

Specification for

High slag blastfurnace cement

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee (CAB/-) to Technical Committee CAB/1, upon which the following bodies were represented:

Association of Consulting Engineers
 Association of Quality Pulverised Fuel Ash Suppliers
 Brick Development Association
 British Aggregate Construction Materials Industries
 British Cement Association
 British Precast Concrete Federation
 British Ready Mixed Concrete Association
 British Steel Industry
 Cementitious Slag Makers' Association
 Concrete Society
 County Surveyors' Society
 Department of the Environment (Building Research Establishment)
 Department of the Environment (Property Services Agency)
 Department of Transport
 Electricity Supply Industry in United Kingdom
 Federation of Civil Engineering Contractors
 Institute of Concrete Technology
 Institution of Civil Engineers
 Institution of Structural Engineers
 Mortar Producers' Association
 Royal Institution of Chartered Surveyors
 Society of Chemical Industry
 Water Services Association of England and Wales

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Amendments issued since publication

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Specification for high slag blastfurnace cement

NOTE. This amendment has been issued to correct the date of publication as stated on this standard. The November *BSI News* announcement (see page 27) correctly identified the publication date as the end of November 1991.

Correction

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January 1992

Inside front cover

In the left-hand column, at the end of the paragraph beginning 'This British Standard,...' delete '20 December 1991' and substitute '29 November 1991'.

CAB/1

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Foreword

This revision of this British Standard is published under the authority of the Technical Sector Board for Building and Civil Engineering. It was revised to align it more closely with developments in the work of Technical Committee 51, Cement and building limes, of the European Committee for Standardization (CEN), which is preparing a European Prestandard for cements. As an intrinsic part of this activity, CEN has published EN 196, a series of methods for testing cement, which the UK is obliged to implement by the withdrawal of the relevant Parts of BS 4550. In consequence, this British Standard specifies requirements in terms of the EN 196 test procedures. It supersedes BS 4246 : 1974 which is withdrawn.

The specification covers a type of blastfurnace cement which was originally intended as a low heat cement for use in structures where large masses of concrete have to be placed. In such masses of concrete, there is often a considerable rise in temperature resulting from the evolution of heat as the cement sets and hardens, and from the slow rate at which this heat is dissipated from the surface. Cracking may result owing to the building up of tensile stresses during the rise and fall of temperature within the mass. Owing to the lower heat of hydration of this type of cement the risk of shrinkage cracking can be reduced. The specification retains an option for the purchaser to specify the heat of hydration, and agree on a method for its measurement with the manufacturer, if advantage is to be taken of the low heat properties of the cement.

Moreover, this cement is now being used for a variety of purposes, e.g. resistance to chemical attack (see BS 8110 and BRE Digest 363) other than for its low heat properties; for those applications due consideration is required of the low early strength which is characteristic of this type of cement, particularly at low temperatures. The rate of strength development of this type of cement is similar to that of low heat Portland cement (see BS 1370) but lower than that of Portland-blastfurnace cements (see BS 146).

The June 1989 draft European Prestandard specification for cements covered blastfurnace cements with blastfurnace slag contents up to 80 % by mass but did not include higher levels. This standard specification thus covers a cement which was outside the original scope of the European Prestandard.

This revision introduces the following changes.

- (a) The two methods of producing high slag blastfurnace cement, i.e. by intergrinding and by dry blending, have been retained (see 5.2). A procedure for combining Portland cement and ground granulated blastfurnace slag in the concrete mixer is included in BS 5328 : Part 1.
- (b) Compositional requirements are expressed as a percentage of the total mass of the constituents but exclude calcium sulfate and any additives. This departure from the traditional method of calculation in the UK is fully explained in appendix B.
- (c) The proportion of blastfurnace slag is specified as 50 % (m/m), to 85 % (m/m), expressed as a percentage of the total mass of the constituents but excluding calcium sulfate and any additives.
- (d) The addition of minor constituents is permitted up to a level of 5 % (m/m), expressed as a percentage of the total mass of the constituents but excluding calcium sulfate and any additives, i.e. about 4.8 % (m/m) expressed as a percentage of the final cement.
- (e) Additives to improve the manufacture or the properties of the cement are permitted up to a level of 1.0 % (m/m) without declaration by the manufacturer.

(f) The requirements are, in general, based on the results of tests on cement according to EN 196 that consists of the following Parts¹⁾.

Part 1	Determination of strength
Part 2	Chemical analysis of cement
Part 3	Determination of setting time and soundness
Part 4	Quantitative determination of constituents
Part 5	Pozzolanicity test for pozzolanic cements
Part 6	Determination of fineness
Part 7	Methods of taking and preparing samples of cement
Part 21	Determination of the chloride, carbon dioxide and alkali content of cement

(g) The requirements are specified as characteristic values and conformity is assessed by means of a statistical procedure for continuous inspection operated by the cement manufacturer (autocontrol) (see appendix A). This includes the concept of 'major defects' which are 'likely to reduce materially the usability of the cement for its intended purpose'. However, the 1989 draft European Prestandard is considered to be inappropriate for the manufacture of cement in the UK and the appendix therefore incorporates several footnotes identifying specific aspects. In particular, it is assumed, for this revision of this British Standard, that some limits are required for acceptance inspection, corresponding to those specified in BS 4246 : 1974. Clause 11 therefore gives appropriate values which in several cases are more stringent than those for major defects given in appendix A.

(h) The strength requirements are based on the EN 196 : Part 1 mortar prism test in place of the BS 4550 concrete cube test.

(i) The test for initial setting time is essentially unchanged, but a requirement is not specified for the final setting time.

(j) Requirements are not specified for fineness limits, but the limit in BS 6699 is applicable to the blastfurnace slag constituent where the dry blending method is used.

(k) The limit for insoluble residue has been changed to an autocontrol maximum of 5.0 % (m/m) (corresponding to an acceptance inspection limit of 5.1 % (m/m) of the final cement) where a minor additional constituent is included in the cement. For cements not containing a minor additional constituent the current limit of 1.5 % (m/m) has been changed to an autocontrol maximum (corresponding to an acceptance inspection limit of 1.6 % (m/m) of the final cement).

(l) The 9.0 % (m/m) limit for magnesium oxide content of the cement has been changed to a maximum of 5.0 % (m/m) for the clinker.

(m) The limit for total sulfur (expressed as SO₃) of 3.0 % (m/m) has been changed to an autocontrol maximum limit for sulfate of 3.5 % (m/m) (corresponding to an acceptance inspection limit of 3.1 % (m/m) of the final cement).

(n) A limit for loss on ignition has been introduced.

(o) A limit for chloride content has been introduced.

(p) Guidance on the use of cement has been included and attention is drawn to the safety precautions recommended in appendix C when working with cement. Cement will partially hydrate when exposed to water vapour; appendix C also includes guidance on storage.

(q) Purchasers are recommended to specify cement manufactured and supplied to a nationally recognized third party product certification scheme.

Other British Standards for cement, i.e. BS 12, BS 146, BS 4027, BS 6588 and BS 6610, have been revised at the same time.

¹⁾ These European Standards will be published as Parts of BS EN 196.