



**SLOVENSKI STANDARD**  
**SIST ENV 13670-1:2003**  
**01-marec-2003**

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**Izvajanje betonskih konstrukcij - 1. del: Splošno**

Execution of concrete structures - Part 1: Common

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**Ta slovenski standard je istoveten z: ENV 13670-1:2000**

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EUROPEAN PRESTANDARD  
PRÉNORME EUROPÉENNE  
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English version

## Execution of concrete structures - Part 1: Common

This European Prestandard (ENV) was approved by CEN on 27 November 1999 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 104 "Concrete (performance, production, placing and compliance criteria)", the secretariat of which is held by DIN.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Because of the close connection between design rules and rules for execution, CEN/TC 104/SC 2 has developed this prestandard in conjunction with CEN/TC 250/SC 2.

This prestandard supersedes the execution and tolerance clauses in ENV 1992-1 Eurocode 2: Design of concrete structures and the execution rules in prEN 206:1997: Concrete - Performance, production, placing and compliance criteria.

This prestandard specifies the required level of execution in assembling products such as fresh concrete, reinforcement, precast concrete elements etc. into a structure that achieves the intended level of mechanical resistance and stability.

This prestandard has three functions:

- to transfer the requirements set during design from the designer to the constructor i.e. to be link between design and execution;
- to give a set of standardized technical requirements for the execution when ordering a concrete structure;
- to serve as a check list for the designer to ensure that he provides the constructor with all relevant technical information for the execution of the structure (see Annex A).

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## Introduction

(1) This European Prestandard assumes:

- the availability of a comprehensive design of the structure
- a project management in charge of the supervision of the works which will ensure the execution of a conforming structure;
- a site management which will take charge of the organisation of the works and ensure the correct and safe use of the equipment and machinery, the satisfactory quality of materials, the execution of a conforming structure and its safe use up to the delivery of the works.

When precast elements are used, the following additional assumptions are made:

- the availability of a specific design of the precast elements conforming to the relevant standards
- the availability of a design coordination between precast elements and site manufactured components.
- a technical specification of the precast structure with instructions for installation;
- there is an erection management to direct the erection team.

(2) This European Prestandard presupposes that the work is carried out with the necessary skill and adequate equipment and resources to perform the work in accordance with the requirements of the project specification and the requirements of this European Prestandard.

It is assumed that generally accepted rules for good workmanship for the various activities are known and applied.

(3) It is assumed that the constructor will conform to provisions valid at the construction site with respect to:

- qualifications for the personnel doing the various activities covered by this prestandard;
- health and safety aspects of construction.

(4) This prestandard assumes that the finished structure after completion is used as intended in the design and submitted to the planned inspection and maintenance necessary to achieve the intended design life and to detect weaknesses or any unexpected behaviour.

## 1 Scope

(1) This European Prestandard gives common requirements for execution of concrete structures. In particular, this part gives requirements for structures designed according to ENV 1992 -1 and for the concrete part of composite structures designed according to ENV 1994-1.

(2) In the case of civil engineering works, different or additional requirements need to be considered and, if required, given in the project specification.

(3) This prestandard permits the project specification to state specific requirements relevant to the particular structure.

(4) This prestandard is applicable to temporary as well as permanent concrete structures.

(5) Additional or different requirements should be considered and, if required, given in the project specification when using:

- Lightweight aggregate concrete;
- other materials (e.g. fibres) or constituent materials;
- special technologies/innovate designs.

(6) Small and simple concrete works and secondary structures of minor importance, defined as such in provisions valid at the construction site, are not within this prestandard.

(7) This prestandard does not apply to concrete members used only as equipment for the execution.

(8) This prestandard does not cover the specification, production and conformity of concrete.

(9) This prestandard is not applicable to the production of precast concrete elements made in accordance with product standards.

(10) This prestandard does not cover the requirements for concrete members in special geotechnical works such as pile foundations, ground anchors, slurry walls, etc.

(11) This prestandard does not cover safety and health aspects of execution.

(12) This prestandard does not state requirements for quality assurance or for qualification of personnel for the various activities.

(13) This prestandard does not cover contractual issues or responsibilities for the identified actions.

## 2 References

(1) This European Prestandard incorporates by dated or undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard, only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

(2) All relevant national standards not covered by European Standards should be stated in the project specification.

### 2.1 Normative references

prEN 206:1997 Concrete – Part 1: Specification, performance, production and conformity

NOTE Presently EN 206 is available as prEN 206:1997 (see also clause 6.6(3), 11.2, E8.5, G 11.1 and G 11.7) and prEN 206-1 is in preparation.

EN 446:1996 Grout for prestressing tendons - Grouting procedures

EN 447:1996 Grout for prestressing tendons - Specifications for common grout

EN 523 Steel strip sheaths for prestressing tendons - Terminology - Requirements and quality control

EN 1065 Adjustable telescopic steel props - Product specifications, design and assessment by calculation and tests

ENV 1991 Eurocode 1: Basis of design and actions on structures

ENV 1992 Eurocode 2: Design of concrete structures

ENV 1994 Eurocode 4: Design of composite steel and concrete structures

prEN 10080:1999 Steel for the reinforcement of concrete - Weldable ribbed reinforcing steel  
Part 1 – Part 6<sup>1)</sup>

ENV 10138 Steel for the prestressing of concrete.<sup>1)</sup>

### 2.2 Informative references

ISO 1803-1 Building construction – Tolerances – Vocabulary – Part 1: General terms

ISO 4463-1 Measurement methods for building – setting – out and measurement – Part 1: Planning and organization, measuring procedures, acceptance criteria

<sup>1)</sup> European Standards for reinforcement and prestressing steels (prEN 10080 and prEN 10138) are presently in preparation. Until these are issued and implemented, national standards apply.



### 3 Definitions

For the purposes of this prestandard, the following definitions apply:

#### 3.1

##### **construction works**

Everything that is constructed or results from construction operations. This term covers both building and civil engineering works. It refers to the complete construction comprising both structural and non-structural components.

#### 3.2

##### **constructor**

The organization executing the works.

#### 3.3

##### **execution**

All activities carried out for the physical completion of the work, i.e. scaffolding, formwork, reinforcing, concreting, curing, erection etc., and the inspection and documentation thereof.

#### 3.4

##### **inspection**

Activities carried out in order to check that the execution is in accordance with the project specification.

#### 3.5

##### **method statement**

Documentation describing the methods and procedures to be used to perform the work.

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#### 3.6

##### **permitted deviation**

Permitted algebraic differences between the limits of size and the corresponding reference size (see ISO 1803/1 Building construction - Tolerances-Vocabulary-Part 1: General terms).

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#### 3.7

##### **precast concrete element**

Concrete element conforming to a product standard, cast and cured in a place other than the final location of use.

NOTE In this prestandard the shorter term "precast element" is used.

#### 3.8

##### **project specification**

Documents covering technical data and requirements for a particular project prepared to supplement and qualify the requirements of this prestandard.

#### 3.9

##### **reference line**

Line defined in the project specification to which sizes are related.

#### 3.10

##### **secondary line**

Any line used for the purpose of setting-out the proposed building and for checking the conformity of the building or building parts (see ISO 4463-1:1998 Measurement methods for building. Setting out measurements - Part 1: Planning and organization measuring procedures, acceptance criteria).

### 3.11 surface finish

Description of the appearance of the concrete surface including aspects of geometry, texture, colour etc.

### 3.12 temporary structure

Structure designed for a short lifetime according to table 2.1 of ENV 1991-1.

### 3.13 tolerances

Permitted variation of size (see ISO 1803/1 Building construction - Tolerances-Vocabulary-Part 1: General terms).

Tolerances for precast concrete elements are subdivided as follows:

- production tolerances i.e. geometrical tolerances as defined in the product standards;
- erection tolerances i.e. geometrical tolerances relating to location, verticality, horizontality or other characteristics of the construction assembly;
- construction tolerances i.e. geometrical tolerances that are a combination of production, site construction and erection tolerances.

#### 3.13.1 normal tolerances

The basic limits for geometrical deviations that ensures that the structure:

- satisfies the design assumptions;
- achieves other functional requirements of the construction works.

NOTE In this prestandard, normal tolerances are referred to as tolerance class 1.

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#### 3.13.2 special tolerances

More stringent tolerances than normal tolerances.

### 3.14 works

In the sense of this prestandard, those parts of the construction works that are structural concrete work and are described in the project specification.

## 4 Documentation

### 4.1 Project specification

(1) It is assumed that the project specification includes:

- all necessary information and technical requirements for execution of the works and agreements made during the execution;

NOTE Annex A4, Table A1 contains a checklist of requirements and information that may have to be included in the project specification as appropriate.

- relevant European Technical Approvals and provisions valid at the construction site.

NOTE Provisions valid at the construction site are national standards and documents approved by a competent authority defined in the project specification.

(2) Before commencement of execution of any part of the works, the project specification relevant to that part of the works shall be complete and available. The following provisions should be included in the project specification:

- procedures for making alterations to previously agreed requirements;
- any requirement for the distribution, the filing and recording of technical documents used for the works.

(3) If a quality plan for the execution of the works is required, this shall be stated in the project specification.

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### 4.2 Execution documentation

#### 4.2.1 Quality plan

(1) If a quality control procedure is required by the project specification, it shall be available at site.

#### 4.2.2 Special documentation

(1) If special documentation is required, the type and extent of the documentation shall be stated in the project specification.

NOTE In inspection classes 2 and 3, documentation of inspection is required, see clause 11.

## 5 Falsework and formwork

### 5.1 Basic requirements

(1) Falsework and formwork including their supports and foundations shall be designed and constructed so that they are :

- capable of resisting any action to which they are submitted during the construction process;
- stiff enough to ensure that the tolerances specified for the structure are satisfied and the integrity of the structural member is not affected.

(2) The form, function, appearance and durability of the permanent works shall not be impaired or damaged due to the performance of the falsework and formwork or their removal.

(3) Falsework and formwork shall conform to the relevant European Standard such as EN 1065.

NOTE A European standard on vertical formwork is under preparation.

## 5.2 Materials

### 5.2.1 General

(1) Any material which leads to the fulfilment of the criteria for the structure given in 5.1 and 5.6 may be used. They shall conform to relevant product standards where they exist. The characteristics of the specific material shall be taken into account.

### 5.2.2 Release agents

(1) Release agents shall be selected and applied in such a way that they are not harmful to concrete, reinforcing steel, or formwork and in such a way that they have no detrimental effects on the environment.

(2) Unless specifically intended, release agents shall have no detrimental effect on the surface quality, its colour, or specified subsequent coatings.

(3) Release agents shall be applied according to the product specification or provisions valid at the construction site.

## 5.3 Falsework

(1) A method statement, where required, shall describe the method of erection and dismantling of temporary structures. It shall specify the requirements for handling, adjusting, intentional precambering, loading, unkeying, striking and dismantling.

(2) The design of the falsework shall take into account the deformation during and after concreting to prevent deleterious cracking in the young concrete. This may be achieved by:

- limiting the deflection and/or settlement;
- controlling the casting sequence and/or concrete specification e.g. retarding the concrete.

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## 5.4 Formwork

(1) Formwork shall keep the concrete in its required shape until it is hardened.

(2) Formwork and the joints between boards or panels shall be sufficiently tight so as to prevent loss of fines.

(3) Formwork likely to absorb significant amounts of water from the concrete or facilitate evaporation shall be suitably wetted to reduce water uptake from the concrete, unless intended specifically for that purpose e.g. controlled permeability formwork.

(4) The internal surface of the formwork shall be clean. If the formwork is used to produce visible concrete surfaces, the treatment of the formwork surfaces shall be such that the required finish is achievable.

## 5.5 Special formwork

### 5.5.1 Slipforming

(1) When using slipforming, the design of the system shall take into account the properties of the formwork material and make provision for controlling the geometry of the works.

(2) Due to the need to batter the forms and the form friction on the young concrete, a continuous guidance system between the reinforcement and the form shall be used to ensure the required concrete cover within the tolerances given in clause 10.

### 5.5.2 Other special formwork

(1) Requirements shall be given in the project specification.

## 5.6 Surface finish

If special finishes are required, these shall be stated in the project specification. Trial concrete panels of suitable size may be specified as a basis for approving the surface quality.

NOTE Surface finish depends on the type of formwork, concrete (aggregates, cement, addition, admixtures), execution and protection during the subsequent construction.

## 5.7 Inserts in formwork and embedded components

### 5.7.1 General

(1) Temporary inserts to keep the formwork in place, bars, ducts and similar items to be cast within the section and embedded components e.g. anchor plates, anchor bolts, spacers, shall :

- be fixed robustly enough to ensure that they will keep their prescribed position during placing and concreting;
- not introduce unacceptable actions on the structure;
- not react harmfully with the concrete, the reinforcement or prestressing steel;
- not produce unacceptable surface blemishes;
- not impair the functional performance and the durability of the structural member;
- not prevent adequate placing and compaction of the fresh concrete.

(2) Any embedded item shall have sufficient strength and stiffness to preserve its shape during the concreting operation and be free of contaminants that would affect them, the concrete or reinforcement.

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### 5.7.2 Temporary inserts

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(1) Recesses and holes used for temporary works shall be filled and finished with a material of similar quality to the surrounding concrete, unless the function of the member is such that they may remain open or another method is agreed or specified.

## 5.8 Removal of formwork and falsework

(1) Falsework and formwork shall not be removed until the concrete has gained sufficient strength :

- to resist damage to surfaces that may arise during the striking;
- to carry the actions imposed on the concrete member at that stage;
- to avoid deflections beyond the specified tolerances due to the elastic and inelastic (creep) behaviour of the concrete.

Striking shall be made in a manner that it will not subject the structure to impact, overload or damage.

The loads in falsework shall be released in a sequence that ensures the other falsework members are not subject to excessive loads. The stability of falsework and formwork shall be maintained when loads are released and during dismantling.

(4) The procedure for propping or re-propping when used to reduce the effects of the initial load, subsequent loading and/or to avoid excessive deflections shall be detailed in a method statement.

(5) If formwork is part of the curing system, the time of its removal shall be taken into account in accordance with the requirements of 8.5.

## 6 Reinforcement

### 6.1 General

(1) The following clauses apply to site and fabricated reinforcement.

### 6.2 Materials

(1) Reinforcing steel shall conform to the European standard for reinforcing steel, prEN 10080:1999, when available and to provisions valid at the construction site.

(2) Each product shall be clearly identifiable.

(3) Anchorage devices and couplers shall conform to ENV 1992-1-1, a European Technical Approval or provisions valid at the construction site.

(4) The surface of the reinforcement shall be free from loose rust and deleterious substances which may adversely affect the steel, concrete, or the bond between them.

(5) Galvanised reinforcement shall only be used together with cement that has no detrimental effect on the bond to the galvanised reinforcement.

### 6.3 Bending, cutting, transport and storage of the reinforcement

(1) The cutting and bending of reinforcing steel shall conform to the project specification. The following requirements apply:

- bending shall be done at a uniform rate;
- where permitted by national standards or provisions valid at the construction site, bending of steel below temperatures of  $-5^{\circ}\text{C}$  is permitted provided the procedure conforms to the given additional precautions;
- unless permitted by the project specification, bending by heating the bars is not permitted.

(2) For bending bars, the diameter of the mandrel used shall be suitable for the actual type of reinforcement and not less than the values given in table 5.1 of ENV 1992-1-1 (see annex C) or provisions valid at the construction site.

(3) For welded reinforcement and fabric bent after welding, the diameter of the mandrel used shall be suitable for the actual type of reinforcement and not less than the values given in table 5.2 of ENV 1992-1-1 (see annex C) or provisions valid at the construction site.

(4) Steel reinforcing bars, welded fabric and prefabricated reinforcement cages shall not be damaged during transporting, storing (clear of ground), handling and placing into position.

Straightening of bent bars shall be allowed only if:

- special equipment to limit local stresses is used,
- the procedure of straightening has been approved.

NOTE Permission may be given in the project specification or provisions valid at the construction site

(5) Reinforcement from coils shall not be used unless appropriate equipment is available and the straightening procedures are approved.

### 6.4 Welding

(1) Welding shall conform to provisions valid at the construction site.

(2) Welding is only permitted on reinforcing steel conforming to prEN 10080:1999 and reinforcing steel classified as weldable in provisions valid at the construction site.

(3) Welding shall not be executed at, or near, bends in a bar. The limits given in table 5.2 of ENV 1992-1-1 apply.

(4) Spot welding is permitted for the assembling of reinforcement provided that it is not restricted by provisions valid at the construction site.

## 6.5 Joints

(1) Bars shall be jointed, by laps, couplers or welding, in accordance with ENV 1992-1-1 provisions valid at the construction site.

## 6.6 Assembly and placing of the reinforcement

(1) The reinforcement shall be placed according to the project specification.

Note 1 Special attention should be given to reinforcement and cover at the location of holes of small dimensions which are not considered in the structural design.

Note 2 It is assumed that the project specification gives detailed information on the layout and spacing of bars, as well as any precautions to be taken in areas of congested reinforcement.

(2) The reinforcement shall be fixed and secured so that its final position is within the tolerances given in this prestandard. Assembly of reinforcement may be done with tie wire or spot welding (see 6.4 (2) and (4)).

(3) The specified cover to the reinforcement shall be maintained by the use of suitable chairs and spacers. Steel spacers in contact with the concrete surface are only permitted in a dry environment i.e. exposure class XO of prEN 206:1997.

(4) Requirement to cover apply to the nominal value,  $C_n$ , and apply to the surface of any reinforcement including possible assembly reinforcement.

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## 7 Prestressing

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### 7.1 General

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(1) The following requirements apply to prestressed concrete procedures incorporating:

- bonded pre-tensioned construction;
- bonded post-tensioned construction;
- unbonded post-tensioned, internal or external construction.

NOTE 1 Special attention to safety measures is necessary.

NOTE 2 Provisions valid at the construction site (see 4.1.3) include approval documents issued by a European or national certification body.

### 7.2 Materials for prestressing

#### 7.2.1 Post-tensioning systems

(1) Post-tensioning systems shall conform to European Technical Approval or provisions valid at the construction site.

(2) All parts of the post-tensioning system shall be compatible e.g. from the same prestressing system.

#### 7.2.2 Sheaths

(1) Steel strip sheaths shall conform to EN 523.

(2) Sheaths of materials other than steel shall conform to provisions valid at the construction site.

(3) Casing sheaths for unbonded strands shall conform to the relevant product standard, if any, or to provisions valid at the construction site.