BRITISH STANDARD

BS EN 1168:2005 +A3:2011

# Precast concrete products — Hollow core slabs

ICS 91.060.30; 91.100.30

# National foreword

This British Standard is the UK implementation of EN 1168:2005+A3:2011. It supersedes BS EN 1168:2005+A2:2009, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by ⟨A1⟩ ⟨A1⟩.

EN 1168 is a candidate "harmonized" European standard and fully takes into account the requirements of the European Commission mandate M/100, Precast concrete products, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking. The date of applicability of EN 1168 as a harmonized European Standard, i.e. the date after which this standard may be used for CE marking purposes, is subject to an announcement in the *Official Journal of the European Communities*.

The Commission in consulation with Member States has agreed a transition period for the co-existence of harmonized European Standards and their corresponding national standard(s). It is intended that this period will comprise a period, usually nine months, after the date of availability of the European Standard, during which any required changes to national regulations are to be made, followed by a further period, usually of 12 months, for the implementation of CE marking. At the end of this co-existence period, the national standard(s) will be withdrawn. In the UK, there are no corresponding national standards.

The UK participation in its preparation was entrusted to Technical Committee B/524, Precast concrete products.

In the opinion of the UK national committee, this product standard does not provide a satisfactory link between product design and building/project design. The design of the bearing support details is likely to include horizontal forces at the support from restraint effects (shrinkage, temperature, creep, etc.) and these forces need to be considered in the plank design. Reference should be made to *Design of Hybrid Contrete Buildings* published by The Concrete Centre (2009).

Subclause 4.3.3.2.2.1 of this Product Standard provides an alternate method of design of Hollowcore Units for shear to that given in EN 1992-1-1:2004, subclause 6.2.2, in regions uncracked in bending. Therefore, use of this method could result in a design that does not conform to the Eurocode EN 1992-1-1:2004.

Practice in the UK has been for the engineer responsible for the overall stability of the structure to ensure the compatibility of the design and details of parts and components, even when some or all of the design and details of those parts are not made by this engineer.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 9 August 2005



**Amendments/corrigenda issued since publication**

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| 28 February 2011 | Implementation of CEN consolidated amendments A1:2008 and A2:2009 |
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EUROPEAN STANDARD

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# EN 1168:2005+A3

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English Version

# Precast concrete products - Hollow core slabs

Produits préfabriqués en béton - Dalles alvéolées

Betonfertigteile - Hohlplatten

This European Standard was approved by CEN on 1 July 2004 and includes Amendment 1 approved by CEN on 14 January 2008, Amendment 2 approved by CEN on 4 January 2009 and Amendment 3 approved by CEN on 11 August 2011.

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-CENELEC 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-CENELEC Management Centre has the same status as the official versions.

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

**Management Centre: Avenue Marnix 17, B-1000 Brussels**



Ref. No. EN 1168:2005+A3:2011: E

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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.

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## Foreword

This document (EN 1168:2005+A3:2011) 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, particularely 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 April 2012, and conflicting national standards shall be withdrawn at the latest by July 2013.

[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, Amendment 2 approved by CEN on 2009-01-04 and Amendment 3 approved by CEN on 2011-08-11.

This document supersedes [A3] EN 1168:2005+A2:2009 [A3].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1], [A2] [A2] and [A3] [A3].

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.

[A3] Eurocodes are taken as a common reference for design aspects. The installation of some structural precast concrete products is dealt with by EN 13670. In all countries it can be accompanied by alternatives for national application. [A3]

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*

— [A1] EN 13747 [A1], *Precast concrete products – Floor plates for floor systems*

— [A1] EN 13978-1, *Precast concrete products - Precast concrete garages - Part 1: Requirements for reinforced garages monolithic or consisting of single sections with room dimensions* [A1]

— [A1] EN 14843 [A1], *Precast concrete products - Stairs*

— [A1] EN 14844 [A1], *Precast concrete products – Box culverts*

— [A1] EN 14991 [A1], *Precast concrete products – Foundation elements*

— [A1] EN 14992, *Precast concrete products – Wall elements* [A1]

— [A2] 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* [A2]

— [A1] EN 15258 [A1], *Precast concrete products – Retaining wall elements*

— [A1] EN 15050 [A1], *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, 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 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).

[A3] Special rules for pre-stressing by means of thermal pre-stressing are given in Annex K. [A3]

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.

[A3] The elements have lateral edges with a grooved profile in order to make a shear key to transfer shear through joints contiguous elements. [A3] For diaphragm action the joints have to function as horizontal shear joints.

[A3] To improve this action vertical grooves may be provided. [A3]

The elements are manufactured in factories by extrusion, slipforming or mouldcasting. [A3] Fitting slabs (narrowed slab elements) and recesses to the hollow core slabs can be made during production or afterwards. Hollow core slabs can have provisions for thermal activation, heating, cooling, sound insulation, etc. Due to these provisions, the concrete temperature remains in it's natural range. [A3]

[A3] This European Standard also deals with solid slab elements used in conjunction with hollow core slabs and manufactured by extrusion, slipforming or mouldcasting, equivalent to the manufacturing of hollow core slabs. These solid slabs have the same overall cross-section as hollow core slabs, however without hollow cores. [A3]

[A3] The application of the standard is limited for prestressed elements to a maximum depth of 500 mm and for reinforced elements to a maximum depth of 300 mm.

For both types, the maximum width without transverse reinforcement is limited to 1 200 mm and with transverse reinforcement to 2 400 mm. [A3]

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 [A2] EN 1991-1-1 [A2] 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*