European Organisation for Technical Approvals
Europäische Organisation für Technische Zulassungen
Organisation Européenne pour l'Agrément Technique

ETAG 004

Edition March 2000

GUIDELINE FOR EUROPEAN TECHNICAL APPROVAL

of

EXTERNAL THERMAL INSULATION

COMPOSITE SYSTEMS WITH RENDERING

E O T A

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FOREWORD

Background of the ETAG

This Guideline has been drawn up by the EOTA Working Group 04.04/11 - External Thermal Insulation Composite Systems.

The WG consisted of members from eight EU-countries (Denmark, Finland, France (Convenor), Germany, Netherlands, Italy, Portugal and the United Kingdom) and four European industrial organisations (EEWISA (European External Wall Insulation Systems Association), EMO (European Mortars Organisation), EUMEPS (European Manufacturers of Expanded Polystyrene) and EURIMA (European Insulation Manufacturers Association)).

The Guideline sets out the performance requirements for External Thermal Insulation Composite Systems for the use as external insulation of building walls, the verification methods used to examine the various aspects of performance, the assessment criteria used to judge the performance for the intended use and the presumed conditions for the design and execution.

The UEAtc Directives for the Assessment of External Insulation Systems for Walls (Expanded Polystyrene Insulation Faced with a Thin Rendering), June 1988 and UEAtc Technical Guide for the Assessment of External Wall Insulation Systems Faced with Mineral Render, April 1992 have formed part of the basis for the Guideline.

List of reference documents

EOTA Guidance Document	The Provision of Data for Assessments Leading to ETA
COMMISSION DECISION	96/603/EC
ISO 7892: 1988	Vertical building elements - Impact resistance tests - Impact bodies and general test procedures
ISO 9932	Paper and board - Determination and water vapour transmission rate of sheet materials - Dynamic sweep and static gas method
EOTA Guideline	Plastic anchors
ISO 3386 – 1 and 2	Polymeric materials cellular flexible – Determination of stress – strain characteristic in compression Part 1 – Low-density materials Part 2 – High-density materials
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
prEN 12524	Building materials and products - Energy related properties - Tabulated design values.
EN ISO 10211-1	Thermal bridges in building - Heat flows and surface temperatures - Part 1: General calculation methods.
ISO EN 8990 (or prEN 1934)	Thermal insulation - Determination of steady state thermal transmission properties - Calibrated and guarded hot box
EN 1609	Thermal insulating products for building applications - Determination of short term water absorption by partial immersion

EN 12086	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN 1607	Thermal insulating products for building applications - Determination of tensile strength perpendicular to the faces
EN 12090	Thermal insulating products for building applications - Determination of shear behaviour
prEN 12667	Building materials – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance.
prEN 12939	Building materials – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Thick products of high and medium thermal resistance.
EN 196-1	Method of testing cement – Determination of strength
EN 1602	Thermal insulating products for building applications - Determination of the apparent density
EN 822	Thermal insulating products for building applications - Determination of length and width
EN 823	Thermal insulating products for building applications - Determination of thickness
EN 824	Thermal insulating products for building applications - Determination of squareness
EN 825	Thermal insulating products for building applications - Determination of flatness
EN 826	Thermal insulating products for building applications - Determination of compression behaviour
EN 1603	Thermal insulating products for building applications - Determination of dimension and shape stability under constant normal laboratory conditions
EN 1604	Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
prEN 13501-1	Fire classification of construction products and building elements: Part 1 – Classification using test data from reaction to fire tests
EC decision	EC OJ (L 229 of 20/8/1997 - Decision 97/556/EC of 14/7/1997
EN ISO 1460 (1992)	Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area.
EN ISO 1461 (1999)	Metallic coatings - Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.

These documents are referred to in the ETAG and are subject to the specific conditions mentioned therein.

Updating conditions

The edition of a reference document given in this list is that which has been adopted by EOTA for its specific use

Section one:
INTRODUCTION

1 PRELIMINARIES

1.1 LEGAL BASIS

This ETAG has been established in compliance with the provisions of the Council Directive 89/106/EEC (CPD) and has been established taking into account the following steps:

- issuing of the final mandate by the EC: 12 February 1997
- issuing of the final mandate by EFTA: 12 February 1997
- adoption of the Guideline by EOTA (Executive Commission) 13 October 1999
- endorsement by the EC / EFTA: SCC opinion of 9-10 December 1999

EC letter of 11 August 2000

This document is published by the Member States in their official language or languages according to Art 11/3 of the CPD.

No existing ETAG is superseded.

1.2 STATUS OF ETA-GUIDELINES

1.2.1 An ETA is one of two types of technical specifications in the sense of the EC 89/106 Construction Products Directive. This means that Member States shall presume that the approved products are fit for their intended use, i.e. they enable works in which they are employed to satisfy the Essential Requirements during an economically reasonable working life, provided that:

- the works are properly designed and built,
- the conformity of the products with the ETA has been properly attested.

1.2.2 This ETAG is a basis for ETA's, i.e. a basis for technical assessment of the fitness for use of a product for an intended use. An ETAG is not itself a technical specification in the sense of the CPD.

This ETAG expresses the common understanding of the approval bodies, acting together within EOTA, as to the provisions of the Construction Products Directive 89/106 and of the Interpretative Documents, in relation to the products and uses concerned, and is written within the framework of a mandate given by the Commission and the EFTA secretariat, after consulting the Standing Committee for Construction.

1.2.3 When accepted by the European Commission after consultation with the Standing Committee for Construction, this ETAG is binding for the issuing of ETA's for the products for the defined intended uses

The application and satisfaction of the provisions of an ETAG (examinations, tests and evaluation methods) leads to an ETA and a presumption of fitness of a product for the defined use only through an evaluation and approval process and decision, followed by the corresponding attestation of conformity. This distinguishes an ETAG from a harmonized European standard which is the direct basis for attestation of conformity.

Where appropriate, products which are outside of the precise scope of this ETAG may be considered through the approval procedure without guidelines according to art. 9.2 of the CPD.

The requirements in this ETAG are set out in terms of objectives and of relevant actions to be taken into account. It specifies values and characteristics, the conformity with which gives the presumption that the requirements set out are satisfied, wherever the state of art permits and after having been confirmed as appropriate for the particular product by the ETA.

2 SCOPE

2.1 SCOPE

This guideline deals with "External Thermal Insulation Composite Systems (ETICS)" with rendering intended for use as external insulation to the walls of buildings. The walls are generally made of masonry (bricks, blocks, stones, ...) or concrete (cast on site or as prefabricated panels).

ETICS are designed and installed in accordance with the ETA-holder's design and installation instructions. The kit comprises components which are factory-produced by the ETA-holder or the component suppliers. The ETA-holder is ultimately responsible for the kit. All components of the ETICS should be specified by the ETA-holder.

The systems comprise prefabricated insulation product bonded onto the wall, or mechanically fixed using anchors, profiles, special pieces, etc..., or a combination of adhesive and mechanical fixings. The insulation product is faced with a rendering consisting of one or more layers (site applied), one of which contains a reinforcement. The rendering is applied directly to the insulating panels, without any air gap or disconnecting layer.

Systems using other facings such as brick slips or tiles will be dealt with in subsequent parts.

Systems where the connection between rendering and insulation product has no function in their behaviour are not covered by this guideline.

The systems include special fittings (eg base profiles, corner profiles, ...) to connect them to adjacent building structures (apertures, corners, parapets, etc, ...).

The systems are designed to give the wall to which they are applied satisfactory thermal insulation. They should provide a minimal thermal resistance in excess of 1 m^2. K/W. In special use, smaller thicknesses of insulation can be used subject to checking that there is no particular problem.

The systems can be used on new or existing (retrofit) vertical walls. They can also be used on horizontal or inclined surfaces which are not exposed to precipitation.

The systems are non load-bearing construction elements. They do not contribute directly to the stability of the wall on which they are installed. The systems can contribute to durability by providing enhanced protection from the effects of weathering.

The systems are not intended to ensure the airtightness of the building structure.

2.2 USE CATEGORIES, PRODUCTS FAMILIES, KITS AND SYSTEMS

From the design point of view, ETICS are differentiated according to the methods of fixing :

Bonded system:

1. Purely bonded systems.
   Systems may be fully bonded (over the entire surface) or partially bonded in strips and/or dabs.

2. Bonded systems with supplementary mechanical fixings.
   The load is totally distributed by the bonding layer. The mechanical fixings are used primarily to

provide stability until the adhesive has dried and act as a temporary connection to avoid the risk of detachment. They can also provide stability in case of fire.

Mechanically fixed system:

3. Mechanically fixed systems with supplementary adhesive
   The load is totally distributed by the mechanical fixings. The adhesive is used primarily to ensure the flatness of the installed system.

4. Purely mechanically fixed systems
   The system are secured to the wall by mechanical fixings only.

Several categories have been adopted to correspond to the degree of exposure to impact in use. These use categories are defined in paragraph 6.1.3.3.

2.3 ASSUMPTIONS

The state of the art does not enable the development, within a reasonable time, of full and detailed verification methods and corresponding technical criteria/guidance for acceptance for some particular aspects or products. This ETAG contains assumptions taking account of the state of art and makes provisions for appropriate, additional case by case approach when examining ETA-applications, within the general framework of the ETAG and under the CPD consensus procedure between EOTA members.

The guidance remains valid for other cases which do not deviate significantly. The general approach of the ETAG remains valid but the provisions then need to be used case by case in an appropriate way. This use of the ETAG is the responsibility of the ETA-body which receives the special application, and subject to consensus within EOTA.

3 TERMINOLOGY

3.1 COMMON TERMINOLOGY AND ABBREVIATIONS

(See Annex A).

3.2 SPECIFIC TERMINOLOGY

3.2.1 Substrates

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

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

3.2.2 System components

The adhesive (§ 3.2.2.1.), the base coat and the finishing coat (§ 3.2.2.3.) can include a range of binders from pure polymeric to pure cementitious. They are available in the following forms:

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

3.2.2.1 Adhesive

A product used for bonding the insulation product to the wall substrate.

3.2.2.2 Insulation product

A pre-fabricated product with a high thermal resistance which is intended to impart insulating properties to the substrate to which it is applied.

3.2.2.3 Rendering system

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

- Reinforcement
  Glass fibre mesh, metal lath or plastic mesh reinforcement embedded in the base coat to improve its mechanical strength.
- Render coating
  The rendering is applied to the insulation product in one or several coats (application of a new coat on top of an existing dry coat).
  Installation can also be done in several layers (putting one layer on top of a fresh layer).
  Generally, multi-coat renders include the following:

- Base coat

  Coat applied directly onto the insulation product; the reinforcement is embedded into it and provides most of the mechanical properties of the rendering.

- Key coat

  Very thin coat which may be applied to the base coat and is intended to act as a preparation for the application of the finishing coat.

- Finishing coat

  Top coat which contributes to the protection of the system against weathering and can provide a decorative finish; it is applied onto the base coat with or without a key coat.

3.2.2.4 Mechanical fixing devices

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

3.2.2.5 Ancillary materials

Any supplementary element, component or product used in the system, e.g. to form joints (mastics, corner strips, etc...) or to achieve continuity (mastic, joint-covers, etc...).

3.2.3 Systems

3.2.3.1 Bonded systems

Systems where the connection to the substrate is ensured by bonding. They may or may not include supplementary mechanical fixings.

3.2.3.2 Mechanically fixed systems

Systems where the connection to the substrate is ensured by mechanical fixings. They may or may not include supplementary bonding.

Section two:
GUIDANCE FOR THE ASSESSMENT OF THE FITNESS FOR USE

GENERAL NOTES:

a) Applicability of the ETAG

This ETAG provides guidance on the assessment of ETICS and their intended uses. It is the manufacturer or producer who defines the ETICS for which he is seeking ETA and how it is to be used in the works, and consequently the scale of the assessment.

It is therefore possible that for some products, which are fairly conventional, only some of the tests and corresponding criteria are sufficient to establish fitness for use. In other cases, e.g. special or innovative ETICS or materials, or where there is a range of uses, the whole package of tests and assessment may be applicable.

b) General lay out of this section

The assessment of the fitness of products with regard to their fitness for intended use in construction works is a process with three main steps:

- Chapter 4 clarifies the specific requirements for the works relevant to the products and uses concerned, beginning with the Essential Requirements for works (CPD art. 11.2) and then listing the corresponding relevant characteristics of products.

- Chapter 5 extends the list in chapter 4 into more precise definitions and the methods available to verify product characteristics and to indicate how the requirements and the relevant product characteristics are described. This is done by test procedures, methods of calculation and of proof, etc...

- Chapter 6 provides guidance on the assessing and judging methods to confirm fitness for the intended use of the ETICS.

- Chapter 7, assumptions and recommendations are only relevant in as far as they concern the basis upon which the assessment of the ETICS is made concerning their fitness for the intended use.

c) Levels or classes or minimum requirements, related to the essential requirements and to the product performance (see ID clause 1.2)

According to the CPD "Classes" in this ETAG refer only to mandatory levels or classes laid down, in the EC-mandate.

This ETAG indicates however the compulsory way of expressing relevant performance characteristics for the ETICS. If, for some uses at least one Member state has no regulations, a

manufacturer always has the right to opt out of one or more of them, in which case the ETA will state "no performance determined" against that aspect.

d) Working life (durability) and serviceability

The provisions, test and assessment methods in this guideline or referred to, have been written, based upon the assumed intended working life of the ETICS for the intended use of at least 25 years, provided that the ETICS is subject to appropriate use and maintenance (cf. chapter 7). These provisions are based upon the current state of art and the available knowledge and experience.

An "assumed intended working life" means that it is expected that, when an assessment following the ETAG-provisions is made, and when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

The indications given as to the working life of a ETICS cannot be interpreted as a guarantee given by the producer or the approval body. They should only be regarded as a means for the specifiers to choose the appropriate criteria for ETICS in relation to the expected, economically reasonable working life of the works (based upon ID. 5.2.2).

e) Fitness for the intended use

According to the CPD it has to be understood that within the terms of this ETAG, products shall "have such characteristics that the works in which they are to be incorporated, assembled, applied or installed, can, if properly designed and built, satisfy the Essential Requirements" (CPD, art. 2.1).

Hence, the ETICS shall be suitable for use in construction works which (as a whole and in their separate parts) are fit for their intended use, account being taken of economy, and in order to satisfy the essential requirements. Such requirements must, subject to normal maintenance, be satisfied for an economically reasonable working life. The requirements generally concern actions which are foreseeable. (CPD Annex I - preamble).

4 REQUIREMENTS

4.0 GENERAL

This chapter sets out the aspects of performance to be examined in order to satisfy the relevant Essential Requirements, by:

- expressing in more detail, within the scope of the ETAG, the relevant Essential Requirements of the CPD in the Interpretative Documents and in the mandate, for works or parts of the works, taking into account the actions to be considered, as well as the expected durability and serviceability of the works,
- applying them to the scope of the ETAG (product and where appropriate its constituents, components and intended uses), and providing a list of relevant product characteristics and other applicable properties. When a product characteristic or other applicable property is specific to one of the Essential Requirements it is dealt with in the appropriate place. If, however, the characteristic or property is relevant to more than one Essential Requirement it, is addressed under the most important one with cross reference to the other(s). This is especially important where a manufacturer claims “No performance determined” for a characteristic or property under one Essential Requirement and it is critical for the assessing and judging under another Essential Requirement. Similarly, characteristics or properties which have a bearing on durability may be dealt with under ER 1 to ER 6. Where there is a characteristic which only relates to durability this is dealt with in 4.7.

This chapter also takes into account further requirements, if any (e.g. resulting from other EC Directives) and identifies aspects of serviceability including specifying characteristics needed to identify the products (cf. ETA-format § II.2).

The following Table 1 presents an overview of the Essential Requirements, the relevant paragraphs of the corresponding Interpretative Documents and the related requirements to product performance.

Table 1. Relationship between ID paragraph for works, ID paragraph for product performance , product characteristic given in the mandate and ETAG paragraph on product performance.

ER	Corresponding ID paragraph for works	Corresponding ID paragraph for system performance	Mandate product characteristic	ETAG paragraph on system performance
1	-	-	-	-
2	4.2.3.4.2b Limitation of spread of fire and smoke beyond the room of origin: Walls 4.2.4.2a Limitation of spread of fire to neighbouring construction works: External walls and facades	4.3.1.1 Reaction to fire requirements: Facades / external walls 4.3.3.5.2b Facades/external walls - fire propagation aspects	Reaction to fire (for application of ETICS subject to fire regulations)	4.2 Reaction to fire
3	3.3.1.2 Indoor environment: Dampness	3.3.1.2.3.2.e1 Dampness control: Walls, walling materials	Watertightness Water absorption Impact resistance to perforation Water vapour permeability Annex 4	4.3.1 Water absorption Watertightness Impact resistance Water vapour permeability 4.3.2 Outdoor environment
4	3.3.2.1 Impacts of falling objects, forming part of the works, upon users	3.3.2.3 Mechanical resistance and stability	Fixing strength (for mechanically fixed ETICS) Bond strength (for bonded ETICS)	4.4 Intrinsic weight Movements of the main structure Resistance to windload
5	-	-	-	-
6	4.2 Energy consumption limitation	4.3.2.1 Fabric materials Table 4.1 Characteristics 4.3.2.2 Fabric components Table 4.2 Component characteristics	Thermal resistance	4.6 Thermal resistance
Aspects of durability and service-ability			Resistance to: - Temperature – Humidity - Freeze/thaw - ...	4.7 Resistance to temperature, humidity and shrinkage Resistance to freeze/thaw Dimensional stability

4.1. ER1: MECHANICAL RESISTANCE AND STABILITY

Requirements with respect to the mechanical resistance and stability of non load bearing parts of the works are not included in this Essential Requirement but are treated under the Essential Requirement Safety in use (see Clause 4.4).

4.2. ER2: SAFETY IN CASE OF FIRE

Requirements for the reaction to fire of ETICS shall be in accordance with laws, regulations and administrative provisions applicable to the end use of the building and will be specified via the CEN classification documents (prEN 13501-1).

4.3. ER3: HYGIENE, HEALTH AND THE ENVIRONMENT

4.3.1 Indoor environment, dampness

As far as dampness is concerned for external walls, two requirements have to be considered, for which ETICS have a favourable effect:

- moisture proofing from outside damp.
  Walls should prevent moisture from the ground from entering the building and should not carry moisture from the ground to any part where it could cause damage.
  External walls should also resist the penetration of rain and snow to the inside of the building; they should not be damaged by rain and snow and should not carry moisture to any part where it could cause damage.
- avoiding condensation on internal surfaces and interstitial condensation. Surface condensation is usually reduced by the application of ETICS.

Under normal conditions of use, harmful interstitial condensation does not occur in the system. Where there is a high incidence of water vapour internally, appropriate precautions must be taken to prevent the system from becoming damp, for example by suitable design of the products and choice of materials.

To ensure that the first of the above mentioned characteristics is sufficiently retained, the performance on exposure to mechanical stresses under normal use should be considered, i.e.:

- the system shall be designed so that it retains its properties under the effect of impacts caused by normal traffic and normal use. Its performance should be such that the effect of normal accidental or deliberately caused unexceptional impact does not cause any damage.
- it should be possible to lean standard maintenance equipment against the system, without causing any breaks or perforation of the render.

This means that for ER3 the following product characteristics have to be assessed for the system and/or each of its components:

- Water absorption,
- Watertightness,
- Impact resistance,
- Water vapour permeability,
- Thermal characteristics (covered under ER6).

4.3.2 Outdoor environment

Installation and construction works shall not release pollutants to the immediate environment (air, soil, water).

The rate of release of pollutants to outdoor air, soil and water for building materials used in external walls shall therefore be in accordance with laws, regulations and administrative provisions, applicable for the location where the product is incorporated in the works.

4.4. ER4: SAFETY IN USE

Even though ETICS is without a structural intended use, mechanical resistance and stability is still required.
The ETICS shall be stable to the combined stresses generated by normal loads such as intrinsic weight, temperature, humidity and shrinkage, as well as movements of the main structure and wind forces (suction).

This means that for ER 4 ETICS the following products characteristics have to be assessed for the system and/or its components.

Effect of intrinsic weight

The system shall support itself without harmful deformation.

Performance on exposure to movements of the main structure
Normal movements of the main structure shall not give rise to any crack formation or loss of adhesion in the system. It is considered that the ETICS should withstand movements due to the temperature and stress variations except at structural joints where special precautions have to be taken.

Effect of the wind suction
The system shall, with a sufficient safety factor, exhibit appropriate mechanical resistance to the forces of pressure, suction and vibration, due to wind.

4.5. ER5: PROTECTION AGAINST NOISE

Requirements with respect to the protection against noise are not addressed, since these requirements should be satisfied by the entire wall including the ETICS as well as windows and other apertures.

4.6. ER6: ENERGY ECONOMY AND HEAT RETENTION

The entire wall should satisfy this requirement.
ETICS improve thermal insulation and make it possible to reduce heating (in winter) and air conditioning (in summer).
Therefore the improvement of the thermal resistance of the wall introduced by the ETICS shall be assessed so that it can be introduced in the thermal calculations required by the national regulations on energy consumption.
Mechanical fixings or temporary anchor fixings can cause localised differences in temperature. Assurance must be obtained that this effect is small enough not to influence the thermal insulating properties.
In order to establish the benefits of the ETICS to the wall, relevant component characteristics shall be specified as follows:
- Thermal conductivity/resistance,
- Water vapour permeability (covered under ER3),
- Water absorption (covered under ER3).

4.7. ASPECTS OF DURABILITY AND SERVICEABILITY

All of the ER's mentioned above must be fulfilled for the life of the system under the actions to which it is subjected.

Comment: It should be noted that the substrate can influence the system's durability.

System durability

The ETICS shall be stable to temperature, humidity and shrinkage.

Neither high nor low temperatures shall exercise a destructive or irreversibly deforming effect.

Low air temperatures of the order of - 20°C and high air temperatures of + 50°C are generally regarded as the extremes in temperature change. In northern European countries however, the temperatures of the air can decrease to - 40°C.

Solar radiation increases the surface temperatures of the ETICS when exposed. The increase depends on the radiation flow and the energy absorption of the surface (colour). It is generally considered that the maximum surface temperature is 80°C.

A change (of the order of 30°C) in the surface temperature shall not cause any damage, eg a sudden change due to prolonged exposure to solar radiation followed by intensive rain, or the change of temperature between sun and shade.

In addition, steps shall be taken to prevent crack formation both at the expansion joints of the structure and where elements of the facade are of different materials, eg connections to windows.

Durability of components

All components shall retain their properties during the overall service life of the system under normal conditions of use and maintenance such that the system quality is maintained. This requires the following:

- All components shall display a chemical-physical stability and be at least reasonably predictable if not absolutely known. Where reactions between materials in contact occur they should take place slowly
- All materials shall be either naturally resistant to, or be treated or protected against attack by corrosion.
- All materials shall be compatible with each other.

5 METHODS OF VERIFICATION

5.0 GENERAL

This chapter refers to the verification methods used to determine the various aspects of performance of the products in relation to the requirements for the works (calculations, tests, engineering knowledge, site experience, etc...).

In order to assess and judge ETICS it is often necessary to adopt verification methods which require the testing of two or more components in a small scale assembly. As such, they are neither systems nor components. By taking this approach, it is possible to either avoid a large number of full scale tests or at least limit the number required, by enabling the selection of the appropriate combination of components to provide an assessment of the complete range.

Therefore, the structure of this chapter is that these tests relate to the system rather than to the individual components.

The relevant Essential Requirements, the relevant verification methods and the related product characteristics to be assessed are indicated in the following table (Table 2).

Table 2. Relationship between ETAG paragraph on product performance, product characteristic and ETAG paragraph on verification method for the system or component.

ER	ETAG Paragraph on product performance	Product characteristic	ETAG paragraph on verification method	
			System	Component
1	-	-	-	-
2	4.2 Reaction to fire	 Reaction to fire	5.1.2 SYSTEM 5.1.2.1 Reaction to fire	5.2.2 INSULATION PRODUCT 5.2.2 Reaction to fire
3	4.3 Water absorption Water tightness Impact resistance Water vapour permeability Outdoor environment	 Water absorption Watertightness Impact resistance Water vapour permeability Release of dangerous substances	5.1.3 SYSTEM 5.1.3.1 Water absorption (capillarity test) 5.1.3.2 Watertightness 5.1.3.2.1 Hygrothermal behaviour 5.1.3.2.2 Freeze/thaw behaviour 5.1.3.3 Impact resistance 5.1.3.3.1 Resistance to hard body impact 5.1.3.3.2 Resistance to perforation 5.1.3.4 Water vapour permeability 5.1.3.5 Release of dangerous substances	5.2.3 INSULATION PRODUCT 5.2.3.1 Water absorption 5.2.3.2 Water vapour permeability

4	4.4 Intrinsic weight Movements of the main structure Resistance to wind load	Bond strength Fixing strength (transverse displacement) Resistance to wind load	5.1.4 SYSTEM 5.1.4.1 Bond strength 5.1.4.1.1 Bond strength between base coat and insulation product 5.1.4.1.2 Bond strength between adhesive and substrate 5.1.4.1.3 Bond strength between adhesive and insulation product 5.1.4.2 Fixing strength (transverse displacement) 5.1.4.2.1 Displacement test 5.1.4.3 Wind load resistance 5.1.4.3.1 Pull-through tests of fixings 5.1.4.3.2 Static foam block test 5.1.4.3.3 Dynamic wind uplift test	5.2.4 INSULATION PRODUCT 5.2.4.1 Tensile strength perpendicular to the faces 5.2.4.2 Shear strength and shear modulus of elasticity
				5.3.4 ANCHORS 5.3.4.1 Pull-out strength of anchors
				5.4.4 PROFILES 5.4.4.1 Pull-through resistance of fixings from profiles
				5.5.4 RENDER 5.5.4.1 Render strip tensile test
5	-	-	-	-
6	4.6 Thermal resistance	Thermal resistance	5.1.6 SYSTEM 5.1.6.1 Thermal resistance	5.2.6 INSULATION PRODUCT 5.2.6.1 Thermal resistance
Aspects of durability and serviceability	4.7 Resistance to temperature, humidity and shrinkage		5.1.7 SYSTEM Resistance to temperature, humidity and shrinkage Resistance to freeze/thaw Dimensional stability (treated under relevant ERs) 5.1.7.1 Bond strength after ageing	5.6.7 REINFORCEMENT 5.6.7.1 Glass fibre mesh – Tearing strength and elongation 5.6.7.2 Metal lath or mesh 5.6.7.3 Other reinforcements

The tests described in the following may not all be necessary if the product is not new and has been used for several years so that existing data are available, see EOTA Guidance Document on The Provision of Data for Assessments Leading to ETA (TB 98/31/12.6).

5.1 TEST ON SYSTEMS

5.1.1 Mechanical resistance and stability

Not relevant

5.1.2 Safety in case of fire

5.1.2.1 Reaction to fire

Testing of ETICS with respect to reaction to fire - including smoke production and flaming droplets - is performed as described in:

Test methods according to classification in Euroclasses A_1 – E developed by CEN (prEN 13501-1). If no performance is determined, the products fall in class F without testing.

The reaction to fire classification and relevant testing should be given twice:

- once for the entire system
- once for the insulation product alone (see 5.2.2)

5.1.3 Hygiene, health and the environment

5.1.3.1 Water absorption (capillarity test)

These tests have 3 purposes, to determine:
- the water absorption, in order to assess, in Chapter 6, whether it is acceptable.
- which finishing coats should be subject to hygrothermal testing (5.1.3.2.1).
- whether the freeze-thaw testing described in 5.1.3.2.2 is necessary.

Preparation of the samples:
Samples are prepared, each by taking a piece of the specified insulation product, surface area to be at least 200 mm x 200 mm, and applying to both the base coat alone and the other complete rendering systems with each type of finishing coat in accordance with the ETA-applicant's instructions, e.g. thickness, mass per unit area and method of application. Three samples are prepared for each configuration.

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

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

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

- 24 h immersion in a water bath (tap water) at (23 ± 2)°C. The samples are immersed base coat face downwards, to a depth of 2 to 10 mm, the depth of immersion dependent upon surface roughness. To achieve complete wetting of rough surface, the samples shall be tilted as they are introduced into the water. The depth of immersion can be regulated in the water tank by means of a height-adjustable slat.

- 24 h drying at (50 ± 5)°C.

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

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

Capillarity test procedure:
To start the capillarity test the samples are again immersed in a water bath as described above.

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

Analysis of results:
Calculation is undertaken to determine the average water absorption of the three samples per square metre after 1 and 24 hours. The outcome of these results will determine the following :

- Acceptability of the system : see § 6.1.3.1

- Hygrothermal behaviour :

In case of finishing coats with a pure polymeric binder (non cementitious) and if the water absorption of the base coat is equal to or more than 0.5 kg/m² after 24 hours at least all these finishing coats shall be submitted to hygrothermal cycles on the rig according to § 5.1.3.2.1. In all other cases, finishing coats shall be submitted to hygrothermal cycles as specified in § 5.1.3.2.1.

- Freeze/Thaw test :

The freeze/thaw test (§ 5.1.3.2.2.) is necessary if the water absorption of either the base coat or the rendering system is equal to or more than 0.5 kg/m² after 24 hours.

Footnote – Special requirements for some systems :

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

- If the ETICS is applied down to the ground and is therefore exposed to rising damp, the Approval Body may need to develop additional tests in an appropriate way subject to consensus within EOTA.

5.1.3.2 Watertightness

5.1.3.2.1 Hygrothermal Behaviour

Based on the outcome of the water absorption test, the specification to be tested is determined, e.g. the number of finishing coats (see 5.1.3.1 and Annex B)

Some samples are prepared at the same time as the rig in order to evaluate the following characteristics after heat/rain and heat/cold cycles (for sample size and number: see relevant test method):

- Bond strength between the base coat and insulation product (5.1.4.1.1)
- Tensile strength and elongation at break (Annex C, C.4.2) (for products with an application thickness up to 5 mm).

Preparation of the rig

- As a general rule, only one base coat and at the very most four finishing coats (vertical divisions) can be applied per rig.
- If several finishing coats are proposed for the system, the maximum number of coats, representative of the different types proposed, shall be tested on the rig. Furthermore, if the water absorption of the base coat after 24 h is equal to or more than 0.5 kg/m² (see 5.1.3.1), each type of finishing coat containing a pure polymeric binder (non cementitious) shall be submitted to hygrothermal cycles on the rig (see Analysis of results 5.1.3.1). Any finishing coats not tested on the rig shall be examined according to 5.1.7.1.2.
  Note : Where the only difference between two finishing coats is due to the size of aggregates, they are designated as one type.
- If different finishing coats can be used in the system, the lower part of the test piece (1,5 x insulating panel height) consists of the base coat only without a finishing coat.
  If several systems differ only in the method of fixing (bonded or mechanically fixed) of the insulation product, the test is only carried out on the system applied with adhesive at the edge of the rig and with mechanical fixings devices in the centre.
- If several systems differ only in the type of insulation product, two can be applied to the rig. The insulation products are divided vertically at the centre of each rig.
- The system is applied, in accordance with the manufacturers instructions, to a sufficiently stabilised masonry substrate.
- The system should also be applied to the lateral faces with a uniform maximum thickness of insulation product of 20 mm.
- The installation details (quantities of material applied, position of the joints between panels, fixing devices, ...), have to be checked and registered by the laboratory.
  Insulation product requiring stabilisation (prescribed delay between production and sale) shall be no older than 15 days beyond the minimum specified period.
- The dimensions of the rig shall be:
  - surface $\geq$ 6 m²
  - width $\geq$ 2.50 m
  - height $\geq$ 2.00 m

An opening is included at the corner of the rig, 0.40 m wide by 0.60 m high, positioned 0.40 m from the edges.

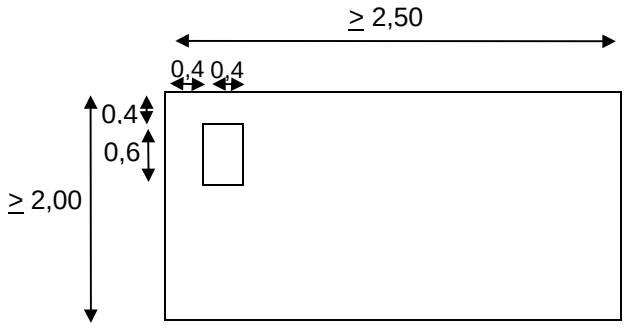


Fig. 1. Dimensions of the rig (quoted in metres)

Remark: if two insulation products are foreseen to be applied to the rig, two symmetrical openings shall be included at both of the upper corners of the rig.

Special methods for reinforcing corners of the opening are applied, if necessary.
Installation of the window sill is the responsibility of the ETA applicant.
The system is cured inside for a minimum of 4 weeks. During the curing time the ambient temperature shall be between 10°C and 25°C. The relative humidity shall not be less than 50 %. To ensure that these conditions are met records shall be made at regular intervals. To prevent the system from drying out too rapidly the ETA applicant may require the render to be wetted once per week by spraying for approximately 5 minutes. This should commence on the third day after installation.
During the curing time any deformations of the system, i.e. blistering, cracking, are recorded.
For a base coat with a thickness up to 5 mm, some samples are prepared according to Annex C § C.4.2 and placed in the opening of the rig.

Method of operation

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

Heat - rain cycles

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

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

Heat-cold cycles

After at least 48 hours of subsequent conditioning at temperatures between 10 and 25°C and a minimum relative humidity of 50 %, the same test rig is exposed to 5 heat/cold cycles of 24 hours comprising the following phases:

1 - exposure to (50 ± 5)°C (rise for 1 hour) and maximum 10 % RH for 7 hours (total of 8 hours),
2 - exposure to (- 20 ± 5)°C (fall for 2 hours) for 14 hours (total of 16 hours).

Observations during the test

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

- the surface finish of the system is examined to establish whether any cracking has occurred. The dimensions and position of any cracks should be measured and recorded,
- the surface should also be checked for any blistering or peeling and the location and extent should again be recorded,
- the sills and profiles should be checked for any damage/degradation together with any associated cracking of the finish. Again, the location and extent should be recorded.

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

5.1.3.2.2 Freeze-thaw behaviour

The freeze-thaw test shall be carried out as determined by the analysis of the capillarity test (§ 5.1.3.1) .

Note: The freeze/thaw test shall be conducted except if the water absorption after 24 hours of both the base coat and the rendering system determined with each finishing coat is less than 0.5 kg/m².

If the Ultrasonic transit time is measurable (generally where the base coat is thicker than 10 mm), this method shall be used if the water absorption of the base coat after 24 hours is equal to or more than 0.5 kg/m² and if the finishing coat is pure polymeric

In all other cases, the freeze-thaw test shall be carried out according to the simulated method.

- Ultrasonic transit time method:

  This test is carried out on three samples of the base coat without reinforcement (thickness x 100 mm x 100 mm) prepared according to the ETA applicant's instructions and then stored for 28 days at a temperature of (23 ± 2)°C and (50 ± 5) % RH.

  The samples are immersed to a depth of 2 to 10 mm in a water bath for 100 hours. The depth of immersion depends on surface roughness. To achieve complete wetting of rough surface, the samples shall be tilted as they are introduced into water. The depth of immersion is regulated in the water tank by a height adjustable slat.

  The samples are weighted before and after 100 hours immersion.

  The ultrasonic transit time is measured after immersion as a reference test (t_o) between the mould surfaces of each sample at two locations.

  The samples are then sealed in a plastic bag and placed in an automatically regulated freeze-thaw apparatus and submitted to 6 cycles:

  - Freezing to (- 20 ± 2)°C in 8 hours [(- 10 ± 2)°C shall be reached in 5 hours]
  - Thawing to reach + 5°C.

  After the cycles, the specimens are allowed to reach room temperature in the plastic bag.

  They are unsealed and weighed immediately after the final thaw.

  The ultrasonic transit time (t_n) is measured between the mould surfaces of each sample at two locations, in the same way as before the freeze-thaw cycles.

  The dynamic modulus ratio (E_n/E_o) is determined for each sample as follows:

$$\frac{E_n}{E_o} = \left(\frac{t_n}{t_o}\right)^2$$

- Simulated method:

  The test shall be carried out on three samples 500 mm x 500 mm consisting of a piece of the specified insulation product and:

  - base coat without finishing coat, where the finishing coat is based on a pure polymeric binder,
  - base coat with each type of finishing coat, in cases of finishing coat not based on pure polymeric binder (a finishing coat formulation presented in various grading sizes constitutes one type).

  These samples are prepared according to the ETA applicant's instructions and then stored for 8 days at (23 ± 2)°C and (50 ± 5) % RH.

  Cycles

  The samples are then subjected to a series of 30 cycles comprising:

  - Exposure to water for 8 hours at (+ 20 ± 2)°C by immersion of the samples, render face downwards, in a water bath, by the method described in 5.1.3.1 Capillarity test.
  - Freezing to (- 20 ± 2)°C (fall for 2 hours) for 14 hours (total of 16 hours).

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

  Remark: The specified temperatures are measured at the surface of the samples. The regulation is obtained by conditioned air.

  Observations during the test:

  At periods of every three cycles during the freeze-thaw cycles, observations relating to a change in characteristics of the surface or to the behaviour of the entire system are recorded according to 5.1.3.2.1.

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

5.1.3.3 Impact resistance

These tests are performed on the rig after the heat-rain and the heat-cold cycles.

These tests can also be carried out on samples aged by immersion in water for 7 days and then dried for 7 days at (23 ± 2)°C and (50 ± 5) % RH.

5.1.3.3.1 Resistance to hard body impact

Hard body impact tests are performed as described in ISO 7892: 1988, "Vertical building elements - Impact resistance tests - Impact bodies and general test procedures". The points of impact are selected taking into account various modes of behaviour of walls and their cladding, varying according to whether the impact point is or is not located in an area of greater rigidity (reinforcement).

Hard body impacts (10 Joules) are carried out with the steel ball weighing 1 kg and from a height of 1.02 m.

Hard body impacts (3 Joules) are carried out with the steel ball weighing 0.500 kg and from a height of 0.61 m.

Observations:

- the diameter of the impact is measured and indicated,

- the presence of any micro cracks or cracks, at the impact point and at the circumference, is noted.

5.1.3.3.2 Resistance to perforation (Perfotest)

Where the total render thickness is less than 6 mm, "Perfotests" shall be carried out in addition.

"Perfotest" (Fig. 2) is an apparatus which enables perforating impacts to be reproduced. It is calibrated with a hemispherical indentors (Fig. 3 – page 33) reproducing the impact of a steel sphere weighing 0.500 kg falling from 0.765 m.

The measurements are taken with the perforating cylindrical indentors shown in the following pictures.

Observations:

The diameter of the indentor used without perforating the rendering is to be noted.

Fig. 2: Perfotest apparatus

5.1.3.4 Water vapour permeability (resistance to water vapour diffusion)

In the case of finishing coats whose binder is pure polymeric, the test shall be carried out with all finishing coats. In all other cases the test is carried out on the system with the finishing coat, which has the thickest continuous layer.

The samples are prepared by applying the rendering system to the insulation product in accordance with the ETA applicant's instructions and conditioned for 28 days at (23 ± 2)°C and (50 ± 5) % RH.

Five test samples of at least 5000 mm² are then obtained by separating the rendering system from the insulation product.

The test is carried out in accordance with EN 12086, Thermal insulating products for buildings application - Determination of water vapour transmission properties.

The test should be carried out in an enclosure at (23 ± 2)°C and (50 ± 5) % RH. The dish contains a saturated solution of ammonium hydrogen phosphate ($NH_4H_2PO_4$).

The results are expressed in metres (of air) and the average value is determined.

This test can also be carried out in accordance with ISO 9932 "Paper and board - Determination and water vapour transmission rate of sheet materials - Dynamic sweep and static gas method".

No	1	2	3	4	5	6	7	8	9
Ø D	4	6	8	10	12	15	20	25	30
A	10	10	15	15	15	15	15	15	15
B	20	20	15	15	15	15	15	15	15

Quenched and tempered steel (R= 180 kgmm^{-2})

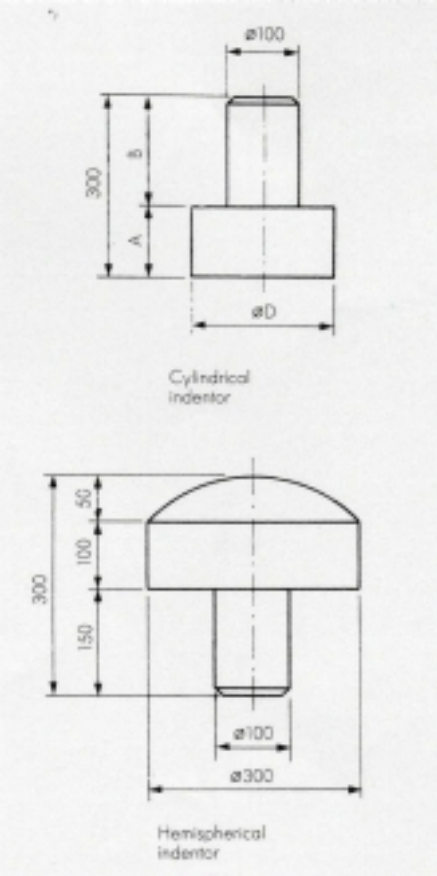


Fig. 3: Indentors

5.1.3.5 Release of dangerous substances

The product specifications (preferably in the form of a chemically unambiguous formula) shall be examined and where it is possible that a substance on the list referred to in clause 6.1.3.5 may be present, the appropriate tests and evaluations shall be carried out.

5.1.4 Safety in use

Which ever type of fixing used, the bond strength between the base coat and the insulation product shall be tested according to 5.1.4.1.1.

Furthermore, depending on the fixing type, the stability of the system on the substrate should be verified according to the tests specified in Table 3 and examination of the substrate as described in chapter 7.

For mechanically fixed systems, the admissible load to be applied to an anchor is that stated in an ETA or that determined according to the EOTA Guideline "Plastic anchors".

Table 3: Tests for verifying the stability of the system on the substrate

		Fixing technique			
		Bonded [1] Fully or partially	Mechanically fixed[2]		
			Anchors fixed through the reinforcement	Anchors fixed through the insulation product only	Profiles
Insulation product type	Cellular plastic or Mineral wool	Bond strength 5.1.4.1.2 and 5.1.4.1.3	Static foam block test 5.1.4.3.2 Displacement test[4] 5.1.4.2.1	Pull-through test 5.1.4.3.1 and/or[3] Static foam block test 5.1.4.3.2 Displacement test[4] 5.1.4.2.1	Static foam block test 5.1.4.3.2 Displacement test[4] 5.1.4.2.1
	Other	Bond strength 5.1.4.1.2 and 5.1.4.1.3 and Dynamic wind uplift test 5.1.4.3.3	Dynamic wind uplift test 5.1.4.3.3 and Displacement test[4] 5.1.4.2.1	Dynamic wind uplift test 5.1.4.3.3 and Displacement test[4] 5.1.4.2.1	Dynamic wind uplift test 5.1.4.3.3 and Displacement test[4] 5.1.4.2.1

[1] The tests on bonded systems with supplementary mechanical fixing devices should be conducted without the fixings.

[2] The tests on mechanically fixed systems with supplementary adhesive should be conducted without the adhesive. If the adhesive is less than 20 %, the system is considered to be purely mechanically fixed.

[3] Decision on which test to perform is based on Fig. 7.

[4] Only for systems not fulfilling the criteria in 5.1.4.2.

5.1.4.1 Bond strength

5.1.4.1.1 Bond strength between base coat and insulation product

Both the following tests are performed:

① on a panel of the insulation product faced with the base coat applied in accordance with the ETA-applicant's instructions and dried for 28 days under the same conditions as the rig.

② on samples taken from the rig after hygrothermal cycles (heat-rain and heat-cold cycles).

③ on samples after the simulated freeze thaw frost test as foreseen in § 5.1.3.2.2.

Five squares, measuring 50 mm x 50 mm for cellular plastic and 200 mm x 200 mm for mineral wool, are cut through the base coat and just into the insulation product layer using an angle grinder. Square metal plates of appropriate size are affixed to these areas with a suitable adhesive (Fig. 4).

Afterwards, the bond strength is measured at a tensioning speed of 1 to 10 mm/minute and individual and average values are recorded.

The results are expressed in MPa.

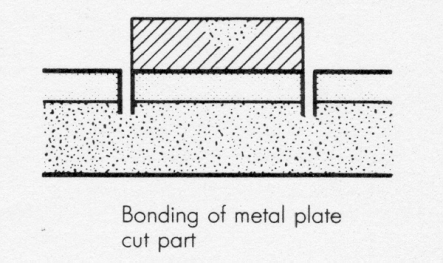


Fig. 4: Bond test

5.1.4.1.2 <u>Bond strength test between adhesive and substrate</u>

The test shall be carried out for bonded systems only.

The tests are performed on the following substrates:

- A substrate consisting of a smooth concrete slab at least 40 mm thick.

  The mix proportions of the concrete substrate shall be five parts by weight of 0/8 sand (the grading curve of the sand shall clearly rise constantly) to one part by weight of Portland cement.

  The total mass of fines less than 0.2 mm (sand and cement) shall not exceed 500 kg/m^3 of concrete.

  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 N/mm². The moisture content of the slab prior to the test shall be a maximum of 3 % of the total weight.

  - And: - For cement-free adhesive the most absorbent substrate of those specified by the ETA-applicant.

The adhesive is spread on the substrate to a thickness of 3 to 5 mm 15 minutes after mixing and, for the concrete slab only, at the end of the pot life stated by the manufacturer; it is then covered with an insulation product to prevent the adhesive curing too rapidly.

After allowing the adhesive to cure at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH for 28 days, and removing the insulation product, 15 squares 15 to 25 cm² in area are cut through the adhesive and just into the substrate. Metal plates of appropriate size are bonded to it using a suitable adhesive (five pieces per test). The pull-off test (see Fig. 4) is performed at a speed of 1 to 10 mm/minute on the following samples (5 samples each):

- without supplementary conditioning (dry condition),
- after immersion of the adhesive in water for 2 days and 2 h drying at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH,
- after immersion of the adhesive in water for 2 days and 7 days drying at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH.

The mean pull-off value is based on the results of five tests.

The individual and average values are recorded and the results are expressed in MPa.

5.1.4.1.3 <u>Bond strength test between adhesive and insulation product</u>

The test shall be carried out for bonded system only.

The test is performed on the insulation product specified for the system.

The adhesive is spread on the insulation product to a thickness of 3 to 5 mm 15 minutes after mixing. After allowing the adhesive to dry at (23 ± 2)°C and (50 ± 5) % RH for 28 days, 15 squares, measuring 50 mm x 50 mm for cellular plastic and 200 mm x 200 mm for mineral wool are cut through the adhesive and just into the insulation layer using an angle grinder. Square metal plates of appropriate size are affixed to this areas with a suitable adhesive.
The pull-off test (see Fig. 4) is performed with the same conditions as described in 5.1.4.1.2:
- without supplementary conditioning (dry condition),
- after immersion of the adhesive in water for 2 days and 2 h drying at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH,
- after immersion of the adhesive in water for 2 days and 7 days drying at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH.

The individual and average values are recorded and the results are expressed in MPa.

5.1.4.2 Fixing strength (transverse displacement)

The purpose of the test is to assess the displacement of the system at the edges of the wall.
The displacement test is not required for systems fulfilling one or more of the following criteria:
- Mechanically fixed systems with supplementary adhesive, where the bonded area exceeds 20 %
- E x d < 50 000 N/mm (E: modulus of elasticity of the base coat without mesh; d: thickness of the base coat)
- Systems intended only for continuous areas of rendering with a width or height less than 10 m
- Systems using an insulation product which is more than 120 mm thick
- Systems having a base coat where after the Render Strip Tensile Test (5.5.4.1) at 2 % render strain value, only cracks with a width of less or equal to 0,2 mm are observed
- Systems using fixing devices of which the fatigue bonding strength has been verified.

5.1.4.2.1 Displacement test

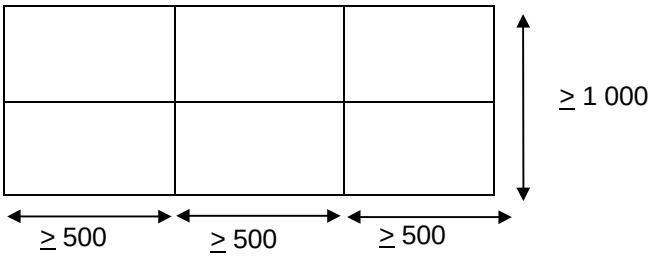
Preparation of samples:
The test is performed with the thinnest insulation product envisaged to be covered by the ETA.
A reinforced concrete slab measuring 1,0 m x 2,0 m with a thickness of 100 mm is prepared with a smooth surface. A small layer of sand is placed on top of the slab to allow the insulation panel to slide. Three (2 + 2/2) insulating panels are applied to the concrete slab with tight butt joints as illustrated in Fig. 5. The system shall be fixed with the minimum number of mechanical fixing devices according to the ETA-applicant's instructions.
The base coat is then applied to the insulation product in the same way as it is normally done in practice. The reinforcement shall protrude on all sides of the slab by about 300 mm.
The rendering shall be cured for 28 days at (23 $\pm$ 2)°C and (50 $\pm$ 5) % RH.
Before testing, a foam block is bonded to the cured rendering; the protruding ends of the reinforcement are then fixed to the clamping jaws over their full length.

Execution of test:

A simulated wind suction load of 2 000 Pa is applied to the ETICS via the foam block. Simultaneously, a normal tensile load is applied to the rendering of the ETICS via the clamped-in reinforcement. At a tensioning speed of 1 mm/min the resulting displacement of the ETICS relative to the concrete slab and the corresponding load is measured.

Preferably, the concrete slab is placed on top and the ETICS is applied under the slab.

At the end of the test, if no failure occurred, the same sample can be used for the static foam block test.



1 – Clamping jaws
2 – Plywood panel
3 – Foam block
4 – Reinforcement
5 – Thinnest insulation product
6 – Reinforced concrete slab

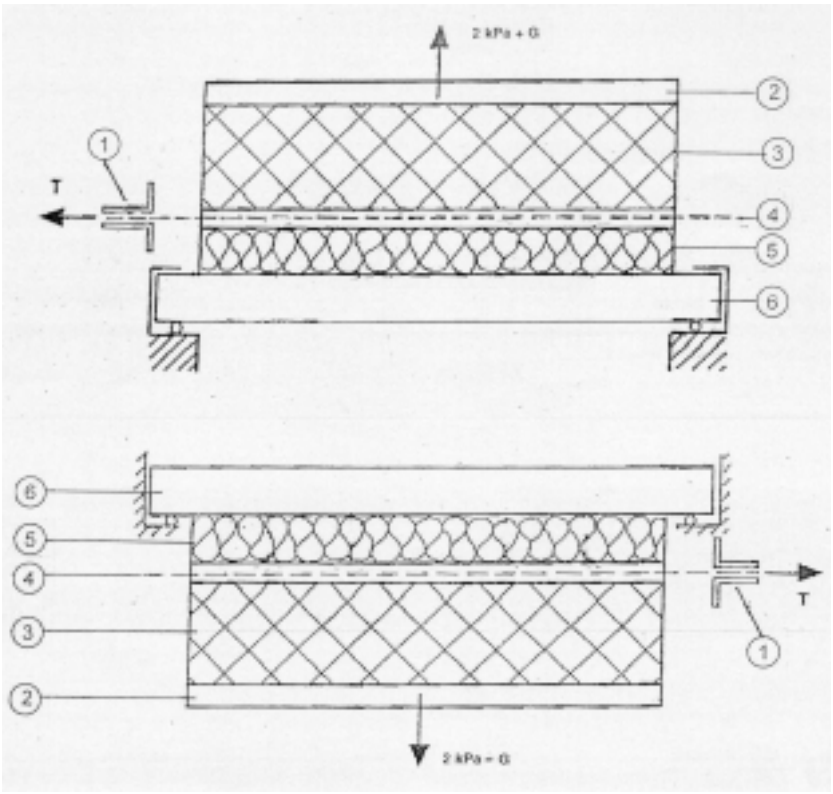


Fig. 5: Principle for preparation of specimens

Analysis of results

The load/displacement curve is recorded until failure occurs and the displacement U_e corresponding to the limit of elasticity is determined (see Fig. 6)

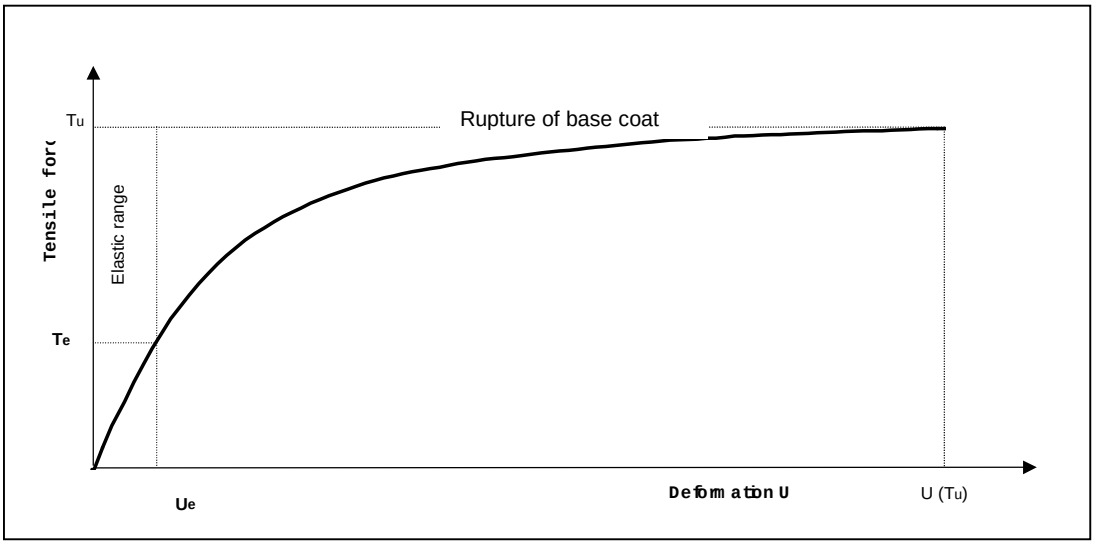


Fig. 6: Load/displacement curve

The length of the wall or the distance between expansion joints is calculated using the following equation as a function of the claimed ΔT :

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

where U_e = displacement corresponding to the elasticity limit (see load/displacement curve)

ε_s = shrinkage (see Annex C § C.4.1.2)

α_{th} = coefficient of linear thermal elongation (10^{-5})

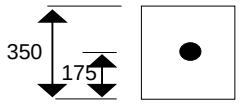
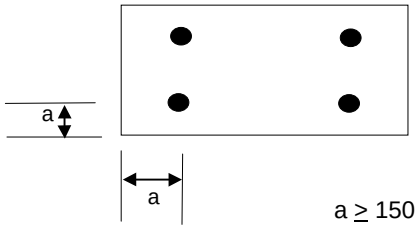
ΔT = temperature variations in the base coat of rendering claimed by the ETA-applicant.

L = length of wall or distance between expansion joints

5.1.4.3 Wind load resistance

The test samples for both the Pull-through test of fixings (5.1.4.3.1) and the Static foam block test (5.1.4.3.2) are described in Fig. 7, whereas the test samples for the Dynamic wind uplift test are described separately in the test description (5.1.4.3.3).

① Anchors not placed at the panel joint

Test samples	Test method
1a 	Pull-through test 5.1.4.3.1
or 1b 	Static foam block test 5.1.4.3.2

① Anchors placed at the panel joint

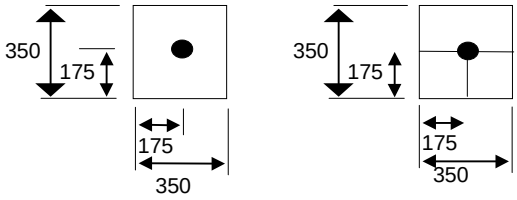
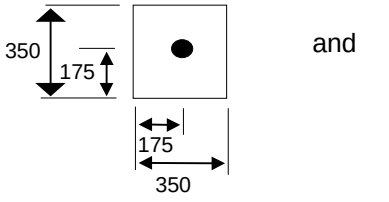
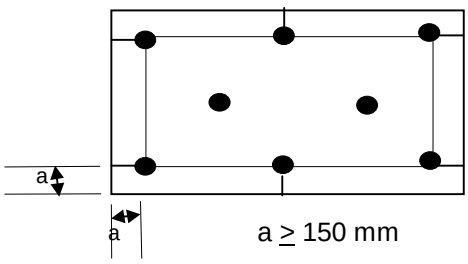
Test samples	Test method
2a 	Pull-through test 5.1.4.3.1
or 2b  and 	Pull-through test 5.1.4.3.1 Static foam block test 5.1.4.3.2

Fig. 7: Test samples for systems mechanically fixed by anchors

Remark: Because (2a) could lead to unfavourable test results, the test samples (2b) can be adopted. The influence of anchors positioned at panel joints is then deduced by calculation.

The two tests are carried out on the thinnest product envisaged to be covered by the ETA. Other insulation product thicknesses may be tested if the ETA-applicant wants the values referred to in the ETA.

The static foamblock test shall be carried out with at least the minimum number of mechanical fixing devices claimed by the ETA-applicant.

5.1.4.3.1 <u>Pull-through tests of fixings</u>

The test is performed in dry conditions.

However, if the tensile strength in wet conditions tested in 5.2.4.1.2 is less than 80% of that determined in dry conditions, the Pull-through test should be carried out in wet conditions as described in 5.2.4.1.2, Series 2 and 3.

Insulation samples, measuring 350 mm x 350 mm x the minimum thickness of product envisaged to be covered by the ETA, with an anchor driven through the centre of each sample (or at panel joints as described at the beginning of 5.1.4.3), are bonded, using a mortar-adhesive, to a rigid substrate. The head of the anchor is covered previously with a self-release sheet.

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

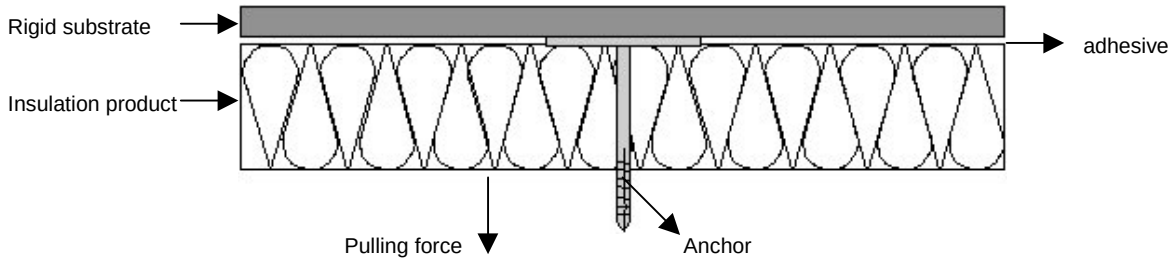


Fig. 8: Pull-through test sample

For cellular plastic insulation product, 3 or more tests (depending on the dispersion of the results) shall be carried out.
For mineral wool insulation product, 5 or more tests (depending on the dispersion of the results) shall be carried out.
Results are void if the rupture occurs in the edge. In such cases, the dimensions of the sample shall be increased.

The test report shall detail:
- each individual value,
- the average value,
- the 5 % fractile value (least value).

5.1.4.3.2 <u>Static foam block test</u>

The system is applied to a concrete slab without any supplementary adhesive, in accordance with the ETA applicant's installation instructions.

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

For systems secured by anchors, test samples are prepared in accordance with the ETA-applicant's instructions and take into account the influence of the anchors positioned at the panel joints as illustrated in 5.1.4.3 Wind load resistance.

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

For mineral wool insulation product, 5 or more tests (depending on the dispersion of the results) should be carried out.

Test details are illustrated in Fig. 9. The testing load F_t is generated by a hydraulic jack and transferred via a load cell to a rigid plate. The loading speed should be in the order of 10 ± 1 mm/minute. The joists are fixed with timber screws to a plywood panel and the timber panel is glued to the foam blocks using a two-component epoxy adhesive. As the surface of the sample is not directly accessible, the displacement of the render surface is measured via an extension rod passing through a hole in one of the foam blocks.

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

<u>Comment</u>: A suitable initial length of the block elements is 500 mm. The blocks can be cut off with a hot wire after the test is finished. They may be reused at least 20 times until the remaining length reaches about 300 mm.

The tensile strength of the material should be in the range of 80 - 150 kPa, the rupture strain should exceed 160 %. The compressive strength according to ISO 3386 should be in the order of 1.5 - 7.0 kPa. An example of a suitable material is polyether foam.

The test is carried out to failure.

The test report must detail the failure loads, the individual values and the average value obtained.

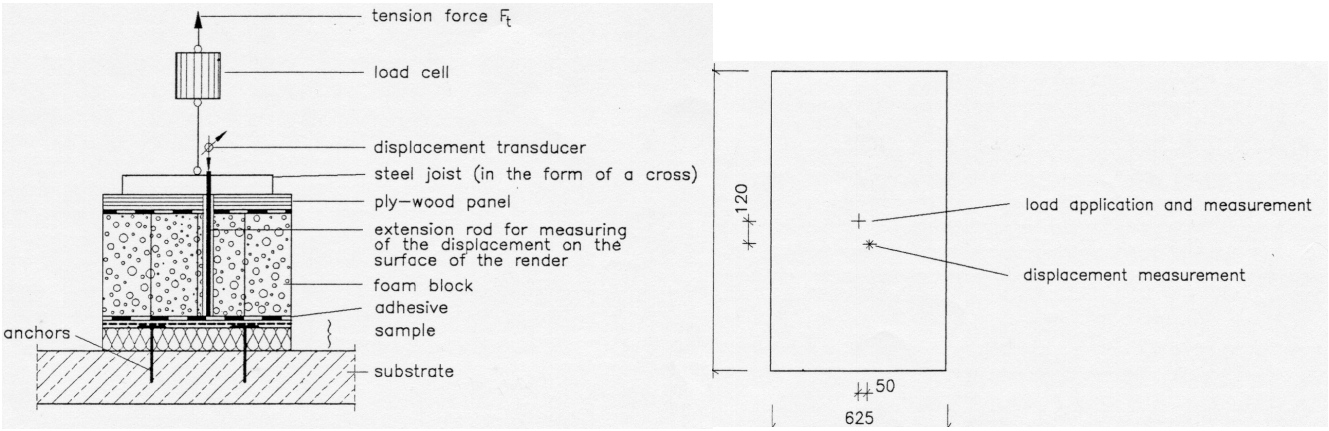


Fig. 9: Test set-up according to the "foam-block-method"

5.1.4.3.3 Dynamic wind uplift test

Preparation of the test specimen

According to the method of attachment

a. Mechanically fixed insulation product

The thinnest and thickest panels to be covered by the approval are tested.

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

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

The test report should state on which fixing devices the test is based and describe the type of rendering and the type of bonding of the rendering.

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

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

b. Bonded insulation product

The test sample should be built with the insulation product thickness corresponding to the lowest strength according to the tensile test (5.2.4.1.1 Tensile strength test perpendicular to the faces in dry condition).

General

The test model comprises:

- a substrate such as concrete or a brick wall,
- the insulation product secured with the specified fixing devices for the system,
- rendering.

To simulate air leakage through the wall, one 15 mm diameter hole is drilled every square metre with the hole corresponding with a joint in the insulation product.

The dimensions of the test model should be at least 2.00 m x 2.50 m.

For insulation product fixed with profiles the minimum dimensions are:

(2a + 200 mm) x (4b + 200 mm).

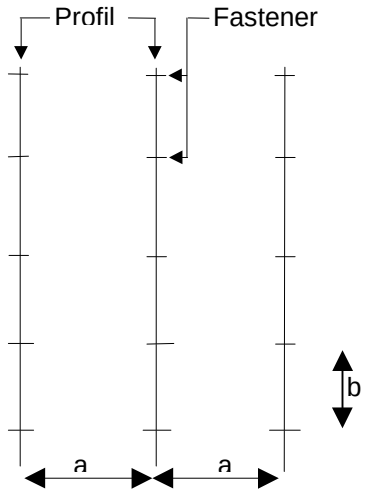


Fig. 10: Dimension of specimen

Test equipment

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

Test procedure

The loads shown in Fig. 11 are applied, each gust having the profile shown in Fig. 12.
The maximum suction of each cycle is $W_{100\%}$ and is defined in the following table:

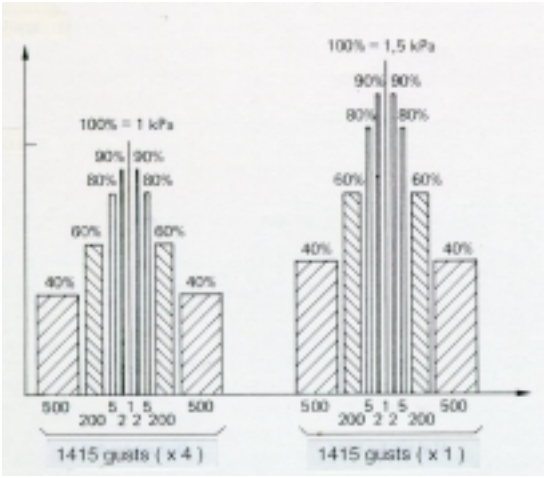


Figure 11: loads to be applied

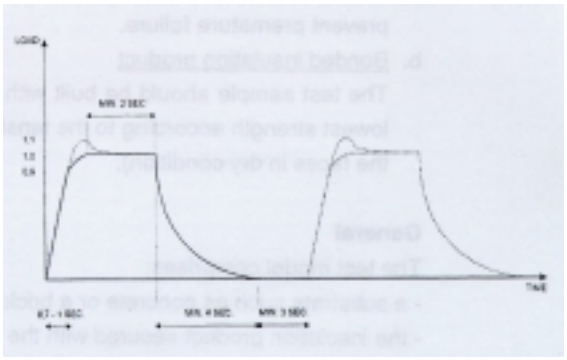


Figure 12: pressure/time profile of cyclic loads

Table 4 - Maximum suction of the cycles $W_{100\%}$

Number of cycles	Maximum suction in kPa
4	1.0
1	1.5
1	2.0
1	2.5
1	3.0
1	3.5
1	4.0
1	etc...

The sample is tested until failure:
Failure is defined by any one of the following events:

1. the insulation panel(s) breaks,
2. delamination occurs in the insulation product or between the insulation product and its facing,
3. the rendering system detaches,
4. the insulation panel is pulled off a fastener,
5. a mechanical fastener is torn out of the substrate,
6. the insulation panel detaches from the supporting structure.

Test results

The test result Q_1 is the $W_{100\%}$ load in the cycle preceding that in which the test specimen fails.

The test result Q_1 is corrected on the basis of the following formula to obtain the admissible value:

$$R_d = \frac{Q_1 \times C_s \times C_a}{m}$$

where:

m = national safety factor of resistance for normal materials (partial safety factor to be chosen in function of the type of failure which occured and the ageing of material properties concerned).

C_a = geometric factor allowing for the difference between the deformation of the system in the test and the real deformation of the system on a complete wall. This factor is used in other fields for very deformable skins. In the field of ETICS Ca = 1.

C_s = statistical correction factor.

- C_s for bonded insulation product

Table 5

Bonding % (B)	C_s
$50 \leq B \leq 100$	1
$10 < B < 50$	0.9
$B \leq 10$	0.8

- C_s for insulation products mechanically fixed by anchors

Table 6

Number of fasteners in the insulation panel	NUMBER OF PANELS IN THE TEST BOX			
	1	2	3	4
2	**	0.90	0.95	0.97
3	0.85	0.95	0.97	0.98
4	0.90	0.97	0.98	0.99

** Not admissible

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

- C_s for insulation products mechanically fixed with profiles

The values of C_s as a function of the dimensions of the chosen test system are given below.

For	(3a + 200 mm) x (4b + 200 mm) and greater:	$C_s = 0.95$
For and and	(4a + 200 mm) x (3b + 200 mm) (2a + 200 mm) x (5b + 200 mm) (2a + 200 mm) x (6b + 200 mm)	$C_s = 0.90$
For	(2a + 200 mm) x (4b + 200 mm):	$C_s = 0.85$

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

5.1.5 Protection against noise

Not relevant.

5.1.6 Energy economy and heat retention

5.1.6.1 Thermal resistance

The additional thermal resistance provided by the system to the substrate wall is calculated from the thermal resistance of the insulation product, determined in accordance with 5.2.6.1, and from the tabulated R value of the render system (R is about 0,02 m^2K/W), as described in:

- EN ISO 6946-1: Building components and building elements - Thermal resistance and thermal transmittance - Calculation method.
- pr EN 12524: Building materials and products - Energy related properties - Tabulated design values.
-EN ISO 10211-1: Thermal bridges in building - Heat flows and surface temperatures - Part 1: General calculation methods.

The thermal bridges caused by mechanical fixing devices (anchors) shall be taken into account using the following calculation:

The thermal transmittance of the ETICS must be increased by $\Delta\chi = \chi p.n$

with χp= local influence of thermal bridge caused by an anchor:

χp= 0.004 W/K for anchors with a galvanized steel screw with the head covered by a plastic material.

χp= 0.002 W/K for anchors with a stainless steel screw with the head covered by plastic material, and for anchors with an air gap at the head of the screw.

n= number of anchors per m^2.

The influence of thermal bridges should be taken into account only if $\Delta\chi > 0.04$ W/m^2.K.

If the thermal resistance cannot be calculated, it can be measured on the complete system as described in:

- ISO EN 8990 (or pr EN 1934): "Thermal insulation - Determination of steady state thermal transmission properties - Calibrated and guarded hot box".

5.1.7 Aspects of durability and serviceability

5.1.7.1 Bond strength after ageing

This test method is dependent on whether a finishing coat has been tested on the rig or not.

5.1.7.1.1 Finishing coat tested on the rig

The bond test is carried out in accordance with 5.1.4.1.1 ②.

5.1.7.1.2 Finishing coat not tested on the rig

The test is performed on an insulation panel faced with the rendering system applied in accordance with the manufacturer's instructions.
After allowing the samples to dry at (23 ± 2)°C and (50 ± 5) % RH for 28 days, squares 15 to 25 cm² in area are cut through the rendering system and just into the substrate. Metal plates of appropriate size (five pieces per test) are bonded to it using a suitable adhesive. The pull-off test (5.1.4.1.1) is performed at a speed of 1 to 10 mm / minute on samples aged by immersion in water for 7 days and then dried for 7 days at (23 ± 2)°C and (50 ± 5) % RH.

The results are expressed in MPa.

TESTS ON COMPONENTS

The component tests indicated in the following by * are also valid as identification tests.

5.2. Insulation product

The tests are carried out in accordance with European standards for the relevant insulation product.

5.2.1 Mechanical resistance and stability

Not relevant for this component.

5.2.2 Safety in case of fire

The indication of the reaction to fire for the insulation product alone is necessary as some Member States have detailed reaction to fire requirements for the insulation product alone. The test should be performed according to the principles of prEN13501-1.
It gives in particular an indication of the flame spread possibility in the insulation product of the ETICS. In order to limit this flame spread, some Member States require the use of “fire” barriers, possibly listed as deemed to satisfy products.
Should an ETA applicant propose the insulation product barrier to prevent fire spread as part of the kit, its capability, can either be evaluated by referring to this prescribed product list or to the results of a large scale test.

5.2.3 Hygiene, health and the environment

5.2.3.1 Water absorption

In accordance with:

- EN 1609 "Determination of short term water absorption by partial immersion".

5.2.3.2 Water vapour permeability

In accordance with:

- EN 12086 "Determination of water vapour transmission properties".

5.2.4 Safety in use

5.2.4.1 Tensile test

5.2.4.1.1 In dry conditions*

In accordance with EN 1607 "Determination of tensile strength perpendicular to the faces".

5.2.4.1.2 In wet conditions*

Where the characteristics of the insulation product could deteriorate by exposure to humidity, the test should be carried out in wet conditions using both of the following methods:

Two test methods have been introduced:

- the first has several years of experience but seems too severe in relation with the real behaviour on site,
- the second is new but seems more appropriate.

It has been agreed to carry out the two methods in parallel in order to compare the results and to select, in the future, only one method for which requirements will be fixed.

The size of the test samples depends on the type of insulation product, for example:

- "Lamella" mineral wool: 150 mm x 150 mm x thickness
- "Slab" mineral wool: 200 mm x 200 mm x thickness

① The testing is performed as a two test series with a minimum of 8 samples exposed to heat-moisture actions at (70 ± 2)°C and (95 ± 5) % RH in a climatic chamber:

- for 7 days followed by a drying period at (23 ± 2)°C and (50 ± 5) % RH until a constant weight is achieved
- for 28 days followed by a drying period at (23 ± 2)°C and (50 ± 5) % RH until a constant weight is achieved.

The tensile strength perpendicular to the face is determined after each conditioning and expressed in MPa.

② The testing is performed as a three test series with a minimum of 8 samples exposed for 5 days to vapour from a warm water bath.

The samples are placed over a container half filled with water. The temperature of the water is regulated at (60 ± 5)°C.

The spaces between the samples must be filled with extruded polystyrene to prevent the water vapour passing through.

The upper surfaces are covered with an aluminium plate.

They are then removed and conditioned as follows:

Series 1: 7 days in a sealed plastic bag at (23 ± 2)°C followed by a drying period, out of the bag at (23 ± 2)°C and (50 ± 5) % RH until constant weight is achieved,

Series 2: 28 days in a sealed plastic bag at (23 ± 2)°C and 2 hours out of the bag at (23 ± 2)°C and (50 ± 5) % HR,

Series 3: 28 days in a sealed plastic bag at (23 ± 2)°C following by a drying period out of the bag at (23 ± 2)°C and (50 ± 5) % RH until constant weight is achieved.

The plastic bag consists of polyethylene material 0,2 mm thick.

The tensile strength perpendicular to the face is determined after each conditioning, and expressed in MPa.

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

5.2.4.2 Shear strength and shear modulus of elasticity test*

In accordance with EN 12090 "Determination of shear behaviour".

5.2.5 Protection against noise

Not relevant for this component.

5.2.6 Energy economy and heat retention

5.2.6.1 Thermal resistance

Thermal resistance of the insulation product is determined as described in:

- pr EN 12667: " Building materials – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance".
- pr EN 12939: "Building materials – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Thick products of high and medium thermal resistance".

5.3 Anchors

5.3.1 Mechanical resistance and stability

Not relevant for this component.

5.3.2 Safety in case of fire

Not relevant for this component.

5.3.3 Hygiene, health and the environment

Not relevant for this component.

5.3.4 Safety in use

5.3.4.1 Pull-out strength of anchor

Evaluated according to ETAG "plastic anchors" or having obtained an ETA.

5.3.5 Protection against noise

Not relevant for this component.

5.3.6 Energy economy and heat retention

Not relevant for this component.

5.4 Profiles and their fixings

5.4.1 Mechanical resistance and stability

Not relevant for this component.

5.4.2 Safety in case of fire

Not relevant for this component.

5.4.3 Hygiene, health and the environment

Not relevant for this component.

5.4.4 Safety in use

5.4.4.1 Pull-through resistance of fixings from profiles

This test establishes the pull-through resistance of a fixing (anchor) through the perforation in the profile.

The test is carried out on 5 samples each measuring 300 mm ± 20 mm with a 6 mm perforation in the centre, obtained by drilling.

The apparatus consists of:

- a dynamometer,
- a support and metal screw as shown in Fig. 13.

The samples are conditioned for at least 2 h at (23 ± 2)°C before the test.

The screw is placed perpendicular to the profile as described in Fig. 13.

The tensile strength is carried out at (23 ± 2)°C.

The tensioning speed is 20 mm/min.

The pull-through resistance is expressed in N.

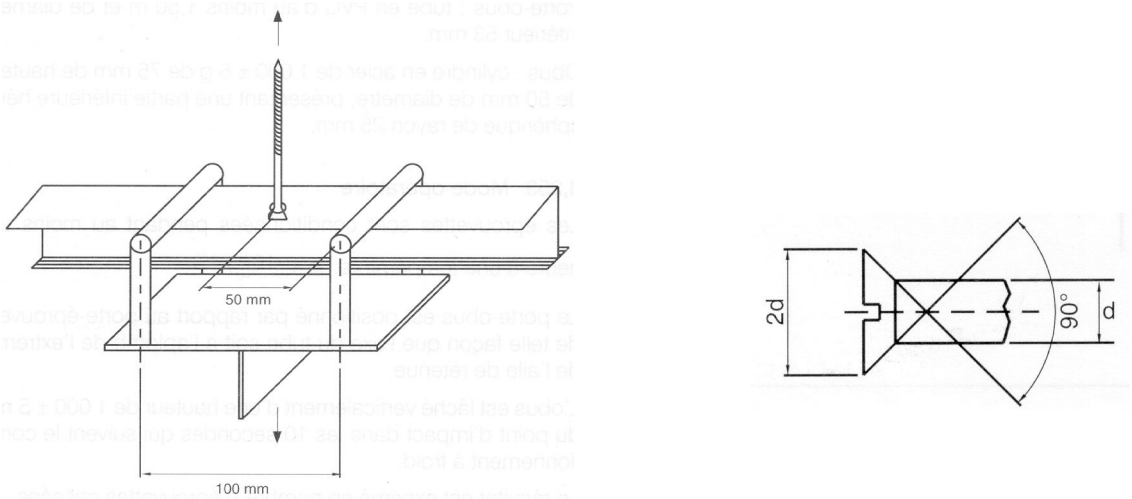


Fig. 13: Profile pull-through test

5.4.5 Protection against noise

Not relevant for this component.

5.4.6 Energy economy and heat retention

Not relevant for this component.

5.5 Render

5.5.1 Mechanical resistance and stability

Not relevant for this component.

5.5.2 Safety in case of fire

Not relevant for this component.

5.5.3 Hygiene, health and the environment

Not relevant for this component.

5.5.4 Safety in use

5.5.4.1 Render Strip Tensile Test

Purpose:

The test is suitable for the determination of the assessment of the cracking of a render system by determining the "typical crack width" W_{typ}.

Test set-up:

A render strip sample has the size 600 mm x 100 mm x d_r and consists of the reinforcement and the base coat. The reinforcement, length 800 mm is arranged within the base coat according to the ETA applicant's instructions. It shall protrude about 100 mm at the ends. The protruding parts of the reinforcement are placed on the render surfaces on which two metal plates are glued (if the reinforcement is not in the middle, two strips shall be bonded upside down together).

As an alternative to bonding the specimen between two steel plates the fixing of the test sample can be done using a PVC foil (thickness 1,5 to 2 mm, shore hardness A82) and pneumatic/hydraulic clamping (see figure 14).

Execution of test

The tensile force is applied deformation-controlled with a cross head speed of 0,5 mm/min. The force is measured via a static uniaxial tensile testing machine (class 1). The displacements are measured by two electronic displacement gauges DD1 for + 2,5 mm, precision class 0,1. The gauge length shall be 150 mm and such that it is at least 75 mm away from the peaks of the metal plates. The two electronic displacement gauges are fixed in the same way on the front and back of the specimen to enable the possibility of separate analysis of the measured results.

The samples are loaded 10 times up to 50 % of the expected crack strength. Loading and unloading should last about 1 to 2 minutes. During the 11^{th} cycle, the samples are loaded up to the formation of cracks and afterwards, until rupture.

If no previous failure occurs, the loading process is interrupted at render strain values of 0,3 %, 0,5 %, 0,8 %, 1,0 %, 1,5 % and 2,0 %. The quantity of cracks is counted, the crack widths are measured and recorded. After having conducted the test, the sample sizes (width, thickness) are measured and recorded.

The test is performed in warp and weft direction on three samples each.

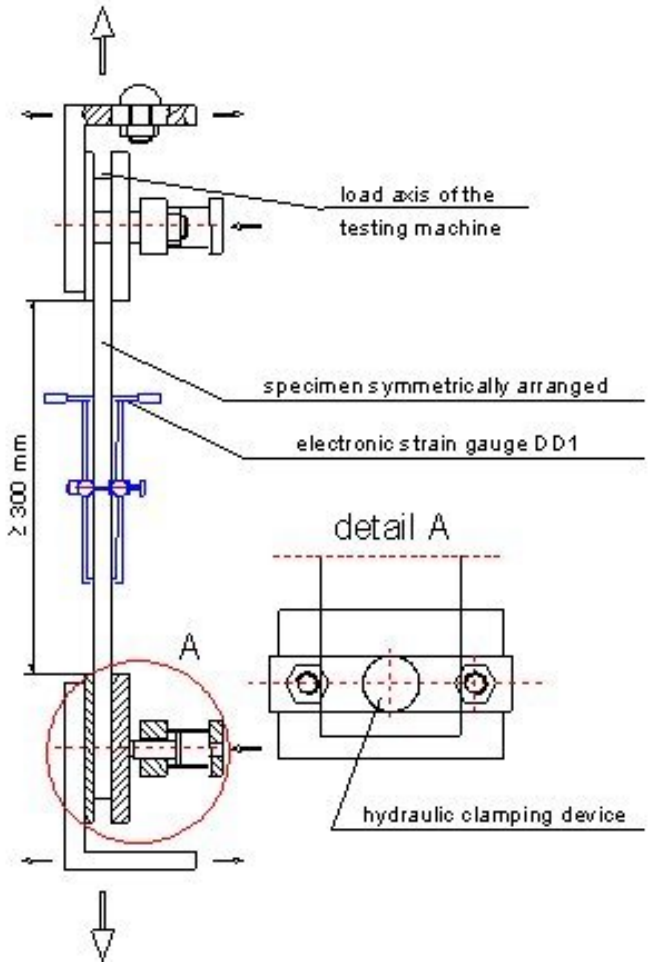


Fig. 14: Test set-up for the Render Strip Tensile Test

5.5.5 Protection against noise

Not relevant for this component.

5.5.6 Energy economy and heat retention

Not relevant for this component.

5.6 Reinforcement

5.6.1 Mechanical resistance and stability

Not relevant for this component.

5.6.2 Safety in case of fire

Not relevant for this component.

5.6.3 Hygiene, health and the environment

Not relevant for this component.

5.6.4 Safety in use

Not relevant for this component.

5.6.5 Protection against noise

Not relevant for this component.

5.6.6 Energy economy and heat retention

Not relevant for this component.

5.6.7 Aspects of durability and serviceability

5.6.7.1 Glass fibre mesh - Tearing strength and elongation* of the reinforcing fabric

The tear strength and the elongation of the reinforcement is to be measured in the weft and warp directions on 10 samples respectively. The samples should measure 50 mm by at least 300 mm. They shall contain at minimum 5 threads within the width.

The clamps of the testing machine shall be covered with a suitable rubber surface and hold the whole width of the samples. They shall be sufficiently rigid to resist deformation during the test.
The sample shall be located perpendicular to the clamp of the tensile testing machine.
The free length of the sample between clamps should be 200 mm.
The tensile force is increased with a constant crosshead speed of (100 ± 5) mm/min until failure occurs.
Testing is done in the as-delivered state and after immersion in alkaline solution (ageing).
The strength in N at failure and the elongation are recorded.
Samples where the specimen is displaced within the clamps or where the failure occurs at the clamps shall be discarded.

Calculation is undertaken to determine:

- the individual values of the tensile strength calculated from the force (F) at failure in relation to the width (w) of the sample

  $$\beta = \frac{F}{w} \text{ in } N/mm$$

- the individual values of elongation calculated from the change of the length $\Delta\lambda$ at failure in relation to the length λ of the sample between the clamps $\varepsilon = \frac{\Delta\lambda}{\lambda}$ in %
- the mean values of tensile strength and elongation calculated from these individual values
- the residual value calculated from the mean tensile strength value after ageing in relation to the mean tensile strength value in the as-delivered state.

5.6.7.1.1 Testing in the as-delivered state

The test is conducted after conditioning the samples at (23 ± 2)°C and (50 ± 5) % RH for at least 24 hours.

5.6.7.1.2 Testing after ageing

The samples are immersed for 28 days in alkaline solution at (23 ± 2)°C (20 samples (10 in the weft and 10 in the warp direction) in 4 litres solution).
The composition of the solution is as follows:
1 g NaOH, 4 g KOH, 0,5 g Ca $(OH)_2$ to one litre of distilled water.
The samples are rinsed by immersion 5 minutes in acid solution (5 ml HCl (35 % diluted) to 4 litres water) and then placed successively in 3 baths of water (4 litres each). The samples are left for 5 minutes in each bath.
They are subsequently dried at (23 ± 2)°C and (50 ± 5) % RH for 48 hours.

5.6.7.2 Metal lath or mesh

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

EN ISO 1460 (1992) : Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area.

EN ISO 1461 (1999) : Metallic coatings - Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.

5.6.7.3 Other reinforcements

Depending on the type of material the Approval Body will perform a suitable test based on 5.6.7.1.

6 ASSESSING AND JUDGING THE FITNESS FOR USE

6.0 GENERAL

This chapter details the performance requirements to be met by an External Thermal Insulation Composite System (chapter 4) into precise and measurable (as far as possible and proportional to the importance of the risk) or qualitative terms, related to the products and their intended use, using the verification methods (chapter 5).

Table 7. Relationship between system and component performance to be assessed and expressions of classification, categorisation and declaration.

ER	ETAG paragraph on product performance to be assessed	Class, use category, criterion
1	-	-
2	6.1.2 SYSTEM 6.1.2.1 Reaction to fire	 Euroclasses A_1 to F
	6.2.2 INSULATION 6.2.2.1 Reaction to fire	 Euroclasses A_1 to F
3	6.1.3 SYSTEM 6.1.3.1 Water absorption (capillarity test) ……. 6.1.3.2 Water tightness 6.1.3.2.1 Hygrothermal cycles …… 6.1.3.2.2 Freeze/thaw test …… 6.1.3.3 Impact resistance 6.1.3.3.1 Resistance to hard body impact …….. 6.1.3.3.2 Resistance to perforation 6.1.3.4 Water vapour permeability …… 6.1.3.5 Release of dangerous substances ……	 Pass/fail Pass/fail Pass/fail No performance determined option Use categories I, II, III Declared value Indication of dangerous substances incl. concentration etc. ”No dangerous substances”
	6.2.3 INSULATION 6.2.3.1 Water absorption …….. 6.2.3.2 Water vapour permeability ……..	 Pass/fail Declared value

4	6.1.4 SYSTEM 6.1.4.1 Bond strength 6.1.4.1.1 Bond strength between base coat and insulation 6.1.4.1.2 Bond strength between adhesive and substrate …… 6.1.4.1.3 Bond strength between adhesive and insulation 6.1.4.2 Fixing strength 6.1.4.2.1 Displacement test ……. 6.1.4.3 Resistance to wind load 6.1.4.3.1 Pull-through of fixings 6.1.4.3.2 Static foam block test …… 6.1.4.3.3 Dynamic wind uplift test	Pass/fail Declared value No performance determined option Declared value of characteristic resistance
	6.2.4 INSULATION 6.2.4.1 Tensile strength perpendicular to the faces …….. 6.2.4.2 Shear strength and shear modulus of elasticity ……	Declared value Declared value
	6.3.4 ANCHORS 6.3.4.1 Pull-out strength of anchors ……..	Declared value No performance determined option
	6.4.4 PROFILES 6.4.4.1 Pull-through of fixings from profiles ……..	Pass/fail
	6.5.4 RENDER 6.5.4.1 Render strip tensile test ……	Statement of crack width No performance determined option
5	-	-
6	6.1.6 SYSTEM 6.1.6.1 Thermal resistance ……	Declared value
	6.2.6 INSULATION 6.2.6.1 Thermal resistance ……	Declared value
Aspects of durability and serviceability	6.1.7 SYSTEM 6.1.7.1 Bond strength after ageing ……..	Pass/fail

	6.6.7 REINFORCEMENT 6.6.7.1 Glass fibre mesh – Tearing strength and elongation 6.6.7.2 Metal lath or mesh 6.6.7.3 Other reinforcements	.....	Pass/fail

6.1 SYSTEMS

6.1.1 Mechanical resistance and stability

Not relevant

6.1.2 Safety in case of fire

6.1.2.1 Reaction to fire

Classification of ETICS with respect to fire is undertaken in accordance with EN 13501-1 Reaction to fire classification

The following range of Euroclasses is used: from A_1 to F.
The classification is given for the entire kit and for the insulation product separately (see 6.2.2).

Existing national fire regulations can require the use of fixings in addition to those required for mechanical resistance and stability (safety in use).

6.1.3 Hygiene, health and the environment

6.1.3.1 Water absorption (Capillarity test)

If the water absorption of the base coat after 1 hour is more than 1 kg/m^2, the water absorption after 1 hour of each rendering system shall be less than 1 kg/m^2.

6.1.3.2 Watertightness

6.1.3.2.1 Hygrothermal performance

On the basis of the assessment of water absorption, 6.1.3.1 above and Annex B, the performance of chosen systems is assessed from testing on the `rig'.

The performance requirements from large scale hygrothermal cyclic testing are that, for either the base coat or the complete render system, the following defects should neither occur during, nor at the end of the test programme:

- blistering or peeling of any paint finish
- failure or cracking associated with joints between insulation product boards or profiles fitted with system

- detachment of the render coat
- cracking allowing water penetration to the insulating layer.

6.1.3.2.2 Freeze-thaw performance

The system is assessed as being freeze-thaw resistant if the water absorption of both the base coat and the rendering system are less than 0.5 kg/m² after 24 hours (see 5.1.3.1).
In all other cases, analysis of results from the tests in 5.1.3.1 is necessary. The performance requirements for the system is judged to be satisfactory if :
small samples tested using the "simulated method" (see 5.1.3.2.2) show none of the defects described in 6.1.3.2.1
or
the dynamic modulus ratio for the base coat En/Eo exceeds 0.9 (see 5.1.3.2.2 / Ultrasonic transit time method).

The method chosen shall be stated in the ETA.

6.1.3.3 Impact resistance

The categories given in the following table have been adopted to correspond to the degrees of exposure in use. They do not include an allowance for acts of vandalism.

Table 8: Definition of use categories

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

The hard body impact with steel ball and the dynamic perforation with Perfotest represent the action from heavy, non deformable or pointed objects which accidentally hit the system. Based upon the obtained test results the system is assessed as being in category I, II or III as follows:

Table 9: Categorisation

	Category III	Category II	Category I
Test 5.1.3.3.1 Impact 10 joule	-------	Rendering not penetrated[2)]	No deterioration[1)]
Test 5.1.3.3.1 Impact 3 joule	Rendering not penetrated[2)]	Rendering not cracked	No deterioration[1)]
Test 5.1.3.3.2 Perfotest	Not perforated[3)] by using an indentor of 20 mm	Not perforated[3)] by using an indentor of 12 mm	Not perforated[3)] by using an indentor of 6 mm

1) Superficial damage, provided there is no cracking, is considered as showing "no deterioration".

2) The test result is assessed as being "penetrated" if circular cracking penetrating as far as the insulation product is observed.

3) The test result is assessed as being "perforated" if a destruction of the rendering is shown up to a level beyond the reinforcement in at least 3 of the 5 impacts.

6.1.3.4 Water vapour permeability (Resistance to water vapour diffusion)

The resistance to water vapour diffusion of the rendering system (base coat and finish coat(s)) should normally not exceed:

- 2,0 metres if the combination involves a cellular plastic insulation product
- 1,0 metre if the combination involves a mineral wool insulation product.

The value shall be stated in the ETA, in order to enable the designer to evaluate the risk of interstitial condensation.

6.1.3.5 Outdoor environment

Release of other dangerous substances:
For the presence of materials listed in Council Directive of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (as amended) and in the document CONSTRUCT 99/348 Working Document of the Commission Services (Construction Products and regulations on Dangerous Substances) and in accordance with CONSTRUCT 99/363 Guidance Paper on a harmonised approach relating to dangerous substances under the Construction Products Directive, three possibilities exist:
– the materials are forbidden at CE level, i.e. no ETA can be issued
– the materials are forbidden in some countries, and the presence shall be declared
– the materials are allowed in all/some countries, but with restrictions, in which case the nature of the materials as well as their concentration/emission rate/etc shall be given.

If no such materials are present, this information shall be given.

6.1.4 Safety in Use

6.1.4.1 Bond strength

The assessment of purely bonded ETICS should be on the following basis in respect of intrinsic weight and movement of the main structure.

When the minimum requirements of 6.1.4.1.1 +.2 + .3 are fulfilled for a purely bonded ETICS, it can be judged to satisfy the performance requirements with regard to wind loads when applied to buildings up to a height of 100 m, without further assessment.

6.1.4.1.1 Bond strength between base coat and insulation product

At the end of the test 5.1.4.1.1, the minimum bond strength to the insulation product should be at least equal to 0.08 N/mm^2 or failure occurs in the insulation product instead.

6.1.4.1.2 Minimum requirement for bond strength between adhesive and substrate

At the end of the test 5.1.4.1.2, the minimum bond strength to the substrate should be at least equal to:

in dry condition: 0.25 N/mm^2
after effect of water:
- 0.08 N/mm^2 at 2 hours after removing the samples from the water
- 0.25 N/mm^2 at 7 days after removing the samples from the water

6.1.4.1.3 Minimum requirements for bond strength between adhesive and insulation product

At the end of the test 5.1.4.1.3, the minimum bond strength (B) of the adhesive to the insulation product should be at least, or failure occurs in the insulation product instead:

in dry condition: 0.08 N/mm^2
after effect of water:
- 0.03 N/mm^2 at 2 hours after removing the samples from the water
- 0.08 N/mm^2 at 7 days after removing the samples from the water.

The minimal bonded surface S, which must exceed 20%, is calculated as follows:

$$\frac{B \times S}{100} \geq 0.03\,N/mm^2 \qquad S(\%) = \frac{\text{bonded surface}}{\text{insulant surface}} \times 100$$

6.1.4.2 Fixing strength (transverse displacement)

6.1.4.2.1 Displacement test

The U_e value and equation for determining L (see § 5.1.4.2.1) as a function of ΔT shall be stated in the ETA.

6.1.4.3 Resistance to wind loading

Judging should either be on the basis of assessing data from “Bond tests”, "pull through" and "foam block" tests or from a “dynamic wind uplift” test. The test or calculation result R_d shall be mentioned in the ETA.

The stability of an ETICS is verified for the wind load suction if the design resistance R_d (taking into account the national safety factors) is equal or greater than the design wind load suction S_d:

$$R_d \geq S_d$$

Remarks: National safety factors can take into account the type of failure indicated in the ETA.

6.1.4.3.1 Pull-through of fixings

The characteristic resistance of the fixings in dry conditions or, if appropriate, in wet conditions shall be stated in the ETA.

6.1.4.3.2 Static foam block test

The characteristic resistance of the fixings in N per fixing shall be stated in the ETA

The data in the ETA is used in conjunction with the fixing pattern to calculate the design resistance to wind load and this figure is judged against the formula in 6.1.4.3.4 (see below).

6.1.4.3.3 Dynamic wind uplift test

Where assessment based on 6.1.4.3.1 and 6.1.4.3.2 is not possible the performance requirements are established using the test method described in 5.1.4.3.3 and the system judged in relation to the formula in 6.1.4.3.

6.1.5 Protection against noise

ETICS are not required to meet this Essential Requirement.

6.1.6 Energy economy and heat retention

6.1.6.1 Thermal resistance

The overall thermal performance requirements of the system can be assessed by means of data relating to the components being included in the calculation procedures set out in 5.1.6.1. The calculation procedure addresses thermal bridges. Nevertheless, the minimum thermal resistance of the system should exceed $1 m^2$ K/W.
The R-value of the system shall be stated in the ETA.

6.1.7 Aspects of durability and serviceability

6.1.7.1 Bond strength after ageing

At the end of the test 5.1.4.1.1, the minimum bond strength value must be at least 0.08 N/mm^2, or failure occurs in the insulation product instead.

TESTS ON COMPONENTS

6.2 Insulation product

6.2.1 Mechanical resistance and stability

Not relevant for this component.

6.2.2 Safety in case of fire

Classification of the insulation product with respect to fire is undertaken in accordance with EN 13501-1 Reaction to fire classification.

The following range of Euroclasses is used: from A_1 to F.

In case of barriers in the insulation product as part of the kit, the results of the large scale test are presented or the material is described in reference to the product list referred to in 5.2.2.

6.2.3 Hygiene, health and the environment

6.2.3.1 Water absorption

Because of the possible deterioration in thermal properties resulting from accidental water penetration water absorption of the insulation product should not exceed 1 kg/m^2 after 24 hours partial immersion.

6.2.3.2 Water vapour permeability

The μ-value shall be stated in the ETA.

6.2.4 Safety in Use

6.2.4.1 Tensile strength

The results shall be stated in the ETA.

6.2.4.2 Shear strength and shear modulus of elasticity

For bonded systems the insulation product has to fulfil the following minimum requirements (see 5.2.4.2):

- shear strength $f_{\tau k} \geq 0.02$ N/mm^2
- shear modulus $G_m \geq 1.0$ N/mm^2

The subscript "k" indicates a characteristic value and "m" a mean value. The characteristic value is normally determined according to a statistical evaluation as the 5 %-fractile of a mechanical property. However for simplification the least value of a test series may be taken as substitute for the 5 %-fractile.

The subscript "τ" stands for shear (strength). According to EC-regulations, the letter "f" describes a strength property (originally derived from "force").

6.2.5 Protection against noise

Not relevant for this component.

6.2.6 Energy economy and heat retention

6.2.6.1 Thermal resistance

The R value shall be stated in the ETA.
However, the assessment and judgement only concerns insulation product with a maximum λ-value of 0.065 W/m.K. If insulation product is provided by a composite material, it should comply with the following:

$$\frac{d}{R} \leq 0.065\,(W/m.k)$$

d: thickness of the composite panel (insulation product) (m)
R: thermal resistance of (m^2.K/W)

6.3 Anchors

6.3.1 Mechanical resistance and stability

Not relevant for this component.

6.3.2 Safety in case of fire

Not relevant for this component.

6.3.3 Hygiene, health and the environment

Not relevant for this component.

6.3.4 Safety in Use

6.3.4.1 Pull-out strength of anchor

The characteristic strength of the anchor shall be stated in the ETA or reference shall be made to the ETA for the anchor.

6.3.5 Protection against noise

Not relevant for this component.

6.3.6 Energy economy and heat retention

Not relevant for this component.

6.4 Profiles and their fixings

6.4.1 Mechanical resistance and stability

Not relevant for this component.

6.4.2 Safety in case of fire

Not relevant for this component.

6.4.3 Hygiene, health and the environment

Not relevant for this component.

6.4.4 Safety in Use

6.4.4.1 Pull through resistance of fixings from profiles

The assessment of the pull through resistance is that value obtained should be at least 500 N. The results shall be stated in the ETA.

6.4.5 Protection against noise

Not relevant for this component.

6.4.6 Energy economy and heat retention

Not relevant for this component.

6.5 Render

6.5.1 Mechanical resistance and stability

Not relevant for this component.

6.5.2 Safety in case of fire

Not relevant for this component.

6.5.3 Hygiene, health and the environment

Not relevant for this component.

6.5.4 Safety in use

6.5.4.1 Render Strip Tensile Test

The width of the cracks shall be stated in the ETA.

6.5.5 Protection against noise

Not relevant for this component.

6.5.6 Energy economy and heat retention

Not relevant for this component.

6.6 Reinforcement

6.6.1 Mechanical resistance and stability

Not relevant for this component.

6.6.2 Safety in case of fire

Not relevant for this component.

6.6.3 Hygiene, health and the environment

Not relevant for this component.

6.6.4 Safety in use

Not relevant for this component.

6.6.5 Protection against noise

Not relevant for this component.

6.6.6 Energy economy and heat retention

Not relevant for this component.

6.6.7 Aspects of durability and serviceability

6.6.7.1 Glass fibre mesh

After ageing, the residual strength must be, at least:
- 50% of the strength in the as-delivered state
- and 20 N/mm.

6.6.7.2 Metal lath or mesh

Metal lath or mesh reinforcement can be made of galvanised steel or austenitic stainless steel. For galvanised laths, the minimum thickness of the zinc coat must be 20 µm ($\geq$ 275 g/m^2), and galvanising shall take place after welding the lath (space between filaments 9 to 13 mm).

6.6.7.3 Other reinforcements

Requirements are to be set depending on the type of other reinforcements.

7 ASSUMPTIONS AND RECOMMENDATIONS UNDER WHICH THE FITNESS FOR USE OF THE PRODUCT IS ASSESSED

7.0 GENERAL

This chapter sets out the assumptions and recommendations for design, installation and execution, maintenance and repair under which the assessment of the fitness for use according to the ETAG can be made (only when necessary and in so far as they have bearing on the assessment or on the products).

The wall on which the system is applied, shall be sufficiently airtight.
The sound insulation factor of the wall may change after application of an ETICS.

7.1 DESIGN OF THE WORKS

The works including the details (connection, joint,...) shall be designed in order to avoid water penetration behind the system. Pr EN ISO 13788 provides guidance as to the risk of condensation.

It should be possible to attach fixtures (down pipes, etc) into the substrate without damaging the integrity of the ETICS to a degree likely to reduce the overall performance.

7.2 EXECUTION OF THE WORKS

The works shall be executed by trained installers.
The ETA and the supporting documents shall include a detailed description of the installation of the system, specifying the required procedures (preparation of substrates, especially in the case of old walls, bonding, projections, etc), their sequence and timing of operations, the method of application (machinery, equipment, tools), amounts of materials used, drying times, as well as the temperature and the substrate's humidity limits for use.

7.2.1 Preparation of the substrate

The substrate has to be strong, dry and free of loose material.

7.2.1.1 Substrates suitable for bonded ETICS

Where the ETICS relies on being bonded the suitability of the substrate needs to be established as follows:

- new concrete or masonry surfaces may be suitable provided they are not contaminated eg by mould, mould oil (concrete) or other pollutants.
- other new substrates will need to be subject to on-site testing.
- old substrates may need surface preparation for example removal of paint finishes or existing renders where their load transfer to the wall cannot be confirmed.
- whenever there is doubt about the quality of an existing substrate, on-site testing shall be undertaken.
- where testing is undertaken no result shall be less than 0.08 N/mm^2 for a bonded system to be used.

7.2.1.2 Susbstrates suitable for mechanically fixed ETICS

Concrete walls (acc. to EC 2) or masonry (acc. to EC 6) for which anchors have been accepted are deemed to satisfy the requirements.
For other substrates, the suitability has to be verified by in-situ tests as described in the EOTA Guideline for Plastic Anchors

7.2.2 Execution of the system

- Rows of insulation products are positioned so that vertical joints are staggered.
- Joints between insulation products shall be tightly butted and must not contain render.
- The installed insulation products shall provide a flush surface to ensure the application of an even thickness of base coat.
- The insulation product shall be protected from the environment before it begins to degrade.
- The thickness of the base coat and the finishing coat must be as specified in the ETA.
- The reinforcement shall be fully embedded in the base coat.
- The execution of the ETICS shall be limited to facades with a length L or with a distance between expansion joints less than L as determined in 5.1.4.2.1 and 6.1.4.2.1.

7.3 MAINTENANCE AND REPAIR OF THE WORKS

It is accepted that, for the system to fully preserve its performance, the finishing coat shall normally be maintained.

Maintenance includes:
- repairs to localised damaged areas due to accidents,
- the application of various products or paints, possibly after washing or ad hoc preparation.

Necessary repairs should be effected rapidly.

It is important to be able to carry out maintenance as far as possible using readily available products and equipment, without spoiling appearance.

Comment: Care should be taken to use products which are compatible with the system.

Section three:
ATTESTATION OF CONFORMITY

8 ATTESTATION AND EVALUATION OF CONFORMITY

8.1 EC Decisions

The systems of attestation of conformity specified by the European Commission in decision published in the EC OJ (L 229 of 20/8/1997 - Decision 97/556/EC of 14/7/1997).

System 1 for ETICS for which the following is valid:
- intended use in external walls subject to fire regulations,
- reaction to fire classes A, B or C,
- made of materials for which the reaction to fire performance is susceptible to change during the production process,

is described in Council Directive (89/106/EEC) Annex III, 2 (i) and is detailed as follows:

a) Tasks of the manufacturer
   - factory production control,
   - further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

b) Tasks of the approved body
   - initial type-testing of the product,
   - initial inspection of the factory and of factory production control,
   - continuous surveillance, assessment and approval of factory production control.

System 2+ for all other ETICS and is described in Council Directive (89/106/EEC) Annex III, 2 (ii), First possibility and is detailed as follows:

a) Tasks of the manufacturer
   - initial type-testing of the product,
   - factory production control.

b) Tasks of the approved body
   - initial inspection of factory and of factory production control,
   - continuous surveillance, assessment and approval of factory production control.

8.2 RESPONSIBILITIES

8.2.1 Tasks of the manufacturer

8.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system shall ensure that the product is in conformity with the European Technical Approval (ETA).

Manufacturers having an FPC system which complies with EN 29000 and which addresses the requirements of an ETA are recognized as satisfiying the FPC requirements of the Directive.

8.2.1.2 Testing of samples taken at the factory (only for system 1)

Both large and small companies produce the various components of the ETICS and there is a wide variation in the volume and in the production processes. Therefore a precise test plan can only be set up on a case by case basis.

8.2.1.3 Declaration of Conformity (only for system 2+)

When all the criteria of the Conformity Attestation are satisfied the manufacturer shall make a Declaration of Conformity.

8.2.2 Tasks of the manufacturer or the approved body

8.2.2.1 Initial Type Testing

Approval tests will have been conducted by the approval body or under its responsibility (which may include a proportion conducted by an approved laboratory or by the manufacturer, witnessed by the approval body) in accordance with section 5 of this ETAG. The approval body will have assessed the results of these tests in accordance with section 6 of this ETAG, as part of the ETA issuing procedure.
These tests should be used for the purposes of Initial Type Testing(1).
For system 1 this work should be validated by the approved body for Certificate of Conformity purposes.
For system 2+ this work should be taken over by the manufacturer for Declaration of Conformity purposes.

8.2.3 Tasks of the approved body

8.2.3.1 Assessment of the factory production control system - initial inspection and continuous surveillance

Assessment of the factory production control system is the responsibility of the approved body.
An assessment must be carried out of each production unit to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment shall be based on an initial inspection of the factory.
Subsequently continuous surveillance of factory production control is necessary to ensure continuing conformity with the ETA.
It is recommended that surveillance inspections be conducted at least twice a year.

(1) In this respect Approval Bodies shall be able to have open arrangements with relevant Approved Bodies to avoid duplication, respecting each others responsibilities.

8.2.3.2 Certification

The approved body shall issue:
Certification of Conformity of product (for system 1)
Certification of Factory Production Control (for system 2+).

8.3 DOCUMENTATION

In order to help the approved body make an evaluation of conformity the approval body issuing the ETA shall supply the information detailed below. This information together with the requirements given in EC Guidance Paper B will generally form the basis on which the factory production control (FPC) is assessed by the approved body.
This information shall initially be prepared or collected by the approval body and shall be agreed with the manufacturer. The following gives guidance on the type of information required:

1) The ETA
   See section 9 of this Guideline.
   The nature of any additional (confidential) information shall be declared in the ETA.

2) Basic manufacturing process
   The basic manufacturing process shall be described in sufficient detail to support the proposed FPC methods.
   The different components of ETICS are generally manufactured using conventional techniques. Any critical process or treatment of the components which affects performance shall be highlighted.

3) Product and materials specifications
   These may include:
   - detailed drawings (including manufacturing tolerances),
   - incoming (raw) materials specifications and declarations,
   - references to European and/or international standards or appropriate specifications manufacturers data sheets.

4) Test plan
   The manufacturer and the approval body issuing the ETA shall agree an FPC test plan.
   An agreed FPC test plan is necessary as current standards relating to quality management systems (Guidance Paper B, EN 29002, etc, ...), do not ensure that the product specification remains unchanged and they cannot address the technical validity of the type of frequency of checks/tests.
   The validity of the type and frequency of checks/tests conducted during production and on the final product shall be considered. This will include the checks conducted during manufacture on properties that cannot be inspected at a later stage and for checks on the final product. The list is given as an example for the components generally used in ETICS. It shall be adapted case by case in order to take into account the risk of proper variation to each component.
   These will normally include:

Table 10

Components	Type of test	Frequency
Adhesive Base coat	- Density - pH (only for material delivered in paste) - Viscosity (only paste) - Dry extract at 105°C* - Ash content at 450°C* - Particule size grading - Setting and drying times - Bond test between adhesive/base coat and insulation product	The frequency is determined case by case depending on the components, the variation in the volume produced and the production process
Insulation product	- Dimension, thickness - Mass per unit - Tensile strength - Compression test - Dimensional stability test (not necessary for mineral wool) - Thermal properties - Water vapour permeability	
Mesh	- Mass per m² - Ash content* - Initial tensile strength - Alkali resistance (glass fibres) - Corrosion (metallic fibres)	
Finishing coat	- Density - Dry extract at 105°C* - Ash content at 450°C* - pH (only for material delivered in paste) - Particle size grading - Viscosity	
Anchors	In accordance with chapter "Attestation of conformity" of the Draft Guideline "Plastic anchors"	
Profile	- Mass per unit - Dimensions - Ash content (for plastic profile only) - Softening temperature - Pull through test	

-These tests need not necessarily be carried out in accordance with test methods described in the Guide.
- Some primary characteristics can be controlled by the determination of secondary characteristics whose correlation has been proved (example: thermal properties by determination of density).
- For components not defined in this table suitable tests must be adopted.

Where materials/components are not manufactured and tested by the supplier in accordance with agreed methods, then where appropriate they shall be subject to suitable checks/tests by the manufacturer before acceptance.

5) Prescribed test plan (only for system 1)
The manufacturer and the approval body issuing the ETA shall agree a prescribed test plan.
Parameters that could influence the reaction to fire of the system are indicated by * in the previous list.
Furthermore, the reaction to fire of the insulating material itself shall be verified.

8.4 CE MARKING AND INFORMATION

The ETA shall indicate the information to accompany the CE marking and the placement of CE marking and the accompanying information (the kit/components itself/themselves, an attached label, the packaging, or the accompanying commercial documents).

According to the CE Guidance Paper D on CE marking, the required information to accompany the symbol "CE" is:
- identification number of the notified body (system 1),
- name or identifying mark of the producer,
- last two digits of the year in which the marking was affixed,
- number of the EC certificate of conformity (system 1)
- number of the ETA (valid as indications to identify the characteristics of the ETICS and the characteristics where the "no performance determined" approach is used).

Section four:
ETA CONTENT

9 THE ETA CONTENT

9.1 THE ETA CONTENT

The format of the ETA shall be based on the Commission Decision of 22-07-1997, EC O.J. L236 of 22-08-1997.
The technical part of the ETA shall contain the following information as applicable to the system (hence given with a reference to the relevant clause of this guideline) or – where relevant - indicate the ”no performance determined option”:

Information on the system:

- Indication of the assumed working life (Section two, GENERAL NOTES d))
- Classification of the system with respect to reaction to fire (Euroclass) (Clause 6.1.2.1)
- Indication of water absorption of the base coat and of the rendering system (Clause 6.1.3.1)
- Statement on acceptable resistance to hygrothermal cycles (Clause 6.1.3.2.1)
- Statement on acceptable resistance to freeze-thaw (Clause 6.1.3.2.2) defining the method used
- Statement on the most severe use application for impact resistance for which the system has been assessed (use category I, II or III, including description) (Clause 6.1.3.3)
- Indication of water vapour diffusion resistance (Clause 6.1.3.4)
- Statement on the presence or otherwise of harmful substances including concentration (Clause 6.1.3.5)
- Indication of the bond strengths (Clause 6.1.4.1)
- Declaration of the U_e value and indication of the equation for determination of the admissible length of wall between expansion joints (Clause 6.1.4.2.1)
- Declaration of the resistance of the system to wind load (Clause 6.1.4.3)
- Declaration of the calculated thermal resistance of the system (Clause 6.1.6.1)
- Indication of the bond strength after ageing (Clause 6.1.7.1).

Information on the components:

- Classification of the insulation product with respect to reaction to fire (Euroclass) (Clause 6.2.2)
- Indication of water absorption of the insulation product (Clause 6.2.3.1)
- Declaration of water vapour permeability for the insulation product (Clause 6.2.3.2)
- Declaration of the tensile strength (perpendicular to the faces) of the insulation product (Clause 6.2.4.1)

- Indication of the shear strength and the shear modulus of elasticity of the insulation product (Clause 6.2.4.2)
- Indication of determined thermal resistance of the insulation product (Clause 6.2.6.1)
- Declaration of the characteristic resistance of the anchors (Clause 6.3.4.1)
- Indication of pull-through resistance of fixings (anchors) from profiles (Clause 6.4.4.1)
- Statement of crack width for render (Clause 6.5.4.1)
- Indication of the residual strength after ageing of the glass fibre mesh (Clause 6.6.7.1)
- Indication of the minimum thickness of the zinc coat for galvanised laths (Clause 6.6.7.2).

Information on the design:

The ETA may include annotated drawings with the dimensions marked and drawn to an adequate scale for components of the system such as insulation boards, reinforcements, corner pieces, mechanical fixings, etc. as well as a series of annotated detailed drawings with the dimensions.

The ETA should include a selection of annotated drawings, to an adequate scale, of sections of the system chosen from the following examples:

- vertical and horizontal sections of apertures (windows and doors),
- horizontal sections of internal and external angles,
- horizontal and vertical sections of insulation product joints,
- sections of a balcony, ledge or recess,
- section of wall,
- special precautions for accessible parts (ground floors, traffic areas, loggias, etc),
- section of air inlet,
- arrangements for fixings (catches, shutters, guard-rails, etc),
- wall/roof junction (pitched or flat),
- section of expansion joint in substrate,
- section of dividing joint in the rendering.

These drawings should be accompanied in each case by a description of the particular installation details.

For refurbishment additional drawings may be required illustrating the same connections with the structures, particularly with regard to frames, fixings for catches and openings.

Information on components:

- All characteristics determined according to chapters 5.2 - 5.6 (clauses 6.2 - 6.6).

For each of the above listed items, the ETA shall either give an indication/classification/ statement/description or state that the verification/assessment of this item has not been carried out (no performance determined).

Annex A:
COMMON TERMINOLOGY AND ABBREVIATIONS

A.1 Works and products

A.1.1 Construction works (and parts of works) (often simply referred to as "works") (ID 1.3.1)

Everything that is constructed or results from construction operations and is fixed to the ground. (This covers both building and civil engineering works, and both structural and non-structural elements).

A.1.2 Construction products (often simply referred to as "products") (ID 1.3.2)

Products which are produced for incorporation in a permanent manner in the works and placed as such on the market.
(The term includes materials, elements and components of prefabricated systems or installations).

A.1.3 Incorporation (of products in works) (ID 1.3.2)

Incorporation of a product in a permanent manner in the works means that:
- its removal reduces the performance capabilities of the works, and
- that the dismantling or the replacement of the product are operations which involve construction activities.

A.1.4 Intended use (ID 1.3.4)

Role(s) that the product is intended to play in the fulfilment of the essential requirements.
(N.B.: This definition covers only the intended use as far as relevant for the CPD).

A.1.5 Execution (ETAG-format)

Used in this document to cover all types of incorporation techniques such as installation, assembling, incorporation, etc...

A.1.6 System (EOTA/TB guidance)

System refers to an assembled system which is a kit after it has been installed in the works.
An "assembled system" may be made up only of the "kit" or it may comprise the "kit" assembled with one or more other products which may or may not themselves be construction products. In the wording of the CPD, "assembled system" is the equivalent of "works or part of the works".
An "assembled system" is not considered to be a construction product in the sense of the CPD because it is the result of the combination of components incorporated in the works and therefore exists only in the works and not on the market.

A.2 Performances

A.2.1 Fitness for intended use (of products) (CPD 2.1)

Means that the products have such characteristics that the works in which they are intended to be incorporated, assembled, applied or installed, can, if properly designed and built, satisfy the essential requirements.

A.2.2 Serviceability (of works)

Ability of the works to fulfill their intended use and in particular the essential requirements relevant for this use.
The products must be suitable for construction works which (as a whole and in their separate parts) are fit for their intended use, account being taken of economy, and in this connection satisfy the following essential requirements where the works are subject to regulations containing such requirements.
Such requirements must, subject to normal maintenance, be satisfied for an economically reasonable working life. The requirements generally concern actions which are foreseeable.

A.2.3 Essential requirements (for works)

Requirements applicable to works, which may influence the technical characteristics of a product, and are set out in terms of objectives in the CPD, Annex I (CPD, art. 3.1).

A.2.4 Performance (of works, parts of works or products) (ID 1.3.7)

The quantitative expression (value, grade, class or level) of the behaviour of the works, parts of works or of the products, for an action to which it is subject or which it generates under the intended service conditions (works or parts of works) or intended use conditions (products).
As far as practicable the characteristics of products, or groups of products, should be described in measurable performance terms in the technical specifications and guidelines for ETA. Methods of calculation, measurement, testing (where possible), evaluation of site experience and verification, together with compliance criteria shall be given either in the relevant technical specifications or in references called up in such specifications.

A.2.5 Actions (on works or parts of the works) (ID 1.3.6)

Service conditions of the works which may affect the compliance of the works with the essential requirements of the Directive and which are brought about by agents (mechanical, chemical, biological, thermal or electro-magnetic) acting on the works or parts of the works.
Interactions between various products within a work are considered as "actions".

A.2.6 Classes or levels (for essential requirements and for related product performances)) (ID 1.2.1)

A classification of product performance(s) expressed as a range of requirement levels of the works, determined in the ID's or according to the procedure provided for in art. 20.2 a of the CPD.

A.3 ETAG-Format

A.3.1 Requirements (for works) (ETAG-format 4)

Expression and application, in more detail and in terms applicable to the scope of the guideline, of the relevant requirements of the CPD given concrete form in the ID's and further specified in the mandate, for works or parts of the works, taking into account the durability and serviceability of the works.

A.3.2 Methods of verification (for products) (ETAG-format 5)

Verification methods used to determine the performance of the products in relation to the requirements for the works (calculations, tests, engineering knowledge, evaluation of site experience, etc...).
This verification methods are related only to the assessment of, and for judging the fitness for use. Verification methods for particular designs of works are called here "project testing", for identification of products are called "identification testing", for surveillance of execution or executed works are called "surveillance testing", and for attestation of conformity are called "AC-testing".

A.3.3 Specifications (for products) (ETAG-format 6)

Transposition of the requirements into precise and measurable (as far as possible and proportional to the importance of the risk) or qualitative terms, related to the products and their intended use.
The satisfaction of the specifications is deemed to satisfy the fitness for use of the products concerned.
Specifications may also be formulated with regard to the verification of particular designs, for identification of products, for surveillance of execution or executed works and for attestation of conformity, when relevant.

A.3.4 EOTA Technical reports

EOTA Technical reports go in to detail expressing the common understanding of existing knowledge and experience of the EOTA bodies at that moment. Where knowledge and experience is developing, especially through approval work, these reports can be amended and supplemented. When this happens, the effect of the changes upon the ETAG will be determined by EOTA.

A.4 Working life

A.4.1 Working life (of works or parts of the works) (ID 1.3.5 [1])

The period of time during which the performance will be maintained at a level compatible with the fulfilment of the essential requirements.

A.4.2 Working life (of products)

The period of time during which the performances of the product are maintained, under the corresponding service conditions, at a level compatible with the intended use conditions.

A.4.3 Economically reasonable working life (ID 1.3.5 [2])

Working life which takes into account all relevant aspects, such as costs of design, construction and use, costs arising from hindrance of use, risks and consequences of failure of the works during its working life and cost of insurance covering these risks, planned partial renewal, costs of inspections, maintenance, care and repair, costs of operation and administration, of disposal and environmental aspects.

A.4.4 Maintenance (of works) (ID 1.3.3 [1])

A set of preventive and other measures which are applied to the works in order to enable the works to fulfill all its functions during its working life. These measures include cleaning, servicing, repainting, repairing, replacing parts of the works where needed, etc...

A.4.5 Normal maintenance (of works) (ID 1.3.3 [2])

Maintenance, normally including inspections, which occurs at a time when the cost of the intervention which has to be made is not disproportionate to the value of the part of the work concerned, consequential costs (e.g. exploitation) being taken into account.

A.4.6 Durability (of products)

Ability of the product to contribute to the working life of the works by maintaining its performances, under the corresponding service conditions, at a level compatible with the fulfilment of the essential requirements by the works.

A.5 Conformity

A.5.1 Attestation of conformity (of products)

Provisions and procedures as laid down in the CPD and fixed according to the directive, aiming to ensure that, with acceptable probability, the specified performance of the product is achieved by the ongoing production.

A.5.2 Identification (of a product)

Product characteristics and methods for their verification, allowing to compare a given product with the one that is described in the technical specification.

A.6 Abbreviations

A.6.1 Abbreviations concerning the Construction products directive

AC: Attestation of conformity
CEC: Commission of the European Communities
CEN: Comité européen de normalisation (European Committee for Standardization)
CPD: Construction products directive
EC: European communities
EFTA: European free trade association
EN: European Standards
ER: Essential requirements
FPC: Factory production control

ID: Interpretative documents of the CPD
ISO: International standardisation organisation
SCC: Standing committee for construction of the EC

A.6.2 Abbreviations concerning approval

EOTA: European organisation for technical approvals
ETA: European technical approval
ETAG: European technical approval guideline
ETICS: External Thermal Insulation Composite System(s)
TB: EOTA-Technical board
UEAtc: Union Européenne pour l'Agrément technique dans la construction (European Union of Agrement)

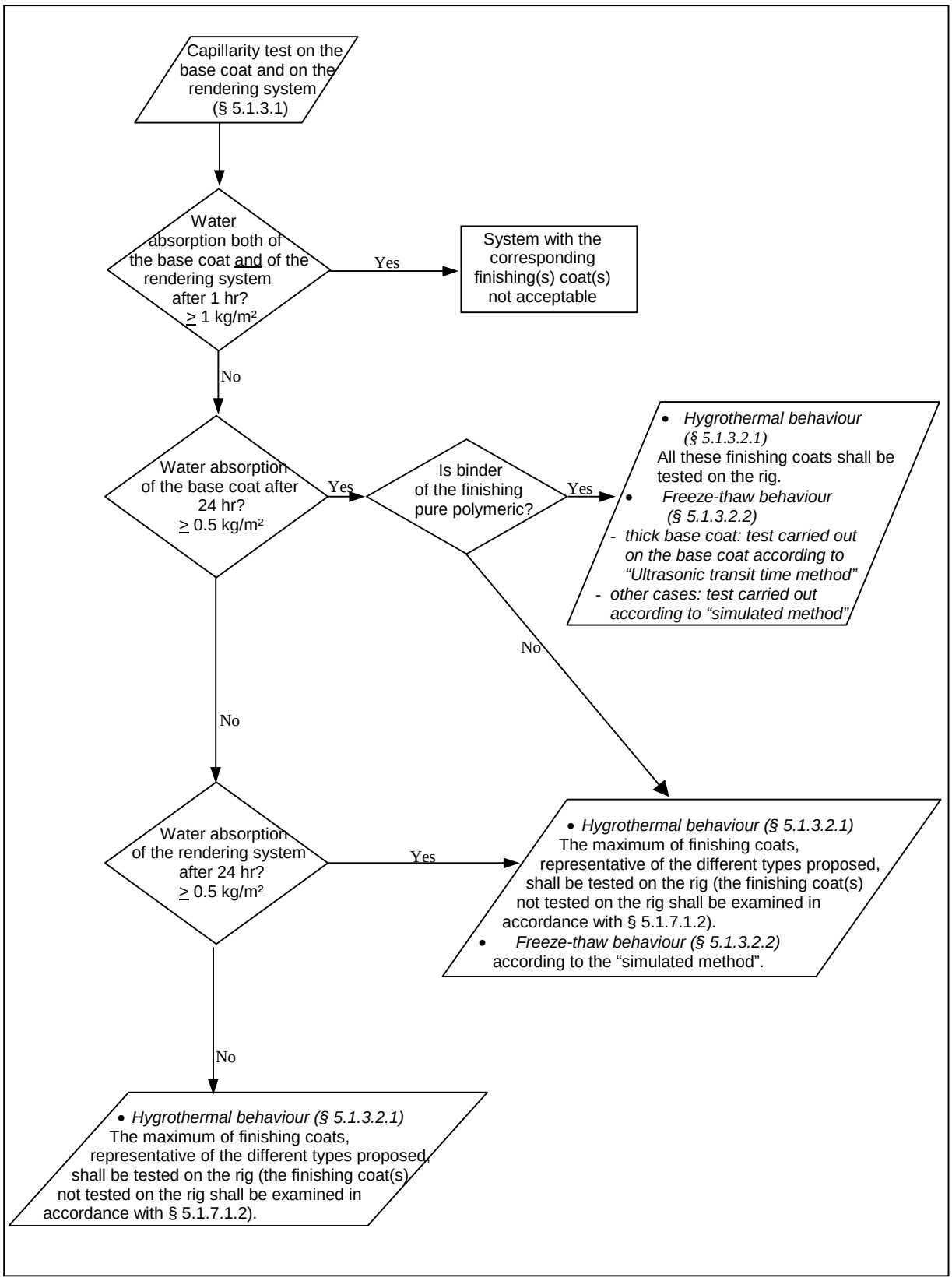
A.6.3 General abbreviations

TC: Technical committee
WG: Working group

Annex B:
SYNOPSIS

Faced with a proposed ETICS to evaluate, the Institute should carry out the capillarity test(s) to determine in accordance with the synopsis below:

- acceptability of the system
- which finishing coats shall be tested on the rig
- whether a freeze/thaw test is required



Annex C: METHODS RELATED TO THE IDENTIFICATION OF THE SYSTEM COMPONENTS

C METHODS RELATED TO THE IDENTIFICATION OF THE SYSTEM COMPONENTS

(Additional identification tests).

C.1 Pastes and liquids

The following tests are performed on homogenised and unmodified products.

C.1.1 Density

This is measured at (20 ± 2)°C in a 100 cm^3 or 1000 cm^3 cylinder.
The results are recorded after maximum packing down (volume stabilisation) and levelling of the surface.
The results are expressed in kg/m^3 (average of 3 tests).

C.1.2 Dry extract

C.1.2.1 Lime and polymer based products

This is determined after placing the sample in a ventilated oven set at (105 ± 5)°C until a constant weight is obtained.
The weight is regarded as constant if the difference in weight between two successive weighings, one hour apart, does not exceed 0.1 g.
Initial weighing for testing:
- 2 g for liquid products (impression, etc ...),
- 5 g for products in paste form.

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

C.1.2.2 Silicate based products

The dry extract is determined by the following method:

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

B - Pre dry for 1 hour at (125 ± 5)°C.
Dry for 2 hours at (200 ± 5)°C.

C - Final weighing.

Weighing accuracy should be within 5 mg.
The difference in weight from the initial weighing is accounted for by volatile components including water of crystalization.
The results are expressed as a percentage relative to the initial weight (average of 3 tests).

C.1.3 Ash content

Ash content is determined on the sample obtained after drying in accordance with **C.**2.1.

C.1.4 Particle size grading (for paste products only)

Particle size is established from a sample of fillers removed from the manufactured product after washing on a sieve, mesh size 0.08 or 0.09 (for ready to use pastes).
The test is carried out after drying at (105 ± 5)°C in accordance with **C.**2.2.

C.2. Powders

C.2.1 Ash content

The ash content is determined at 450°C and 900°C on a sample of approximately 5 g predried at (100 ± 5)°C or at (200 ± 5)°C for silicate based products, to constant weight. The weight is regarded as constant if the difference in weight between two successive weighings, one hour apart, does not exceed 0.1 g.
Method of operation:

- The sample is placed in a crucible either fitted with a lid or enclosed in a leak-tight container. It is then tared and the whole is weighed,
- After the lid has been removed, where necessary, the crucible is placed in the oven maintained at ambient temperature,
- The temperature of the oven is then raised to (450 ± 5)°C (ash content at 450°C) or to (900 ± 5)°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 desiccator before being weighed.

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

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

C.2.2 Particule size grading

The test is performed using air streamed sieving on a 50 g powder specimen for 5 minutes per sieve. The curve is traced from 0.04 to 4 mm.

C.3 Fresh mortar

C.3.0 Preparation of mortar

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

C.3.0.1 Dry mortar

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

C.3.0.2 Paste requiring addition of cement and powder requiring addition of extra binder

- For pastes, 1 litre of paste is poured in the container and the amount of cement prescribed by the manufacturer is added.
- For powder, 2 kg of powder is poured in the container and the amount of extra binder prescribed by the manufacturer is added.

- the whisk is turned manually a few times to clear the path of the mixer,
- the material is mixed for 30 seconds at low speed,
- the walls of the container are scraped and powder gathered on the whisk is detached with a spatula, if necessary,
- the material is mixed again for 3 minutes at high speed.

C.3.0.3 Ready to use paste

Pastes have to be homogenised before use.

C.3.1 Water retention capability

Water retention capability is determined for the fresh mortar, mixed as detailed in § **C.**3.0.
The test is performed using the apparatus described in the Standard ASTM C.91. The mortar is subjected to vacuum for 15 minutes as follows:

- For base coat and finishing coat(s) (except coat(s) whose binder is pure polymeric), the vacuum applied is 50 mmHg (pressure difference between the exterior and the interior of the container)

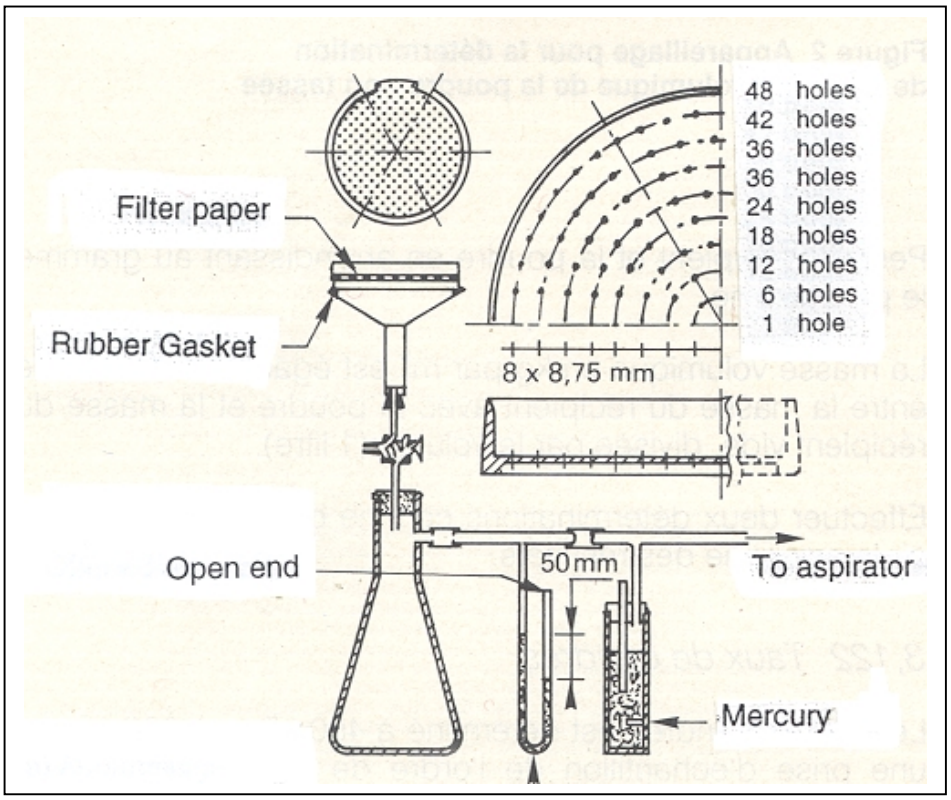


Fig. 15: Apparatus Assembly for the water retention test under 50 mmHg vacuum

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

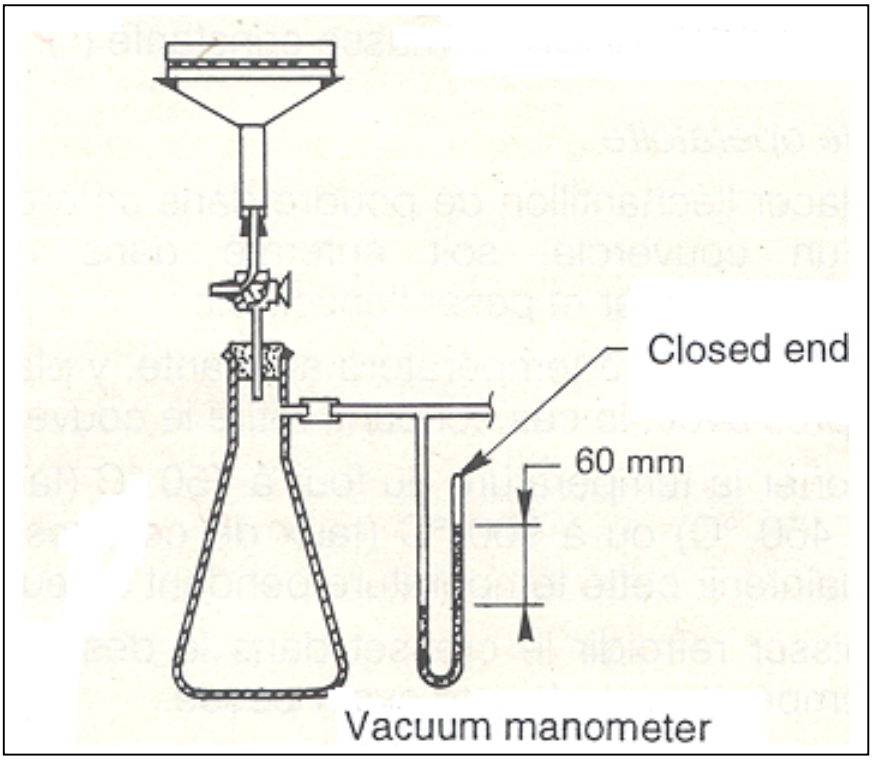


Fig. 16: Apparatus Assembly for the water retention test under 60 mmHg residual pressure

The dish is fitted with a filter paper (diameter 150 mm of 65 g/m²), previously moistened and drained by placing on a dry filter paper, filled with paste, levelled and weighed prior to the test (as the weight of the empty dish including the moist filter paper is known, the weight of the mixed paste and the corresponding weight of the water used for mixing can be calculated in g). These operations take place within 10 minutes of mixing. After 15 minutes (from when mixing started) the apparatus is subjected to vacuum for 15 minutes ; the dish is then weighed again after wiping off the undersurface, and the loss of water (e) in g can be calculated by subtraction.

The water retention capability is expressed as a % of the initial weight of the water used for mixing (E):

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

C.3.2 Density of fresh mortar

The mortar is prepared as detailed in § **C.**3.0.

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

The density of the paste is measured immediately after mixing.

C.4 Hardened base coat (without reinforcement)

The apparent density is determined on all the test samples by measuring weight and dimensions.

The precision for weighing is 1/1000 and for the dimensions 1/100.

C.4.1 Products with a thickness greater than 5 mm

C.4.1.0 Preparation and storing of test samples

The mortar is prepared by mixing as described in C.3.0.
Test samples, conforming to the dimensions defined in the paragraphs below, are prepared in metal moulds in two layers.
Each layer is compacted into position by dropping alternately each side of the mould from a height of 5 mm approximately ten times. The test samples are then levelled with a metal ruler.
The test samples are removed from the mould after 24 h.
They are then stored for 28 days at (23 ± 2)°C and (50 ± 5) % relative humidity.

C.4.1.1 Dynamic modulus of elasticity (Resonance frequency method)

The dynamic modulus of elasticity is determined on prismatic test samples measuring 25 mm x 25 mm x 285 mm.
The test is carried out on the following:
- 3 samples prepared as described in C.4.1.0.
- 3 samples prepared with product taken at the time of the preparation of the rig described (cf. § 5.1.3.2.1).

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

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

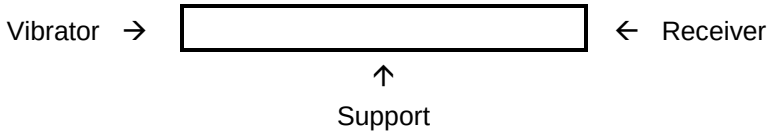
1 - Apparatus

The apparatus used for carrying out this measurement comprises:

a) A variable frequency oscillator, with a frequency range of 20 kHz and a precision of 1 %.
b) An electromagnetic vibrator which may or may not be in mechanical contact with the test sample; its weight must be very light compared to that of the test sample.
c) A receiver, an electromechanical transducer and an amplifier; its weight must be very light compared to that of the test sample.
   The resonance frequencies of the vibrator and the receiver must not fall between 0.5 kHz and 20 kHz.
d) An amplifier.
e) An apparatus indicating the vibration amplitudes (a voltmeter or a milliampmeter or an oscilloscope).
f) A very narrow support on which the test sample rests during the measurement, which must not hinder the longitudinal vibration of the test sample and which shall be in the nodal plane.

2 - Testing

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



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

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

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

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

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

Expressing the results

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

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

E_d = Longitudinal dynamic modulus of elasticity in Newton's per square millimetre.

L = Length of test piece in metres.

F = Longitudinal resonance frequency in Hertz.

ρ = Mass per unit volume in kg/m^3.

C.4.1.2 Shrinkage test

The measurement is carried out on three samples of base coat measuring 10 mm x 40 mm x 160 mm prepared and stored as described in C.4.1.0, by inserting measuring spindles in the front end (10 mm x 40 mm) of the samples. Measurements are carried out at regular intervals. The value after 28 days is recorded. In addition if there is doubt in the curve associated with stabilisation, the test is continued and the value after 56 days is recorded.

C.4.2 Products with a thickness up to 5 mm: static modulus of elasticity, tensile strength and elongation at break

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

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

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

The test sample is subjected to a tensile test until it breaks using a suitable machine which records the tensile stress and elongation. The distance between the jaws of the machine is 200 mm. The sample is held between the jaws with the interposition of pads.
The tensioning speed is 2 mm/minute.
The tests are carried out on five samples stored for 28 days at (23 ± 2)°C and (50 ± 5) % RH and on five samples which have undergone the hygrothermal test (placed in the window of the rig).

C.5 Insulation product

C.5.1 Density measurement

In accordance with EN 1602 "Determination of the apparent density".

C.5.2 Dimensional characteristics and appearance

C.5.2.1 Length and width

In accordance with EN 822 "Determination of length and width".

C.5.2.2 Thickness

In accordance with EN 823 "Determination of thickness".

C.5.2.3 Squareness

In accordance with EN 824 "Determination of squareness".

C.5.2.4 Flatness

In accordance with EN 825 "Determination of flatness".

C.5.2.5 Surface condition

This is visually assessed.

C.5.3 Compression test

In accordance with EN 826 : "Determination of compression behaviour".
This test is not necessary for EPS insulation.

C.5.4 Dimensional stability tests

In accordance with:
- EN 1603 "Determination of dimension and shape stability under constant normal laboratory conditions" (23°C / 50 % RH).
- EN 1604 "Determination of dimensional stability under specified temperature and humidity conditions" (exposition at 70°C for 7 days).

C.6. Reinforcement

C.6.1 Mass per unit area

The mass per unit area is determined by measuring and weighing a one metre length of mesh.
The width of the sample should be the same as the roll width.
The result is expressed in g/m².

C.6.2 Ash content

This test applies to glass fibre mesh only.
The ash content is determined at (625 ± 20)°C on three 100 mm square samples cut of parallel to the yarn and at least 100 mm apart from the side to constant weight.
The result is expressed as a percentage relative to the initial weight.

C.6.3 Mesh size and number of filaments

The mesh size is determined by measuring the distance between 21 yarns (e.g. 20 mesh) in warp and in weft direction.
The mesh opening is calculated by subtracting the thickness of the yarn from the mesh size.

C.6.4 Elongation

The result of the test § 5.6.7.1 shall be stated in the ETA.

C.7 Mechanical fixing devices

C.7.1 Dimensions

The measurements must be stated in the ETA.

C.7.2 Load characteristics if necessary (depending on the type of material)

The result must be stated in the accompanying documents.