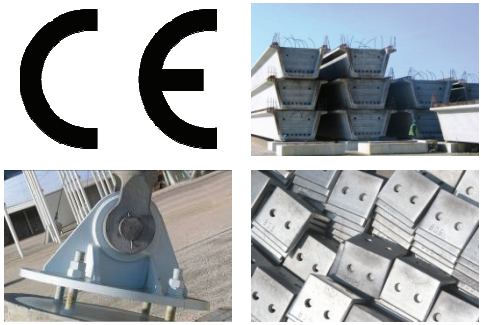
# B3 The Eurocodes and Construction Products



DG Enterprise and Industry
Joint Research Centre

Eurocodes
Building the future

This booklet was produced by the JRC in the framework of

the Administrative Arrangement
between
the Enterprise and Industry Directorate General (DG ENTR)
and
the Joint Research Centre (JRC)

regarding support to the implementation, harmonization and further development
of the Eurocodes



JRC 61692



This booklet is available to download from: http://eurocodes.jrc.ec.europa.eu

| | |
|---|---|
| Eurocodes – Building the future | http://eurocodes.jrc.ec.europa.eu |
| DG ENTR, Construction Sector | http://ec.europa.eu/enterprise/construction/index_en.htm |
| CEN | http://www.cen.eu |
| EOTA | http://www.eota.eu |
| NANDO | http://ec.europa.eu/enterprise/newapproach/nando |

# 1. THE EUROCODES

## 1.1. The Eurocodes suite

The Eurocodes are a set of European Standards (EN) for the design of buildings and other civil engineering works and construction products.

| | |
|---|---|
| EN 1990 | Eurocode: Basis of structural design |
| EN 1991 | Eurocode 1: Actions on structures |
| 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 1996 | Eurocode 6: Design of masonry structures |
| EN 1997 | Eurocode 7: Geotechnical design |
| EN 1998 | Eurocode 8: Design of structures for earthquake resistance |
| EN 1999 | Eurocode 9: Design of aluminium structures |

*The EN Eurocodes*

The Eurocodes cover in a comprehensive manner the basis of design, actions on structures, the principal construction materials, all major fields of structural engineering and a wide range of types of structures and products.

## 1.2. The Eurocodes and EU Legislation

The Eurocodes serve as reference documents recognised by authorities of the Member States of the European Union (EU) and the European Free Trade Association (EFTA) for the following purposes:

- as a means of compliance of buildings and civil engineering works with the Essential Requirements (ER) set out in the Construction Products Directive (Council Directive 89/106/EEC), particularly ER 1 “Mechanical resistance and stability” and parts of ER 2 “Safety in case of fire” and ER 4 “Safety in use”.

  It should be noted that the Construction Products Directive is presently being revised.

- as a basis for specifying contracts for public construction and related engineering service contracts. This relates to the Directive on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (Directive 2004/18/EC of the European Parliament and of the Council).

- as a **framework for drawing up** harmonised European Standards (hEN) and European Technical Approvals (ETA) for construction products.

*The **European Free Trade Association** (EFTA) is an intergovernmental organisation for the promotion of free trade and economic integration to benefit its four Member States: Iceland, Liechtenstein, Norway and Switzerland.*

## 2. THE CONSTRUCTION PRODUCTS DIRECTIVE (CPD)

### 2.1. Essential Requirements

The Construction Products Directive aims at removing any artificial barrier to trade and is intended for products placed on the market.

For the purpose of the Construction Products Directive, a construction product is defined as "any product which is produced for incorporation in a permanent manner in construction works, including both buildings and civil engineering works".

*Construction products may be structural materials and constituent products as well as prefabricated structural components and kits consisting of structural components.*

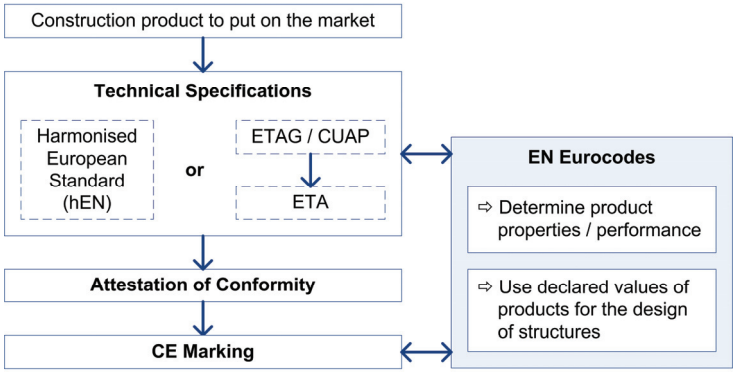
According to the Construction Products Directive, products intended for use in construction works, should have such characteristics that the works satisfy the following six Essential Requirements (ER):

- mechanical resistance and stability;
- safety in case of fire;
- hygiene, health and the environment;
- safety in use;
- protection against noise;
- energy economy and heat retention.

### 2.2. The routes to CE Marking

The Construction Products Directive is based on four elements:

1. **A system of technical specifications** which are harmonised European Standards and European Technical Approvals (see section 4).
2. An agreed system of **Attestation of Conformity** for each product family which may involve a third party (a Notified Body) to assess conformity (see section 5).
3. A framework of **Notified Bodies** (see section 6).
4. **CE Marking** of construction products, based on the provisions of the technical specifications for a product (see section 7).




*The use of Eurocodes for CE Marking of products according to the CPD*

# 3. THE EUROCODES AND CONSTRUCTION PRODUCTS

## 3.1. The Eurocodes and technical specifications

The Eurocodes embody in technical terms the Essential Requirements and are used to **determine the performance of products** with regard to these requirements.

Technical specifications (hENs and ETAs) for construction products:

- provide all the necessary performance values of the products needed to use the Eurocodes for the design of works;
- define the characteristics considered to assess the performance of products in a manner allowing a direct use in the Eurocodes;
- assess and express the declared performance values of the products in terms compatible with the Eurocodes.

In order to assure **consistency** between product and design standards, the Eurocodes:

- take into account the technical definitions and test methods used to assess the performance of the product, without requesting other or additional assessments;
- provide the rules to adjust the declared values of performance to use the product in specific works (partial safety factors);
- provide the application rules for the use of the products in specific works or types of works.

## 3.2. The Eurocodes and CE Marking

When the product properties to be declared for CE Marking are obtained from calculations, three methods are foreseen:

1. Indication of geometrical data of the component/kit and of properties of the materials and constituent products. The information on the geometrical data and properties of materials enable the structural component to be designed, using the Eurocodes, for verifying its adequacy in construction works.

2. Determination of properties by means of the Eurocodes, with the results expressed as characteristic or design values. This is the prime method that uses the Eurocodes to determine the mechanical resistance and resistance to fire of a construction product.

3. A structural component or kit is produced in accordance with the design details prepared by the designer of the work (based on harmonised calculation methods, i.e., Eurocodes) or following the provisions of the client's order.

The **performance values** of the products declared with the CE Marking are used as **input for the calculations needed to design a structure** according to the Eurocodes.

*The level of safety is set by Member States through the **Nationally Determined Parameters**; this means that design values may vary in different countries.*

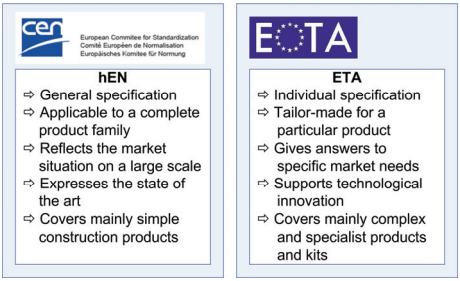
## 4. A EUROPEAN SYSTEM OF TECHNICAL SPECIFICATIONS

Harmonised European Standards (hENs) and European Technical Approvals (ETAs) constitute the system of technical specifications.

European Technical Specifications for construction products cover all product characteristics. They provide methods for the verification and evaluation of these characteristics, considering different levels or classes of performance.

The preferred route is for harmonised European Standards, but where this is not possible, a European Technical Approval may be written.

*Technical aspects arising from the Eurocodes have to be taken into account by writers of technical specifications, with a view to achieving full compatibility between the product specifications and the Eurocodes.*




*European Standards and European Technical Approvals*

### 4.1. European Standards

A European Standard (EN) is published by one of the European Standards Organisations, i.e., CEN, CENELEC and ETSI, and must be transposed into National Standard by the National Standards Bodies. The Eurocodes are produced by CEN/TC250.

The European Standards family related to construction comprises the EN Eurocodes for design and Standards for construction products, including execution and test Standards.

Construction products covered by European Standards include:

- timber, masonry, glass and metallic products;
- structural bearings;
- precast concrete products;
- anti-seismic devices;
- reinforcing steel;
- road lighting columns and road equipment.

***Annex ZA*** *is a key section in all CEN Standards for construction products. It addresses the provisions of the EU Construction Products Directive.*

### 4.2. European Technical Approvals

For innovative products that are too early in their life to be covered by a harmonised European Standard (e.g., because of the type and complexity of the product, or of the intended use), a European Technical Approval (ETA) may be issued by one of the EOTA Approval Bodies.

The CDP mentions ETA as a favourable technical assessment of the fitness for use of a product for an intended use, based on the fulfilment of the Essential Requirements for construction works in which the product is used.

There are two possibilities for ETAs to be based on:

- An **ETA Guideline** (ETAG) is a document drafted by EOTA Approval Bodies as a result of a mandate from the European Commission and EFTA. Its basic aim is to establish how Approval Bodies should evaluate the specific characteristics/requirements of a family of products.

- For individual products for which no ETAG exists, ETAs can be awarded, subject to the agreement of all EOTA Bodies and the European Commission, through the **Common Understanding of Assessment Procedure** (CUAP), in which the assessment criteria for the product and its intended use are set out.

Construction products covered by ETAs include:

- timber frame building kits;
- prefabricated stair kits;
- three-dimensional nailing plates;
- stress skin panels;
- shuttering hollow blocks;
- post-tensioning systems;
- road joints;
- light composite wood-based beams;
- internal partition kits;
- self-supporting translucent roof kits.

*The **European Organisation for Technical Approvals** (EOTA) comprises the Approval Bodies nominated to issue European Technical Approvals by EU Member States and EFTA States who have contracted to the European Economic Area Agreement.*

# 5. ATTESTATION OF CONFORMITY

## 5.1. Systems of Attestation of Conformity

In the Construction Products Directive the following systems of Attestation of Conformity (AoC) are foreseen:

- System 1: product conformity certification without audit testing.
- System 1+: product conformity certification with audit testing.
- System 2: Factory Production Control (FPC) certification without surveillance.
- System 2+: Factory Production Control certification with continuous surveillance.
- System 3: Initial Type-Testing.
- System 4: manufacturer's tasks only.

*According to the CPD, "the manufacturer, or his agent established in the Community, shall be responsible for the attestation that products are in conformity with the requirements of a technical specification".*

| | AoC system | | | | |
|---|---|---|---|---|---|
| | 1+ | 1 | 2+ | 2 | 3 | 4 |
| **Tasks for the manufacturer** | | | | | | |
| Factory production control | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Further testing of samples | ✓ | ✓ | ✓ | - | - | - |
| Initial type-testing | - | - | ✓ | ✓ | - | ✓ |
| **Tasks for the Notified Body** | | | | | | |
| Initial type testing | ✓ | ✓ | - | - | ✓ | - |
| Certification of FPC | ✓ | ✓ | ✓ | ✓ | - | - |
| Surveillance of FPC | ✓ | ✓ | ✓ | - | - | - |
| Audit of test samples | ✓ | - | - | - | - | - |

*Attestation of Conformity (AoC) tasks*

**The AoC procedure is defined in a Commission Decision** for each product family. Preference is given to the least onerous system consistent with safety.

The choice of the AoC system depends upon the production process (e.g., susceptibility to defects in manufacture), the characteristics of the product (e.g., effect of variability on the serviceability, nature of the product) and the consequences of failure of the product.

| Construction product | AoC |
|---|---|
| Cement, reinforcing steels | 1+ |
| Timber frame buildings, concrete frame buildings | 1 |
| Pre-cast concrete products; timber roof members | 2+ |
| Damp proof courses | 3 |
| Sanitary products | 4 |

*Example of construction products and required AoC*

### 5.2. Methods of control of conformity

**Initial Type-Testing (ITT)** comprises a complete set of tests or other procedures that determine the performance of samples of products representative of the product type. It is performed by the manufacturer and demonstrates that the product complies with the requirements of the technical specification.

**Factory Production Control (FPC)** implies a permanent internal control of production by the manufacturer. It is required that all the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner.

**Audit Testing** refers to testing of the construction product in accordance with the test methods given in the technical specification and the ITT. The test results are compared with the declared performances and a report is delivered, confirming that the findings are in conformity with the technical specifications, the ITT and FPC provisions.

**Product performance by calculation** applies in particular to products (components and kits) that contribute to the mechanical resistance and stability and/or fire resistance of construction works.

## 6. NOTIFIED BODIES

Notified Bodies are entities designated by their respective Member States to perform conformity assessment activities, where a third party intervention is requested. Distinction is made between:

- *certification bodies* which carry out product certification or Factory Production Control certification according to specific rules and procedures;
- *inspection bodies* which assess, recommend for acceptance and audit quality control operations, for selection and evaluation of products to specific criteria;
- *testing laboratories* which measure, examine, test, calibrate or otherwise determine the characteristics of the performance of materials and products.

Member States must inform the Commission and other Member States that a qualified body was designated to do conformity assessment according to a certain Directive.

**Manufacturers are free to select the conformity assessment body** among the list of Notified Bodies.


*The list of New Approach Notified and Designated Organisations is available at http://ec.europa.eu/enterprise/newapproach/nando*

# 7. CE MARKING FOR CONSTRUCTION PRODUCTS

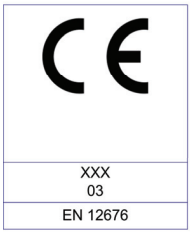
## 7.1. What is CE Marking?

CE Marking is **mandatory** for any product which is produced for incorporation in a permanent manner in construction works. It is based on hEN or ETA and is accompanied by technical information, e.g. declared values and classes.

In the context of the CPD, CE Marking means that the product has been assessed in accordance with the applicable hEN or ETA and that the manufacturer has applied the required Attestation of Conformity procedure.

Members of the European Economic Area Agreement are not allowed to restrict the free movement, placing on the market and putting into service in their territory of CE marked products, unless such measures can be justified on the basis of evidence for the non-compliance of the product.

*The **European Economic Area** (EEA) unites the EU Member States, Iceland, Liechtenstein and Norway into an internal market, where goods, services, capitals and persons move freely.*




*Example of CE marking with minimal information, e.g. where the reference to the European Standard (EN) contains all the required information.*

*XXX is the name and address, or identifying mark, of the producer. 03 are the two last digits of the year when the CE marking was affixed.*

*Example of CE Marking*

## 7.2. Benefits of CE Marking

CE Marking positively impacts the competition, creates order in markets and informs consumers and users.

It allows the manufacturers to freely circulate their products throughout the countries of the EEA.

There is only one set of requirements and procedures for the entire EEA. This implies reduced costs for the attestation of conformity.

Product testing by independent third parties, particularly during the design phase of product development process, helps manufacturers avoid costly decisions.

Consumers have wider choice of goods and services, lower prices and greater levels of information.

## 8. THE ROLE OF NATIONAL AUTHORITIES AND INDUSTRY

More than 500 harmonised European Standards and 600 European Technical Approvals in support of the Construction Products Directive have been published. This implies different actions for regulatory authorities and practitioners.

The role of **National Authorities** is to:

- adapt National legislation and regulations;
- transpose harmonised European Standards;
- transpose related European Standards, e.g., the Eurocodes;
- publish ETA Guidelines in national languages;
- withdraw National conformity assessment systems;
- designate Approval Bodies and notify the Commission and other Member States;
- survey the market to ensure that CE Marking is correctly used.

**Manufacturers and the construction industry** will need to:

- obtain information on applicable technical specifications and legal requirements of the destination country;
- adapt production to requirements;
- maintain Factory Production Control;
- acquire Notified Bodies services if necessary;
- verify information accompanying CE Marking;
- provide technical support to clients.

The European Commission with the Recommendation of December 2003 urged the Member States to "*adopt the Eurocodes as a suitable tool for designing construction works, checking the mechanical resistance of components, or checking the stability of structures*" and to "*refer to the Eurocodes in their national provisions on structural construction products*".

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In this series:

Booklets
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B5: The Eurocodes: Use outside EU
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L3: The Eurocodes: Increasing competitiveness
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2010