SLOVENSKI STANDARD
SIST EN 1168:2005/kFprA3:2011

01-april-2011

Montažni betonski izdelki - Votle plošče

Precast concrete products - Hollow core slabs

Betonfertigteile - Hohlplatten

Produits préfabriqués en béton - Dalles alvéolées

Ta slovenski standard je istoveten z: EN 1168:2005/FprA3

ICS:

91.100.30	Beton in betonski izdelki	Concrete and concrete products

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This draft amendment is submitted to CEN members for unique acceptance procedure. It has been drawn up by the Technical Committee CEN/TC 229.

This draft amendment A3, if approved, will modify the European Standard EN 1168:2005+A2:2009. If this draft becomes an amendment, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration.

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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/FprA3:2011: E

Foreword

This document (EN 1168:2005/FprA3:2011) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR.

This document is currently submitted to the Unique Acceptance Procedure.

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.

1 Modification to the Foreword

Replace paragraph 13, referring to Eurocodes, with the following:

"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.".

2 Modification to the Introduction

Add the following paragraph after the 4th paragraph:

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

3 Modifications to Clause 1, Scope

Replace the 1st sentence of the 4th paragraph with the following:

"The elements have lateral edges with a grooved profile in order to make a shear key to transfer shear through joints contiguous elements.".

Add after this paragraph the following new paragraph:

"To improve this action vertical grooves may be provided.".

Add after the 1st sentence of the 5th paragraph:

"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.".

Add after the 5th paragraph the following new paragraph:

"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.".

Replace the 6th paragraph with the following:

"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.".

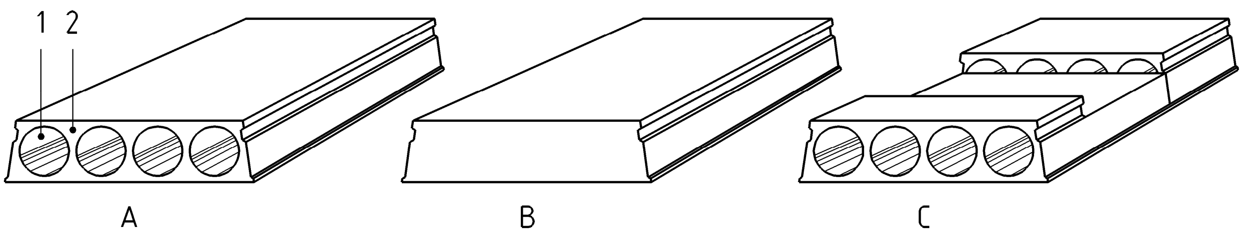
4 Modification to Clause 2, Normative references

Add the following reference:

"EN ISO 15630-3, *Steel for the reinforcement and prestressing of concrete — Test methods - Part 3: Prestressing steel (ISO 15630-3:2010)*".

~~5~~ Modifications to 3.1, Definitions

Replace Figure 1 in 3.1.1 with the following: "



Key

A hollow core slab

B solid slab

C combined slab

1 core

2 web

Figure 1 — Types of hollow core slabs (examples)".

Insert three new definitions after 3.1.1: "

3.1.2
solid slab
slab with the same overall cross-section as a hollow core slab where, during manufacturing no voids are made (Figure 1 B). This slab is manufactured in the same manner (machine, bed, …) as hollow core slabs with voids

NOTE Hollow core slabs where the voids are filled with concrete after manufacturing of the hollow core element can not be considered as a solid slab.

3.1.3
combined slab
hollow core slab that has partially a solid cross section (Figure 1 C). The depth of the cross section may vary over the length of the element

3.1.4
fitting slab
slab sawn from a standard slab with a width ≥ 250 mm with at least two webs".

Update the term numbers as follows:

3.1.2 core into 3.1.5 core

3.1.3 web	into 3.1.6 web
3.1.4 lateral joint	into 3.1.7 lateral joint
3.1.5 topping	into 3.1.8 topping
3.1.6 screed	into 3.1.9 screed
3.1.7 hollow core slab floor	into 3.1.10 hollow core slab floor
3.1.8 composite hollow core slab floor	into 3.1.11 composite hollow core slab floor

Add 3.1.12: "

3.1.12
solid slab floor
floor made of solid core slabs after the grouting of the joints".

Add 3.1.13: "

3.1.13
composite solid slab floor
solid slab floor complemented by a cast in situ topping".

6 Modification to 4.1.1.1, Maximum diameter of prestressing steel

Replace the text of the subclause with the following:

"The diameter of pre-stressing steel is limited to:

— Class 1: Elements with pre-stressing steel with a maximum of 11 mm for wires and 16 mm for strands;

— Class 2: Elements with thermal pre-stressed bars with a maximum of 16 mm.

The use of pre-stressing bars is only allowed in accordance with Annex K.".

7 Modification to 4.2.1.1.1, Longitudinal bars

Replace the existing text of c) with the following: "

c) in the outermost webs there shall be at least one bar, for solid slabs, the equivalent position shall be considered;".

8 Modifications to 4.3.1.1.2, Tolerances for construction purposes

Replace the text of b) with the following: "

b) slab width:

— general ± 5 mm;

— in case of fitting slabs ± 25 mm;

Add d) as follows: "

d) length of protruding strands.

The minus deviation from the measured length of the protruding part of the protruding strand in regard to the nominal (design) value:

— 10 mm.

This value may be increased with half of the actual deviation (positive) of the measured slab length (a)).".

9 Addition of 4.3.1.2.5 Vertical grooves shape

Add a new subclause 4.3.1.2.5: "

4.3.1.2.5 Vertical grooves shape

The shape of possible vertical grooves used to improve the diaphragm action shall be appropriate with regard to the resistance of the grout against horizontal shear. A typical shape of vertical grooves is given in Annex B.

In any case vertical grooves shall not be compulsory for diaphragm action, but only an additional provision.".

10 Modification to 4.3.3.2.1, Resistance to spalling for prestressed hollow core slabs

Replace the definitions for P_0 and b_w with the following: "

P_0 is the initial prestressing force just after release in the considered web or the total prestressing force of the slab in case of solid slabs;

b_w is the thickness of the individual web or the total width b of the slab in case of a solid slab;".

11 Modification to 4.3.3.2.2, Shear and torsion capacity

Replace the whole subclause with the following: "

4.3.3.2.2.1 General verification procedure

Shear failure of hollow-core slabs without shear reinforcement may occur in regions cracked by bending or in regions uncracked by bending. If a flexural crack arises within the anchorage length of the reinforcement, an anchorage failure can also occur. All the three failure modes shall be considered.

1) Shear resistance in cracked regions shall be calculated using EN 1992-1-1:2004, Expressions (6.2.a) and (6.2.b).

2) Shear resistance in uncracked regions shall be calculated using EN 1992-1-1:2004, Expression (6.4), taking into account, when relevant, the additional shear stresses due to the transmission of the prestressing force and referring to the most unfavourable position in the cross section. A procedure to apply this calculation is given in 4.3.3.2.2.2 and 4.3.3.2.2.3.

NOTE A guidance on the calculation of the additional shear stresses in the anchorage zones of prestressing tendons can also be found in CEB-FIP Model Code 90, clause 6.9.12.

3) Resistance against anchorage failure shall be calculated following EN 1992-1-1:2004, 9.2.1.4.

In case of flexible supports, the reducing effect of transversal shear stresses on the shear resistance shall be taken into account.

For hollow-core slabs deeper than 450 mm the shear strength, both for regions cracked and uncracked by bending, shall be reduced by 10 % with respect to the equations and procedures quoted above.

4.3.3.2.2.2 Shear resistance in uncracked regions

Regions uncracked by bending are defined by a flexural tensile stress smaller than $f_{\mathrm{ctk0,05}}/\gamma_{\mathrm{C}}$. Here the shear resistance shall be calculated with the following equation:

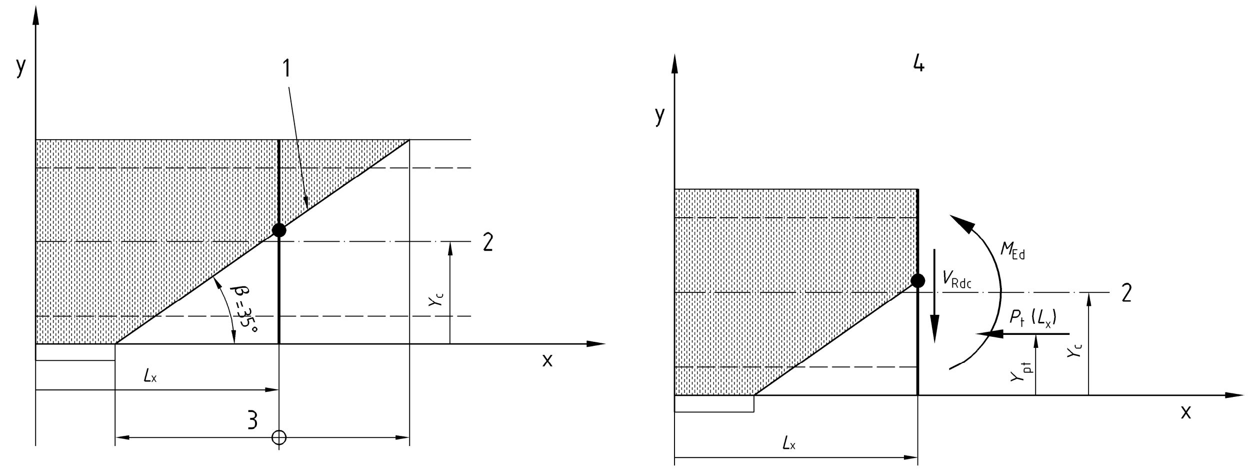
$$V_{\mathrm{Rdc}} = \frac{I b_{\mathrm{w}}(y)}{S_{\mathrm{c}}(y)} \left(\sqrt{(f_{\mathrm{ctd}})^2 + \sigma_{\mathrm{cp}}(y) f_{\mathrm{ctd}}} - \tau_{\mathrm{cp}}(y) \right)$$

where

$$\sigma_{\mathrm{cp}}(y) = \sum_{t=1}^{\mathrm{n}} \left\{ \left[\frac{1}{A} + \frac{(Y_{\mathrm{c}} - y)(Y_{\mathrm{c}} - Yp_{\mathrm{t}})}{I} \right] \times P_{\mathrm{t}}(l_{\mathrm{x}}) \right\} - \frac{M_{\mathrm{Ed}}}{I} \times (Y_{\mathrm{c}} - y) \qquad \text{(positive if compressive)}$$

$$\tau_{\mathrm{cp}}(y) = \frac{1}{b_{\mathrm{w}}(y)} \times \sum_{t=1}^{\mathrm{n}} \left\{ \left[\frac{A_{\mathrm{c}}(y)}{A} - \frac{S_{\mathrm{c}}(y) \times (Y_{\mathrm{c}} - Yp_{\mathrm{t}})}{I} + Cp_{\mathrm{t}}(y) \right] \times \frac{dP_{\mathrm{t}}(l_{\mathrm{x}})}{dx} \right\}$$

This equation shall be applied with reference to the critical points of a straight line of failure rising from the edge of the support with an angle β = 35° with respect to the horizontal axis. The critical point is the point on the quoted line where the result of the expression of $V_{\mathrm{Rd,c}}$ is the lowest.



Key

1 line of failure

2 height of centroidal axis

3 considered cross-section

4 forces in considered cross-section

Figure 3 a) Line of failure

Figure 3 b) Forces and moments in considered cross-section

Figure 3 — Shear structure in uncracked regions

The definition of symbols is given here below.

I is the second moment of area of the cross section

$b_w(y)$ is the web width at the height y

Y_c is the height of the centroidal axis

$S_c(y)$ is the first moment of the area above height y and about the centroidal axis

y is the height of the critical point on the line of failure

l_x is the distance of the considered point on the line of failure from the starting point of the transmission length (= x)

$\sigma_{cp}(y)$ is the concrete compressive stress at the height y and distance l_x

n is the number of tendon layers

A is the fictive cross section surface

$P_t(l_x)$ is the prestressing force in the considered tendon layer at distance l_x. The transfer of prestress shall be taken into account according to EN 1992-1-1:2004, 8.10.2.2

M_{Ed} is the bending moment due to the vertical load

$\tau_{cp}(y)$ is the concrete shear stress due to transmission of prestress at height y and distance l_x

$A_c(y)$ is the area above height y

$Cp_t(y)$ is a factor taking into account the position of the considered tendon layer
$Cp_t = -1$ when $y \leq Yp_t$

$Cp_t = 0$ when $y > Yp_t$

Yp_t is the height of the position of considered tendon layer

4.3.3.2.2.3 Simplified expression

As an alternative to the above equation, the following simplified equation may be applied

$$V_{Rdc} = \varphi \frac{I b_w}{S} \sqrt{(f_{ctd})^2 + \beta \alpha_\ell \sigma_{cp} f_{ctd}}$$

where

I is the second moment of area;

S is the first moment of area above and about the centroidal axis

b_w is the width of the cross-section at the centroidal axis,

$\alpha_\ell = l_x / l_{pt2}$ is the degree of prestressing transmission ($\alpha_l \leq 1{,}0$);

l_x is the distance of the considered section from the starting point of transmission length;

l_{pt2} upper value of transmission length (see EN 1992-1-1:2004, Expression (8.18));