BS EN 15037-5:2013

BSI Standards Publication

Precast concrete products — Beam-and-block floor systems

Part 5: Lightweight blocks for simple formwork

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National foreword

This British Standard is the UK implementation of EN 15037-5:2013.

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.

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Foreword

This document (EN 15037-5:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.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 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(s).

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

Eurocodes are taken as a common reference for design aspects. This document was examined and agreed upon by a liaison ad-hoc group with CEN/TC 250, particularly for its compatibility with structural Eurocodes. The installation of some structural precast concrete products is dealt with in EN 13670, *Execution of concrete structures.*

EN 15037, *Precast concrete products — Beam-and-block floor systems* is composed of the following parts:

— *Part 1: Beams*

— *Part 2: Concrete blocks*

— *Part 3: Clay blocks*

— *Part 4: Expanded polystyrene blocks*

— *Part 5: Lightweight blocks for simple formwork* (the present document)

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

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

— 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 15037-1, *Precast concrete products — Beam-and-block floor systems — Part 1: Beams*

— EN 15050, *Precast concrete products — Bridge elements*

— EN 15258, *Precast concrete products — Retaining wall elements*

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

Introduction

The evaluation of conformity 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.

1 Scope

This European Standard deals with the requirements and the basic performance criteria for lightweight blocks used as formwork during the construction of the floor system. The blocks are used in conjunction with precast concrete beams in compliance with EN 15037-1, with or without cast-in-situ concrete for the construction of beam-and-block floor systems.

This European Standard does not deal with blocks made in polystyrene, with or without tong, or combined with different materials where polystyrene contributes to more than 50 % of the mechanical resistance of the block. These blocks are covered by EN 15037-4, *Precast concrete products — Beam-and-block floor systems — Part 4: Expanded polystyrene blocks*.

Examples of typology of floor systems are given in Annex B of EN 15037-1:2008.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN 13369:2013, *Common rules for precast concrete products*

EN 13501-1, *Fire classification of construction products and buildings elements — Part 1: Classification using data from reaction to fire tests*

EN 13823:2010, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 15037-1:2008, *Precast concrete products — Beam-and-block floor systems — Part 1: Beams*

EN ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO 10211)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
lightweight block for simple formwork
block with no mechanical function in the final floor system

Note 1 to entry: Its only mechanical function is that of formwork during the construction of the floor system.

Note 2 to entry: This block is mentioned in the present standard as lightweight block. See Figure 1.

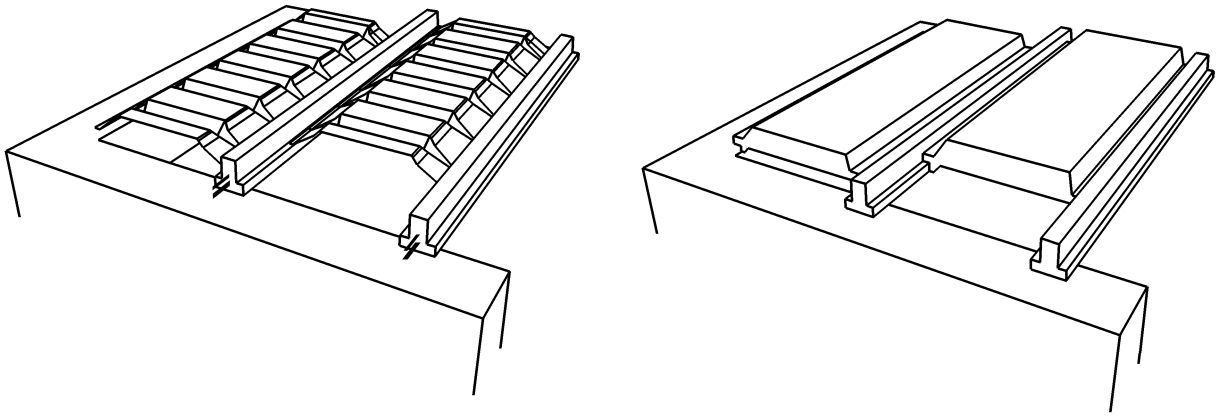


Figure 1 — Examples of lightweight blocks

3.2
cut block
lightweight block, the form of which is obtained by cutting

3.3
moulded block
lightweight block formed by moulding, either by injection of the material in a mould (injected blocks), or by pressing of the material in a mould (pressed block)

3.4
thin block
lightweight block formed as a vault made of one or several layers of material

3.5
thick block
lightweight block constituted by one or several materials, which forms a filled product

3.6
family
group of products for which the test results for one or more characteristics from any one product within the family are valid for all other products within the family

Note 1 to entry: The definition of the family takes into account at least a same material and a similar shape and geometry.

3.7
batch
quantity of lightweight blocks defined by either a same reference of raw material, or similar parameters and conditions of manufacturing, or manufactured during the same day of production (or 24 h in case of continuous production), without exceeding a length of 10 000 m

4 Requirements

4.1 Material requirements

Only materials with established suitability shall be used.

Lightweight block may be manufactured from:

a) wood material (plywood, fibreboards, Oriented Strand Board OSB);

b) plastic material (polyethylene PE, polypropylene PP);

c) cardboard, cellulose;

d) composite material (Glass Reinforced Plastic GRP);

e) polymer concrete;

f) metallic material;

g) combination of the materials a) to f);

h) one of the materials a) to f) combined with polystyrene, if this one contributes to not more than 50 % of the mechanical resistance of the block.

For a particular material, other than the ones mentioned above, the establishment of suitability may result from a European Standard which refers specifically to the use of this material for a similar use; in absence of a European Standard it may also result, under the same conditions, from an ISO standard.

Where this material is not covered by a European or an International Standard, or if it deviates from the requirements of these standards, the establishment of suitability may result from:

— the relevant national standards or provisions valid in the place of use of the product which refer specifically to the use of this material for a similar use;

or

— a European Technical Approval specifically for the use of this material for a similar use.

4.2 Production requirements

Only the materials described in 4.1 shall be used in the production of lightweight blocks.

4.3 Finished product requirements

4.3.1 Geometrical properties

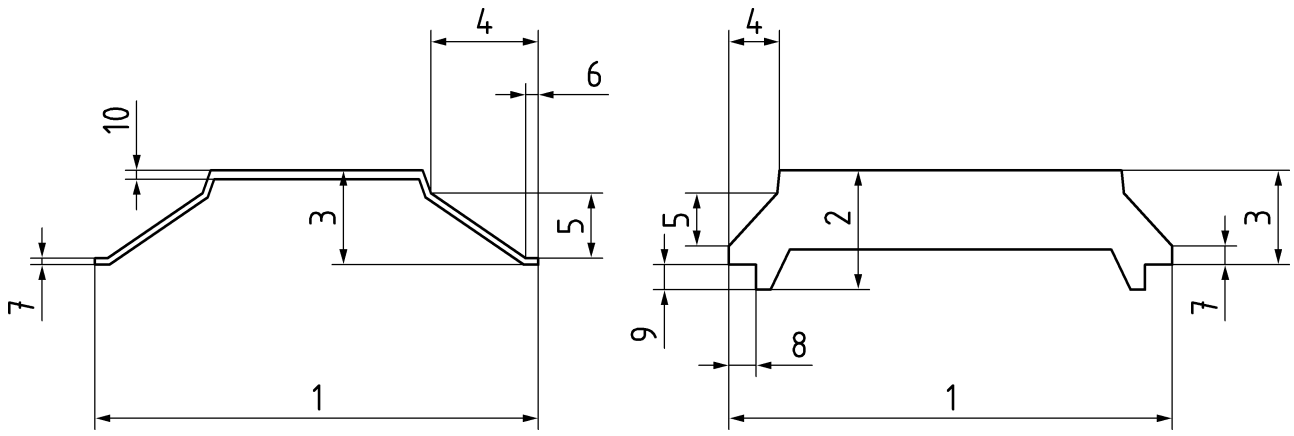
The dimensions shall be verified according to 5.1.1.

For technical documentation, see Clause 8.

4.3.1.1 Production tolerances

4.3.1.1.1 Dimensional tolerances

The tolerances on the dimensions are given in Table 1. An example of the dimensions is given in Figure 2.



Key

1 block width l
2 block height h for blocks with a rebate or end plates for beams
3 height above beam support h_1
4 chamfer width l_c
5 chamfer height h_c
6 width of the support nib l_n (when relevant)
7 height of the support nib h_n
8 rebate width l_r (when relevant)
9 rebate height h_r (when relevant)
10 minimal thickness e_m for thin blocks

Figure 2 — Dimensions of the lightweight block

Table 1 – Dimensional tolerances

Dimensions	Tolerance
1 — width of the block l	± 5 mm
2 — height of the block h for blocks with rebate or end plates	[- 3 mm ; + 7 mm]
3 — height above beam support h_1	± 5 mm
length of the block L (see Figure 6)	± Max [0,6 % ; 5 mm] ≤ 12 mm
4 — width of the chamfer l_c	± 10 mm
5 — height of the chamfer h_c	± 5 mm
6 — width of the support nib in upper part l_n (when relevant)	± 3 mm
7 — height of the support nib h_n	[- 2 mm ; + 4 mm]
8 — width of the rebate l_r (when relevant)	± 3 mm
9 — height of the rebate h_r (when relevant)	± 3 mm
10 — minimal thickness e_m [a] for thin blocks	[- e_m/10 ; + 2 mm]
[a] Applicable on the vault and the wall(s) of the block, outside the zones where the mechanical contribution is negligible.	
Lower tolerances may be declared by the manufacturer.	

4.3.1.1.2 Straightness

Straightness shall be verified according to 5.1.2.

The tolerances are:

— ± 1/250th of the block length in the vertical plane;

— ± Min [1/250th of the block length; 5 mm] in the horizontal plane.

4.3.1.1.3 Warping

Warping shall be verified according to 5.1.3.

The tolerance is ± 1/250th of the block length.

4.3.1.1.4 Weight

The manufacturer shall declare the weight of the blocks in kilograms.

The tests shall be carried out according to 5.2. The results should not deviate from the manufacturer's declared values by more than ± 10 %.

4.3.1.2 Shape of blocks

The following nominal dimensions (see Figures 3, 5 and 6) shall be declared:

— block width l;

— block height above beam support h_1;

— block length L.

The characteristic width of lightweight block's rebate shall not be less than 20 mm.

4.3.2 Surface characteristics

Blocks shall not have defects which may be detrimental to their mechanical and thermal performances.

For test method, see 5.1.4.

4.3.3 Mechanical resistance

4.3.3.7 Resistance to concentrated load

The manufacturer shall declare the class and the conditions of installation of the blocks such as the set of fitting or tightening.

The guaranteed value by the manufacturer shall be the characteristic resistance to concentrated load for 5 % fractile P_{Rk}, and shall be recorded in the documentation of the manufacturer for its factory production control (see 6.3).

For each class, the characteristic resistance to concentrated load P_{Rk} shall not be less than the value given in Table 2.

The test shall be carried out according to 5.3.4 and 5.3.5. The results shall be evaluated in accordance with the statistical procedure described in Table 3. Annex E shall be used for the assessment of conformity.

Table 2 — Lightweight block classes

Class	Concentrated load	Minimum characteristic resistance to concentrated load P_{Rk} (5 % fractile) in kN
R1	Test on individual blocks according to 5.3.5	1,5
R2	Test on restrained blocks according to 5.3.4	1,5
	And test on individual blocks according to 5.3.5	1,3

4.3.4 Resistance and reaction to fire

4.3.4.1 Resistance to fire

Where applicable, subclauses 4.3.4.1 to 4.3.4.3 of EN 13369:2013 shall apply.

For the verification of fire resistance of the floor system by testing, EN 1365-2 may apply. A method of calculation is given in Annex K of EN 15037-1:2008 to determine the fire resistance of the floor system.

4.3.4.4 Reaction to fire

The manufacturer shall declare a Euroclass reaction to fire in accordance with EN 13501-1.

NOTE The experience shows that lightweight blocks on the market might be classified E or F.

4.3.5 Acoustic properties

Acoustic properties depend on the finished floor system (type of blocks, applied elements in upper and/or lower face of the floor, etc.).

When required for the product, subclause 4.3.5 of EN 13369:2013 shall apply.

For design purposes, and in the absence of measurement results, the method given in Annex L of EN 15037-1:2008 may be used (airborne and impact sound insulation).

4.3.6 Thermal properties

When relevant, the $\lambda_{90,90}$ value (thermal conductivity) and the R value (thermal resistance) and the U value (thermal transmittance) of the specified floor shall be declared.

The thermal conductivity ($\lambda_{90,90}$) shall be measured in accordance with 5.5.

For the calculation of the thermal resistance of the floor (R value / U value), the non-rounded λ value may be used. A method is given in 5.6. Another method may be used, provided that the results are equivalent.

If the thermal properties are calculated, the calculation assumptions for thermal resistance of floor which are given in Annex F of EN 15037-4:2010 should be used.

4.3.7 Durability

The durability of blocks shall be consistent with the building methods used for the construction of the floor system.

NOTE For example, EN 335-1 defines classes for wood and wood based materials.

4.3.9 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/

5 Test methods

5.1 Measuring of dimensions

5.1.1 Block dimensions

5.1.1.1 General

The following dimensions shall be checked with a measurement device having an accuracy of 1/5 or better of the tolerance to be checked. For irregular or ribbed surfaces, the measurement points shall be consistent with the definition of the relevant dimensions in the manufacturer documentation, except the thickness of the vault "e_m" to the nearest 0,1 mm.

5.1.1.2 Procedure

a) Block width *l*

Measure the width of each end section as shown in Figure 3 (the larger width).

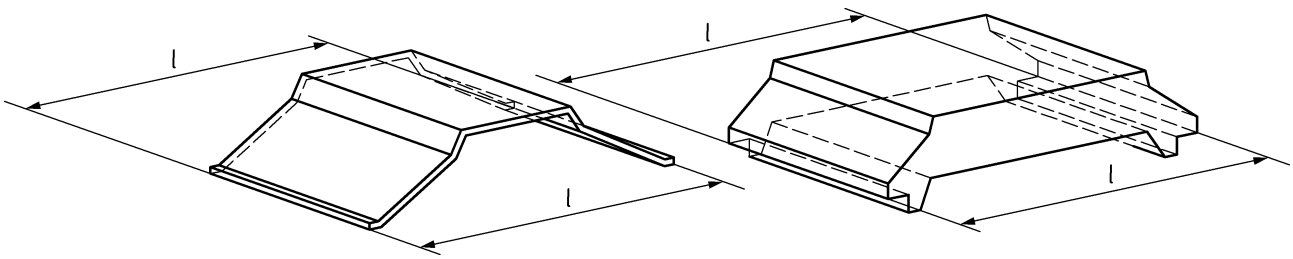


Figure 3 — Measurement of the width of the block

Calculate the width for the block as the mean of the two measurements values.

The dimensions shall comply with the requirements of 4.3.1, and the values declared by the manufacturer, within the tolerances given in 4.3.1.1.1.

b) Block height *h* (for blocks with a rebate or end plates for beams)

Measure the height *h* of each end section as shown in Figure 4 approximately at its mid-width.

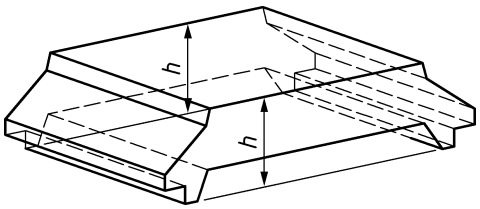


Figure 4 — Measurement of the height of the block

Calculate the height for the block as the mean of the two measurements values.

The dimensions shall comply with the requirements of 4.3.1, and the values declared by the manufacturer, within the tolerances given in 4.3.1.1.1.

c) Height above beam support h_1

Measure the height above beam support of each end section as shown in Figure 5.

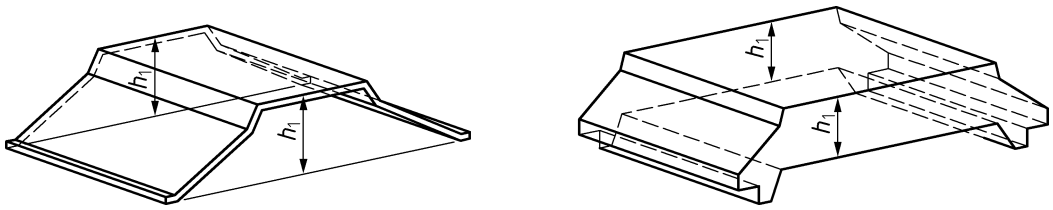


Figure 5 — Measurement of the height above beam support

Calculate the height above beam support for the block as the mean of the two measurement values.

The dimensions shall comply with the requirements of 4.3.1, and the values declared by the manufacturer, within the tolerances given in 4.3.1.1.1.

d) Block length L

Measure the length of each side as shown in Figure 6.

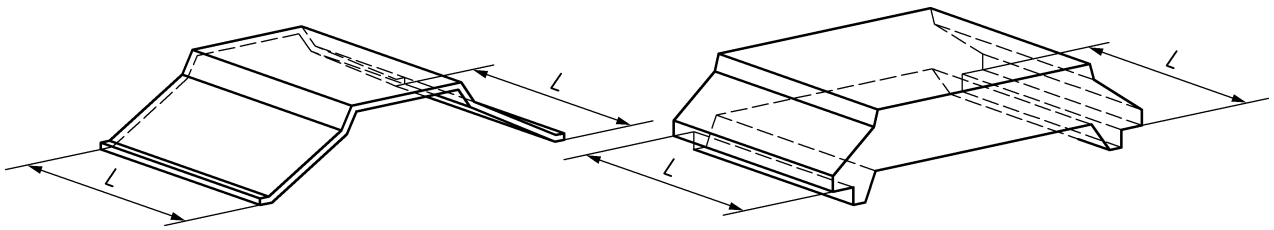


Figure 6 — Measurement of the length of the block

Calculate the length for the block as the mean of the two measurements values.

The dimensions shall comply with the requirements of 4.3.1, and the values declared by the manufacturer, within the tolerances given in 4.3.1.1.1.

e) Width l_c and height h_c of the chamfer

Measure the width and the height of each chamfer in the vicinity of each end section as shown in Figure 7.

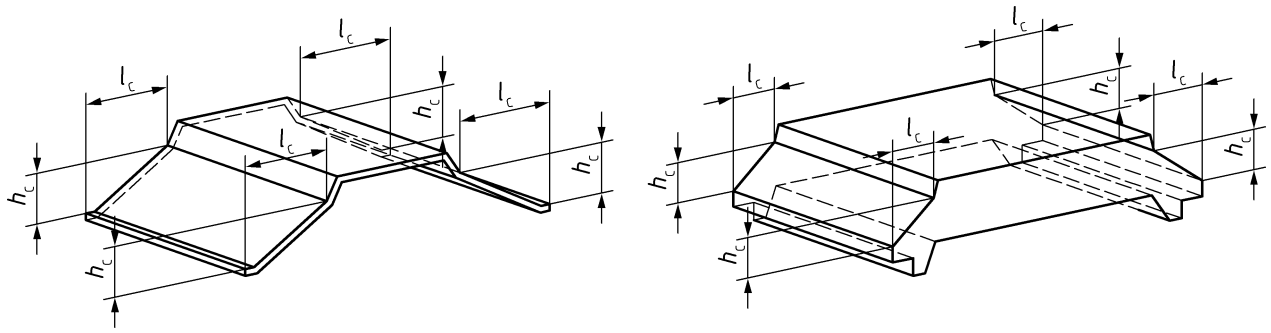


Figure 7 — Measurement of the width and the height of the chamfer

The tolerance defined in 4.3.1.1.1 applies to each measurement result (four measurements results for width, four measurements results for height).

f) Width l_n and height h_n of the support nib

Measure the width and the height of each support nib (when relevant) in the vicinity of each end section as shown in Figure 8.

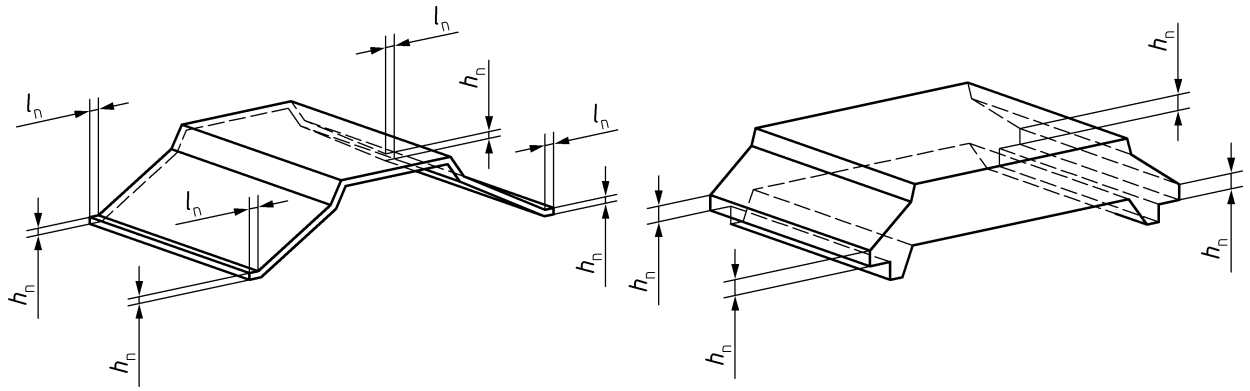


Figure 8 — Measurement of the width and the height of the support nib

The tolerance defined in 4.3.1.1.1 applies to each measurement result (four measurements results for width, four measurements results for height).

g) Width l_r and height h_r of the rebate

Measure the width and the height of each support nib (when relevant) in the vicinity of each end section as shown in Figure 9.

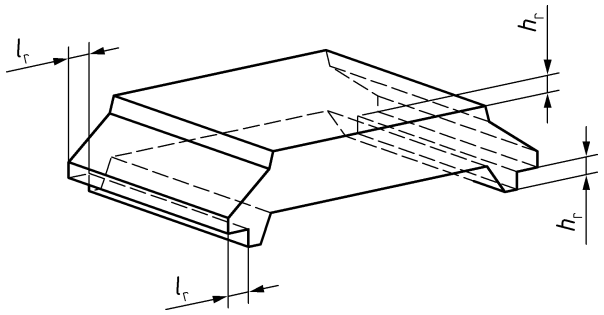


Figure 9 — Measurement of the width and the height of the rebate

The tolerance defined in 4.3.1.1.1 applies to each measurement result (four measurements results for width, four measurements results for height).

h) Thickness e_m

When relevant, measure the minimum thickness of the vault and the wall(s) at the edge of the product or if necessary in a cut section of the product.

The tolerance defined in 4.3.1.1.1 applies to each measurement results.

5.1.1.3 Test report

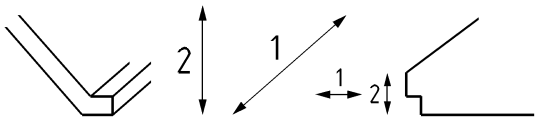
All individual measurements and the calculated values of each specimen shall be recorded.

5.1.2 Straightness

Measure the straightness of the edge of each nib to the nearest 0,5 mm over their entire length, in the two directions specified in Figure 10.

The bow is the maximum distance between the edge and a reference straight line (ruler, stretched wire, etc.).

When relevant, the measurement in the vertical plane shall be obtained with a pressure on the top of the lightweight block which does not exceed more than 50 Newtons per meter of block length.



Key

1 measurement direction in the horizontal plane
2 measurement direction in the vertical plane

Figure 10 — Measurement of straightness

The tolerance defined in 4.3.1.1.2 applies to each of the four measurements results.

5.1.3 Warping

Measure the warping to the nearest 1 mm. With the block resting on two supports as shown in Figure 14 or Figure 15, ensure that one of the support nibs of the block is in contact with the corresponding support over its entire length; the warping is measured by the maximum gap between the opposite edge of the support nib and the corresponding support.

When relevant, the measurement shall be obtained with a load on the top of the lightweight block which does not exceed more than 50 Newtons per meter of block length.

The tolerance defined in 4.3.1.1.3 applies to the measurement result of each block.

5.1.4 Surface characteristics

The surface appearance of blocks shall be inspected visually.

Defective products shall be rejected.

5.2 Determination of the weight

5.2.1 Equipment

A weighing instrument capable of weighing the specimen to an accuracy of 0,1 % of their mass shall be used.

5.2.2 Procedure

Weight each specimen of the sample.

The requirement defined in 4.3.1.1.4 applies to each measurement result.

5.2.3 Test report

All individual measurements of each specimen shall be noted to the nearest 0,01 kg.

5.3 Mechanical strength

5.3.1 General

The test methods given in the next paragraphs shall apply to determine the resistance to concentrated load of lightweight block.

5.3.2 Equipment

5.3.2.1 Testing machine

a) Minimum class 3 testing machine for applying forces according to EN 12390-4;

b) frame sufficiently rigid to withstand the forces applied when loading the test specimen;

c) supports: the two supports representing beams; one support shall be fixed, the other adjustable.

The two supports may be covered with abrasive fabric (40 grains) or a system achieving equivalent roughness. The abrasive fabric covers the effective bearing length and adheres to the supports. It may be cleaned and replaced regularly, at the discretion of the manufacturer.

d) In addition, for tests on restrained blocks:

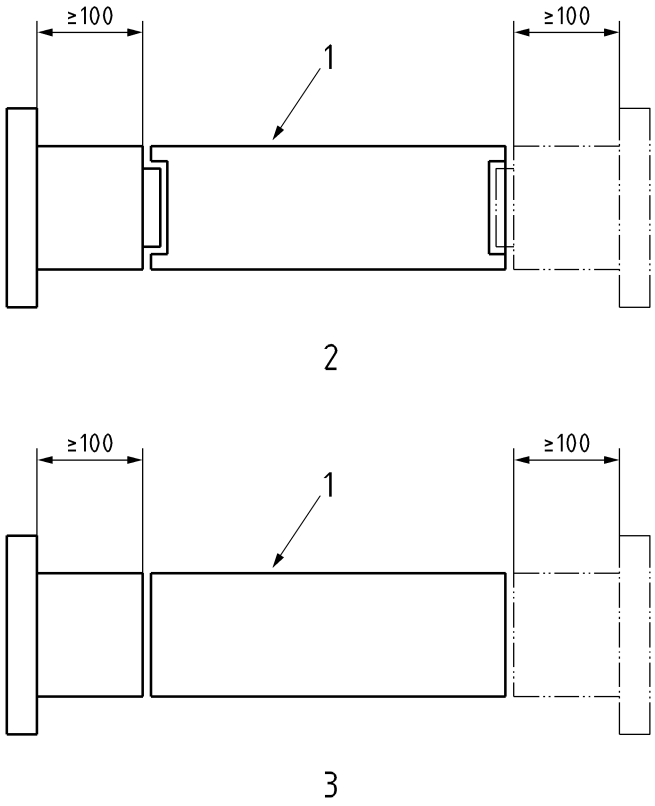
1) Longitudinal block restraining device, which simulates the effect produced by block (n - 1) and possibly block (n + 1) in the span.

   The device is constituted of one or two end blocks from the same batch allowing the restraint of the test piece to be adapted to the recommended conditions.

   The restraining device shall be simply placed in contact with the test piece, on its both sides or on one of its two sides.

   The test frame should be ensured that the restraining devices in the longitudinal direction remain perfectly parallel with one another and perpendicular to the supports so as to allow for deviations from straightness on the end faces of the blocks at first contact (Figure 11).

Nominal dimensions in millimetres



Key

1 test piece
2 moulded block
3 cut or moulded block

Figure 11 — Longitudinal block restraining device

2) it is possible to use a lateral block restraining device, if the manufacturer specifies in the technical documentation that lateral tightening of the beams is necessary:

   i) a load of 30 N/m ± 5 N/m is applied to the moving support by a reliable, manageable and traceable means;

ii) the device can simulate the effect produced by the beams moving laterally closer on contact with the block;

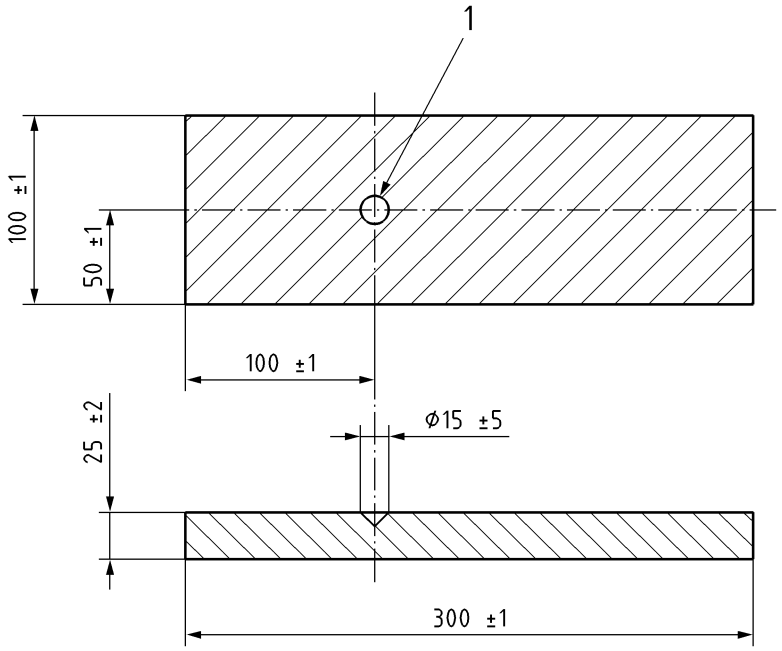
iii) the support spacing is a function of the block width.

5.3.2.2 Loading device

The loading device shall consist of a jack (electric or hydraulic,…), a rigid loading plate (e.g. wood, steel) of 100 mm x 300 mm x 25 mm (Figure 12), a ball joint and a load cell.

The loading plate may be mounted on a balls plate to reduce the effect of horizontal strength (Figure 13) determined in 5.3.3.

Dimensions in millimetres



Key

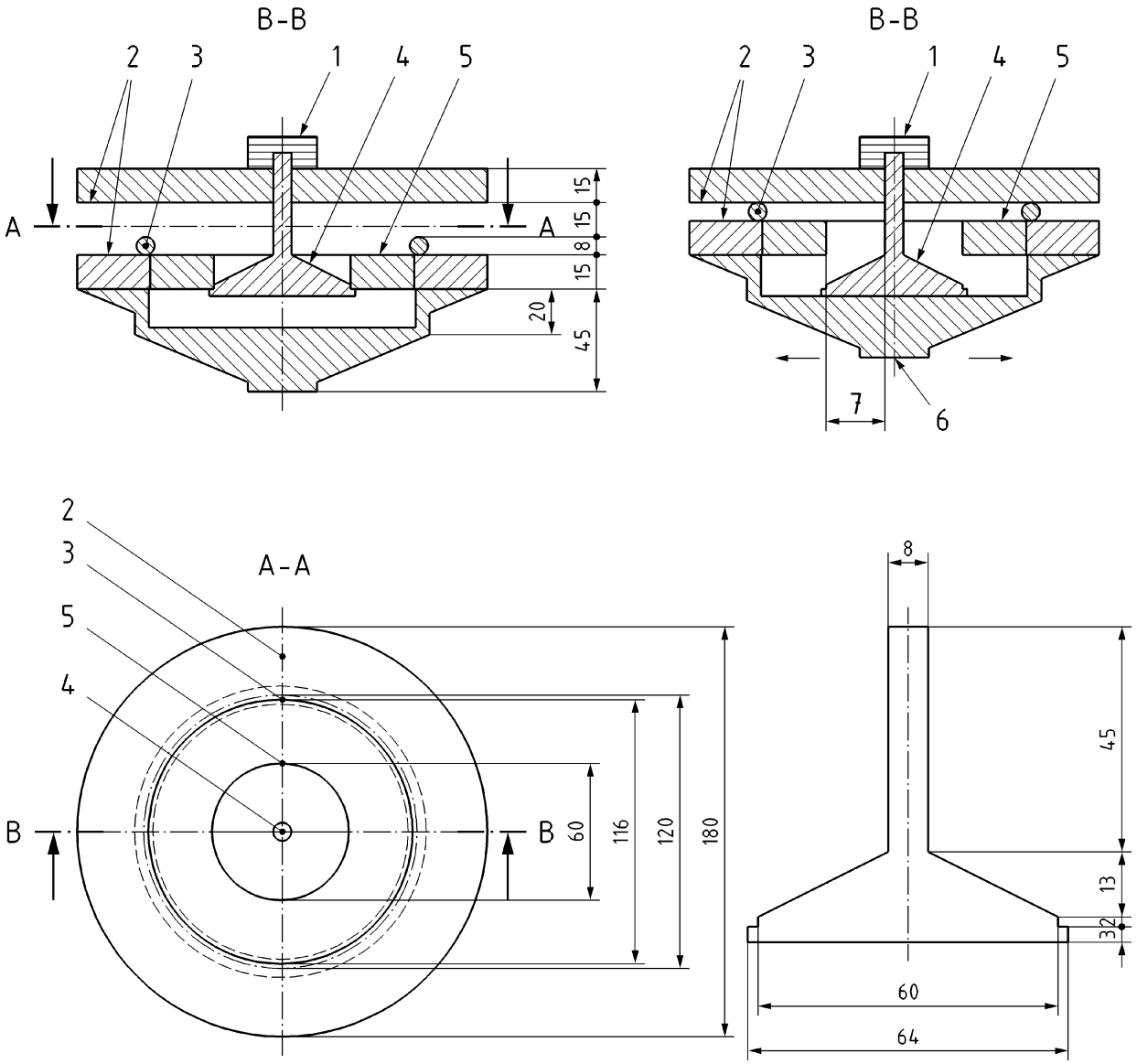
1 position of the ball join

Figure 12 — Rigid loading plate

Dimension in millimetres

a) Balls plate just before load application

b) Balls plate under load



c) Balls plate

d) Suspension axis

Key

1 connection to the load cell
2 hardened surface of the plates
3 balls Ø8 mm and cage thrust assembly
4 suspension axis
5 washer interdependent with the lower plate
6 connection of the ball join to the rigid loading plate
7 transversal displacement ≥ 25 mm

Figure 13 — Example of balls plate

The cage thrust assembly for balls shall have a diameter of minimum 80 mm.

Just before the application of the load, the axis of the load cell shall be lined up with the axis of the ball join.

During the load application, the balls plate shall allow transversal displacements of the rigid loading plate of minimum 25 mm in any direction.

5.3.2.3 Measuring system

a) Load cell: cylindrical shape and flat with a measuring range of 0,5 to 5 kN.

   It shall allow for class 3 of the testing machine in accordance with EN 12390-4.

b) Conditioner: display of minimum resolution 10,000 pixels, analogue output bandwidth $\geq$ 100 Hz. The reading of the maximum load is given by a conditioner with digital display of the maximum value reached.

c) Display unit:

   1) digital screens or dials allowing display of the load value while complying with the required accuracy;

   2) a system making it possible to read the maximum load reached at the end of the test, until resetting;

   3) screens that can be read from the operator's work station.

d) The smallest verifiable value of each measuring range shall be less than or equal to 20 % of the maximum value of the measuring range. If the machine is provided with several measuring ranges, this requirement applies to each of the ranges.

e) The machine's force indication system should not be affected by a possible failure due to bursting of the test specimen.

5.3.3 Calibration

Strength results obtained by the testing machine described in 5.3.2 (with or without a balls plate) shall be multiplied by a calibration factor Cf, resulting from the calibration with the gravity test rig defined in Annex C.

Annex D shall apply for calibration of the testing machine.

If the calibration is not carried out, the following default calibration factor Cf shall be used:

— 0,95 when the tests are realised with a balls plate as mentioned in 5.3.2.2;

— 0,85 when the tests are realised without a balls plate.

5.3.4 Test on restraining blocks

5.3.4.1 Placing the lightweight block on the testing machine

The longitudinal block restraining device shall be simply placed in contact of the test piece (Figure 11). The two elements placed in contact with the test piece are blocks coming from the same manufacturing batch. They are neither mechanically connected nor bonded at the ends.

When the technical document of the manufacturer does not specify a lateral tightening of the beams, the test piece shall be placed on the support in the same conditions as the tests on individual blocks (adjustments of support lines according to Figure 16, 17 or 18).

If the manufacturer specifies in the technical documentation conditions of installation with a lateral tightening of the beams, a load of 30 N/m $\pm$ 5 N/m is applied laterally on the blocks by the moving support before locking it.

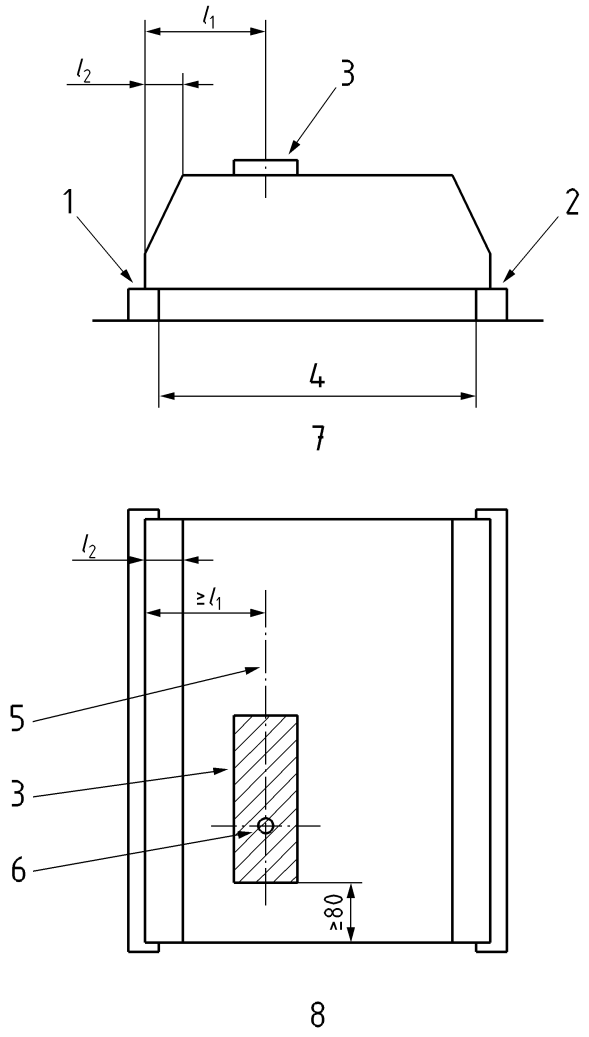
5.3.4.2 Positioning the rigid loading plate on the lightweight block

The load shall be applied via the rigid loading plate (as shown in Figure 12) placed in the most unfavourable situation:

— for a longitudinal positioning, the axis of the plate is parallel to the axis of the block. The plate is laid out in the most critical position, respecting the distances to the edge of the block defined in Figure 14; or

— for a transversal positioning, the axis of the plate is perpendicular to the axis of the block. The plate is laid out in the most critical position, respecting the distances to the edge of the block defined in Figure 15.

Nominal dimensions in millimetres



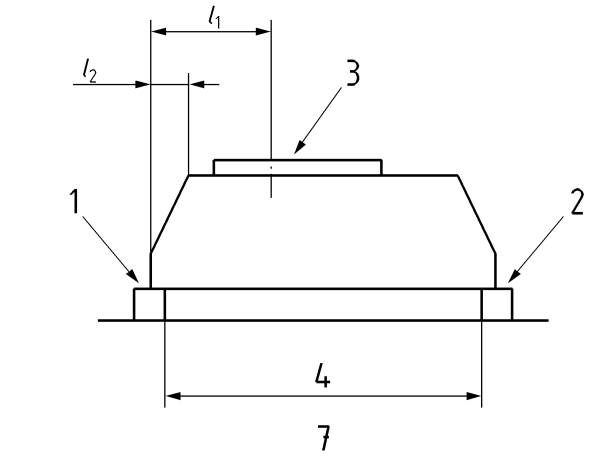
If $l_2 \leq 100$ mm, $l_1 = 150$ mm and if $l_2 > 100$ mm, $l_1 = (l_2 + 50)$ mm

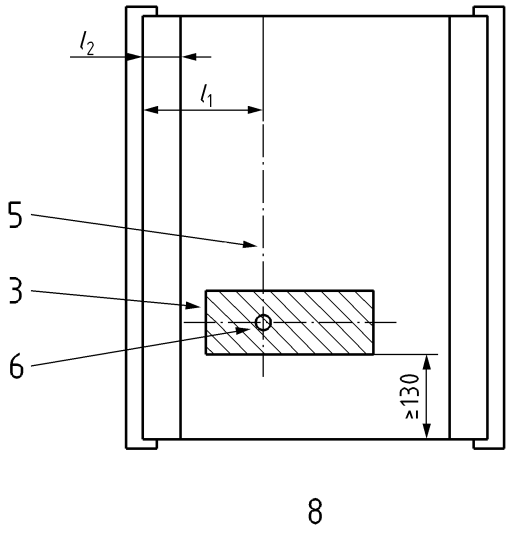
Key

1 fixed support
2 adjustable support
3 loading plate
4 distance between supports D
5 longitudinal axis of the loading plate
6 point of load application
7 end view
8 plan view

Figure 14 — Plate in a longitudinal position on the block

Nominal dimensions in millimetres





If $l_2 \leq 50$ mm, $l_1 = 150$ mm and if $l_2 > 50$ mm, $l_1 = (l_2 + 100)$ mm.

It is admitted that the loading plate can go beyond the top of the block by its larger side.

Key

1 fixed support
2 adjustable support
3 loading plate
4 distance between supports D
5 transversal axis of the loading plate
6 point of load application
7 end view
8 plan view

Figure 15 — Plate in a transverse position on the block

5.3.4.3 Loading

The load, P, shall be applied gradually up to the maximum load to the sample, at a speed of 100 N/s ± 30 N/s.

5.3.4.4 Expression of results

The load P, corresponding to the maximum load that the block can support during the test, is recorded and rounded to the nearest Newton.

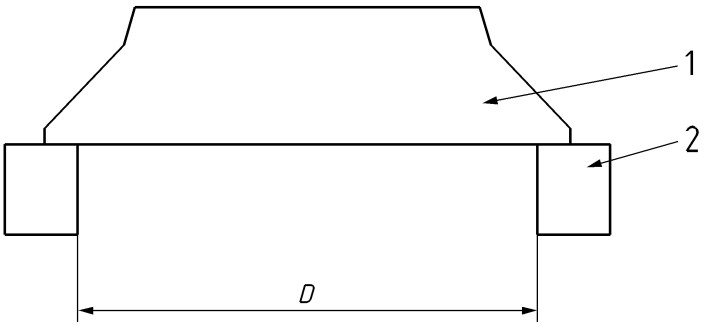
By applying a concentrated load, the block can not be broken systematically. In this particular case, the block can detach itself from the device.

5.3.5 Test on individual blocks

5.3.5.1 Placing the lightweight block on the testing machine

The test piece shall be the block simply resting on supports representing the beams.

The distance D between the two supports corresponds to the conditions of installation defined in the technical documentation (see Figure 16).

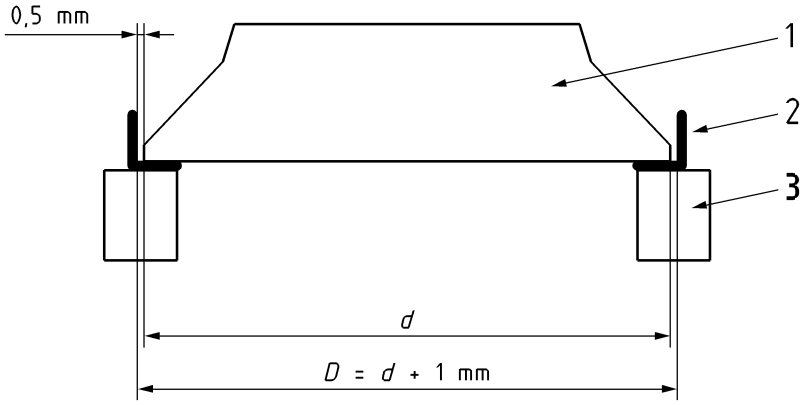


Key

1 test specimen
2 support

Figure 16 — Adjustment of support lines for block without rebate or end plates

It is possible to install an angle on each support to simulate the rib of the beam. In that case, the space between the edge of the block and the angle shall be equal to 0,5 mm (see Figure 17).



Key

1 test specimen
2 angle
3 support

Figure 17 — Adjustment of support lines with angles for block without rebate or end plates

If the blocks have rebates or end plates are used to position the lightweight block on the beams, the distance D between the two supports is equal to:

$$D = d + 1 \text{ mm} \quad (1)$$

where

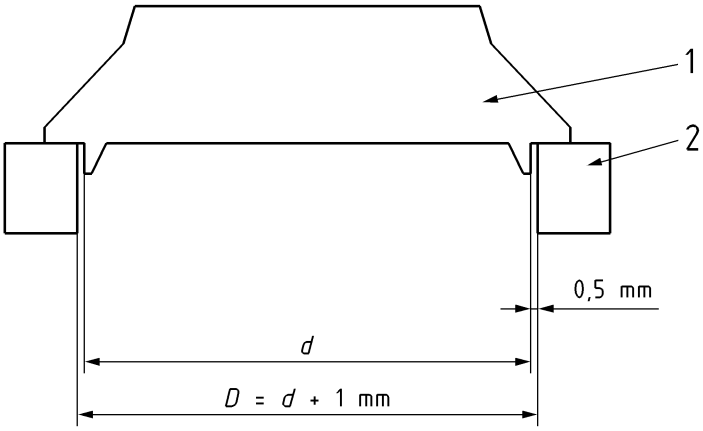
D is the distance between the two supports, in millimetres;

d is the block width between rebates or end plates, in millimetres.

The position shall be adjusted as follows:

— measure the width d of the bottom part of the block,

— adjust the support lines to the measured value increased by 1 mm (Figure 18).



Key

1 test specimen
2 support

Figure 18 — Adjustment of support lines for block with rebates or end plates

5.3.5.2 Positioning the rigid loading plate on the lightweight block

In accordance with 5.3.4.2.

5.3.5.3 Loading

In accordance with 5.3.4.3.

5.3.5.4 Expression of results

In accordance with 5.3.4.4.

5.3.6 Interpretation of tests results

The characteristic resistance to concentrated load P_{Rk}, in accordance with 4.3.3.7, shall be verified in accordance with the procedure described in Table 3. Annex E shall be used for the assessment of conformity.

Table 3 — Conformity criteria for determining the characteristic resistance to concentrated load of lightweight blocks

Production	Number of blocks "n"	criterion 1 $\overline{P}_n$ (kN)	criterion 2 P_i (kN)
at start	5	$\geq 1{,}2\ P_{Rk}$	$\geq 0{,}8\ P_{Rk}$
during production	≥ 15	$\geq P_{Rk} + 1{,}48\ \sigma$	$\geq 0{,}8\ P_{Rk}$

where

n is the number of individual results;

$\overline{P}_n$ is the average strength of the n individual results obtained:

— with the specimens constituting the sample for the test (at start); or

— with the specimens tested over the moving period considered (during production);

P_i is the individual strength of each block;

P_{Rk} is the characteristic resistance to concentrated load in accordance with 4.3.3.7;

σ is the standard deviation determined from at least 35 test results over a period of at least three months immediately preceding the period in which conformity is to be substantiated.

5.3.7 Test report

The test report shall mention:

a) the manufacturing plant;

b) the class (R1 or R2) and the designation of blocks;

c) the date of manufacture or some other code;

d) the date of testing;

e) the laboratory and the person in charge of testing;

f) the type of test (individual blocks or restraining blocks, with or without lateral restrained device);

g) the individual strength P_i, to the nearest 10 Newtons, multiplied by the calibration factor Cf;

h) the weight of each block;

i) a statement that the tests were carried out in compliance with this standard;

j) identification of the testing machine and the calibration factor.

5.4 Reaction to fire test

For the determination of Euroclass:

a) ignability shall be tested according to EN ISO 11925-2 for Euroclass E and F;

b) for other Euroclasses, B, C and D, ignability test shall be completed by a single burning item test:

1) For thick blocks, EN 13823 shall apply.

2) For thin blocks, Annex F shall apply.

5.5 Thermal conductivity

When relevant, EN 12667 shall apply.

5.6 Thermal resistance of the floor system

When relevant, the thermal resistance of floor systems is determined by calculation. The method used shall meet the requirements of EN ISO 10211.

The thermal resistance is determined from the thermal conductivity of the lightweight expressed for a mean temperature of 10 °C.

6 Evaluation of conformity

6.1 General

The manufacturer shall demonstrate compliance for the products with the requirements of this European Standard. The evaluation of conformity shall be carried out in accordance with Clause 6 of EN 13369:2013, and shall be based both on:

a) initial type testing of the product (see 6.2);

b) factory production control (see 6.3).

Alternative methods of test to the reference methods specified in this European Standard may be adopted except for the initial type tests and in case of dispute, provided that these alternative methods satisfy the following:

c) a relationship can be shown to exist between the results from the reference test and those from the alternative test; and

d) the information on which the relationship is based is available.

6.2 Initial type tests

After completion of the development of a new product (not belonging to an existing family) type and before commencement of manufacture and offering for sale, appropriate initial type tests shall be carried out to confirm that the properties predicted from the development meet the requirements of this standard and the values to be declared for the product family. Whenever a major change in the source, blend, or nature of raw materials occurs, or when there is a change in processing conditions, leading to what the manufacturer considers will constitute a new product type being produced, the appropriate initial type test shall be repeated. Annex A of this document shall apply.

The results of initial type tests shall be recorded.

6.2 of EN 13369:2013 shall also apply.

NOTE For the performance characteristics to be determined in order to address the CE marking provisions, see Table ZA.1.

6.3 Factory production control

6.3.1 General

A factory production control system shall be established and documented. The factory production control system shall consist of procedures for internal control of the production to ensure that such products placed on the market are to conform to this standard and the declared values. Annex B of this document shall apply.

6.3 of EN 13369:2013 shall also apply.

6.3.2 Finished product test

As appropriate, the factory production control system incorporates a sampling plan and the frequency of testing the finished product. The results of sampling and testing shall be recorded.

7 Marking

Delivered batches of blocks shall be uniquely identifiable and traceable until erection with regard to their production site and data. For this purpose, the manufacturer shall mark the products or the delivery documents so the relation to the corresponding quality records required in this standard can be secured. The manufacturer shall keep these records for the required period of archiving and make them available when required.

NOTE For CE marking refer to Annex ZA.

8 Technical documentation

The geometry of lightweight blocks shall be compatible with that of the beams used in the floor system, particularly with respect to the connection between the beam and any cast in-situ concrete.

The geometry of lightweight blocks shall be given by the manufacturer in the technical documentation if the manufacturer himself does not assure the design of the floor system.

The design of the floor system may be given by the manufacturer in the technical documentation.

Design recommendations for beam-and-block floor systems are given in informative annexes of EN 15037-1:2008 about monolithism of composite floor systems (Annex C), detailing of supports and anchorage reinforcement (Annex D), design of composite floor systems (Annex E), diaphragm action (Annex G), resistance to fire (Annex K) and acoustic insulation (Annex L).

The composition of technical documentation is given in Clause 8 of EN 13369:2013.

Annex A
(normative)

Sampling for initial type testing and for independent testing of consignments

A.1 General

This sampling procedure shall apply for initial type testing and in the event that there is a requirement for an assessment of product compliance. For independent testing, representatives of all parties shall have the opportunity to be present at the time of sampling.

Only those properties declared by the manufacturer shall be assessed by this procedure.

The required number of lightweight blocks to determine compliance with specification shall be sampled from a consignment of up to 200 m or part thereof (see A.2.4).

NOTE Lightweight blocks manufactured to this European Standard which have been the subject of third party inspection of their conformity control procedures are not normally subjected to independent testing of consignments after delivery.

A.2 Sampling procedure

NOTE The choice of the method of sampling will normally be dictated by the physical form of the consignment in question.

A.2.1 Random sampling

Whenever possible, the random sampling method shall be used, in which every block in the consignment has an equal chance of being selected for the sample. The appropriate number of blocks shall be selected at random from positions throughout the consignment without any consideration being given to the condition or quality of those selected except that blocks damaged in transit shall not be selected.

NOTE In practice, random sampling is normally only convenient either when the blocks forming the consignment are being moved in a loose (unpacked) form from one place to another or when they have been split into a large number of small stacks, e.g. on scaffolding awaiting laying.

A.2.2 Representative sampling

A.2.2.1 General

When random sampling is impracticable or not convenient, e.g. when the blocks form a large stack or stacks with ready access to only a limited number, a representative sampling procedure shall be used.

A.2.2.2 Sampling from a stack

The consignment shall be divided into at least six real or imaginary sections, each of a similar size. An equal number of units shall be selected at random from within each section in order to give the required number of units without any consideration being given to the quality of those selected except that units damaged in transit shall not be selected.

NOTE Some parts of the stack or stacks can be removed in order to access to the blocks in the centre of those stacks while taking the sample.

A.2.2.3 Sampling from a consignment formed of banded packs

At least six packs shall be selected at random from a consignment. The band around one blade or slice in each pack shall be removed and an equal number of not more than four blocks shall be sampled at random from within each of the broken blades or slices in order to give the required number without any consideration being given to the condition or quality of those selected except that blocks damaged in transit shall not be selected.

A.2.3 Dividing the sample

When the sample is to provide lightweight blocks for more than one test, the total number shall be collected together and then divided by taking blocks at random from within the total sample to form each successive sub-sample.

The exact number of lightweight blocks required for the tests (dimensions, straightness, warping and surface characteristics, weight, mechanical strength, reaction to fire, thermal characteristics) shall be taken at random from those sampled from the consignment by one of the methods given in A.2.2.

A.2.4 Number of blocks required per test

When the characteristic is concerned, the sample per test is defined in Table A.1.

Table A.1 — Number of blocks required per test

Subject	Test method	Quantity of blocks
Geometrical properties, straightness, warping and surface characteristics	5.1	6
Weight	5.2	10
Resistance to concentrated load	5.3.4 [a]	5
	5.3.5	5
Reaction to fire	5.4	3
Thermal properties (when relevant)	5.5	3

[a] For blocks in class R2 only.

Annex B
(normative)

Factory production control

Table B.1 — Finished product inspection *(1 of 2)*

	SUBJECT	PURPOSE [a]	METHOD			FREQUENCY [a]	
Product testing							
1	Dimensions: — length, width and height block — height above beam support — width and height of the chamfer — width and height of the rebate (when relevant) — width and height of the support nib	Conformity with drawing and specified tolerances (see 4.3.1)	Measuring according to 5.1.1			Once per manufacturing batch per family, on 1 block	
2	Thickness			Direct testing	Indirect testing	Direct testing	Indirect testing
				and		and	
				According to 5.1.1	—	1 per batch per family, on 1 block	—
			or	—	Product weight (using a manufacturer correlation) [b]	—	1 per batch per family on 3 blocks
3	Straightness		Measuring according to 5.1.2			Once per year per family, on 6 blocks	
4	Warping		Measuring according to 5.1.3				
5	Surface characteristics: — general appearance	Detection of defects (see 4.3.2)	Visual inspection (see 5.1.4)			Daily	
6	Weight	Conformity with the declared (see 4.3.1.1.4)	Measuring according to 5.2			Once per manufacturing batch per family on 3 blocks	

Table B.1 — Finished product inspection *(2 of 2)*

	SUBJECT	PURPOSE [a]	METHOD			FREQUENCY [a]	
Product testing							
7	Resistance to concentrated load	Conformity with the specified value(s) (see 4.3.3.7)	Testing according to 5.3			Once per manufacturing batch/family: — Class R1: on 5 blocks for tests in accordance with 5.3.5 (individual blocks); — Class R2: on 5 blocks for tests in accordance with 5.3.4 (restrained blocks) and 2 blocks for tests in accordance with 5.3.5 (individual blocks).	
8	Resistance and reaction to fire	Conformity with the declared values (see 4.3.4)	Testing according to 5.4			See 4.3.4	
9	Thermal conductivity (when relevant)	Conformity with the specified requirements of the product standard and with the specified or declared values (see 4.3.6)		Direct testing	Indirect testing	Direct testing	Indirect testing
				and		and	
				According to 5.5	—	1 per 24 h and at least one per batch	—
			or	According to 5.5	Product weight or density (using a manufacturer correlation)	1 per 3 month	1 per 2 h
			or	According to 5.5	Other test method for thermal conductivity	1 per 3 month	1 per week

[a] The indicated tests and frequencies may be adapted or even deleted when equivalent information is obtained directly or indirectly from the product or process.

[b] At the beginning of production, the manufacturer determines the mean value of the weight on 10 blocks, which are submitted to the direct testing in accordance with 5.1.1.

Annex C
(normative)

Gravity loading tests

C.1 Test rig

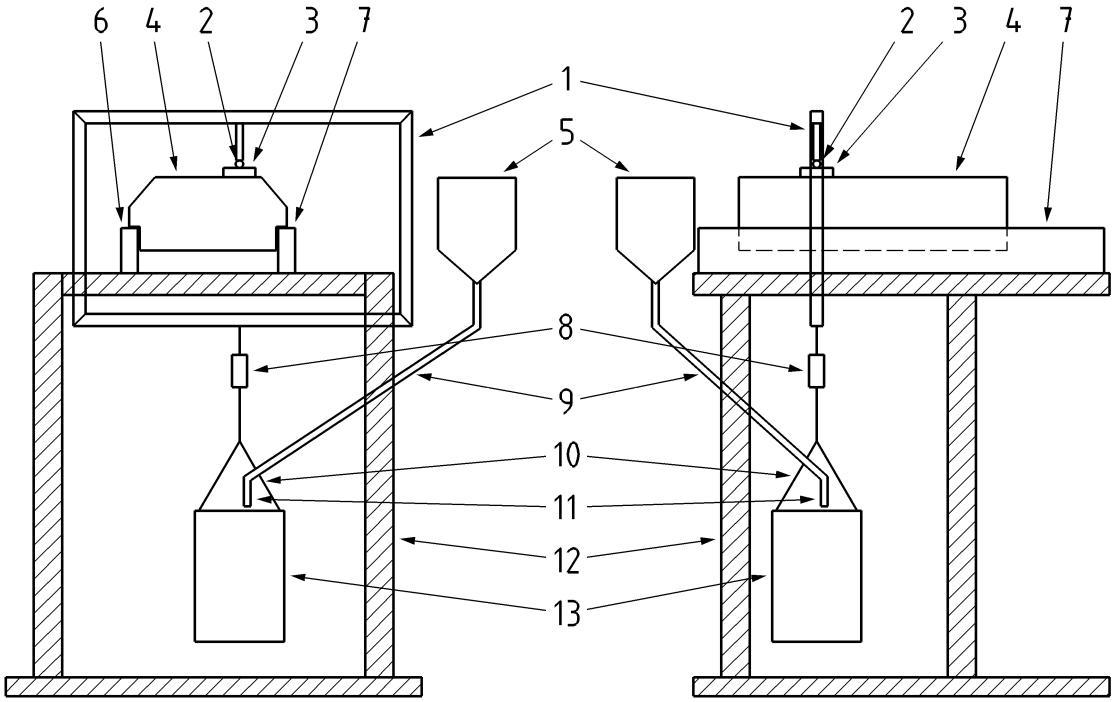
C.1.1 General

The gravity-type test rig applies a point load through a hinge to a rigid plate placed on top of a lightweight block.

The load is applied by a gravity weighting system beneath the lightweight block which is free to move in the horizontal plane. The loading is increased constantly by a regular stream of lead pellets or water until the block fails.

A loading frame transfers the load to the rigid plate.

A load cell between the loading weight and the loading frame measures the gravitational force applied to the block.



Key

1 loading frame
2 (20 ± 2) mm diameter ball bearing
3 rigid loading plate
4 lightweight block
5 lead pellet or water hopper
6 adjustable support
7 fixed support
8 load cell
9 supply pipe
10 non-stretch straps
11 valve
12 frame
13 loading canister

Figure C.1 — Gravity test rig

C.1.2 Supports

— One support shall be fixed, the other adjustable.

— Material: the supports shall be steel.

The two supports, representing beams, shall be covered with abrasive fabric (40 grains) or a system achieving equivalent roughness. The abrasive fabric shall adhere to the supports and cover the effective bearing length. The abrasive fabric shall be cleaned and replaced regularly.

— Dimensions: Length = at least the length of blocks

Width ≥ 25 mm.

— Position: one of the supports shall be securely attached to the frame to prevent any tilting when the block is loaded.

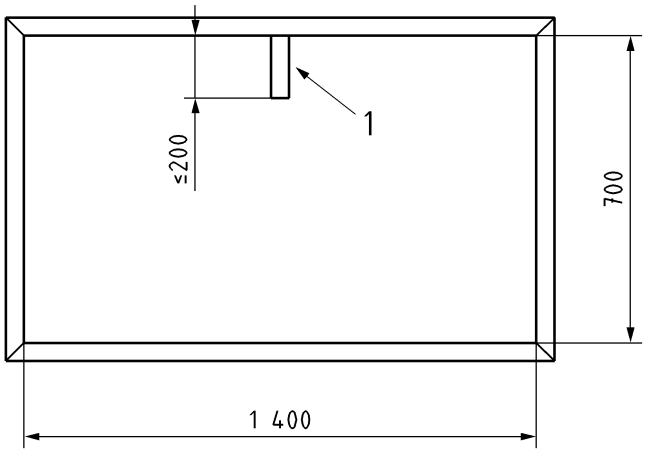
The adjustable support is set so as to have a distance D with the fixed support, with D in accordance to the installation defined in the technical documentation (see Figures 16, 17 or 18).

C.1.3 Loading frame

— Material: the frame shall be a rigid material, but shall be light in order to reduce preloading on the block.

— Dimensions (Figure C.2):

Dimensions in millimetres



Key

1 loading rod, with conical depression at bottom end

Figure C.2 — Loading frame

The conical depression at the bottom of the loading rod shall be designed to receive a (20 ± 2) mm diameter ball bearing. Since the ball bearing can rotate freely in this depression and a matching depression in the rigid loading plate, the loading rod will remain vertical at all times.

C.1.4 Loading weight

— Material: lead pellets (diameter of 2 mm ± 1 mm) or water.

— Loading canister: rigid and able to contain the material.

The lead pellets or water shall run into the loading canister from a storage hopper.

— Supply pipe: the loading canister shall be loaded by the pellets or water flowing under gravity from the storage hopper through a 63 mm diameter pipe inclined at 45° ± 1°. A valve (mounted on a 45° fitting) shall control the flow of pellets or water into the canister. The supply system shall be designed to attain a constant rate of load increase of 100 N/s ± 30 N/s.

— Attachment: the load shall be attached to the centre of the loading frame (to the bottom bar). Stable balance shall be achieved by the symmetry of mass about the loading rod.

C.1.5 Measuring system

The load applied to the block shall be measured with a load cell.

— Load cell: measuring range – 0,5 kN to 5 kN.

It shall allow the test rig to be ranked in class 2 in accordance with EN 12390-4.

— Display unit: the force applied to the block shall be recorded against time.

C.1.6 Rigid loading plate

— Material: flat metal or hardwood plate block attached to a retaining cable (when block falls).

— Dimensions: Length 300 mm, width 100 mm, thickness 25 mm (Figure C.3).

Dimensions in millimetres

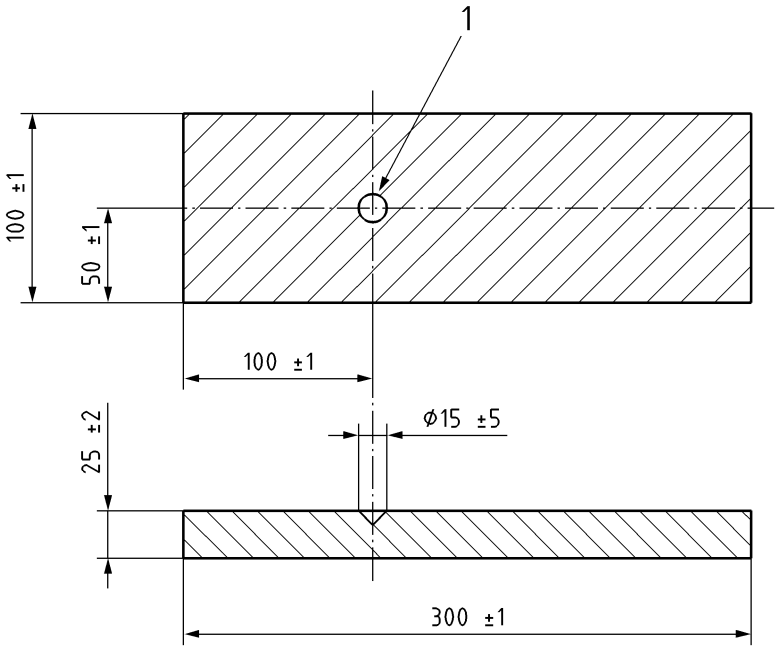


Figure C.3 — Rigid loading plate

The rigid loading plate shall be placed on top of the lightweight block, in the most critical position defined in 5.3.4.2.

C.2 Procedure

a) Conditioning of specimens:

The lightweight blocks shall be conditioned indoors, at ambient temperature, for at least 24 h before the test.

b) Placing the lightweight block on the gravity test rig:

The lightweight block shall rest horizontally on supports of a shape declared by the manufacturer for the type of product tested.

The distance between supports shall be adjusted in accordance with C.1.2.

c) Determining preloading:

The preload prior to the start of the test is the mass bearing on the block before the flow of lead pellets or water starts. It corresponds to the weight (in kN) of the empty loading canister, the load cell, the straps, the loading frame, the ball bearing, and the rigid loading plate.

d) Positioning the rigid loading plate on the lightweight block:

The load shall be applied via the rigid loading plate placed at the more critical positions defined in 5.3.4.2.

e) Positioning of loading system:

The loading frame shall be placed on the ball bearing placed on the rigid loading plate. Stable balance shall be achieved by the symmetry of mass about the loading rod. The frame shall be free to move in the horizontal plane.

f) Loading:

The load cell shall be zeroed with the system at rest, i.e. with an empty loading canister.

When the valve is opened, lead pellets or water shall flow into the loading canister at a rate of 100 N/s $\pm$ 30 N/s until the block breaks.

g) Expression of results:

The load registered by the load cell when the block breaks shall be recorded. The total weight applied to the block during the gravity test (registered load + preload) is the maximum load withstood by the block.

C.3 Test report

The test report shall mention:

a) the manufacturing plant;

b) the class (R1 or R2) and the designation of blocks;

c) the date of manufacture or some other code;

d) the date of testing;

e) the laboratory and the person in charge of testing;

f) the position of the loading plate;

g) the weight of the preload;

h) the material used for loading (lead pellets or water);

i) the individual load in Newtons;

j) the characteristic resistance Rc_{grav} in Newtons calculated as defined in Annex D;

k) the weight of each block;

l) a statement that the tests were carried out in compliance with this standard.

Annex D
(informative)

Calibration of mechanical strength testing machine

D.1 Sample

The calibration is carried out to determine the calibration factor Cf (5.3.3) of a testing machine for a family of blocks.

The calibration factor obtained with a testing machine on a family of blocks could be used with similar testing machines on products which would have a calibration factor superior or equal. For each family of blocks, the results obtained with the similar testing machines shall be then compared to the results obtained by the testing machine used for the calibration. The justification of the calibration factor should be documented.

NOTE The most penalising calibration factor is generally obtained with the lightweight block which has the greatest deformation of the material under a load.

The calibration is realised on lightweight blocks without lateral or longitudinal restraint.

20 couples of lightweight blocks are sampled, that is 40 blocks are sampled in the considered family.

— Cut blocks:

20 couples of blocks are sampled. Each couple is taken in a symmetrical position in the block of material.

— Moulded blocks:

20 couples of blocks are sampled. Each couple is taken on the same print on two consecutive cycles.

The couples are identified and weighed. One of the blocks of the couple is tested in accordance with 5.3.5. The second block of the couple is tested in accordance with Annex C.

The mode of conservation will be the nearest possible for the two blocks.

D.2 Procedure

The tests will be carried out at least 15 days after the sampling. Before the tests, the blocks are stored indoors, in an environment higher than 10 °C.

The parameters of adjustment of the testing machine are recorded.

The tests carried out shall take place in a nearest possible period.

The calibration factor Cf is calculated by the formula:

$$Cf = Rc_{grav} / Rc_{mach} \quad \text{(D.1)}$$

where

Rc_{mach} is the characteristic resistance of testing machine results obtained in accordance of 5.3.5;

Rc_{grav} is the characteristic resistance of gravitary test results obtained in accordance of Annex C.

Characteristic resistances are calculated by the formula:

$$Rc = m - k_1 \cdot s \qquad \text{(D.2)}$$

where

m is the average of the series of test results;

s is the standard deviation of the series of test results;

k_1 = 1,21, with k_1 calculated on the basis of:

— a number of results N = 20;

— a fractile of 0,20;

— a confidence level of 95 %;

— a standard deviation known.

D.3 Validity

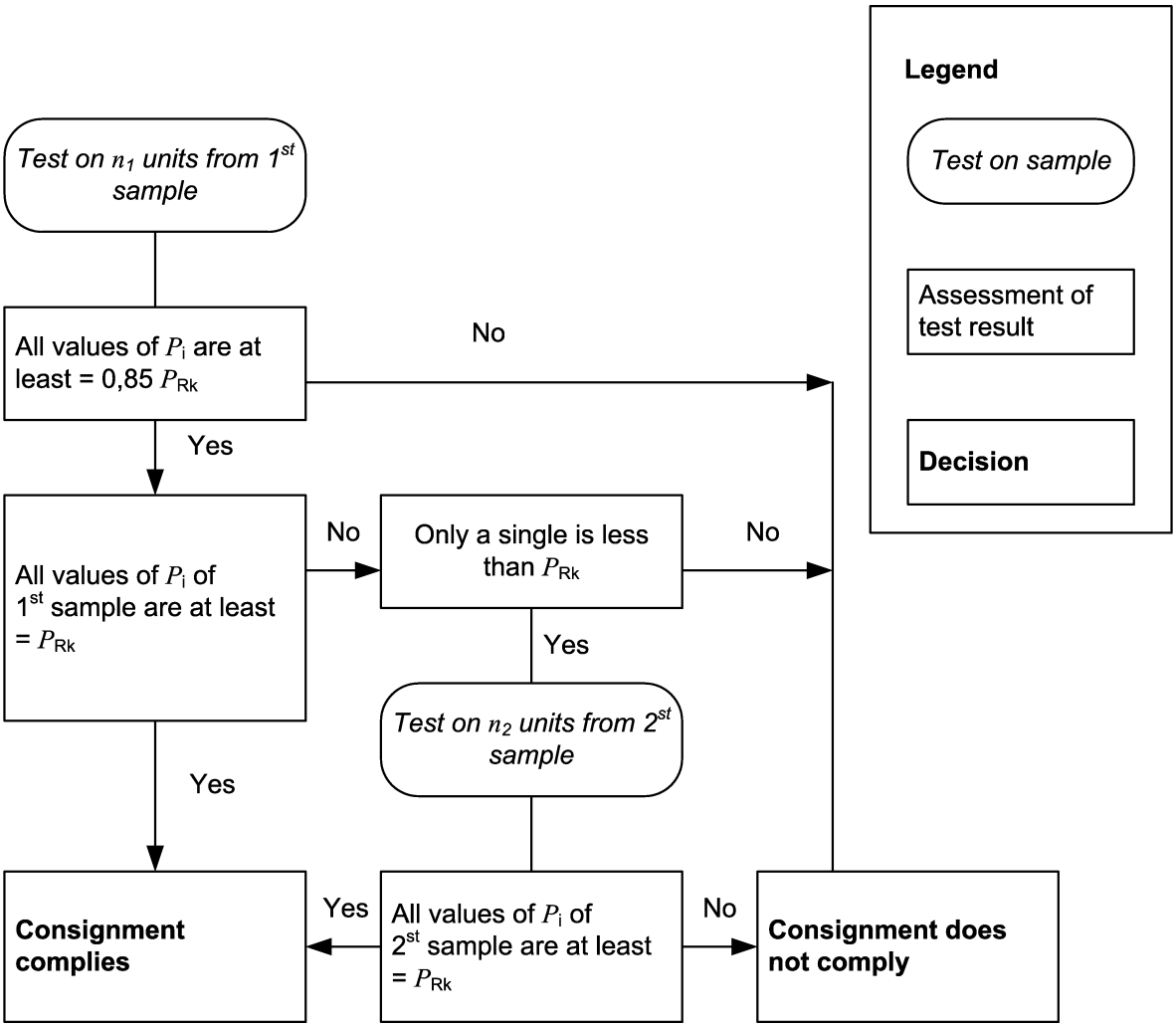
The calibration factor Cf is valid if the characteristic resistance of gravitary test results (Rc_{grav}) does not deviate more than 300 N from the characteristic resistance to concentrated load P_{Rk} in accordance with 4.3.3.7 for blocks used for calibration.

i.e. $\left| R_{cgrav} - P_{Rk} \right| \leq 300$ N

Annex E
(normative)

Compliance criteria for mechanical strength

The characteristic strength shall comply with the requirements given in 4.3.3.7 above. The assessment of compliance shall be based on the procedure shown in Figure E.1.



Key

P_{Rk} characteristic resistance to concentrated load in accordance with 4.3.3.7, in kN

P_i individual strength for each unit, in kN

n_1 and n_2 as given in Table E.1

Figure E.1 — Scheme for the assessment of characteristic resistance of units

Table E.1 — Number of test units

Tests carried out	Test according to 5.3.4 (restrained blocks)		Test according to 5.3.5 (individual blocks)	
Number of test units	n_1	n_2	n_1	n_2
Class R1	—	—	5	8
Class R2	5	8	2	4

Annex F
(normative)

Fire testing test for thin blocks

F.1 General

Because of the 3-dimensionnal shape of the blocks, and since their use in a horizontal position (as testing according to EN 13823 is made on vertical samples), this procedure is applied to determine the reaction fire for thin lightweight blocks with an adaptation of EN 13823.

F.2 Terminology

Extended application: the outcome of a process (involving the application of defined rules that may incorporate calculation procedures) that predicts, for a variation of a product property and/or its intended use application(s), a test result on the basis of one or more tests to the same test standard.

F.3 Mounting and fixing

F.3.1 General

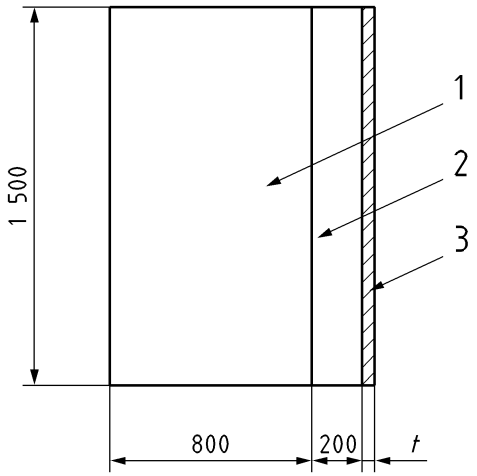
The mounting and fixing rules for this product are simplified with a test on plane sheet (as proposed in 5.2.2, list entry h) of EN 13823:2010) and with vertical joints (5.2.2, list entry e) of EN 13823:2010), edge to edge.

F.3.2 Dimensions of test rig

The test rig consists of a corner with a long (1 000 mm) and a short (495 mm) wing, both 1 500 mm high.

The vertical joints on the long wing are positioned as defined in Figure F.1.

Dimensions in millimetres



Key

1 long wing
2 vertical joints (or vertical joint)
3 short wing
t thickness of the assembly

Figure F.1 — Positioning of joints in EN 13823 on the long wing

F.3.3 Test specimen

The product parameter variables shall be defined and tests conducted to determine the influences of these variables on classification. For example, the influences of different thicknesses, densities or colours shall be determined by following the rules given below.

The type and characteristics of materials and products used shall be recorded in the test report.

F.3.4 Mounting and fixing of the test assembly

When testing to EN 13823, the test assembly shall be as representative as possible of end use conditions. In practise, concrete is poured onto the lightweight block. The test assembly shall consist of flat sheets of the same material as the one of the lightweight block onto which A1 concrete[1)] is poured. The total thickness should not exceed 35 mm because of the weight of the whole assembly.

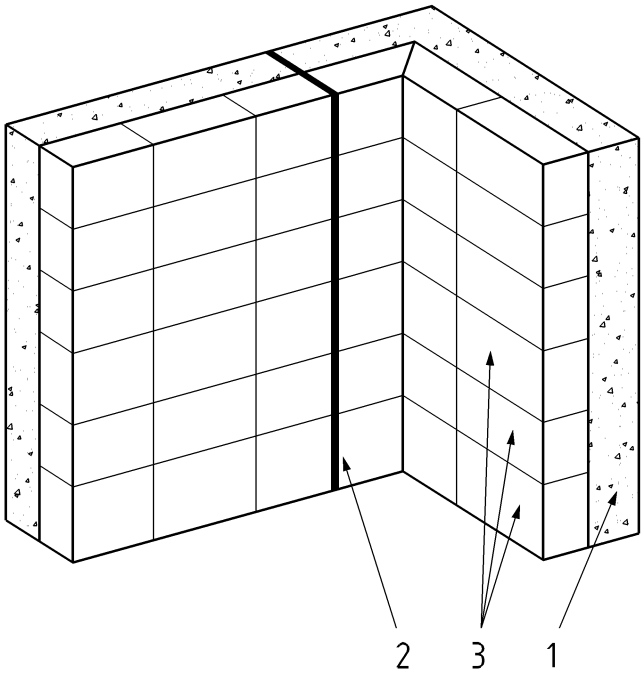
The concrete aggregates should not exceed 10 mm diameter. Concrete may be reinforced with steel bars or mesh. The test can be carried out after the age of 28 days.

The flat sheets can be obtained by assembled units whose standard surface is not less than 1 200 cm^2 for the current elements.

The backing board shall then be placed against the assembly, without any air gap between the assembly and the backing board.

Figure F.2 gives an example of mounting and fixing:

1) An A1 concrete contains less than 1 % in weight or volume (according to the lowest value) of organic material distributed in a homogeneous way.



Key

1 concrete
2 edge to edge joint
3 assembled units

Figure F.2 — Example of mounting and fixing arrangement in EN 13823

The assembly may be prepared and fixed together away from the test chamber. The complete assembly can then be transported to the chamber. The tests shall be carried out at the earliest 28 days after the casting of the concrete.

F.4End Use Application Rules

F.4.1 General

The conditions of the test influence the classification of the product or the family of the product and the possible uses in building construction. When determining the testing programme all aspects of the product in terms of its own parameters and its end-use parameters need to be considered. For this construction product, the following provides guidance on the potential end-use application rules which may apply depending on the testing programme undertaken.

F.4.2 Air gap

The test assembly shall avoid any air gap.

F.4.3 Substrate

The test configuration validates the use of any A1 concrete, eventually reinforced, poured onto the lightweight block.

F.4.4 Influence of the thickness

The lightweight block has a 3-dimensional shape; its thickness may be not constant. The tests shall be conducted on flat sheets with lowest thickness (full test = three samples) and the highest thickness (full test = three samples) of the lightweight block that will be classified. The lowest classification obtained applies for the lightweight block.

F.4.5 Influence of the density of the material

For on type of material, if the tests conducted the minimum density (full test = three samples) and the maximum density (full test = three samples) yield the same classification, the classification will apply for the intermediate densities.

F.4.6 Influence of the formulation

Each different formulation shall be evaluated.

F.4.7 Influence of colour

One indicative test shall be conducted on three different colours. If the tests conducted on the darkest, lightest and mid range colours yield the same classification that classification will apply to all colours. If different classifications are obtained, additional testing should be conduced to redefine the product family to which a single classification applies.

F.4.8 Influence of other variables

Other variable parameters such as texture and grain are to be addressed in a similar manner to the above.

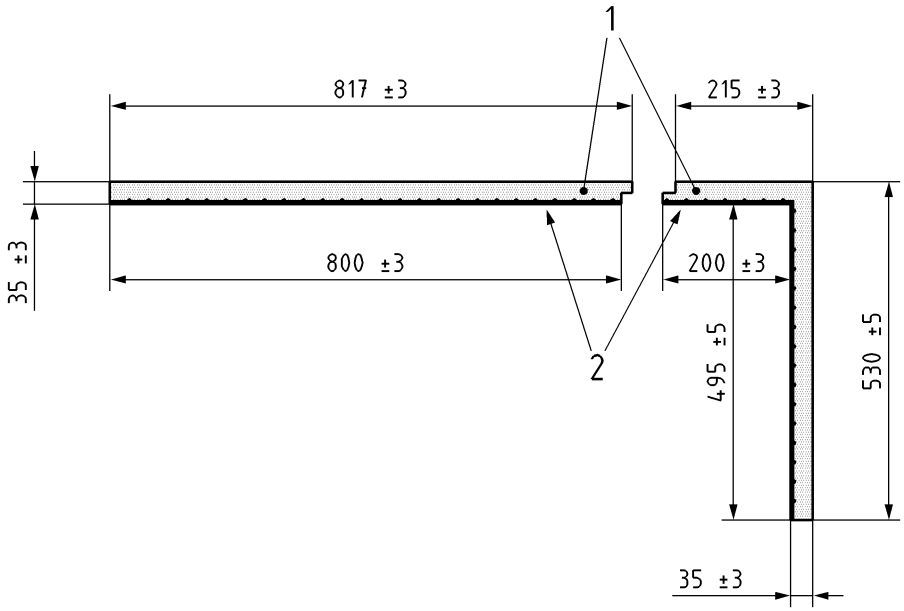
F.5Additional conditions for polypropylene blocks

Figure F.3 gives an example of joint system.

— Thickness for test assembly : ± 3 mm;

— flatness defaults: 3 mm with the straightedge of 20 cm length on the flatness of the exposed face;

— straightness of the edges of the sample: 2 mm for straightness of edges corresponding to the joint and 3 mm in other cases.

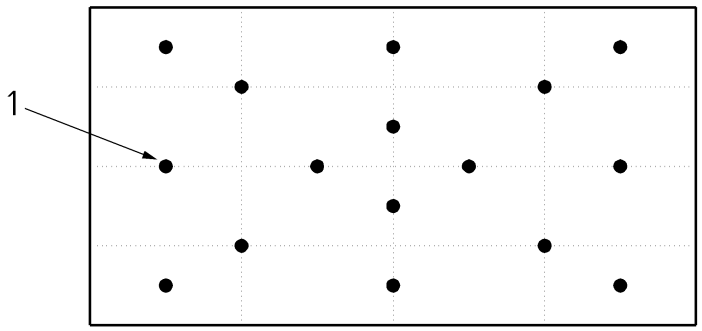


Key

1 concrete
2 flat sheets assembled together

Figure F.3 — Example of joint system

— Thickness of the units constituting the flat sheet: thickness is measured in different points (see Figure F.4). Each effective individual value shall meet the aimed thickness with a tolerance of ± 0,1 mm.



Key

1 position of the measure of the thickness

Figure F.4 — Example of measure sharing out of a single unit

— When the flat plates are made from single units heat welded, the over-thickness found straight above the joint on each sides shall not exceed the maximum thickness of the relief of the considered face.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under the mandate M/100 "Precast Concrete Products"[2)] given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the lightweight blocks for beam-and-block floor systems covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for CE marking of blocks made of lightweight, used in conjunction with beams in compliance with EN 15037-1 for beam-and-block floor systems, used for the construction of the structures of buildings and other civil engineering works, except bridges and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.

2) As amended.

Table ZA.1 — Relevant clauses for lightweight blocks used in beam-and-block floor systems

Essential characteristics	Requirement clauses in this standard	Levels and/or class(es)	Notes and Unit
Detailing	4.3.1 Geometrical properties	None	mm
Load bearing capacity (by testing)	4.3.3 Mechanical strength		Declared class
Resistance to fire	4.3.4.1 Resistance to fire	R	Testing, tabulated data, calculation
Reaction to fire	4.3.4.4 Reaction to fire	Euroclass A1 to F[a]	
Airborne sound insulation and impact noise transmission (when the product is intended also for acoustic applications)	4.3.5 Acoustic properties	None	dB
Thermal conductivity and thermal resistance	4.3.6 Thermal properties	None	Declared value of thermal conductivity in W/m.K and thermal resistance in m².K/W
Durability	4.3.7 Durability	None	Ambient conditions
Dangerous substances	4.3.9 Dangerous substances	None	
[a] The experience shows that lightweight blocks on the market might be E or F.			

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements for that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor to declare the performance of their products with regard to this characteristic and the option “No Performance Determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure for attestation of conformity of lightweight blocks for beam-and-block floor systems

ZA.2.1 System of attestation of conformity

The system of attestation of conformity of lightweight blocks for beam-and-block floor systems, for the essential characteristics indicated in Table ZA.1, in accordance with the decision of the Commission 1999/94/EC of 25 January 1999 as amended by Commission Decision 2012/202/EU of 29 March 2012 (published as L109 the 21 April 2012). and as given in Annex III of the Mandate M/100 ”Precast concrete products”, is shown in Table ZA.2, for the indicated intended use and relevant levels or classes:

Table ZA.2 — System of attestation of conformity

Products	Intended Uses	Levels or Classes	Attestation of Conformity systems
Precast normal/lightweight/autoclaved aerated concrete products	For structural use	—	2+
Beam/block floor units and elements incorporating organic materials	For uses subject to regulations on reaction to fire	(A1, A2, B, C)*	1
		(A1, A2, B, C)**, D, E	3
		(A1 to E)***, F	4
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples. System 2+: See Directive 89/106/EEC (CPD) Annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory production and of factory production control as well as of its continuous surveillance, assessment and approval. System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility. System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), third possibility			
* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material). ** Products/materials not covered by footnote (*). *** Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of Class A1 according to the Decision 96/603/EC, as amended).			

The attestation of conformity of lightweight blocks for beam-and-block floor systems, for the essential characteristics indicated in Table ZA.1, shall be based on the evaluation of conformity procedure indicated in Table ZA.3 a) to ZA.3 c), resulting from the application of the clauses of this or other European Standards indicated therein.

Table ZA.3 a) — Assignment of evaluation of conformity tasks for lightweight blocks for beam-and-block floor systems under system 2+, classified (A1, A2, B, C)* for reaction to fire under system 1

Tasks		Content of the tasks	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	6.3
	Further testing of samples taken at factory	All characteristics of Table ZA.1 relevant for the intended use	6.3
	Initial type testing by the manufacturer	Parameters related to all characteristics of Table ZA.1 relevant for the intended use except reaction to fire	6.2
Tasks under the responsibility of the product certification body	Initial type testing	Reaction to fire	6.2
	Initial inspection of factory and of FPC	Reaction to fire	6.3
	Continuous surveillance, assessment and approval of FPC	Reaction to fire	6.3
Tasks under the responsibility of the FPC certification body	Initial inspection of factory and of FPC	Parameters related to the relevant characteristics of Table ZA.1, i.e. – dimensions; – mechanical resistance; – resistance to fire;	6.3
	Continuous surveillance, assessment and approval of FPC		6.3

Table ZA.3 b) - Assignment of evaluation of conformity tasks for lightweight blocks for beam-and-block floor systems under system 2+ , classified (A1, A2, B, C), D, E for reaction fire under system 3**

Tasks		Content of the tasks	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	6.3
	Initial type testing	All characteristics of Table ZA.1 relevant for the intended use except the reaction to fire	6.2
	Initial type testing by a notified laboratory	Reaction to fire	6.2
	Further testing of samples taken at factory according to the prescribed test plan	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	6.3
Tasks under the responsibility of the FPC certification body	Initial inspection of factory and of FPC	Parameters related to the relevant characteristics of Table ZA.1, i.e. - dimensions; - mechanical resistance; - resistance to fire	6.3
	Continuous surveillance, assessment and approval of FPC		6.3

Table ZA.3 c) — Assignment of evaluation of conformity tasks for lightweight blocks for beam-and-block floor systems under system 2+ , classified (A1 to E)*, F for reaction fire under system 4**

Tasks		Content of the tasks	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to EC of Table ZA.1 relevant for the intended use	6.3
	Initial type testing	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	6.2
	Further testing of samples taken at factory according to the prescribed test plan	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	6.3
Tasks under the responsibility of the FPC certification body	Initial inspection of factory and of FPC	Parameters related to the relevant characteristics of Table ZA.1, i.e. - dimensions; - mechanical resistance; - resistance to fire	6.3
	Continuous surveillance, assessment and approval of FPC		6.3

ZA.2.2 EC Certificate and Declaration of conformity

In case of products under systems 2+ and 1 (for reaction to fire)

When compliance with the conditions of this annex is achieved, the certification body shall draw up the EC Certificate of conformity (for fire only), which entitles the manufacturer to affix the CE marking. The EC certificate of conformity shall include:

— name, address and identification number of the certification body,

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production,

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use, ...),

— provisions to which the product conforms (i.e. Annex ZA of this European Standard),

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),

— the number of the certificate,

— conditions of validity of the certificate, where applicable,

— name of, and position held by, the person empowered to sign the certificate.

When compliance with the conditions of this annex is achieved, and once the notified body has drawn up the certificate mentioned below(for characteristics subject to system 2+ excluding the reaction to fire), the manufacturer or his agent established in the EEA shall draw up and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production,

NOTE 2 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking,

NOTE 3 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this European Standard), and a reference to the ITT report(s) and factory production control records (if appropriate),

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),

— the number of the accompanying factory production control certificate, and FPC records, where applicable,

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The declaration shall be accompanied by a factory production control certificate, drawn up by the notified body, which shall contain, in addition to the information above, the following:

— name and address of the notified body,

— the number of the factory production control certificate,

— conditions of validity of the certificate, where applicable,

name of, and position held by, the person empowered to sign the certificate

In case of products under systems 2+ and 3 (for reaction to fire), under systems 2+ and 4 (for reaction to fire)

When compliance with the conditions of this annex is achieved, and once the notified body has drawn up the FPC certificate mentioned below, the manufacturer or his agent established in the EEA shall draw up and retain the EC declaration of conformity, which entitles the manufacturer to affix the CE marking. This EC declaration of conformity shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production,

NOTE 4 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking,

NOTE 5 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this European Standard), and a reference to the ITT report(s) and factory production control records (if appropriate),

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),

— the number of the accompanying factory production control certificate, and FPC records, where applicable,

— name and address of the notified laboratory (only when system 3 applies for reaction to fire),

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The EC declaration of conformity shall be accompanied by the FPC certificate, drawn up by the notified body, which shall contain, in addition to the information above, the following:

— name and address of the notified body,

— the number of the factory production control certificate,

— conditions of validity of the certificate, where applicable,

— name of, and position held by, the person empowered to sign the certificate.

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production,

NOTE 6 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking,

NOTE 7 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this European Standard), and a reference to the ITT report(s) and factory production control records (if appropriate),

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned EC declaration of conformity or the EC certificate of conformity shall be presented in the language or languages accepted in the Member State in which the product is to be used.

ZA.3 CE marking and labelling

ZA.3.1 General

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EEC and shall be shown on the lightweight block (or when not possible it may be on the accompanying label, the packaging or on the accompanied commercial documents e.g. a delivery note). The following information shall be added to the CE marking symbol:

— identification number of the certification body;

— name or identifying mark and registered address of the producer;

— the last two digits of the year in which the marking is affixed;

— number of the EC factory production control certificate;

— reference to this European Standard;

— description of the product: generic name, dimensions, … and intended use;

— information on those relevant essential characteristics taken from Table ZA.1;

— "No performance determined" for characteristics where this is relevant.

The "No performance determined" (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

In the following subclauses the conditions are given for the application of CE marking. Figure ZA.1 gives the simplified label to affix to the product, containing the minimum set of information and the link to the accompanying document where the other required information are given. The minimum set of information to be put directly in the affixed label or in the companying document is given in Figure ZA.2.

ZA.3.2 Simplified label

In the case of simplified label, the following information shall be added to the CE marking symbol:

— name or identifying mark and registered address of the producer;

— identification number of the unit (to ensure traceability);

— the last two digits of the year in which the marking is affixed;

— number of the CE factory production control certificate;

— reference to this European Standard.

The same identification number shall mark, in the accompanying documents, the information related to the unit.

All information shall be provided in the accompanying documents.

Figure ZA.1 gives the simplified label to affix to the product, containing the minimum set of information. The other information defined in ZA.3.1 and not given with the simplified label shall be provided with the accompanying documents.

CE	CE conformity marking consisting of the CE symbol given in Directive 93/68/EEC
AnyCo Ltd, PO Bx 21, B-1050	Name or identifying mark and registered address of the producer
45PJ76/02	Identification number and last two digits of the year in which the marking was affixed
0123-CPD-0456	Number of the FPC certificate
EN 15037-5	Number of this European Standard

Figure ZA.1 — Example of simplified label

ZA.3.3 Information to be provided with the CE marking

Figure ZA.2 gives, for a type of lightweight blocks for beam-and-block floor systems, an example of the information to be provided with CE marking.

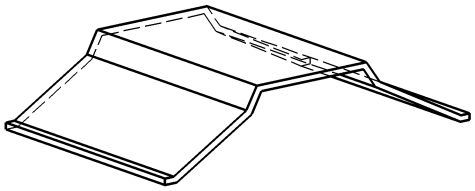
CE	CE conformity marking consisting of the CE symbol given in Directive 93/68/EEC
123	Identification of the notified body
AnyCo Ltd, PO Bx 21, B-1050	Name or identifying mark and registered address of the producer
13	Last two digits of the year in which the marking was affixed
0123-CPD-0456	Number of the FPC certificate
EN 15037-5 **Beam-and-block floor systems — Part 5: Lightweight blocks for simple formwork**	Number and title of European Standard concerned
LIGHTWEIGHT BLOCKS FOR SIMPLE FORMWORK	Generic name and intended use
Mechanical resistance:.....R2	
	Conditions of installation as the clearance with beams or the lateral tightening of the beams
	Information on product geometry and material characteristics including detailing (to be adapted to the specific product by the producer)
	Definition of the compatible beams for the lightweight blocks and the inner spacing beams corresponding
Reaction to fire.....Class F Thermal conductivity .....0,40 W/m.K Thermal resistance of the floor .....0,28 m^2.K/W	NOTE 1 Numerical values are only as example.
For detailing and durability see Technical Information Technical Information : Product Catalogue ABC : 2002 – clause ii Dangerous substances: see technical information	NOTE 2 The sketch may be omitted if equivalent information are available in clearly identified Technical Information (product catalogue) referred to.

Figure ZA.2 — Example of CE marking information

Bibliography

[1] EN 335-1, *Durability of wood and wood-based products — Definition of use classes — Part 1: General*

[2] EN 826, *Thermal insulating products for building applications — Determination of compression behaviour*

[3] EN 1365-2, *Fire resistance tests for loadbearing elements — Part 2: Floors and roofs*

[4] EN 1990, *Eurocode — Basis of structural design*

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

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

[7] EN 15037-4:2010, *Precast concrete products — Beam-and-block floor systems — Part 4: Expanded polystyrene blocks*

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