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**GUIDELINE FOR EUROPEAN TECHNICAL APPROVAL
OF
PREFABRICATED BUILDING UNITS**

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FOREWORD

Background to the subject

This Guideline has been drawn up by EOTA Working Group 02.02/01 – Prefabricated Building Units.

The Working Group consisted of members from 5 EC-countries; Germany, France, Belgium, the Netherlands, the Czech Republic and the United Kingdom. In addition, Austria, Denmark and Finland have been corresponding members.

The Guideline sets out the performance requirements for Prefabricated Building Units, the verification methods used to examine the performance, the assessment methods used to evaluate the performance for the intended use, and the presumed conditions for the design and installation of the products in the works.

Prefabricated Building Units, according to this Guideline are construction products, defined in the Mandate (ref. Construct 01/503) as follows:

This Mandate covers those industrially prepared Building Units, marketed for use as buildings (singly or in combination). The Building Units are intended for production in series and are made of pre-designed and pre-fabricated components. This mandate defines minimum requirements on the contents of such Building Units. Units not meeting these minimum requirements are outside the scope of this mandate and shall not be CE marked on the basis of the ETAG. These minimum requirements comprise all of the following: the structural elements of the Building Units, the essential components of the external envelope including all necessary thermal insulation and the internal linings in so far as they are necessary for the satisfaction of the Essential Requirements applied to the building (See 2.1 Scope regarding the assessment of 'typical' details).

The design process (including the approval of detailed plans, applications for planning permission, building permits, ...) must comply with the procedures foreseen in the Member States in which the building is to be built. This Mandate does not amend this process in any way. The completed building (the works) must comply with the building regulations (regulations on works) applicable in the Member States in which the building is to be constructed. The procedures foreseen in that Member State for demonstrating compliance with the building regulations must also be followed by the entity held responsible for this act. This mandate does not amend this process in any way.

Although some components may be prepared in different factories, only the final Building Unit for delivery, and not the different components, can be CE marked as a whole, under the responsibility of the ETA holder.

An ETA is a favourable technical assessment of a construction product for an intended use, ie incorporated in the works. The ETA deals only with the product, and states classes or product characteristics to be used by the designer of the works.

The declared performance of the product must be compared with the relevant requirements in the building regulations from case to case, taking into account the intended use in relation to type of building, site, etc.

Verification of the performance of Prefabricated Building Units requires an assessment of many construction details. These include the performance of joints between prefabricated elements with respect to air permeability and durability, the strength of lining materials with respect to impact loads and safety in use, watertightness of internal wet areas, etc. Relevant standardised verification methods may not always be available or judged to be necessary since the performance of many construction details has been proven to be acceptable by long-term experience from use in traditional designs. In accordance with the general advice in the Format of Guidelines for ETA's it is recognised in this guideline that some product properties can be assessed by a pass/fail approach on the basis of engineering judgement and experience from the use of well-known materials and designs.

Reference documents

Reference documents are referred to within the body of the ETAG, and are subject to the specific conditions mentioned therein.

The list of reference documents for this ETAG is given in Annex B. When additional parts for this ETAG are written afterwards, they may comprise modifications to the list of reference documents applicable to that part.

Updating conditions

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

When a new edition becomes available, this supersedes the edition mentioned in the list only when EOTA has verified or re-established (possibly with appropriate linkage) its compatibility with the guideline.

EOTA Comprehension Documents will permanently take on board all useful information on the updating of reference documents and on the general understanding of this ETAG as developed when delivering ETA's in consensus by EOTA members.

EOTA Technical Reports go into detail in some aspects and as such are not part of the ETAG, but express the common understanding of existing knowledge and experience of the EOTA-bodies at that moment. When 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 and laid down in the relevant comprehension documents.

Readers and users of this ETAG are advised to check the current status of the content of this document with an EOTA member.

SECTION ONE: INTRODUCTION

1 PRELIMINARIES

1.1 Legal basis

This ETA Guideline has been established in compliance with the provisions of the Council Directive 89/106/EC and has been established taking into account the following steps:

- the final mandate issued by the EC - 03/02/2003
- the final mandate issued by EFTA – 03/02/2003
- adoption of the Guideline by the Executive Commission of EOTA – November 2005
- opinion of the Standing Committee for Construction – December 2005
- endorsement by the EC – 19/09/2006

This document is published by the Member states in their official language or languages according to art. 11/3 of the CPD. No existing ETA guideline is superseded.

1.2 Status of ETAG

a. **An ETA is one of the two types of technical specifications** in the sense of the EC Construction Products Directive (89/106/EEC). This means that Member States shall presume that the approved **Prefabricated Building Units** 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.

b. **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 **product** 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.

c. 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 Prefabricated Building Units 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 an approval process and decision, followed by the corresponding attestation of conformity. This distinguishes an ETAG from a harmonised European standard, which is the direct basis for attestation of conformity.

Where appropriate, Prefabricated Building Units that 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 presumptions 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.

This guideline indicates alternative possibilities for the demonstration of the satisfaction of the requirement.

2 SCOPE

2.1 Scope

Prefabricated Building Units, designed as box-like structures but transportable to site in flat-pack or three-dimensional format. The Units may form a building individually or in conjunction, horizontally and/or vertically, with other units and rapidly provide a weatherproof envelope, possibly subject to final weathering, jointing between units, connection to services and any foundation connections.

The structural elements are prefabricated¹ and assembled in a factory. They usually comprise a frame of metal, metal and timber or concrete. Concrete Units² may be monolithic or may comprise joined panels. In some cases, prefabricated composite panels are part of the load bearing structure. Floors may be prefabricated, installed or, in the case of concrete, cast in-situ.

Building Units may be supplied with varying degrees of completion but all components required for structural stability (when the Units are assembled into a building) shall be included.

There are a number of options for assessment available to the Approval Body, in discussion with the ETA Applicant.

- If the Unit(s) under assessment is/are 'complete' as offered by the ETA applicant, i.e. all elements of the roof, walls etc are supplied, then a full evaluation can be made (taking account of rules for joining Units together) and data presented accordingly, covering weathertightness, acoustic performance, fire resistance etc, in addition to structural data.
- Where the Unit does not include all elements e.g. external cladding, roof covering, internal lining, external cladding, flooring etc then the ETA Applicant may ask for assumptions to be made about typical solutions. In this case the ETA shall make clear what assumptions have been made.

Where windows, door sets, the external skin (e.g. a brick outer leaf), and pitched roofs etc do not form part of the product then the interface between these components and the Units shall always be subject to assessment.

Prefabricated Building Units covered by this ETAG may be relocateable and intended for use in any building subject to regulatory requirements. However, Units incorporating a permanently fixed wheel system are excluded from this Guideline. Complementary structures (including foundation or substructure) and Units for use in cold storage buildings³ are also excluded.

For some uses, other ancillary fittings and equipment will be required for the assembled building. The suitability of any particular piece of ancillary equipment required in this context will not be included in the ETAG. Electrical and water services, sanitary equipment etc. will not be covered. The influence of any provisions for their incorporation, e.g. conduits/pipes or cut-outs in members, will be included in the assessment.

¹The term 'prefabricated' indicates that the products are manufactured using industrial series production or a process similar to series production. 'Similar' in this context shall be taken to mean production on the basis of a pre-designed system.

²Pre-cast concrete components should be assessed taking account of relevant harmonised standards, where applicable. A list of such standards (not exhaustive) is included, for reference, in Annex B. When such components are assessed only as part of the Unit, subsequent CE marking of the component itself is not permissible.

³ETAG 021 makes reference to relevant sections of this ETAG to enable such Units to be assessed.

2.2 Use categories, product families

The product performance of Prefabricated Buildings Units in relation to the Essential Requirements will normally be required to correspond with national regulatory requirements for the works relevant to the intended use of the product in, for example, dwellings, office buildings, schools, hospital and medical buildings, dormitories³. These requirements will vary between the member states, and the product performance shall be expressed in numerical terms. For performance in case of fire, standard European fire classification is applied.

³List not exhaustive.

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 and products. This ETAG contains assumptions taking account of the state of art and makes provisions for appropriate, additional case by case approaches 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 that 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 that receives the special application, and subject to consensus within EOTA. Experience in this respect is collected, after endorsement in EOTA-TB, in the ETAG Comprehension document.

3 TERMINOLOGY

3.1 Common terminology and abbreviations

See Annex A

3.2 Specific terminology

Building Unit:

A Unit, defined as a construction product, and designed as a three-dimensional structure, transportable to site in three-dimensional or flat pack format and rapidly providing a weatherproof envelope, possibly subject to final weathering, jointing between Units, connection between Units and any foundation connections.

Design climatic conditions:

Outdoor and indoor air temperature and moisture levels, snow loads, wind load, etc, which may be stated in national building regulations or in other specifications to be used for design.

Integrated components:

Components such as windows, doors, conduits, etc that are built into the Building Units.

Joint/Connection:

Junction between two materials, components, sub-structures or Building Units.

Substructure:

The structural elements below the Building Unit(s), including the foundation, that transmit all loads from the Units to the ground.

Pre-designed:

Pre-determined technical solutions.

Production in series:

Production of Building Units for a series of buildings on the basis of the same materials, structural design and construction details. The buildings and components do not have to be exactly of the same size or shape.

Production unit:

Production line or facility where the product is manufactured and/or processed.

Separating walls and floors:

Walls and floors where national regulations can require sound insulation, fire resistance performance, etc.

Supporting documents:

Documents included in the formal part of the approval, but where the content is not included in the ETA-document itself. The valid version of a supporting document is the last updated version filed by the approval body.

Suspended floors:

Floor structures with a free span between supports.

UDL:

Uniformly distributed load.

Wet area surface:

Floors and wall areas in bathrooms and other “wet rooms” where the surface may be exposed to water spray from showers, etc, and where the ETA applicant declares the surfaces to be watertight.

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 a family of prefabricated building units and their intended uses. It is the ETA applicant or producer who defines the family of products for which he is seeking an 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 prefabricated building units, which are fairly conventional, only some of the tests and corresponding criteria are necessary to establish fitness for use. In other cases, e.g. special or innovative products, or where there is a range of uses, the whole range of tests and assessment may be applicable.

(b) *General layout of this section*

The assessment of fitness of prefabricated building units 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 Prefabricated Building Units and uses concerned, beginning with the Essential Requirements for works (CPD art. 11.2) and then listing the corresponding relevant characteristics of the 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 other appropriate methods.
- Chapter 6 provides guidance on **the assessing and judging methods** to confirm fitness for the intended use of the prefabricated building units.
- Chapter 7, assumptions and recommendations are only relevant in as far as they concern the basis upon which the assessment of the prefabricated building units 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 and EC Guidance Paper E)*

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 prefabricated building units. If, for some uses at least one Member state has no regulations, a manufacturer always has the right to opt out one or more of them, in which case the ETA will state "no performance determined" against that aspect, except for those properties for which, when no determination has been made, the prefabricated building units does not any longer fall under the scope of the ETAG; such cases shall be indicated in the ETAG.

(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 prefabricated building units for the intended use of 50 years for the loadbearing structure and for non-accessible components and materials, and 25 years for repairable or replaceable components and materials like such as claddings, roofing materials, exterior trims and integrated components such as windows and doors, provided that the product is subject to appropriate use and maintenance (chapter. 7). An Applicant may request an ETA for Building Unit with a shorter intended working life provided this can be justified in the proposed intended use.

The use of components and materials with shorter intended working life shall be clearly stated in the ETA. 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 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 Prefabricated Building Unit can not 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 Prefabricated Building Units in relation to the expected, economically reasonable working life of the works (based upon ID. Par. 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 product must be suitable for use in construction works, in which (as a whole and in their separate parts) they 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 1, preamble).

4 REQUIREMENTS

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 assessments may be dealt with under ER 1 to ER 6, with reference under 4.7. 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 par. II.2).

Table 1 on the next page shows the links between the Essential Requirements (ER) in the EC Construction Products Directive (CPD), the relevant paragraphs of the corresponding Interpretative Documents (ID) to the CPD, and the related requirements and product performances in this ETA Guideline:

Table 1

ER	Corresponding ID paragraph for works	Corresponding ID paragraph for product performance	Product performance characteristics from the Mandate, and ETA-Guideline paragraphs on product performance
1	2.1.3 Collapse 2.1.4 Inadmissible deformation 2.1.5 Damage by an event to an extent disproportionate to the original cause	3.2 (2) Permanent actions Variable actions Accidental actions	4.1 - Mechanical resistance and stability
2	4.2.2 Load bearing capacity of the construction 4.2.3 Limitation of generation and spread of fire and smoke within the construction works 4.2.4 Limitation of spread of fire to neighbouring construction works	4.3.1.1 Products subject to reaction to fire requirements 4.3.1.2 Products for roofs subject to fire requirements 4.3.1.3 Products subject to resistance to fire requirements, load-bearing elements with or without separating function	4.2 - Safety in case of fire 4.2.1 Reaction to fire 4.2.2 Resistance to fire 4.2.3 External fire performance (of the roof covering) 4.2.4 Fire compartmentation
3	3.3.1.1 Air quality 3.3.1.2 Dampness (indirect effect inducing mould-growth and increased deposit of house dust mites)	3.3.1.1.3.2 a Emission and release of radiation and pollutants. Susceptibility to the growth of harmful micro-organisms 3.3.1.2.3.2 e Building products	4.3 - Hygiene, health and environment 4.3.1 Vapour permeability and moisture resistance 4.3.2 Watertightness 4.3.3 Release of dangerous substances
4	3.3.1.2 Falling after slipping. Falling due to changes in level or sudden drops. 3.3.2. Direct impact – Performance of the works	3.3.1.3 Falling after slipping Falling due to changes in level or sudden drops. 3.3.2.3 Essential characteristics of products	4.4 - Safety in use 4.4.1 Slipperiness of floor finishes 4.4.2 Falling due to changes in level or sudden drops. 4.4.3 Resistance to eccentric loads including impact resistance.
5	2.3.1, 2.3.2, 2.3.2 Protection against air-borne and impact noise between enclosed spaces and from outside of works	4.3.2 Acoustic properties (according to 4.3.3)	4.5 - Protection against noise 4.5.1 Airborne sound insulation 4.5.2 Impact sound insulation 4.5.3 Sound absorption
6	4.2 Energy consumption limitation	Table 4.2 Component characteristics	4.6 - Energy economy and heat retention 4.6.1 Thermal resistance 4.6.2 Air permeability 4.6.3 Thermal inertia

4.1 Mechanical resistance and stability (ER 1)

The properties of the Building Units shall be such that when a building is constructed from them, in accordance with the agreed assembly instructions and design rules, the loadings that are liable to act on it during construction and use will not lead to any of the following:

- *collapse of the whole or part of the Works*
- *major deformations to an inadmissible degree*
- *damage to other parts of the works or to fittings or installed equipment as a result of major deformation of the load-bearing construction*
- *damage by an event to an extent disproportionate to the original cause*

4.2 Safety in case of fire (ER 2)

The Essential Requirement laid down in the Council Directive 89/106/EEC is as follows:

The construction works shall be designed and built in such a way that in the event of an outbreak of fire:

- *the load bearing capacity of the construction can be assumed for a specific period of time*
- *the generation and spread of fire and smoke within the works are limited*
- *the spread of fire to neighbouring construction works is limited*
- *occupants can leave the works or be rescued by other means*
- *the safety of rescue teams is taken into consideration*

The following aspects of performance are relevant to this Essential Requirement for Prefabricated Building Units:

4.2.1 Reaction to Fire

The reaction to fire performance of the individual components of the Units shall be in accordance with laws, regulations and administrative provisions applicable to the product in its intended end use application. This performance shall be expressed in the form of a classification specified in accordance with the relevant EC decision and the appropriate CEN classification standards.

4.2.2 Resistance to Fire

The resistance to fire performance of the Units shall be in accordance with laws, regulations and administrative provisions applicable to the product in its intended end use application. This performance shall be expressed in the form of a classification specified in accordance with the relevant EC decision and the appropriate CEN classification standards.

4.2.3 External fire performance of the roof covering

The external fire performance of the roof covering of the Building Unit shall be in accordance with laws, regulations and administrative provisions applicable to the product in its intended end use application. This performance shall be expressed in the form of a classification specified in accordance with the relevant EC decision and the appropriate CEN classification standards.

4.2.4 Fire compartmentation

The fire compartmentation of an assembled building shall be in accordance with laws, regulations and administrative provisions applicable to Works where the building is to be constructed.

4.3 Hygiene, health and environment (ER 3)

4.3.1 Vapour permeability and moisture resistance

The properties of the Units shall be such that there will be no threat to the occupants or neighbours due to the [presence of damp in the works or on surfaces within the works formed from the Units.

4.3.2 Watertightness

4.3.2.1 External envelope

The external envelope including joints between Units shall prevent leakage of water from rain and melting snow into the works.

4.3.2.2 Internal surfaces

Internal wall and floor surfaces in bathrooms, toilets, etc claimed to be watertight by the ETA applicant, shall be sufficiently tight to avoid water penetration to rooms below (short-term effects) and to avoid moisture levels in materials and components which may lead to unacceptable growth of micro-organisms (long-term effects). Where wet surfaces are shared between adjacent Units, the joint shall be watertight.

4.3.3 Release of dangerous substances

The product shall be such that, when installed according to the appropriate provisions of the Member States, it allows for the satisfaction of the ER3 of the CPD as expressed by the national provisions of the Member States and in particular does not cause harmful emission of toxic gases, dangerous particles or radiation to the indoor environment nor contamination of the outdoor environment (air, soil or water).

4.4 Safety in use (ER 4)

4.4.1 Slipperiness of floor finishes

To limit accidental falls in buildings under normal use, finished floor surfaces shall not be unacceptably slippery and any unexpected change of slipperiness shall be avoided.

4.4.2 Falling due to changes in level or sudden drops.

Prefabricated Building Units or buildings formed from the Units shall be so designed that the risk to occupants by falling due to changes in level or sudden drops is minimised. This can be achieved by minimising the hazard itself or ensuring that protective measures are used.

To protect persons against falling appropriate guardrails, balustrades or parapets can protect accessible openings. Appropriate stairways, fixed ladders, ramps can be used at changes in levels and appropriate safety catches and hinges can be used on windows in upper storeys. Such measures shall meet with regulatory requirements where the building is erected.

4.4.3 Resistance to eccentric loads including impact resistance.

The Units shall have sufficient mechanical resistance and stability to ensure that the safety of the occupants is not endangered (See also ER1). This means that they shall have sufficient mechanical resistance and stability to withstand accidentally large static or dynamic loads, such as can arise from the action of persons or objects, without full or partial collapse. Equally, such loads shall not lead to the production of dangerous (sharp or cutting) fragments, give rise to a risk of falling through, particularly at a change of level, nor endanger the safety of other people in or around the building.

The loads may be in the form of:

- impacts resulting from a person falling against the wall
- differential air pressure
- a large number of people leaning or pressing against the wall at the same time (crowd pressure)
- impacts resulting from the movement of heavy non-deformable objects such as pieces of furniture or equipment
- slamming of doors
- heavy objects such as furniture and sanitary or heating fixtures.

4.5 Protection against noise (ER 5)

4.5.1 Airborne sound insulation

Walls and floors shall provide the necessary airborne sound insulation applicable to the intended use of the building.

The external envelope shall provide the necessary sound insulation applicable to the intended use of the building concerning airborne noise from the outside (i.e. noise from industry, road and air traffic, etc).

4.5.2 Impact sound insulation

Floors shall provide the necessary impact sound insulation applicable to the intended use of the building.

4.5.3 Sound absorption

Internal surfaces that are part of the unit shall provide the necessary sound absorption applicable to the intended use of the building.

4.6 Energy economy and heat retention (ER 6)

4.6.1 Thermal resistance

The external envelope shall provide the necessary thermal insulation that is applicable to the intended use of the building. Thermal bridges, which may cause uncomfortably low temperatures or water vapour condensation affecting hygiene, health and environment related to ER 3, shall be avoided.

4.6.2 Air permeability

The external envelope shall provide adequate airtightness to limit unnecessary energy loss and to prevent cold draughts which may affect persons health in relation to ER 3.

4.6.3 Thermal inertia

Thermal inertia of the main building parts shall be known, where applicable, to assess the effect on energy and heat retention.

4.7 Aspects of durability, serviceability and identification

4.7.1 Aspects of durability

The design of the Prefabricated Building Unit shall ensure that deterioration of materials and components during the assumed intended working life does not significantly affect the performance of the product in relation to fulfilling all the Essential Requirements 1 – 6. Deterioration may be caused by physical, biological and chemical agents.

4.7.2 Aspects of serviceability

Load bearing elements shall have sufficient stiffness to avoid unacceptable deflections and dynamic effects from normal use. Units shall have adequate resistance to loads imposed during transportation and installation.

4.7.3 Identification

The materials used in Prefabricated Building Units shall be identifiable in relation to those properties that have an influence on the ability of the product to fulfil the Essential Requirements.

5 METHODS OF VERIFICATION

This chapter refers to the verification methods used to determine the various aspects of performance of Prefabricated Building Units in relation to the requirements for the works (calculations, tests, engineering knowledge, site experience etc.) as set out in chapter 4. For the acceptance criteria of data (e.g. test reports) see EOTA Guidance Document 004.

When Eurocodes are quoted in this ETAG as the method for verification of certain product characteristics, their application in this ETAG, as well as in subsequent ETA's issued according to this ETAG, shall be in accordance with the principles laid down in the EC Guidance Paper L (system 1, 2 or 3) 'Application and Use of Eurocodes'

The information to be supplied by the ETA applicant will depend on the type, design approach and form of construction of the Unit.

Examples of the possibilities are indicated in Figure 1, Figure 2 and Figure 3. The extent of dimensional data required in order to carry out the verification process are indicated in Table 1.

Table 1 Data required for verification process by Unit type and design approach.

Property *	Type (Figure 1)						Design Approach (Figure 2)			
	A	B	C	D1	D2	D3	I	II	III	IV
Maximum unit length	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum unit width	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum unit height	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum spacing of external columns	✓	✓	✓	✗	✗	✗	✓	✓	✗	✗
maximum opening size in external walls	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓
Maximum spacing of internal columns	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
maximum opening size in internal structural walls	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓

* Property is applicable only if the relevant column in both type and design approach column are ticked

Verification by testing shall be in accordance with the test methods referenced in this Guideline.

When the performance is assessed by reference to traditional methods, general experience, etc the Technical Dossier of the ETA shall as far as possible refer to documents where such methods or experience are described.

Where Units are sold without, for example, internal linings, cladding, roofing etc (See also 2.1 Scope) this will limit the assessment that an Approval Body is able to make. Where an ETA applicant wishes to offer his product in this 'incomplete' form, two options are available:

- The Applicant may specify typical details/materials for the assessment. It shall be made clear in the ETA which components are an assumed specification and that any performance given for the Units depends on the use of the specified additional materials or components.
- Alternatively, at the request of the ETA applicant, the Approval Body may make a partial assessment and include in the ETA such data as can be determined for the Unit, making it clear what additional performance is to be determined, on a case by case basis, for the works. An example of this would be the fire resistance of a wall from the outside when the final cladding was not supplied as part of the Unit.

As a minimum, the Units shall be fully specified in relation to their structural integrity individually and, where relevant, when joined together.

Assessment of individual materials and components that are part of the Building Units and their assembly into Units shall, in general, be carried out on the basis of the relevant product standards or

approvals for these products, or as far as possible on the basis of technical specifications for products with the same intended use.

The relationship between the product performance characteristics and the corresponding paragraphs on verification methods are summarised in Table 2

FIGURE 1 TYPE OF UNIT

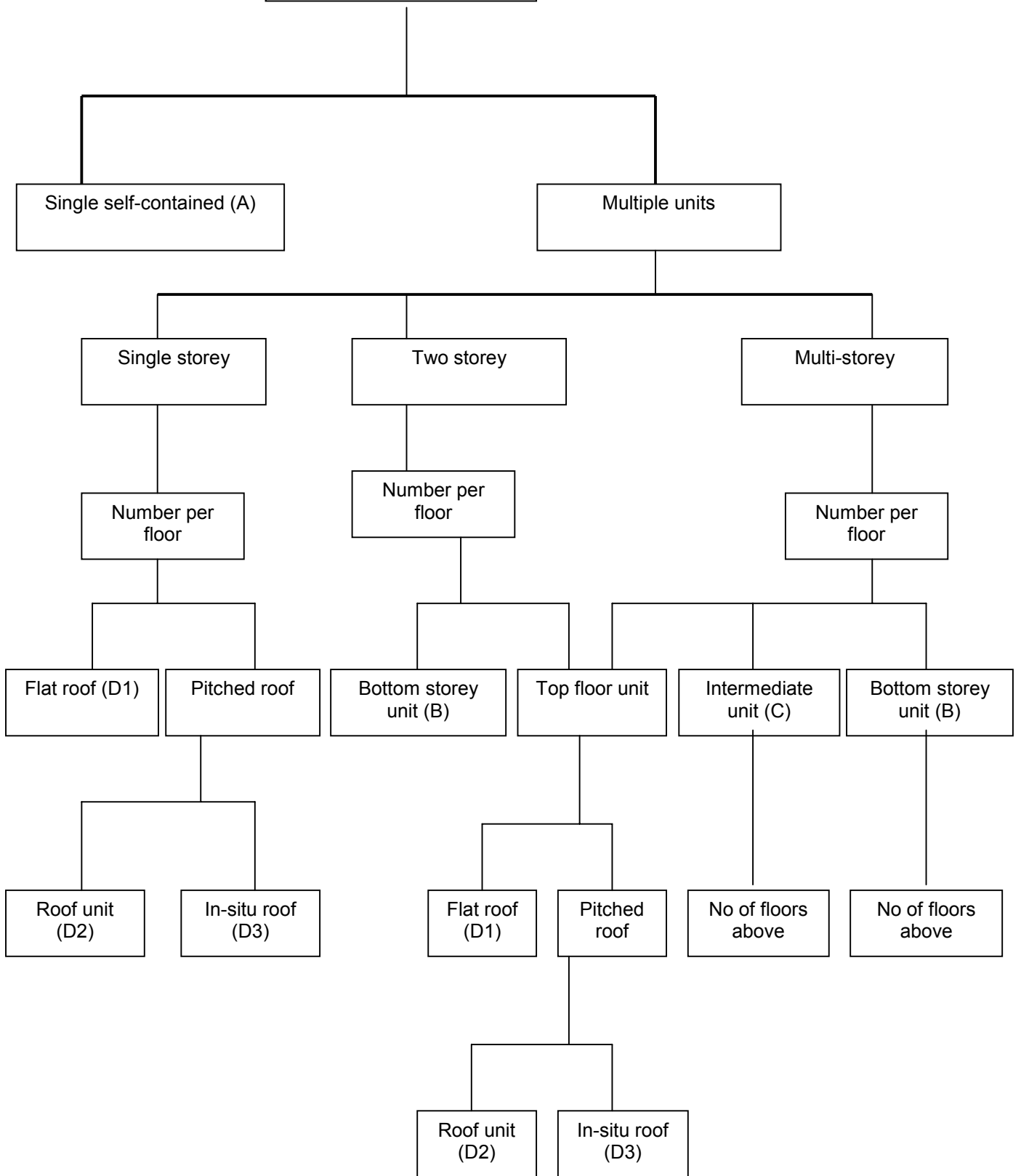


FIGURE 2 DESIGN APPROACH OF UNIT

Units incorporate a box structure with a floor and ceiling such that they are capable of being transported as one unit.
 Assumed wind load path: wall to beams to floor to perpendicular walls
 Diaphragm action of floor based on shear resistance of fixings
 Stability provided by diaphragm action of walls and/or bracing

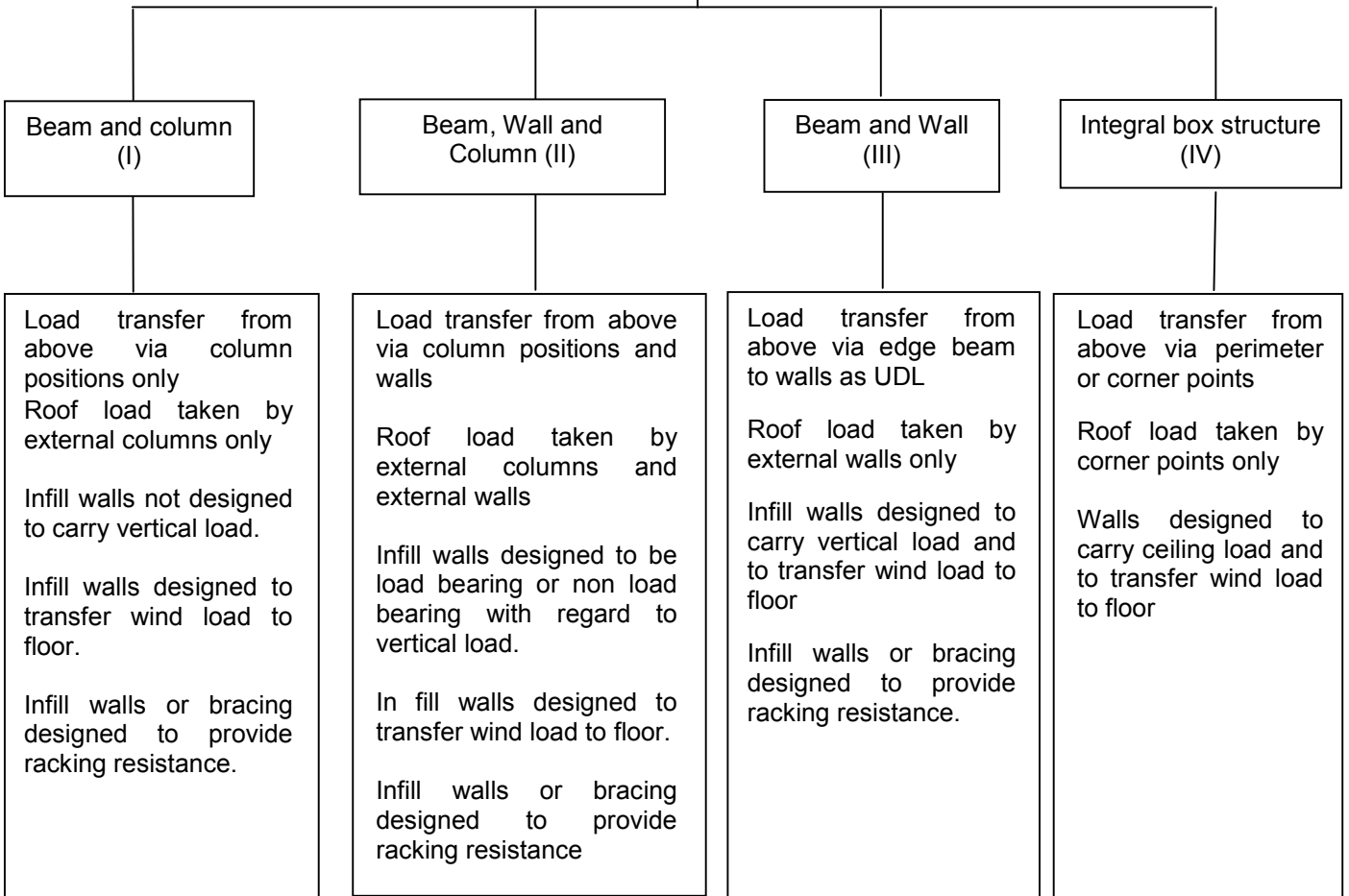
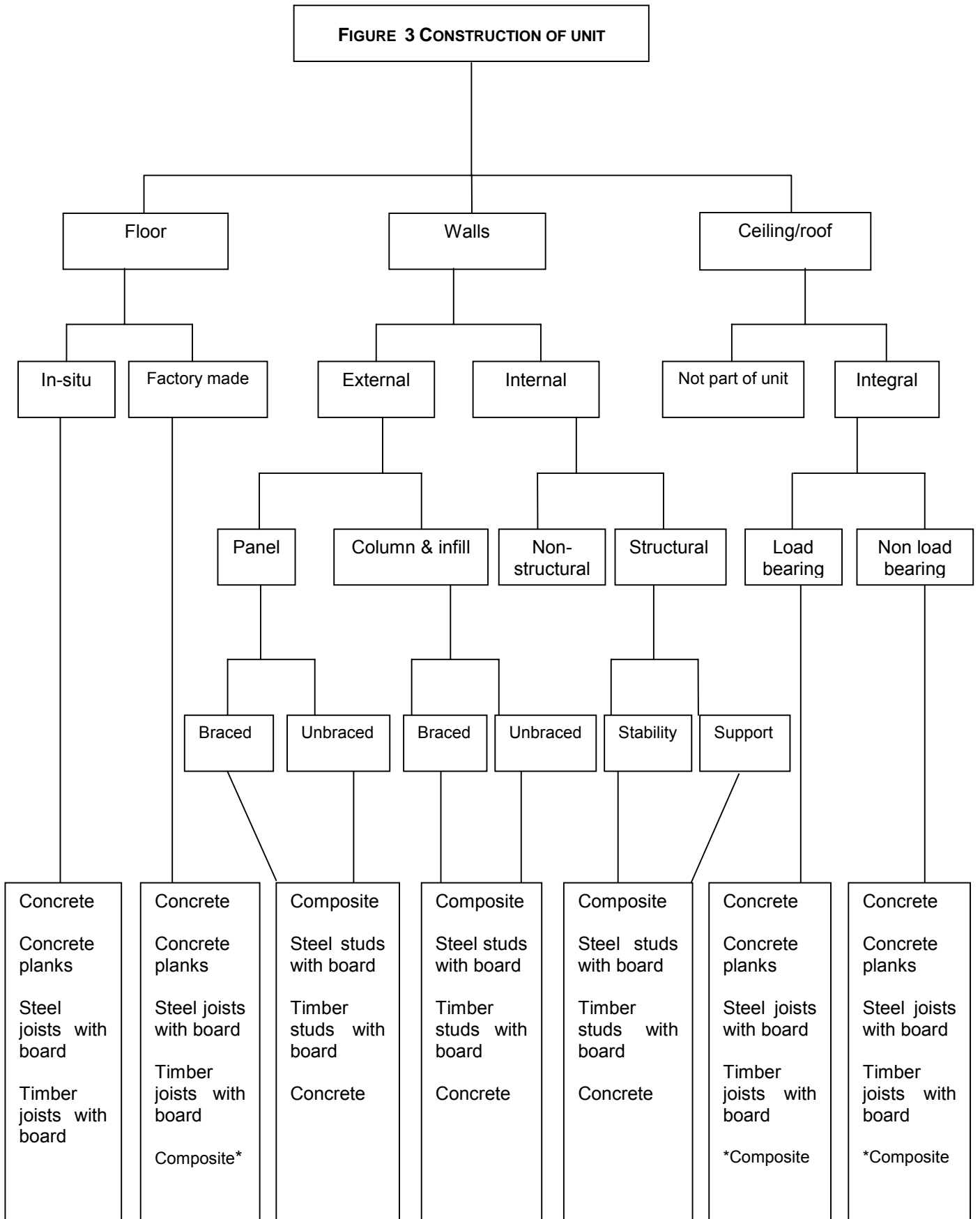


FIGURE 3 CONSTRUCTION OF UNIT



*'Composite' includes all products made from more than one material, that are bonded together to enhance their structural performance and includes products such as GRP and sandwich panels.

Table 2

ER	ETAG paragraph on product performance	ETAG paragraph on verification method
1	4.1 Mechanical resistance and stability	5.1 Mechanical resistance and stability 5.1.0 Verification of structural capacities in general 5.1.1 Indication of geometrical data 5.1.2 Verification by calculation 5.1.3 Verification by calculation by testing
2	4.2 Safety in case of fire 4.2.1 Reaction to fire 4.2.2 Resistance to fire 4.2.3 External fire performance of the roof covering	5.2 Safety in case of fire 5.2.1 Reaction to fire 5.2.2 Resistance to fire 5.2.3 External fire performance of the roof covering
3	4.3 Hygiene, health and environment 4.3.1 Vapour permeability and moisture resistance 4.3.2 Watertightness	5.3 Hygiene, health and environment 5.3.1 Vapour permeability and moisture resistance 5.3.2 Watertightness 5.3.2.1 External envelope 5.3.2.2 Internal surfaces
	4.3.3 Release of dangerous substances	5.3.3 Release of dangerous substances
4	4.4 Safety in use 4.4.1 Slipperiness of floor finishes 4.4.2 Falling due to changes in level or sudden drops 4.4.3 Resistance to eccentric loads, including impact resistance	5.4 Safety in use 5.4.1 Slipperiness of floor finishes 5.4.2 Falling due to changes in level or sudden drops 5.4.3 Resistance to eccentric loads, including impact resistance.
5	4.5 Protection against noise 4.5.1 Airborne sound insulation 4.5.2 Impact sound insulation 4.5.3 Sound absorption	5.5 Protection against noise 5.5.1 Airborne sound insulation 5.5.2 Impact sound insulation 5.5.3 Sound absorption
6	4.6 Energy economy and heat retention 4.6.1 Thermal resistance 4.6.2 Air permeability 4.6.3 Thermal inertia	5.6 Energy economy and heat retention 5.6.1 Thermal resistance 5.6.2 Air permeability 5.6.3 Thermal inertia

5.1 Mechanical resistance and stability

5.1.0 Verification of structural capacities in general

The loadbearing capacities of the pre-designed structural parts of the Building Unit, including relevant connections/joints, shall be verified in conformity with EN 1990 and other product-specific Eurocodes, as appropriate. Consideration should be given to the relevant actions on structures as defined in EN 1991.

The verification can normally be undertaken by structural calculations, supplemented if necessary by testing and shall, when relevant, include resistance against disproportionate collapse.

The extent of claimed load bearing capacities to be declared by the ETA applicant for the range of Unit types, design approach and forms of construction covered by this guide in Figures 1, 2 and 3 are indicated in Table 3

Table 3 Extent of loadbearing capacities to be declared by the applicant

Property *	Type (see figure 1)						Design Approach (see figure 2)			
	A	B	C	D1	D2	D3	I	II	III	IV
<i>Horizontal elements</i>										
Maximum imposed floor load	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum imposed ceiling load	✗	✓	✓	✗	✗	✓	✓	✓	✓	✓
Maximum imposed roof load (snow and wind loads)	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓
<i>Face elements vertical</i>										
Maximum wind load pressure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum wind load suction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Estimate of ultimate racking strength for each wall construction.	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Acceptable loads from above</i>										
column supporting roof loads	✗	✓	✓	✗	✓	✓	✓	✓	✗	✗
wall supporting roof load	✗	✓	✓	✗	✓	✓	✗	✓	✓	✗
external or internal column no roof load	✗	✓	✓	✗	✗	✓	✓	✓	✗	✗
walls not supporting roof loads	✗	✓	✓	✗	✗	✓	✗	✓	✓	✗
maximum corner load (systems with load transfer via corner points only)	✗	✓	✓	✗	✗	✓	✗	✗	✗	✓
<i>General</i>										
Capacity of fixings to structure	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Capacity of fixings between units	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓

* Property is applicable only if the relevant column in both type and design approach column are ticked

5.1.1 Indication of geometrical data

Although indication of geometrical data is acceptable (EC Guidance Paper L), it will necessitate structural calculations on a case-by-case basis, once the ETA has been delivered.

The Approval body shall verify at least the following information:

- the geometrical data (dimensions and cross sections, including tolerances) of the components of the Unit
- as far as possible, the properties of the materials and constituent products used that are needed to determine, according to the National Provisions, valid in the place of use, or possible use, load-bearing capacities and other properties, including aspects of durability and serviceability, of the Unit(s) installed in the works.

Note: The possibility of providing geometrical data is especially relevant in those cases where Eurocodes are not available

5.1.2 Verification by calculation

Calculations shall be made according to the relevant parts of the appropriate Eurocode for the materials used in each component of the structure:

The relevant Eurocodes (numbers to be amended if necessary) are:

- EN 1992, EN 1993, EN 1994, EN 1995 and EN 1999

If other structural materials are used for the components, the relevant Eurocode, European Technical Approval or other European Specification should be used.

Detailed calculation relating to the relevant actions on structures shall be performed and shall include checks to establish the resistance to the Ultimate Limit State (collapse) and the Serviceability Limit State (deflection). Such calculations shall be performed on the maximum building unit size and will, depending on the structural system, normally include:

- Checks on the adequacy of floor joists and floorboards
- Checks to establish adequacy of diaphragm action of floor(s)
- Checks on the adequacy of ring beams to upper floors
- Checks on the adequacy of main columns
- Checks on the adequacy of wall units or wall studs, as appropriate
- Checks on the support provided by diagonal bracing, where appropriate
- Checks on the adequacy of lintel detail(s) for maximum opening
- Checks on the adequacy of ground floor ring beam
- Checks on the suitability of roof trusses and connections
- Checks on the resistance to loading during transportation/installation.
- Checks on the structural adequacy of the connection details at the following junctions:
 - wall panels to corner columns
 - roof frame to wall panel/columns
 - upper storey units to lower storey units
 - ground floor units to foundation
 - transmission of load above door and window opening
 - panel to panel connection
 - floor board to joists and joists to ring beam or wall panel
 - brick ties where applicable
 - wall panels to supporting studs
 - bracing fixing

Overall stability checks, where appropriate (e.g. where the building is a single unit), should be carried out utilising conventional structural analysis. Stability of multiple unit construction is the responsibility of the building designer, using relevant performance data and connection rules for the Units. See chapter 7.

Notes:

1. Checks are necessary for each of the different unit types. (Examples of the possible Unit types and forms of construction are given in Figures 1, 2 and 3.)
2. Supplementary calculations, which are relevant for the resistance against seismic actions, should be made according to the provisions in EN 1998, for various materials and elements. Other information on capacities against seismic actions based on Nationally Determined Parameters or other national regulations may be undertaken as a basis for the specific structural design for each building.

5.1.3 Verification by calculation assisted by testing

5.1.3.1 General

Evaluation by testing can be used to establish characteristic values for elements of the Building Unit or of the complete Unit.

Such tests shall be carried out in accordance with the relevant Eurocode or other European technical specification to verify or calibrate a theoretical static model of the Building Unit or element, or to derive properties where calculation is not practical or possible for particular properties

Calculation assisted by testing comprises:

- verification of the static model by testing a complete Unit or
- determination of properties of the elements or components by test as input data for the static model, e.g. the racking resistance of a composite wall panel or section modulus of complex profile or
- combination of the above

5.1.3.2 Testing

5.1.3.2.1 Current Test Specifications

Relevant harmonised European Standards e.g. EN 1993-1-3 Annex A and EN 13339

5.1.3.2.2 Annex C Test specification for verification of resistance to vertical loads

Compliance with clause 4.1 may be established directly by this test.

The loads to be applied shall be established in accordance with EN 1990 to verify adequate resistances are provided in relation to each limit state.

Further guidance will be given in an EOTA Technical Report being developed in conjunction with CEN TC 250.

Typically the worst case value for the ultimate limit state will be when permanent and variable actions are combined and assumed to cover the complete area under consideration.

5.1.3.2.3 Annex D Test specification for verification of racking resistance of elements of building units.

5.1.3.2.3.1 Racking tests on full size panels

The racking resistance of a full size panel may be tested directly using this test.

In such cases the characteristic values for racking stiffness and racking strength shall be established in accordance with the statistical procedures given in EN 1990 Chapter 10

The design racking resistance of the panel will then be the lesser of either:

- i) the characteristic stiffness racking load divided by a factor or
- ii) the characteristic racking strength divided by an appropriate factor γ_{rs} .

The factor γ_{rs} shall be determined in accordance with the procedures defined in the relevant Eurocode. For example timber based boards resisting wind load:

$$\gamma_{rs} = 1.86 = \gamma_m / k_{mod} = 1.3 / 0.7$$

In the absence of explicit procedures the values may be derived as follows:

Based on the experience of the approval body or where racking performance relies on adhesives, foams, or bond between composite products or several complimentary factors then:

$$\gamma_{rs} = 2.4 \times \gamma_{lt} \times \gamma_m$$

where

γ_m = a material factor based on the most appropriate value from a Eurocode, or an appropriate nationally determined parameter, and

γ_{lt} = a factor to cover long term reduction in bond properties to be used if appropriate.

Note: The material reduction factor may be taken as unity where:

- a) panel stiffness is derived from screw fixing at defined centres or
- b) where the bond strength in a composite panel exceeds the bond stress by a factor of 10

5.1.3.2.3.2 Racking tests on other panels

The racking characteristics for the panel tested shall be analysed as in 5.1.3.2.3.1. The data generated can be converted to provide the specific values for the panels in the Building Unit as follows:

$$F_{kp} = K_w \cdot K_h \cdot F_{test,k}$$

Where:

F_{kp} is the design racking resistance of the panel

w_{test} is the width of the panel tested

w is the width of the panel in the building unit

h_{test} is the height of the panel tested

h is the height of the panel in the building unit

$F_{test,k}$ is the design racking resistance of the panel of the panel tested

K_w is the width coefficient and

$$K_w = w/w_{test} \text{ if } w > w_{test} \quad \text{or} \quad \text{or}$$

$$K_w = (w/w_{test})^2 \text{ if } w > w_{test}/2 \quad \text{or}$$

$$K_w = 0 \text{ if } w < w_{test}/2$$

K_h is the height coefficient and

$$K_h = (h_{test}/h)^2 \text{ if } h \geq h_{test} \quad \text{or}$$

$$K_h = 1 \text{ if } h < h_{test}$$

The type and spacing of fixing at the lower and upper face of the panel and between the sheathing and the structural members shall be identical in the panel under evaluation with the tested panel

Only sections of walls without openings can be considered to resist racking. Where panels incorporate windows or doors the effective racking length shall be taken as the overall length minus the plan width of openings. In such cases adequately stiff members shall be provided, to link the wall above and below the opening.

5.1.3.2.4 Other tests

Such tests shall simulate the behaviour of the Building Unit under practical conditions, and the loading, support and constraint conditions used in the test shall model those that apply in practice. As the Eurocodes are general documents, and due to the large variation in product type covered in this Guideline, it is not possible to provide detailed test specifications covering all the possibilities. Some general principles, which shall be adopted for the tests, are given below.

- Choose the test configuration to create the appropriate mode of failure. (e.g. bending, shear or deformation)
- Avoid undue influence arising from the method of load application and member support.
- Make sure that the load transmission principles within the arrangement are determinable, e.g. by using additional load cells to determine the exact load transferred by the building unit or element; if relevant, the weight of the test equipment should be taken into account in the recorded data.
- Determine and record the relevant characteristics of the components tested and of the material used to manufacture the component, e.g. dimensions of components and coupon tests to establish actual tensile strength of material tested.
- A comprehensive record of load-deformation behaviour should be made for each variable of interest.
- Testing may be carried out using incremental or continuous loading.

Further guidance will be given in an EOTA Technical Report being developed in conjunction with CEN TC 250.

5.2 Safety in case of fire

5.2.1 Reaction to fire

5.2.1.1 General

It should be noted that in some Member States (e.g. Germany) minimum requirements exist for the reaction to fire behaviour of all construction products. For Building Units this means that, where the product is to be used in a Member State having such requirements, a classification shall be given for all the materials used, from test data related to the product/material in end use conditions. However, the product need only be tested and classified in accordance with these rules when its use is intended in those Member States where requirements exist. The Approval Body should agree with the ETA applicant what testing will be required to suit the market. Certain small components are exempted from reaction to fire requirements and current EOTA (PT4) guidance should be followed.

In some Member States requirements may exist to demonstrate the behaviour of products with respect to continuous glowing combustion in case of fire. The mandates for the product standards, therefore, are currently under revision. Additional national assessment e.g. on the basis of national procedures to demonstrate this behaviour might be required until a European harmonised procedure is available.

For façades a European fire scenario has not been laid down. This may be a factor in the assessment of some types of Building Units. An additional assessment according to national provisions (e.g. on the basis of examining design solutions or a large scale test) might be necessary to comply with Member State regulations until the existing European classification system has been completed.

Due to the complexity of Building Units, several approaches may need to be combined in order to determine reaction to fire characteristics, using harmonised classification:

5.2.1.2 Testing

Individual components, as part of an assembly, as appropriate, shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1:2002. Where individual components are covered by harmonised product standards, reference can be made to these for guidance on mounting and fixing provisions. The following paragraphs provide further guidance for some components.

5.2.1.2.1 COMPOSITE PANELS

Testing of composite panels, with respect to reaction to fire shall be undertaken as described in :

- For metal faced sandwich panels: prEN 14509
- For other composite panels: ETA-Guideline 016
- For floor panels: Although not part of the scope of the technical specifications covered by the above two bullet points, floor panels should be assessed in accordance with those documents. In addition, the provisions of clause 5.2.2.1.2 apply.

5.2.1.2.2 Additional information regarding the determination of the burning behaviour using a radiant heat source

This test method is only required for floor panels and their coverings (if any). It shall be performed in accordance with EN ISO 9239-1, unless modified below.

5.2.1.2.2.1 Number of test specimen (EN ISO 9239-1, clause 5)

Where the ETA covers more than one floor covering, the test will need to be repeated for each type of floor covering but not necessarily each colour option, provided it can be established that the colour and/or type of pigment do not affect the result.

5.2.1.2.2.2 Test specimen (EN ISO 9239-1, clauses 5.2, 5.3 and 5.4)

In accordance with the note in clause 5.2, the length of the specimen shall be reduced to 1025 ± 5 mm, unless the test is performed on the floor covering alone.

The test specimen consists of the floor panel and the floor covering (if any), using the adhesive specified by the ETA-applicant (if any). The test specimen shall be secured to the substrate by mechanical means. The test substrate shall be in accordance with clause 5.1 of EN 13238.

No durability assessment is foreseen in connection with this characteristic.

Note: Guidance is under development in GNB-SH02 and should be used by Approval Bodies when approved.

5.2.1.2.2.3 Conditioning (EN ISO 9239-1, clauses 5.4 and 6)

The curing time of the adhesive is in accordance with the ETA-applicant's specifications.

5.2.1.2.2.4 Test report (EN ISO 9239-1, clause 9)

In addition to the requirements of EN ISO 9239-1, the test report shall be in accordance with EC Guidance paper K.

5.2.1.3 Classification as Class A1

Individual components of the Unit are considered to satisfy the requirements for performance Class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that Decision.

5.2.1.4 Classification without further testing

Products classified without the need for further testing (CWFT). Individual components, [as appropriate] are considered to satisfy the requirements for a performance Class of the characteristic reaction to fire in accordance with an EC Decision without the need for testing on the basis of its conformity with the specification of the product detailed in that Decision and its intended end use application being covered by that Decision. This option may only be used if relevant and once a successful case for its use has been made to the EC Expert Group -Fire, endorsed by the SCC.

5.2.2 Resistance to fire

The complete Building Unit or, where relevant, its components in an assembly representing end use conditions, shall be tested, using the test method relevant for the corresponding fire resistance class, in order to be classified according to the appropriate Part of EN 13501. Determination of the loadbearing capacity of the units, when exposed to fire, may also be undertaken by calculation according to, or tabulated values in, relevant Eurocodes.

When testing sandwich panel assemblies, conventional thermocouples shall be used for the first five minutes of all fire resistance tests and then a transition to plate thermometer control shall be made (see EN 1363-1, 5.1.2 – Note).

Note:

Ideally, a smooth transition should be made taking a maximum of five minutes before full control by plate thermometers. If the furnace control system does not allow this, then a sudden transition can be made. With care, if both control systems are set to follow the time temperature curve specified in EN 1363-1, the resulting time-temperature curve, as measured by the plate thermometers, should be within the tolerances allowed by EN 1363-1.

5.2.3 External fire performance of the roof covering

The external fire performance of any roof covering included in the Building Unit shall be verified using the appropriate method from the following:

- The component, or the assembled system of which the component may form part of, shall be tested using the test method relevant for the corresponding external fire performance roof class, in order to be classified according to EN 13501-5
- The component, or the assembled system of which the component may form part of, is considered to satisfy all the provisions for external fire performance of all national regulations of the Member States without the need for testing on the basis that it is included within the definitions given in Commission Decision 2000/553/EC and provided that any national provisions on the design and execution of works are fulfilled. In this case, the Approval body shall verify product compliance with the definitions of the decision.
- The component, or the assembled system of which the component may form part of, is considered to satisfy the requirements for performance class of the characteristic external fire performance in accordance with an EC Decision published in the OJEC without the need for testing on the basis of its conformity with the specification of the product detailed in that EC Decision and its intended end use application being covered by that EC Decision. In this case, the Approval body shall verify product compliance with the definitions of the decision.

5.2.4 Fire compartmentation

Fire compartmentation of a building is a function of its application and the regulations for Works in force in the Member State where the building is to be built (see boxed wording in the Foreword to this ETAG). The ETA shall give details of the reaction to fire and resistance to fire of elements of the Building Unit, such as internal walls. It is for the designer of the Works to determine their suitability and their position for particular buildings.

5.3 Hygiene, health and environment

5.3.1 Vapour permeability and moisture resistance

Assessment shall be undertaken on the basis of calculations according to EN ISO 13788, taking into account the relevant design climatic conditions. This standard includes information on the assessment of the risk of mould growth.

The risk of condensation can normally be verified on the basis of hygrothermal characteristics of the products used in each component and the construction details.

Water vapour resistance of the relevant layers should be based upon:

Design values given in EN 12524 or European technical specifications
or
Tests according to EN ISO 12572 or European technical specifications

It should be noted that the permeability of some materials can vary dependent on whether they are wetting-up (absorption) or drying-down (desorption) in a particular environment (hysteresis effects). This should be considered, particularly when using design values. This is described in EN ISO 12572 7.1 Test conditions, Note 1 and has to be taken into consideration when calculations are made.

In addition, the design of joints and any fixings/services penetrating any vapour control element or membrane shall be assessed in relation to the risk of airborne moisture coming into contact with cold surfaces within the construction.

It should be further noted that some Member States have prescriptive requirements for the relative humidity in buildings and in building elements (although it may be possible for other values to be accepted, based on an analysis of the system). This should be investigated by the Approval Body and the ETA applicant, in relation to the intended market.

5.3.2 Watertightness

5.3.2.1 External envelope

Water leakage resistance of the building envelope, including driving rain on facades and possibly snow penetration, shall primarily be assessed by the Approval Body on the basis of the standard construction details for the Building Unit, and by using the available technical knowledge and experience from similar well-known technical solutions. The assessment shall include the full external

envelope, including joints within Units, joints between the Units and joints between the Unit and the substructure, where the latter are intended to provide weathertightness.

If the resistance against the effects of weather cannot be assessed by the use of existing knowledge, e.g. because of unfamiliar solutions to the relevant construction details, the Approval Body may find it necessary to require testing of the external envelope performance. Laboratory tests may be carried out according to EN 1027 (Doors and Windows), EN 12865 (Walls) or ETAG 016.

Dependent upon the design of the Unit, it may be necessary to consider the watertightness of the envelope before the final outer layer e.g. a brick skin, is added. Temporary provisions may be incorporated at the factory or the ETA applicant will make recommendations for on-site provisions. It will not normally be necessary to undertake tests, as the requirement for watertightness is normally short-term. However, the Approval Body shall ensure that in the period before final completion of the external envelope, the risk of damage to the structure and/or to internal finishes will be minimised, taking account of the possible effects of driving rain and strong winds on vulnerable materials.

5.3.2.2 Internal surfaces and membranes

The performance of watertight membranes, or surface layers in wet areas such as bathrooms, may be assessed on the basis of experience/technical knowledge. Alternatively, it may be verified by reference to conformity with relevant performance standards for the products involved, e.g. product standards for roofing membrane systems. For products with unknown performance, verification can be according to the Nordtest methods NT BUILD 058, 230 and 448 and/or ETAG 022 (Watertight coverings for bathrooms).

The primary purpose of the membrane is to ensure that the construction does not attain a moisture content such that damage, particularly in relation to durability, could occur.

It should be noted that some Member States have prescriptive requirements for the vapour permeability of these membranes (although it may be possible for more permeable membranes to be accepted, based on an analysis of the system). This should be investigated by the Approval Body and the ETA applicant, in relation to the intended market.

5.3.3 Release of dangerous substances

5.3.3.1 Presence of dangerous substances in the product

The applicant shall submit a written declaration stating whether or not the product contains dangerous substances according to European and national regulations, when and where relevant in the Member States of destination, and shall list these substances.

5.3.3.2 Compliance with the applicable regulations

If the product contains dangerous substances as declared above, the ETA will provide the method(s) which has been used for demonstrating compliance with the applicable regulations in the Member States of destination, according to the dated EU data-base (method(s) of content or release, as appropriate).

5.3.3.3 Application of the precautionary principle

An EOTA member has the possibility to provide to the other members, through the Secretary General, warning about substances which, according to Health authorities of its country, are considered to be dangerous under sound scientific evidence, but are not yet regulated. Complete references about this evidence will be provided.

This information once agreed upon, will be kept in an EOTA data base, and will be transferred to the Commission services.

The information contained in this EOTA database will also be communicated to any ETA applicant.

On the basis of this information, a protocol of assessment of the product, regarding this substance, could be established on request of a manufacturer with the participation of the Approval Body that raised the issue.

5.4 Safety in use

5.4.1 Slipperiness of floor finishes

Verification of slip resistance of flooring materials shall be undertaken in accordance with the relevant EN-standards for the specified finished flooring products.

5.4.2 *Falling due to sudden changes in level or sudden drops*

The Approval Body shall assess the design and shall give the dimensions of any unprotected changes in floor level in the ETA. This shall include any discontinuities that might arise from coupling units together. Where the Unit includes stairs, guard rails, balustrades etc at openings, if not already covered by CE marking, these shall be assessed as part of the Unit. Reference can be made to ETAG 008 for Stair Kits and to relevant EN standards for other components/systems. When such components are assessed only as part of the Unit, subsequent CE marking of the component itself is not permissible.

5.4.3 *Resistance to eccentric loads, including impact resistance.*

Mechanical resistance against dynamic loads shall primarily be assessed by the Approval Body on the basis of existing knowledge related to the intended use. Walls with well-known internal lining materials, such as standard gypsum boards, wood-based panel products and solid timber boards with studs, should generally be accepted to have a satisfactory impact resistance for normal use in, for example, dwellings and office buildings.

When the performance is not known to be acceptable, or a quantified performance is to be declared due to national building regulations in some member states, the impact resistance should be tested. Testing of walls is to be carried out in accordance with EOTA Technical Report TR001.

Roofs and timber floors can be tested according to EN 1195.

For wood-based panels used as loadbearing sub-floor panels on joists and as roof sheathing the impact resistance should be accepted as adequate when the panels conform to the requirements in prEN 12871.

Where an approach is described in a relevant Eurocode, it will be acceptable to calculate impact resistance using this method.

Assessment of resistance to structural damage from eccentric load from fixtures shall be carried out following testing in accordance with the relevant sections of Chapter 5.4 of ETAG 003.

5.5 Protection against noise

5.5.1 *Airborne sound insulation*

The airborne sound insulation performance (between rooms, of facades and of roofs, dependent on regulatory provisions in the destination Member State) of the main building parts of an assembly of Units shall be verified by either laboratory or field tests according to the relevant parts of EN ISO 140-3, -10 or -12 (laboratory tests) and -4 or -5 (field tests). The rating of airborne sound insulation shall be undertaken according to EN ISO 717-1.

Estimated values for airborne sound insulation in completed buildings, based on laboratory tests, can be determined according to EN 12354-1, -3 or -4.

Indicative field testing of an assembly within a manufacturer's range may be possible, as part of the Approval process. However, National Regulations in some Member States may require field testing of the completed building in each case.

5.5.2 *Impact sound insulation*

The impact sound insulation performance of the floors of an assembly of Units shall be verified by either laboratory or field tests according to the relevant parts of EN ISO 140-6, -8, -9, -10, -11 or -12 (laboratory tests) and -7 (field tests), and the rating of impact sound insulation shall be undertaken according to EN ISO 717-2.

Estimated values for impact noise level in completed buildings, based on laboratory tests, shall be determined according to EN 12354-2.

Indicative field testing of an assembly within a manufacturer's range may be possible, as part of the Approval process. However, National Regulations in some Member States may require field testing of the completed building in each case.

5.5.3 Sound absorption

Sound absorption shall be measured according to EN ISO 354.

Estimated values for sound absorption in an assembly of Units, based on laboratory tests, shall be determined according to prEN 12354-6.

5.6 Energy economy and heat retention

5.6.1 Thermal resistance

Thermal resistance (R-value) and the corresponding thermal transmittance (U-value) of the relevant parts (eg external walls) shall be calculated according to EN ISO 6946, using the declared thermal conductivity values given in the CE marking for materials, if possible according to the various harmonised specifications.

If CE marking is not possible, the thermal conductivity values can be obtained from:

- Thermal conductivity values tabulated in EN 12524 for general building materials
- Declared thermal conductivity values determined according to EN ISO 10456
- Declared values obtained from non-harmonised European standards.

Declared values from non-harmonised standards and prescribed values should be treated with some caution. For example the moisture content of materials can affect the thermal conductivity. When necessary, the declared thermal conductivity value can be corrected due to moisture content, ageing and temperature of the different materials resulting from work conditions, according to the method in EN ISO 10456 (chapter 6). See also paragraph 5.3.1

Verification of thermal transmittance for windows, doors and shutters may be undertaken by calculation according to EN ISO 10077-1, prEN ISO 10077-2 or by testing according to relevant EN/ISO-standards for these products.

If the design incorporates significant thermal bridges, not covered by the normal verification of the thermal resistance as mentioned above, the effect on the overall thermal resistance and the surface temperatures in relation to 4.3.1 shall be verified. In particular, the possible effect of the moisture due to condensation at these thermal bridges shall be examined. Such verification may be undertaken by calculations according to EN ISO 10211-1 and EN ISO 10211-2, or by testing according to EN ISO 8990 or relevant test standards for specific products.

5.6.2 Air permeability

Assessment of the air permeability of the external envelope is normally undertaken by judgement of the construction details, on the basis of the knowledge and experience from traditional technical solutions. The assessment shall include joints between components in a Building Unit and, if relevant, joints between one Unit and another.

When the Approval Body finds it necessary, e.g. when non-traditional joints are used, the air permeability shall be verified by testing. Tests may be carried out by pressurisation of completed buildings according to EN 13829, or by laboratory testing according to EN 1026, EN 12114 or other relevant test standards. Consideration shall be given to long-term performance, when relevant (e.g. when joints incorporate tape or sealants).

The assessment of air permeability should be undertaken both with regard to energy economy (unintentional ventilation), cold draughts (see 4.6.2) and the risk of water vapour condensation inside the construction (see 4.3.1) due to inadequate ventilation. The assessment shall be undertaken on the basis of the intended use of the Building Unit, taking into account the internal and external design climates (e.g. geographical areas).

5.6.3 Thermal inertia

Verification of the thermal inertia of assembled buildings is undertaken in accordance with EN 832 on the basis of the following properties of the relevant building components which the Approval Body shall verify:

- the total mass per unit area (determined in accordance in the framework of identification)

- density (determined in accordance in the framework of identification or EN 1991-1-1, Annex A)
- specific heat capacity (determined in accordance with EN 12524 or appropriate product standards)
- thermal resistance (determined in the framework of ER6).

5.7 Durability, serviceability and identification

5.7.1 Durability – General

The product specification shall be examined and tests carried out where necessary, to ensure the product durability is appropriate for the intended use. It is necessary to consider the Prefabricated Building Unit in relation to its individual components and materials as well as its behaviour as an assembly (compatibility of components/materials). Durability shall be considered in relation to each regulated requirement.

The estimated working life of the various materials and components of the Unit shall be determined by the Approval Body, mainly by examining the specification against the requirements of relevant standards etc and on the basis of experience and general knowledge. Due account shall be taken of ease, and the cost implications, of replacement of the component when the Unit is incorporated into a building. It is not normally acceptable for major structural components to require replacement within the envisaged working life of the building.

References and other information, in the following paragraphs, relate to materials and components commonly used in Building Units. Where materials are used that are not covered by these standards or where the manufacturer makes specific performance claims, the Approval Body may make use of documented evidence of performance, existing approvals or compliance with relevant European or other standards or European Technical Approvals. Where products are used that already bear CE marking, due account shall be taken of any use categories or other limitations embodied in such marking.

5.7.1.1 Panels

The durability of sandwich panels shall be determined in accordance with:

- For metal faced sandwich panels: prEN 14509
- For other sandwich panels: ETA-Guideline 016 and/or ETA-Guideline 019
- For floor panels and supporting profiles: Although not part of the scope of the above mentioned technical specifications, these components can be assessed in accordance with these documents.

5.7.1.2 Sealants

Sealants may be classified in accordance with ISO 11600. Their durability shall be determined in accordance with ISO 10590 (adhesion / cohesion properties at maintained extension after immersion in water) and ISO 11431 (adhesion / cohesion properties after exposure to heat and artificial light).

5.7.1.3 Gasket and weatherstripping

Gaskets and weatherstripping shall be classified in accordance with EN 12365-1. On the basis of the determined classification, an assessment can be made of the suitability of the gasket in the proposed application.

5.7.1.4 Windows and doors

Windows and doors that form part of the Building Unit, and are not already covered by CE marking, may be tested and assessed by reference to pr EN14351.

5.7.1.5 Rainwater goods

Gutter systems/components in PVC-U and sheet metal may be assessed by reference to EN 607, EN1462, prEN 12200 and EN612.

5.7.1.6 Miscellaneous materials

The following materials may be encountered in the construction of Building Units :

5.7.1.6.1 Painted steel

The adequacy of a coating on steel can be assessed by reference to EN ISO 12944 in its various parts.

5.7.1.6.2 Coil coated aluminium

Coil coated aluminium can be assessed against EN 1396.

5.7.1.6.3 Galvanised or aluminium coated steel

The adequacy of this type of corrosion protection can be assessed by reference to EN ISO 14713, which gives general recommendations on corrosion protection.

5.7.1.6.4 Coil coated steel

Coil coated steel can be assessed by reference to EN 10169.

5.7.1.6.5 Stainless steel

Stainless steels are classified by reference to EN 10088. Annex B of EN 10088 contains general guidance on the use of stainless steels including the aspect of corrosion resistance.

Ferritic stainless steels have relatively low corrosion resistance and their use should normally be restricted to mild indoor or similarly protected environments.

Austenitic stainless steel: The most common alloys are 1.4301 (X5CrNi18-10) and 1.4401 (X5CrNiMo17-12-2). These austenitic stainless steels are normally suitable for use in all use categories. However, where high chloride contents or more severe conditions are likely to be present in the environment (e.g. rooms with indoor swimming pools, facades in cities with heavy traffic, in coastal areas), alloys with higher molybdenum content, e.g. 1.4429 (X2CrNiMoN17-13-3), 1.4539 (X1NiCrMoCu25-20-5) or 1.4529 (X1NiCrMoCuN25-20-7), are recommended.

Austenitic-ferritic steels, e.g. 1.4462 (X2CrNiMoN22-5-3), are comparable to a CrNiMo-steel with 2,5 to 3% Mo.

5.7.1.6.6 Thermoplastic polymeric materials

Extruded profiles in PVC-U shall be designated and assessed for suitability using EN 13245-1 or 3 and the associated tests in EN 13245-2. These standards allow a distinction to be made between profiles that are to be externally exposed and those that are for internal use only.

In determining suitability of a profile in a particular application the Approval Body shall take due account of the consequences of failure, in particular related to the costs of access and the associated dismantling of the building.

For injection moulded components, the effects of heating can be determined, as a measure of quality, using the method described in EN 763, on 3 samples selected from each of 5 production batches.

After conditioning, no weld line shall have opened completely and no cracks or delamination shall penetrate more than 50 % of the thickness, at the point of injection. If 1 of any 3 samples exhibits a failure a retest may be undertaken on 6 further components. If any of these samples fails the product shall be deemed unacceptable.

5.7.1.6.7 GRP (Glass reinforced plastic) faced panels

Where GRP is used, for example as a face for composite panels in Prefabricated Building Units, in the absence of standardised methods, its durability can be assessed by undertaking the following tests to determine how moisture might affect the long-term bond strength of the composite:

- Effects of boiling in water. An accelerated ageing test shall be undertaken by boiling a sample of the panel in water, followed by tensile strength tests perpendicular to the faces. The samples shall correspond to the provisions of EN 1607. The sample shall be boiled for a period of (120 ± 10) min. The tensile strength, perpendicular to the faces, in accordance with EN 1607, shall be determined before and after this accelerated ageing.
- Effects of condensation. Samples shall be exposed to condensation by assembling the panel samples above a heated water bath, followed by a tensile strength tests

perpendicular to the faces. The samples shall correspond to the provisions of EN 1607. The temperature of the water shall be (65 ± 2) °C and the exposure period is (35 ± 1) days. The tensile strength, perpendicular to the faces, in accordance with EN 1607, shall be determined before and after this accelerated ageing.

It is for the Approval Body to judge the significance of the results of the above tests, based on the way the GRP faced composite panel is used in the Building Unit, for example its contribution to structural strength.

5.7.1.6.8 Wood

The adequacy of wood components in can be judged by reference to EN 350-1 and-2 and EN 335-1 -2 and -3.

5.7.1.6.9 Concrete and concrete products

Durability of concrete and concrete products can be judged by reference to Eurocode 2, EN 206, EN 13369 and the related product-specific standards. See Annex B for a list of possibly relevant Standards.

5.7.1.6.10 Facing materials – render, brick, stone etc

Where a facing material is known to be or is suspected of being sensitive to hygrothermal variations e.g. factory applied render, brick slips or stone, the tests described in ETAG 017 shall be applied. The Approval Body shall determine a suitable test sample to best represent the facing as applied to the Building Unit.

5.7.1.7 Component and materials compatibility

The Approval Body shall examine the design of the Building Unit and make an assessment, using well-established principles, of the suitability of materials in contact. It is impossible to prescribe all the possible risk areas but these include the possibility of bi-metallic corrosion, the effects of wood preservatives on metals or plastics and the effects of solvent based coatings on the impact strength of plastics.

5.7.2 Aspects of serviceability

Deflection of the loadbearing elements is covered in clause 5.1. The stiffness of suspended floor structures shall be calculated in accordance with the relevant Eurocode to check adequate serviceability under normal traffic loads.

In assessing the structural strength and stiffness of the Units, in 5.1, it will be necessary to ensure that they can withstand the additional stresses imposed during the transport and installation process. In making this assessment it is to be assumed that the Units will only be lifted in accordance with the ETA applicants instructions using, for example, the lifting points provided.

Where Units are claimed to be re-locatable, this shall also be taken into account in assessing structural adequacy although it can be assumed that buildings will be subjected to a structural condition survey before dismantling and re-location. This is particularly relevant where re-location is to take place late in the design life of the Units.

5.7.3 Identification

All components of the Building Unit shall be identified, either by reference to:

- Harmonised product standards
- European Technical Approvals, based on other ETA-Guidelines and CUAP's
- Non-harmonised European product standards
- Non-harmonised International product standards
- Descriptive identification, identifying the products by their composing materials and their function

In any case, dimensions (length, width, thickness), geometry (squareness, flatness, ...), significant properties (mechanical, physical, chemical, ...) and their tolerances shall be given. In those cases where the above listed product specifications do not specify test methods for identification, test methods used should be based on European standards (CEN), International standards (ISO), EOTA Technical Reports, UEATc Guidelines, Nordtest standards or RILEM test methods.

Ultimately, a formulation, an ETA applicant's specific reference or a similar unique specification can also be accepted.

6 ASSESSING AND JUDGING THE FITNESS FOR USE

This chapter details the performance requirements to be met (chapter 4) in precise and measurable (as far as possible and proportional to the importance of the risk) or qualitative terms, related to the product and its intended use, using the outcome of the verification methods (chapter 5).

The performance characteristics are summarised in Table 4.

Where at least one Member State has no regulated requirement against a performance characteristic, or some aspect of that characteristic, then the 'No performance Determined' (NPD) option is available. The ETA applicant and the Approval Body can agree where this option applies, taking account of the intended market. The ability of the Approval Body to determine performance in relation to regulated characteristics will be limited where the Unit(s) under assessment are 'incomplete' (See 2.1 Scope). This should be noted in the ETA but does not necessarily allow the use of the NPD option.

Table 4

ER	ETAG paragraph on product performance	Type of performance declaration in ETA's
1	6.1 Mechanical resistance and stability	<ul style="list-style-type: none"> - Imposed floor load capacity - Imposed roof/ceiling capacity - Racking load capacity in each plane - Wind load capacity of walls and roof - Horizontal diaphragm shear load capacity floor and ceiling/roof - Capacity to support other units - Anchorage load capacity
2	6.2.1 Reaction to fire	- Classification according to Euroclasses in EN 13501-1
	6.2.2 Resistance to fire	- Classification according to EN 13501-2
	6.2.3 External fire performance of roof covering	- Classification according to prEN 13501-5
	6.2.4 Fire compartmentation	- Classification statement for relevant elements
3	6.3.1 Vapour permeability and moisture resistance	- Assessed to be acceptable in relation to the intended use of the building and any limitations regarding climatic zones
	6.3.2 Watertightness	
	6.3.2.1 External envelope	- Assessed to be acceptable in relation to any limitations regarding climatic zones
	6.3.2.2 Internal surfaces	- Assessed to be acceptable
	6.3.3 Release of dangerous substances	- Declaration of dangerous substances defined in Council Directive 76/769/EEC, and possible measures to be taken
4	6.4.1 Slipperiness of floors	- Assessed to be acceptable or - Slip resistance of flooring
	6.4.2 Falling due to changes in level or sudden drops	Geometric properties
	6.4.3 Resistance to eccentric loads, including impact resistance	- Assessed to be acceptable by judgement or - measured horizontal soft and hard body impact resistance of walls - measured vertical impact load resistance of floors and roof

ER	ETAG paragraph on product performance	Type of performance declaration in ETA's
5	6.5.1 Airborne sound insulation	<ul style="list-style-type: none"> - Weighted apparent sound reduction index for separating walls and floors - Weighted apparent sound reduction index for all other walls and floors - Weighted apparent sound reduction index for external walls and roof
	6.5.2 Impact sound insulation	<ul style="list-style-type: none"> - Weighted normalised impact sound pressure level for separating floors - Weighted normalised impact sound pressure level for all other floors
	6.5.3 Sound absorption	<ul style="list-style-type: none"> - Sound absorption coefficient of internal surfaces
6	6.6.1 Thermal resistance	<ul style="list-style-type: none"> - Total thermal resistance R_t and corrected thermal transmittance U_c for: Exterior walls Windows and external doors Floors Internal walls Roof
	6.6.2 Air permeability	<ul style="list-style-type: none"> - Measured air leakage of type tested buildings and/or components. <p>or</p> <ul style="list-style-type: none"> - Assessed to be acceptable in relation to energy loss, cold draughts (ER3), interstitial or surface condensation (ER3), and intended use.
	6.6.3 Thermal inertia	<ul style="list-style-type: none"> - Information on relevant data
	6.7.2 Aspects of serviceability	<ul style="list-style-type: none"> - Maximum deflections at serviceability limit state related to the loadbearing capacities declared under ER1. - Stiffness against floor vibrations.

No performance determined is **not** an option for the following:

	6.7.1 Aspects of durability	<ul style="list-style-type: none"> - Assessed to be acceptable in relation to intended use and the effect on performance related to relevant aspects of ER1 – ER6 - Possible conditions regarding maintenance
	6.7.3 Identification	<ul style="list-style-type: none"> - Values of appropriate identification parameters

6.1 Mechanical resistance and stability

6.1.1 Mechanical Resistance and Stability

6.1.1.1. Indication of geometrical data

The ETA shall include at least the following information:

- the geometrical data (dimensions and cross sections, including tolerances) of the Units
- as far as possible, the properties of the materials and constituent products used that are needed to determine, according to the National Provisions, valid in the place of use, or possible use, load-bearing capacities and other properties, including aspects of durability and serviceability, of the Unit(s) installed in the works.

6.1.1.2 Verification by calculation with or without assistance through testing

6.1.1.2.1 General

The properties of structural components related to mechanical resistance and stability should be specified in the ETA with regard to the needs of fulfilling National Provisions.

This may be done by expressing the properties in terms of:

- characteristic values for strength and other cross section properties from which the load-bearing capacities of the Units can be calculated taking into account the National Provisions,

or

- design values provided that the Nationally Determined Parameters (NDP) applicable to works have been taken into account by the use of defined sets of NDP's.

Notes

1. Each declared value shall correspond, as far as practicable, to a defined statistical confidence (defined fractile and confidence level).
2. To express a property by the "design value" requires that the set of applicable NDP's is expressed in the ETA.
3. All methods presented in EC Guidance paper L are available for Approval Bodies, but NDP's used in calculations shall always be specified in the ETA. Providing more than geometrical data and properties (see §6.1.4.2.1, i.e. method 1 of EC Guidance paper L) is a possibility, it is not an obligation. If the ETA-applicant only places the product covered in the ETA in one country, the ETA will need to specify the design values and NDP's for that country. If the ETA-applicant places the product covered by the ETA in more than one country, he will need to provide various design values, using the various sets of NDP's.

6.1.2 Structural capacities to be declared

6.1.2.1 General

The loadbearing capacities to be declared should preferably be given in the form of a Table in the ETA.

Typical characteristics, see Table 5, to be declared by the manufacturer and verified by the approval body depend on the basic unit type, design approach and unit construction (see Figures 1 to 3).

Table 5 Declared values for each specification of building unit by unit type and design approach.

Property *	Type (see figure 1)						Design Approach (see figure 2)			
	A	B	C	D1	D2	D3	I	II	III	IV
<i>Horizontal elements</i>										
Maximum imposed floor load	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum imposed ceiling load	✗	✓	✓	✗	✗	✓	✓	✓	✓	✓
Maximum imposed roof load (snow and wind loads)	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓
<i>Vertical elements</i>										
Maximum opening size in external walls	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓
Maximum opening size in internal structural walls	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓
Maximum wind load pressure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum wind load suction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Characteristic racking strength kNm ⁻¹ for a 2.4 m long panel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Characteristic panel stiffness kNm ⁻¹ for a 2.4 m long panel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total racking resistance provided in the long direction (includes contribution from walls and bracing)	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total racking resistance provided in the short direction (includes contribution from walls and bracing)	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Acceptable loads from above</i>										
column supporting roof loads	✗	✓	✓	✗	✓	✓	✓	✓	✗	✗
wall supporting roof load	✗	✓	✓	✗	✓	✓	✗	✓	✓	✗
external or internal column no roof load	✗	✓	✓	✗	✗	✓	✓	✓	✗	✗
walls not supporting roof loads	✗	✓	✓	✗	✗	✓	✗	✓	✓	✗
maximum corner load (systems with load transfer via corner points only)	✗	✓	✓	✗	✗	✓	✗	✗	✗	✓
<i>Loads to structure below (service and ultimate)</i>										
column supporting roof loads kN	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
walls supporting roof loads kN/m	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗
external or internal column no roof load kN	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗
internal walls not supporting roof loads kN/m	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗
intermediate supports below ground floor units kN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
maximum corner load (systems with load transfer via corner points only) kN	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓
deadload and centroid of deadload	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>General</i>										
Capacity of fixings to structure	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Capacity of fixings between units	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
Number of units per floor level (for terraced properties the number per dwelling)	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
The maximum number of storey heights supported	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Property is applicable only if the relevant column in both type and design approach column are ticked

6.1.2.2 Specific notes regarding declared resistances

6.1.2.2.1

The load-carrying capacity of floors and of roof structures with specified maximum spans shall normally be given as net imposed load resistances, and net design snow load and/or wind load resistance as defined in EN 1991-2-3 and EN 1991-2-4. (The effect of the self-weight of the floor and roof structure shall be taken into account in order to declare the net load capacity).

When tested according to Annex C the characteristic value for deformation at service loads may be calculated from measurements taken at several similar points on the tested Unit. This shall comply with the acceptance criteria given in 6.7.2.

When tested according to Annex C the Units are considered to have satisfactory resistance to applied loading if the unit withstands the maximum test load without collapsing.

6.1.2.2.2

The load-carrying capacity of walls shall be given for specified wall heights as vertical resistance and racking strength per unit length of the walls, and as horizontal design resistance perpendicular to the wall per unit area.

6.1.2.2.3

In all cases it will also be necessary to establish the adequacy of connections to ensure that they have a factor of safety in line with the requirements of the Eurocodes.

6.1.2.2.4

The methods for determining the characteristic performance of the Unit shall be specified and include the requirements for the factory production control and for the conformity attestation of the characteristic values.

6.1.3 Resistance against seismic actions

Load-bearing capacities of the main building parts and anchorage, including racking resistance and horizontal diaphragm shear load capacity, is covered by 6.1.2. If a Building Unit is to be put on the market in areas with seismic zones, the masses of the building parts shall be declared, as well as the specific characteristics of connections and factors for energy dissipation according to the methods of calculation given in 5.1.2.

6.1.4 Structural analysis

The detailed structural analysis to verify the declared capacities mentioned in 6.1.1 shall be available to the Approved (Notified) Body as a part of the technical file for the ETA.

6.2 Safety in case of fire

6.2.1 Reaction to fire

The components/materials, as incorporated into the Building Units, shall be classified according to EN 13501-1.

6.2.2 Resistance to fire

The Building Units shall be classified according to the appropriate Part of EN 13501.

6.2.3 External fire performance

The components, or the assembled system of which the component may form part of, shall be classified according to EN 13501-5.

6.2.4 Fire compartmentation

The ETA shall give details of the classification of elements, such as internal walls, so that the designer of the Works can make use of this data when seeking to meet the regulatory requirements in force in the Member State in which the building is to be constructed.

6.3 Hygiene, health and environment

6.3.1 Vapour permeability and moisture resistance

The product specifications shall be examined and performance, in respect of exposure to moisture, assessed on the basis of known material properties, design details and the intended use. It shall be established that condensation in the structure as a result of water vapour diffusion will not occur or will occur only to an extent where damage is not caused during the condensation period and that the structure will dry out again during the evaporation period.

The assessment is to be undertaken with respect to both to interstitial and internal surface condensation.

The performance of the building is stated in the form of acceptable intended uses relevant to the design climatic conditions, e.g. types of buildings and geographical zones.

6.3.2 Watertightness

6.3.2.1 External envelope

The performance of the building will normally have to be declared in qualitative terms in relation to the intended use (potential climatic zones) and with respect to durability aspects (see EC Guidance Paper F on Durability and the Construction Products Directive), as well as to the requirements mentioned in 4.3.2. When a Building Unit is assessed as being inadequate for use in buildings in certain regions (for example in areas with exceptional amounts of driving rain or potential snow penetration), the limitations on the intended use shall be clearly stated in the ETA.

In cases where tests have been performed, the test results shall be declared.

6.3.2.2 Internal surfaces

It shall be clearly indicated in the ETA which parts of the Building Unit are classified as watertight surface areas.

6.3.3 Release of dangerous substances

The Building Unit shall comply with all relevant European and national provisions applicable for the uses for which it is brought to the market. The attention of the applicant should be drawn on the fact that for other uses or other Member States of destination there may be other requirements, which would have to be respected. For dangerous substances contained in the product but not covered by the ETA, the NPD option (no performance determined) is applicable.

6.4 Safety in use

6.4.1 Slipperiness of floor finishes

When this performance is determined the slip resistance of finished floorings shall be declared according to the relevant standard for the specified flooring product.

6.4.2 Falling due to changes in level or sudden drops

The ETA shall include details and dimensions of changes in level and drops, including details of protection arrangements such as guard rails and balustrades.

6.4.3 Resistance to eccentric loads, including impact resistance

Impact resistance can normally be declared as acceptable under defined conditions and not be quantified. Any limitations on intended use shall be stated in the ETA.

When wall structures have been tested according to EOTA TR 001 and/or floors and roof according to EN 1195, the determined impact resistance shall be declared in the ETA.

The minimum accepted impact resistance should normally be 100 Nm for soft body impact with the 50 kg bag and 10 Nm for hard body impact with the 1 kg steel ball, when the intended use is building units for residential housing, office buildings, etc. However, national building regulations in some member states require a minimum soft body impact resistance of 900 Nm for external walls.

Reference shall be made to Annex A of the EOTA Technical Report No 001 in order to determine the suitability of internal and external walls, for particular applications, in relation to their impact resistance.

Where the resistance of the structure to eccentric loads, such as those imposed by fixtures, has been determined by test, this shall be declared taking account of Table 7 in ETAG 003.

6.5 Protection against noise

Sound insulation performance of building elements shall be declared in the ETA as estimated values for airborne sound insulation and impact noise level to be expected in completed buildings. The performance shall be specified with designations according to EN ISO 717, and should preferably be specified as given below. Other designations for the sound insulation performance mentioned in EN ISO 717 may be added in the approval, to agree with the verification methods according to national building regulations based on such designations.

6.5.1 Airborne sound insulation

The airborne sound insulation between rooms, of facades and/or of roofs, as relevant, shall be declared in the ETA, as weighted apparent sound reduction index R'_w , according to EN ISO 717-1. Other designations mentioned in EN ISO 717-1 may be added in the approval, to agree with the verification methods according to national building regulations based on such designations.

6.5.2 Impact sound insulation

The impact sound insulation for floors shall be declared in the ETA, as Weighted normalised impact sound pressure level $L'_{n,w}$ (band width 1/3 octave), according to EN ISO 717-2.

Other designations mentioned in EN ISO 717-2 may be added in the approval, to agree with the verification methods according to national building regulations based on such designations.

6.5.3 Sound absorption

The sound absorption coefficient of internal surfaces shall be declared.

6.6 Energy economy and heat retention

6.6.1 Thermal resistance

Thermal resistance values for the main parts of the Building Unit shall be declared as the total thermal resistance R_t in m^2K/W , including the surface resistances. The thermal resistance shall be an average value for the main parts, including the effect of studs, joists, plates, etc based on an average length in relation to $1m^2$ of the building part. Thermal resistance of windows and doors in the external envelope, which are included in the Unit, shall be declared separately, also in the term m^2K/W .

The corresponding thermal transmittance shall be specified as the corrected thermal transmittance $U_c = 1/R_t + \Delta U$, where the correction term ΔU is calculated according to EN ISO 6946.

When significant thermal bridges are present, their thermal transmittance, in addition to the normal thermal transmittance U_c , shall be declared in units of $W/m^2 K$. If relevant, the potential surface condensation risk due to these thermal bridges shall be stated in the ETA (see 4.3.1).

6.6.2 Air permeability

Quantified national building regulations concerning air permeability are related to energy economy in the Member States, although there may be no quantified requirements related to health and the effect on the indoor climate. Requirements on the overall air permeability are related to the completed building, and not to separate building parts.

Declaration of the degree of air permeability will normally have to be in qualitative terms, ie that the Unit will provide adequate airtightness in relation to the intended use, including climatic zones, taking into account energy economy and heat retention, risk of cold draughts as mentioned in 4.6.2, and risk of condensation within the construction as mentioned in 4.3.2. When a Unit is assessed to be inadequate for use in buildings in certain regions, the limitations on the intended use shall be clearly stated in the ETA.

6.6.3 Thermal inertia

For relevant components, the information on:

- total mass per unit area
- density,
- specific heat capacity
- thermal resistance

shall be declared as a means for the designer to calculate the project-dependent thermal inertia of the building, in accordance with EN 832 (or prEN 13790).

6.7 Durability, serviceability and identification

6.7.1 Aspects of durability

For products covered by standards, referenced in 5.7, durability can be declared by reference to those standards. It may be necessary to summarise in the ETA the basis on which the material has been accepted and give details of supplementary supporting evidence and experience of use, details of which shall be retained on file by the Approval Body. Where the reference standard describes use categories, these should be quoted, with conditions as necessary.

For products not covered by standards, it is necessary to provide information, to be summarised in the ETA, on the satisfactory performance of the product, for example experience in service in similar conditions. Again, details shall be retained on file by the Approval Body.

6.7.2 Aspects of serviceability

Maximum deflections at serviceability limit states, applied in the verification of structural capacities related to ER 1, shall be declared in the ETA, when this is relevant for the serviceability or to meet possible national regulations. When relevant the deflections and other serviceability requirements shall be declared in accordance with the rules given in the relevant Eurocode.

In other cases, for example where there is no relevant Eurocode, values for deflection under design loads should be restricted to the following default values:

- | | |
|--|--|
| - Floors and beams | span/360 variable action (e.g. imposed load) only. |
| - Floors and beams | span/250 combination of actions (e.g. permanent and primary variable). |
| - Lintels | span/360 or 10mm whichever is less. |
| - Walls spanning between beam or columns | span/360 |
| - Sway deformation | height/300 |

The deflection criteria should not be exceeded during transportation or installation.

6.7.3 Identification

The appropriate identification parameters shall be given in the ETA. See also 9.1.3.

7 ASSUMPTIONS AND RECOMMENDATIONS UNDER WHICH THE FITNESS FOR USE OF PREFABRICATED BUILDING UNITS IS ASSESSED

7.0 General

This chapter sets out the assumptions and recommendations for design, installation and execution, packaging, transport and storage, use, 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 a bearing on the assessment or on the products).

7.1 Design of the works

7.1.1 Local building regulations

Normally a specification of relevant requirements concerning fire resistance and reaction to fire, sound insulation performance, thermal insulation performance and ventilation provisions should be elaborated for each delivery as a basis for the production of the Units.

The design process (including the approval of detailed plans, applications for planning permissions, building permits, etc.) shall comply with the procedures foreseen in the Member States in which the building is to be built. An ETA for a Prefabricated Building Unit does not amend this process in any way.

When necessary, declared thermal conductivity values can be corrected due to moisture content, ageing and temperature of the different materials resulting from conditions in the works, according to the method in EN ISO 10456 (chapter 6)

7.1.2 Structural design

Selection of a Prefabricated Building Unit for a particular application should be made on the basis of a specific structural design for the building (the works) in the location where it is to be used, assuming that for the Unit to be claimed to be in conformity with an ETA, the structural design is within the range covered by the ETA. The structural design should confirm that, according to the structural requirements for the works, the imposed actions do not exceed the loadbearing capacities of the Prefabricated Units or combinations thereof. The structural design should include specifications of any wind load anchors and other supplementary structural works when these are not a part of the prefabricated building, but are essential for the fitness for use of the works.

7.1.3 Substructure

The maximum required tolerances of the substructure dimensions, levelling and maximum permitted differential settlement should be assessed for the Prefabricated Building Units, and be specified in the ETA.

Similarly, requirements concerning damp-proof membranes or other protection against moisture from the substructure should be specified in order to ensure durability of the Units and the health of the occupants. These requirements and those for protection against radon gas must be considered in relation to each building.

7.1.4 Ventilation

It should be assumed that buildings will be designed to have adequate ventilation rates in relation to the intended use.

7.1.5 Rainwater systems

It is for the designer of the Works to ensure that rainwater goods (gutters and down pipes) supplied as part of the Building Units, are suitable for the application in terms of the area of roofs and the weather conditions prevailing in the area where the building is to be constructed.

7.2 Transport and storage

Instructions for the transport and storage (where temporary storage is required on site) of the Building Units should be available from the ETA holder, and be assessed by the Approval Body. The instructions should, in particular, cover requirements concerning handling equipment and transportation systems, and methods and requirements for protecting the unit(s) from weather exposure and mechanical damage during transportation. Reference to the instructions should be made in the ETA.

7.3 Execution of works

General instruction for the installation of the Building Units in the works should be available from the ETA holder, and should be assessed by the approval body. The instructions should cover all important aspects related to the site work, such as:

- erection techniques and necessary equipment
- temporary bracing and weather protection
- completion of joints between units (structural fixing, weather sealing etc.)
- fixing of wind anchorage and any seismic anchorage to the substructure and between building parts
- additional materials and components, including roofs, windows, doors and cladding as relevant, which may be fitted on the site and for which correct fitting are a precondition for the fitness for use of the assembled building.
- requirements for correct connection of services such that fire protection and damp-proofing are not compromised.

As a supplement to the general instructions, specific instructions, which, describe special aspects related to each individual building project (e.g. special crane requirements, hoisting strap positions, etc) should normally be provided. Reference to the instructions for installation of the Units should be made in the ETA.

The completed building (the Works) shall comply with the building regulations (regulations on the Works) applicable in the Member States in which the building is to be constructed. The procedures foreseen in the Member State for demonstrating compliance with the building regulations shall also be followed by the entity held responsible for this act. An ETA for a Prefabricated Building Unit does not amend this process in any way.

7.4 Maintenance and repair

It is normally assumed that some regular maintenance and repairs will be required to retain performance and to obtain the estimated working life of the building. The type and frequency of such maintenance should be specified, and should be part of the assessment.

7.5 Re-location

Where Units are designed to be re-locatable, this will be stated in the ETA and will have been taken into account in the assessment. It is assumed that in the re-location process it will be necessary to replace minor components such as seals and screws etc. The ETA should state whether other components such as external cladding are re-usable.

It is assumed that, prior to dismantling for re-location, the building will be surveyed for structural condition to ensure that deterioration such as corrosion of members has not taken place such that repairs or special precautions are necessary prior to moving. This will be particularly relevant where a building is to be re-located late in its working life.

It is likely that a building will be required to meet regulations in the area where it is re-located. However, it has to be recognised that the Units are no longer in new condition and the time for which regulations will continue to be met could be limited to the balance of the working life.

SECTION THREE: ATTESTATION OF CONFORMITY (AC)

8 EVALUATION AND ATTESTATION OF CONFORMITY AND CE MARKING

8.1 System of attestation of conformity

According to the decision 2003/728/EC of the European Commission¹ the system(s) of attestation of conformity given in Table 6 applies.

Table 6 – System of attestation of conformity applicable to Prefabricated Building Units

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Prefabricated Building Units	In Building Works	Any	1

The system of attestation of conformity referred to above is defined as follows:

System 1: Certification of the conformity of the product by a notified certification body on the basis of:

(a) *Tasks for the manufacturer:*

- (1) *factory production control;*
- (2) *further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;*

(b) *Tasks for the notified body:*

- (3) *initial type-testing of the product;*
- (4) *initial inspection of factory and of factory production control;*
- (5) *continuous surveillance, assessment and approval of factory production control.*

Note: In addition, in the case of system 1 of attestation of conformity, the manufacturer shall make a declaration of conformity of the product.

8.2 Tasks and responsibilities of the manufacturer and notified bodies

8.2.1 Tasks for the manufacturer - Control Plan for FPC

Prefabricated Building Units may be manufactured using a wide variety of materials and design approaches (See Para 5.1). It is therefore not possible to prescribe exactly the actions to be undertaken by the manufacturer of Prefabricated Building Units for FPC in the procedure of attestation. Table 7 shows a typical Control Plan.

It is for the Approval Body and the ETA applicant to agree a Control Plan for the type of Prefabricated Building Unit under consideration. The objective is to ensure, by direct or indirect methods, that the product specification remains unchanged from that covered by the ETA, allowing for normal tolerances on material properties and manufacturing processes and that the performance of the Unit is consistent with the ETA holder's declaration, in relation to all the applicable Essential Requirements. The test methods used may be in accordance with recognised standards or may be methods agreed between the Approval Body and the manufacturer. In the case of the latter, the methods shall be fully documented as part of the manufacturer's control system.

¹ Official Journal of the European Communities L262/34 of 14/10/2003

Table 7 – Typical Control Plan for the manufacture of Prefabricated Building Units

Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Properties of structural components				
Structural profiles, framework etc	See prEN 1090-1			
Structural connections	Documented in-house method	To be agreed with Approval Body	1	To be agreed with Approval Body
Properties of core/insulation material				
Formulation	-	Supplier's declaration	-	Every delivery
Density (in situ foams only)	Documented in-house method	-	3	1 every shift
Properties of face materials				
Material specification		Supplier's declaration	-	Every delivery
Thickness	Suitably calibrated instruments	Conformity with ETA specification	3	Every delivery
Tensile strength	Documented in-house method			
Properties of adhesives/adhesive joints (where relevant)				
Coverage (spread)	Documented in-house method	ETA holder's declaration	-	Continuously
Density or viscosity	EN 542 or EN 12092	ETA holder's declaration	-	1 every shift
Workshop conditions e.g. temperature	Suitably calibrated instruments	In accordance with adhesive supplier's recommendations	-	Continuously
Tensile strength of bonded joint (after curing)	Documented in-house method	ETA holder's declaration	-	1 every shift

Table 7 (Continued)

Properties of panels				
Dimensions – thickness, height, width, squareness and flatness as relevant	Suitably calibrated instruments	Conformity with ETA specification	1	1 every shift
Compressive and tensile strength	Documented in-house method		3	1 every 5 shifts
Shear strength	Documented in-house method		1	1 every 10 shifts
Properties of the assembled Unit				
Sealing of joints	-	Visual check	1	Every unit
Correct operation of doors and windows (where relevant)	-	Visual check	1	Every unit
Similar properties as agreed between the ETA holder and Approval Body	-	-	-	-

8.2.2 Tasks for notified bodies

The corner stones of the actions to be undertaken by the notified body (bodies) in the procedure of attestation of conformity for Prefabricated Building Units are laid down in Table 8.

Table 8 - Control plan for the notified body (bodies) for Prefabricated Building Units - corner stones

Table 8a - Initial type-testing of the product (ITT)	
<p>If *approval tests have been required, the tests should have been done by a notified body or under its responsibility (which may include a proportion conducted by an independent laboratory or by the manufacturer and witnessed by the Approval Body. The Approval Body will have assessed the results of these tests as part of the ETA issuing procedure.</p> <p>The checking of calculations for mechanical resistance and stability of components or materials also forms part of the initial type testing.</p> <p>The tests and calculation checks undertaken during the approval process should be used for the purposes of initial type testing. <i>*Note that in some instances the ETA holder may have chosen the npd option and ITT on these aspects is not necessary or possible.</i></p>	
<p>The following list shows those tests and criteria that are related to the characteristics subject to Initial Type Testing.</p>	
Characteristic of the Prefabricated Building Unit	ETAG paragraphs related to tests/assessment and criteria
ER1 Mechanical resistance and stability	5.1 and 6.1
ER2 Reaction to fire	5.2.1 and 6.2.1
Resistance to fire	5.2.2 and 6.2.2
Fire compartmentation	This characteristic can only be determined in relation to specific building designs. ITT should be based on confirmation of product design and specification.
ER3 Vapour permeability	5.3.1 and 6.3.1
Water tightness	5.3.2 and 6.3.2 Note that an assessment is permissible and therefore ITT should be based on confirmation of product design and specification.
Moisture resistance	5.3.1 and 6.3.1
Release of dangerous substances	5.3.3 and 6.3.3 ITT should be based on confirmation of product design and specification.
ER4 Slipperiness of floors	5.4.1 and 6.4.1, where the product specification includes a floor finish
Impact resistance	5.4.3 and 6.4.3
Falling due to changes of level or drops	5.4.2 and 6.4.2 ITT should be based on confirmation of product design and specification.
Resistance to eccentric loads	5.4.3 and 6.4.3
ER5 Airborne sound insulation	5.5.1 and 6.5.1
Sound absorption	5.5.2 and 6.5.2
Impact sound insulation	5.5.3 and 6.5.3
ER6 Thermal resistance	5.6.1 and 6.6.1
Air permeability	5.6.2 and 6.6.2
Thermal inertia	5.6.3 and 6.6.3

Table 8b, below, is intended as a guide for notified bodies involved in initial inspection and the continuous surveillance of the production of Building Units,

Initial inspection of the factory and factory production control (FPC)

The initial inspection of the factory provides for the identification and documentation of the type of manufacturing process and factory production control of the products. This is to enable the notified body/inspection body to assess the compliance with the provisions of the ETA and to provide a baseline to identify possible changes that may occur during surveillance.

During the first visit by a notified body to a new production location or when a new production line is set within an existing factory, the notified body shall ensure that the product specification complies with the ETA i.e. that the results of the Initial Type Tests (Approval Tests) remain valid for the new location or production line. This means that generic materials shall be bought to the same specification, products/components accepted on the basis of a particular manufacturer's declaration shall continue to be supplied by that manufacturer or his agent and, where calculation forms the basis of ITT, the same method shall be used.

Surveillance of factory production control (FPC)

The surveillance of the manufacturing process includes checking the documentation of the factory production control to ensure continuing compliance with the provisions of the ETA and the identification of changes by comparing data obtained during the initial inspection with those from the last or previous inspection(s).

Surveillance visits should normally take place at a minimum frequency of twice per year.

Table 8b			
Initial inspection of factory and factory production control (FPC)			
and			
Continuous surveillance, judgment and assessment of factory production control (FPC)			
<i>(Text in italics in the questions relates to continuous surveillance)</i>			
Questions to be considered		<i>Initial inspection</i>	<i>Continuous Surveillance</i>
01	For which types of Building Unit has factory production control been established?	x	x
02	Has an ETA been issued for these Units?	x	
03	Has the Approval testing been validated as Initial Type Testing?	x	
04	Does the ETA-holder apply a quality management system related to the technical specification and if so, is that proved by a valid certificate and by whom?	x	
05	Does the factory production control for the products to be certified form part of the quality management system?	x	
06	Does the ETA-holder still apply a quality management system that covers the factory production control of the certified products, and is there a valid certificate?		x
07	Has the production and/or the ETA changed since the last continuous surveillance? If yes, has the ETA-holder adapted the documentation accordingly?		x
08	Does the ETA-holder have direct control of the appropriate machinery for the production of the products to be certified, or are key elements of the production with respect to the essential characteristics subcontracted to others on or off the site?	x	
09	Is the maintenance of machinery and measuring equipment carried out properly, regularly, and is this documented and is the documentation up to date (<i>as before</i>)?	x	x

Table 8b continued

10	Are the personnel involved in the production sufficiently qualified and trained to operate and maintain the production equipment (<i>as before</i>)?	x	x
11	Have the personnel involved in the production been identified?	x	
12	Have there been alterations in the personnel involved in the production since the initial or the last continuous surveillance?		x
13	Are all processes and procedures of the production recorded at regular intervals or continuously (automatically) (<i>as before</i>)?	x	x
14	How is the documentation organised?	x	
15	Have there been changes in the manner of recording or documentation since the initial or the last continuous surveillance?		x
16	For the products to be certified, does the ETA-holder have a system to document the production process from purchasing/delivery of the basic materials through to the storage and the delivery of the finished products (<i>as before</i>)?	x	x
17	Has traceability of Unit components and constituents been assured (<i>as before</i>)?	x	x
18	Is an inspection of the incoming material carried out (<i>as before</i>), and if yes, how and at what intervals?	x	x
19	Have the provisions for procurement of the basic materials and/or the suppliers been changed?		x
20	Is there a certificate for raw materials or components that are being certified on a voluntary basis and are the inspection/laboratory reports available (<i>as before</i>)?	x	x
21	Which characteristics of the products are tested and recorded in the course of the production process and/or on the final products or documented in any other manner?	x	
22	Is the manner, extent and frequency of factory production control in accordance with the provisions of the ETA and the documented system ?	x	
23	What are the test methods and equipment used?	x	
24	If proxy values of characteristics are being used, have appropriate measurements been performed and documented linking the test methods and equipment used with the technical specification?	x	
25	Are the manner, extent and frequency of factory production control still in accordance with the provisions of the ETA?		x
26	Have any changes been made concerning test methods and/or testing equipment? If so, have appropriate comparable measurements been performed and documented?		x
27	Do the findings of these tests (<i>still</i>) correlate with the requirements laid down in the technical specification for initial type testing, and for testing for surveillance purposes of the FPC?	x	x
28	Is the testing equipment correctly maintained and calibrated on a continuous basis (<i>as before</i>) to ensure consistent accuracy of the tests performed during factory production control and its surveillance?	x	x


8.3 CE marking and accompanying information

According to Council Directive 93/68/EEC² the CE marking consists of the letters "CE" in the form laid down in the Directive, followed by the identification number of the notified certification body, where applicable. For products subject to Council Directive 89/106/EEC the identification number of the notified certification body shall be given for Prefabricated Building Units as Systems 1 applies.

The CE marking of Prefabricated Building Units shall be accompanied by the following information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- characteristics, performances, use categories, etc. in accordance with the provisions of this ETAG,

Example of CE marking and accompanying information:

 1234	Letters "CE" Identification number of notified certification body
Any Company Street 1, City, Country 04 1234-CPD-0321	Name and address of the producer (legal entity responsible for the manufacture) Two last digits of year of affixing CE marking Number of EC certificate of conformity
ETA-04/2135 ETAG 092 Use category 3	ETA number ETAG number : Type / intended use / characteristic(s) / declared values and/or classes in accordance with section(s) ... of the ETA

² Official Journal of the European Communities L 220 of 30.8.1993

SECTION FOUR: ETA CONTENT

9 THE ETA CONTENT

9.1 *The ETA*

9.1.1 *Format*

The ETA Format (EC Official Journal L.236 of 27.08.1997) states the content in general.

In section II.2 "characteristics of products and methods of verification", the ETA shall include the following note:

"In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply."

"The ETA is issued for the product/kit on the basis of agreed data/information, deposited with the Approval Body name}, which identifies the product/kit that has been assessed and judged. Changes to the product/production process/kit, which could result in this deposited data/information being incorrect, should be notified to the {the Approval Body name} before the changes are introduced. The {Approval body name} will decide whether or not such changes affect the ETA and if so whether further assessment/alterations to the ETA, shall be necessary."

9.1.2 *Scope*

The section entitled Scope of the ETA shall clearly describe the Units, detailing the intended use, the design system (See Figures 1, 2 and 3) and the rules for and limitations on the assembly of Units into a finished building – e.g. maximum number of storeys, maximum and minimum number side by side, allowable overhang of upper storeys etc, related to the Units in question. Details shall be given of the rules for connections between Units that have been assessed in relation to the ability of finished buildings, constructed from the Units, to meet all relevant regulated requirements.

The Scope shall also make clear whether components such as claddings, stairs, roofs (See 2.1 for more details) form part of the Units to be included in the ETA.

Construction products that may be delivered together with the Building Units, but which have not been assessed by the approval body (ancillary components), shall be clearly separated from those covered by the ETA.

9.1.3 *Identification of components*

The ETA shall contain information and/or references relating to components and materials used in the construction of the Units enabling determination whether the products on the market, or intended to be put on the market, are the approved product as described in the ETA (e.g. for attestation of conformity [see Chapter 8], market surveillance or investigation of complaints or accidents).

When such information/references is/are of a confidential nature it/they shall exist on the ETA file managed by the Approval body and as necessary on the relevant file of any Notified body involved. This/these information/references may also be of assistance in any renewal of the ETA. The type, scale, range of information shall be based on the identification paragraphs in Chapter 5 of this ETA-Guideline.

9.1.4 *Product characteristics*

The performance characteristics of the Building Units related to the requirements and methods of verification and assessment mentioned in chapters 4, 5 and 6 shall be clearly stated. When a product

includes optional designs, such as a set of standard dimensions (thermal insulation thicknesses, loadbearing members etc.), it may be convenient to express these characteristics in table form. The latter approach will facilitate the identification, on site, of Units claimed to be the subject of an ETA and bearing CE marking.

9.1.5 Drawings

The ETA document shall include section drawings of the Building Unit(s). The purpose of the drawings is to illustrate the general build-up of the Unit, ie structural system and loadbearing components, insulation layers, claddings etc. Material specifications may also be shown directly in these drawings of the Unit.

If required by the ETA holder, it is permissible to keep some design details confidential, by using neutral parts in the drawings contained in the ETA, provided the Approval body does not find this in conflict with the need to supply sufficient information to ensure correct application of the product and evaluation of conformity by the Approved body.

In addition, the Unit shall be described by a set of construction details as specified in 9.2. These drawings shall be a formal part of the approval, but are presented as supporting documents and not in the ETA itself.

9.1.6 Erection details

The ETA shall include particular preconditions linked to the erection details of the building, which the approval body finds to be of special importance. This may include requirements related to the substructure (levels, tolerances etc), completion of joints on site, wind load anchors, roof bracing etc (see also 7.3).

Reference shall be made to the ETA holder's erection instructions.

9.1.7 Estimated working life

The minimum estimated working life of the Units shall be stated and attention drawn to the use of any shorter life components.

9.1.8 Maintenance

The ETA shall describe basic maintenance, necessary to obtain the minimum estimated working life of the units and the assembled building. (see also 7.4).

9.2 Supporting documents

A set of drawings showing the essential construction details of the Units shall form a supporting document as a formal part of the ETA. The purpose of this document is to provide the necessary detailed description of the Units, including the assembly details on site and the conditions for the installation of the Units in the works.

The set of construction details shall describe the general design of the Building Units, including joints within the Units i.e. between panels, and joints between the Units when they are assembled in a building. The detail drawings shall form the necessary documentation for assessing all the performance requirements specified in chapter 4, including weather resistance and air permeability.

Only the most essential construction details, which are directly related to the main building parts, and which are the pre-designed standard details for the Unit, shall be included.

9.3 Additional information

It shall be stated in the ETA whether or not any additional (possibly confidential) information shall be supplied to the approved body for the attestation of conformity.

ANNEX A

COMMON TERMINOLOGY AND ABBREVIATIONS

1. **Works and products**

1.1 **Construction works (and parts of works)** (often simply referred to as “works”) (ID1.3.1)

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).

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, components and prefabricated systems or installations.)

1.3 **Incorporation** (of products in works) (ID 1.3.1)

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.

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)

1.5 **Execution** (ETAG-format)

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

1.6 **Kit** (EC Guidance Paper C)

Construction product consisting of at least two separate components that need to be put together to be installed permanently in the works (Further clarified for the purpose of this ETAG in the Scope, chap. 2, and in the boxed wording from the Mandate reproduced in the Foreword).

2. **Performance**

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.

(N.B. This definition covers only the intended fitness for intended use as far as relevant for the CPD)

2.2 **Serviceability** (of works)

Ability of the works to fulfil 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, subject to normal maintenance, be satisfied for an economically reasonable working life. The requirements generally concern actions which are foreseeable (CPD Annex I, Preamble).

2.3 **Essential requirements** (for works)

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

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.

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-mechanical) acting on the works or parts of the works. Interactions between various products within a work are considered as "actions".

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. 20.2a of the CPD.

3. **ETAG-Format**

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.

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.)

These 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".

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.

4. **Working life**

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.

4.2 **Working life** (of products)

Period of time during which the performance of the product is maintained - under the corresponding service conditions - at a level compatible with the intended use conditions.

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.

4.4 **Maintenance** (of works) (ID 1.3.3(1))

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

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.

4.6 **Durability** (of products)

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

5. **Conformity**

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.

5.2 **Identification** (of a product)

Product characteristics and methods for their verification, allowing comparison of a given product with that described in the technical specification.

6. **Approval and approved bodies**

6.1. **Approval Body**

Body notified in accordance with Article 10 of the CPD, by an EU Member State or by an EFTA State (contracting party to the EEA Agreement), to issue European Technical Approvals in (a) specific construction product area(s). All such bodies are required to be members of the European Organisation for Technical Approvals (EOTA), set up in accordance with Annex II.2 of the CPD.

6.2. **Approved Body(*)**

Body nominated in accordance with Article 18 of the CPD, by an EU Member State or by an EFTA State (contracting party to the EEA Agreement), to perform specific tasks in the framework of the Attestation of Conformity decision for specific construction products (certification, inspection or testing). All such bodies are automatically members of the Group of Notified Bodies.

(*) *Also known as Notified Body*

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 Standard
FPC:	Factory production control
ID:	Interpretative Documents of the CPD
ISO:	International Standardisation Organisation
SCC:	Standing Committee for Construction of the EC.

Concerning approval:

EOTA:	European Organisation for Technical Approvals
ETA:	European Technical Approval
ETAG:	European Technical Approval Guideline
TB:	EOTA - Technical Board
UEAtc:	Union Européenne pour l'Agrément Technique dans la Construction (European Union of Agrément).

General:

TC:	Technical committee
WG:	Working group.

ANNEX B

LIST OF REFERENCE STANDARDS

Verification of loadbearing capacity

EN 1990 Eurocode: Basis of Structural Design

EN 1991 Eurocode 1: Actions on Structures

The relevant material-specific Eurocodes are:

- EN 1992 Eurocode 2: Design of Concrete Structures
- EN 1993 Eurocode 3: Design of Steel Structures
- EN 1994 Eurocode 4: Design of Composite Steel and Concrete Structures
- EN 1995 Eurocode 5: Design of Timber Structures
- EN 1999 Eurocode 9: Design of Aluminium Structures

EN 1998: Eurocode 8: Design of structures for earthquake resistance

EN 380:1993 Timber structures - Test methods - General principles for static load testing

EN 594:1995 Timber structures - Test methods - Racking strength and stiffness of timber frame wall panels

EN 595:1995 Timber structures - Test methods - Test of trusses for the determination of strength and deformation behaviour

EN 596:1995 Timber structures - Test methods - Soft body impact test of timber framed walls

EN 789:1996 Timber structures - Test methods – Mechanical properties of wood based panels

EN 1095:1997 Timber structures - Product requirements for prefabricated trusses using punched metal plate fasteners

EN 1195:1997 Timber structures - Test methods - Performance of structural floor decking

PrEN 12871:Wood-based panels. Structural roof decking on joists.

EOTA Technical Report XXX – Interpretation of results of structural tests (Under preparation with CEN TC 250)

Verification of fire resistance and reaction to fire

Eurocode 1: Basis for design and actions on structures - Part 2-2: Actions on structures - Actions on structures exposed to fire

Eurocode 5: Design of timber structures - Part 1-2: General rules - Structural fire design

EN 1363-1:1999 Fire resistance tests – Part 1: General requirements

EN ISO 9239-1 Reaction to fire tests for floorings – Part 1: Determination of the burning behaviour using a radiant heat source.

EN 13501 Fire classification of construction products and building elements

Part 1 Classification using data from reaction to fire tests

Part 2 Classification using data from fire resistance tests, excluding ventilation services

(prEN)Part 5 Classification using data from external fire exposure tests on roofs

Verification of resistance against weather effects

EN 1027 Windows and doors - Water tightness - Test method

prEN 12155 Curtain walling - Water tightness - Laboratory test under static pressure

prEN 12865-1 Hygrothermal performance of buildings – Determination of resistance to driving rain under pulsating air pressure – Part 1: External wall systems

Verification of water vapour resistance

EN 12524 : 2000 Building materials and products. Hygrothermal properties. Tabulated design values

EN ISO 12572 :1997 Determination of Water Vapour Transmission Properties

EN ISO 13788 Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods

Verification of safety in use

EOTA Technical Report TR001 Feb 2003 Determination of impact resistance of panels and panel assemblies
EN 1195 Timber structures - Test methods - performance of structural floor decking

Verification of sound insulation performance

EN ISO 140 Acoustics - Measurement of sound insulation in buildings and of building elements
EN ISO 354 Acoustics - Measurement of sound absorption in a reverberation room
EN ISO 717 / EN 20717 Part 1 and 2 Acoustics - Rating of sound insulation in buildings and of building elements.
EN 12354-1 Building acoustics - Estimation of acoustic performance of buildings from the performance of elements
-1 Part 1: Airborne sound insulation between rooms
-2 Part 2: Impact sound insulation between rooms
-3 Part 3: Airborne sound insulation against outdoor sound
-4 Part 4: Transmission of indoor sound to the outside
-6 Part 6: Sound absorption in enclosed spaces

Verification of thermal insulation

EN 832 Thermal performance of buildings - Calculation of energy use for heating - Residential buildings
EN ISO 6946:1996 Building components and building elements - Thermal resistance and thermal transmittance- Calculation method
EN ISO 8990:1996 Thermal insulation - Determination of steady-state thermal transmission properties - Calibrated and guarded hot box.
EN 10077-1 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: Simplified method
PrEN 10077 2
EN ISO 10211-1:1995 Thermal bridges in building construction - Heat flows and surface temperatures –Part 1: General calculation methods
prEN ISO 10211-2 Thermal bridges in building construction - Heat flows and surface temperatures – Part 2: Linear thermal bridges
EN 10456 :1999 Thermal insulation - Building materials and components - Determination of declared values and design thermal values
EN 12524 Building materials and products - Hygrothermal properties - Tabulated design values
EN ISO 13788 Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods

Verification of airtightness

EN 1026:2000 Windows and doors - Air permeability - Test method
EN 12114:2000 Thermal performance of buildings. Air permeability of building components and building elements. Laboratory test methods.
EN 13829 Thermal insulation - Determination air permeability of buildings – Fan pressurisation method (ISO 9972:1996, modified)

Verification of durability

EN 335 Hazard classes of wood and wood-based products against biological attack:-
EN 335 -1:1992 Classification of hazard classes
EN 335-2:1992 Guide to the application of hazard classes to solid wood
EN 335-3:1995 Application to wood-based panels
EN 350-1:1995 Durability of wood and wood based products - Preservative-treated solid wood - Part 1: Classification of preservative penetration and retention
EN 350-2:1994 Durability of wood and wood based products - Natural durability of solid wood - Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe
EN 594:1995 Timber structures. Test methods. Racking strength and stiffness of timber-framed wall panels.
EN 607 Eaves gutters and fittings made of PVC-U - Definitions, requirements and testing

EN 1462 Brackets for eaves gutters - requirements and testing
 EN 612 Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet
 EN 743:1994 Plastics piping and ducting systems. Thermoplastic pipes. Determination of longitudinal reversion.
 EN 1396 Aluminium and aluminium alloys - Coil coated sheet and strip for general applications – Specifications
 EN 1607:1997 Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces
 EN 10088-1:1995 List of stainless steels
 EN 10169:1996 Continuously organically coated (Coil coated) steel flat products. – General information (Definitions, materials, tolerances, test methods)
 EN ISO 10590:1997 Building construction. Sealants. Determination of adhesion/cohesion properties at maintained extension after immersion in water.
 ISO 11431:1993 Building construction. Determination of adhesion/cohesion after exposure to artificial light through glass.
 ISO 11600 : 1993 Building construction. Sealants. Classification and requirements.
 EN ISO 12944 Paints and varnishes. Corrosion protection of steel structures by protective paint systems.
 EN 12365-1 Building hardware – Gaskets and weatherstripping for doors, windows, shutters and curtain walling – Part 1; Performance requirements and classification.
 EN 13245-1 Plastics-Unplasticised poly(vinyl) chloride(PVC-U) profiles for building applications – Part 1: Designation of light coloured profiles.
 2: Profiles for internal and external wall and ceiling finishes
 3: Designation of coloured profiles
 EN14351 Windows and external pedestrian doors. Product standard.
 prEN 14509 Metal faced sandwich panels
 EN ISO 14713:1999 Protection against corrosion of iron and steel in structures. Zinc and aluminium coatings. Guidelines.

Harmonised Standards for Pre-cast Concrete

EN 1168, Pre-cast concrete products – Hollow core slabs
 EN 13225, Pre-cast concrete products – Linear structural elements
 EN 13693, Pre-cast concrete products – Special roof elements
 EN 13747, Pre-cast concrete products – Floor plates for floor systems
 EN 13978, Pre-cast concrete products – Pre-cast concrete garages
 EN 13224, Pre-cast concrete products – Ribbed floor elements
 prEN 14843, Pre-cast concrete products – Stairs
 prEN 14992, Pre-cast concrete products - Wall elements : Products properties and performance
 prEN 15037-1, Pre-cast concrete products - Beam-and-block floor systems - Part 1: Beams
 prEN 15037-2, Pre-cast concrete products - Beam-and-block floor systems - Part 2: Concrete blocks

Miscellaneous

ETAG 003. Internal Partition Kits
 ETAG 008 Prefabricated Stair Kits
 ETAG 016 Composite Lightweight Panels
 ETAG 017 Vetures
 ETAG 021 Cold storage Premises Kits – Part 2: Cold Storage Building Envelope and Building Kits
 ETAG 022 Watertight coverings for bathrooms
 EOTA Guidance Document 004 The Provisions of Data for Assessments Leading to ETA.

ANNEX C

Test specification for verification of resistance to vertical loads

C.1 Objective

The objective of these tests is to determine the structural adequacy of individual building units when subjected to uniformly distributed loads.

C.2 Test Specimen

A standard sample constructed to the maximum size for each type of module. Specimens of each standard type shall be tested. Typically this would include:

- a. A unit with four external walls, floor and roof and
- b. A unit with two external and two internal walls floor and ceiling and
- c. A unit with two external and two internal walls floor and roof
- d.

Where several different load capacity units are to be covered then the types designed to support the maximum and minimum capacity should be tested.

In each case the construction shall incorporate components at the maximum approved span.

Calculations or specifications shall be provided with each unit indicating the design value for each property under investigation. Such data to identify any material and load factors used to derive such values and the assumptions used in the design.

C.3 Characterisation

The detailed specification and quality control records of the module shall be provided with the unit and checks carried out to verify compliance with the specification. Such checks to include:

- dimensions of structural members
- spacing of structural members
- fixing details, etc

C.4 Procedure

a. The Unit shall be installed in accordance with the applicant's instructions, but ensuring that supports to the underside are provided at the most onerous location/spacing permitted by the design.

b. The Unit shall be installed on a solid sub-base and the supports adjusted to provide the maximum out of level considered acceptable by the ETA applicant.

c. Floor test — Provisions shall be made to permit the application of a uniformly distributed load covering either the full floor area of the Unit or, for multi-span situations, the worst loading configuration (e.g. on cantilever sections only or centre spans only). Normally this will involve providing a watertight membrane within the Unit, which extends up the walls, so that the load can be applied by filling the area with water. A temporary internal wall may be required to support the watertight membrane when the Unit is only partly loaded.

d. Dial gauges or transducers to an accuracy of 0.1 mm shall be positioned at the locations where the maximum deflection is expected and cover both vertical deflection and horizontal movement.

e. Load shall be applied in four equal increments up to the declared design load. (Serviceability floor load).

f. Record any observations regarding movement, creaking, local damage, etc,

Items e. and f. shall be repeated to cover other loading cases if it is not obvious which loading case will give the worst result.

g. Roof tests— Provisions shall be made to permit the application of a uniformly distributed load covering the full roof area of the Unit. Normally this will involve providing a watertight membrane above

the roof, with up-stand perimeter walls, to enable the required depth of water to be applied above the roof.

h. Dial gauges or transducers to an accuracy of 0.1 mm shall be positioned at the locations where the maximum deflection is expected and cover both vertical deflection and horizontal movement.

i. Load shall be applied in four equal increments up to the declared design load. (Serviceability roof load).

j. Record any observations regarding movements, creaking, local damage, etc,

Note: For the following ultimate failure test it is only necessary to test the fully loaded situation.

k. The roof shall then be subjected to gradually increased load until it reaches the maximum test load (see clause 5.1.3.2.2) and any observations or damage should be recorded.

l. Examine the Unit and report any sign of permanent damage.

m. The floor shall then be subjected to gradually increased load until it reaches the maximum test load (see clause 5.1.3.2.2) and any observations or damage should be recorded.

n. Examine the Unit and report any sign of permanent damage.

o. The test may be extended to cover the ability of the Unit to withstand loading from Units above. In such cases, the load shall be applied to the Unit at the location appropriate to the design approach and the values calculated in accordance with the principles outlined for floors and roofs.

C.5 Supplementary tests

It is necessary to establish that the factor of safety for joints between components is no worse than the value used if joints are designed by calculation to an appropriate Eurocode.

If calculations cannot be provided to verify compliance with the appropriate Eurocode then tests should be carried to determine its ultimate resistance to the anticipated mode of failure when installed in the Unit. Such tests shall verify that the joints have an equivalent factor of safety to calculated values.

For example, the maximum design load for a connection between two steel members utilising standard bolts and normal hole sizes can be evaluated by using the Eurocode. However, if the connection is between two thin members and a pressed indentation increases the shear capacity then tests would be necessary.

Such tests should be set-up and carried out in accordance with the principles of EN 1990.

A minimum of three tests is normally necessary to derive the characteristic values that, when factored appropriately, should derive adequate ultimate resistance to failure.

ANNEX D

TEST SPECIFICATION FOR VERIFICATION OF RACKING RESISTANCE OF ELEMENTS OF BUILDING UNITS.

D.1 Objective

The objective of these tests is to determine the racking resistance provided by the vertical wall elements of a Building Unit.

D.2 Principle

The test method measures the resistance to racking load of panels or vertical wall elements, which can deform both vertically and horizontally in the plane of the panel.

In this test method, the panel is fastened to the substrate in accordance with manufacturer's specifications, ensuring that the test result corresponds with behaviour in normal use.

D.3 References

This test method is derived from the following reference documents:

- ASTM E72-98 Standard test methods of conducting strength tests of panels for building construction
- EN 594:1996 Timber structures - Test methods - Racking strength and stiffness of timber frame wall panels

D.4 Definitions

racking strength:

capacity of a panel to resist a horizontal load in the plane of the panel

racking stiffness:

calculated stiffness of a panel when it is loaded to approximately 40% of its racking strength

D.5 Symbols

F	applied racking load, in N;
F_{max}	maximum racking load, in N;
$F_{max,est}$	estimated maximum racking load, in N;
F_y	applied vertical load, in N;
R	racking stiffness, in N/mm;
v	panel deformation, in mm.

D.6 Test Specimen

The test specimen should have the maximum height and width of the components covered by the ETA. An example is shown in Figure D.1.

Notes:

- 1) Typical test specimens are 2,4 m x 2,4 m panels or panels the width and height of the building unit.
- 2) Typical panel types for building units that should be tested include:
 - An external wall end with maximum window opening — the preferred size for this element is the maximum actual height by the maximum width of the end panel to be covered by the ETA
 - An external wall with no window opening
 - An internal non load-bearing wall panel

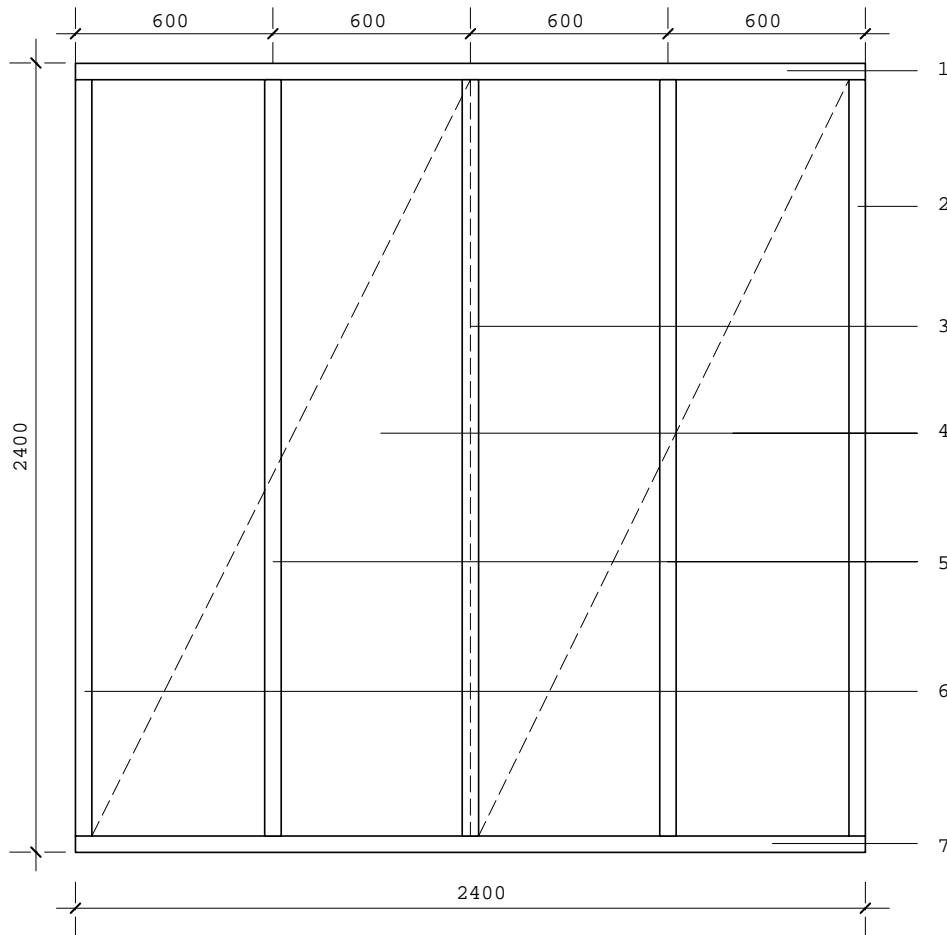


Figure D.1: Details of test panels (example)

Key	4 Two 1200 mm wide faces joined on centre stud
1 Top rail	5 Intermediate studs
2 Trailing stud	6 Leading stud
3 Centre stud	7 Bottom rail

D.7 Number of tests

The test shall be carried out on a test assembly representing the most onerous application, unless different assemblies are covered by the ETA, depending on the intended uses, and the ETA-applicant claims different performances for each. However, wherever possible, more than one structure of the same design and loading regime should be tested to permit the assessment of the likely variability in performance.

If the interface (connection) between panels or wall elements is being assessed, 2 tests should be performed, i.e. a test with one panel (for those cases where the panels are not connected) and a test with 2 panels (for those cases where the panels are connected).

Note 1: Different panels should be tested for each condition of vertical load (see D.12.2 and D.12.3). Normally it is sufficient to test the maximum and minimum conditions of vertical load appropriate to the design of the panel.

Note 2: The number of panels tested will depend on the variability in materials and manufacture, the required level of confidence and the number of loading conditions to be applied.

D.8 Characterisation

The detailed specification of the panel or element shall be provided and checks carried out to verify compliance with the specification. Such checks include:

- dimensions of the panel or wall element
- dimensions of structural members (if any)
- spacing of structural members
- dimensions and specification of face and core materials
- fixing details, etc

Note: Verifying characterisation data may not be necessary if sample taking was performed by the Approval body, but the test report should at least present this information (if applicable).

D.9 Preparation of specimens

The sample conditioning shall be recorded. The conditioning period shall be agreed between the ETA-applicant and the Approval Body to represent end use conditions.

The test shall be carried out in a laboratory environment.

D.10 Test apparatus

D.10.1 Loading apparatus

The test apparatus shall be in accordance with the schematic presentation in Figure D.2 and with the detailed specifications as set out below, or equivalent.

It shall be capable of applying, separately, both racking load F , and vertical loads F_v . The method of application of the loads shall be such that no significant resistance to movement in the panel is induced.

The apparatus shall be capable of continuously recording the loads F and F_v with an accuracy of $\pm 3\%$ of the load applied, or, for loads of less than $0,1 \times F_{\max,est}$ with an accuracy of $\pm 0,3\%$ $F_{\max,est}$. The panel displacements shall be measured to the nearest 0,1 mm.

If necessary, a metal casing shall be used to prevent the load being applied on only the composite panel core or facing or on parts of a designed panel joint, causing unrepresentative local deformations.

D.10.2 Deflection transducers

Deflection transducers, fixed as indicated in Figure D.2, to monitor deflection.

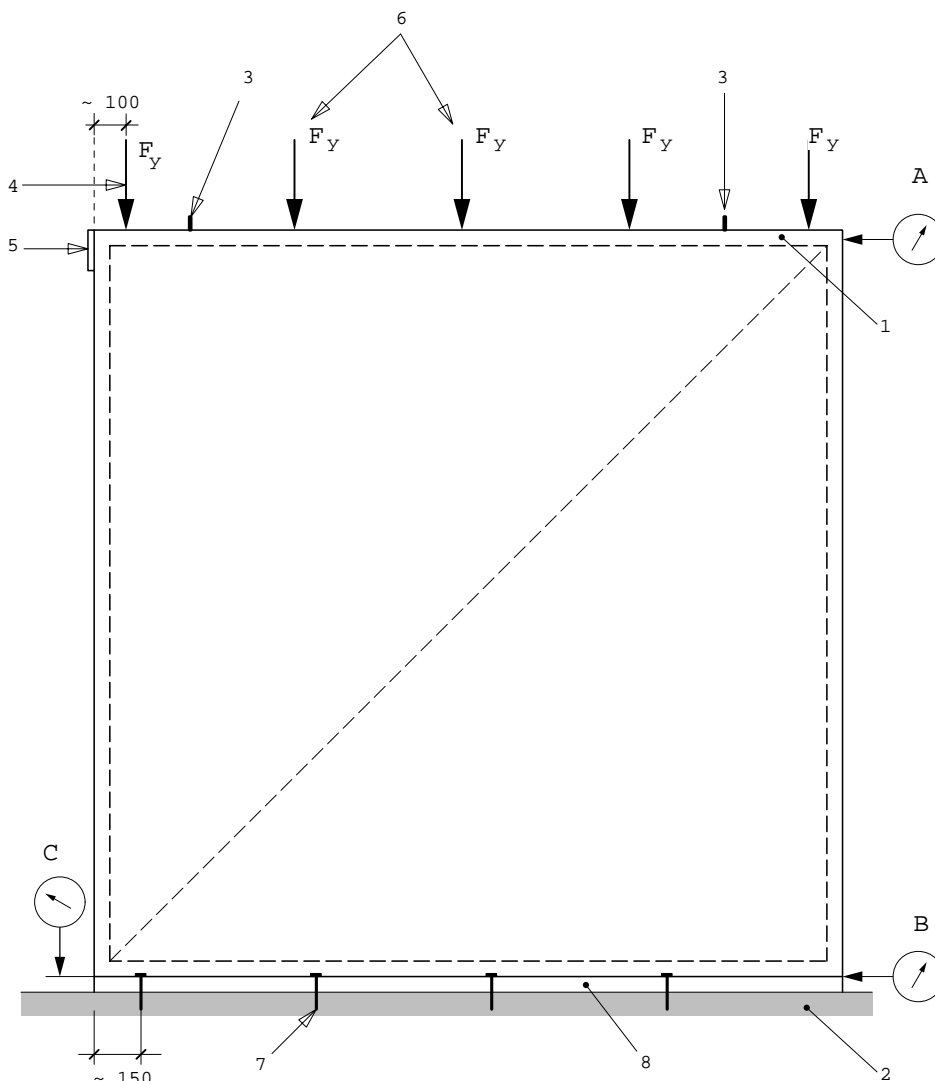


Figure D.2: Test apparatus

Key

- 1 Head binder
- 2 Base of test rig
- 3 Lateral restraints arranged so as to not impede movement of panel within its plane
- 4 Leading loading point set back if using fixed loading position allowing 100 mm maximum racking deflection
- 5 Racking load (F_y) applied at top of panel or to metal plate attached to top rail of panel and head binder
- 6 Vertical load spread equally to each stud (or equivalently distributed) and applied so as not to impede racking reflection on panel
- 7 Fastening system in accordance with manufacturer's specifications
- 8 Timber packer of similar section as the panel

D.11 Test assembly

D.11.1 Panel assembly or wall element

The panel assembly consists either of 1 panel, in cases where adjacent panels are not interlocked, or 2 panels. The assembly shall be mounted in accordance with the ETA-applicant's installation specifications, with regard to the intended use, so that the test assembly corresponds as much as possible with the end-use conditions.

The way in which components are fixed to each other and to the floor shall be in accordance with the ETA-applicant's specifications and reproduce actual conditions of use, particularly with respect to the nature, type and position of the fixings and the distance between them.

If the ETA-applicant's specifications allows more than one possible end-use assembly, the Approval Body should perform a test on at least the most onerous one. The ETA-applicant can request tests on additional assemblies, if he claims better performance.

In principle, for composite panels, the most onerous assembly shall be the following:

- Panel: the panel with the highest ratio length (or height) over width in its minimum thickness
- Span: Maximum distance between supports

D.11.2 Base and loading frame

The base of the test assembly shall provide a level bed to receive the test panel. The base shall be sufficiently stiff so as not to distort during the test. A rigid datum (independent of the test rig) shall be provided for the measurement of the deformation of the panel.

D.11.3 Mounting of test panel

The head binder shall be rigidly attached to the top rail or top of the panel. The cross-sectional dimensions and position shall provide a firm interface between the loads and the panel and allow the free movement of the panel sheathing of faces during the test. Lateral restraints shall be provided through the head binder so that the head or top of the panel will deflect only in the plane of the panel.

D.12 Test procedure

D.12.1 General

The vertical loads F_v shall be applied at locations appropriate to the design of the panel normally above the stud positions as shown in Figure D.2 (or equivalently distributed). The method of application of the vertical loads shall allow for racking deflections up to 100 mm.

If fixed jacking points are used, the vertical load on the stud nearest the point of application of the racking load shall be positioned approximately 100 mm from the end of the panel (see Figure D.2). The racking load F shall be applied as shown in Figure D.2. The load shall be applied at a constant rate of movement related to the displacement at gauge A.

For loading and unloading up to $0,4 \times F_{\max,est}$ the rate of loading shall be $(2 \pm 0,5)$ mm/min. For loading above $0,4 \times F_{\max,est}$ this rate of loading shall be (4 ± 1) mm/min. The displacements of the panel shall be monitored at points A, B and C (see Figure D.2). The deformation v shall be taken as the displacement at A minus the displacement at B. The displacement at C shall be reported separately. The procedure for applying the racking load, shown in Figure D.3, shall be used.

D.12.2 Vertical preload

In some cases, e.g. when the vertical loads F_v to be applied in the stiffness or strength tests are less than 1 kN per stud (or equivalent), a vertical preload cycle is required. The procedure is carried out by applying vertical preloads of $1 \text{ kN} \pm 10\%$.

These loads shall be maintained for (120 ± 10) s, then released and the panel allowed to recover for a minimum of (300 ± 10) s before continuing the test.

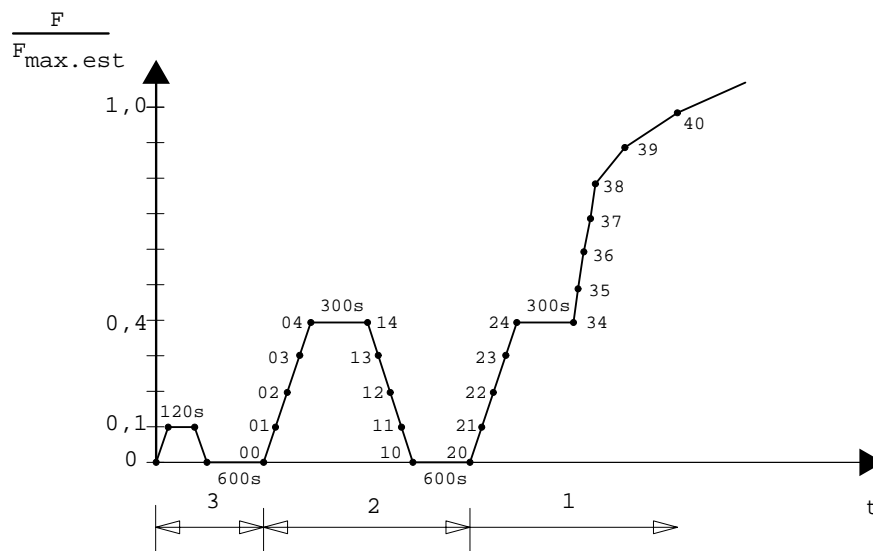


Figure D.3: Diagram - racking load versus time

Key
1 Strength test

2 Stiffness load cycle
3 Stabilising load cycle

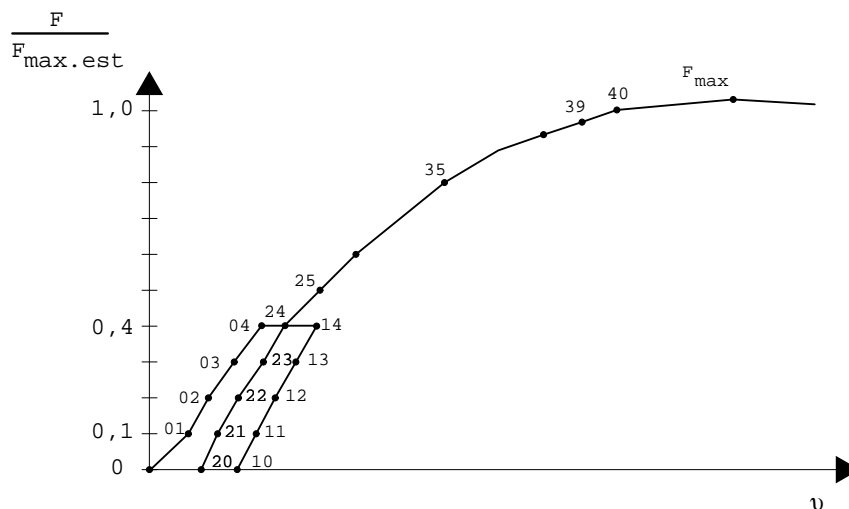


Figure D.4: Typical racking load versus deflection curve

D.12.3 Stabilising load cycle

The vertical loads F_v shall be applied to the head binder at the stud positions (or equivalent), as shown in Figure D.2 and maintained constant throughout the cycle. The racking load F shall then be applied and increased to $0,1 \times F_{max,est}$ and maintained for (120 ± 10) s. It shall then be removed and the panel allowed a recovery period of (600 ± 300) s, before continuing the test.

D.12.4 Stiffness load cycle

Maintain the vertical loads F_v applied in the stabilizing load cycle. The racking load F shall then be applied and increased to $0,4 \times F_{max,est}$ and maintained for (300 ± 10) s. It is then removed and the panel is allowed a recovery period of (600 ± 300) s. The deformations v_{01} to v_{10} and the corresponding racking loads F_1 to F_{10} shall be recorded (see Figure D.4).

D.12.5 Strength test

Maintain the vertical loads F_v applied in the stabilizing load cycle. The racking load $F = 0,4 \times F_{max,est}$ shall then be applied and this load shall be maintained for (300 ± 10) s. The racking load F shall then be increased until F_{max} is reached. The racking load shall be applied at the rate specified above (see D.12.1).

Note 1. The rate of loading should ensure that 90 % of the racking load F_{max} is reached within (300 ± 120) s. It is advised that the mean time to this load is about 300 s.

Note 2. See D.12.2 for a description of the relationship between $F_{max,est}$ and F_{max}

F_{max} is reached when either:

- the panel collapses, or
- the panel attains a deformation v (see D.12.1) of 100 mm, whichever occurs first.

The deformations v_{20} and v_{40} and the corresponding racking loads shall be recorded (see Figure D.4).

Note 3 It is important to ensure that the panel has totally failed when the racking load begins to reduce; it is common for panels to recover the load lost when individual fixings fail by redistributing the load to the remaining fixings.

D.12.6 Expression of results

The test results shall contain:

- a) racking stiffness of the panel, calculated from the equation
$$R = 0,5 \times ((F_4 - F_1)/(v_{04} - v_{01}) + (F_{24} - F_{21}) / (v_{24} - v_{21}))$$
Where:
 F_1 is the racking load of $0,1 \times F_{max,est}$, in N, and v_{01} is the deformation, in mm, and
 F_4 is the racking load of $0,4 \times F_{max,est}$, in N, and v_{04} is the deformation, in mm as determined in the stiffness test;
 F_{21} is the racking load of $0,1 \times F_{max,est}$, in N, and v_{21} is the deformation, in mm and
 F_{24} is the racking load of $0,4 \times F_{max,est}$, in N, and v_{24} is the deformation, in mm, as determined in the strength test;
- b) racking strength, expressed as the value of the maximum racking load F_{max} as found in the strength test;
- c) vertical loads F_v the total vertical load, and the nominal spacing of the studs (if relevant);
- d) a record of the displacement at C (see Figure D.2).

Note: The estimated maximum racking load $F_{max,est}$ shall be determined on the basis of experience, calculation or preliminary tests. If $F_{max,est}$ deviates by more than 20 % from a mean value of F_{max} obtained for all similar tests, the value of R for that test shall be rejected.

D.13 Test report

The test report shall include at least the following information:

- a) reference to this EOTA ETA-Guideline, Annex D
- b) the name of the testing laboratory
- c) the name of the ETA-Applicant (and manufacturer of the product, if different)
- d) date of the test
- e) description of the test instruments
- f) identification of the product tested (designation, dimensions and any relevant identification characteristic, e.g. moisture content of the timber framing and the sheathing material)
- g) identification of the sample(-s) tested (dimensions, shape, etc.) and reference to its marking (if any)
- h) surface structure (e.g. smooth, profiled, structured, ...)
- i) description of conditioning and preparation of the sample (if any)
- j) the rate of applying the load
- k) description of test conditions (temperature and RH)
- l) test loads attained during the tests together with the corresponding deformations at all measurement positions; the vertical loads F_v applied in the racking stiffness and strength tests
- m) values of R and F_{max} and the circumstances in which F_{max} occurred;

- n) gap between the sheets in the panel (if any);
- o) direction of greater strength of the sheathing material;
- p) specification of the mechanical fasteners (including corrosion protection), and their quantity and positioning;
- q) any deviation in panel construction from that shown in Figure D.1;
- r) description of the method of loading the panel and of measuring the panel deformations;
- s) type and position of any failure, including failures that have no relationship with the racking resistance of the panel (e.g. failure of the connection to the substrate);