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भारतीय मानक

चूर्ण ईंधन की राख — विशिष्टि

भाग 2 मसाला (मोर्टार) व कंक्रीट में अपमिश्रण की तरह प्रयोग के लिए

(तीसरा पुनरीक्षण)

Indian Standard

PULVERIZED FUEL ASH — SPECIFICATION

PART 2 FOR USE AS ADMIXTURE IN CEMENT MORTAR AND CONCRETE

(Third Revision)

ICS 91.100.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2013 **Price Group 5**

Cement and Concrete Sectional Committee, CED 2

FOREWORD

This Indian Standard (Part 2) (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

Pulverized fuel ash is a residue resulting from the combustion of ground or powdered or crushed bituminous coal or sub-bituminous coal (lignite). About 80 percent of the total ash is finely divided and get out of boiler along with flue gases and is collected by suitable technologies. This ash generally and in this standard is termed as fly ash. It is sometimes referred as chimney ash and hopper ash. The balance about 20 percent of ash gets collected at the bottom of the boiler and is taken out by suitable technologies and is referred as bottom ash. Fly ash is collected and stored in dry condition. When fly ash and/or bottom ash is carried to storage or deposition lagoon or pond in the form of water slurry and deposited, it is termed as pond ash. Whereas, if fly ash and/or bottom ash is carried to a storage or deposition site in dry form and deposited, it is termed as mound ash.

Pulverized fuel ash is available in large quantities in the country as a waste product from a number of thermal power stations and industrial plants using pulverized or crushed or ground coal or lignite as fuel for boilers. The effective use of pulverized fuel ash as a pozzolana in the manufacture of and for part replacement of cement, as an admixture in cement, cement mortar and concrete, lime pozzolana mixture and products such as fly ash lime bricks, concrete blocks, asbestos cement products, etc, have been established in the country. Investigations of Indian pulverized fuel ashes have indicated greater scope for their utilization as a construction material. Greater utilization of pulverized fuel ash will lead to not only saving of scarce construction materials but also assist in solving the problem of disposal of this waste product. The investigations have also indicated the necessity to provide proper collection methods for fly ash so as to yield fly ash of quality and uniformity which are prime requirements of fly ash for use as a construction material.

This standard was first published in 1966 in three parts to cater to the requirements of fly ash for three specific uses: Part 1 covering use of fly ash as a pozzolana, Part 2 covering use of fly ash as an admixture for concrete, and Part 3 covering use of fly ash as fine aggregate for mortar and concrete. The Committee responsible for the formulation of this standard subsequently felt that the performance of fly ash as a pozzolana or an admixture or a fine aggregate, was complementary and not separable and hence requirements of fly ash for these uses should be covered by a single standard. This standard was, therefore, revised in 1981 by combining the three parts into a single standard, also incorporating the modifications found necessary based on the experience gained with the use of earlier standards. This revision classified fly ash in two grade, Grade 1 for incorporation in cement, mortar and concrete and in lime pozzolana mixture, and for manufacture of Portland pozzolana cement, and Grade 2 for incorporation in cement mortar and concrete and in lime pozzolana mixture.

Improvements have taken place over time in combustion technologies and ash collection technologies. These technological developments have resulted in improvement in ash qualities; specially the fineness and loss on ignition. Technologies have also been developed for a large number of utilizations of wide range of pulverized fuel ash. Application of technologies in the collection, transportation and deposition of ash have also resulted in availability of pulverized fuel ash in four forms, namely fly ash, bottom ash, pond ash and mound ash. The second revision was brought out in 2003 as ‘Specification for pulverized fuel ash’ in two parts. Part 1 covering its use as pozzolana in cement, cement mortar and concrete and Part 2 covering its use as admixture in cement mortar and concrete; these parts replaced the specifications of erstwhile Grade I and Grade II. The significant modifications in the last revision were: four forms of pulverized fuel ash namely fly ash, bottom ash, pond ash and mound ash defined, new clause on beneficiation, segregation and processing of pulverized fuel ash added, chemical requirements prescribed on the basis of siliceous and calcareous pulverized fuel ash, requirement for total chlorides added, additional requirement of particle retained on 45 micron IS Sieve (wet sieving) added under physical requirements as an optional test, requirement for drying shrinkage, lime reactivity and compressive strength deleted, and a clause on uniformity requirement added.

(*Continued on third cover*)

Indian Standard

PULVERIZED FUEL ASH — SPECIFICATION

PART 2 FOR USE AS ADMIXTURE IN CEMENT MORTAR AND CONCRETE

(Third Revision)

1 SCOPE

1.1 This standard (Part 2) covers the extraction and the physical and chemical requirements of pulverized fuel ash for use as admixture in cement mortar and concrete.

1.2 Pulverized fuel ash to be used as admixture in cement mortar and concrete in accordance with this standard may be fly ash, bottom ash, pond ash or mound ash which may be either in as collected condition or beneficiated, segregated or processed.

2 REFERENCES

The standards given in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 4305 and the following shall apply.

3.1 Admixture — A material other than water, aggregates, cementitious materials, and fiber reinforcement, used as an ingredient of a cementitious mixture to modify its freshly mixed, setting, or hardened properties and that is added to the batch before or during its mixing.

3.2 Bottom Ash — Pulverized fuel ash collected from the bottom of boilers by any suitable process.

3.3 Calcareous Pulverized Fuel Ash — Pulverized fuel ash conforming to the provisions of calcareous fly ash given in this standard and having reactive calcium oxide not less than 10 percent by mass. Such ash is normally produced from burning lignite or sub-bituminous coal and has both pozzolanic and hydraulic properties.

3.4 Fly Ash — Pulverized fuel ash extracted from flue gases by any suitable process such as by cyclone separator or electro-static precipitator.

3.5 Mound Ash — Fly ash or bottom ash or both mixed in any proportion and conveyed or carried in dry form and deposited dry.

3.6 Pond Ash — Fly ash or bottom ash or both mixed in any proportion and conveyed in the form of water slurry and deposited in pond or lagoon.

3.7 Pulverized Fuel Ash — Ash generated by burning of ground or pulverized or crushed coal or lignite fired boilers. It can be fly ash, bottom ash, pond ash or mound ash.

3.8 Reactive Calcium Oxide (CaO) — That fraction of the calcium oxide which under normal hardening condition can form calcium silicate hydrates or calcium aluminate hydrates.

NOTE — To evaluate this fraction, the total calcium oxide content is to be reduced by the fraction calculated as calcium carbonate ($CaCO_3$), based on the measured carbon dioxide (CO_2) content and the fraction calculated as calcium sulphate ($CaSO_4$), based on the measured sulphate (SO_3) content, disregarding the SO_3 taken up by alkalis.

3.9 Siliceous Pulverized Fuel Ash — Pulverized fuel ash conforming to the provisions of siliceous fly ash given in this standard and having reactive calcium oxide less than 10 percent, by mass. Such ash is normally produced from burning anthracite bituminous coal and has pozzolanic properties.

4 EXTRACTION OF PULVERIZED FUEL ASH

4.1 Fly ash may be extracted from flue gases of ground or pulverized or crushed coal or lignite fired boilers by any suitable process; such as by cyclone separation or electrostatic precipitation; bottom ash from the boilers shall not be added to the fly ash. Fly ash collected at later stages of electro static precipitation are finer than the fly ash collected at initial stages of electro static precipitator.

4.2 Bottom ash may be extracted from the bottom of ground or pulverized or crushed coal or lignite fired boiler by any suitable process. It is generally in the form of clinkers, which are ground or broken to smaller size to facilitate extraction.

4.3 Pond ash may be extracted from the pond or lagoon by conventional techniques.

4.4 Mound ash may be extracted from the mound by conventional excavation techniques.

5 BENEFICIATION, SEGREGATION AND PROCESSING OF PULVERIZED FUEL ASH

5.1 Pulverized fuel ash as collected, if does not conform to the requirements given in Table 1 and Table 2 or if required otherwise, may be processed and/or beneficiated and/or segregated to modify its physical or chemical characteristics to meet the requirements given in Table 1 and Table 2.

5.2 Appropriate technologies may be applied for beneficiation, segregation and processing of pulverized fuel ash to improve its properties, such as loss on ignition, particle size distribution and any of other physical and/or chemical properties. Some of the technologies presently in use are burning/removal of unburnt carbon, sieving/grading of fineness, grinding/attrition for reducing particle size, thermal treatment and blending of pulverized fuel ash of different qualities.

6 CHEMICAL REQUIREMENTS

6.1 Pulverized fuel ash, shall conform to the chemical requirements given in Table 1.

6.2 Limits regarding moisture content of pulverized fuel ash shall be as agreed to between the purchaser and the supplier; the moisture content being determined, where required in accordance with Annex C. All tests for the properties specified in **6.1** shall, however, be carried out on oven dry samples.

7 PHYSICAL REQUIREMENTS

7.1 Pulverized fuel ash, when tested in accordance with the methods of test specified in IS 1727, shall conform to the physical requirements given in Table 2.

7.2 Uniformity Requirements

In tests on individual samples, the specific surface and particles retained on 45 μ IS Sieve (wet sieving) value shall not vary more than 15 percent from the average established from the tests on the 10 preceding samples or of all preceding samples if less than 10.

8 TESTS

8.1 The sample or samples of pulverized fuel ash for test shall be taken as described in **9** and shall be tested in accordance with **6** and **7**.

8.2 All tests for the properties of the pulverized fuel ash shall be carried out in 'as supplied' condition. In

Table 1 Chemical Requirements
(*Clauses* 5.1 *and* 6.1)

Sl No.	Characteristic	Requirements		Method of Test, Ref to	
		Siliceous Fly Ash	Calcareous Fly Ash	Annex	IS No.
(1)	(2)	(3)	(4)	(5)	(6)
i)	Silicon dioxide (SiO_2) plus aluminium oxide (Al_2O_3) plus iron oxide (Fe_2O_3) in percent by mass, *Min*	70	50	—	IS 1727
ii)	Silicon dioxide (SiO_2) in percent by mass, *Min*	35	25	—	IS 1727
iii)	Magnesium oxide (MgO) in percent by mass, *Max*	5.0	5.0	—	IS 1727
iv)	Total sulphur as sulphur trioxide (SO_3) in percent by mass, *Max*	5.0	5.0	—	IS 1727
v)	Available alkalies as equivalent sodium oxide (Na_2O) in percent by mass, *Max*	1.5	1.5	B	—
vi)	Total chlorides in percent by mass, *Max*	0.05	0.05	—	IS 4032[1)]
vii)	Loss on ignition in percent by mass, *Max*	7.0	7.0	—	IS 1727

[1)] For the purpose of this test, wherever reference to 'cement' has been made in IS 4032, it may be read as 'pulverized fuel ash'.

Table 2 Physical Requirements
(*Clauses* 5.1 *and* 7.1)

Sl No.	Characteristic	Requirements
(1)	(2)	(3)
i)	Fineness — Specific surface in m^2/kg by Blaine's permeability method, *Min*	200
ii)	Particles retained on 45 micron IS sieve (wet sieving) in percent[1)], *Max*	50
iii)	Soundness by autoclave test — Expansion of specimen in percent, *Max*	0.8

[1)] Optional test.

case the pulverized fuel ash supplied is to be beneficiated or segregated or processed, the tests shall be carried out only after beneficiation, segregation or processing as applicable.

8.3 Independent Testing

8.3.1 If the purchaser or his representative requires independent test, the samples shall be taken before or immediately after delivery at the option of the purchaser or his representative, and the tests shall be carried out/arranged by the purchaser in accordance with this standard. The supplier shall make available, free of charge, the pulverized fuel ash required for testing.

8.3.2 After a representative sample has been drawn, tests on the sample shall be carried out as expeditiously as possible.

9 SAMPLING

9.1 Samples for Testing and by Whom to be Taken

A sample or samples for testing may be taken by the purchaser or his representative, or by any person appointed to superintend the work for purpose of which the pulverized fuel ash is required or by the latter's representative.

9.2 In addition to the requirements of **9.1**, the methods and procedure of sampling shall be in accordance with IS 6491.

9.3 Facilities for Sampling and Identifying

The supplier shall afford every facility, and shall provide all labour and materials for taking and packing the samples for testing the pulverized fuel ash and for subsequent identification of pulverized fuel ash sampled.

10 STORAGE

Pulverized fuel ash may be stored in accordance with the recommendations given in IS 4082 for storage of fly ash. Additionally, during bulk storing, the pulverized fuel ash should be suitably covered to avoid getting air borne.

11 DELIVERY

11.1 Supplies of pulverized fuel ash may be made in bulk in suitable quantities mutually agreed upon between the purchaser and the supplier. Where so required by the purchaser, the pulverized fuel ash may be supplied in bags (jute, jute-laminated, multiple paper or polyethylene lined) bearing the net quantity (may be 15 kg, 30 kg, 300 kg, 600 kg as agreed to between the purchaser and the supplier), supplier's name or registered trade-mark, if any. The tolerance on the quantity of pulverized fuel ash in each bag or consignment shall be as per **11.2** unless mutually agreed upon between the purchaser and the supplier.

11.2 Tolerance Requirements for the Quantity of Pulverized Fuel Ash Packed in Bags

11.2.1 The average of net quantity of pulverized fuel ash packed in bags at the plant in a sample shall be equal to or more than 15 kg, 30 kg, 300 kg, 600 kg as applicable. The number of bags in a sample shall be as given below:

Batch Size	*Sample Size*
100 to 150	20
151 to 280	32
281 to 500	50
501 to 1 200	80
1 201 to 3 200	125
3 201 and over	200

The bags in a sample shall be selected at random (*see* IS 4905).

11.2.2 The number of bags in a sample showing a minus error greater than 2 percent of the specified net quantity shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in the sample shall exceed 4 percent of the specified net quantity of fly ash in the bag.

NOTE — The matter given in **11.2.1** and **11.2.2** are extracts based on the *Standards of Weights and Measures (Packaged Commodities) Rules*, 1977 to which reference shall be made for full details. Any modification made in these Rules and other related Acts and Rules would apply automatically.

11.2.3 In case of a wagon or truck load of 5 to 25 t, the overall tolerance on net quantity of pulverized fuel ash shall be 0 to + 0.5 percent.

12 MANUFACTURER'S CERTIFICATE

The manufacturer (the beneficiating agency, if any, otherwise source thermal power station) shall satisfy himself that the pulverized fuel ash conforms to the requirements of this standard, and if requested, shall supply a certificate to this effect giving actual results.

13 MARKING

13.1 Each bag/consignment of pulverized fuel ash shall be legibly and indelibly marked with the following information:

a) Indication of the source of producer (source thermal power station);
b) Name of beneficiating agency, if any;
c) Name of packaging/supplying agency;
d) Type of pulverized fuel ash that is, siliceous or calcareous, as applicable;

e) Form of Pulverized fuel ash that is, fly ash, bottom ash, pond ash or mound ash, as applicable;
f) Net quantity in kg;
g) Fineness, *Min*;
h) Batch/control unit number; and
j) Month and year of packing.

13.2 BIS Certification Marking

The pulverized fuel ash may also be marked with the Standard Mark.

13.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

14 REJECTION

14.1 Pulverized fuel ash shall be rejected if it does not comply with any of the requirements of this standard.

14.2 Pulverized fuel ash in bulk storage for more than 6 months or in bags for more than 3 months after completion of tests, shall be retested before use and shall be rejected, if it fails to conform to any requirements of this standard.

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
1727 : 1967	Methods of test for pozzolanic materials (*first revision*)		storage of construction materials and components at site (*second revision*)
4032 : 1985	Method of chemical analysis of hydraulic cement (*first revision*)	4305 : 1967	Glossary of terms relating to pozzolana
4082 : 1996	Recommendations on stacking and	4905 : 1968	Methods for random sampling
		6491 : 1972	Methods for sampling fly ash

ANNEX B
[*Table* 1, *Sl No.* (v)]

METHOD FOR DETERMINATION OF AVAILABLE ALKALIES

B-1 PROCEDURE

B-1.1 Weigh 5.0 g of the sample and 2.0 g of hydrated lime on a piece of weighing paper, carefully mix using a metal spatula, and transfer to a small plastic vial of approximately 25 ml capacity. Add 10.0 ml of water to this mixture, seal the vial by securing the cap or lid to the vital with tape (*see* Note), blend by shaking until the mixture is uniform, and store at 38 ± 2°C.

NOTE — To ensure that moisture loss from the paste does not occur, place the sealed vial in a sealable container (such as a small sample or mason jar), add sufficient water to cover the bottom of the container, and seal.

B-1.2 Open the vial at the age of 28 days and transfer the contents to a 250 ml casserole. Break up and grind the cake with a pestle, adding a small amount of water, if necessary, so that a uniform slurry containing no lumps is obtained (*see* Note). Add sufficient water to make the total volume 200 ml. Let it stand for 1 h at room temperature with frequent stirring. Filter through a medium-textured filter paper onto a 500 ml volumetric flask. Wash thoroughly with hot water (eight to ten times).

NOTE — At times it may be necessary to break the vial and peel off the plastic from the solid cake. In such cases, care should be exercized to avoid the loss of material and to remove all solid material from the fragments of the vial. If the cake is too hard to break up and grind in the casserole, a mortar should be used.

B-1.3 Neutralize the filtrate with dilute HCl (1+3), using 1 to 2 drops of phenolphthalein solution as an indicator. Add exactly 5 ml of dilute HCl (1+3) in excess. Cool the solution to room temperature and fill

the flask to the mark with distilled water. Determine the amount of sodium and potassium oxides in the solution using the flame photometric procedure, described in IS 4032, except that the standard solutions shall be made up, to contain 8 ml of calcium chloride ($CaCl_2$) stock solution per litre of standard solution, and the solution as prepared shall be used in place of the solution of cement.

NOTE — The standard solutions made up with 8 ml of calcium chloride ($CaCl_2$) stock solution contain the equivalent of 504 ppm of CaO. Tests have shown that this amount closely approximates the amount of calcium dissolved in the test solution.

B-2 CALCULATION AND REPORTING OF RESULTS

Calculate the results as percent by mass of the original sample material. Report as equivalent percentage of sodium oxide (Na_2O), calculated as follows:

$$\text{Equivalent } Na_2O, \text{ percent} = Na_2O, \text{ percent} + 0.658 \times K_2O, \text{ percent}$$

ANNEX C
(*Clause* 6.2)

METHOD OF TEST FOR DETERMINATION OF MOISTURE CONTENT

C-1 PROCEDURE

Dry the clean empty Petri dish (approximately 100 mm diameter) at a temperature of 105 °C to 110°C and weigh it, after cooling in a desiccator. Spread uniformly, not less than 2.5 ± 0.5g, fly ash sample, as received basis, in this Petri dish and weigh. Heat this uncovered Petri dish with fly ash in a drying oven at a temperature 105 °C to 110°C for 1 h. Cool the Petri dish with heated fly ash in a desiccator and weigh. Repeat the process until there is no further loss in mass.

C-2 CALCULATION AND REPORTING OF RESULTS

Calculate the percentage of moisture to the nearest 0.1 percent as follows:

$$\text{Moisture content, percent} = \frac{x}{y} \times 100$$

where

x = loss in mass of fly ash during drying; and

y = mass of fly ash taken, as received basis.

ANNEX D
(*Foreword*)

COMMITTEE COMPOSITION

Cement and Concrete Sectional Committee, CED 2

Organization	*Representative(s)*
Delhi Tourism and Transportation Development Corporation Ltd, New Delhi	Shri Jose Kurian (***Chairman***)
ACC Ltd, Mumbai	Shri S. A. Khadilkar Shri Sharad Kumar Shrivastava (*Alternate*)
Ambuja Cements Limited, Mumbai	Shri C. M. Dordi Dr A. N. Vyasa Rao (*Alternate*)
Association of Consulting Civil Engineers (India), Bangalore	Shri Avinash D. Shirode Shri K. K. Meghashyam (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	Shri L. R. Bishnoi Shri Saurav Acharya (*Alternate*)
Builders' Association of India, Mumbai	Dr Narendra D. Patel

Organization	*Representative(s)*
Building Materials and Technology Promotion Council, New Delhi	Shri J. K. Prasad Shri C. N. Jha (*Alternate*)
Cement Corporation of India Limited, New Delhi	Shri R. R. Deshpande Shri M. K. Agarwal (*Alternate*)
Cement Manufacturers' Association, Noida	Shri N. A. Viswanathan Dr S. K. Handoo (*Alternate*)
Central Board of Irrigation and Power, New Delhi	Secretary Director (Civil) (*Alternate*)
Central Building Research Institute (CSIR), Roorkee	Dr B. K. Rao Dr S. K. Agarwal (*Alternate*)
Central Public Works Department, New Delhi	Shri A. K. Garg Shri Manu Amitabh (*Alternate*)
Central Road Research Institute (CSIR), New Delhi	Dr Rakesh Kumar Dr Renu Mathur (*Alternate*)
Central Soil and Materials Research Station, New Delhi	Shri Murari Ratnam Shri N. Sivakumar (*Alternate*)
Central Water Commission, New Delhi	Director (CMDD) (N&W) Deputy Director (CMDD) (NW&S) (*Alternate*)
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Construction Industry Development Council, New Delhi	Shri P. R. Swarup Shri Ravi Jain (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (QAC) Director (Material Management) (*Alternate*)
Engineers India Limited, New Delhi	Shri Vinay Kumar Shri A. K. Mishra (*Alternate*)
Fly Ash Unit, Department of Science and Technology, New Delhi	Dr Vimal Kumar
Gammon India Limited, Mumbai	Shri Venkataramana N. Heggade Shri Manish Mokal (*Alternate*)
Grasim Industries Limited, Mumbai	Shri A. K. Jain Dr S. P. Pandey (*Alternate*)
Hindustan Construction Company Ltd, Mumbai	Dr Chetan Haazaree Shri Manohar Cherala (*Alternate*)
Housing and Urban Development Corporation Limited, New Delhi	Shri Deepak Bansal
Indian Association of Structural Engineers, New Delhi	Prof Mahesh Tandon Shri Ganesh Juneja (*Alternate*)
Indian Bureau of Mines, Nagpur	Shri S. S. Das Shri Meerul Hasan (*Alternate*)
Indian Concrete Institute, Chennai	Shri Vivek Naik Secretary General (*Alternate*)
Indian Institute of Technology Kanpur, Kanpur	Dr Sudhir Misra Dr Sudib K. Mishra (*Alternate*)
Indian Institute of Technology Madras, Chennai	Prof Devdas Menon Dr Manu Santhanam (*Alternate*)
Indian Institute of Technology Roorkee, Roorkee	Prof V. K. Gupta Dr Bhupinder Singh (*Alternate*)
Indian Roads Congress, New Delhi	Secretary General Director (*Alternate*)
Institute for Solid Waste Research & Ecological Balance, Visakhapatnam	Dr N. Bhanumathidas Shri N. Kalidas (*Alternate*)

Organization	*Representative(s)*
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Lafarge India Pvt Ltd, Mumbai	Ms Madhumita Basu Shri Sanjay Jain (*Alternate*)
Madras Cements Ltd, Chennai	Shri Balaji K. Moorthy Shri Anil Kumar Pillai (*Alternate*)
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Ministry of Road Transport & Highways, New Delhi	Shri A. N. Dhodapkar Shri S. K. Puri (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Dr M. M. Ali (*Alternate*)
National Test House, Kolkata	Shri B. R. Meena Shrimati S. A. Kaushil (*Alternate*)
Nuclear Power Corporation of India Ltd, Mumbai	Shri U. S. P. Verma Shri Arvind Shrivastava (*Alternate*)
OCL India Limited, New Delhi	Dr S. C. Ahluwalia
Public Works Department, Government of Tamil Nadu, Chennai	Superintending Engineer Executive Engineer (*Alternate*)
Research, Design & Standards Organization (Ministry of Railways), Lucknow	Shri R. M. Sharma Shri V. K. Yadava (*Alternate*)
Sanghi Industries Limited, Sanghi Nagar	Shri D. B. N. Rao Dr H. K. Patnaik (*Alternate*)
Structural Engineering Research Centre (CSIR), Chennai	Dr K. Ramanjaneyulu Shri P. Srinivasan (*Alternate*)
The India Cements Limited, Chennai	Dr D. Venkateswaran Shri S. Gopinath (*Alternate*)
The Indian Hume Pipe Company Limited, Mumbai	Shri P. R. Bhat Shri S. J. Shah (*Alternate*)
The Institution of Engineers (India), Kolkata	Dr H. C. Visvesvaraya Shri S. H. Jain (*Alternate*)
The National Institute of Engineering, Mysore	Dr N. Suresh Shri H. N. Ramathirtha (*Alternate*)
Ultra Tech Cement Ltd, Mumbai	Dr Subrato Chowdhury Shri Biswajit Dhar (*Alternate*)
Voluntary Organization in Interest of Consumer Education, New Delhi	Shri M. A. U. Khan Shri H. Wadhwa (*Alternate*)
In personal capacity (*36, Old Sneh Nagar, Wardha Road, Nagpur)*	Shri L. K. Jain
In personal capacity (*EA-92, Maya Enclave, Hari Nagar, New Delhi*)	Shri R. C. Wason
In personal capacity (*E-1, 402, White House Apartments, R.T. Nagar, Bangalore*)	Shri S. A. Reddi
BIS Directorate General	Shri A. K. Saini, Scientist 'G' and Head (Civ Engg) [Representing Director General (*Ex-officio*)]

Member Secretaries

Shri Sanjay Pant
Scientist 'E' & Director (Civ Engg), BIS

Shri S. Arun Kumar
Scientist 'C' (Civ Engg), BIS

Cement, Pozzolana and Cement Additives Subcommittee, CED 2 : 1

Organization	*Representative(s)*
In personal capacity (*E-1, 402, White House Wardha Road, Nagpur*)	Shri S. A. Reddi (***Convener***)
ACC Ltd, Mumbai	Shri S. A. Khadilkar Shri Sharad Kumar Shrivastava (*Alternate*)
AIMIL Ltd, New Delhi	Dr V. M. Sharma Shri Aman Khullar (*Alternate*)
All India Mini Cement Manufacturers' Association, Hyderabad	Shri S.R.B. Ramesh Chandra Shri S. Srikanth Reddy (*Alternate*)
Ambuja Cements Ltd, Ahmedabad	Shri C. M. Dordi Dr A. N. Vyasa Rao (*Alternate*)
Atomic Energy Regulatory Board, Mumbai	Shri L. R. Bishnoi Shri Saurav Acharya (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	Shri J. K. Prasad Shri C. N. Jha (*Alternate*)
Cement Corporation of India Ltd, New Delhi	Shri M. K. Agarwal Shrimati Saraswathi Devi (*Alternate*)
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Central Electricity Authority, New Delhi	Shri Y. K. Sharma Shri Mohan Kumar (*Alternate*)
Central Pollution Control Board, Delhi	Shri J. S. Kamyotra Shri P. K. Gupta (*Alternate*)
Central Public Works Department, New Delhi	Shri A. K. Garg Shri Manu Amitabh (*Alternate*)
Central Road Research Institute (CSIR), New Delhi	Dr A. K. Misra Shri J. B. Sengupta (*Alternate*)
Central Soil and Materials Research Station, New Delhi	Shri Murari Ratnam Shri N. Sivakumar (*Alternate*)
Central Water Commission, New Delhi	Director, CMDD (N&W) Deputy Director, CMDD (NW&S) (*Alternate*)
Dalmia Cement (Bharat) Limited, New Delhi	Dr K. C. Narang Shri C. S. Sharma (*Alternate*)
Fly Ash Unit, Ministry of Science and Technology, New Delhi	Dr Vimal Kumar
Gammon India Limited, Mumbai	Shri Avinash Y. Mahendrakar Shri Manish Mokal (*Alternate*)
Grasim Industries Limited, Mumbai	Shri A. K. Jain Dr S. P. Pande (*Alternate*)
Gujarat Engineering Research Institute, Vadodara	Shri B. M. Rao Shri K. L. Dave (*Alternate*)
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Indian Concrete Institute, Chennai	Dr Anant M. Pande Secretary General (*Alternate*)
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In personal capacity (*II/69, President's Estate, New Delhi*)	Shri K. H. Babu

Panel for Revision of Cement Standards, CED 2 : 1/P1

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(*Continued from second cover*)

This standard covers the extraction and the physical and chemical requirements of pulverized fuel ash for use as pozzolana for use as admixture in cement mortar and concrete. The other part being Part 1 'For use as Pozzolana in cement, cement mortar and concrete'.

This revision has been brought out to incorporate modifications found necessary in light of the use of last version of the standard and various feedback received thereon. The significant modifications in this revision include:

a) Definition of admixture has been added.
b) Method for determination of available alkalies has been added.
c) For estimation of chloride content, reference has been given to IS 4032 : 1985 'Method of chemical analysis of hydraulic cement (*first revision*)' which gives volumetric method and also gives enabling provision for using rapid methods such as colorimetric analysis as per IS 12423 : 1988 'Method for colorimetric analysis of hydraulic cement'.
d) Requirement of loss of ignition has been revised from 5.0 percent to 7.0 percent in view of the type of use prescribed as per this standard.
e) Method for determination of moisture content has been added.
f) Provisions on manufacturer's certificate and marking have been modified to reflect the beneficiating agency, when involved.
g) References to the cross-referred Indian Standards have been updated.

This standard contains Sl No. (ii) of Table 2 which gives optional test and clause **11.1** which calls for agreement between the purchaser and the supplier.

The composition of the Technical Committee responsible for the formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Review of Indian Standards

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This Indian Standard has been developed from Doc No.: CED 2 (7698).

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