

Betoonvalmistooted. Õõnespaneelid
KONSOLIDEERITUD TEKST

Precast concrete products - Hollow core slabs
CONSOLIDATED TEXT

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 1168:2006+A2:2009 sisaldab Euroopa standardi EN 1168:2005+A2:2009 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 30.04.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 11.03.2009.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 1168:2006+A2:2009 consists of the English text of the European standard EN 1168:2005+A2:2009.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 30.04.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 11.03.2009.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

ICS 91.060.30, 91.100.30

Võtmesõnad: betoonvalmistooted, ehitusmaterjalid, õõnespaneelid

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:
Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

English Version

Precast concrete products - Hollow core slabs

Produits préfabriqués en béton - Dalles alvéolées

Vorgefertigte Betonerzeugnisse - Vorgefertigte Hohlplatten

This European Standard was approved by CEN on 1 July 2004 and includes Amendment 1 approved by CEN on 14 January 2008 and Amendment 2 approved by CEN on 4 January 2009.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, 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 United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

The numbering of clauses is strictly related to EN 13369: Common rules for precast concrete products, at least for the first three digits. When a clause of EN 13369 is not relevant or included in a more general reference of this standard, its number is omitted and this may result in a gap on numbering.

Foreword.....	4
Introduction	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
3.1 Definitions	8
4 Requirements	9
4.1 Material requirements	9
4.1.1 Prestressing steel	9
4.2 Production requirements	9
4.2.1 Structural reinforcement	9
4.3 Finished product requirements	10
4.3.1 Geometrical properties	10
4.3.2 Surface characteristics	13
4.3.3 Mechanical resistance	13
4.3.4 Resistance and reaction to fire	20
4.3.5 Acoustic properties	20
4.3.6 Thermal properties	20
4.3.7 Durability	20
4.3.8 Other requirements	21
5 Test methods	21
5.1 Tests on concrete	21
5.2 Measuring of dimensions and surface characteristics	21
5.2.1 Element dimensions	21
5.3 Weight of the products	22
6 Evaluation of conformity	22
6.1 Ⓐ₂ General	22
6.2 Type testing	22
6.2.1 General	22
6.2.2 Initial type testing	22
6.2.3 Further type testing	23
6.3 Factory production control Ⓐ₂	23
7 Marking	23
7.1 General	23
8 Technical documentation	24
Annex A (normative) Inspection schemes	25
Annex B (informative) Typical shapes of joints	28
Annex C (informative) Transverse load distribution	30
Annex D (informative) Diaphragm action	38
Annex E (informative) Unintended restraining effects and negative moments	39
Annex F (informative) Mechanical resistance in case of verification by calculation: shear capacity of composite members	42

Annex G (informative) **Resistance to fire** 45

Annex H (informative) **Design of connections** 48

Annex J (normative) **A1 Full scale test A1** 50

Annex ZA (informative) **A2 Clauses of this European Standard addressing essential requirements or other provisions of EU Directives A2** 56

Bibliography 70

This document is a preview generated by EVS

Foreword

This document (EN 1168:2005+A2:2009) has been prepared by Technical Committee CEN/TC 229 "Precast concrete products", the secretariat of which is held by AFNOR ^{A2} and was examined by and agreed with a joint working party appointed by the Liaison Group CEN/TC 229 – CEN/TC 250, particularly for its compatibility with structural Eurocodes ^{A2}.

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 September 2009, and conflicting national standards shall be withdrawn at the latest by December 2010.

^{A1} This European Standard 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. ^{A1}

This document includes Amendment 1 approved by CEN on 2008-01-14 and Amendment 2 approved by CEN on 2009-01-04.

This document supersedes ^{A2} EN 1168:2005+A1:2008 ^{A2}.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ^{A1} ^{A1} and ^{A2} ^{A2}.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Construction Products Directives (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 ENV 13670-1: *Execution of concrete structures – Part 1: Common rules*, which has at the moment the status of an European Prestandard. In all countries it can be accompanied by alternatives for national application and it shall not be treated as a European standard.

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

- ^{A1} EN 1168:2005+A1 ^{A1}, *Precast concrete products – Hollow core slabs*
- ^{A1} EN 12794:2005+A1 ^{A1}, *Precast concrete products – Foundation piles*
- EN 12843, *Precast concrete products – Masts and poles*
- ^{A1} EN 13224:2004+A1 ^{A1}, *Precast concrete products – Ribbed floor elements*
- EN 13225, *Precast concrete products – Linear structural elements*

- EN 13693, *Precast concrete products – Special roof elements*
- $\boxed{A_1}$ EN 13747 $\boxed{A_1}$, *Precast concrete products – Floor plates for floor systems*
- $\boxed{A_1}$ EN 13978-1, *Precast concrete products - Precast concrete garages - Part 1: Requirements for reinforced garages monolithic or consisting of single sections with room dimensions* $\boxed{A_1}$
- $\boxed{A_1}$ EN 14843 $\boxed{A_1}$, *Precast concrete products - Stairs*
- $\boxed{A_1}$ EN 14844 $\boxed{A_1}$, *Precast concrete products – Box culverts*
- $\boxed{A_1}$ EN 14991 $\boxed{A_1}$, *Precast concrete products – Foundation elements*
- $\boxed{A_1}$ EN 14992, *Precast concrete products – Wall elements* $\boxed{A_1}$
- $\boxed{A_2}$ EN 15037-1, *Precast concrete products – Beam-and-block floor systems – Part 1: Beams*
- EN 15037-2, *Precast concrete products – Beam-and-block floor systems – Part 2: Concrete blocks*
- EN 15037-3, *Precast concrete products – Beam-and-block floor systems – Part 3: Clay blocks*
- prEN 15037-4, *Precast concrete products – Beam-and-block floor systems – Part 4: Polystyrene blocks*
- prEN 15037-5, *Precast concrete products – Beam-and-block floor systems – Part 5: Lightweight blocks* $\boxed{A_2}$
- $\boxed{A_1}$ EN 15258 $\boxed{A_1}$, *Precast concrete products – Retaining wall elements*
- $\boxed{A_1}$ EN 15050 $\boxed{A_1}$, *Precast concrete products – Bridge elements*

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, 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 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 reference is made to EN 1992-1-1. Additional complementary rules are provided where necessary.

The verification of the mechanical resistance of hollow core slabs is, at this stage of standardisation, only fully accepted by calculation; ^{A2} however, concrete properties adopted as input for calculation of shear resistance depend on the proper functioning of the production machine; therefore a full scale test method to confirm both the shear resistance obtained by calculation and the proper functioning of the production machine, is given in Annex J (normative). ^{A2}

Special rules for structures with hollow core elements are presented in annexes about load distribution (Annex C), diaphragm action (Annex D), negative moments (Annex E), shear capacity of composite members (Annex F) and design of connections (Annex H).

Because of some specialities of the product, e.g. the absence of transverse reinforcement, some complementary design rules to EN 1992-1-1 are necessary. Furthermore, research on hollow core slabs has resulted in special, widely used, design rules which are not incorporated in the design rules of EN 1992-1-1. According to subclause 1.2 of EN 1992-1-1:2004 the complementary rules, given in informative annexes in this standard, comply with the relevant principles given in EN 1992-1-1.

Because of the fact that the experimental evidence is mainly based on elements with limited depth and width, this standard is applicable to elements with these limited dimensions. This limitation is not intended to prohibit the application of elements with larger sizes, but the experience is not yet wide enough to draw up standardised design rules.

1 Scope

This European Standard deals with the requirements and the basic performance criteria and specifies minimum values where appropriate for precast hollow core slabs made of prestressed or reinforced normal weight concrete according to EN 1992-1-1:2004.

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

Hollow core elements are used in floors, roofs, walls and similar applications. In this European Standard the material properties and other requirements for floors and roofs are dealt with; for special use in walls and other applications, see the relevant product standards for possible additional requirements.

The elements have lateral edges provided with a longitudinal profile in order to make a shear key for transfer of vertical shear through joints between contiguous elements. For diaphragm action the joints have to function as horizontal shear joints.

The elements are manufactured in factories by extrusion, slipforming or mouldcasting.

The application of the standard is limited for prestressed elements to a maximum depth of $\boxed{A_1}$ 500 $\boxed{A_1}$ mm and a maximum width of 1 200 mm. For reinforced elements the maximum depth is limited to 300 mm and the maximum width without transverse reinforcement to 1 200 mm and with transverse reinforcement to 2 400 mm.

The elements may be used in composite action with an in situ structural topping cast on site.

The applications considered are floors and roofs of buildings, including areas for vehicles in the category F and G of $\boxed{A_2}$ EN 1991-1-1 $\boxed{A_2}$ which are not subjected to fatigue loading. For building in seismic zones additional provisions are given in EN 1998-1.

This European Standard does not deal with complementary matters. E.g. the slabs should not be used in roofs without additional protection against water penetration.

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 206-1:2000, *Concrete – Part 1: Specification, performance, production and conformity*

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 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 12390-4:2000, *Testing hardened concrete – Part 4: Compressive strength – Specification for testing machines*

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

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

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

$\boxed{A_1}$ EN 13791, *Assessment of in-situ compressive strength in structures and precast concrete components* $\boxed{A_1}$