SLOVENSKI STANDARD
SIST EN 13224:2012

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SIST EN 13224:2004+A1:2007

Montažni betonski izdelki - Rebraste etažne plošče

Precast concrete products - Ribbed floor elements

Betonfertigteile - Deckenplatten mit Stegen

Produits préfabriqués en béton - Eléments de plancher nervurés

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91.100.30	Beton in betonski izdelki	Concrete and concrete products

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Precast concrete products - Ribbed floor elements

Produits préfabriqués en béton - Eléments de plancher nervurés

Betonfertigteile - Deckenplatten mit Stegen

This European Standard was approved by CEN on 1 October 2011.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 13224:2011) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by August 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13224:2004+A1:2007.

Significant technical changes compared to the previous version are:

a) change in the scope to also cover elements with bottom slab (as shown in Annex A);

b) deletion of the requirement on planarity (in 4.3.1.1 and 5.2);

c) deletion of the requirement on camber or sag (in 4.3.1.1 and 5.2);

d) addition of a rule for elements without shear reinforcement in 4.3.3.3;

e) adoption of the new template for Annex ZA.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the Construction Products Directive (89/106/EEC) of the European Union (EU).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This standard is one of a series of product standards for precast concrete products.

For common aspects, reference is made to *EN 13369: Common rules for precast products*, from which also the relevant requirements of the *EN 206-1: Concrete — Part 1: Specification, performances, production and conformity* are taken.

The references to EN 13369 by CEN/TC 229 product standards are intended to make them homogeneous and to avoid repetitions of similar requirements.

Eurocodes are taken as a common reference for design aspects. The installation of some structural precast concrete products is dealt with by EN 13670:2009 *Execution of concrete structures.* In all countries it can be accompanied by alternatives for national application.

The programme of standards for structural precast concrete products comprises the following standards, in some cases consisting of several parts:

— EN 1168, *Precast concrete products — Hollow core slabs*

— EN 12794, *Precast concrete products — Foundation piles*

— 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, *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*

— EN 15037, *Precast concrete products — Beams for beam-and-block floor systems*

This standard defines in Annex ZA the application methods of CE marking to products designed using the relevant EN Eurocodes (EN 1992-1-1 and EN 1992-1-2). Where, in default of applicability conditions of EN Eurocodes to the works of destination, design Provisions other than EN Eurocodes are used for mechanical strength and/or fire resistance, the conditions to affix CE marking to the product are described in ZA.3.4.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The evaluation of conformity given in this standard refers to the completed precast elements which are supplied to the market and covers all the production operations carried out in the factory.

For design rules and resistance to fire, reference is made to EN 1992-1-1 and EN 1992-1-2. Additional complementary rules are provided where necessary.

4.3.3 and 4.3.4 include specific provisions resulting from the application of EN 1992-1-1, and EN 1992-1-2 rules made specific for the concerned product. The use of these provisions is consistent with a design of works made with EN 1992-1-1 and EN 1992-1-2.

1 Scope

This document identifies the requirements, the basic performance criteria and evaluation of conformity for precast ribbed elements made of reinforced or prestressed normal weight concrete, used in floors or roofs. The elements consist of a top and/or bottom slab and one or more (usually two) ribs; transverse ribs may also be present.

Some examples of precast elements considered in this document are shown in Annex A.

Specific requirements for minor floor elements are listed in Annex B.

This document covers terminology, performance criteria, tolerances, relevant physical properties, test methods and aspects of transport and erection.

This document does not cover load-bearing capacity determined by testing.

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.

EN 1990:2002, *Eurocode: Basis of structural design*

EN 1991-1-6:2005, *Eurocode 1 — Actions on structures — Part 1-6: General actions — Actions during execution*

EN 1992-1-1:2004, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*

EN 1992-1-2:2004, *Eurocode 2: Design of concrete structures — Part 1-2: General rules — Structural fire design*

EN 13369:2004, *Common rules for precast concrete products*

3 Terms, definitions, and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1992-1-1:2004 and EN 13369:2004 and the following apply.

3.1.1
ribbed precast concrete element
precast unit consisting in a slab stiffened by one or more ribs

3.1.2
minor floor element
ribbed precast floor elements having limited dimensions, which are in compliance with Annex B

4 Requirements

4.1 Material requirements

For general aspects, reinforcing and prestressing steel, inserts and connectors, the relevant subclauses of EN 13369:2004, 4.1 shall apply. For constituent materials of concrete EN 206-1 applies. In particular, the ultimate tensile and tensile yield strength of steel shall be considered.

4.2 Production requirements

The production of precast ribbed elements shall comply with the requirements in EN 13369:2004, 4.2.

NOTE In addition to EN 13369:2004, 4.2.2 for cast-in-situ concrete considered to act compositely with precast units in the structural resistance (e.g. structural top layer), the minimum strength class is C 20/25.

In particular, the compressive strength of concrete shall be considered.

For minor floor elements, strength classes shall comply with B.2.3.

4.3 Finished product requirements

4.3.1 Geometrical properties

4.3.1.1 Production tolerances

Complementary to EN 13369:2004, 4.3.1.1 the following tolerances shall apply (Figure 1).

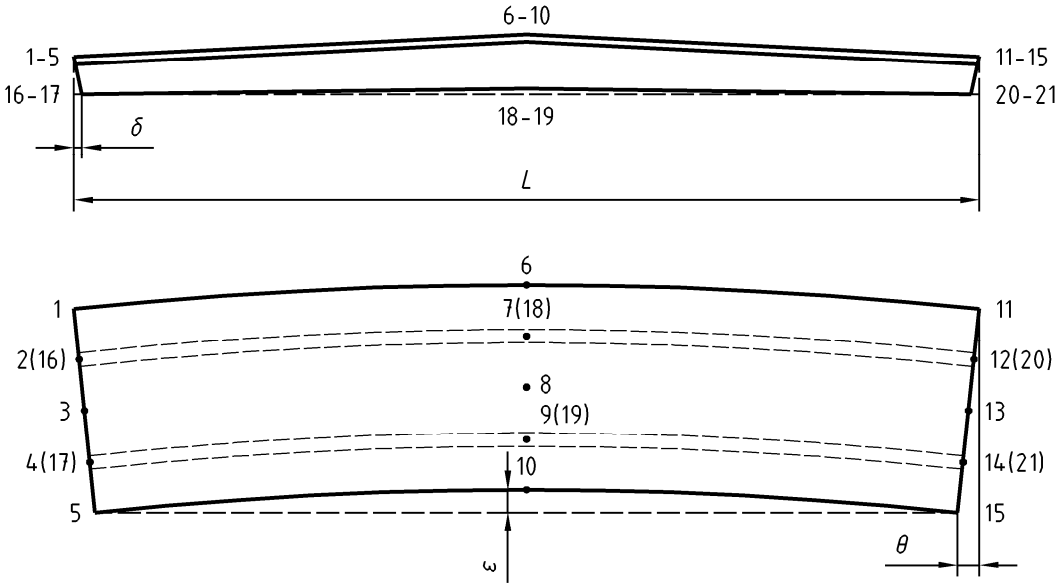

Figure 1 — Reference points for standard check of tolerances

DIMENSION	PERMITTED DEVIATION (mm)
Skewness (θ)	± 15
Lateral bow (ε)	± 10 or L/1 000 (whichever is greater)
Angular deviation of ribs (δ)	± 15

Methods of measurements are given in 5.3.

For prestressed elements the values of tolerance in lateral bow (ε) and angular deviation of ribs (δ) can be increased by 50 %; this includes the effect of prestressing tolerances.

For minor floor elements according to Annex B, the permitted deviation on length is ± 25 mm.

4.3.1.2 Minimum dimensions

EN 13369:2004, 4.3.1.2 shall apply.

4.3.1.3 Longitudinal connections

If the precast units are connected along their longitudinal edges by means of a cast in situ mortar or concrete joint, the minimum joint width shall be at least 30 mm at the top to allow satisfactory casting. The joint face shall be provided with at least one groove. The size shall be appropriate with regard to the shear resistance of the grout.

If tie bars are to be anchored within the joint, the joint width at the tie bar level shall be at least three times the diameter of the bar to enable a satisfactory bond and a complete encasing of the bar.

If welded connections are used, the connection devices should be designed in order to allow an easy compensation of camber and erection deviations and welding execution.

4.3.1.4 Concrete cover

For the protection against corrosion EN 13369:2004, 4.3.7 shall apply.

For minor floor elements see Annex B.

4.3.2 Surface characteristics

EN 13369:2004, 4.3.2 shall apply.

4.3.3 Mechanical resistance

4.3.3.1 General

EN 13369:2004, 4.3.3.1 to 4.3.3.5 shall apply except 4.3.3.4.

For minor floor elements see Annex B.

For transverse distribution of loads see Annex E.

For diaphragm actions see Annex F.

4.3.3.2 Transient situations

For transient situations, EN 13369:2004, 4.3.3.6 shall apply.

Unless compensating devices are used during lifting, each suspension point should be verified on the basis that only two are being active.

In the erection phases in which the access of workers on the elements can be expected, the construction loads of EN 1991-1-6 shall be considered and the supports for safety devices shall withstand the appropriate horizontal force, placed in the most unfavourable position of the upper side of the protection rail.

4.3.3.3 Shear reinforcement

It is allowed to omit the transversal shear reinforcement where it is not required by the resistance to loads or fire verification provided adjacent units are connected.

At least the minimum shear reinforcement according to EN 1992-1-1:2004, 9.2.2 shall be provided in the anchorage zone of prestressing tendons, unless a greater area is required by the relevant verification.

This minimum shear reinforcement is not required for ribbed elements used for roofs, provided the spalling stress in the webs is lower than the tensile strength of concrete at time of prestress release.

In ribs with a thickness not exceeding 120 mm the shear reinforcement may be shaped in one leg only, placed in the middle plane of the rib and properly anchored beyond the main reinforcement.

4.3.3.4 Shear and negative moments

In elements without shear reinforcement, negative moments and unintended restraining effects at the supports should be considered in the design of the elements and in the detailing of the connections at the supports in order to prevent possible restraint cracks which can initiate shear failure near the support.

Two methods to deal with negative or unintended fixing moments are applicable:

— detailing the connection in such a way that these negative moments will not occur;

— design by calculations. Design methods to consider negative or unintended moments are given in Annex C.

4.3.3.5 Longitudinal shear

EN 1992-1-1:2004, 6.2.4 shall apply.

If the composite action with a cast on site topping is considered, the manufacturer shall declare the type of roughness of the surface according to EN 1992-1-1:2004, 6.2.5.

4.3.4 Resistance and reaction to fire

4.3.4.1 Resistance to fire

Fire resistance dealing with load bearing capacity R, integrity E and insulation I of ribbed floor elements, expressed in terms of classes, shall be declared following EN 13369:2004, 4.3.4.1 and 4.3.4.2.

Load bearing classification R by calculation can be carried out using the thermal maps given in Annex D.

Load bearing classification R by tabulated data may be made on the basis of data given in EN 1992-1-2 using beam data for the ribs and slab data for the slab, respectively.

NOTE If the option of tabulated data is selected, as they do not take into account the actual position of the reinforcement nor the actual load level, they usually lead to an over dimensioning of the cross section.

4.3.4.2 Reaction to fire

For reaction to fire, EN 13369:2004, 4.3.4.4 shall apply.

4.3.5 Acoustic properties

EN 13369:2004, 4.3.5 shall apply.

4.3.6 Thermal properties

EN 13369:2004, 4.3.6 shall apply.

4.3.7 Durability

EN 13369:2004, 4.3.7 shall apply.

4.3.8 Other requirements

4.3.8.1 Safety in handling

EN 13369:2004, 4.3.8.1 shall apply.

4.3.8.2 Safety in use

EN 13369:2004, 4.3.8.2 shall apply.