

Specification for

Pozzolanic

pulverized-fuel ash

cement

Ciment pouzzolanique à cendres volantes
pulvérisées comme pouzzolane—
Spécifications

Puzzolanzenient mit Flugasche als Puzzolan

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 29 November 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 89/17440 DC

ISBN 0 580 20335 2

Amendments issued since publication

Amd. No.	Date	Text affected

Contents

	Page
Committees responsible	Inside front cover
Foreword	2
Specification	
1 Scope	5
2 Definitions	5
3 Cement	5
4 Constituents	5
5 Composition and manufacture	6
6 Compressive strength	6
7 Physical properties	6
8 Chemical properties	7
9 Marking	7
10 Information to be provided	7
11 Sampling and testing for acceptance inspection at delivery	8
12 Conformity criteria (cement manufacturer's autocontrol)	8
13 Heat of hydration	8
Appendices	
A Conformity criteria (cement manufacturer's autocontrol)	9
B Compositional requirements for cements of all types	13
C Product guidance	14
Tables	
1 Chemical properties	7
2 Acceptance inspection limits	8
3 Minimum testing frequencies	10
4 Parameters determining the conformity procedure	11
5 Major defects	11
6 Acceptability constant k_A	12
7 Acceptable number of defects c_A	12
8 Extreme compositional possibilities	13

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 6610 : 1985 which is withdrawn.

In the United Kingdom, experience of pozzolanas is limited to pulverized-fuel ash and only this material is specified in this British Standard. Pozzolan cement will generally be used as low heat cement to reduce the temperature rise in concrete. It can be used to impart a degree of resistance to the action of sulfates and weak acids (see BS 8110 and BRE Digest 363).

If a value for the heat of hydration is required, a method can be agreed between the purchaser and the manufacturer.

BS 6588 for Portland pulverized-fuel ash cement is published for cements containing not more than 40 % (m/m) of pulverized-fuel ash. The greater proportion of pulverized-fuel ash in the cement specified in this standard, 41 % (m/m) to 53 % (m/m), enables it to comply with the pozzolanicity test.

The June 1989 draft European Prestandard specification for cements specifies requirements for pozzolan cement with pozzolana content up to 40 % (m/m) but did not include higher levels. This British Standard specifies requirements for a cement which is outside the original scope of the European Prestandard.

This revision introduces the following changes.

- (a) The two methods of producing pozzolan pulverized-fuel ash cement, i.e. by intergrinding and by dry blending, have been retained (see 5.2). 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 41 % (m/m) to 53 % (m/m), expressed as a percentage of the total mass of the constituents but excluding calcium sulfate and any additives, the minimum value avoids an overlap with the scope of BS 6588 and the maximum corresponds to the current value of 50 % (m/m), expressed as a percentage of the final 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

(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 6610 : 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.

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

(j) Requirements for fineness are not specified for pozzolanic pulverized-fuel ash cement, but the limit in BS 3892 : Part 1 is applicable to the pulverized-fuel ash constituent where the dry blending method is used (see clause 12).

(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 sulfate (expressed as SO₃) of 3.0 % 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).

(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 limit of 7.0 % (*m/m*), as required by BS 6610 : 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 6588, have been revised at the same time.

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

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.