-variations of a product family (as defined by a certain combination of raw materials, e.g., type of binder and additives / treatment, and produced in a certain type of production process)¹⁷;
- the product or product variant with the highest and lowest density, determined by tests in accordance with EN ISO 29470;
- the product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined by tests in accordance with EN ISO 29466 on at least three specimens;
- each different produced orientation (i.e. lengthwise and crosswise to the length direction of the specimen);
- specimens without any facings, coatings, or suchlike (mass < 1 kg/m², and thickness < 1 mm); otherwise, Clause C.6.2 applies.

C.6.2 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 highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

If clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.6.3 Extended application of test results

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

- of the same defined product-family;
- with all densities between those evaluated;

- with lower thickness and also with greater thickness when 100 mm thick specimens were tested;
- with all orientations, if all relevant orientations had been tested;
- with any external non-substantial facings or coatings or suchlike (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, and
- for any end-use conditions.

C.7 Provisions for products made of vacuum insulation panels

In addition to EN 16733, the provisions given in EAD 040011-01-1201, clause 2.2.2 and Annex D, in combination with EN 17140 shall be considered for sampling and preparing test samples as well as for the application of test results.

C.8 Provisions for factory-made products from materials other than those regulated in C.1 to C.7

C.8.1 Sample input data

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

- product-variations of a product family (as defined by a certain combination of raw materials, e.g., type of fibres, type of binder and additives / treatment, and produced in a certain type of production process)¹⁷;
- if applicable, at least the product or product variant with the highest organic content (in percentage per mass) determined in accordance with EN 13820 shall be taken as the critical case for testing;
- at least the product or product variant with the highest and lowest density, determined by tests in accordance with EN ISO 29470;
- at least the product or product variant with the highest thickness or – if greater than 100 mm – highest testable thickness of 100 mm, determined by tests in accordance with EN ISO 29466 on at least three specimens;
- if relevant, each different product orientation, (i.e., lengthwise and crosswise to the length direction of the specimen) shall be tested;
- specimens without any non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm); otherwise, Clause C.8.2 applies.

C.8.2 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 highest thickness is greater than 100 mm, then the specimen thickness shall be reduced from the reverse (non-exposed) side to the maximum testable thickness of about 100 mm.

Existing non-substantial facings, coatings or similar (mass < 1 kg/m², and thickness < 1 mm) shall be removed when preparing the test specimens.

If clause 6.2.5 of EN 16733 applies, a permanent contact between the pieces shall be assured.

C.8.3 Extended application of test results

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

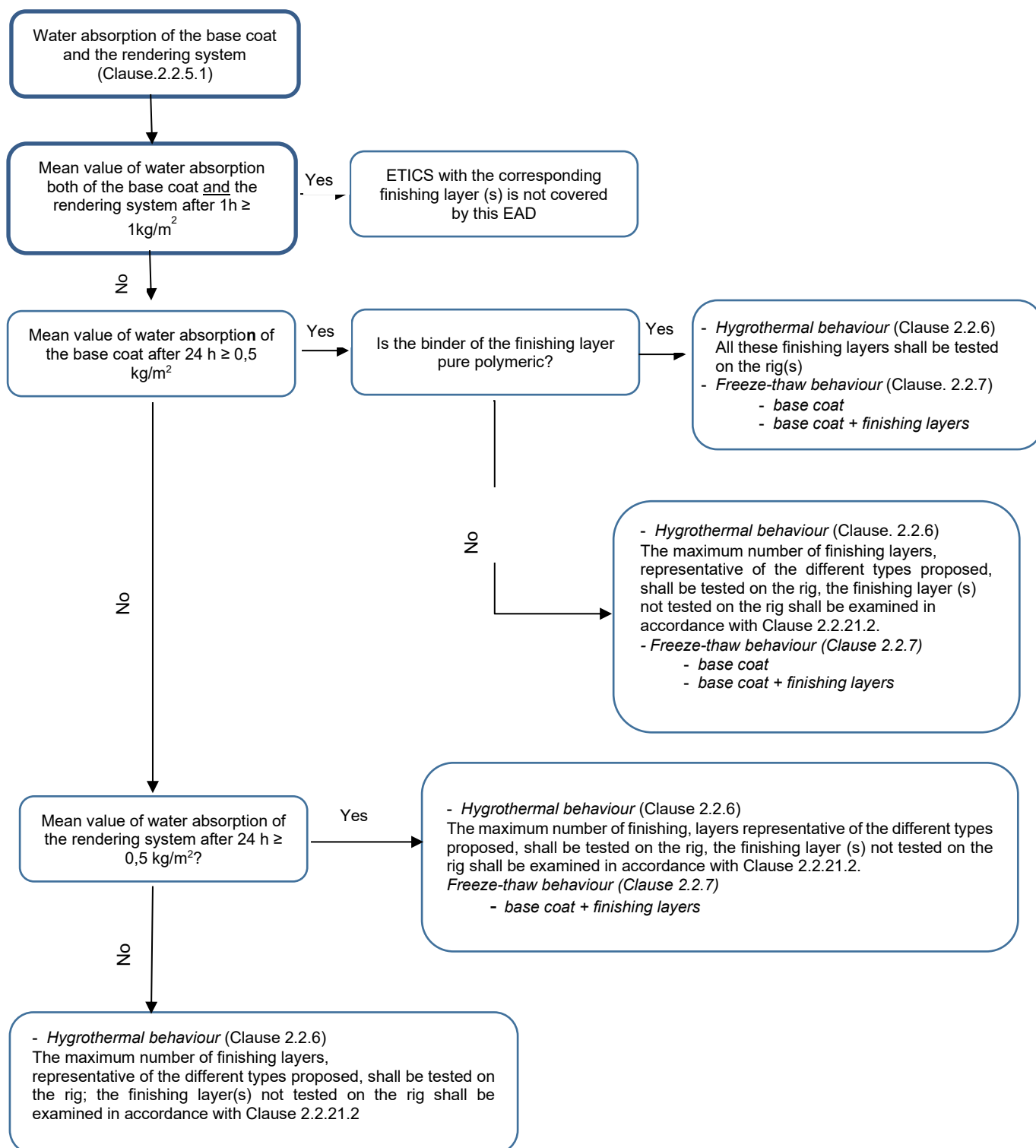
- of the same defined product-family;
- with lower organic content;

- with all densities between those evaluated;
- with lower thickness and also with higher thickness if 100 mm thick specimens were tested;
- with all the tested product orientations;
- with any external non-substantial facings or coatings (mass < 1 kg/m², and thickness < 1 mm) as defined by EN 13501-1, clause 3.1.5, and,
- for any end-use conditions.

ANNEX D: TESTING PROGRAMS FOR ASSESSING THE WATERTIGHTNESS AND SAFETY IN USE OF ETICS

D.1 Testing program for assessing the watertightness of ETICS

D.1 gives information of the products (e.g., the number of finishing coats) to be tested on the rig.



D.2 Testing program for assessing the safety in use of ETICS

Testing program for assessing the safety in use of the ETICS depends on the different fixing methods and the thermal insulation materials (see Table D.2.1). This testing programme is intended for guiding TABs in the process of selection of appropriate assessment method for given composition of the ETICS with the aim to rationalise number of tests and incurred costs.

Table D.2.1 Testing program for the assessing of safety in use of ETICS

		Methods of fixing of thermal insulation product (see Clause 1.1)			
		Purely bonded or bonded ETICS with supplementary mechanical fixings ¹	Mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS ²		
			Mechanical fixing devices fixed through the reinforcement layer (through glass fibre mesh)	Mechanical fixing devices fixed through the thermal insulation product only	Profiles
Thermal insulation product type	Cellular plastic Cellular glass Mineral wool	Bond strength between base coat and thermal insulation product in accordance with 2.2.10.1			
		Bond strength 2.2.10.2 and 2.2.10.3 or 2.2.10.4 ³	Bond strength 2.2.10.2. and 2.2.10.3 or 2.2.10.4 ³ Static foam block test 2.2.12.2 and Displacement test 2.2.11	Bond strength 2.2.10.2. and 2.2.10.3 or 2.2.10.4 ³ Pull-through test 2.2.12.1 Displacement test 2.2.11	Static foam block test 2.2.12.2 and Displacement test 2.2.11 and Pull-through resistance of fixings from profiles 2.2.15
	Wood wool, expanded cork, natural cork, wood fibre, vegetable and animal fibres, mineral materials and expanded perlite, agglomerated natural cork, factory –made vacuum insulation panel	Bond strength between base coat and thermal insulation product in accordance with 2.2.10.1.			
		Bond strength 2.2.10.2 and 2.2.10.3 and Dynamic wind uplift test 2.2.12.3	Bond strength 2.2.10.2 ⁴ and 2.2.10.3 ⁴ and Dynamic wind uplift test 2.2.12.3 and Displacement test 2.2.11	Bond strength 2.2.10.2 ⁴ and 2.2.10.3 ⁴ and Dynamic wind uplift test 2.2.12.3 and Displacement test 2.2.11	Dynamic wind uplift test 2.2.12.3 and Displacement test 2.2.11 and Pull-through resistance of fixings from profiles 2.2.15
1) The tests on bonded ETICS with supplementary mechanical fixing devices shall be conducted without the fixings. 2) Directions whether to use the adhesive during the test of mechanically fixed ETICS with supplementary adhesive are given in the clauses of the relevant test method. 3) Only for EPS or XPS thermal insulation products. The alternative between Clause 2.2.10.3 and 2.2.10.4 depends on the type of adhesive in ETICS 4) Except for purely mechanical fixed without supplementary adhesive.					

ANNEX E: WATER ABSORPTION OF THE BASE COAT AND THE RENDERING SYSTEM

E.1 General

The water absorption shall be performed in the following base coat and rendering system configurations on each type of thermal insulation product:

- The reinforced base coat alone (without any finishing layer).
- All the types of rendering systems (base coat with finishing layers).

In case where no more layers (finishing layer or decorative coat) are applied on a base coat (the base coat functions as a finishing layer as well), the application of a finishing layer 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). In case of difference in the surface of the finishing coat all superficial structures shall be tested separately.

Within a type of finishing coat, when the application of the key coat and/or the decorative coat is optional, at least configurations without them shall be tested.

The worst-case scenario shall be defined in accordance with the extended application of test results given in Clause E.4.

E.1.1 Test specimen

Three specimens are prepared for each configuration.

Testing is performed on specimens which are prepared as follows:

Each specimen shall be prepared by taking a piece of the specified thermal insulation product of size 200 mm x 200 mm, and applying on it, according to MPII, the corresponding configuration as given in Clause E.1. If the size of the thermal insulation product does not permit such a measurement, the test specimen shall be prepared by juxtaposing two thermal insulations to obtain the required measurement.

When the finishing layer is a prefabricated strip, at least the test with maximal area of joints shall be used. If the size of a render strip is bigger than the size of test specimen (200 mm × 200 mm), the specimens shall be built with a cross joint in the middle of the specimen.

E.1.2 Curing and conditioning of the specimen

The prepared specimens shall be conditioned for at least 7 days at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$. The amount and/or thicknesses of rendering system applied shall be recorded.

The edges of the specimens, including the thermal insulation product, shall be 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 shall be then subjected to a series of three cycles comprising the following phases:

- 24 h immersion in a water bath (tap water) at $(23 \pm 2) ^\circ\text{C}$. The specimens shall be immersed rendered face downwards, to a depth of 2 mm to 10 mm, the depth of immersion dependent upon surface roughness. To achieve complete wetting of rough surfaces, the specimens shall be tilted as they are introduced into the water. The depth of immersion can be regulated in the water tank by means of a height-adjustable slat.

- 24 h drying at $(50 \pm 5) ^\circ\text{C}$, the constant dry weight (when the weight of two successive measurements differs less than 1 %) shall be achieved and checked.

If interruptions are necessary, e.g., at weekends or holidays, the specimens shall be stored at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ after the drying at $(50 \pm 5) ^\circ\text{C}$.

After the cycles, the specimens shall be stored for at least 24 h at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$.

E.2 Test procedure

To start the water absorption test, the same specimens which were subjected to a series of three cycles shall be again immersed in a water bath as described above.

Each test specimen shall be weighed after three minutes of immersion in the bath (reference mass, $m_{3\text{min}}$) and then after 1 hour ($m_{1\text{h}}$) and 24 hours ($m_{24\text{h}}$) measured in grams. Water adhering to the surface shall be removed manually prior to each weighting (e.g., with paper towel or cloth).

E.3 Criteria for test results

For each test specimen the following individual calculation shall be undertaken to obtain the results in kg/m^2 :

For each test specimen configuration, the arithmetic average value after 1 hour immersion and after 24 hours immersion of the three tested specimens shall be calculated.

All the individual measured values and calculated values shall be included in the test report.

Water absorption after 1 hour:

$$W_{p, 1h} = \frac{(m_{1h} - m_{3\text{min}})}{A} \quad (E.3.1)$$

Where:

$W_{p,1h}$ is water absorption after 1 h in kg/m^2 .

m_{1h} is mass of the test specimen after 1 hour in kg.

$m_{3\text{min}}$ is mass of the test specimen after 3 minutes in kg.

A is surface of the test specimen in m^2 .

And

Water absorption after 24 hours:

$$W_{p,24h} = \frac{(m_{24h} - m_{3\text{min}})}{A} \quad (E.3.2)$$

Where:

$W_{p,24}$ is water absorption after 24 h in kg/m^2 .

m_{24h} is mass of the test specimen after 24 hours in kg.

$m_{3\text{min}}$ is mass of the test specimen after 3 minutes in kg.

A is surface of the test specimen in m².

The mean value of water absorption of the reinforced base coat or of the rendering system after one hour shall be less than 1 kgm² as defined in Clause 2.2.5.1, and Clause D.1.

When the water absorption after 24 hours is equal or greater than 0,5 kg/m², it is used for deciding:

- The configuration of finishing layers to be considered in the hygrothermal behaviour assessment (see Clause 2.2.6 and Clause D.1);
- The need for carrying out the assessment of freeze-thaw resistance (see Clause 2.2.7 and Clause D.1).

E.4 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Base coat: the same base coat as the one tested and applied with the same or lower thickness.
- Standard mesh: any.
- Reinforced mesh: any.
- Key coat: test results obtained without a key coat apply to the use of any key coat. Test results obtained with a key coat apply only to same key coat as the one tested with the same or higher amount applied.
- Finishing coat: any finishing coat of the same type (1.3.1.14) applied with the same or lower thickness as the one tested. In case of finishing coats with different structure results are applicable only for the tested superficial structure.
- Decorative coat: test results obtained without a decorative coat apply to the use of any decorative coat. Test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or higher amount applied.
- In case of ETICS with prefabricated strips, the test results are valid only for the same render strip as the one tested with equal or lower thickness and with equal or lower weight and, if used, the tested grout and the tested adhesive of prefabricated strips. The assessment is valid only for surface areas of joints lower than tested.

ANNEX F: WATERTIGHTNESS. HYGROTHERMAL BEHAVIOUR

F.1 Preparation of specimen

The test method consists in the application of the ETICS on a test wall (Rig) as described in this annex. Any finishing layer not tested on the rig shall be examined in accordance with Clause 2.2.21.2. and Clause D.1.

F.2 Principles related to the preparation of the rig

- Only one reinforced base coat, applied in a continuous way 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 four finishing coats are proposed for the ETICS, the maximum number of coats, representative of the different types proposed (see Clause 1.3.1.14), shall be tested on rig(s). Furthermore, if the water absorption of the reinforced base coat after 24 h is equal to or higher than 0,5 kg/m², each type of finishing coat containing a pure polymeric binder (non-cementitious) shall be submitted to hygrothermal cycles on rig(s).
- In case of ETICS with prefabricated strips at least the configuration with highest surface of joints shall be tested on the rig, other configurations shall be tested in accordance with Clause 2.2.21.2.
- 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.
- 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 fixing devices in the centre.
- If several ETICS differ only in the type of thermal insulation product, only two different thermal insulation products can be applied to the rig. The thermal insulation products are divided vertically at the centre of each rig.
- If finishing coat or adhesive glue prefabricated strips on the base coat are made of mineral binder and are applied in thickness more than 6 mm, the rig shall be built with maximum two type of finishing coats or adhesives to glue prefabricated strips (the rig cannot be divided into four sectors but at most into two).

F.2.1 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 according to MP11.
- 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 (percentage of bonded area) and, if relevant, type of fixing installation.
 - Figure describing the rig (place of the fixings and of the joints between the panels, etc.).
 - Way of rendering system preparation (tool, percentage of mixing, possible pause time before application) as well as their way of application (hand tool, machines, number of layers, etc.).
 - Quantities and/or thickness of rendering system applied per square meter, if relevant the type of structure of the finishing coat (see Clause 1.3.1.14).
 - Drying period between each layer.
 - Use and position of accessories.
 - Any other information (for example if wetting is required).

F.2.2 Observations during the test

At the end of every set of cycles (HW, HC, WFT), observations to the naked eye or using appropriate tools to magnify defects, related to any 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 in the laboratory for traceability.

Observations related to:

- 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 surface near ancillary components, if present, shall be checked for any damage/degradation together with any associated cracking of the finish. Again, the location and extent shall be recorded in the test report.

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

In case of doubt a gauge capable to measure the crack width from 0,1 mm and be graduated in steps of 0,05 mm (as the one used for impact test in Clause 2.2.8) should be used or other appropriate tools to magnify the crack, should be used.

F.3 Criteria for test results

The following defects shall be observed on the ETICS and recorded during and after hygrothermal cycles HWC or HWCFT:

- Blistering or peeling of any finishing coat.
- Failure or cracking of finishing coats, bigger than 0,2 mm, associated with joints between thermal insulation product boards or profiles fitted with ETICS.
- Detachment of the finishing layer/ rendering system.
- Cracks in any layer with width bigger than 0,2 mm. In case of doubt a gauge capable to measure the crack width from 0,1 mm and be graduated in steps of 0,05 mm (as the one used for impact test in Clause 2.2.8) should be used.

The defects listed above shall not occur during or after the test, see Clause 2.2.6.

F.4 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Adhesive: any.
- Thermal insulation product: any thermal insulation products of the same type (see Clause 1.3.1.7).as the one tested and with equal or better nominal dimensional stability in accordance with EN 1604.
- Anchors: any.
- Base coat: when the range of application thickness is between 3-5 mm, the results are valid for the same base coat as the one tested with the same range of thickness application. When the range of application thickness is more than 5 mm, the results are valid for the same base coat as the one tested with the application range of thickness -2/ +3 mm.
- Standard mesh: with tensile strength after conditioning equal or higher than tested and with coverage rate, in accordance with Clause 1.3.6 of EAD 040016-01-0404, equal or higher than tested.
- Reinforced mesh: with tensile strength after conditioning equal or higher than tested and with coverage rate, in accordance with Clause 1.3.6 of EAD 040016-01-0404 equal or higher than tested.
- Key coat: test results obtained without a key coat apply to the use of any key coat. Test results obtained with a key coat apply only to the same key coat as the one tested with the same or higher amount applied.
- Finishing coat: test results apply to the same finishing coat type as the one tested. If the tested finishing coat thickness is up to 3 mm, the results are valid for the tested finishing coat type in any thickness up to 3 mm. If the tested thickness is more than 3 mm the test results are applicable to the tested thickness ± 1 mm. In case of finishing coats with different structure (ribbed or floated/smooth) the results apply only to the tested superficial structure.
- Decorative coat: test results obtained without a decorative coat apply to the use of any decorative coat. Test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or higher amount applied.
- In case of ETICS with prefabricated strips, the test results are valid only for the same render strip as the one tested with configurations with surface area of joints higher than the one tested on the rig.

ANNEX G: WATER TIGHTNESS OF THE ETICS: FREEZE-THAW RESISTANCE

G.1 Preparation of the specimens

The freeze–thaw conditioning shall be performed on three specimens.

Each specimen shall be prepared by taking a piece of the specified thermal insulation product of size 500 mm x 500 mm, and applying it according to MPII. If the size of the thermal insulation product does not permit such a measurement, the test specimen shall be prepared by juxtaposing two panels to obtain the required measurement.

The test specimen shall include:

- Reinforced base coat without finishing coat if its water absorption is equal to or higher than 0,5 kg/m² after 24 hours (see Clause D.1).
- All the configurations of rendering according to MPII (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/m² after 24 hours see Clause D.1).
- When the application of the key coat and/or the decorative coat is optional, at least configurations without them shall be tested.
- For ETICS with prefabricated strips, at least test arrangements with maximum area of joints shall be used.

G.2 Cycles

The specimens 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 specimens, rendering system facing downwards, in a water bath, by the method described in 2.2.5.1, water absorption test.
- Freezing to $(- 20 \pm 2)$ °C (fall for 5 hours at the specimen 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 specimens are handled manually and there are stops during the weekends or holidays, the specimens shall always be maintained immersed in tap water between the cycles.

The specified temperatures are measured at the surface of the specimens. The temperature is obtained by conditioned air.

G.3 Criteria for test results

The following defects shall be observed on the specimens and recorded during and after the freeze – thaw cycles:

- 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.
- Cracks with width bigger than 0,2 mm.

In case of doubt a gauge capable to measure the crack width from 0,1 mm and be graduated in steps of 0,05 mm (as the one used for impact test in Clause 2.2.8) should be used.

The defects listed above shall not occur on either the reinforced base coat or the rendering system during or after freeze-thaw cycles, see Clause 2.2.7.

G.4 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Adhesive: any.
- Thermal insulation product: any thermal insulation products with the same material as the one tested.
- Anchors: any.
- Base coat: the same as the one tested and applied with the same or lower thickness.
- Standard mesh: any.
- Reinforced mesh: any.
- Key coat: test results obtained without a key coat apply to the use of any key coat. Test results obtained with a key coat apply only to the same key coat as the one tested with the same or higher amount applied.
- Finishing coat: any finishing coat of the same type (see Clause 1.3.1.14) applied with the same or lower thickness as the one tested. In case of finishing coats with different structure (ribbed or floated/smooth) the results on the floated structure apply to the ribbed finishing coats.
- Decorative coat: test results obtained without a decorative coat apply to the use of any decorative coat. Test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or higher amount applied.
- In case of ETICS with prefabricated strips, the test results are valid only for the same render strip as the one tested, with equal or lower thickness and with equal or lower weight and if used, the tested grout and the tested adhesive of prefabricated strip. The assessment is valid only for surface areas of joints lower than tested.

ANNEX H: IMPACT TEST

H.1 General

This annex describes the method based on the principles in accordance with ISO 7892 to assess 3 Joule and/or 10 Joule impact energies. The alternative methods for assessing 3 Joule and/or 10 Joule impact or for more than 10 Joules are described in EN 13497.

H.1.1 Tested configurations

The hard body impact test shall be performed after one of the following test settings 1, 2 or 3:

1. Tested on the rig preconditioned by HWC cycles: heating and wetting (HW) + heating and cooling (HC); see Clause 2.2.6 “Hygrothermal behaviour” for details.
2. Tested on the rig preconditioned by HWCFT cycles: heating and wetting (HW) + heating and cooling (HC); + wetting, freezing and thawing (WFT); see Clause 2.2.6 “Hygrothermal behaviour” for details.

For finishing layers not tested on the rig, in accordance with the indication of Clause F.2 and Clause D1, or for complementary tests (double meshes, etc.), these tests shall also be carried out on specimens aged by immersion in water for 6 to 8 days and then dried for at least 7 days at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ in accordance with point 3 below.

3. Tested on a panel of thermal insulation product covered with rendering system, cured for at least 28 days at $23 \pm 2 ^\circ\text{C}$ and $50 \% \pm 5 \text{ RH}$ and then submitted to immersion in water for 6 to 8 days and then dried for at least 7 days at $23 \pm 2 ^\circ\text{C}$ and $50 \% \pm 5 \text{ RH}$. Within a type of finishing coat (Clause 1.3.1.14) the test shall be carried out with at least the thinnest layer, generally the lowest particle size.

The hard body impact resistance shall be assessed on the ETICS with each rendering system.

In case where no more layers (finishing layer or decorative coat) are applied on a base coat (the base coat functions as a finishing coat as well), the application of a finishing layer prescribed in test procedures shall be omitted. It means that the impact resistance of ETICS is the impact resistance of the base coat.

When ETICS with prefabricated strips is tested, the impacts shall be carried out both on the middle and on the joint of the strips.

H.2 Test method in accordance with ISO 7892

Impacts shall be performed after one of the three test settings described above in Clause H.1.1 (1 or 2 on the rig or 3 on thermal insulation products covered with rendering system) at the points of impact with different rigidity such as in the centre or in the joint of the thermal insulation, near the mechanical fixing device and on double reinforcement layer around corners of windows. The number of impacts shall be five.

If testing render strips, three impacts shall be carried out in the joint of render strips and three impacts at approximate centre of the render strip.

- Hard body impacts with 3 and/or 10 Joules using ISO 7892 impacts are performed with the steel ball weighing $500 \pm 5 \text{ g}$ and from a height of 0,61 m;

and

- Five hard body impacts are performed with the steel ball weighing $1000\text{g} \pm 10 \text{ g}$ and from a height of 1,02 m.

After the test, the observation of defects is made from the external surface for each impact zone.

Observation shall be taken at each impact zone. An appropriate tool to magnify the crack should be used and it is necessary to use a gauge capable to measure the crack width from 0,1 mm and be graduated in steps of 0,05 mm (as described in Clause 5.3 of EN 13497). Top view does not usually reveal the widest part of the crack.

H.3 Criteria for test results

The assessment of impact resistance is based on observation of the defects in accordance with EN 13497 at different levels of impact energy.

Level of damage A –no cracks (not even hairline cracks) and no defects observed on the test surface for all five impact points.

Level of damage B –no cracks wider than 0,1 mm and no defects observed on the test surface for five impacts out of five impact points.

Level of damage C –no cracks wider than 0,2 mm and no defects observed on the test surface for five impacts out of five impact points.

Level of damage D –cracks wider than 0,2 mm.

Notes for identifying defects:

- Delamination between the finishing layer and the base coat.
- Delamination between the base coat and the insulation product.
- Delamination within the base coat.
- Visibility of the reinforcement.
- Perforation of the finishing layer and/ or base coat.

H.4 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Adhesive: any.
- Thermal insulation product: any thermal insulation products of the same type as the one tested.
- Anchors: any.
- Base coat: the same base coat as the one tested and applied with the same or higher thickness.
- Standard mesh: any standard mesh with the same or higher tensile strength at initial state and/or after ageing (in accordance with EAD 040016-01-0404 Clause 2.2.7). Test results with one layer of mesh apply to two layers of mesh.
- Reinforced mesh: test results apply also to any reinforced mesh with the same or higher tensile strength at initial state and/or after ageing (in accordance with EAD 040016-01-0404 Clause 2.2.7) as the reinforced mesh tested.
- Key coat: test results obtained without a key coat apply to the use of any key coat. Test results obtained with a key coat apply only to the same key coat as the one tested with the same or higher amount applied.
- Finishing coat: any finishing coat of the same type (see Clause 1.3.1.14) applied with the same or higher thickness as the one tested.

- Decorative coat: test results obtained without a decorative coat apply to the use of any decorative coat. Test results obtained with a decorative coat apply only to the same decorative coat as the one tested with the same or higher amount applied.
- In case of ETICS with prefabricated strips, the test results are valid only for the tested adhesive of the render strips with the same or higher amount applied and the tested render strips grout. If no grout is used, test results are applicable only for the use without grout. The assessment is applicable for surface area of joints lower or the same as the one tested.

Test results obtained for a certain energy level within the three test conditionings, can be considered also for lower energies.

ANNEX I: ADDITIONAL INFORMATION FOR TESTING BOND STRENGTH

This Annex contains additional information to assess the characteristics described in Table 2.2.10.1.

This annex in Clause I.4 gives also the formula to define the minimum bonded area B_s for bonded ETICS whose results shall be reported in test report.

I.1. Bond strength between base coat and the thermal insulation

The assessment of the bond strength between the base coat and the thermal insulation product shall be performed on each combination with each thermal insulation type with the lowest tensile strength (nominal value) in accordance with Clause 2.2.13.1 included in MPII.

I.1.1 Configurations for bond strength between the base coat and the thermal insulation product

The following configurations are used for the assessment of the bond strength between the base coat and thermal insulation product:

- On one panel faced with the base coat applied according to MPII and dried for at least 28 days (cured in laboratory condition -dry condition), (see Table 2.2.10.1).
- On specimens taken from the rig after hygrothermal cycles (HWC cycles; or after HWCFT cycles in accordance with Clause 2.2.6 and Table 2.2.10.1).
- When freeze-thaw cycles apply (see Clause 2.2.7), on the specimens of the reinforced base coat alone after the freeze-thaw cycles (see Clause G.1 and Table 2.2.10.1) and dried at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$ for at least 7 days after the end of the cycles.

I.1.2 Preparation of the specimens and pull-off test

The number of specimens is five. The indications in Clause 6.2 of EN 13494, shall be followed also for thermal insulation specimens with thickness lower than 50 mm.

Size of specimens (Clause 5.2 of EN 13494) shall be the same as the size of specimens for tensile strength perpendicular to faces defined in the relevant technical specification (see Table 1.1.2.1). If absent the dimensions $200 \times 200 \text{ mm}$ shall be used.

I.1.3 Calculation of test results

The calculation of tensile bond strength results shall be done in accordance with Clause 8 of EN 13494 and expressed in kPa.

In case the individual bond strength test results are higher than the nominal tensile strength (TR) perpendicular to the faces of the thermal insulation product, each value shall be corrected to the nominal TR value of the insulation product as given in Table I.1.3.1 and expressed in kPa.

Table I.1.3.1 Example of individual tensile bond strength results compared to nominal TR of insulation and mode of failure

Example: nominal TR100 of EPS (100 kPa)

Tensile bond strength results and mode of failure (kPa)				
120 (in insulation)	90 (in between the base coat and insulation product)	80* (in insulation)	110 (in between the base coat and insulation product)	90 kPa (in base coat)
Tensile bond strength results corrected to the nominal insulation values for all mode of failure (kPa)				
100	90	80	100	90
Mean: $(100+90+80+100+90)/5$				
Minimum: 80				

*In case the tensile bond strength test values are lower than the nominal TR value of the thermal insulation product they shall be indicated without any correction.

Pictures with mode of failure in accordance with indications of Clause I.1.4 from each test result have to be recorded in test report.

I.1.4 Criteria for test results

All the test results of the tensile bond strength (corrected, if needed) between the base coat and the thermal insulation product after each conditioning shall fulfil the following limit values, otherwise, mechanically fixed ETICS with fixing devices fixed through the reinforcement layer (through glass fibre mesh) shall be considered for the assessment (see Table D.2.1).

- Minimum 80 kPa for each individual result with adhesive failure or cohesive failure in the base coat. One single value lower than 80 kPa but higher than 60 kPa is accepted,

or

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

The mode of failure shall be stated in accordance with Clause 8.2 of standard EN 13494:

The failure is considered as cohesive if more than 50% of the failure occurs in the thermal insulation product. This percentage will be determined by visual inspection and touch. The failure shall be stated in the ETA according to the prevalent mode of failure among the test specimens; in case a prevalent mode does not occur, the mixed failure shall be stated.

I.1.5 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Base coat: the same base coat as the one tested.
- Thermal insulation product: any thermal insulation product of the same type (definition in Clause 1.3.1.7) as the one tested with the same or higher nominal tensile strength (TR) perpendicular to the faces.

I.2 Bond strength between adhesive and the substrate

I.2.1 Preparation of the specimens and pull -off test

The tests shall be performed on 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.

The adhesive shall be spread on the substrate. Normally, the thickness shall be from 3 to 5 mm, unless another value is given in the MPII. The adhesive shall cure at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$ for at least 28 days.

After each of the three following conditionings, five square specimens of 15 to 25 cm² shall be cut in area through the adhesive. Metal plates of appropriate size are bonded to the squares using a suitable adhesive.

The pull-off test shall be performed at a tensioning speed of $(10 \pm 1) \text{ mm/minute}$ on the following specimens (five specimens each) in accordance with Table 2.2.10.1:

- Without supplementary conditioning (dry condition).
- After immersion of the adhesive in water for 2 days and 2 h drying at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$.
- After immersion of the adhesive in water for 2 days and at least 7 days drying at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$.

The calculation of tensile bond strength results shall be done in accordance with Clause 8 of EN 13494 and expressed in kPa.

I.2.2 Criteria for test results

For bonded ETICS (both purely bonded ETICS and bonded ETICS with supplementary mechanical fixings), all the test results of the bond strength between the adhesive and the substrate after each conditioning shall be at least equal to the values indicated in Table I.2.2.1.

Table I.2.2.1 Minimum values for tensile bond strength between the adhesive and the substrate for purely bonded ETICS and bonded ETICS with supplementary mechanical fixings.

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 specimens from the water	At 7 days after removing the specimens from the water
Any	250 **	80*	250**
* One single value lower than 80 kPa but higher than 60 kPa is accepted.			
** One single value lower than 250 kPa but higher than 200 kPa is accepted.			

The minimum values given in Table I.2.2.1 are not applicable for mechanically fixed ETICS with supplementary adhesive.

Pictures with mode of failure in accordance with indications of Clause I.1.4 from each test result have to be recorded in test report.

For bonded ETICS, the minimum bonded surface area B_s shall be calculated according in accordance with Clause I.4.

I.3 Bond strength between the adhesive and the thermal insulation product

The assessment of the bond strength between adhesive and the thermal insulation shall be performed when using adhesive regardless fixing methods of thermal insulation product (see Table D.2.1).

The test shall be performed on all intended combinations of thermal insulation types (see Clause 1.3.1.7) and adhesives according to MPII of ETICS. Within the same type of thermal insulation product, the test shall be performed at least on a specimen with the lowest nominal tensile strength.

I.3.1. Preparation of the specimens and pull - off test

The number of specimens shall be five. See Clause I.1.2.

The pull-off test shall be performed submitting five specimens for each test condition (see Table 2.2.10.1):

- Without supplementary conditioning (dry condition).
- After immersion of the adhesive in water for 2 days and 2 h drying at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$.
- After immersion of the adhesive in water for 2 days and at least 7 days drying at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$.

I.3.2 Calculation of test results

See Clause I.1.3.

I.3.3 Criteria for test results

See Clause I.1.4 considering the limit values indicated in Table I.3.3.1.

Table I.3.3.1 – Minimum values for bond strength between the adhesive and the thermal insulation product for purely bonded ETICS and bonded ETICS with supplementary mechanical fixings

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 specimens from the water	At 7 days after removing the specimens from the water
Adhesive failure	80*	30	80*
Cohesive failure in adhesive			
Cohesive failure in thermal insulation product	30**	no limit value	no limit value
* One single value lower than 80 kPa but higher than 60 kPa is accepted.			
** With respect to the minimum accepted bonded surface, as described in I.4.			

The bonded surface area B_s is calculated in accordance with Clause I.4.

I.4 Minimum bonded area for bonded ETICS

Depending on the minimum value of the bond strength results between the adhesive and the thermal insulation product (see Clause I.3) or the bond strength of PU-foam adhesive (see Clause 2.2.10.4), the following aspects shall be considered for defining the minimum bonded area:

- When the minimum value of tested bond strength is in the range of 30 kPa to 75 kPa, the minimum bonded area B_s shall be calculated as follows:

$$B_s = (30 \times 100) / B \quad \text{in \%} \quad (\text{I.4.1})$$

Where:

B_s is the minimum bonded area, expressed in %.

B is the minimum value of bond strength between the adhesive and the thermal insulation product in dry condition for all failure modes (see Clause I.1.4), expressed in kPa, corrected if needed (see Table I.1.3.1).

30 is the minimum value of bond strength between the adhesive and the thermal insulation product in kPa.

- When the minimum value of tested bond strength is greater than 75 kPa, the minimum bonded area B_s is 40%, as the minimum given in Clause 1.1 for bonded ETICS.

Note: when the minimum value of tested bond strength is lower than 30 kPa, it would lead to a bonded area greater than 100% which is not physically possible, therefore, the ETICS is not a bonded ETICS as defined in point 1 of Clause 1.1.

ANNEX J: CRITERIA FOR TEST RESULTS FOR BOND STRENGTH ASSESSMENT FOR PU-FOAM ADHESIVES

The purpose of this annex is to provide criteria for test results for bond strength assessment for PU-foam adhesives using expanded or extruded polystyrene thermal insulation product for ETICS (Clause J.1) and extended application rules (Clause J.2.).

J.1 Criteria for test results

The test results for purely bonded ETICS and bonded ETICS with supplementary mechanical fixings, of the bond strength in accordance with Annex I, shall be at least equal to the values indicated in Table J.1.1.

Table J.1.1 Minimum values for bond strength of foam adhesives for purely bonded ETICS and bonded ETICS with supplementary mechanical fixings

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 accepted.	

Minimum bonded surface B_s , which exceed 40 %, shall be calculated in accordance with Clause I.4.

For mechanically fixed ETICS with supplementary adhesive, the performance shall be indicated without fulfilling any minimum value.

J.2 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Adhesive: the same PU-foam adhesive as the one tested.
- Thermal insulation product: any EPS or XPS thermal insulation product with nominal TR perpendicular to the faces higher than the one tested.

ANNEX K: ADDITIONAL INFORMATION FOR FIXING STRENGTH TRANSVERSE DISPLACEMENT TEST

This Annex provides in Clause K.1 additional information and amendments with respect to EN 13495 method D (for fixing strength transverse displacement test with tension load, in accordance with Clause 2.2.11.1) and method E (for fixing strength transverse displacement test with tension load, in accordance with Clause 2.2.11.2). Extended application rules are provided in Clause K.2 for both methods.

K.1 Additional information and amendments with respect to EN 13495

K.1.1 ETICS configurations

The configurations for mechanically fixed ETICS with supplementary adhesive are relevant for:

- Thermal insulation product of any thickness in case of countersunk installation, spiral and special injected anchors (see clauses 1.3.1.19; 1.3.1.20; 1.3.1.21).

The configurations for purely mechanically fixed ETICS are relevant for:

- Thermal insulation product of any thickness.

K.1.2 Test equipment

Test equipment shall follow the Clause 5 of EN 13495 with the following additional information and amendments:

- clauses 5.1.1, 5.1.2, 5.3, 5.4 and 5.5 are fully applicable.
- clause 5.1.3 is not applicable.
- clause 5.2 is applicable for test specimens without adhesive (see Clause K.1.3).
- clause 5.6 is applicable for Method D, as given in Clause 2.2.11.1 for fixing strength transverse displacement test with tension load, or Method E, as given in Clause 2.2.11.2 for fixing strength transverse displacement test without tension load.

K.1.3 Test specimen

Test specimen shall follow the Clause 6 of EN 13495 with the following additional information and amendments:

- clause 6.2 is fully applicable.
- clause 6.1 is applicable with the following additional information:
 - The test shall be performed with the thickest thermal insulation type with the lowest mechanical properties (tensile strength; compressive strength and shear strength and shear modulus) for given ETICS according to MPII.
 - The specimen shall consist of four parts of boards as indicated in the figure K.1.3.1. Test specimen should be at least 800 mm wide and at least 1200 mm long (at least 400 mm x3) with the thickness needed for the test. The dimensions can be adjusted according to availability of dimensions of thermal insulation product.
 - The ETICS shall be fixed with at least the minimum number of mechanical fixing devices per unit area according to MPII. In addition, the manufacturer may request testing also with higher number of fixing devices.

- The minimum width and length of the test specimen shall be selected for allowing allocate the minimum number of mechanical fixing devices per unit area in the corresponding pattern according to MPII.
 - For mechanically fixed ETICS with supplementary adhesive, two installation options may be used:
 - With supplementary adhesive: in this case, the adhesive shall be applied with the minimum percentage of bonded area specified by the MPII.
- or
- Without adhesive: either a foil as indicated in Clause 5.2 of EN 13495 or a small layer of sand definition, (amount, weight, layer thickness shall be recorded) shall be placed on top of the substrate to allow the thermal insulation products to slide.

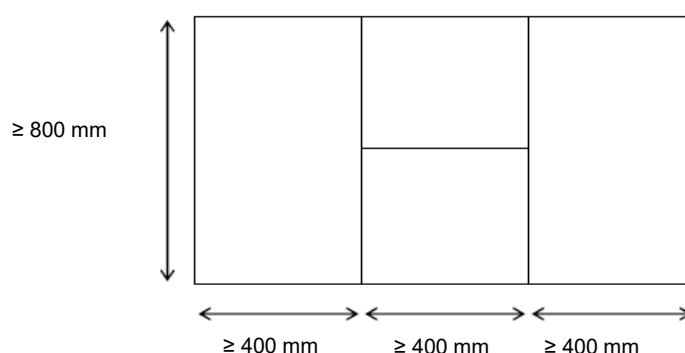


Figure K.1.3.1: Schematic drawing with dimensions of the test specimen

K.1.4 Test preparation

Clause 7 of EN 13495 is fully applicable.

K.1.5 Test procedure

Test procedure shall follow the Clause 8 of EN 13495 with the following additional information and amendments:

- clause 8.1 is fully applicable.
- clause 8.2.2 is applicable for Methods D, (with constant tension load 2,0 kPa) as given in Clause 2.2.11.1, and E as given in Clause 2.2.11.2, the lateral shear load shall act in the direction of the length of specimen.
- clause 8.2.1 is applicable with the following additional information:
 - The thermal insulation product used for the test specimen shall be tested for obtaining the following properties:
 - Tensile strength perpendicular to the faces in accordance with Clause 2.2.13.1.
 - Shear strength and shear modulus in accordance with Clause 2.2.15.
 - Compressive strength in accordance with EN ISO 29469.

K.1.6 Calculation of results

Clause 9 of EN 13495 is fully applicable.

K.1.7 Test report

Test procedure shall follow the clause 10 of EN 13495 with the following additional information:

- In addition to EN 13495, reference to this Annex K shall be included.
- The description (e.g., by means of a sketch) of the location of the failure within the test specimen and the full description of the tested configuration including the dimensions of the test specimen and the number and position of mechanical fixing devices used in the test specimen.
- Minimum measured values of tensile strength perpendicular to the faces, shear strength, shear modulus and compressive strength, expressed in kPa, of the thermal insulation product used for the test specimen.

K.2 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Adhesive: test results obtained with one specific adhesive apply only to the same adhesive as the one tested, applied in the same or higher percentage of area coverage; test results obtained without adhesive apply to the use of any adhesive.
- Thermal insulation product: any thermal insulation product of the same type as the one tested with the same or lower thickness and the same or higher mechanical performances (shear strength, shear modulus, tensile strength perpendicular to the faces and compressive strength at 10%) as the one tested. The conditions of equal or better mechanical performances shall be fulfilled for all these properties.
- Anchors/ mechanical fixing devices: test results apply to ETICS with the same or bigger number of mechanical fixing devices than tested. Test results obtained with anchors with plastic nails/screws and flush installation (see Clause 1.3.1.18) apply to any other anchors with plate diameter equal or bigger than tested and with mechanical characteristics equal or bigger than tested, such as plate stiffness and load resistance.

And

Test results apply to the tested pattern (even if more than one type of anchors is included) of placement of anchors and to any other pattern that adds more anchors to the tested pattern.

Or

Test results obtained with other mechanical fixings (e.g., profiles, countersunk, spiral, injected anchors see Clauses 1.3.1.19; 1.3.1.20; 1.3.1.21) are only applicable to the tested products and pattern.

Or

Test results obtained with other mechanical fixings anchors with other surface installation (see Clause 1.3.1.18) only apply to the same products as those tested.

Test results are valid for the installation (surface, countersunk, spiral, injected, see Clauses 1.3.1.18; 1.3.1.19; 1.3.1.20; 1.3.1.21) as those tested.

- Base coat: the same base coat as the one tested.
- Standard mesh: any glass fibre mesh with the same or higher tensile strength at initial state and after ageing/conditioning as that tested.

- Reinforced mesh: any reinforced mesh with the same or higher tensile strength at initial state and after ageing/conditioning as those tested.

ANNEX L: WIND LOAD RESISTANCE

The configurations to be selected for wind load resistance depend on the position of fixing of thermal insulation product which can be placed in the centre, in the joint or in both positions or placed under or through the reinforcement layer according to MPII.

This Annex contains the information needed to perform pull-through in accordance with EN 16382 (Method 1 and alternative Method 2; see Clause 2.2.12.1) and some additional information relevant also to perform static foam block test and extended application rules for both characteristics.

In particular:

- Clause L.1 contains additional information to perform pull-through in accordance with EN 16382 (Method 1 and alternative Method 2; see Clause 2.2.12.1), and Figure L.1.1.1 summarizes the configurations to be submitted to pull-through test. (The configurations to be submitted to static foam test are reported in Figure M.1.1).
- Clause L.2 contains relevant data of mechanical fixing devices, such as nominal values of plate stiffness, load resistance and the different installation methods (according to 1.3.1.18 to 1.3.1.20) needed for the assessment of pull-through test (see Clause 2.2.12.1) and static foam block (see Clause 2.2.12.2).
- Clause L.3 provides extended application rules for both pull-through test and static foam block test.

L.1 Additional information for pull-through with respect to EN 16382

L.1.1 Configuration

Pull-through resistance is relevant for the configurations indicated in Figure L.1.1.1 (1a ,2a and 2b) where the mechanical fixing device is placed in the centre and in the joint of the panel.

The pull-through test shall be performed without adhesive.

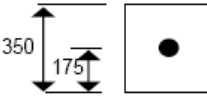
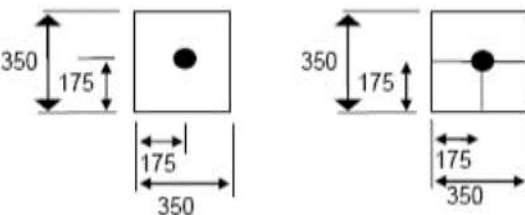
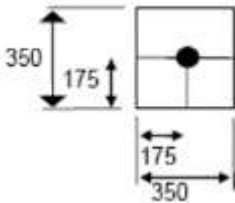
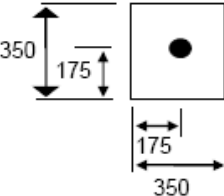
Test specimens	Configurations of mechanical fixed ETICS to be submitted to pull-through resistance Clause 2.2.12.1
(1a) 	Mechanical fixing device is placed only in the centre of the thermal insulation
(2a) 	Mechanical fixing devices are placed in the centre and in the joints of the thermal insulation.
(2a1) 	Mechanical fixing devices are placed in the joints of the thermal insulation
(2b) 	Mechanical fixing device is placed through the reinforcement layer and only in the centre of the thermal insulation

Figure L.1.1.1 Test specimens for ETICS mechanically fixed with supplementary adhesive or purely mechanically fixed by mechanical fixing devices for the different configurations (dimensions in mm)

L.1.2 Test equipment

The tensile testing machine is in accordance with Clause 5.5 of EN 16382.

L.1.3 Preparation of test specimen for both methods

The tests shall be carried out at least on the thinnest thermal insulation type with the lowest mechanical performances (tensile strength perpendicular to the face in accordance with Clause 2.2.13.1 and compressive strength in accordance with EN ISO 29469 shall be measured for the thermal insulation products used for the test specimens).

For thermal insulation products considered sensitive to humidity, as described in Clause 2.2.13.2, and when the tensile strength (measured value $\sigma_{mt,wet}$) of the thermal insulation product in wet conditions, (see Clause

2.2.13.2) is less than 80% of that tested in dry condition (measured value $\sigma_{mt,dry}$) (see Clause 2.2.13.1) (performed on same thermal insulation type), the pull-through test shall be carried out in wet condition as described in 2.2.13.2 / "28 days exposure".

L.1.4 Test apparatus and test procedure for Method 2

Test method 2 partially deviates from EN 16382 in test set-up and in test preparation. The test set up does not provide the use of templates and clamping leading to precautionary test results due to the less rigidity of the specimen. The indication below shall be followed.

Thermal insulation product specimens shall be squared shaped of side length minimum 350 mm x 350 mm.

The test specimens shall be bonded using a suitable adhesive (not part of the ETICS), to a rigid substrate with an anchor driven through the centre of each specimen or at thermal insulation joints. The head of the anchor shall not be bonded to the rigid substrate, for example it can be covered previously with a self-releasing sheet.

When the adhesive has cured, a pulling force shall be exerted, after a preload of 10 N at a loading rate of 20 mm/minute between the rigid plate and the end of the anchor protruding through the thermal insulation product until failure.

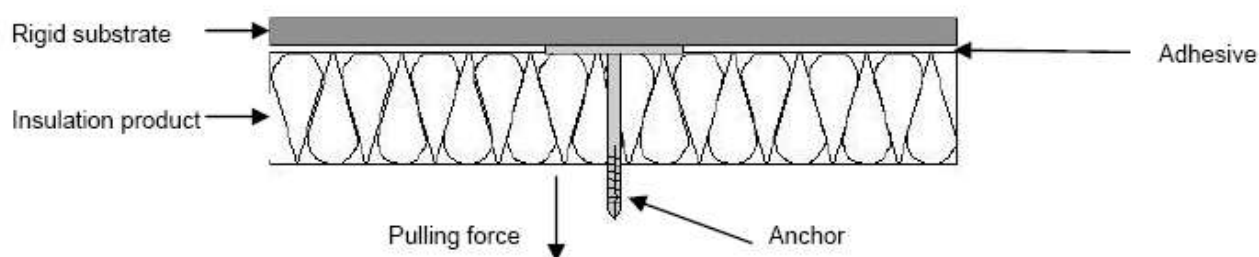


Figure L.1.4.1: Pull-through test specimen for method 2

Results are void if the failure occurs in the edge. In such cases, the dimensions of the specimen shall be increased (for example: 400 mm x 400 mm or 500 mm x 500 mm). If the specimen size cannot be further increased due to the limited size of the thermal insulation product, the results shall not be considered void and shall be used.

L.1.5 Calculation of results

The pull-through resistance of the combination of tests (1a, 2a, 2a1 and 2b) shall be performed by the determination of:

- $F_{mean,position,5mm,condition}$: mean value of the loads of pull-through measured at the displacement value 5 mm within a test series of at least 5 specimens, with the same preconditioning and anchor position, expressed in kN.
- $F_{mean,position,10mm,condition}$: the mean value of the loads of pull-through measured at the displacement value 10 mm within a test series of at least 5 specimens, with the same preconditioning and anchor position, expressed in kN.
- $F_{5\%position,5mm,condition}$: the characteristic value of loads of pull-through measured within a test series of at least 5 specimens, with the same preconditioning and mechanical fixing position at displacement of 5 mm, expressed in kN.
- $F_{5\%position,10mm,condition}$: the characteristic value of loads of pull-through measured within a test series of at least 5 specimens, with the same preconditioning and mechanical fixing position at displacement 10 mm, in kN;

Calculation of: $F_{5\%position,5/10m,condition} = F_{mean,position5/10mm,condition} - s \cdot k.$ (L.1.1.1)

Where:

k is the value selected in accordance with EN 1990, Annex D, Table D1 for unknown V_x .

s is the standard deviation between five results of the loads at different displacement.

When the maximum load is reached before 5 mm of displacement only F_{mean} and d_{mean} shall be determined by means of the following equations and the 5 mm displacement will not be carried out.

When the maximum load is reached between 5 mm and 10 mm of displacement only $F_{mean,position,condition}$ and $d_{mean,position,condition}$ at 5 mm displacement shall be determined by means of the following equations.

$$F_{mean,position,condition} = \sum_{i=1}^n \frac{F_{max,i,position,condition}}{n} \quad (L.1.1.2)$$

$$d_{mean,position,condition} = \sum_{i=1}^n \frac{d_{Fmax,i,position,condition}}{n} \quad (L.1.1.3)$$

where the subscripts are defined as:

$F_{mean,position,condition}$	is the mean value of the load expressed in kN at a position of the anchor expressed as “centre” or “joint, at a condition “dry” or “wet” referring to the conditions of the thermal insulation in accordance with Clause 2.2.13.2).
$F_{max,i,position,condition}$	is the maximum value of the loads of each specimen expressed in kN, at a position of the anchor expressed as “centre” or “joint, at condition “dry” or “wet” referring to the conditions of the thermal insulation in accordance with Clause 2.2.13.2).
$d_{mean,position,condition}$	is the mean displacement expressed in mm at a position of the anchor expressed as “centre” or “joint”, at condition “dry” or “wet” referring to the conditions.
$d_{Fmax,position,condition}$	is the displacement value corresponding to the maximum load expressed in mm, with a position of the anchor as “centre” or “joint, at condition “dry” or “wet” referring to the conditions of the thermal insulation in accordance with Clause 2.2.13.2).
n	is the number of specimens.
displacement	is the mean value of displacements corresponding to the measured F values rounded up to the nearest 1,0 mm.

L.2 Test of plate stiffness of plastic anchors for ETICS

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 following clauses cover tests to evaluate the pull-through resistance of the anchor plate and the plate stiffness of plastic anchors for fixing of ETICS with rendering system.

L.2.1 Details of method and criteria for assessment

The failure load of the anchor plate shall be determined from at least five 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 transmitted at the inside edge of the support ring. If the anchor plate is stiffened by ribs, recesses, which prevent contact between the ribs and the supporting ring and the load transmission is not affected by the ribs, shall be designed in the steel ring.

The test setup shall follow the principles given in Figure L.2.1.1.

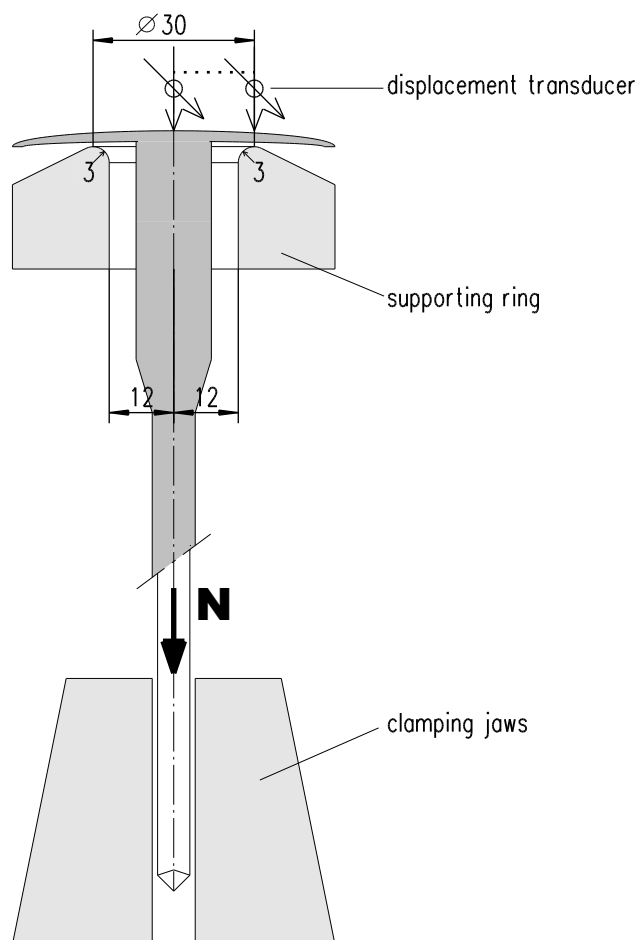


Figure L.2.1.1 Description of the test for determination of the plate stiffness

The test specimens shall be conditioned for at least seven days at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$. The measurements shall be conducted at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$. The tensile load is raised until failure with a rate of $(1 \pm 0,2) \text{ kN/min}$.

L.2.2 Load resistance criteria for assessment

The characteristic value shall be determined by using the appropriate value of kN for unknown V_x in accordance with EN 1990, Annex D, Table D1. This value shall be stated in the ETA.

L.2.3 Plate stiffness criteria for assessment

To obtain 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 load N_o in the load-displacement-diagram (see Figure L.3.1).

The plate stiffness and the diameter of the anchor plate shall be stated in the test report together with the maximum load (F) expressed in kN.

Plate stiffness (Pt_{1m}), expressed in kN/mm, is the tangent stiffness (c) to the load-displacement graph at displacement 1mm.

Tangents stiffness (c) (in kN/mm):

$$c = \frac{N_o - N_u}{s_o - s_u} = \frac{N_o}{1 \text{ mm} - s_u} \quad (\text{L.2.3.1})$$

with $s_u \leq 0,3 s_o$

The evaluated values should be rounded upward to the nearest $1/10$ kN and be stated related to 1mm 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 shall be stated in test report. The coefficient of variation shall not exceed 20 %.

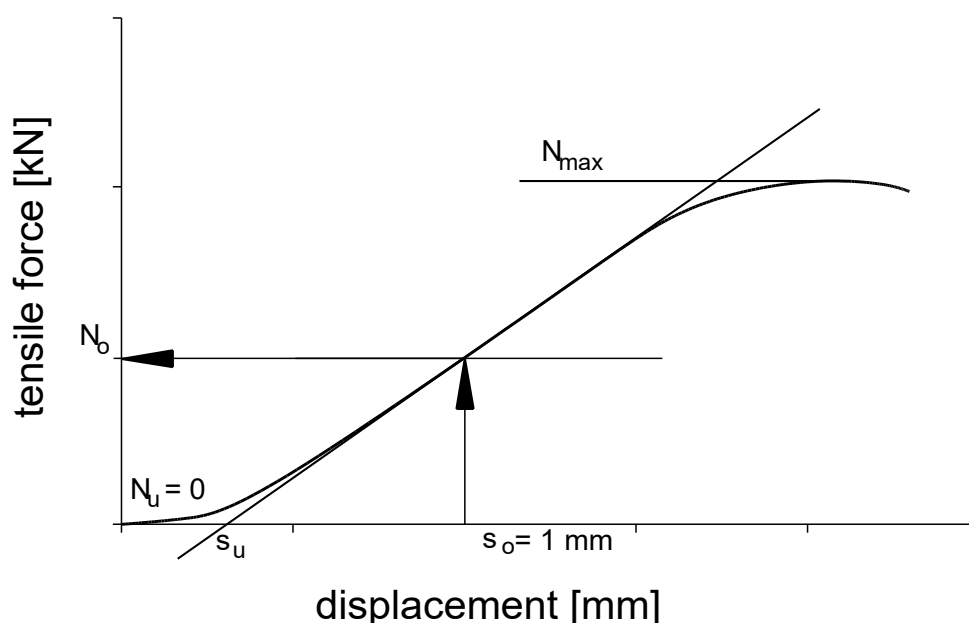


Figure L.3.1 Load-displacement-diagram with the idealized straight line

L.3 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Thermal insulation product: any thermal insulation product of the same type (see Clause 1.3.1.7) with:
 - The same or greater thickness;
 - The same or higher measured tensile strength perpendicular to the faces (see Clause 2.2.13) and/or compressive strength in accordance with EN ISO 29462.
- Anchor plates: any anchor with:

- The same or larger plate diameter; and the same or higher plate stiffness and the same or higher load resistance.
- If the tested mechanical fixing devices are installed in the test specimen with an additional plate, the test results are applicable only to the tested combination of the specific anchor and the specific plate.

Specific rules: regarding installation technique and spiral anchors:

- If the tested anchor is fitted by flush installation (see Clause 1.3.1.18), the test results are applicable also for countersunk installation (see Clause 1.3.1.19), provided that the remaining thickness of undamaged insulation product resisting the pull-through of anchor after the countersunk installation is the same or higher as the tested thickness.
- If the tested anchor is fitted by countersunk installation, the test results applicable only to the same or lower depth to which the anchor was countersunk.
- If the tested anchor with additional plate is fitted by countersunk installation the test results apply only to the tested combination of anchor and plate.
- If the tested anchor is of countersunk installation of spiral anchors (see Clause 1.3.1.20) the test results are applicable only to the tested type of anchor.

Specific rules: regarding multi-layered insulation products:

- The test results obtained with multi-layered thermal insulation products can only be used for other insulation products of the same type with higher mechanical properties than the tested product, namely:
 - The same or higher tensile strength perpendicular to the faces (EN 1607) and
 - The same or higher compressive stress at 10 % compression (EN ISO 29469) and
 - The same or higher apparent density (EN ISO 29470).
- If results obtained with multi-layered thermal insulation products apply to another multi-layered thermal insulation product it has to be, in addition, ascertained that the layers showing higher mechanical properties are of at least the same thickness as such layers of the tested product.

Specific rule: regarding insulation products with distinctive manufacturing process:

- If the tested insulation product undergoes a specific manufacturing process that uniquely influences its tensile and compressive behaviour (for example for EPS: elastification), the test results shall only be used for the specific, tested, insulation product type.
- In case of using profiles, the test results are only applicable to the tested geometry and type of the profiles.

ANNEX M: WIND LOAD RESISTANCE: STATIC FOAM BLOCK RESISTANCE

M.1 Configurations, preparation of the specimens

The configuration of specimens depends on the position of the mechanical fixing devices: in the centre or in the joint of the thermal insulation product, through the reinforcement layer (through glass fibre mesh) or when the ETICS is mechanically fixed by profile, according to the scheme given in Figure M.1.1.

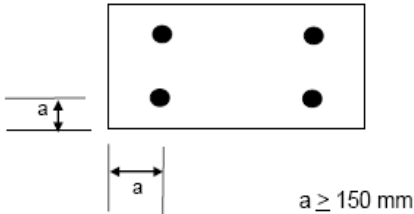
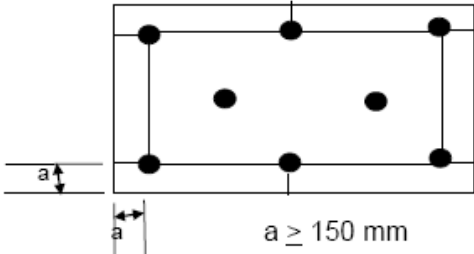
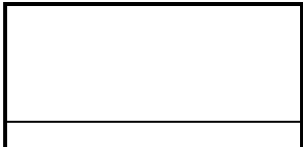
Test specimens	Configurations of mechanical fixed ETICS to be submitted to static foam block test. Clause 2.2.12.2
(1c) 	Mechanical fixing devices are fixed through the reinforcement layer and placed only in the centre of the thermal insulation
(2c) 	Mechanical fixing devices are placed through the reinforcement layer, in the centre and in the joint of the thermal insulation
(3d) 	ETICS is fixed by profiles (example)

Figure M.1.1 Test specimens for ETICS mechanically fixed with supplementary adhesive or purely mechanically fixed by mechanical fixing devices to be submitted to static foam block test (dimensions in mm).

- Configuration of ETICS with mechanical fixing devices:

At least three test specimens shall be carried out.

Test specimens shall be prepared according to MPII and without supplementary adhesive.

Size of specimens: for configurations 1c and 2c of Figure M.1.1 the thermal insulation product shall be at least 1000 mm long and at least 400 mm wide; the distance of mechanical fixing devices to the edge of the thermal insulation shall be at least 150 mm.

- Configuration of ETICS fixed with profiles:

At least three test specimens shall be carried out.

Test specimens shall be prepared according to MPII and without adhesive. Each profile shall be tested with the configuration of profiles according to MPII.

M.1.1 Conditioning of specimens

The test shall be carried out to failure in dry conditions at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ RH}$.

For the thermal insulation products considered sensitive to humidity, as described in Clause 2.2.13.2, and when the tensile strength of the thermal insulation product in wet conditions, measured value ($\sigma_{\text{mt,mean,wet}}$), (see Clause 2.2.13.2) is less than 80% of that tested in dry condition (see Clause 2.2.13.1) measured value ($\sigma_{\text{mt,mean,dry}}$) (performed on same thermal insulation type), the static foam block test shall be completed as follows:

- For mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS: static foam block test shall be carried out in wet conditions as described in Clause 2.2.13.2 "28 days exposure".
- For mechanically fixed ETICS with profiles (see Figure L.2.1.1 configuration 2c): the static foam block test after conditioning of the thermal insulation product in accordance with Clause 2.2.13.2 "28 days exposure".

M.2 Calculation of test results:

- Configuration of ETICS with mechanical fixing devices:

Calculate F values for one anchor, i.e., use:

For configuration (1c):

$$F_{\text{centre,condition}} = \frac{F_{\text{foam block,condition}}}{4} \quad (\text{M.2.1})$$

$$\text{Calculation } F_{5\%} = F_{\text{centre,condition}} - s \cdot k. \quad (\text{M.2.2})$$

For configuration (2c):

$$F_{\text{joint,condition}} = \frac{F_{\text{foam block,condition}} - 2 \times F_{\text{centre,condition}}}{6}. \quad (\text{M.2.3})$$

$$\text{Calculation } F_{5\%} = F_{\text{joint,condition}} - s \cdot k. \quad (\text{M.2.4})$$

Where:

$F_{\text{centre,condition}}$ is the maximum load for each fixing device placed in the centre of thermal insulation in configuration 1c, expressed kN at the tested condition.

$F_{\text{foam block,condition}}$ is the mean value of the maximum load of the three specimens in static foam test, expressed in kN. at the tested condition.

$F_{\text{joint,condition}}$	is the maximum load for each mechanical fixing device placed through the reinforcement layer in the joint of thermal insulation, expressed in kN, at the tested condition.
k	is the value selected in accordance with EN 1990, Annex D, Table D1 for unknown V_x .
s	is the standard deviation between three results of the loads

For ETICS fixed by profiles, configuration (3d):

Calculate the mean value of $F_{\text{foam block,condition}}$ considering the mean value of the maximum load at break of the three specimens, expressed in kN.

The characteristic values of $F_{5\%} F_{\text{foam block,condition}}$ expressed in kN:

Calculation $F_{5\%} = F_{\text{foam block,condition}} - s \cdot k$. (M.2.5)

ANNEX N: WIND LOAD RESISTANCE. DYNAMIC WIND UPLIFT RESISTANCE

Dynamic wind uplift resistance is relevant for configurations of ETICS indicated in Table D.2.1.

This test shall be carried out for each different thermal insulation type.

N.1 Preparation of specimen

The dimensions of the test specimen shall be at least 2,0 m x 2,5 m.

At least one test specimen for each configuration of ETICS as defined below shall be tested.

The test specimen comprises:

- A non-airtight substrate (test rig) shall be used such as wood or steel rigid frame. Masonry or concrete wall may also be used as substrate; however, it shall include at least a 30% of its area with holes (e.g., a substrate wall made from honeycomb bricks with a thickness greater than or equal to 150 mm). The substrate wall shall not be plastered unless for applying the adhesive on the ETICS side. The test rig shall be secured along its perimeter to the test equipment. The substrate shall have sufficient area for installing the fixing devices or applying the minimum bonded area, or both. The ETICS specimens shall be attached to the test rig.
- The ETICS specimens shall be prepared considering, at least, the base coats and, where relevant, the adhesives, with the weakest bond strengths in accordance with Clauses 2.2.10.1 and 2.2.10.3 respectively.
- The ETICS specimens shall be prepared depending on the different fixings methods of ETICS:
 - a) Mechanically fixed ETICS with supplementary adhesive and purely mechanically fixed ETICS:

The thinnest and thickest thermal insulation products, according to MPII, with the lowest tensile strength perpendicular to the faces (see Clause 2.2.13.1) shall be tested.

The thinnest thermal insulation product shall be tested with the minimum number of fixing devices in the designated position according to MPII. This configuration provides information about the resistance of the mechanical fixing devices and the bending or punching of the thermal insulation product.

The thickest thermal insulation product shall be tested with the maximum number of fixing devices in the designated position according to MPII. This configuration provides information about the adhesion of the rendering system to the thermal insulation product.

The fixing devices shall be installed according to MPII. No supplementary adhesive shall be applied (worst scenario).

Thermal insulation products at the edge of the test equipment shall be secured with additional fixing devices to prevent premature failure.

For ETICS fixed by means of vertical profiles and fasteners, the minimum configuration shall correspond with the Equation N.1.1 (see Figure N.1.1).

$$(2a + 200 \text{ mm}) \times (4b + 200 \text{ mm}) \quad (\text{N.1.1})$$

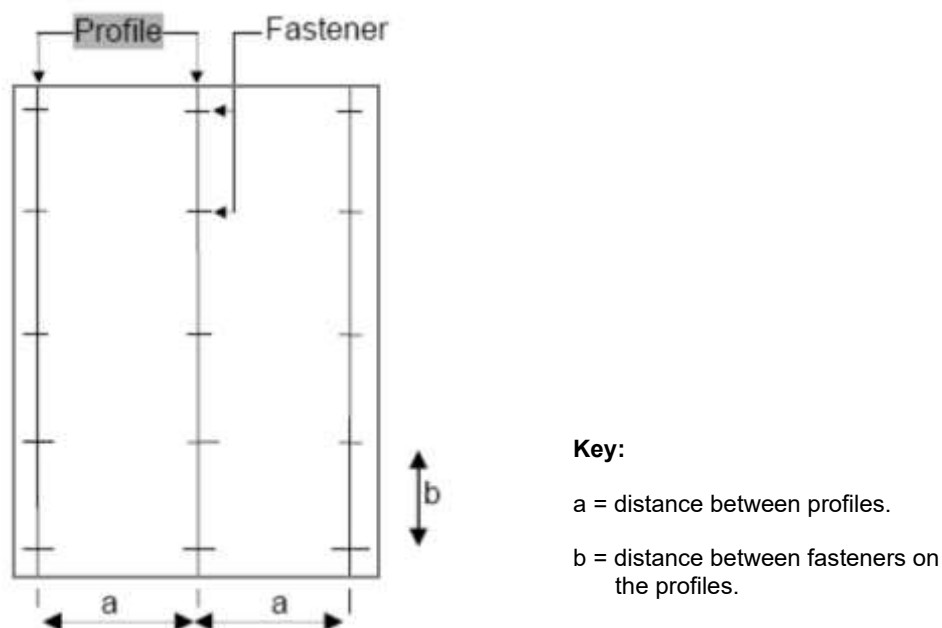


Figure N.1.1: ETICS with profiles configuration.

b) Bonded ETICS:

The test specimen shall be built with the thermal insulation product thickness corresponding to the measured lowest tensile test strength perpendicular to the faces in accordance with Clause 2.2.13.1.

Adhesive shall be applied with the minimum bonded area according to MPII. No supplementary mechanical fixings shall be applied (worst scenario).

N.2 Test equipment

The test equipment consists of a suction (negative pressure) chamber (see Figure N.2.1) against which the test specimen shall be placed. The depth of the chamber shall be sufficient for a constant suction to be exerted on the test specimen applied to the external surface of the ETICS irrespective of its possible deformation. The chamber shall be mounted on a rigid frame which surrounds the test specimen. The rendering system serves as the seal between the 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.

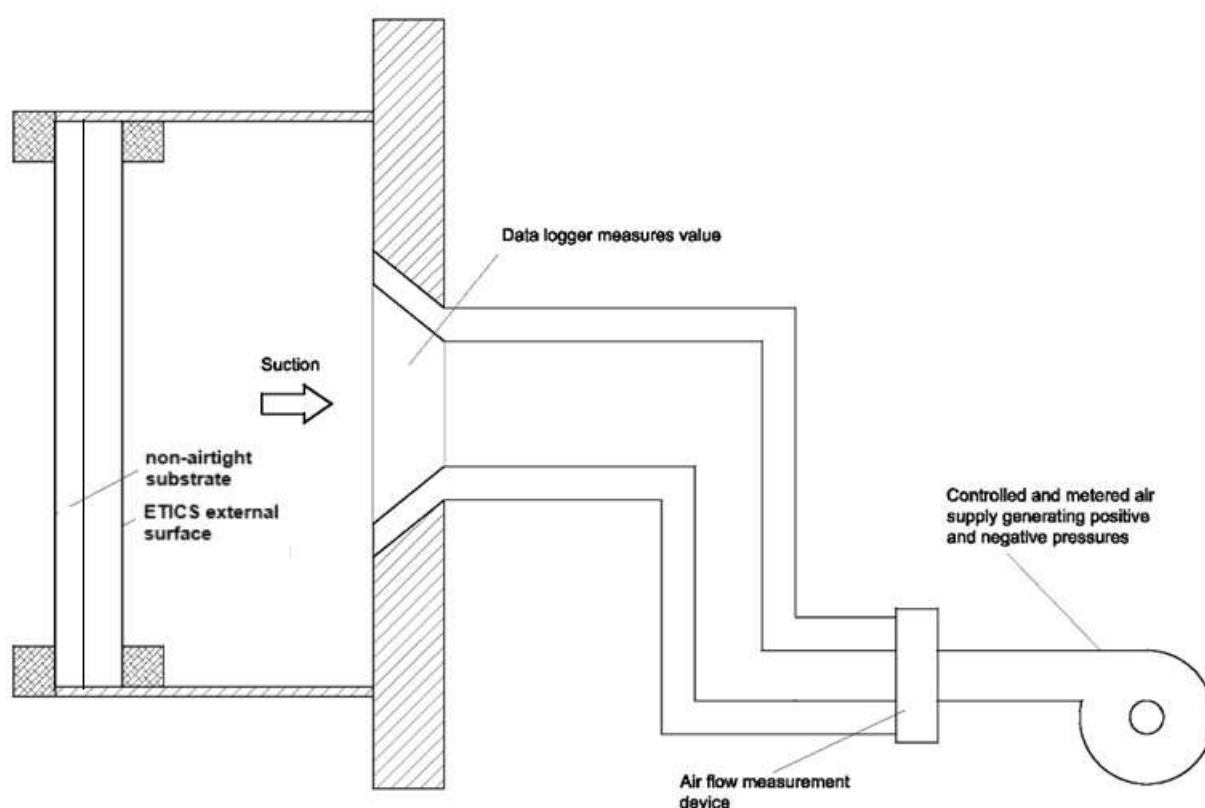


Figure N.2.1: Example of wind suction test equipment.

N.3 Test procedure

The loads shown in Figure N.3.1 shall be applied with an accuracy on the suction pressures of $\pm 10\%$, each gust having the diagram shown in Figure N.3.2.

The maximum suction of each cycle shall be $W_{100\%}$ and it is defined in the Figures N.3.1 and N.3.2 and in Table N.3.1.

The specimen shall be tested until failure. Failure is defined by any one of the following events:

1. The thermal insulation product(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 product is pulled off a mechanical fixing device.
5. A mechanical fixing device is torn out of the substrate.
6. The thermal insulation product detaches from the substrate. If failure occurs between the thermal insulation product and the substrate, the test may be repeated with a stronger bond made between the thermal insulation product and the substrate.

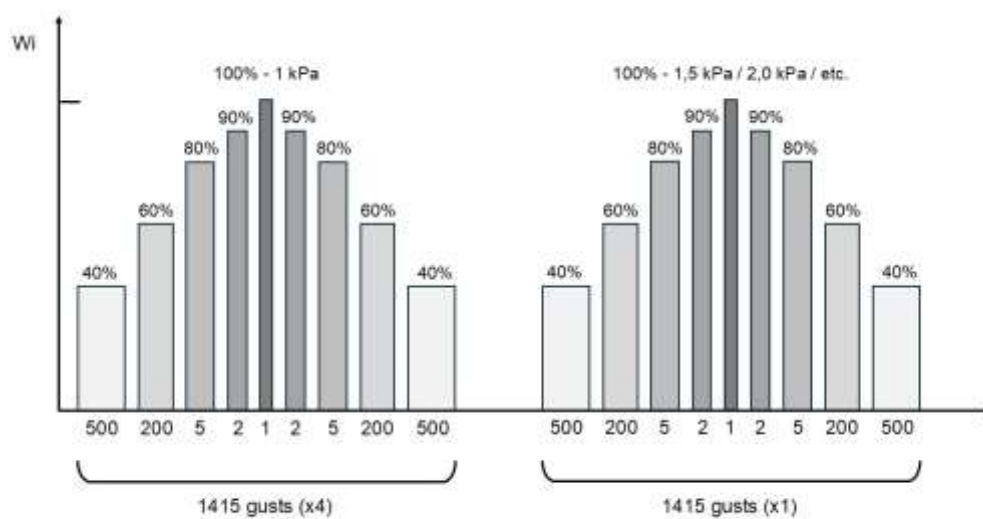


Figure N.3.1: Loads to be applied.

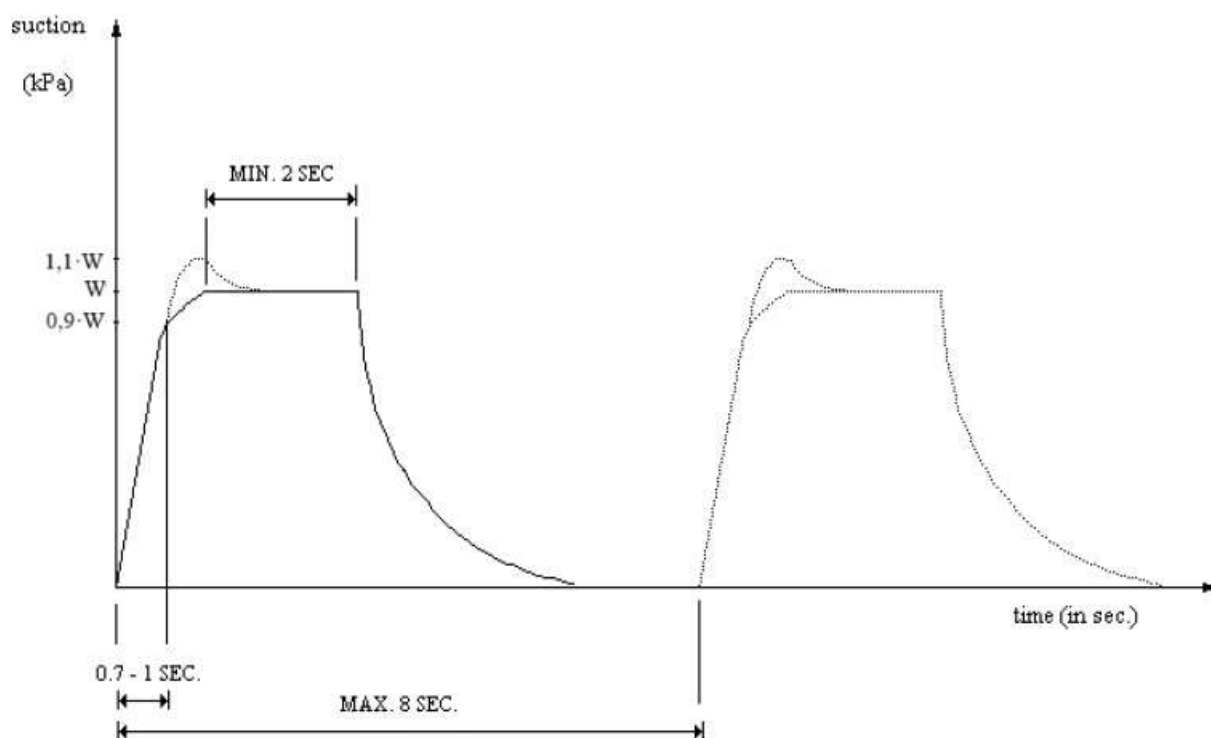


Figure N.3.2: Load-time diagram of cyclic loading.

Number of cycles	Maximum suction ($W_{100\%}$) 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 N.3.1: Maximum suction of the cycles $W_{100\%}$.

N.4 Test results

The test results are only valid for those fixing patterns tested.

The test result Q_1 shall be the $W_{100\%}$ load in the cycle preceding that in which the test specimen fails, expressed in kPa.

The test result Q_1 shall be corrected on the basis of the Equation N.4.1 to obtain the characteristic resistance R_k in kPa.

$$R_k = Q_1 \times C_s \times C_a \quad (\text{N.4.1})$$

where:

R_k is the characteristic wind uplift resistance expressed in kPa.

C_a is the 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 $C_a = 1$.

C_s is the statistical correction factor given in Table N.4.1, Table N.4.2 or Table N.4.3 depending on the ETICS fixing method.

Bonding area (B_s) in %	C_s
$50 \leq S \leq 100$	1,0
$40 \leq S < 50$	0,9

Table N.4.1: C_s for bonded ETICS

Number of fixing devices for each thermal insulation product	Number of thermal insulation products in the test specimen			
	1	2	3	4 or more
2	Not allowed	0,90	0,95	0,97
3	0,87	0,95	0,97	0,98
4 or more	0,90	0,97	0,98	0,99

Table N.4.2: C_s for mechanically fixed ETICS with supplementary adhesive or purely mechanically fixed ETICS

Test specimen configuration	C_s
$(3a + 200 \text{ mm}) \times (4b + 200 \text{ mm})$ and greater	0,95
$(4a + 200 \text{ mm}) \times (3b + 200 \text{ mm})$	0,90
$(2a + 200 \text{ mm}) \times (5b + 200 \text{ mm})$	
$(2a + 200 \text{ mm}) \times (6b + 200 \text{ mm})$	
$(2a + 200 \text{ mm}) \times (4b + 200 \text{ mm})$	0,85
$(2a + 200 \text{ mm}) \times (3b + 200 \text{ mm})$	Not allowed

Table N.4.3: C_s for ETICS fixed by means of profiles and mechanical fixing devices.

N.5 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Thermal insulation product: any with the same material as the one tested with the same or greater thickness and the same or greater tensile strength perpendicular to faces as the one tested.
- Fixing devices: tested pattern with the same or greater amount of fixing devices per square meter; when the pattern configuration is tested “at the joints” the result is valid for pattern combined “at the joints” and configuration “in the centre” of thermal insulations”.
- Base coat: any with the same or greater thickness and the same or greater bond strength as the one tested.
- Adhesive: any with the same or greater bond strength and the same or greater bonded area as the one tested.

ANNEX O: PULL-THROUGH RESISTANCE OF MECHANICAL FIXING DEVICES FROM PROFILES

O.1 Preparation of specimen

A minimum of five specimens shall be tested.

Each test specimen shall be composed of one profile fixing device (number 1 in the Figure O.1.1), and the fastener or fixing for attaching the profile on the substrate (number 2 in the Figure O.1.1).

The length of the profile shall be (300 ± 20) mm (see Figure O.1.1).

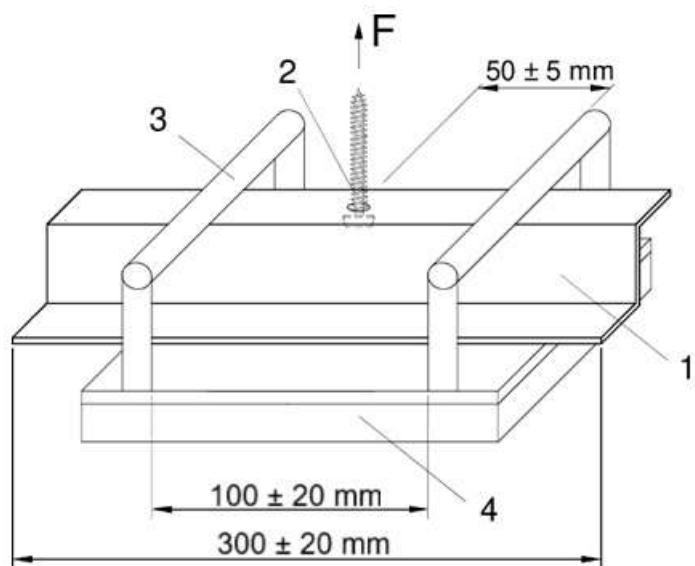
The test specimens shall be prepared according to the MPII. When MPII does not provide any information, the profile shall include a 6 mm perforation in the centre, obtained by drilling.

Test specimen shall be clamped by a testing-tool (number 3 in the Figure O.1.1) fastened to the testing machine support (number 4 in the Figure O.1.1). The testing-tools shall be either supporting rollers with diameter (20 ± 5) mm or other kind of clammer where the part for the fastener side shall be rounded part with diameter (20 ± 5) mm.

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

The apparatus shall consist of:

- A dynamometer.
- A testing support as shown in the Figure O.1.1.



Key:

1. Profile.
2. Fastener or fixing (profile – substrate).
3. Testing-tool.
4. Testing support.

Figure O.1.1: Example of fixing from profile.

O.2 Test procedure

The fastener or mechanical fixing devices (number 2 in the Figure O.1.1) shall be placed perpendicular to the profile (number 1 in the Figure O.1.1), and the force F (in kN) shall be applied until failure.

The test shall be carried out using a tensioning speed of (20 ± 1) mm/min. When is observed that the test specimen behaviour is affected by this tensioning speed (e.g., there is not accurate force/displacement measurements), lower speeds, not less than $(5 \pm 0,5)$ mm/min, shall be considered.

Failure shall be defined by any of the following events:

- Profile breaks.
- Fastener or fixing breaks.

O.3 Test report

Test report shall include at least:

- Type, material and geometry of the profile and fastener / fixing used in the test.
- Each individual failure load value expressed in kN.
- The arithmetic average values, F_{mean} , expressed in kN.
- The mode of failure description of the test specimen.

O.4 Extended application rules

The worst-case scenario shall be selected by considering the following extended application rules for the relevant components:

- Profile fixing devices: any material with higher resistance of material or greater thickness or both as the profile tested.
- Fastener or fixing on the substrate: any with higher resistance of material or greater diameter (body or head) or both, as the one used in the testing.

ANNEX P: RENDER STRIP TENSILE STRENGTH

P.1 Test set-up

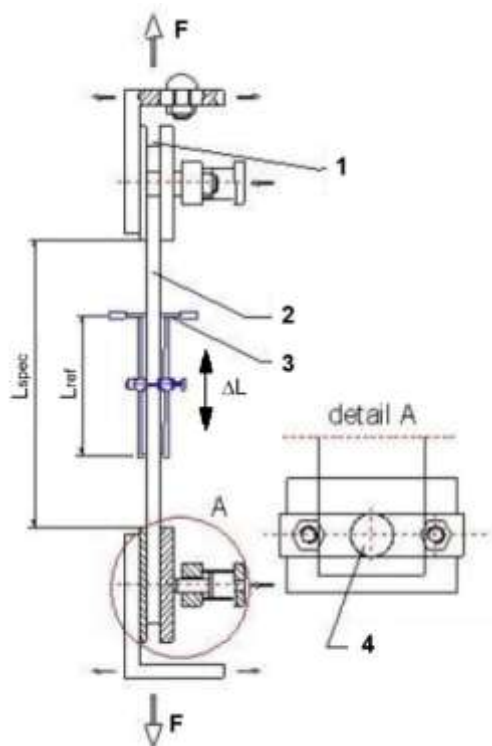
Six render strip specimens (to be used in warp and weft direction in accordance with Clause P.2), consisting of the reinforcement and the base coat, shall be prepared with the size 600 mm x 100 mm x d_r (where, d_r = thickness of the base coat with embedded reinforcement). The base coat shall be tested with the mean thickness indicated in the range defined in MP11.

Additionally, two extra specimens (to be used in warp and weft direction) shall be prepared to measure the crack load which is the load when the first crack occurs (L_{crack}).

The specimens shall be prepared on smooth substrate (for example, plastic foil PVC or EPS thermal insulation) which allows the easy detaching the specimens from the substrate after drying.

The reinforcement with a length of 800 mm shall be arranged within the base coat according to the MP11. It shall protrude about 100 mm at both ends. The protruding parts of the reinforcement shall be placed on the reinforced base coat surfaces on which two metal plates shall be 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 shall be in the middle of the specimen) see Figure P.1.2.

The test shall be 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.



Key:

- 1. Load axis of the testing machine.
 - 2. Specimen symmetrically arranged.
 - 3. Extensometer.
 - 4. Hydraulic clamping device.
- F = Applied tensile load (in N).
 ΔL = Extensometer measured displacement (in mm).
 L_{ref} = Extensometer reference length (in mm).
 L_{spec} = Specimen free length (minimum 300 mm).

Figure P.1.1: Test set-up for the render strip tensile strength.

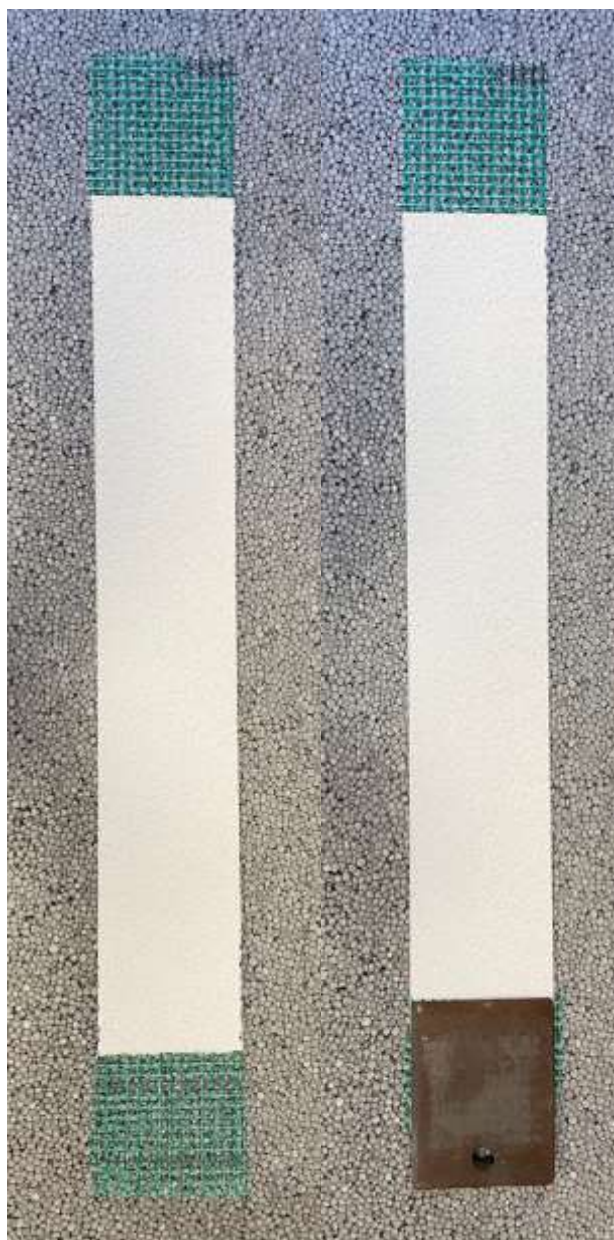


Figure P.1.2: Test specimens showing the protruding part of the reinforcement of the base coat, in the left side, and in the right side one of the metal plate glued to perform the test.

P.2 Execution of the test

The tensile load shall be applied displacement-controlled with a rate of displacement of $(0,5 \pm 0,1)$ mm/min. The load shall be measured via a static uniaxial tensile testing machine (class 1, in accordance with EN ISO 7500 - 2). The displacement shall be measured by one extensometer, precision class 0,2 in accordance with EN ISO 9513. The reference length where the extensometer shall measure, shall amount to at least $L_{ref} = 100$ mm. The measuring area shall be arranged such that it is at least 75 mm off the outer limits of the load introducing elements.

Before the test, the determination of L_{crack} , when the first crack occurs, is needed; it shall be measured in warp and weft direction on the additionally specimens using the same parameters described in Clause P.1 (displacement-controlled with a rate of displacement of $(0,5 \pm 0,1)$ mm/min).

The test consists in the following consecutive steps:

- 1 10 cycles of pre-loading: the render strips shall be loaded 10 times up to 50 % of the crack load (L_{crack})
- 2 11th cycle of loading from zero until failure or ϵ_r . If no early failure occurs, the loading process shall be interrupted at render strain values of $\epsilon_r = 0,8\% = \Delta L/L_{ref}$ (where ΔL = displacement measured by the extensometer). In case no cracks occur at 0,8% of strain the test shall be continued until the failure and the result shall be given at ϵ_r 1% of strain.

The quantity of cracks within the metering range shall be counted and recorded. The crack width shall be classified in the record (see Table P.2.1). Each crack width ($w_{x,i}$) shall be measured by means of a digital camera with high resolution of 6576 x 4384 pixel and shall be recorded with an accuracy of 1/100 mm.

Table P.2.1: Crack developing record for the render strip tensile strength

Sample	ϵ [%]	Number of cracks on specimen front side with a crack width [mm]								Number of cracks on specimen rear side with a crack width [mm]							
		$\leq 0,05$	$\leq 0,10$	$\leq 0,15$	$\leq 0,20$	$\leq 0,25$	$> 0,25$	Max	Σ crack	$\leq 0,05$	$\leq 0,10$	$\leq 0,15$	$\leq 0,20$	$\leq 0,25$	$> 0,25$	Max	Σ crack
	0,8																

P.3 Test procedure

For each of the three specimens, the characteristic crack width for $\epsilon_{rk} = 0,8\%$ shall be 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 strain value ϵ_r in accordance with the formula where n is the number of cracks:

$$w_{mx} = \sum_{i=1}^n \frac{w_{x,i}}{n} \quad (P.3.1)$$

In case the failure occurs before the specimen reaches the $\epsilon_r = 0,8\%$ strain, the crack shall be recorded at $\epsilon_r = 0,5\%$ strain (if reached) or $\epsilon_r = 0,3\%$ strain. In case first crack occurs after the specimen reaches the $\epsilon_r = 0,8\%$, the crack shall be recorded at $\epsilon_r = 1,0\%$ strain.

The w_m value shall be determined by the following equation:

$$w_m = \sum_{x=1}^3 \frac{w_{mx}}{3} \quad (P.3.2)$$

Calculation of the "characteristic crack width" at the deformation d :

$$w_{rkd} = w_m + s \cdot k. \quad (P.3.3)$$

where

w_m is the mean value of the cracks width of the three specimens expressed in mm.

x is the number for the tested specimen.

w_{mx} is the mean value of the cracks width of the specimen x , in mm.

k is the value selected in accordance with EN 1990, Annex D, Table D1 for unknown V_x .

s is the standard deviation of the mean values of the three specimens (w_{mx})

ANNEX Q: THERMAL RESISTANCE OF ETICS AND THERMAL TRANSMITTANCE OF FIXING DEVICES

Q.1 Thermal resistance of ETICS without thermal bridge

The thermal resistance of the ETICS (R_{ETICS}) without thermal bridge shall be calculated in accordance with Clause 6.7.1.2 of EN ISO 6946 (see Equation Q.1.1) without the internal and external surface resistances (R_{si} and R_{se}) and considering the following homogeneous layers:

- Thermal resistance of the thermal insulation product ($R_{insulation}$) obtained in accordance with Clause 2.2.20.1.
- Thermal resistance of the rendering system (R_{render}) e, obtained either in accordance with EN ISO 6946 Clause 6.7.1.1 Equation (3) where the thermal conductivity shall be obtained by tabulated values in accordance with Clause 8 of EN ISO 10456 (as a default value, 0,02 m²K/W may be considered); or by testing in accordance with EN 12667 or EN 12664 (depending on expected thermal resistance).

$$R_{ETICS} = R_{insulation} + R_{render} \quad [(m^2 \cdot K)/W] \quad (Q.1.1)$$

Note: the adhesive layer is considered negligible for the thermal resistance of ETICS.

Q.2 Point thermal transmittance of anchors

Point thermal transmittance of anchors shall be obtained by means of the following methods:

Method 1 (reference method):

The point thermal transmittance value (χ -value) shall be obtained by means of the relevant product thermal specifications (see Table 1.1.3.1), however, when the relevant product thermal specification does not give any assessment method, the χ -value shall be obtained in accordance with Clause Q.3.

Method 2:

When the number of anchors per square meter is 16 or less, χ -values given in Table Q.2.1 shall be applied:

Anchor	χ -values [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	0,002
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	0,004
For all other anchors (worst-case)	0,008

Table Q.2.1: Reference χ -values for anchors.

Q.3 Point thermal transmittance of anchors and linear thermal transmittance of profiles

Q.3.1 General

This clause describes the assessment method of the point thermal transmittance χ -value [in W/K] of anchors, and the linear thermal transmittance ψ -value [in W/(m·K)] of subframe profiles that may penetrate in the ETICS's thermal insulation layer.

This method is based on the comparative results of the thermal transmittance of an undisturbed model wall (without anchors or profiles) and a disturbed model wall (with anchors or profiles, which create a thermal bridge and the consequent heat loss).

The higher the thermal resistance of the undisturbed wall, the higher the influence of the anchors and profiles related to the thermal transmittance of the wall. Therefore, the calculation model considers the most unfavourable substrate (made of normal-weight concrete) and a range of thermal insulation thickness with low thermal conductivity.

The point thermal transmittance χ -value and linear thermal transmittance ψ -value may increase or decrease with increasing thickness of the thermal insulation layer material depending on the type of anchors (dimensions and material) and type of profile (dimensions, material and penetration in the thermal insulation layer). The behaviour is not linear as it is represented in the Figure Q.3.1.1 for three different situations (different χ -values).

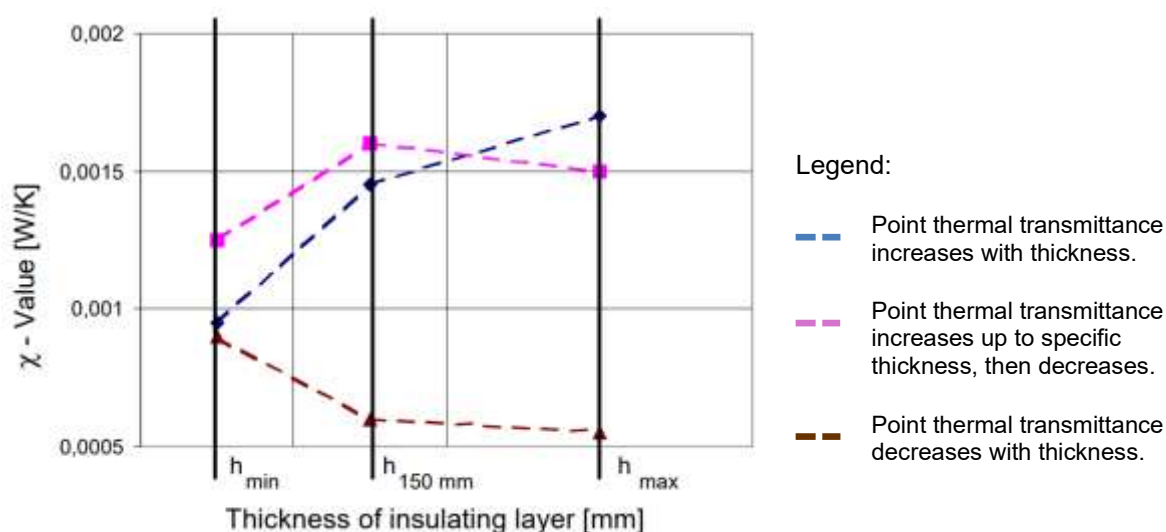


Figure Q.3.1.1: Variants of point thermal transmittance χ -value depending on the thickness of the thermal insulation layer.

The point thermal transmittance χ -value for anchors results from Equation (Q.3.2.1.1).

The linear thermal transmittance ψ -value of profiles results from Equation (Q.3.2.1.2).

$$\chi = \frac{U_c - U}{n} \quad [\text{W/K}] \quad (\text{Q.3.2.1.1})$$

$$\psi = \frac{U_c - U}{n} \quad [\text{W/K}] \quad (\text{Q.3.2.1.2})$$

Where

χ [W/K]	is the point thermal transmittance of anchors.
ψ [W/(m·K)]	is the linear thermal transmittance of profiles.
U_c [W/(m ² ·K)]	is the thermal transmittance of the disturbed wall, with anchors or profile penetrating in the thermal insulation layer.
U [W/(m ² ·K)]	is the thermal transmittance of the undisturbed wall, without anchors or profile penetrating in the thermal insulation layer.
n	is the number of anchors per unit area [1/m ²] or number of profiles per unit area [m/m ²] in the calculation or test model.

Q.3.2 Assessment method

Q.3.2.1 General

The point thermal transmittance (χ -value) and the linear thermal transmittance (ψ -value) shall be carried out by means of calculation or testing. Both methods are considered equivalent and shall be carried out for the reference wall model (test specimen) described in Clause Q.3.2.2.

The point thermal transmittance χ -value results from calculation in accordance with Equation (Q.3.1.1) with the thermal transmittance U_c of the disturbed wall model (i.e., including “n” anchors) determined by means of calculation (see Clause Q.3.2.5) or by means of testing (see Clause Q.3.2.6).

The linear thermal transmittance ψ -value results from calculation in accordance with Equation (Q.3.1.2) with the thermal transmittance U_c of the disturbed wall model (i.e., including “n” profiles) determined by means of calculation (see Clause Q.3.2.5) or by means of testing (see Clause Q.3.2.6).

Q.3.2.2 Wall model (test specimen)

The wall model¹⁹ for the calculation and testing for determination of the point thermal transmittance χ -value and linear thermal transmittance ψ -value shall consider the following dimensions and conditions:

- The disturbed wall model shall be configured as an area (at least 1,0 m x 1,0 m) that includes, at least one anchors or, at least one profile. The final dimensions of the wall area shall be selected depending on the number and position of the anchors and profiles to be considered. See Figure Q.3.2.2.1 for anchors and Figure Q.3.2.2.2 for profiles.
- The undisturbed wall model shall have the same area than the one considered for the disturbed wall model. See Figure Q.3.2.2.3.
- The dimensions and materials to be considered shall be the ones defined in Table Q.3.2.2.1 specified in accordance with EN ISO 10456.
- The thickness of the thermal insulation layer “h” is described in Clause Q.3.2.3. The anchors and profiles shall be arranged according to the Manufacturer’s Product Installation Instructions (MPII). The data concerning the wall model component layers shall remain untouched.
- In the case of profiles, profile shall cover all the length of wall model (test specimen).

Table Q.3.2.2.1: Values of thermal conductivity of materials and dimensions of the wall model

Wall model layer	Thermal conductivity [W/(m·K)]	Thickness of the layer [mm]
Interior plaster: gypsum plaster without aggregate	0,57	10
Substrate (normal-weight concrete) (***)	2,30	175
Thermal insulation layer	0,035 (*)	See Clause Q.3.2.3
Anchors / profile	According to the material (see EN ISO 10456)	According to the actual dimensions (**)
(*) In the case of testing, the thermal insulation layer shall be made of mineral wool in accordance with EN 13162 with a thermal conductivity in the range from 0,035 to 0,040 W/(m·K) and an airflow resistance in accordance with EN ISO 9053-1 in the range from 8 to 12 kPa·s/m ² . (**) At least the worst case shall be considered (i.e., the anchors or profiles with maximum area in contact with the thermal insulation layer, maximum thickness and maximum thermal conductivity). (***) In addition to normal-weight concrete, other substrate materials and thermal conductivity may be used as follows: Solid masonry = 1,20 W/(m·K); Hollow or perforated masonry = 0,56 W/(m·K); Lightweight aggregate concrete with open structure = 0,36 W/(m·K); Autoclaved aerated concrete = 0,16 W/(m·K).		

¹⁹ The wall model shall not be understood as a complete external wall but the specific specimen configuration.

Legend to Figures Q.3.2.2.1 to Q.3.2.2.3:

- 1 – Interior plaster.
- 2 – Concrete substrate wall.
- 3 – Thermal insulation layer.
- 4 – Rendering system layer.
- 5 – Anchor.
- 6 – Profile.
- 7 – Fastener of profile.

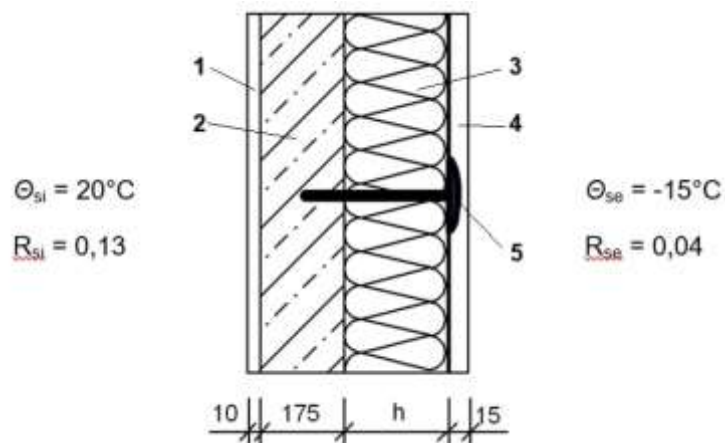


Figure Q.3.2.2.1: Cross-section scheme of the reference wall model considering an anchor (not full-scale). Top-view.

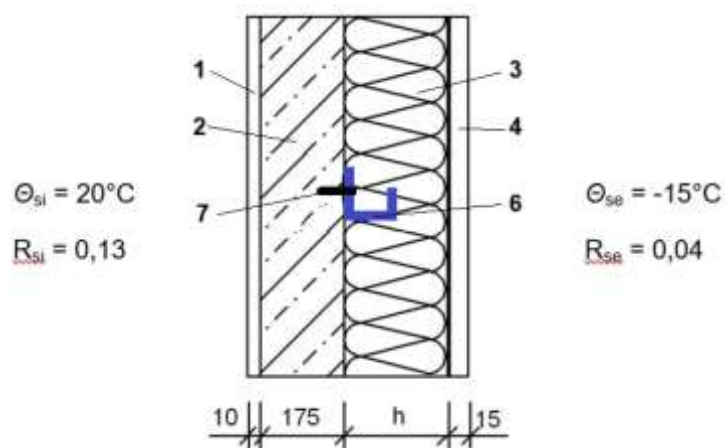


Figure Q.3.2.2.2: Cross-section scheme of the reference wall model considering a profile (not full-scale). Top-view in the case of a vertical profile or lateral-view in the case of horizontal profile.

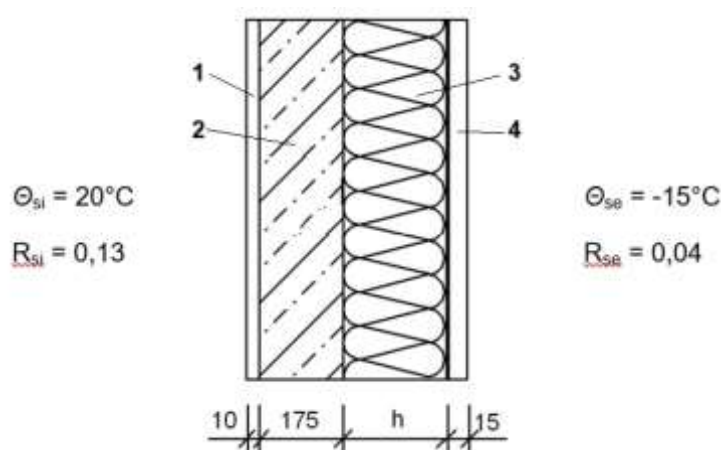


Figure Q.3.2.2.3: Cross-section scheme of the reference wall model for undisturbed wall (not full-scale). Top-view or lateral-view.

Q.3.2.3 Thickness of the thermal insulation layer

The thickness of the thermal insulation layer material has a significant influence on the point thermal transmittance χ -value and the linear thermal transmittance ψ -value.

The χ -value and ψ -value shall be determined for the ranges of thermal insulation layer thickness ($h_{\min}$, $h_{\max}$), in addition, when relevant, an intermediate reference thickness $h = 150$ mm also shall be considered.

The point thermal transmittance χ -value for the extreme thicknesses of thermal insulation layer ($h_{\min}$, $h_{\max}$), and additionally for the intermediate reference value (h_{150}) shall be determined as follows:

$\chi(h_{\min})$ = for the minimum thickness ($h_{\min}$) of the thermal insulation layer range intended to be used.

$\chi(h_{150})$ = for the reference thickness of the thermal insulation layer $h = 150$ mm.

$\chi(h_{\max})$ = for the maximum thickness ($h_{\max}$) of the thermal insulation layer range intended to be used.

In case of the result $\chi(150 \text{ mm})$ is smaller than $\chi(h_{\min})$, calculation or testing of $\chi(h_{\max})$ can be neglected. It is assumed that in any case $\chi(h_{\max})$ is smaller than or equal to $\chi(150 \text{ mm})$.

The linear thermal transmittance ψ -value shall be determined in the same way:

$\psi(h_{\min})$ = for the minimum thickness ($h_{\min}$) of the thermal insulation layer range intended to be used.

$\psi(h_{150})$ = for the reference thickness of the thermal insulation layer $h = 150$ mm.

$\psi(h_{\max})$ = for the maximum thickness ($h_{\max}$) of the thermal insulation layer range intended to be used.

In case of the result $\psi(150 \text{ mm})$ is smaller than $\psi(h_{\min})$, calculation or testing of $\psi(h_{\max})$ can be neglected. It is assumed that in any case $\psi(h_{\max})$ is smaller than or equal to $\psi(150 \text{ mm})$.

Q.3.2.4 Boundary conditions

The conventional surface resistances shall be used in accordance with EN ISO 6946 Table 7, for the horizontal direction of the heat flow thermal conductivity, symbols given in Clause 1.3.2:

$$R_{se} = 0,04 \text{ (m}^2\cdot\text{K)/W}$$

$$R_{si} = 0,13 \text{ (m}^2\cdot\text{K)/W}$$

For the measurement applies:

The temperature difference between inside and outside shall be $\Delta T = 35 \text{ K}$.

(e.g., $\theta_{se} = -15 \text{ }^{\circ}\text{C}$; $\theta_{si} = 20 \text{ }^{\circ}\text{C}$, symbols given in Clause 1.3.2).

The edge surfaces of the test specimen shall be considered as adiabatic.

Q.3.2.5 Calculations in accordance with EN ISO 10211

For the determination of the point thermal transmittance χ -value and the linear thermal transmittance ψ -value, the thermal transmittance of the wall with anchors or profiles U_c shall be determined for each of the wall model to be considered (see Clause Q.3.2.2). The dimensions of the wall model area to be considered shall be chosen in accordance with EN ISO 10211 so that the disturbance caused by the anchors or profiles shall have no effects on the edges.

The thermal conductivity of potential cavities (e.g., in case of tested profile of U-shape, with cavity rotated into insulation surface) shall be determined in accordance with EN ISO 6946 Table 8.

The subdivision of the wall model for calculation by means of the numerical method shall be accomplished in accordance with EN ISO 10211.

Annex A, Clause A.2 (d) of this standard determines that the subdivision shall be sufficiently fine, that if “n” subdivisions are chosen, the sum resulting from the heat flows does not deviate from the subdivisions more than 1 % which would result in the case of second subdivisions.

The thermal transmittance U_c of the disturbed wall model area (with anchors or profiles) shall be determined in accordance with EN ISO 10211 by the thermal coupling coefficient calculated.

Where:

Deviating from EN ISO 10211 the thermal transmittance shall be determined with five decimal places. This is necessary because the point thermal transmittance χ -value and the linear thermal transmittance ψ -value, to be calculated shall be given rounded to four decimal places.

The thermal transmittance U of the undisturbed model wall (i.e., without anchors or profiles, see Figure Q.3.2.2.3) shall be calculated in accordance with EN ISO 6946.

Q.3.2.6 Testing

The determination of the thermal transmittance U_c of the disturbed wall model (with anchors or profiles) shall be tested in accordance with EN ISO 8990 or EN 1934 (both methods are considered equivalent). A reference test specimen shall be used in accordance with Clause Q.3.2.2.

The thermal transmittance U of the undisturbed model wall (without anchors or profiles) shall be measured in accordance with the same method and test specimen materials and dimensions as for the thermal transmittance U_c .

When placing the pieces (anchors or profiles), the distance to the edge and between them should not fall below 300 mm.

Q.3.3 Example for determining the point thermal transmittance χ -values of an anchor

Below there is an example for the expression of the results when determining the point thermal transmittance χ -value of a anchors.

Example:

Considering that an anchor is defined to be used for thicknesses of thermal insulation layer $h_{\min} = 50$ mm to $h_{\max} = 320$ mm, and the following values of point thermal transmittance χ -value in accordance with thicknesses of thermal insulation layer have been determined by calculation or testing:

$$\chi(h_{\min}) = 0,159 \text{ W/K}; \quad \chi(h_{150}) = 0,181 \text{ W/K} \quad \text{and} \quad \chi(h_{\max}) = 0,215 \text{ W/K}.$$

One of the following cases may be used for the expression of the results depending on the range of thermal insulation thickness:

Case 1: One χ -value for the whole area of insulation thicknesses from 50 mm to 320 mm:

$$\chi(h=50-320 \text{ mm}) = 0,215 \text{ W/K}$$

Case 2: Two χ -values with distinction between areas of insulation thicknesses up to 150 mm and above 150 mm:

$$\chi(h \leq 150 \text{ mm}) = 0,181 \text{ W/K}; \quad \chi(h > 150 \text{ mm}) = 0,215 \text{ W/K}.$$