BRITISH STANDARD

Cast stone –

Specification

ICS 91.100.15

British Standards

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 29 August 2008. It was prepared by Technical Committee B/524, *Precast concrete products*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 1217:1997, which is withdrawn.

Information about this document

This new edition of BS 1217 takes cognizance of the publications of BS EN 771-5 and BS EN 845-2 and represents the requirements of a long-established industry manufacturing products both for buildings and for use in other applications. It does not represent a full review or revision of the Standard which will be undertaken in due course.

Apart from a general tidying of the text, omission of any requirements regarding concreting material, the Standard concentrates on product requirements. The reinforcement section has been extended to permit non-metallic material provided such reinforcement has the requisite reinforcing properties. Annex C remains informative on slenderness ratios and minor improvements have been made to the figures to make them clearer.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

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.

1 Scope

This British Standard specifies performance requirements for cast stone products other than for those products conforming to BS 5642-1, *Sills*, BS 5642-2, *Copings*, BS EN 771-5, *Manufactured stone masonry units* and BS EN 845-2, *Lintels*, which contain product specific requirements.

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.

BS 1881-208, *Testing concrete – Part 208: Recommendations for the determination of the initial surface absorption of concrete*

BS EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests*

BS EN 12390-3, *Testing hardened concrete – Part 3: Compressive strength of test specimens*

3 Terms and definitions

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

3.1 cast stone
any material manufactured with aggregate and cementitious binder, intended to resemble in appearance, and which may be used in a similar way to, natural stone

NOTE Cast stone units are either homogeneous throughout or consist of facing and backing materials.

3.2 visual face
any face or part of a cast stone unit visible after completion of works

3.3 exposed face
any face which is not bedded or otherwise protected in the works (e.g. with mortar or bitumen)

NOTE Unbedded parts of a sill face or faces exposed to a cavity are examples of exposed faces. Visual faces are exposed faces but not necessarily vice versa.

3.4 interface
irregular face between the facing and backing mixes in two-part mixes

NOTE See Clause 4.

4 Two-part mix units

When cast stone units are made from separate facing and backing mixes:

a) visual faces shall have a minimum facing mix thickness of 20 mm at any point;

b) a bond between the facing and backing mixes shall be made either by a mechanical key or by inter-diffusion.

5 Reinforcement

Untreated steel shall have actual minimum covers of 40 mm from any visual face and 30 mm from any other exposed face. Such reinforcement shall neither be placed closer than 10 mm to the interface of stone, nor across the interface unless the cementitious binder used in both mixes is identical.

Galvanized steel shall have actual minimum covers of 30 mm from any visual face and 20 mm from any other exposed face. Such reinforcement shall neither be placed closer than 10 mm to the interface of cast stone units, nor across the interface unless the cementitious binder used in both mixes is identical.

Non-corroding metals (e.g. austenitic stainless steel, bronze alloys, copper) or other materials shall have a minimum actual cover of 10 mm or two bar diameters (of the nearest bars to the surface), whichever is the greater, from any exposed face.

Cut galvanized or epoxy-coated reinforcement shall have the cut faces protected by suitable means (e.g. zinc paint and epoxy paint respectively).

6 Compressive strength

Three cube test specimens either 100 mm or 150 mm in size shall be made from the facing or homogeneous mix, and where appropriate three further cube specimens 100 mm or 150 mm in size shall be made from the backing mix.

The method of compaction shall be as similar as possible to represent the relevant production and the cubes shall be cured in accordance with BS EN 12390-2 and crushed up to 28 days old in accordance with BS EN 12390-3. The average strength of any set of three cubes shall not be less than 25.0 MPa. In addition, the strength of any single cube shall not be less than 20 MPa.

7 Surface finish

The colour and texture of the visual face shall be the subject of contractual agreement based upon samples and/or mock ups representative of the planned production.

8 Tolerances

8.1 Linear dimensions

The actual dimensions of individual regular units shall conform to the declared work dimensions subject to the tolerances given below in Table 1.

NOTE Tighter tolerances than these can be achieved subject to agreement between purchaser and manufacturer.

Table 1 **Tolerances**

Dimension mm	**Tolerance** mm
< 600	± 2
601 to 1 000	± 3
1 001 to 2 500	± 4
2 501 to 4 000	± 5
> 4 000	± 6

8.2 Flatness of plane surface

When the visual surfaces are declared by the manufacturer/supplier to be plane, they shall not deviate from a plane by more than 0.3% of the diagonal length or 2 mm, whichever is the greater, across the two diagonals as measured with appropriate equipment.

9 Weathering

NOTE 1 Whichever test method is selected the three products need to be of convenient sizes to suit the test requirements but cutting is not permitted.

NOTE 2 The establishment of CAT or ISAT conformity is not expected to be on as regular a basis as cube testing. The data relevant to any specific mix is expected to be held by the manufacturer and should not be more than one year old.

9.1 Capillary absorption test (CAT)

Three representative products at least 17 days old, tested according to Annex A shall not exhibit an average capillary absorption (C) exceeding 1.0 mg/mm^2 nor shall any individual value of C (C_1, etc.) exceed 1.3 mg/mm^2.

9.2 Initial surface absorption test (ISAT)

Three representative products at least 14 days old and stored in warm dry conditions at not less than 15 °C for at least 72 h shall be tested according to the method in BS 1881-208. The values obtained shall not exceed 0.25 ml/(m^2·s) at 10 min and 0.10 ml/(m^2·s) at 1 h for each product.

10 Marking

The following particulars shall be clearly marked on the delivery note, drawings, invoice or supplier's certificate supplied with a consignment of cast stone products:

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

b) the weathering class, i.e. CAT and/or ISAT (see Clause **9**);

c) the number and date of this British Standard, i.e. BS 1217:2008 [1)].

[1)] Marking BS 1217:2008 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (normative) CAT weathering

A.1 Apparatus

Usual laboratory equipment, including:

A.1.1 *area measuring device*, capable of measuring visual test faces and reading in millimetres or square millimetres, resolution of one millimetre;

A.1.2 *oven*, capable of maintaining temperature at 70 ± 5 °C;

A.1.3 *enclosure*, air-tight, capable temperature of 70 ± 5 °C and capable of holding at least three CAT samples;

A.1.4 *balance*, capable of weighing products to an accuracy of ± 0.1%;

A.1.5 *tray*, minimum depth 10 mm, water-tight and capable of holding at least three CAT samples;

A.1.6 *spacer devices*, capable of supporting the CAT samples in the tray;

NOTE Stainless steel washers, 15 mm diameter and 5 mm thick have been found to be suitable.

A.1.7 *stopwatch/clock*, capable of counting 10 minutes, displaying in at least 30 second divisions.

NOTE A stopwatch or clock can also be used to measure the sample heating period of 72 hours below.

A.2 Test

Measure the visual face of each product by suitable means and record the area of each in square millimetres to the nearest 10 mm^2. Record as A_1, A_2, A_3.

At not less than 14 days old, dry the three products in a well ventilated oven or ovens at 70 ± 5 °C for at least 72 h and allow to cool to room temperature 15 to 25 °C in an air-tight enclosure. Weigh and record the mass of each unit to the nearest 0.1% of the product weight and record as W_1, W_2, W_3.

Place each product, supported on suitable spacer devices, into a tray and fill with cold water so that the visual face under test is under a maintained 5 ± 1 mm head of water. After 10 ± 0.5 min, remove each product; remove excess water with a damp rag and within 30 s of the removal, reweigh and record the masses as above. Record as X_1, X_2, X_3.

Calculate the capillary absorption C_1 in mg/mm^2 to the nearest 0.1 mg/mm^2:

$$C_1 = \frac{1\,000\,(X_1 - W_1)}{A_1}$$

Similarly repeat the calculation for the other samples C_2 and C_3 substituting the relevant values of X and W.

Finally calculate the mean value C (in mg/mm^2) as:

$$C = \frac{C_1 + C_2 + C_3}{3}$$

Record the mean value to one decimal place.

Annex B (informative) General notes for guidance

It is critical that the term "representative of the planned production" is correctly understood. All parties should realize that, no matter how strictly controlled the manufacture is, there will be variations in colour, texture, shade and reflection. Over a period of 6 months to 24 months of natural weathering, most concretes, including cast stone, mature towards uniformity depending upon exposure. Attempts to change the appearance should be avoided; such attempts often aggravate the situation and natural weathering then has little or no chance of alleviating it. (See Clause **7**.)

Cube testing represents the potential of the material. Although it would be ideal to have a strength test on the actual product, the variety of cast stone products produced generally precludes this. It is not always possible to obtain the same degree of compaction. The rebound hardness test may be used as indicative, provided that the manufacturer has data on the same test on cubes of that mix. The results may not be used as acceptance or rejection criteria unless specifically the subject of contractual agreement. (See Clause **6**.)

Cast stone should not be transported or installed before it is 14 days old unless accelerated curing processes allow a reduction of this time.

The CAT conforming product will weather much more quickly than the ISAT conforming product and in this respect will give cast stone a behaviour similar to many natural stones. The ISAT conforming variety will give a product that tends to maintain its initial appearance over many years. Therefore a lot depends on what stone is being imitated, the location on the building, topography, etc.

This standard does not refer to freeze/thaw durability risks as there are no known reports of such damage in the UK.

NOTE Table B.1 provides selection guidance for the specifier with reference to the manufacturing of cast stone units.

Table B.1 **Selection guidance to specifier with reference to the manufacturing method of cast stone units**

Property	**Semi-dry**	**Wet cast**
Cube strength	Typical range (25 to 50) MPa	Typical range (25 to 50) MPa
Size	More common to small units	More common to large units
Handling	As natural stone	More robust
Appearance as supplied	Similar appearance to natural stone (e.g. Portland)	Dense, close texture
Appearance on weathering	Similar to natural stone	Retains supplied appearance for a longer period
Weathering (Clause **9**)	Usual to achieve CAT conformity. More difficult to achieve ISAT conformity.	Usual to achieve both ISAT and CAT conformity
Product strength	Function of unit geometry (see also Annex C). For structural requirements reference should be made to BS EN 1991-1-1	
Cost	Function of mould reusage and finishing processes	
Cleaning and repair	Refer to BS 8221-1 (mainly for older cast stonework)	

NOTE The guidance given in this table is general in nature.

Annex C (informative) Guidance on slenderness ratios (S_R)

For guidance, reference should be made to the diameter, d, of the circle illustrated as inscribed or superscribed in the sections shown, which are those in fairly common use (see Figure C.1). Other sections should be discussed with the manufacturer. Care needs to be exercised in using superscribed circle diameters for rectangular sections as it assumes that the norm is that the unit is made, transported, stacked or lifted with the longest cross-sectional axis always vertical. This could be a dangerous assumption on most sites and might only apply if stonemasons are fixing the units.

Based upon the illustrated circles and product length, L, the slenderness ratio S_R (in mm) is given by the equation:

$$S_R = \frac{L}{d}$$

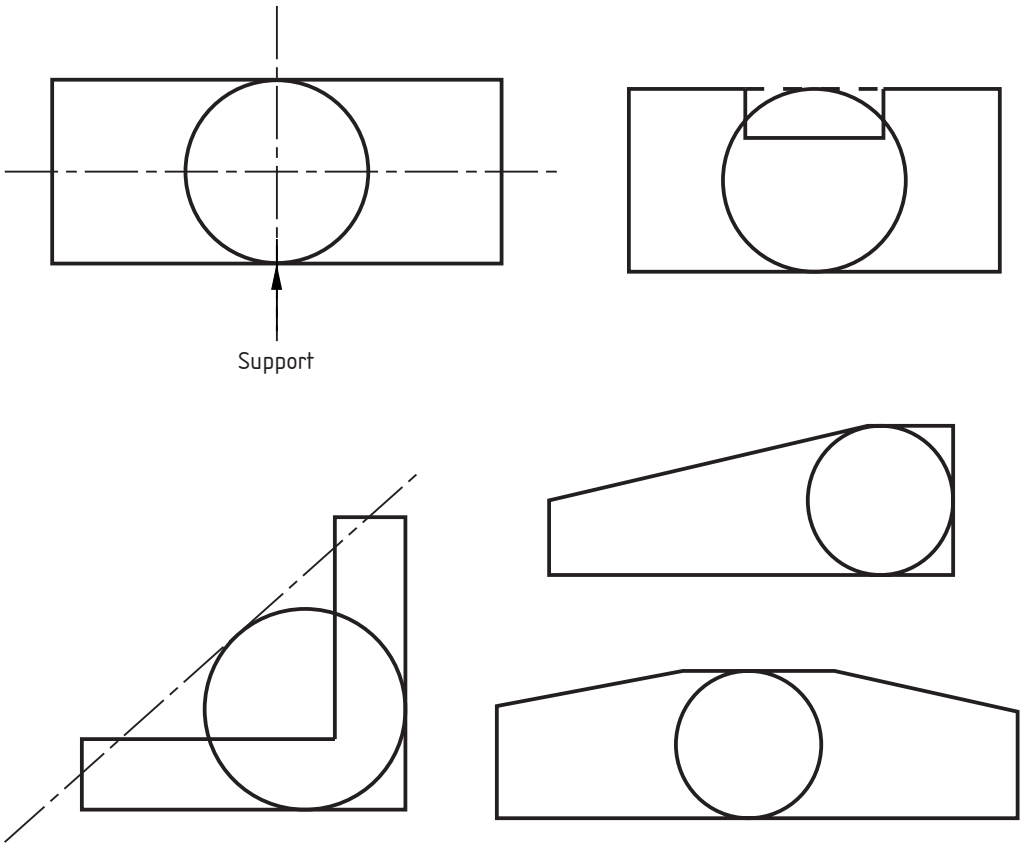
where:

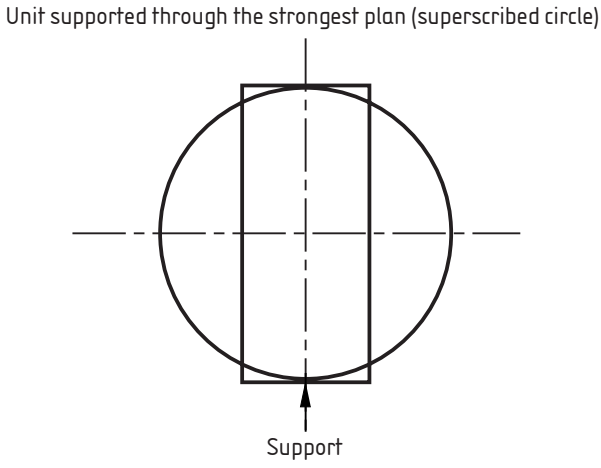
L is the product length (in mm);

d is the diameter of the circle (in mm).

S_R should be less than or equal to 15 for wet cast units or less than or equal to 12 for semi-dry units.

Figure C.1 **Typical sections of cast stone product illustrating the inscribed or superscribed circle for estimating the slenderness ratio**





Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5642-1, *Sills and copings – Part 1: Specification for window sills of precast concrete, cast stone, clayware, slate and natural stone*

BS 5642-2, *Sills and copings – Part 2: Specification for copings of precast concrete, cast stone, clayware, slate and natural stone*

BS 8221-1, *Code of practice for cleaning and surface repair of buildings – Part 1: Cleaning of natural stones, brick, terracotta and concrete*

BS EN 771-5, *Specification for masonry units – Part 5: Manufactured stone masonry units*

BS EN 845-2, *Specification for ancillary components for masonry – Part 2: Lintels*

BS EN 1991-1-1, *Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings*

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