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Skupna pravila za montažne betonske izdelke

Common rules for precast concrete products

Allgemeine Regeln für Betonfertigteile

Règles communes pour les produits préfabriqués en béton

Ta slovenski standard je istoveten z: prEN 13369

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Common rules for precast concrete products

Règles communes pour les produits préfabriqués en béton

Allgemeine Regeln für Betonfertigteile

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 229.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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Foreword

This document (prEN 13369:2010) has been prepared by Technical Committee CEN/TC 229 "Precast concrete products", the secretariat of which is held by AFNOR, and was examined by and agreed with a joint working party appointed by the Liaison Group CEN/TC 229-TC 250, particularly for its compatibility with structural Eurocodes.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13369:2004.

This standard is intended for use for all precast products unless the product is covered by a specific product standard.

NOTE At the approval stage of this standard the following specific product standards prepared by Technical Committee CEN/TC 229 for which this standard is common reference, were available:

- EN 1168, *Precast concrete products – Hollow core slabs*
- EN 12737, *Precast concrete products – Floor slats*
- EN 12794, *Precast concrete products – Foundation piles*
- EN 12839, *Precast concrete products – Fences*
- EN 12843, *Precast concrete products – Masts and poles*
- EN 13224, *Precast concrete products – Ribbed floor elements*
- EN 13225, *Precast concrete products – Linear structural elements*
- EN 13693, *Precast concrete products – Special roof elements*
- EN 13747, *Precast concrete products – Floor plates for floor systems*
- EN 13978-1, *Precast concrete products – Precast concrete garages*
- EN 14843, *Precast concrete products - Stairs*
- EN 14844, *Precast concrete products – Box culverts*
- EN 14991, *Precast concrete products – Foundation elements*
- EN 14992, *Precast concrete products – Wall elements*
- prEN 15037, *Precast concrete products – Beams for beam-and-block floor systems*
- EN 15050, *Precast concrete products – Bridge elements*
- EN 15258, *Precast concrete products – Retaining wall elements*
- EN 15498, *Precast concrete products – Wood chip concrete shuttering blocks – Product properties and performances*

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Eurocodes are taken as a common reference for design aspects of structural products. The installation of some structural precast concrete products is dealt with by EN 13670: *Execution of concrete structures* which is at the moment under approval as a European Standard. In all countries it can be accompanied by alternatives for national application and it should not be treated as a European Standard.

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Introduction

This standard has been produced as part of the total CEN programme for construction and refers to the relevant specifications of associated standards EN 206 for concrete and EN 1992 for the design of concrete structures. Complementary design rules for structural elements are provided where necessary in Annex R and Annex S.

The design of structural elements should be verified to ensure the fitness of their properties for the particular application, particular attention being paid to design co-ordination with other parts of the construction.

The evaluation of conformity given in this European Standard refers to the completed precast elements which are supplied to the market but cover all equipment, material, production process and finished product aspects.

This standard does not cover design rules for the works in which the concrete products are to be used. It is required, however, to declare values for those parameters which are needed to design the interaction between the product and the surrounding parts of the works unless design of the product is performed entirely by the client. Such information can be given in the documentation, see clause 8.

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1 Scope

This European Standard identifies the requirements, the basic performance criteria and evaluation of conformity for unreinforced, reinforced and prestressed precast products made of compact light-, normal- and heavyweight concrete (oven-dry density of 800-2000 kg/m³, 2000-2600 kg/m³ and more than 2600 kg/m³ respectively) with no appreciable amount of entrapped air other than entrained air. It does not cover prefabricated reinforced components of lightweight aggregate concrete with open structure.

This standard is of general use for all types of precast products and it may be used as a common reference in specific product standards (see Foreword).

If a specific product standard exists it takes precedence over this standard.

The precast products dealt with in this standard are factory produced for building and civil engineering works, in series or individually. This standard may also be applied to products manufactured in temporary plants on site if the production is protected against adverse weather conditions and controlled following clause 6 provisions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 General references

EN 1990, *Eurocode – Basis of structural design*.

EN 1992-1-1, *Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings*.

2.2 Concrete

EN 206-1, *Concrete – Part 1: Specification, performance, production and conformity*.

EN 933-1, *Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution - Sieving method*.

EN 934-2, *Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling*.

EN 1097-6, *Tests for mechanical and physical properties of aggregates – Part 6: Determination of particle density and water absorption*.

EN 1008, *Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*.

EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests*.

EN 12390-3, *Testing hardened concrete – Part 3: Compressive strength of test specimens*.

EN 12390-6, *Testing hardened concrete – Part 6: Testing hardened concrete – Tensile splitting strength of test specimens*.

EN 12390-7, *Testing hardened concrete – Part 7: Density of hardened concrete*.

EN 12504-1, *Testing concrete in structures – Part 1: Cored specimens – Taking, examining and testing in compression.*

2.3 Structural reinforcement

EN 10080, *Steel for the reinforcement of concrete – Weldable reinforcing steel – Part 1: General requirements.*

prEN 10138-1, *Prestressing steels – Part 1: General requirements.*

prEN 10138-2, *Prestressing steels – Part 2: Wire.*

prEN 10138-3, *Prestressing steels – Part 3: Strand.*

prEN 10138-4, *Prestressing steels – Part 4: Bars.*

2.4 Fire performance

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

EN 1991-1-2, *Eurocode 1: Actions on structures – Part 1-2: General actions – Actions on structures exposed to fire.*

EN 1992-1-2, *Eurocode 2: Design of concrete structures – Part 1-2: General rules – Structural fire design.*

2.5 Acoustic insulation (standards.iteh.ai)

EN ISO 140-3, *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995).*

EN ISO 140-6, *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 6: Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998).*

EN ISO 717-1, *Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation (ISO 717-1:1996).*

EN ISO 717-2, *Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation (ISO 717-2:1996).*

2.6 Thermal resistance

EN ISO 10456, *Building materials and products – Procedures for determining declared and design thermal values (ISO 10456).*

2.7 Statistics

ISO 3951-1:2005, *Sampling procedures for inspection by variables – Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL.*

ISO 7870:1993, *Control charts – General guide and introduction.*

ISO 7873:1993, *Control charts for arithmetic average with warning limits.*

ISO 7966:1993, *Acceptance control charts.*

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ISO 8258/1991, *Shewhart control charts*.

3 Symbols, terms and definitions

Symbols are defined at the appropriate places in this standard. Symbols which are not defined are taken from relevant Eurocodes.

For the purposes of this document, the following terms and definitions apply.

3.1 General**3.1.1****precast concrete product**

product made of concrete and manufactured in accordance with this standard or a specific product standard in a place different from the final destination of use, protected from adverse weather conditions. The product is the result of an industrial process under a factory production control system and with the possibility of sorting before delivery.

3.1.2**finished concrete product**

precast concrete product as supplied to the market

3.1.3**structural precast product**

precast concrete product which has a critical function with respect to the mechanical resistance and/or stability of the construction work in which it is incorporated

3.1.4**structural element**

Specific structural precast product as identified in this standard (e.g. bridge elements)

3.1.5**light- or non-structural element**

precast concrete product for which there is no regulatory requirements for mechanical resistance in the place of use

3.1.6**concrete unit**

a single specimen of a precast concrete product

3.1.7**(concrete) cover**

distance from the surface of embedded reinforcement to the nearest concrete surface

3.1.8**nominal cover**

value of the cover quoted in the design documentation (at least equal to the minimum cover plus the permitted negative deviation) and targeted at manufacture

NOTE "design cover" or "work cover" are frequently used as an alternative.

3.1.9**minimum cover**

minimum required value for actual cover

3.1.10**actual cover**

cover found by measurement

3.1.11**type of hardened concrete**

concrete made with the same strength class and exposure class.

3.1.12**tendon**

prestressing unit (wire, strand or bar) subjected to pre- or post-tensioning

3.1.13**anchorage**

device to connect the end of a tendon to the prestressing retaining frame (pre-tensioning) or to the hardened concrete (post-tensioning) and retain the force in the tendon

3.2 Dimensions**3.2.1****principal dimensions**

length, width, depth or thickness

3.2.2**critical dimension**

dimension having a critical influence on the mechanical resistance and durability of the precast concrete product

3.2.3**nominal dimension**

dimension quoted in the design documentation and targeted at manufacture

NOTE "Design dimension" or "work dimension" are frequently used as an alternative.

3.2.4**actual dimension**

dimension found by measurement

3.3 Tolerances**3.3.1****tolerance**

permitted deviation of an actual dimension with respect to corresponding nominal dimension

3.3.2**deviation**

difference between an actual dimension and the corresponding nominal dimension

3.3.3**production tolerance**

tolerance on dimensions or other geometrical properties (e.g. straightness, planarity) after production of a precast unit

3.4 Durability**3.4.1****durability**

ability of a construction or a component to maintain adequate levels of stability and serviceability during its design working life under intended use with normal maintenance

prEN 13369:2010 (E)**3.4.2****working life**

period of time during which the performance of the concrete product in the works will be kept at a level compatible with the fulfilment of the performance requirements of the works, provided it is subject to normal maintenance

3.4.3**design working life**

working life assumed for the design purposes

3.4.4**environmental condition**

ambient actions on the construction during working life affecting its durability

3.4.5**ambient condition**

hygrothermic conditions in the factory affecting the hardening process of the concrete

3.5 Mechanical properties**3.5.1****standard strength**

compressive concrete strength derived from tests on 150mm x 300 mm cylinders (standard cylinder strength) conforming to EN 12390-1 or 150 mm cubes (standard cube strength)

NOTE The strength definition of this clause may be combined with the definitions of clauses 3.5.2 and 3.5.3.

3.5.2**potential strength**

compressive concrete strength derived from tests on cubes or cylinders moulded and cured in laboratory conditions in accordance with EN 12390-2

3.5.3**structural strength**

compressive concrete strength derived from tests on specimens extracted from the finished product (direct structural strength) or derived from tests on moulded specimens (as for potential strength) but cured in the same ambient conditions as the product itself (indirect structural strength)

3.5.4**characteristic strength (of concrete)**

limit value below which 5% of the population of all individual compressive or tensile strength values of a consignment of the concrete under consideration are expected to fall

NOTE The strength definition of this clause may be combined with the definitions of clauses 3.5.1 to 3.5.3.

3.5.5**slippage**

shortening of a tendon in relation to the concrete at the ends of a prestressed product after transfer of the prestressing force to hardened concrete

4 Requirements

4.1 Material requirements

4.1.1 General

Only materials with established suitability shall be used.

For a particular material, the establishment of suitability may result from a European Standard which refers specifically to the use of this material in concrete or in concrete products; in absence of a European Standard it may also result, under the same conditions, from an ISO standard.

Where this material is not covered by a European or International Standard, or if it deviates from the requirements of these standards, the establishment of suitability may result from:

— the relevant national standards or provisions valid in the place of use of the concrete product which refer specifically to the use of this material in concrete or in concrete products;

or

— an European Technical Approval specifically for the use of this material in concrete or concrete products.

4.1.2 Constituent materials of concrete

4.1.2.1 General

EN 206-1:2000, 5.1 shall apply, including additional provisions in national annexes to EN 206-1.

4.1.2.2 Crushed recycled concrete aggregates

Crushed recycled concrete aggregates, mixed in concrete with other aggregates, shall not adversely alter the rate of setting and hardening of concrete, nor shall it be detrimental to the durability of the concrete product in the end use conditions.

In normal weight concrete only crushed recycled aggregates obtained from normal weight concrete shall be used.

While using recycled concrete aggregates in percentage higher than 10% in weight the validity of hardened concrete properties derived from compressive concrete strength according to Table 3.1 of EN 1992-1-1 shall be verified if these properties are used for the calculation of the mechanical resistance of concrete products. If the validity is not confirmed appropriate type testing shall be performed to determine these properties.

NOTE Recommendations on the use of crushed recycled concrete aggregates with other aggregates are given in the Annex Q.

4.1.3 Reinforcing steel

Reinforcing steel shall meet the requirements in 3.2 of EN 1992-1-1, including R.3.2.

Other types of reinforcing steel may be used according to relevant national standards or national provisions valid in the place of use of the product, provided they are fit for the intended purpose and have the required properties. Suggestions are given in Annex N.

prEN 13369:2010 (E)**4.1.4 Prestressing steel**

Prestressing steel shall meet the requirements in 3.3 of EN 1992-1-1, including R.3.3.

Other types of prestressing steel may be used according to relevant national standards or national provisions valid in the place of use of the product.

4.1.5 Inserts and connectors

Mechanical inserts and connectors shall:

- resist the design actions;
- have the necessary ductility;
- maintain these properties for the lifetime of the concrete product.

National standards or national provisions valid in the place of use of the product shall be taken into account.

4.2 Production requirements**4.2.1 Concrete production****4.2.1.1 General**

For concrete composition, type of cement, use of aggregates, additions and admixtures, and for resistance to alkali-silica reaction, chloride content, air content and concrete temperature, EN 206-1:2000, 5.2 and 5.3 shall apply.

For specification of concrete EN 206-1:2000, 6.1 and 6.2 shall apply.

Additional provisions given in National annexes to EN 206-1 shall be taken into account.

4.2.1.2 Placing and compaction of concrete

Concrete shall be placed and compacted so as to retain no appreciable amount of entrapped air other than entrained air and to avoid detrimental segregation. Within the concrete the reinforcement shall be properly embedded.

4.2.1.3 Curing (protection against drying out)

The concrete shall be protected during curing so that loss in strength and cracking due to temperature and shrinkage is avoided. All surfaces of newly cast concrete shall be protected by at least one of the methods listed in Table 2, unless it can be shown by tests on the finished product or otherwise, that no loss in strength or surface cracking will occur in the production environment without protection.

The protection shall be maintained until the standard structural strength at the end of curing expressed either by the degree of hardening or by numerical values as given in Table 1 is reached. For bridge elements, design working life more than 50 years, or specific to local environmental conditions, other values may be given following the requirements of their destination as indicated in the design documentation.

The degree of hardening in Table 1 may either be measured by testing a concrete sample or estimated by calculation using a hardening law based on initial type testing of the maturity concept.

Table 1 — Standard structural strength at the end of protection against drying out

Exposure conditions in the place of use (EN 1992-1-1 exposure classes)	Standard structural strength at the end of curing		
	degree of hardening as % of required strength class		Mean numerical values (cylinder/cube) N/mm ²
For concrete without X0 reinforcement or embedded metal: all exposures except where there is freeze/thaw, abrasion or chemical attack. For concrete with reinforcement or embedded metal: Dry Or Permanently wet XC1	only the requirement on numerical values applies		12/15
Wet, rarely dry XC2 Moderate humidity XC3, XA1 Moderate saturation XC4, XD1 Without de-icing agent XF1	40	or	16/20
All other exposure conditions	60	or	25/30

Table 2 — Protection against drying out

Method	Typical means of execution
A - Without addition of water	<ul style="list-style-type: none"> — keeping the concrete in an environment with a relative humidity above 75 %; — keeping the formwork in place; — covering the concrete surface with vapour-resistant sheets that are secured at the edges and joints to prevent through draughts.
B - Keep the concrete moist by addition of water	<ul style="list-style-type: none"> — maintaining wet coverings on the concrete surface; — keeping the concrete surface visibly wet by spraying with water; — ponding the concrete surface with water.
C – Use of curing compounds	NOTE Effectiveness of this method should be estimated by initial type testing showing that the structural strength reached with curing compounds is of the same order as the structural strength obtained by one of the above accepted means of curing.

4.2.1.4 Curing (limitation of curing temperature and temperature gradients)

Where heat treatment at atmospheric pressure is applied to concrete during production in order to accelerate its hardening, it shall be demonstrated by initial type testing that the required strength is achieved for each concrete family.

The following conditions shall be fulfilled when the maximum mean temperature T_{mean} within the concrete exceeds 40°C during the curing process unless previous positive experience has shown that special measures are not necessary to avoid micro cracking and/or durability defects:

- a preheating period shall be applied during which T_{mean} does not exceed 40°C;