

Precast concrete products — Floor plates for floor systems

ICS 91.100.30

National foreword

This British Standard is the UK implementation of EN 13747:2005+A2:2010, incorporating corrigendum December 2006. It supersedes BS EN 13747:2005+A1:2008 which is withdrawn.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.

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

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

EN 13747 is a “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.

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.

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Precast concrete products - Floor plates for floor systems

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de planchers

Betonfertigteile - Deckenplatten mit Ortbetonerfüllung

This European Standard was approved by CEN on 17 February 2005 and includes Corrigendum 1 issued by CEN on 6 December 2006, Amendment 1 approved by CEN on 14 September 2008 and Amendment 2 approved by CEN on 14 February 2010.

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.

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Foreword

This document (EN 13747:2005+A2:2010) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR, 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.

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 2010, and conflicting national standards shall be withdrawn at the latest by September 2010.

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 European Standard includes Corrigendum 1 issued by CEN on 2006-12-06, Amendment 1 approved by CEN on 2008-09-14 and Amendment 2 approved by CEN on 2010-02-14.

This document supersedes  EN 13747:2005+A1:2008 .

The start and finish of text introduced or altered by amendment is indicated in the text by tags   and  .

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags  .

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 EU Directive 89/106/EEC.

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 a 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 on 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 13747, *Precast concrete products — Floor plates for floor systems*

-  prEN 15037, *Precast concrete products — Beam-and-block floor systems* 
- EN 13224, *Precast concrete products — Ribbed floor elements*
- EN 13225, *Precast concrete products — Linear structural elements*
- EN 14992, *Precast concrete products — Wall elements*
- EN 13693, *Precast concrete products — Special roof elements*
- EN 14844, *Precast concrete products — Box culverts*
- EN 13978, *Precast concrete products — Precast concrete garages*
- EN 14991, *Precast concrete products — Foundation elements*
- EN 15050, *Precast concrete products — Bridge elements*
- EN 14843, *Precast concrete products — Stairs*

This standard defines in Annex ZA the application methods of CE marking to products designed using the relevant EN Eurocodes (EN 1992-1-1:2004 and EN 1992-1-2:2004). 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 reference is made to EN 1992-1-1:2004. Additional complementary rules are provided where necessary.

In clauses 4.3.3 and 4.3.4, the present standard includes specific provisions resulting from the application of EN 1992-1-1:2004 and EN 1992-1-2:2004 rules made specific for the concerned product. The use of these provisions is consistent with a design of works made with EN 1992-1-1:2004 and EN 1992-1-2:2004.

1 Scope

This European standard deals with the requirements, the basic performance criteria and evaluation of conformity for precast floor plates made of reinforced or prestressed normal weight concrete according to EN 1992-1-1:2004, used in conjunction with cast-in-situ concrete (topping) for the construction of composite floor slabs. Annex B gives different types of composite slabs made with floor plates.

These floor plates, with or without void formers, can include lattice girders or stiffening ribs incorporated during the precasting.

They shall be manufactured in factories by casting, slip forming or extrusion.

A2 If major part of mechanical resistance is taken up by the precast stiffening ribs, the product belongs to EN 1168 or to EN 13224, according to the section. **A2**

The products covered by this standard are intended to be used as part of structural floors in applications such as:

- floors and roofs of buildings (including industrial and storage buildings, public buildings as schools, hospitals, etc.);
- parking/circulation areas;
- cover for culverts;
- etc.

A2 Floor plates for bridge decks belong to the scope of EN 15050 and are not covered by this European Standard. **A2**

The products may be used in seismic areas provided they fulfil the requirements specific to this use.

This standard does not cover:

- reinforced **A1** and prestressed **A1** floor plates with a nominal thickness less than 40 mm;
- prestressed floor plates with a nominal thickness less than 50 mm **A1** without stiffening ribs or lattice girder **A1**;
- floor plates with a very smooth upper face, such as defined in 6.2.5 of EN 1992-1-1:2004.

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

AC EN 10080:2005 **AC**, *Steel for the reinforcement of concrete — Weldable reinforcing steel — General*

EN 12390-4, *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 1991-1-1:2002, *Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings*

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*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply. For general terms EN 13369:2004 shall apply.

3.1 Floor plates

3.1.1

floor plate

reinforced or prestressed concrete plates generally used as a permanent formwork A_2 for cast-in-situ concrete, which, when hardened, forms a structurally composite slab with the floor plate

NOTE Some floor plates may be used as formwork for cast-in-situ concrete, with no contribution to the strength of the finished floor.

3.1.2

reinforced floor plate

floor plate in which reinforcing steel constitutes the main reinforcement of the composite slab

3.1.3

prestressed floor plate

floor plate in which the prestressing steel constitutes all or part of the main reinforcement of the composite slab

3.1.4

floor plate with lattice girders

floor plate in which continuous lattice girders are incorporated generally in the longitudinal direction (i.e. parallel to the span) to provide strength and rigidity for transient situations

3.1.5

floor plate with ribs

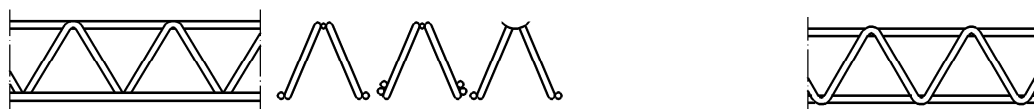
floor plate in which continuous stiffening ribs are positioned generally in the longitudinal direction (i.e. parallel to the span) to provide strength and rigidity for transient situations

3.2

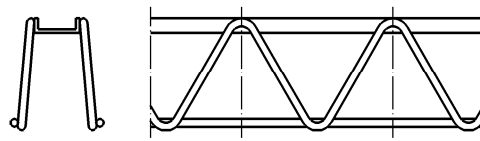
lattice girders

two dimensional or three dimensional metallic structure comprising an upper chord, one or more lower chords and continuous or discontinuous diagonals which are welded or mechanically connected to the chords

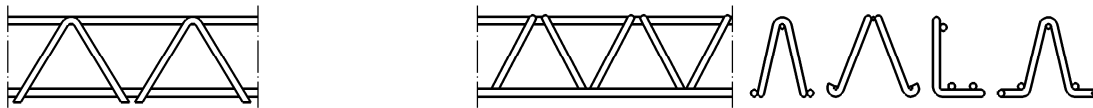
Figure 1 gives some examples of lattice girders.



a) continuous diagonals



b) continuous diagonals with steel profile unfilled with concrete

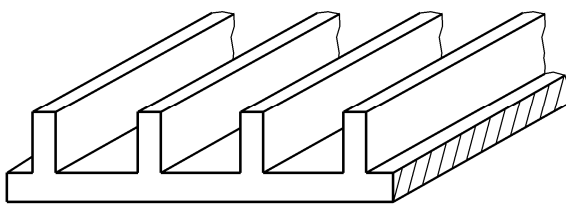


c) discontinuous diagonals

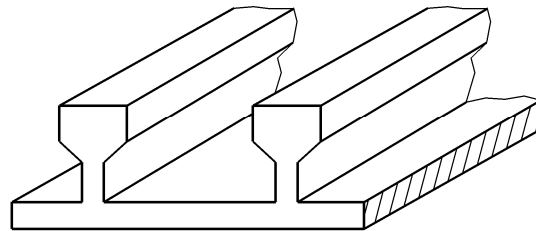
Figure 1 — Examples of lattice girders

3.3 stiffening rib

continuous concrete profile formed on the upper surface of the floor plate during the precasting operation. It extends generally in the main direction of the floor plate. Figure 2 gives examples of different stiffening rib configurations



a) rectangular ribs



b) T-section ribs

Figure 2 — Examples of stiffening ribs

3.4 Dimensions

3.4.1 length, L

dimension of the product in the main mechanical direction (i.e. supporting the most important bending moment) $\text{[A}_2\text{]}$, protruding reinforcement, if any, not included $\text{[A}_2\text{]}$

3.4.2 width, b

dimension perpendicular to the length

3.4.3 thickness, h_p

nominal distance between the upper and the lower faces of the floor plate. Where the upper surface is uneven (see Figure 3) the distance should be measured to the mean plane of the surface

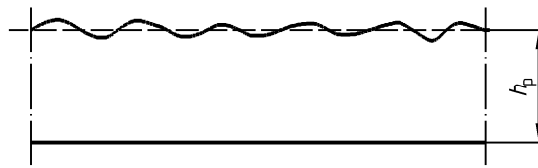


Figure 3 — Thickness h_p of a floor plate

3.4.4 edge

side of the floor plate. A distinction is made between:

- supported edge: edge intended for connection to the support elements of the structure;
- lateral edge: edge between contiguous floor plates;
- free edge: edge left free after construction of the floor

3.4.5 upper face

face of the floor plate when in its final position of use. It forms the interface with cast-in-situ topping above the floor plate

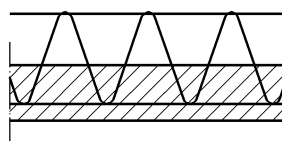
3.4.6 lower face

visible face of the precast element in opposition to the upper face

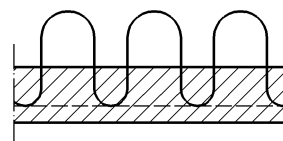
3.5 Reinforcements

3.5.1 connecting reinforcement

reinforcement anchored on both sides of the interface between the floor plate and the cast-in-situ concrete. It consists of the diagonals of the lattice girder, individual or continuous reinforcement in the form of loops, possibly with a longitudinal bar welded at the top and/or bottom (see Figure 4).



a) lattice girder



b) loops

Figure 4 — Examples of connecting reinforcement

3.5.2

shear reinforcement

reinforcement with angles, α and β , generally between 45° and 90° to the plane of the floor plate and the cast-in-situ concrete. In practice it consists of pieces of lattice girders, loops or stirrups (see Figure 5)



Figure 5 — Examples of shear reinforcements

3.6 Void formers

3.6.1

void former

element glued, connected or otherwise incorporated into the floor plate during or after precasting (see Figure 6), but before delivery. These elements are generally intended to decrease the weight of the floor

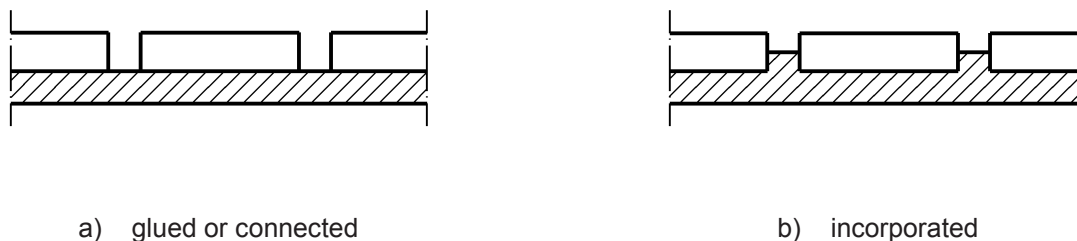


Figure 6 — Void formers

3.6.2

non-structural void former

void former that does not contribute to the mechanical strength of the composite slab

3.6.3

structural void former

void former that, together with the cast-in-situ concrete, contributes to the mechanical strength of the composite slab

3.7

cast in unit

unit incorporated into the floor plate during precasting, e.g. lifting inserts, junction or switch boxes, conduits, ducts, etc.

3.8

topping

in-situ concrete layer cast over the entire floor plate surface, so that it acts monolithically by bond, with or without connecting reinforcement

3.9

composite slab

slab comprising a floor plate and bonded topping, which together behave as a monolithic slab after the hardening of the topping

4 Requirements

4.1 Material requirements

4.1.1 General

Clause 4.1.1 of EN 13369:2004 shall apply.

4.1.2 Constituent materials of concrete

Clause 4.1.2 of EN 13369:2004 shall apply.

4.1.3 Reinforcing steel

4.1.3.1 Bars, coils and welded fabric

Clause 4.1.3 of EN 13369:2004 shall apply.

4.1.3.2 Lattice girders

Bars and coils used in production of lattice girder shall comply with EN 10080.

The weld strength or the mechanical strength of joints of lattice girder shall match the anchorage requirements in the concrete.

4.1.3.3 Connecting reinforcement

Connecting reinforcement, other than lattice girder, shall be ribbed, indented or smooth steel complying with their relevant standards. Where its suitability can be proven prestressing wires and strands may also be used.

When a welded longitudinal bar is present the steel of connecting reinforcement shall be weldable.

The weld strength or the mechanical strength of joints of connecting reinforcement shall match the anchorage requirements in the concrete.

4.1.4 Prestressing steel

Clause 4.1.4 of EN 13369:2004 shall apply.

For prestressing steel, the nominal diameter shall be less than or equal to 13 mm. Only indented wire or strands made of several smooth or indented wires shall be used.

4.1.5 Inserts and connectors

Clause 4.1.5 of EN 13369:2004 shall apply.

4.2 Production requirements

4.2.1 Concrete production

Clause 4.2.1 of EN 13369:2004 shall apply.

4.2.2 Hardened concrete

4.2.2.1 Strength classes

Clause 4.2.2.1 of EN 13369:2004 shall apply.

4.2.2.2 Compressive strength

Clause 4.2.2.2 of EN 13369:2004 shall apply. In addition, the minimum concrete compressive strength at delivery shall be specified.

The concrete class shall not be less than C25/30 for reinforced floor plates and C30/37 for prestressed floor plates.

$\square_{A2}$ The minimum concrete cylinder strength at delivery shall not be less than 15 MPa for reinforced floor plates and 20 MPa for prestressed floor plates. $\square_{A2}$

4.2.2.3 Tensile strength

When a characteristic value or a minimum value for the concrete tensile strength is referred to, it shall be expressed as axial tensile strength. It should be determined by testing (for example by converting values obtained according to EN 12390-6 or deduced from the compressive strength at the same age by applying 3.1.2 of EN 1992-1-1:2004).

4.2.3 Structural reinforcement

4.2.3.1 Processing of reinforcing steel

Clause 4.2.3.1 of EN 13369:2004 shall apply.

4.2.3.2 Tensioning and prestressing

4.2.3.2.1 Initial tensioning stresses

Clause 4.2.3.2.1 of EN 13369:2004 shall apply.

$\square_{A2}$ Spalling stress in the ribs without shear reinforcement shall be evaluated and shall not exceed the tensile strength of concrete at prestress release. $\square_{A2}$

4.2.3.2.2 Accuracy of tensioning

Clause 4.2.3.2.2 of EN 13369:2004 shall apply.

4.2.3.2.3 Minimum concrete strength at transfer

At the time of transfer of prestressing, the minimum compressive strength, $f_{cmin,p}$, measured on cylinder specimens shall be at least $(5/3) \sigma_{cp}$ where σ_{cp} is the compressive stress developed in the bottom fibre of the floor plate under the final prestressing force, or 20 MPa, whichever is the greater.

Minimum concrete strength at transfer shall be verified in accordance with 5.1.

4.2.3.2.4 Slippage of tendons

For sawn products, Clause 4.2.3.2.4 of EN 13369:2004 shall apply.

For protruding tendons, 2 classes are given:

- class A: the maximum slippage values are evaluated according to 4.2.3.2.4 of EN 13369:2004;
- class B: the maximum slippage values are deduced from Table 1. If the initial prestressing force, σ_0 , is lower than the maximum prestressing force, $\sigma_{0\max}$, as defined in 4.2.3.2.1 of EN 13369:2004, the values of Table 1 shall be reduced by $\sigma_0/\sigma_{0\max}$ ratio.

Table 1 — Maximum slippage values for prestressing tendons, ΔL_0 , in mm

Wires			Strands		
diameter	$f_{cmin,p} = 20 \text{ MPa}$	$f_{cmin,p} = 30 \text{ MPa}$	diameter	$f_{cmin,p} = 20 \text{ MPa}$	$f_{cmin,p} = 30 \text{ MPa}$
Ø 4	2,0	2,0	Ø 5,2	2,5	2,5
Ø 5	2,2	2,0	Ø 6,85	2,8	2,5
Ø 6	2,4	2,0	Ø 9,3	3,0	2,5
Ø 7	2,6	2,3	Ø 12,5	3,5	3,0

NOTE “Good” bond conditions may be assumed for extruded, slipformed and cast elements on conditions given in Figure 8.2 of EN 1992-1-1:2004.

Slippage of tendons shall be verified in accordance with 5.4.2.

4.2.3.2.5 Limit values for prestressing force

The value of the prestressing force shall be limited by the following two conditions:

a) Minimum prestress

The mean value of compressive stress, $\sigma_{p,m}$, in the concrete cross section of the floor plate as a result of the only action of the final prestressing force shall not be less than 1,5 MPa.

b) Maximum prestress

In the absence of reinforcement in upper part of the floor plate, the maximum tensile stress in the upper fibre of the floor plate shall be limited to $0,30 f_{cmin,p}^{2/3}$.

NOTE $f_{cmin,p}$ is the strength of the concrete at the time of prestressing.

The maximum compressive stress in the lower part of the floor plate shall not exceed $0,66 f_{cmin,p}$.

4.2.3.2.6 Losses of prestress

The final prestressing force, $P_{m,\infty}$, is equal to the initial prestressing force, P_0 , less the total losses ΔP after an infinite time.

For the determination of prestressing losses, in the absence of more accurate calculation, the values should be deduced from Table 2.

Table 2 — Final losses of prestress

Initial stress in the tendons ($\sigma_{0\max}$)	Final losses at infinite time in percentage of initial prestress force ($\Delta P/P_0$ %)
$\min(0,85 f_{pk}; 0,95 f_{p0,1k})$	22 %
$0,80 f_{pk}$	21 %
$0,75 f_{pk}$	20 %
$0,70 f_{pk}$	19 %
$0,65 f_{pk}$	17 %

4.2.4 Positioning of reinforcement

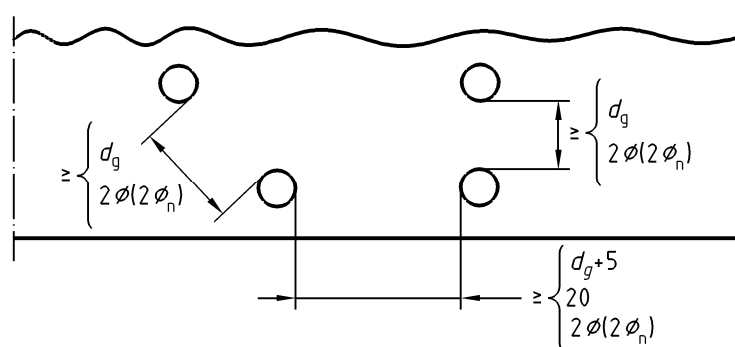
4.2.4.1 Common requirements for positioning of reinforcement

Reinforcement transverse to the main reinforcement is not required in floor plates with width equal to or less than 1,2 m when the transverse moment need not to be considered.

4.2.4.1.1 $\boxed{A_2}$ Positioning of main and transverse reinforcement $\boxed{A_2}$

Unless it can be justified otherwise, the nominal clear distance between bars constituting the main $\boxed{A_2}$ and transverse $\boxed{A_2}$ reinforcement shall be at least equal to those as shown in Figure 7.

Dimensions in millimetres



Key

d_g = maximum aggregate size
 ϕ = diameter of the bar

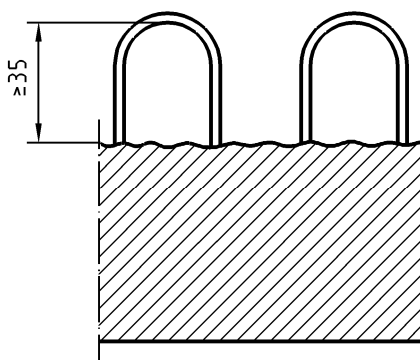
NOTE For definition of ϕ_n see 8.9.1 of EN 1992-1-1:2004.

$\boxed{A_2}$ Figure 7 — Minimum distances $\boxed{A_2}$

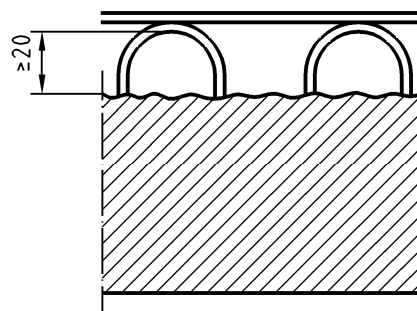
A2 The free distance **A2** between the upper surface of the floor plate and the underside of loops or stirrups shall not be less than 35 mm. If there is a longitudinal bar welded to the top of the loops or stirrups, this distance may be reduced to 20 mm (see Figure 8).

Dimensions in millimetres

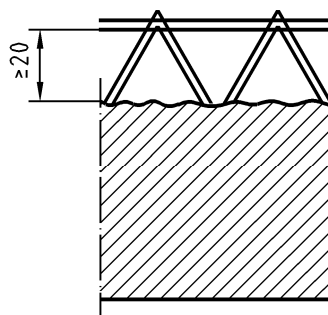
AC



a) loops without longitudinal bar



b) loops with longitudinal bar



c) lattice girder with welded longitudinal bar **AC**

Figure 8 — Protruding connecting reinforcement

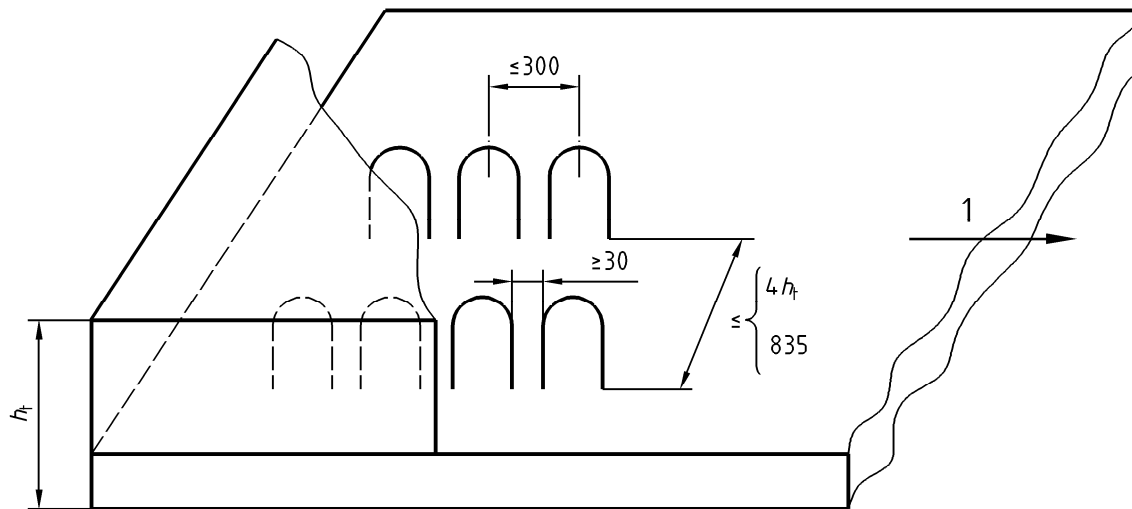
4.2.4.1.2 Positioning of connecting reinforcement in the floor plate

When the connecting reinforcement is made of continuous loops, the nominal distance between two adjacent reinforcement lines shall be no greater than $4 h_t$ or 835 mm whichever is the lesser (see Figure 9).

The distance between vertical legs of a same loop or of two adjacent loops shall be as follows:

- between the centre axes of two adjacent loops ≤ 300 mm;
- between the adjacent legs of two loops ≥ 30 mm.

Dimensions in millimetres



Key

1 shear force direction

Figure 9 — Spacing of connecting reinforcement

4.2.4.1.3 Connection with the supporting structure

Some typical construction details are indicated in Annex E.

4.2.4.1.4 Connection between adjacent floor plates

Connection details shall be given in project specifications.

Examples of reinforcement details between adjacent floor plates are shown in Annex F.

4.2.4.2 Particular requirements for positioning of lattice girders

The positioning of lattice girders shall comply with the following requirements:

4.2.4.2.1 Distance between lattice girders

The nominal distance between axis of lattice girders shall be such that (see Figure 10):

$$a \leq [835 \text{ or } (15 h_p + 125)] \text{ mm} \quad \text{whichever is the lesser}$$

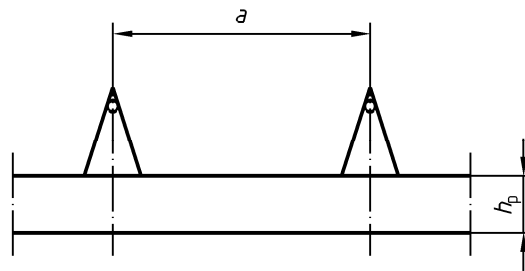


Figure 10 — Distance between axis of lattice girders

4.2.4.2.2 Distance between the outer lattice girder and the nearest edge of the floor plate

The nominal distance between the centreline of the edge lattice girder and the nearest edge of the floor plate shall be such that (see Figure 11):

$$a_2 \leq 0,5 [835 \text{ or } (15 h_p + 125)] \text{ mm} \quad \text{whichever is the lesser}$$

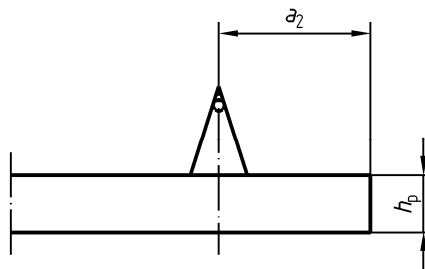


Figure 11 — Distance between the axis of the outer lattice girder and the nearest edge

4.2.4.2.3 Specific case of reinforced floor plate with a single lattice girder

The nominal width of a reinforced floor plate with a single lattice girder shall be such that (see Figure 12):

$$b \leq 0,75 (15 h_p + 125) \text{ mm or } b \leq 630 \text{ mm} \quad \text{whichever is the lesser}$$

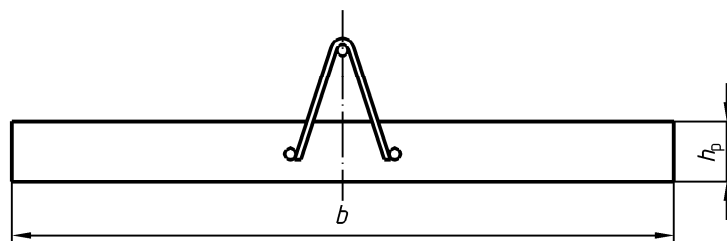


Figure 12 — Case of a floor plate with a single lattice girder

4.2.4.2.4 Minimum embedment of the lower chord into the floor plate

The minimum actual embedment of the lower chord of the lattice girder into the floor plate shall be not less than 10 mm (see Figure 13).

Dimensions in millimetres

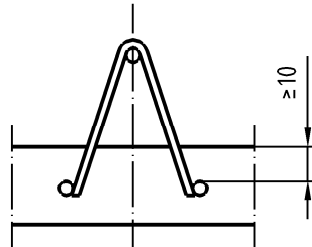


Figure 13 — Minimum embedment of lower chord of the lattice girder into the floor plate

4.2.4.2.5 Longitudinal positioning of lattice girder

The nominal distance, l_g , from the lower joint of the first diagonal to the nearest edge of the floor plate shall not be greater than 250 mm if this element should be a reinforced plate with lattice girder (see Figure 14).

NOTE Short lattice girders which do not fit this requirement should be added (e.g. as bond reinforcement).

Dimensions in millimetres

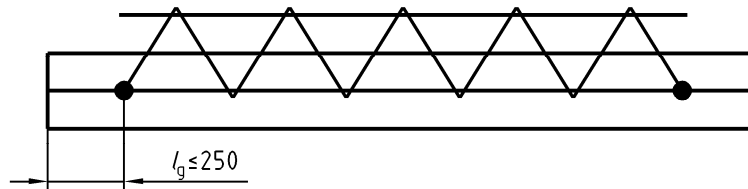


Figure 14 — Longitudinal positioning of lattice girders

4.2.4.3 Particular requirements for positioning of prestressing tendons

4.2.4.3.1 Positioning of prestressing tendons in the floor plates without ribs

The pretensioned tendons shall be located on one or more layers according to the thickness of the floor plate.

When the floor plate thickness is less than 60 mm the prestressing tendons should be located on one layer, situated close to the middle plane of the floor plate in order to avoid tensile stress in the concrete.

In the absence of specific calculation or tests, the following requirements shall be complied with:

- a) the number of prestressing tendons shall be restricted to 30 tendons per layer and per meter;
- b) the prestressing tendons shall be distributed evenly in each layer;
- c) in every floor plate at least two prestressing tendons shall be provided;
- d) the nominal clear spacing l_i , between individual prestressing tendons shall comply with the two following conditions (see Figure 15):
 - maximum clear spacing $l_{i, \max} = 300 \text{ mm}$;
 - minimum clear spacing $l_{i, \min} = 5\varnothing$ if $\varnothing \leq 7,0 \text{ mm}$ or $7\varnothing$ if $\varnothing > 7,0 \text{ mm}$;
 - for groups of tendons, the nominal clear spacing between tendons shall be at least:
 - horizontally: $(d_g + 5 \text{ mm})$, 20 mm or $\varnothing$, whichever is the largest;
 - vertically: d_g , 10 mm or $\varnothing$ whichever is the largest.
- e) the nominal distance l_e , between the outer tendon edge and the nearest longitudinal edge of the floor plate shall be not lesser than $3\varnothing$ and not greater than 150 mm .

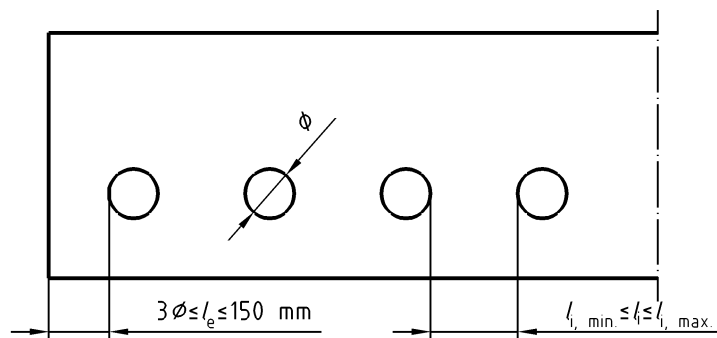


Figure 15 — Positioning of prestressing tendons in floor plate without ribs

4.2.4.3.2 Positioning of prestressing tendons in ribs

When prestressing tendons are located in ribs and in the absence of specific justifications, the nominal concrete cover, c , defined as the distance of the prestressing tendon to the nearest edge of the rib shall comply with (see Figure 16):

$$c \geq (3\varnothing \text{ or } 15 \text{ mm}) \quad \text{whichever is the greater}$$

where $\varnothing$ is the greatest nominal diameter of tendons.

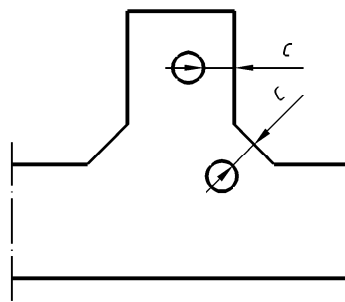


Figure 16 — Positioning of prestressing tendons in ribs

4.3 Finished product requirements

4.3.1 Geometrical properties

4.3.1.1 Production tolerances

4.3.1.1.1 $\boxed{A_2}$ Geometrical tolerances $\boxed{A_2}$

The maximum deviations, measured in accordance with 5.2, on the specified nominal dimensions shall satisfy the following requirements:

- a) ± 20 mm for the nominal length;
- b) $(+ 5, - 10)$ mm for the nominal width;

NOTE 1 These values should apply to floor plates of standard width. In the other cases, different tolerances may be defined.

- c) $(+ 10, - X)$ mm for the nominal average thickness with $X = \text{Min}(h_p/10 ; 10 \text{ mm}) \geq 5$ mm (greater tolerances as $+ 15, -10$) mm may be accepted locally however);
- d) $\pm (5 + L_e/1000)$ mm for straightness of edges of the floor plate where L_e is the nominal length of a edge of the floor plate;
- e) 1 mm with the straightedge of 20 cm length and 3 mm with the straightedge of 1,0 meter length on the flatness of the moulded surface;
- f) ± 30 mm for the position and the dimensions of cut outs and notches;
- g) ± 50 mm in the longitudinal direction and $\pm b_w/10$ in the transversal direction for the position of incorporated units and void formers, where b_w is the nominal width of a stiffening or a cast-in-situ rib between void formers (generally at the weakest level);
- h) $(+ 10, -X)$ mm for the $\boxed{A_2}$ height $\boxed{A_2}$ h_r of the ribs with $X = \text{Min}(h_r/10 ; 10 \text{ mm}) \geq 5$ mm.

NOTE 2 Reduced tolerance values, in place of those given above, should be declared by the manufacturer.

4.3.1.1.2 Tolerances in the positioning of reinforcement

The tolerances on the positioning of reinforcement shall be specified on the basis of analysis of quality control results. The tolerances given by the manufacturer shall under no circumstances be higher than the values given below:

- ± 5 mm vertically on individual values for passive longitudinal reinforcement;
- ± 5 mm on the vertical position of each strand or wire;
- ± 3 mm on the centre of gravity of strands or wires, taken on one meter of width of floor plate;
- $+ 50$ mm on the distance from the first diagonal/lower chord joint to the edge of the floor plate;
- ± 10 mm on the vertical positioning for connecting and shear reinforcements.

4.3.1.2 Minimum dimensions

Clause 4.3.1.2 of EN 13369:2004 shall apply.

For stiffening ribs and void formers, Annex C may be used.

4.3.2 Surface characteristics

4.3.2.1 Edges

The edges of the floor plate shall be free of any excess concrete that could be detrimental to the positioning of adjacent floor plates.

4.3.2.2 Upper surface

Requirements given in 6.2.5 of EN 1992-1-1:2004 shall apply.

The upper surface of the floor plates shall be clean and free of any soiling that could be detrimental to the bonding.

4.3.3 Mechanical resistance

Complementary to 4.3.3 of EN 13369:2004, 4.3.3.6 of this standard shall apply.

4.3.3.6 Transient situations

The transient situations covered by this sub-clause relates to storage, handling, transport and installation.

The strength and properties of the concrete floor plate to be considered in transient situations are those specified by the manufacturer at the time of delivery.

Main and secondary transverse reinforcements provided in the floor plate shall be capable to withstand the loadings expected for the transient situations.

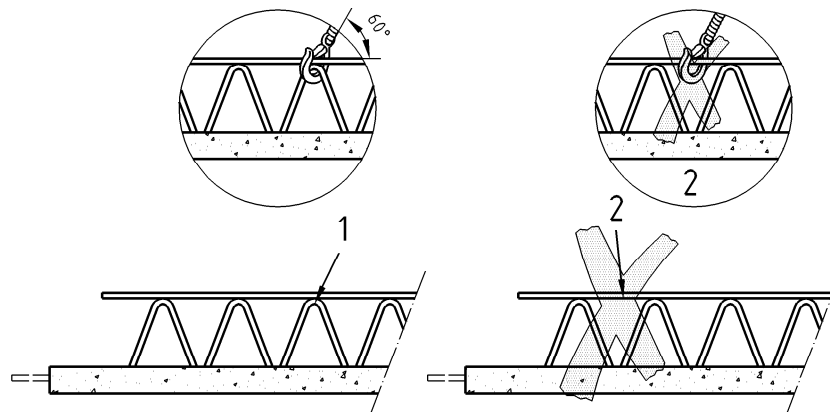
4.3.3.6.1 Storage and transportation

The methods of storage and transportation, and the position of bearing points shall be indicated on documentation provided.

4.3.3.6.2 Handling

When the floor plates are handled using lattice girders, as shown in Figure 17, the anchorage of lattice girders in the concrete shall be verified, taking into account the guarantee strength of the welds and the distribution of lattice girders on the floor plate.

AC



AC

Key

- 1 minimum 3 nodes
- 2 prohibited

Figure 17 — Handling with lattice girders

4.3.3.6.3 Conditions for use

Floor plates shall be installed in accordance with technical A_2 documentation A_2 .

Floor plates shall be erected with provisional supports (props) at intermediate and/or edge positions if required by technical A_2 documentation A_2 .

The effective support lengths, the distances between the bearing supports and between the props, the actions on the props together with the loads taken into account in determining them, shall be specified.

The erection spans shall be determined by calculation or by means of type tests, examples of which are given in Annex J. If not calculated according to 4.3.3 of EN 13369:2004 the design method shall initially be validated by tests.

NOTE 1 When the spans are determined by calculation, the assumptions of loading as well as the limitations of deformation may be taken from J.2.

When the spans between temporary supports are determined by calculation, the tensile stress in the concrete should not exceed $1,4 f_{ctmin,j}$.

NOTE 2 The value of $f_{ctmin,j}$ should be taken equal to $0,30 f_{cmin,j}^{2/3}$ where $f_{ctmin,j}$ and f_{cmin} are respectively the minimum tensile strength and the minimum compressive strength of concrete at the time of erection of the unit.

In the case of floor plates without lattice girders nor ribs, the nominal thickness of which is less than 80 mm, a defavourable deviation on the nominal thickness of the floor plate shall be taken into account by reducing the nominal thickness by:

$\text{Max}(e_r ; e_h)$ in the case of erection with props;

$\sqrt{e_r^2 + e_h^2}$, in the case of erection without props;

where

e_r is the tolerance on the centre of gravity of the main reinforcement position, in mm;

e_h is the tolerance for the floor plate thickness, in mm.

4.3.3.7 Permanent situations

Floor plates shall comply with the design of the floor system in which they are used. Recommended design procedures for composite slabs are given in Annex F.

4.3.4 Resistance and reaction to fire

Complementary to 4.3.4 of EN 13369:2004, the following requirements shall apply:

- the fire resistance of a composite slab made of floor plates without void formers is the same as for a solid slab of identical characteristics. Calculation of the temperatures is carried out without taking into account the joint between floor plates as much as the width b_j is lower than 20 mm (see Figure 18);

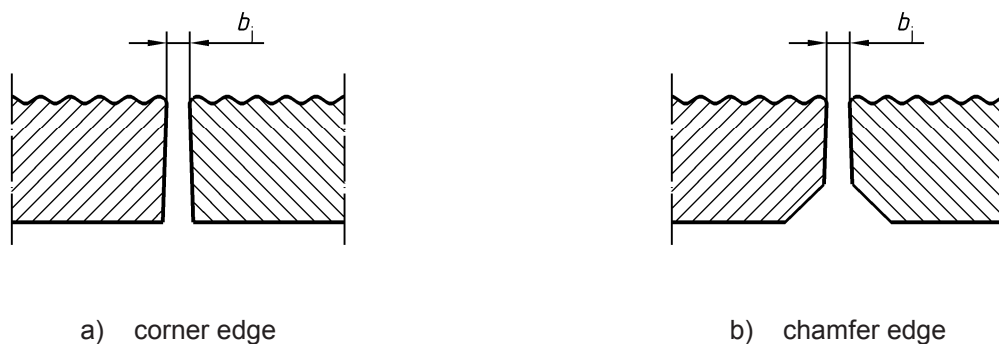


Figure 18 — Examples of current joint profiles

- the fire resistance of a composite slab made of floor plates with void formers requires the details of the fire properties of the void forming materials and the determination of the temperatures profiles. Specific information are given in Annex H.

4.3.5 Acoustic properties

Clause 4.3.5 of EN 13369:2004 shall apply.

The sound insulation properties of a composite slab made of floor plates without void formers is the same as for a solid slab of identical characteristics, the influence of the joint between floor plates being negligible.