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SPECIFICATION FOR CINDER AGGREGATES FOR USE IN LIME CONCRETE

(First Revision)

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

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Indian Standard

SPECIFICATION FOR CINDER AGGREGATES FOR USE IN LIME CONCRETE

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 September 1977, after the draft finalized by the Building Limes Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Cinder, which is available in plenty as a waste product from locomotives, thermal power houses, etc, and possessing pozzolanic properties may be advantageously utilized as a building material. Its pozzolanic properties make it particularly suitable as an aggregate for lime concrete. Its light-weight makes it fit for the manufacture of precast blocks. However, for satisfactory use, the quality of cinder needs control with regard to chemical composition, soundness, etc, and this standard is intended to provide guidance in this respect.

0.2.1 This standard was published in 1964. The revision has been prepared so as to keep in line with the latest British Standard on this subject. The principal modifications made are in regard to the provision of grading and also deleting the requirement of soundness test which is not considered necessary.

0.3 It is considered that in view of the varying conditions of production of cinder aggregate, grading requirements are difficult to be specified. However, average grading requirements have been given and it is expected that users may further crush these so as to suit their requirements.

0.4 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, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the requirements for cinder for use as aggregates in lime concrete.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Cinder — Well-burnt furnace residue which has been fused or sintered into lumps of varying sizes. The same material in a finely powdered form is found to possess some pozzolanic activity.

3. GENERAL

3.1 Cinder aggregates shall be well-burnt furnace residue obtained from furnaces using only coal as fuel. It shall be clean and free from clay, dirt, wood ash or other deleterious matter.

4. CLASSES

4.1 The cinder aggregate shall be of the following three classes:

a) Class A — for general purposes,
b) Class B — for interior work not exposed to damp conditions, and
c) Class C — for precast blocks.

5. GRADING

5.1 The average grading for cinder aggregate is as under:

IS Sieve Designation	*Percentage Passing*
10-mm	100
4·75-mm	80
2·36-mm	60
1·18-mm	40
600-micron	30
300-micron	25
150-micron	16

6. CHARACTERISTICS

6.1 Sulphate Content — The content of sulphate as determined by the method given in Appendix A shall not exceed 1 percent when expressed as sulphur trioxide.

6.2 Loss on Ignition — The percentage loss of mass on ignition when tested by the method given in Appendix B shall not exceed 10 percent for Class A, 20 percent for Class B and 25 percent for Class C.

7. SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Sampling — The details of sampling are given in Appendix C.

7.2 Criteria for Conformity — The test prescribed in **6.1** and **6.2** shall be carried out and if the material fails to comply any of these requirements, the test or tests in which it fails shall be repeated on each of the two further portions of the same sample. If both of these further portions satisfy the requirements, the consignment shall be deemed to comply with the standard. If one or more of these further portions fail to satisfy the requirement, then the consignment shall be deemed not to comply with the standard.

APPENDIX A

(*Clause* 6.1)

METHOD FOR THE DETERMINATION OF SULPHATE CONTENT

A-1. PREPARATION OF SAMPLE

A-1.1 A quantity of approximately 1 g of the sample prepared as specified in **C-2** shall be accurately weighed and transferred to a 400-ml conical beaker. To this shall be added 50 ml of 2 N hydrochloric acid, and the solution shall then be heated to boiling point, boiled for 3 minutes, filtered and the residue washed with hot distilled water. The residue shall be discarded.

A-2. PROCEDURE

A-2.1 To the filtrate add a little filter paper pulp. Heat the filtrate almost to boiling point and make alkaline to methyl red indicator by means of ammonia and simmer for half a minute. Filter the precipitate under gentle suction through a filter paper of medium porosity, wash once with hot distilled water and set aside the filtrate. Transfer the filter paper and precipitate to a 250-ml beaker and redissolve the precipitate in 5 ml of concentrated hydrochloric acid to which has been added 70 ml hot distilled water. Bring the solution nearly to the boiling and reprecipitate by making it alkaline to methyl red indicator with ammonia. Filter and wash the precipitate as before. Combine the filtrates and reject the precipitate.

A-2.2 Boil until the combined filtrates and washings are reduced to about 200 ml, make acid with 1 ml concentrated hydrochloric acid and add to the hot solution 10 ml of cold barium chloride solution from a pipette held so that the liquid falls into the middle of the hot solution while this is rotated or shaken. Maintain just below boiling point for 30 minutes.

NOTE — With the excess of barium chloride used and under the conditions of precipitation, complete recovery of the barium sulphate can be achieved by filtering after 30 minutes.

A-2.3 Filter the precipitate through:

a) an ashless close textured double acid washed paper, or

b) a filter pad, or

c) an asbestos pad or a filter crucible dried at 105 ± 5°C to constant mass.

NOTE — Macerate filter paper clippings of approximately 100 mm^2 or ashless paper tablets with distilled water. Form a pad about 5 mm thick on a porcelain cone or Witt plate in a 75-mm filter funnel taking care to avoid trapping air bubbles beneath the plate. Tamp the pad lightly with a glass rod and wash with water before use. When removing the barium sulphate precipitate for ignition, place the pad on one half of a 125-mm filter paper and use the other half to wipe the funnel.

A-2.4 Wash with distilled water until free from chloride. After filtration either by method (a) or (b), fold the wet filter paper and contents into a previously ignited and weighed silica capsule, stand this on a silica plate and place both in the muffle furnace at 800°C. Heat for 15 minutes, remove the capsule, cool in a desiccator and weigh. After filtration by method (c) dry the crucible and precipitate at 105 ± 5°C to constant mass.

NOTE — Ignition of the wet paper and contents gives more accurate results than drying before ignition. Loss by shock heating is prevented by the use of the silica plate.

A-3. EVALUATION

A-3.1 The residue shall be expressed as percent by mass to the original sample.

APPENDIX B

(*Clause* 6.2)

METHOD OF DETERMINATION OF LOSS ON IGNITION

B-1. PREPARATION OF SAMPLE AND PROCEDURE

B-1.1 Approximately 1 g of the sample prepared as specified in **C-2** shall be accurately weighed in a previously ignited and weighed shallow silica dish. It shall then be placed in a muffle furnace and maintained at 775 ± 25°C for 2 hours. During the first 10 minutes the dish should be covered with a suitable crucible lid. After 2 hours the dish shall be removed, allowed to cool in a desiccator and reweighed.

B-2. EVALUATION

B-2.1 The loss in mass expressed as a percentage of the dry mass shall be taken as the loss on ignition thus:

$$\text{Percentage loss on ignition} = \frac{\text{Loss in mass}}{\text{Mass of sample}} \times 100$$

APPENDIX C

(*Clause* 7.1)

METHOD OF SAMPLING

C-1. GENERAL

C-1.1 It is essential that the sample should represent as nearly as possible the proportions of coarse and fine material in the consignment; as it is in the latter that the more deleterious constituents are likely to be present.

C-1.2 If the material to be sampled is in heaps, delivered at the same time and from the same source, it may be regarded as one consignment and a sample drawn from approximately one out of three heaps shall suffice. Heaps of material from different sources, or delivered at different times from the same source shall be sampled and tested separately.

C-1.3 The size of the initial sample drawn will vary with the size of the consignment. From a consignment of 5 to 10 tonnes an initial sample of 15 to 20 kg will suffice, while from a consignment of 50 tonnes or more an initial sample of 45 to 90 kg is advisable. For consignments of intermediate weight, the size of sample should be proportionate. In order to ensure that a representative sample is obtained, the procedure as given in **C-2** shall adopted.

C-2. SAMPLING

C-2.1 The surface material shall be removed down the side of the heap along a strip of about 30 cm width from top to bottom.

C-2.2 Starting at the bottom, samples shall be taken by means of large shovels (scoop like) at 60 cm intervals up to the top of the heap. These shall be put aside for the initial sample. The process shall be repeated twice on different sides of the heap.

C-2.3 Very large lumps, if present in the composition of the sample, shall be broken up, if necessary, and a representative portion taken for the sample. This combined sample shall be thoroughly mixed with a shovel and spread out into a flat heap. The heap shall be marked into four equal parts with the shovel and alternate quarters shall be taken, repeating this process, if necessary, so that a sample of 10 to 15 kg is obtained. The sample thus obtained shall then be crushed until it passes through 6·3-mm IS Sieve. The material thus passing through this sieve shall again be mixed and the quartering process shall be repeated until a sample weighing approximately 2 kg is obtained.

This 2 kg sample shall be ground to pass 850-micron IS Sieve and when it has all passed through the sieve, it shall be again mixed and quartered down to a final sample of about 25 to 45 g.

C-2.4 This final sample shall then be ground until it completely passes 150-micron IS Sieve. Drying of the sample, if necessary, for this purpose shall be done over a steam-bath. If machine grinding is used, care shall be taken that it does not reduce the mass to an excessive fineness. The sample so obtained shall be subjected to the desired tests.

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Alteration

(*First Cover, pages 1 and 3, title*) - Substitute the following for the existing title:

'*Indian Standard*

SPECIFICATION FOR CINDER AS FINE AGGREGATES FOR USE IN LIME CONCRETE'

(First Revision)

(BDC 4)

Reprography Unit, BIS, New Delhi, India