BRITISH STANDARD

BS EN
15498:2008

Precast concrete products — Wood-chip concrete shuttering blocks — Product properties and performance

ICS 91.100.30

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15498:2008.

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.

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

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 May 2008

ISBN 978 0 580 56734 6

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15498

April 2008

ICS 91.100.30

English Version

Precast concrete products - Wood-chip concrete shuttering blocks - Product properties and performance

Produits préfabriqués en béton - Blocs de coffrage en béton utilisant des copeaux de bois comme granulat - Propriétés et performances des produits

Betonfertigteile - Holzspanbeton-Schalungssteine - Produkteigenschaften und Leistungsmerkmale

This European Standard was approved by CEN on 18 March 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 15498:2008: E

Contents

Page

Foreword

This document (EN 15498:2008) 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 October 2008, and conflicting national standards shall be withdrawn at the latest by January 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 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 Construction Products Directive (89/106/EEC).

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

It also takes into account the EN 13369:2004 *Common rules for precast concrete products*.

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

1 Scope

This European Standard specifies the properties, performance and test methods of factory made, non-load-bearing hollow wood-chip concrete shuttering blocks, which may include factory installed thermal insulation.

These blocks are intended to be used for external and internal walls and partitions when filled with concrete.

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 772-14, *Methods of test for masonry units - Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units*

EN 772-16, *Methods of test for masonry units - Part 16: Determination of dimensions*

EN 772-20, *Methods of test for masonry units - Part 20: Determination of flatness of faces of aggregate concrete, manufactured stone and natural stone masonry units*

EN 1607, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 1793-1, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 1 : Intrinsic characteristics of sound absorption*

EN 1793-2, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 2 : Intrinsic characteristics of airborne sound insulation*

EN 1934, *Thermal performance of buildings — Determination of thermal resistance by hot box method using heat flow meter — Masonry*

EN 12524, *Building materials and products — Hygrothermal properties — Tabulated design values*

EN 12664, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Dry and moist products of medium and low thermal resistance*

EN 12390-5, *Testing hardened concrete — Part 5 : Flexural strength of test specimens*

EN 13162, *Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification*

EN 13163, *Thermal insulation products for buildings - Factory made products of expanded polystyrene (EPS) - Specification*

EN 13164, *Thermal insulation products for buildings - Factory made products of extruded polystyrene foam (XPS) - Specification*

EN 13165, *Thermal insulation products for buildings - Factory made rigid polyurethane foam (PUR) products - Specification*

EN 13166, *Thermal insulation products for buildings - Factory made products of phenolic foam (PF) - Specification*

EN 13167, *Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification*

EN 13168, *Thermal insulation products for buildings - Factory made wood wool (WW) products - Specification*

EN 13169, *Thermal insulation products for buildings - Factory made products of expanded perlite (EPB) - Specification*

EN 13170, *Thermal insulation products for buildings - Factory made products of expanded cork (ICB) - Specification*

EN 13171, *Thermal insulating products for buildings - Factory made wood fibre (WF) products - Specification*

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

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

EN 14474, *Precast concrete products — Concrete with wood-chips as aggregate — Requirements and test methods*

EN ISO 140-3, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 3: Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995)*

EN ISO 354, *Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 6946, *Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:2007)*

EN ISO 10456, *Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)*

EN ISO 12572, *Hygrothermal performance of building materials and products - Determination of water vapour transmission properties (ISO 12572:2001)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1
shuttering block
hollow block, having outer shells connected by recessed webs, intended to be dry-stacked or laid with mortar and filled with concrete

3.1.2
wood-chip concrete shuttering block
shuttering block made of wood-chip concrete according to EN 14474

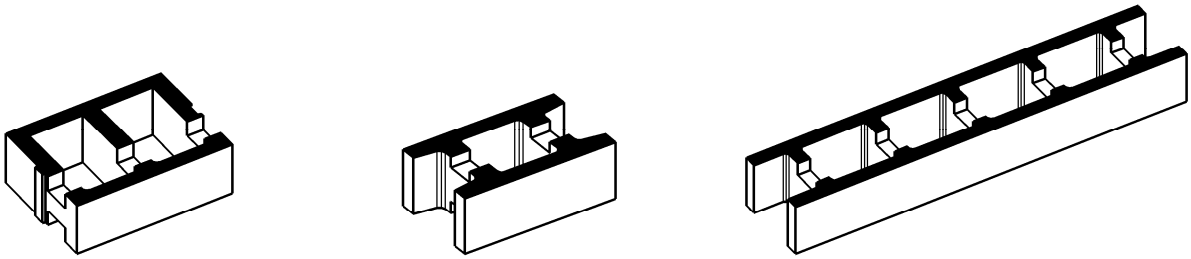


Figure 1 — Examples of shuttering blocks without additional thermal insulation

3.1.3
shuttering block with supplementary thermal insulation
shuttering block with factory installed thermal insulation to enhance thermal resistance

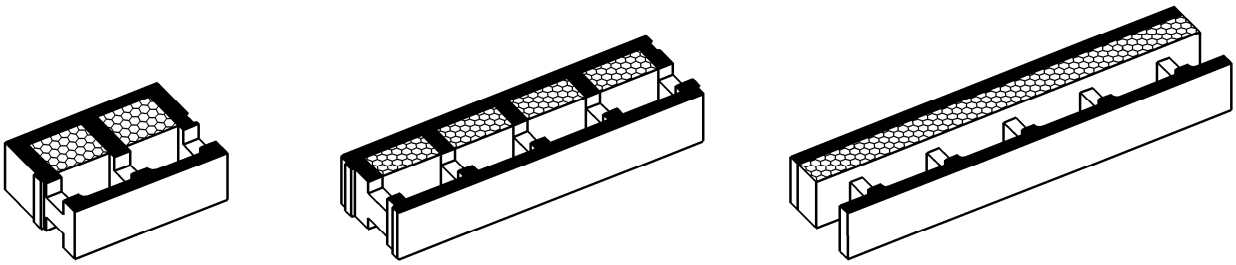


Figure 2 —Examples of shuttering blocks with supplementary thermal insulation

3.1.4
ancillary block
specially shaped shuttering block for the execution of constructional details, such as corners, reveals, lintels, etc.

3.1.5
design (nominal) dimension
dimension targeted in the project documentation

3.1.6
actual dimension (of the product)
dimension found by measurement (on the finished product)

3.2 Symbols and abbreviations

l_b	length of shuttering block, in mm
t_b	width (thickness) of shuttering block, in mm
t_c	thickness of concrete infill, in mm
t_i	thickness of insulation, in mm
$t_{wi,\ (w1,\ w2,\ )}$	thickness of web, in mm
t_S	thickness of shell, in mm

t_{S1}	thickness of outer shell, in mm
t_{S2}	thickness of inner shell, in mm
a_1, a_2	length of hollow space, in mm
a_3	length of cantilever shell, in mm
h_b	height of shuttering block, in mm
h_R	height of web recess ($h_R = h_{R1} + h_{R2}$), in mm
h_w	height of recessed web ($h_w = h_b - h_R$), in mm
w_R	width of web recess, in mm
s	cross-sectional area of recessed webs ($s = t_{wi} * h_w$), in mm²
s_1	cross-sectional area of recessed web with thickness t_{w1} ($s_1 = t_{w1} * h_w$), in mm²
A_R	total web recess area ($A_R = A_{R1} + A_{R2}$), in mm²
A_{R1}	upper web recess area, in [mm²]
A_{R2}	lower web recess area, in [mm²]
l	supporting length of shell ($l = a + 2 * t_{w1}/2$), in mm²
p	filling pressure, in N/mm²
p_{max}	maximum filling pressure of concrete infill, in N/mm²
p_{msd}	measured maximum filling pressure, in N/mm²
P_t	web tensile failure load, in N
$P_{t,min}$	minimum required web tensile failure load, in N
$P_{t,msd}$	measured web tensile failure load, in N
$f_{t,min}$	minimum required web tensile strength, in N/mm²
$f_{t,msd}$	individual value of the web tensile strength, in N/mm²
$f_{t,m}$	mean tensile strength of web, in N/mm²
P_f	shell flexural failure load, in N
$P_{f,msd}$	measured shell flexural failure load, inN
$f_{f,min}$	minimum required shell flexural strength, in N/mm²
$f_{f,msd}$	individual value of the shell flexural strength, in N/mm²
$f_{f,m}$	mean flexural strength of the shells, in N/mm²
f_{tp}	tensile strength of shells perpendicular to faces, in N/mm²
λ	thermal conductivity, in W/(m.K)
c	specific heat capacity, in kJ/(kg.K)

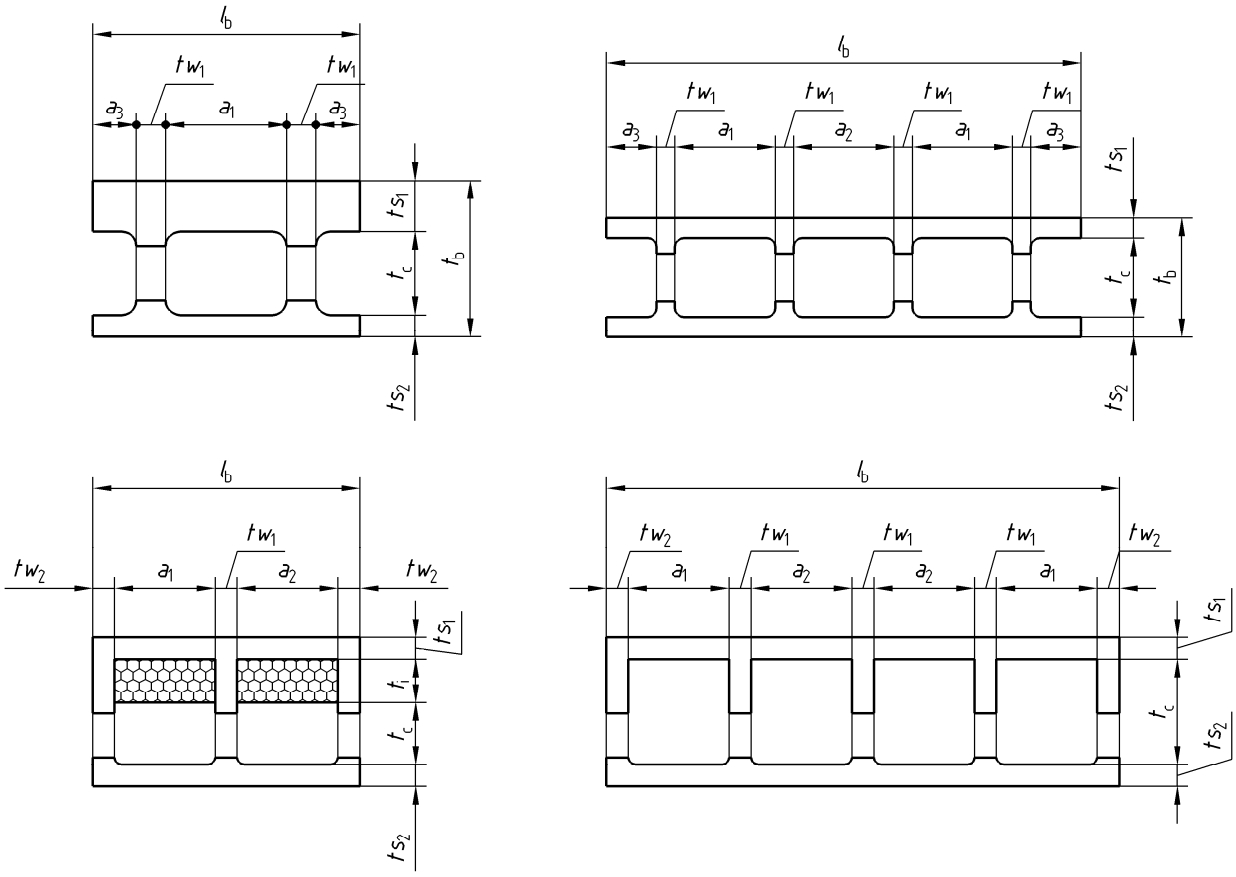


Figure 3a) — Symbols for geometric characteristics

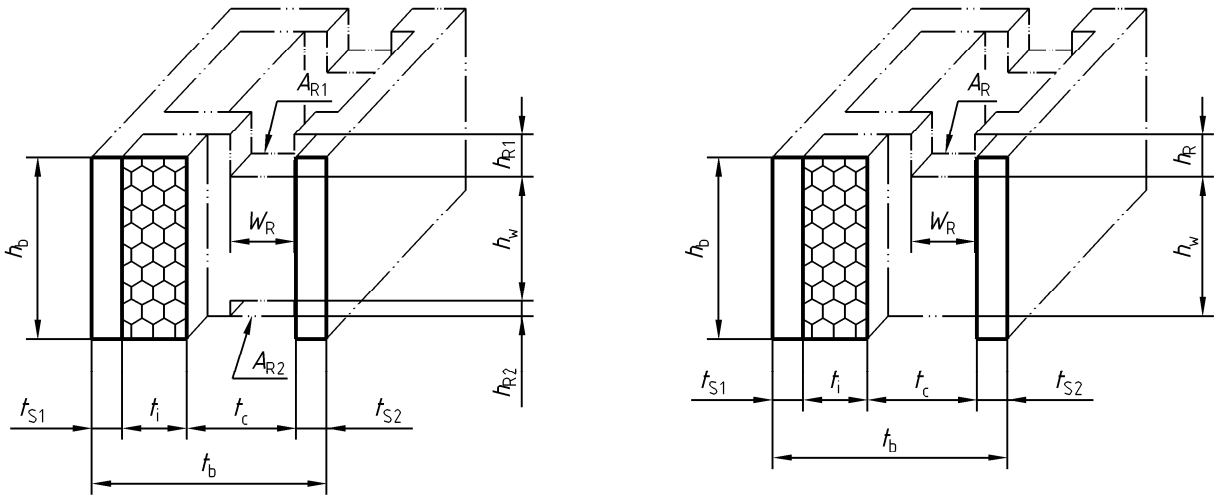


Figure 3b) —Symbols for geometric characteristics

4 Requirements

4.1 Material requirements

4.1.1 Wood-chip concrete

Only wood-chip concrete conforming to EN 14474 shall be used for the manufacture of wood-chip concrete shuttering blocks.

4.1.2 Supplementary thermal insulation materials

When supplementary thermal insulation materials are used, they shall comply with the relevant standard of the series EN 13162 to EN 13171.

4.2 Finished product requirements

4.2.1 Geometric characteristics

4.2.1.1 Dimensions

The work size of shuttering blocks shall be given in dimensioned drawings.

The external dimensions of the shuttering blocks shall be declared in mm in the order length, width and height.

The dimensions of voids and web-recesses shall be declared in mm.

The permissible deviations on declared work size of individual regularly shaped shuttering blocks shall conform to Table 1. Closer deviations may be declared.

Table 1 — Permissible deviations

Permissible deviations				
Length	**width**	**height**	**Dimensions of voids**	**Dimensions of web recesses**
± 5 mm	± 5 mm	± 3 mm	+10 / - 3 mm	

Deviations for non-regularly shaped shuttering blocks shall be as given in Table 1 or as declared.

Dimensions shall be determined according to 5.2.1.2.

4.2.1.2 Web recess area

If not otherwise declared, the web recess area A_R per web in a shuttering block in mm² shall be at least 0,2 times the core thickness t_c in millimetres multiplied by the height of the shuttering block h_b in millimetres (formula 1).

$$A_R = A_{R1} + A_{R2} \geq 0{,}2 \times t_c \times h_b \quad (1)$$

The web recess area for ancillary shuttering blocks shall conform to this requirement or shall be declared.

The web recess area shall be determined according to 5.2.1.3 .

4.2.1.3 Flatness

The deviation from flatness shall not exceed 5 mm for the side faces and 3 mm for the bed faces.

Deviation from flatness shall be determined according to 5.2.1.4.

4.2.1.4 Squareness

When required for shuttering blocks with bed faces, end faces and side faces designed to be at right angles the deviation from a right angle shall not exceed 4 mm over a length of 250 mm.

Deviation from squareness shall be determined according to 5.2.1.5.

4.2.2 Density

The material oven dry density shall be declared. The mean material oven dry density shall deviate by not more than ± 10 % from the declared value.

The material dry density shall be determined according to 5.2.2.

4.2.3 Moisture movement

If required, the moisture movement (shrinkage, expansion) of shuttering blocks to be used in exposed conditions shall be declared.

The moisture movement shall be determined according to 5.2.3 .

4.2.4 Reaction to fire

Shuttering blocks shall meet the requirements of class B according to EN 13501-1.

Reaction to fire shall be determined according to 5.2.4 .

4.2.5 Water vapour permeability

For shuttering blocks intended to be used in external walls water vapour permeability shall be given as design values for the wood-chip concrete and for any supplementary thermal insulation in the shuttering blocks.

Water vapour permeability shall be determined according to 5.2.5.

4.2.6 Mechanical strength

4.2.6.1 General

The mechanical strength of shuttering blocks shall be sufficient to allow handling and withstand a maximum filling pressure of $p_{\max}$ according to Annex A.

4.2.6.2 Tensile strength of web

The mean tensile strength of the web with the smallest cross-sectional area $f_{t,m}$ shall not be less than the minimum tensile strength of web $f_{t,\min}$ according to Annex A and Annex B.

$$f_{t,m} \geq f_{t,\min} \tag{2}$$

The tensile strength shall be determined according to 5.2.6.2.

4.2.6.3 Flexural strength of shells

The mean flexural strength of shells with the smallest thickness $f_{f,\mathrm{m}}$ shall not be less than the minimum flexural strength of shells $f_{f,\min}$ in according to Annex A and Annex C.

$$f_{f,m} \geq f_{f,\min} \tag{3}$$

The flexural strength of shells shall be determined according to 5.2.6.3.

4.2.6.4 Tensile strength of shells perpendicular to faces

For shuttering blocks intended for use in external walls of buildings with a bonded external insulation system, the value of the tensile strength of shells perpendicular to faces f_{tp} shall not be less than 0,15 N/mm².

$$f_{tp} \geq = 0{,}15 \text{ N/mm}^2 \tag{4}$$

The tensile strength of shells perpendicular to faces shall be determined according to 5.2.6.4 .

4.2.7 Acoustic properties

4.2.7.1 General

When relevant to the intended uses, the manufacturer shall provide information on the acoustic properties of the shuttering blocks.

NOTE Acoustic properties are mainly dependent on the density, surface characteristics, geometry and structure of the shuttering blocks and/or the mass of the wall when the blocks are filled with concrete. Other factors (e.g. air-tightness of the wall and the shape of the block-construction) also have an influence.

4.2.7.2 Airborne sound insulation

Airborne sound insulation is a property of finished walls.

Airborne sound insulation shall be determined according to 5.2.7.1.

4.2.7.3 Sound absorption

The sound absorption coefficient shall be given as a design value when shuttering blocks are used without an applied finish.

Sound absorption shall be determined according to 5.2.7.2.

4.2.8 Thermal properties

4.2.8.1 General

When relevant to the intended uses, the manufacturer shall provide information on the thermal properties of the shuttering blocks.

NOTE Thermal properties are mainly dependent on the thermal conductivity of wood-chip concrete, additional thermal insulation, concrete in-fill and the geometry of the shuttering blocks.

4.2.8.2 Thermal conductivity

Thermal conductivity λ shall be given as design values for the wood-chip concrete and for any additional insulating material in the shuttering blocks.

Thermal conductivity λ for the wood-chip concrete shall be determined according to 5.2.8.1.

4.2.8.3 Specific heat capacity

When required, specific heat capacity c for the wood-chip concrete shall be determined according to 5.2.8.2.

Specific heat capacity *c* shall be given as design values for any supplementary thermal insulation in the shuttering blocks according to EN 12524.

4.2.8.4 Thermal resistance of the finished wall

The thermal resistance is a property of finished walls.

The thermal resistance shall be calculated or measured according to 5.2.8.3.

4.2.9 Durability

4.2.9.1 General

When relevant to the intended uses, the manufacturer shall declare the frost-resistance with or without direct contact with de-icing salt.

4.2.9.2 Frost resistance

For shuttering blocks to be used in exposed conditions, frost resistance shall be given on the basis of long-term-experience or testing according to 5.2.9.1.

When tested, loss of mass shall be no more than 10 %.

4.2.9.3 Frost resistance in direct contact with de-icing-salt

For shuttering blocks to be used in direct contact with de-icing-salt, frost resistance may be given on the basis of long-term-experience or testing according to 5.2.9.2.

When tested, loss of mass shall be no more than 10 %.

5 Test methods

5.1 Principle

Tests shall be conducted on six specimens, unless specified otherwise. Shuttering blocks shall be sampled in accordance with E.2.

5.2 Procedure

5.2.1 Geometric characteristics

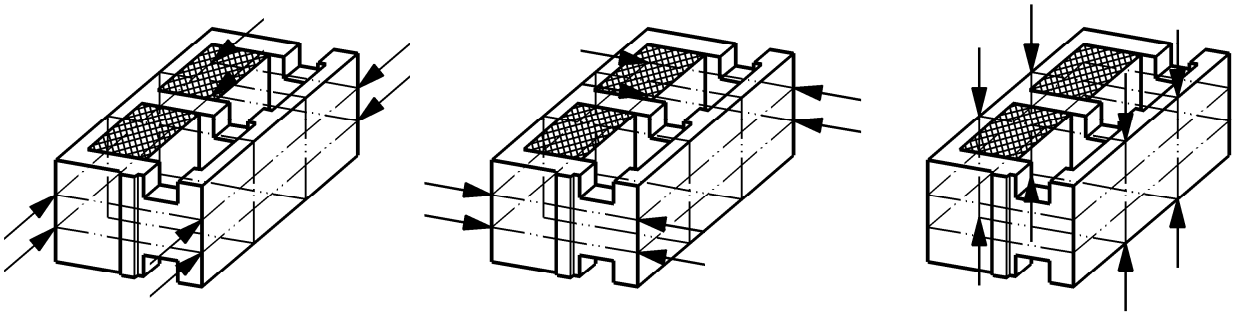
5.2.1.1 General

Geometric characteristics shall be measured on whole shuttering blocks.

The results shall be evaluated in accordance with Annex F.

5.2.1.2 Dimensions

Length, width and height shall be measured at the one third and two third positions of each pair of relevant faces. The mean value for length, width and height shall be calculated from the four measurements taken, rounded to the nearest mm (see Figure 4).



a) length of block **b) width of block** **c) height of block**

Figure 4 —Positions for measurement of geometrical characteristics

Lengths and widths of voids shall be measured on the centre line of each void on the upper and the lower surfaces of the block. The mean value for length and width shall be calculated from the two measurements taken rounded to the nearest millimetre.

Dimensions shall be measured by adjustable gauge in accordance with EN 772-16.

5.2.1.3 Web recess area

The area of each web recess shall be determined in mm² by measurement using a steel rule.

5.2.1.4 Flatness

Deviation from flatness of side faces and bed faces shall be measured in accordance with EN 772-20 and given in millimetres.

5.2.1.5 Squareness

Deviation of squareness between bed face, side-face and end-face shall be measured using a try square and feeler gauges and given in millimetres.

5.2.2 Density

The oven dry density shall be established from three test specimens cut from shuttering blocks having individual volumes of at least 3 000 cm³, which have been dried to constant mass at (105 ± 5) °C.

A specimen may comprise more than one cut piece of wood chip concrete if each piece has a minimum volume of 750 cm³.

Constant mass is considered to have been reached when the results of two successive weighings carried out at 24 h intervals differ by not more than 0,5 % of the specimens mass.

Each specimen or constituent piece of a specimen shall be measured to the nearest millimetre and each specimen shall be weighed to the nearest gram. The density of each specimen shall be calculated to the nearest 10 kg/m³.

Density shall be established as the mean value of the density of the three test specimens and evaluated in accordance with Annex F.

5.2.3 Moisture movement

Moisture movement shall be determined in accordance with EN 772-14.

The results shall be evaluated in accordance with Annex F.

5.2.4 Reaction to fire

Reaction to fire shall be classified in accordance with EN 13501-1.

NOTE Resistance to fire should be tested in end use conditions according EN 1364-1 and EN 1365-1 and classified according to EN 13501-2.

The results shall be evaluated in accordance with Annex F.

5.2.5 Water vapour permeability

Water vapour permeability shall be determined in accordance with EN ISO 12572.

The results shall be evaluated in accordance with Annex F.

5.2.6 Mechanical strength

5.2.6.1 General

Tests shall be done after the 28th day and before the 56th day after production.

Test-specimen shall be cut out from whole shuttering blocks.

Prior to testing, test-specimen shall be dry-stored at least 14 days at a minimum temperature of 15 °C.

5.2.6.2 Tensile strength of web

The tensile strength of the web shall be determined in accordance with Annex B and Figure B.6.

The results shall be evaluated in accordance with Annex F.

5.2.6.3 Flexural strength of shells

The flexural strength of shells shall be determined in accordance with Annex C and Figure C.1.

The results shall be evaluated in accordance with Annex F.

5.2.6.4 Tensile strength of shells perpendicular to faces

The tensile strength of shells perpendicular to faces shall be determined in accordance with EN 1607 on test specimens taken from shells with the least thickness and of plan size 200 mm x 200 mm

The results shall be evaluated in accordance with Annex F.

5.2.7 Acoustic properties

5.2.7.1 Airborne sound insulation

Airborne sound insulation shall be determined in end-use conditions in accordance with EN ISO 140-3 and EN 1793-2.

The results shall be evaluated in accordance with Annex F.

5.2.7.2 Sound absorption

Sound absorption shall be determined in accordance with EN ISO 354 and EN 1793-1.

The results shall be evaluated in accordance with Annex F.

5.2.8 Thermal properties

5.2.8.1 Thermal conductivity

Thermal conductivity λ of wood-chip concrete shall be determined on specimens with a maximum thickness of 75 mm in accordance with EN 12664.

Design values of thermal conductivity shall be obtained by converting measured values in accordance with EN ISO 10456.

The results shall be evaluated in accordance with Annex F.

5.2.8.2 Specific heat capacity

Specific heat capacity *c* of wood-chip concrete shall be determined in accordance with Annex D.

The results shall be evaluated in accordance with Annex F.

NOTE In the absence of a measured value of specific heat capacity for wood-chip concrete, a design value of c = 1,50 kJ/(kg.K) may be used.

5.2.8.3 Thermal resistance of the finished wall

For specified end-use conditions, thermal resistance shall be calculated or tested in accordance with EN ISO 6946 or EN 1934.

The results shall be evaluated in accordance with Annex F.

5.2.9 Durability

5.2.9.1 Frost-resistance

Frost resistance shall be determined in accordance with EN 14474.

The results shall be evaluated in accordance with Annex F.

5.2.9.2 Frost resistance in direct contact with de-icing-salt

Frost resistance in the presence of de-icing salts shall be determined on shuttering blocks in accordance with EN 14474 using a 3 % sodium chloride solution in place of water.

The results shall be evaluated in accordance with Annex F.

6 Evaluation of conformity

6.1 General

For testing, the manufacturer may group products into families, where it is considered that the value of a selected property is common to all products within that family. Such families are:

a) density family: blocks manufactured using the same type of materials and production methods, irrespective of dimensions and colours;

b) blocks without supplementary thermal insulation: blocks according 3.1.2;

c) blocks with supplementary thermal insulation: blocks according 3.1.3.

6.2 Demonstration of conformity

The manufacturer shall demonstrate compliance of the product with the relevant requirements of this standard and with the specified or declared values for the properties of the product by carrying out both of the following tasks:

— type testing of shuttering blocks and

— Factory Production Control.

6.3 Assessment of conformity

In addition, conformity of the product with this standard may be assessed:

— either by the manufacturer’s type testing and factory production control procedures

— or by acceptance testing of a consignment at delivery (see Annex F).

6.4 Initial type testing

When a new product type is developed, and before offering it for sale, appropriate initial type tests shall be carried out to confirm that the achieved properties of the product meet the requirements of this standard and the values to be declared for it by the manufacturer.

Whenever a major change occurs in the raw materials, the proportions used or the production process, which would change the properties of the finished product, the appropriate initial type test shall be repeated.

The initial type tests shall be reference tests according to clause 5 for the properties selected from the following list relevant to the manufacturer's declaration for the product types intended use, e.g. :

— geometrical characteristics;

— density;

— moisture movement;

— reaction to fire;

— water vapour permeability;

— mechanical strength;

— airborne sound insulation;

— thermal conductivity;

— durability.

When the results of initial type testing show that the new type does not comply with the requirements, production shall not be started until further type testing, following appropriate changes shows that the new type complies with the requirements.

Sampling for initial type testing shall be carried out in accordance with Annex E and compliance shall be established on the basis of the criteria given in Annex F.

The result of the initial tests shall be recorded.

6.5 Factory production control

6.5.1 General

The manufacturer shall establish, document and maintain a factory production control system to ensure that the products placed on the market will conform with the specified or declared values.

The factory production control system shall consist of procedures, instructions, regular inspection and tests and the utilisation of the results to control raw and other incoming materials, equipment, the production process and the product.

Test methods other than the reference methods specified in this European Standard may be adopted, except for initial type tests and in the event of a dispute, provided that these alternative methods satisfy the following conditions:

1) correlation can be demonstrated between the results from the reference test and those from the alternative test and

2) information on which such correlation is based is available.

An example of a suitable inspection scheme for Factory Production Control is given in Annex G.

The results of inspections requiring action and the results of tests shall be recorded.

The action to be taken when control values or criteria are not met shall be given.

6.5.2 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to the documented procedures, criteria and frequencies.

An inspection scheme for equipment is given in G.1.

6.5.3 Materials

The specifications of the used materials and the required inspections to ensure that they comply with the requirements according 4.1 shall be documented.

An inspection scheme for the used materials is given in G.2.

6.5.4 Production process

The relevant features of the plant and production process shall be defined giving the frequency of the inspection checks and tests, together with the criteria required both on equipment and on work in progress.

An inspection scheme for the production process is given in G.3.

6.5.5 Product testing

A sampling and testing plan of products shall be prepared and implemented.

The sample shall be representative of production.

The tests shall be carried out in accordance with the methods called up in this standard or applying alternative test methods with a proven correlation to the standard methods.

The results of testing shall meet the specified conformity criteria and be available.

An example of an inspection scheme for product testing is given in G.4.1.

Switching rules for product testing are given in G.5.

6.5.6 Stock control

The stock control of finished shuttering blocks, together with procedures for dealing with non-conforming products shall be documented.

7 Marking and labelling

7.1 Marking and labelling on product

At least one product in fifty or four products per packaging unit shall carry the identification of the producer.

7.2 Marking and labelling on delivery documentation

The following particulars shall be clearly marked on the shuttering blocks, or on packaging, delivery notes or any certificate supplied with the shuttering blocks:

a) name, trademark or other means of identification of the manufacturer;

b) means of identifying the shuttering blocks and relating them to their description and designation;

c) date of manufacture.

Annex A
(normative)

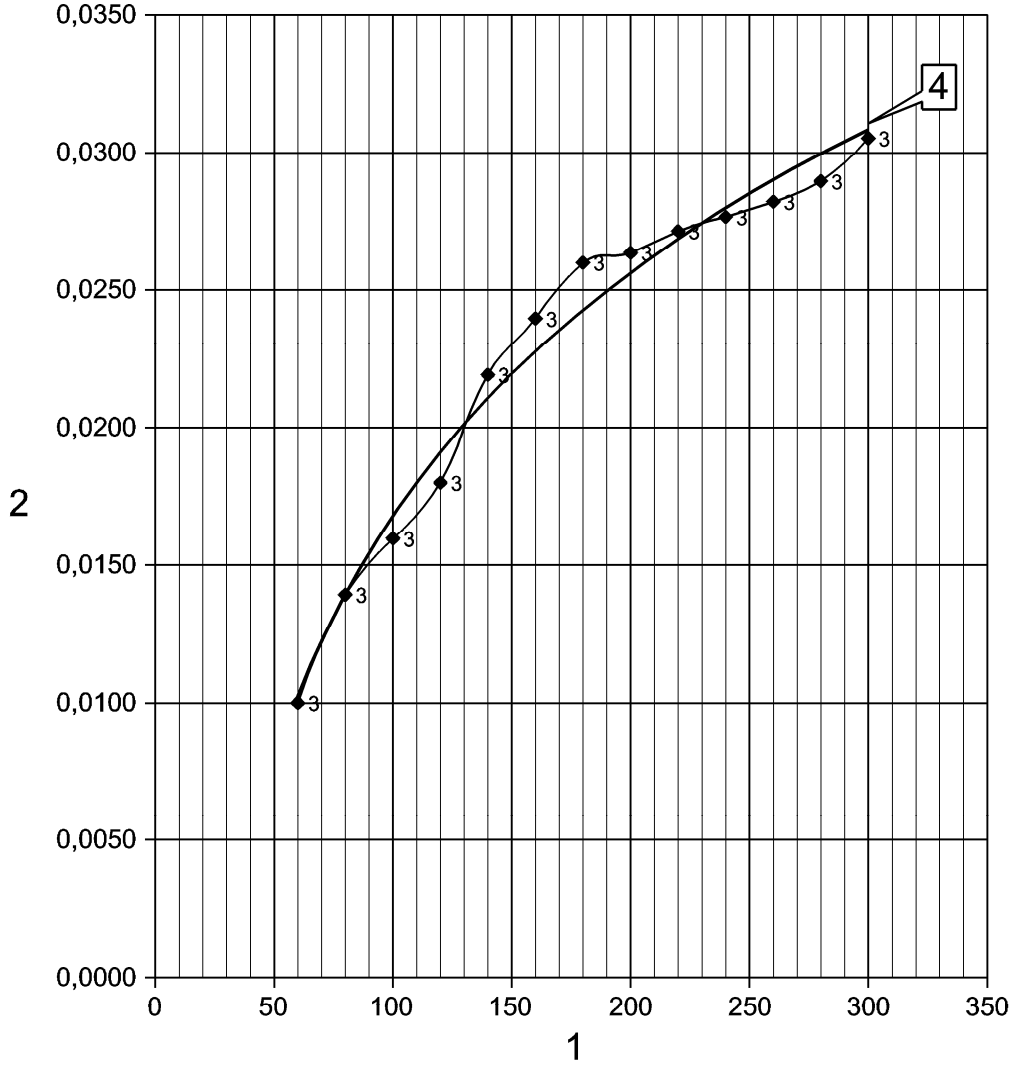
Filling pressure of concrete infill

This Annex provides guidance on the filling pressure exerted by fresh concrete infill (Flow class F4, filling height: 2,00 m in 20 min) on the shells of shuttering blocks. Table A.1 gives measured filling pressure values for a range of concrete thickness.

Table A.1 — Measured values of filling pressure

Thickness of concrete infill t_c	Filling pressure p_{msd}
mm	N/mm²
60	0,0 100
80	0,0 140
100	0,0 160
120	0,0 180
140	0,0 220
160	0,0 240
180	0,0 261
200	0,0 265
220	0,0 273
240	0,0 278
260	0,0 284
280	0,0 291
300	0,0 307

Figure A.1 gives a relationship of filling pressure versus concrete thickness derived from the values in Table A.1.



Key

1 Thickness of concrete infill t_c, in mm

2 Filling pressure p, in N/mm²

3 Measured maximum filling pressure p_{msd}, in N/mm²

4 Rated values of maximum filling pressure, in N/mm²

Figure A.1 — Filling pressure of concrete infill

Filling pressure is used to determine the minimum tensile strength of webs and minimum flexural strength of shells required by clauses 4.2.6.2 and 4.2.6.3.

The values from Figure A.1 should be used for this purpose.

Annex B
(normative)

Determination of tensile strength of web

B.1 Principle

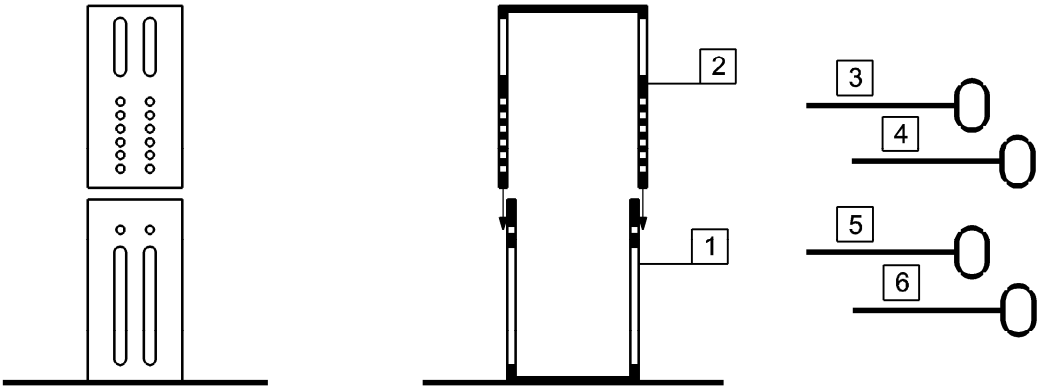
This method uses a standard compression-testing machine operated in its normal loading direction used in conjunction with a two part steel frame containing the specimen placed between the platens.

The relative movement of the two steel parts of the frame converts the compression force exerted by the machine into a tensile force acting on the specimen.

B.2 Apparatus

Compression testing machine.

A steel frame comprising two U-shaped interlocking sections containing perforations for two 20 mm diameter steel retaining rods and two 20 mm diameter steel pull rods (see Figure B.1 and Figure B.4). One section of the frame is static. The other section of the frame can be moved. Both sections of the frame can be moved as the platens of the compression testing machine close.



Key

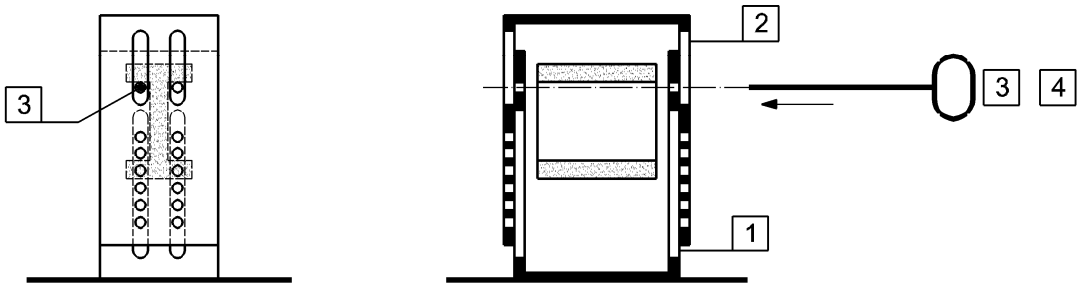
1 Static section of the frame
2 Movable section of the frame
3 Retaining rod 1
4 Retaining rod 2
5 Pull rod 1
6 Pull rod 2

Figure B.1 — Two part interlocking steel frame

B.3 Procedure

Six test specimens are prepared by cutting webs from six shuttering blocks of the same type and size (see Figure B.6). The shoulders on either side of the web shall extend at least 40 mm from the web.

The two sections of the steel frame (see Figure B.1) are assembled and the two retaining rods are inserted through the frame and under the shoulders of a test specimen (see Figure B.2).

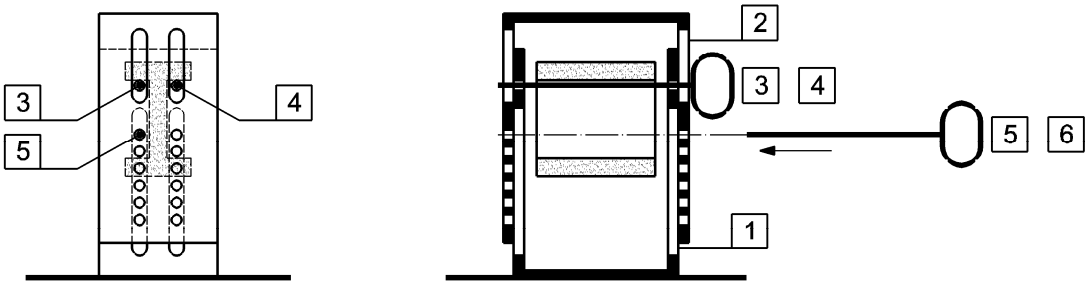


Key

1 Static section of the frame
2 Movable section of the frame
3 Retaining rod 1
4 Retaining rod 2

Figure B.2 —Insertion of two retaining rods to support the specimen

The two pull rods are then inserted through the frame using holes in close proximity to the lower shoulders of the test specimen (see Figure B.3 and Figure B.4) and the specimen is centred on the retaining rods.

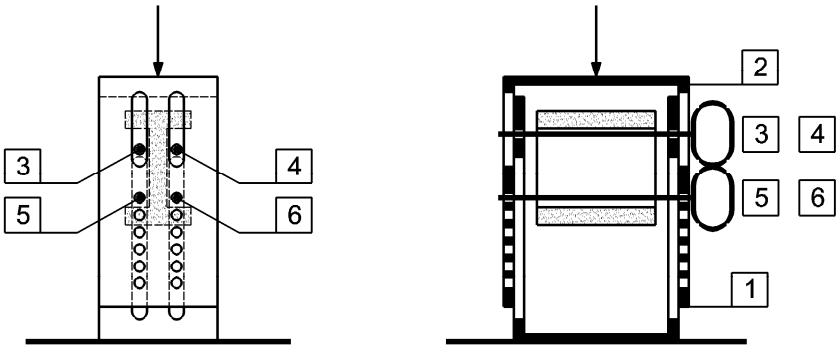


Key

1 Static section of the frame
2 Movable section of the frame
3 Retaining rod 1
4 Retaining rod 2
5 Pull rod 1
6 Pull rod 2

Figure B.3 —Insertion of two pull rods for transmission of the tensile force to the specimen

The moving platen of the compression-testing machine is then activated until the pull rods are in light contact with the lower shoulders of the test specimen (see Figure B.4). It is important, that the test specimen is located between the retaining rods centric.

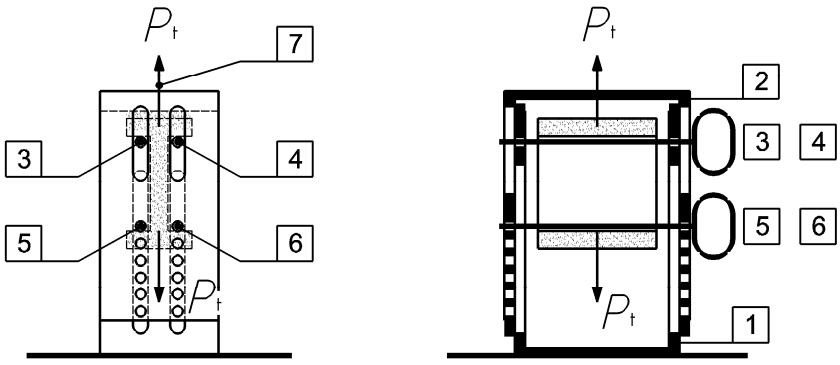


Key

1 Static section of the frame
2 Movable section of the frame
3 Retaining rod 1
4 Retaining rod 2
5 Pull rod 1
6 Pull rod 2

Figure B.4 —Centring of specimen on the retaining rods

The web tensile load P_t is applied at a rate of (0,1 ± 0,05) N/mm² per second. A constant loading rate shall be maintained for at least the second half of the loading. For the first half of the assumed maximum load a higher rate of loading is permitted (see Figure B.5).



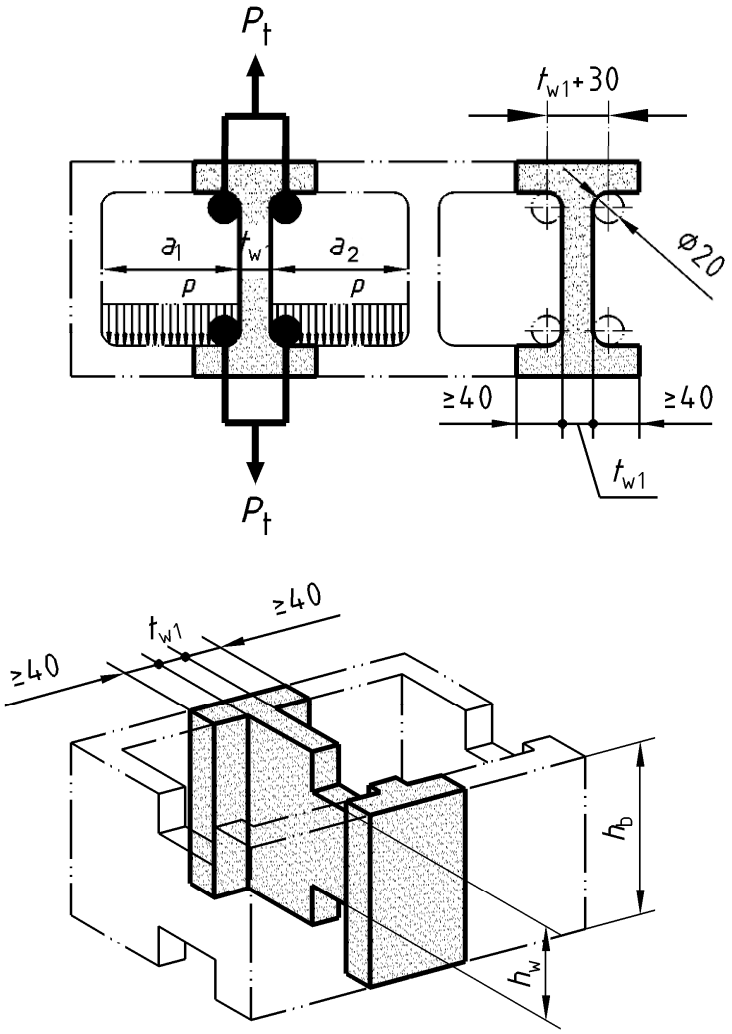
Key

1 Static section of the frame
2 Movable section of the frame
3 Retaining rod 1
4 Retaining rod 2
5 Pull rod 1
6 Pull rod 2
7 Web tensile load P_t in N

Figure B.5 — Web undergoing tensile strength test

B.4 Determination of tensile strength

B.4.1 Principle



Key

a_1, a_2	Length of hollow space, in mm
t_{w1}	Thickness of web, in mm
th_b	Height of shuttering block, in mm
h_w	Height of recessed web, in mm
p	Filling pressure of concrete infill, in N/mm²
P_t	Web tensile failure load, in N
≥ 40	Shoulders on either side of the web extending ≥ 40 mm

Figure B.6 —Tensile strength of web

B.4.2 Calculation of the minimum required tensile strength of the web

For each specimen the minimum required web tensile strength ($f_{t,\min}$) in N/mm² shall be calculated on basis of the maximum filling pressure of concrete infill ($p_{\max}$) according to Annex A using the formula:

$$f_{t,\min} = \frac{P_{t,\min}}{s_1} \tag{B.1}$$

where

$$P_{t,\min} = (p_{\max} \times h_b) \times \left(\frac{a_1}{2} + \frac{a_2}{2} \right) \tag{B.2}$$

where

$f_{t,\min}$ is the minimum required web tensile strength, in N/mm²;

$P_{t,\min}$ is the minimum required web tensile failure load, in N;

s_1 is the cross-sectional area of recessed web = (t_{w1} * h_w), in mm²;

$p_{\max}$ is the maximum filling pressure of concrete infill, in N/mm²;

h_b is the height of shuttering block, in mm;

a_1, a_2 is the length of hollow space, in mm.

B.4.3 Measurement of the web tensile failure load and calculation of the tensile strength of webs

The web tensile failure load ($P_{t,msd}$) in N of six specimens shall be determined.

From the measured web tensile failure load ($P_{t,msd}$) in N calculate the individual values of web tensile strength ($f_{t,msd}$) in N/mm² and, subsequently, the mean tensile strength of webs ($f_{t,m}$) in N/mm² :

$$f_{t,msd} = \frac{P_{t,msd}}{s_1} \tag{B.3}$$

$$f_{t,m} = \frac{\sum_{i=1}^{6} f_{t,msd,i}}{6} \tag{B.4}$$

where

$f_{t,msd}$ is the individual value of the web tensile strength, in N/mm²,

$P_{t,msd}$ is the measured web tensile failure load, in N;

s_1 is the cross-sectional area of recessed web = (t_{w1} * h_w), in mm²;

$f_{t,m}$ is the mean tensile strength of webs, in N/mm²;

$f_{t,msd,\mathrm{i}}$ is the individual values of the web tensile strength, in N/mm².

B.5 Test report

The test report shall contain the following information:

1) laboratory carrying out the test;
2) date of test;
3) description of shuttering blocks tested;
4) age of shuttering blocks at time of testing;
5) individual values of measured web tensile failure load $P_{t,msd}$ in N
6) minimum required web tensile strength $f_{t,\mathrm{min}}$ in N/mm²;
7) mean tensile strength of webs $f_{t,\mathrm{m}}$ in N/mm².

Annex C
(normative)

Determination of flexural strength of shells

C.1 Principle

The method uses a standard flexural strength-testing device operated in its normal loading direction. Specimens are supported in two rollers in a flexural testing machine and a load is applied centrally through a third roller.

C.2 Apparatus

Flexural strength testing device with centre-point loading in accordance with EN 12390-5 using rollers with a diameter of 20 mm ± 2 mm.

C.3 Procedure

Six test specimens are prepared by cutting sections of shells from six shuttering blocks of the same type and size (see Figure C.1).

The support rollers are adjusted so that the distance between them equals the length of the void in the shuttering blocks plus the width of the adjoining web. The specimen is located squarely on the lower rollers with each roller centrally under a web.

The upper roller is then located centrally between the two support rollers.

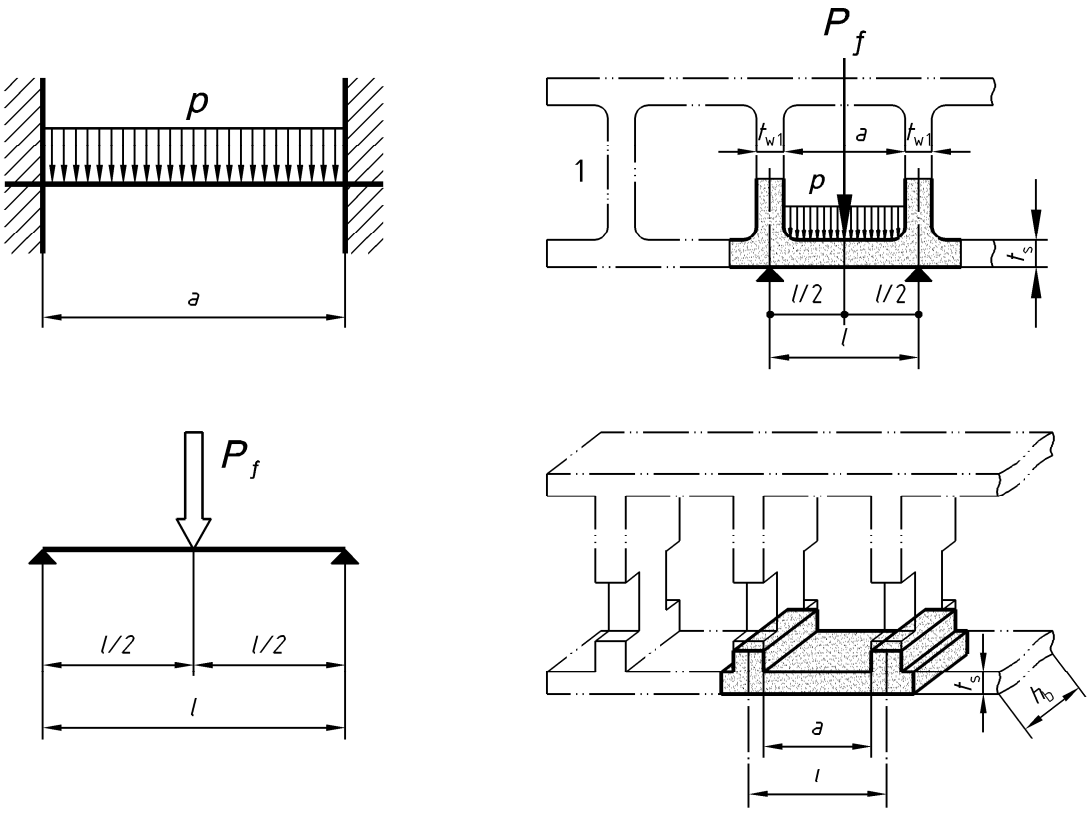
The flexural strength-testing device is then activated until the upper roller is in light contact with the test specimen.

The load is applied at a rate of (0,1 ± 0,05) N/mm² per second. A constant loading rate should be maintained for at least the second half of the loading. For the first half of the assumed maximum load a higher rate of loading is permitted.

C.4 Determining the flexural strength of shells

C.4.1 General

Determining the flexural strength of shells assumes that the flexural strength is the same as for a fixed end beam stressed by a uniformly distributed load (p) and a suspended beam stressed by an axial point load (P_f).



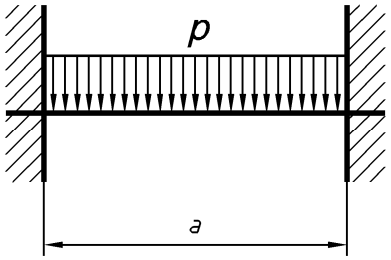
Key

h_b Height of shuttering block, in mm
l Distance of axis of webs, in mm
a Length of hollow space, in mm
t_{w1} Thickness of web, in mm
t_s Thickness of shells, in mm
p Filling pressure of concrete infill, in N/mm^2
P_f Shell flexural failure load, in N

Figure C.1 — Testing of shell flexural strength

C.4.2 Calculation of the minimum required flexural strength of shells

For calculation of miminum required shell flexural strength the structural system of a fixed end beam, stressed by an uniformly distributed load, is used.



Key

a Length of hollow space, in mm

p Filling pressure of concrete infill, in N/mm^2

Figure C.2 — Static system of calculation minimum required shell flexural strength

For each specimen the minimum required shell flexural strength ($f_{f,\min}$) shall be calculated on basis of the maximum filling pressure of concrete infill ($p_{\max}$) according to Annex A using the formula:

$$f_{f,\min} = \frac{\frac{(p_{\max} \times h_b) \times a^2}{24}}{\frac{t_s^{\,2} \times h_b}{6}} = \frac{(p_{\max} \times h_b) \times a^2}{4 \times t_s^{\,2} \times h_b} = \frac{p_{\max} \times a^2}{4 \times t_s^{\,2}} \qquad \text{(C.1)}$$

where

$f_{f,\min}$ is the minimum required shell flexural strength, in N/mm^2;

$p_{\max}$ is the maximum filling pressure of concrete infill, in N/mm^2;

a is the length of hollow space, in mm;

h_b is the height of shuttering block. in mm;

t_s is the thickness of shell, in mm.

C.4.3 Measurement of the flexural failure load and calculation of the flexural strength of shells

The shell flexural failure load ($P_{f,msd}$) in N of the six specimens shall be determined.

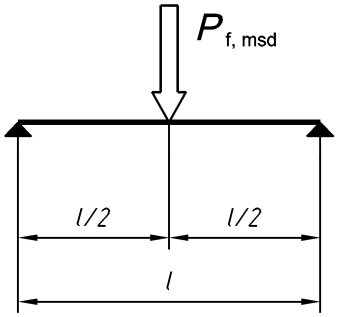


Figure C.3 — Static system of testing the shell flexural failure load

From the measured shell flexural failure load ($P_{f,msd}$) in N calculate the individual values of the shell flexural strength ($f_{f,msd}$) in N/mm².

$$f_{f,msd} = \frac{\frac{P_{f,msd} \times l}{4}}{\frac{t_s^2 \times h_b}{6}} = \frac{3 \times P_{f,msd} \times l}{2 \times t_s^2 \times h_b} \qquad \text{(C.2)}$$

where

$f_{f,msd}$ is the individual value of the shell flexural strength, in N/mm^2;

$P_{f,msd}$ is the measured shell flexural failure load, in N;

l is the distance of axis of webs, in mm;

t_s is the thickness of shell, in mm;

h_b is the height of shuttering block, in mm.

Subsequently, from the individual values of the shell flexural strength ($f_{f,msd}$) calculate the mean flexural strength of shells ($f_{f,m}$) in N/mm².

$$f_{f,m} = \frac{\sum_{i=1}^{6} f_{f,msd,i}}{6} \qquad \text{(C.3)}$$

where

$f_{f,m}$ is the mean flexural strength of the shells, in N/mm^2;

$f_{f,msdi}$ is the individual values of the shell flexural strength, in N/mm^2.

C.5 Test report

The test report shall contain the following information:

1) laboratory carrying out the test
2) date of test;
3) description of shuttering blocks tested;
4) age of shuttering blocks at time of testing;
5) individual values of measured shell flexural failure load ($P_{f,\mathrm{msd}}$) in N;
6) minimum required shell flexural strength $f_{f,\mathrm{min}}$ in N/mm²;
7) mean flexural strength of the shells $f_{f,\mathrm{m}}$ in N/mm².

Annex D
(normative)

Test methods for determination of specific heat capacity

D.1 Principle

This test method serves to determine the specific heat capacity of building materials, of which the density and the thermal conductivity are known, by means of measurement.

Specific heat capacity *c* is the amount of heat 1 kg of a building material can absorb at a temperature-difference of 1 K. The unit is kJ/(kg.K).

D.2 Test device

The test device is a thermally isolated container with a volume of at least 50 l filled with silicone oil and equipped with a heating device for heating the fluid.

It is to take care for thorough mixing of the fluid throughout the container.

Thermal isolation shall be assessed that at the end of the heating process the temperature is kept constant ≤ 0,2 K over a period of 30 min.

D.3 Specimen

Specimen is a sandwiched specimen of two panels of 150 mm x 150 mm with a thickness of not more than 40 mm. The sandwiched specimens are held together near the edges by braces consisting of a material with good thermal conductivity (metal), with a sufficiently thin thermocouple positioned centrally between the two panels.

If the panels have a hard surface, the panel surface may be prepared to place the thermocouple in the surface.

For panels consisting of absorbent materials, the sandwiched specimen may be wrapped in a thin foil.

NOTE The fact that the wrapping does not influence the result can be demonstrated, for instance, by comparing it with the results of a second wrapping.

It shall be ensured that the thermocouple does not transfer heat to the end of the thermocouple.

Specimens shall be conditioned under the test conditions according EN 12664.

D.4 Procedure

D.4.1 Core temperature measurement

The specimen shall be immersed in the heated oil bath for a period of 10 min (600 s) and core temperature of specimen shall be measured at 10 s intervals to the nearest 0,01 K.

D.4.2 Core temperature calculation

Core temperature shall be calculated by means of known dry density and thermal conductivity of conditioned specimen and of an assumed specific heat capacity as follows:

$$\vartheta(Bi, Fo) = \sum_{k=1}^{\infty} \frac{2 \cdot \sin(q_k)}{q_k + \sin(q_k) \times \cos(q_k)} \times \exp(q_k^2 \cdot Fo) \quad \text{(D.1)}$$

with the following assumptions :

$$Bi = \frac{h \times D}{\lambda} \text{ Biot-number} \quad \text{(D.2)}$$

$$F_o = \frac{a \times t}{D^2} \text{ Fourier-number} \quad \text{(D.3)}$$

$$a = \frac{\lambda}{\rho \times c} \text{ temperature conductivity} \quad \text{(D.4)}$$

provided that:

$$\cot q_k = \frac{q_k}{Bi} \quad \text{(D.5)}$$

Table D.1 —Symbols and units

Symbol	Unit	Designation	Other symbols used (VBA)
ϑ	°C	core temperature	`tempkern`
t	s	time coordinate	`time`
D	m	thickness of panels, core depth	`d`
λ	W/(m.K)	thermal conductivity coefficient	`l`
ρ	kg/m³	dry density	`r`
c	J/(kg.K)	specific heat capacity	`c`
h	W/(m².K)	heat transfer coefficient (100 W/m².K)	`h`
T_{start}	°C	conditioned temperature of specimen (e.g.: 20°C)	`Tstart`
T_{final}	°C	temperature of oil-bath (e.g.: 60°C)	`Tfinal`

D.4.3 Comparison of measured and calculated core temperature

The measured and the calculated core temperature shall be compared respectively converged by variation of the assumed specific heat capacity until an adequate match is reached.

Adequate match of the measured and the calculated core temperature is considered, if for all values between 300 s and 600 s of test the absolute deviation between the calculated and the measured temperature is ≤ 0,25 K.

The assumed specific heat capacity achieving the most adequate match of the measured and the calculated core temperature shall be considered the test result.

D.5 Determination of specific heat capacity

Specific heat capacity of a building material shall be the mean value of at least three measurements.

D.6 Test report

The test report shall contain the following information:

1) testing body;
2) testing conditions;
3) description of the test item;
4) thickness, dry density, thermal conductivity;
5) description of specimen;
6) measured and calculated core temperature;
7) test results;
8) mean value of specific heat capacity c.

D.7 VBA-Routine for calculation of core temperature (informative)

In the following a VBA-Routine (Visual Basic for Application-Routine) is given, which can be used for calculation of core temperature:

Making use of the known cot function, this macro solves the intrinsic value equation (see Equation D.5) with an accuracy of 1/10 000.

Apart from the calculated values for the first minute, it makes practically no difference whether n = 10 or 100.

Due to the simplicity of the solution and the short calculation time (ca. 2 s for all 61 calculation values at n = 100 on a Pentium III/800 MHz PC) one generally uses 100 intrinsic values.

NOTE Other ways of proposed solutions for this condition (Equation D.5) are existing certainly, but the described variation was selected for the sake of simplicity and the knowledge of the adequate precision.

```
Function tempkern(l, r, cp, d, h, time, Tstart, Tfinal, n)
    Dim q(100), c(100)
    Pi = 4 * Atn(1)
    a = l / (r * cp)
    Bi = h * d / l
    Fo = time * a / (d * d)
    dT = Tfinal - Tstart
    For k = 1 To n
        qq = (k - 1) * Pi
        Do
            qq = qq + 0.01
            delta = 1 / Tan(qq) - qq / Bi
        Loop Until delta < 0.01
        qq = qq - 0.01
        Do
            qq = qq + 0.001
            delta = 1 / Tan(qq) - qq / Bi
        Loop Until delta < 0.001
        qq = qq - 0.001
        Do
            qq = qq + 0.0001
            delta = 1 / Tan(qq) - qq / Bi
        Loop Until delta < 0.0001
        q(k) = qq
        c(k) = 2 * Sin(q(k)) / (q(k) + Sin(q(k)) * Cos(q(k)))
    Next k
    tempkern = 0
    For k = 1 To n
        tempkern = tempkern + c(k) * Exp(-((q(k)) ^ 2) * Fo)
    Next k
    tempkern = Tfinal - tempkern * dT
End Function
```

Figure D.1 — FVBA-Routine for calculation of core temperature

Annex E
(normative)

Sampling for initial type testing

E.1 General

This sampling procedure shall be used for initial type testing and in the event that there is a requirement for an assessment of product compliance by independent testing. 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 number of shuttering blocks required to determine compliance with the specification should be sampled from a consignment of up to 200 m³ or part thereof.

NOTE Shuttering 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.

E.2 Sampling procedure

NOTE The physical form of the consignment in question will normally dictate the choice of the method of sampling.

E.2.1 Random sampling

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

NOTE In practice, random sampling is normally only convenient either when the shuttering blocks forming the consignment are being moved in 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.

E.2.2 Representative sampling

E.2.2.1 General

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

E.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 shuttering blocks shall be selected at random from within each section in order to give the required number of shuttering blocks without any consideration being given to the quality of those selected except that shuttering blocks damaged in transit shall not be selected.

NOTE It will be necessary to remove some sections of the stack or stacks in order to gain access to the shuttering blocks within the body of such stacks when taking samples.

E.2.2.3 Sampling from a consignment formed of packs

At least six packs shall be selected at random from the consignment. The packaging shall be removed and an equal number of shuttering blocks shall be sampled at random from within each of the opened packs in order to give the required number of shuttering blocks without any consideration being given to the quality of those selected except that shuttering blocks damaged in transit shall not be selected.

E.2.3 Dividing the sample

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

E.2.4 Number of shuttering blocks required for testing

The sample size for each test shall be in accordance with Table E.1.

Table E.1 — Number of shuttering blocks required for a test

Property	Clause number	Test method	Number [a] of shuttering blocks per sample	
			1st sample n_1	2nd sample n_2
Geometric properties	5.2.1	EN 772-16 EN 772-20	6	6
Density	5.2.2	5.2.2	6	6
Moisture movement	5.2.3	EN 772-14	6	6
Reaction to fire	5.2.4	EN 13238 EN 13501-1	according to EN 13238	repeat test
Water vapour permeability	5.2.5	EN ISO 12572	according to EN ISO 12572	repeat test
Mechanical strength	5.2.6	Annex B and C EN 1607	6 [b]	10 [b]
Sound absorption	5.2.7.2	EN ISO 354 EN 1793-1	according to EN ISO 354 and EN 1793-1	repeat test
Thermal conductivity	5.2.8.1	EN 10456 EN 12664	3	6
Specific heat capacity	5.2.8.2	Annex D	3	6
Frost resistance	5.2.9.1	EN 14474	according to EN 14474	repeat test
Frost resistance in direct contact with de-icing-salt	5.2.9.2	EN 14474	according to EN 14474	repeat test

[a] If appropriate, e.g. when the shuttering blocks are not effected by test procedure, the same shuttering blocks may be used for different tests.

[b] Where shuttering blocks require cutting as described in 4.2.6.2 and 4.2.6.3, the number of shuttering blocks required should be adjusted so that the sample size can be conveniently satisfied.

E.3 Place and dates of inspection and acceptance testing

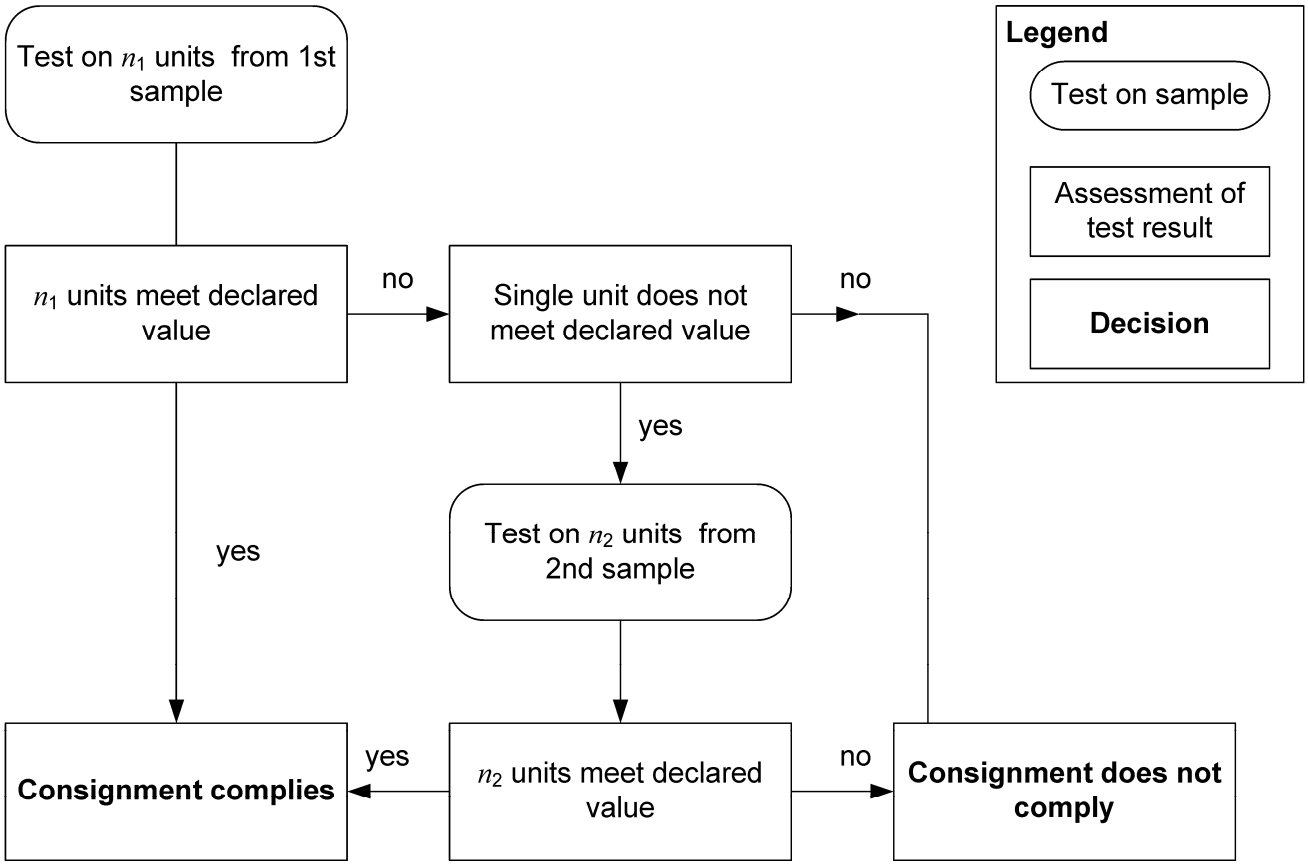
The location of the laboratory or place for inspection and testing, the dates and representation by the parties shall be subject to agreement between them.

The agreed tests shall be carried out in the sequence agreed by the parties. If a particular property of a batch of shuttering blocks shows non-compliance, the remaining tests may be carried out by agreement between the parties.

Annex F
(normative)

Compliance criteria for initial type testing and for independent testing of consignment

The assessment of compliance shall be based on the procedure shown in Figure F.1.



Key

n_1 and n_2 are as given in Table E.1

Figure F.1 — Procedure for the assessment of compliance

Annex G
(informative)

Example of an inspection scheme

G.1 Equipment inspection

Subject		Aim	Method	Frequency [1)]
G.1.1 Testing and measuring equipment				
1	Testing and measuring equipment	Correct functioning and accuracy	Where applicable calibrating against equipment which has been calibrated traceable to national standards and is used exclusively for this purpose except as indicated in the test method	on (re)installation, after major repair or once per year
G.1.2 Storage and production equipment				
1	Storage of materials	Absence of contamination	Visual inspection or other appropriate method	— on installation — weekly
2	Weighing or volumetric batching equipment	Correct functioning	Visual inspection	daily
3		Block manufacturer's declared accuracy	Calibrating against equipment which is used exclusively for this purpose	— on (re)installation — Weighing : — — once a year — Volumetric : — — twice a year — — in case of doubt
4	Mixers	Wear and correct functioning	Visual inspection	weekly
5	Moulds	Cleanliness and condition	Visual inspection	before using

[1)] Or as stated in FCP documentation.

G.2 Materials inspection

Subject		Aim	Method	Frequency [1)]
G.2.1 All materials				
1	All materials	To ascertain that the consignment is as ordered and from the correct source	Inspection of delivery ticket and/or label on the package showing conformity with the order	each delivery
G.2.2 Materials not submitted to an assessment of conformity before delivery [2)]				
1	Cement and other cementitious materials	Conformity with manufacturer's requirements	Inspection of delivery ticket	each delivery
2	Wood-chips	Conformity with manufacturer's requirements	Visual inspection	each delivery
3	Aggregates	Conformity with manufacturer's requirements	Visual inspection	each delivery
4	Admixture	Conformity with manufacturer's requirements	Inspection of delivery ticket and/or label on the package showing conformity with the order	each delivery
5	Additions/ pigments	Conformity with manufacturer's requirements	Inspection of delivery ticket and/or label on the package showing conformity with the order	each delivery
6	Water not taken from a public distribution system	Conformity with manufacturer's requirements	Compliance with EN 1008	first use of new source in case of doubt
7	Recycled water	Check for solid content and other contaminants	Visual	weekly
8			Manufacturer's method	in case of doubt

1) Or as stated in FCP documentation.

2) Materials not audited by the manufacturer or by a third party acceptable to the manufacturer.

G.3 Production process inspection

	Subject	Aim	Method	Frequency [1)]
1	Mixture composition	Conformity with intended composition (weight or volumetric batched)	— Visual on measuring and weighing equipment — Checking against production process documents	daily
2	Fresh concrete	Correct mixing	Visual check	daily for each mixer
3	Production	Conformity with documented factory procedures	Checking actions against factory procedures	daily

1) Or as stated in FPC documentation.

G.4 Product inspection

	Subject	Aim	Method	Frequency [1), 2), 3), 4)]
G.4.1 Product testing				
1	Visual aspects	Compliance with provisions of manufacturer	Visual check	daily
3	Geometrical characteristics	See 4.2.1	see 5.2.1	weekly one block per machine and type of block
4	Density	See 4.2.2	see 5.2.2	weekly one block per machine and type of block
5	Mechanical strength	See 4.2.6.2 and 4.2.6.3	see 5.2.6.2 and 5.2.6.3	weekly one block per machine and type of block
G.4.2 Marking, storage, delivery				
1	Marking	Marking of product according to clause 7	Visual check	daily
2	Storage	Segregation of non-conforming product	Visual check	daily
3	Delivery	Correct delivery age, loading and loading documents	Visual check	daily

1) Or as stated in FCP documentation.

2) Type testing according to 6.2 of this standard not included.

3) The switching rules apply (see G.5).

4) See 6.1.

G.5 Switching rules

G.5.1 Normal inspection

The rate of sampling should be in accordance with G.4.1.

G.5.2 Normal to reduced inspection

Reduced inspection corresponds to half the rate of normal inspection [1)].

It should be used when normal inspection is effective and the preceding 10 successive samples have been accepted.

A supplementary reduced inspection is allowed if the same conditions as above are satisfied under reduced inspection.

This supplementary reduced inspection should correspond to half the rate of the reduced inspection.

G.5.3 Reduced to normal inspection

When reduced inspection or supplementary reduced inspection is in effect, normal inspection should be reinstated if any of the following occurs :

— sample is not accepted;

— production becomes irregular or delayed;

— other conditions warrant that normal inspection should be instituted.

G.5.4 Tightened inspection

Tightened inspection requires the number of blocks in the sample to be doubled.

It should be used if during normal inspection two out of five successive samples fail.

G.5.5 Tightened to normal inspection

Tightened inspection should continue until five successive samples are accepted.

Then normal inspection may be resumed.

G.5.6 Stopped production

If production remains on tightened inspection for ten successive samples, the production line should be deemed to be out of control and stopped.

The production system should be reviewed and any necessary changes made.

Having corrected the production system, production should start again on tightened inspection.

1) If the number of blocks in the sample is even, the reduction should be performed by dividing the number of blocks by two. In the other cases, the rate of sampling should be reduced by two.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive Constructions products

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under mandate M/139 "Precast concrete products“, which is an extension of the mandate M/100, given to CEN by the European Commission and the European Free Trade Association.

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

Compliance with these clauses confers a presumption of fitness of the wood-chip concrete shuttering blocks covered by this European Standard for the intended use; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting suitability for the intended use, can be applicable to the wood-chip concrete shuttering blocks falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this Standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through *http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm*)

This annex establishes the conditions for the CE marking of wood-chip concrete shuttering blocks intended for the uses indicated in Table ZA.1 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

Table ZA.1 — Relevant clauses

Product : Wood-chip concrete shuttering blocks **Intended use :** Shuttering blocks to be dry-stacked without mortar and filled with concrete to construct external walls, internal walls and partitions			
Essential characteristics	**Requirement clauses in this Standard**	**Levels and/or class(es)**	**Notes**
Detailing	4.2.1.1 and 4.2.1.2	None	Declared values in mm and mm^2
Drying shrinkage	4.2.3 – Moisture movement	None	Declared shrinkage and expan-sion
Reaction to fire	4.2.4	Reaction to fire class B	Declared reaction to fire class B
Water vapour permeability	4.2.5	None	Declared value
Mechanical strength			
Tensile strength of webs	4.2.6.2	None	Declared value in N/mm^2
Flexural strength of shells	4.2.6.3	None	Declaredvalue in N/mm^2
Tensile strength of shells perpendicular to faces	4.2.6.4	None	0,15 N/mm^2
Acoustic properties	4.2.7.2	None	Declared value
Thermal resistance	4.2.8.2	None	Declared values in W/(m.K)
Durability	4.2.9	None	Loss of mass : maximum value 10 % in kg

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these Member States are not obliged to determine nor 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 Table 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(s) for attestation of conformity of wood-chipconcrete shuttering blocks

ZA.2.1 System(s) of attestation of conformity

The system(s) of attestation of conformity of the wood-chip concrete shuttering blocks, included in Table ZA.2 for the essential characteristics indicated in Table ZA.1, in accordance with the Decision of the Commission 1999/94/EC of 1999-01-25 as given in Annex III of the mandate M/100 for "Precast concrete products”, is described in Table ZA.2 for the intended use(s) and relevant level(s) or class(es):

Table ZA.2 — System(s) of attestation of conformity

Product(s)	**Intended use(s)**	**Level(s) and/or class(es)**	**Attestation of conformity system(s)**
Non-load-bearing hollow wood-chip concrete shuttering blocks	Non-load bearing and load bearing external and internal walls and partitions	-	4 [(a)]
[(a)] System 4: see Directive 89/196 (CPD) Annex III-2 (ii), third possibility.			

The attestation of conformity of the wood-chip concrete shuttering blocks in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Table ZA.3 resulting from the application of the clauses of this or other European Standard indicated therein.

Table ZA.3 – Assignment of evaluation of conformity tasks for wood-chip concrete shuttering blocks under system 4

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	Parameters related to all relevant characteri-stics in Table ZA.1	6.5
	Initial type testing by the manufacturer	All relevant characteri-stics in Table ZA.1	6.4
	Initial type testing by the notified laboratory	Reaction fo fire	6.4

ZA.2.2 EC Certificate and Declaration of conformity

When compliance with the conditions of this annex is achieved, the manufacturer or his agent established in the EEA shall prepare 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 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, ...), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in CE marking information it does not need to be repeated.

— provisions to which the product conforms (e.g. Annex ZA of this EN), and a reference to the ITT report(s) and factory production conctrol records;

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

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

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

ZA.3 CE marking and labelling

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/EC and shall be shown on the product (or, when not possible, it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note). The following information shall be added to the CE marking symbol :

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

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

— reference to this European Standard;

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

— information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as:

  — declared values and, where relevant, level or class (including “Pass” for Pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in column ”Notes” of 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.

Figure ZA.1 gives an example of the information to be provided in the enclosed documents (e.g. delivery note).

CE	*CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC.*
AnyCo Ltd, PO Box 21, B-1050	*Name or identifying mark and registered address of the producer*
08	*Last two digits of the year in which the marking was affixed*
EN 15498	*No. of this European standard*
Wood-chip concrete shuttering block	*Product description and manufacture identification code / name*
Detailing :	
— dimensions : xxx mm	
— dimensions tolerances : xxx mm	
— web recess area : xxx mm^2	
Moisture movement : NPD	
Reaction to fire : Euroclass B	
Water vapour permeability : 4/6	
Mechanical strength	
— tensile strength of web : 0,15 N/mm²	
— flexural strength of shells : 0,50 N/mm²	
— minimum tensile strength of shells perpenticular to faces : 0,15 N/mm²	
Sound absorption : NPD	
Thermal conductivity : 0,12 W/(m².K)	
Durability	
— frost resistance (loss of mass) : NPD	
— frost resistance in the presence of de-icing-salts (loss of mass) : NPD	

Figure ZA.1 — Examples of CE marking information

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 1 European legislation without national derogations need not be mentioned.

NOTE 2 Affixing the CE marking symbol means, if a product is subject to more than one directive that it complies with all applicable directives.

Bibliography

[1] Doctoral thesis of Dipl.-Ing. Dr. Christian PÖHN at Vienna University of Technology entitled "Entwicklung einer Prüfeinrichtung zur Ermittlung der spezifischen Wärmekapazität von Werkstoffen des Bauprodukten-bereiches (Development of a test device for determining the specific heat capacity of materials in the area of construction products)"

[2] EN 1364-1, Fire resistance tests for non-load bearing elements — Part 1: Walls

[3] EN 1365-1, Fire resistance tests for load bearing elements — Part 1: Walls

[4] EN 13501-2, Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL