

Specification for

Portland pulverized-fuel ash cements

Ciments Portlands à base de cendres volantes
pulvérisées — Spécifications

Portlandzemente mit Beimischungen aus
Flugasche

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

This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 20 December 1991

© BSI 1991

First published July 1985
 Second edition November 1991

The following BSI references relate to the work on this standard:
 Committee reference CAB/1
 Draft for comment 89/17439 DC

ISBN 0 580 20334 4

Amendments issued since publication

Amd. No.	Date	Text affected

**Amendment No. 1
published and effective from 31 January 1992
to BS 6588 : 1991**

**Specification for Portland pulverized-fuel ash
cements**

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

AMD 7124
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'.

Contents

	Page
Committees responsible	Inside front cover
Foreword	2
Specification	
1 Scope	4
2 Definitions	4
3 Cement	4
4 Constituents	4
5 Composition, notation and manufacture	5
6 Compressive strength	5
7 Physical properties	6
8 Chemical properties	6
9 Marking	6
10 Information to be provided	6
11 Sampling and testing for acceptance inspection at delivery	7
12 Conformity criteria (cement manufacturer's autocontrol)	7
Appendices	
A Conformity criteria (cement manufacturer's autocontrol)	8
B Compositional requirements for cements of all types	11
C Product guidance	12
Tables	
1 Composition	5
2 Compressive strength	6
3 Chemical properties	6
4 Acceptance inspection limits	7
5 Minimum testing frequencies	9
6 Parameters determining the conformity procedure	10
7 Major defects	10
8 Acceptability constant k_A	11
9 Acceptable number of defects c_A	11
10 Extreme compositional possibilities	12

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 specification 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 6588 : 1985 which is withdrawn.

This revision introduces the following changes.

(a) The two methods of producing Portland pulverized-fuel ash cement, i.e. by intergrinding and by dry blending, have been retained (see 5.3). A procedure for combining Portland cement and pulverized-fuel ash 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 pulverized-fuel ash is specified as 6 % (m/m) to 28 % (m/m) for Portland fly ash cement or as 0 % (m/m) to 40 % (m/m) for pozzolanic cement, which has to satisfy the requirements for pozzolanicity. These proportions are expressed as a percentage of the total mass of the constituents but excluding calcium sulfate and any additives. Thus, the maximum permissible pulverized-fuel ash content of cement complying with BS 6588 has been raised to 40 % (m/m) from its current level of 35 % (m/m), expressed as a percentage of the final cement which corresponds to 37 % (m/m), but it should be noted that the highest proportions may not produce a cement complying with the higher strength requirements. (A cement with a proportion of pulverized-fuel ash of 41 % (m/m) to 53 % (m/m) is specified in BS 6610 with the name pozzolanic pulverized-fuel ash cement.)

(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

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

(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 6588 : 1985. 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 and the concept of a maximum value for the strength at 28 days has been introduced. In addition to the two classes of standard strength, 32.5 and 42.5, with two subclasses of early strength, this British Standard includes a higher class of standard strength, 52.5, to cover all Portland pulverized-fuel ash cements available in the UK (see table 2). It should be noted that for prescribed or standard mixes, as described in BS 5328 : Part 1, unless the cement content is increased appropriately, the use of cements of the 32.5 standard strength class will lead to concrete of lower compressive strength and may reduce durability, compared with cements of a higher strength class.

(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 given in BS 3892 : Part 1 is applicable to the pulverized-fuel ash constituent where the dry blending method is used (see 5.3).

(k) The 4.0 % (m/m) limit for magnesium oxide content of the cement has been changed to a maximum of 5.0 % (m/m) for the clinker.

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

(m) Requirements are not specified for loss on ignition of the cement; the value for the pulverized-fuel ash constituent is limited to an autocontrol maximum of 5 % (m/m), which corresponds to an acceptance inspection limit of 7.0 % (m/m), as required by BS 6588 : 1985.

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

(o) 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.

(p) 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 4246 and BS 6610, have been revised at the same time.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

Compliance with a British Standard does not of itself confer immunity from legal obligations.