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[PCD 7: Solid Mineral Fuels]

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SIZE ANALYSIS OF COAL AND COKE FOR MARKETING

(Third Revision)

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(*Continued on page* 11

Indian Standard

SIZE ANALYSIS OF COAL AND COKE FOR MARKETING

(Third Revision)

0. FOREWORD

0.1 This Indian Standard (Third Revision) was adopted by the Indian Standards Institution on 26 March 1979, after the draft finalized by the Solid Mineral Fuels Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 This standard was first issued in 1953 as a tentative standard. It was reviewed and revised in 1956 and 1965. Nationalization of coal and coke industry in the country, rapid industrialization and avenues for export of these items, have made it necessary to re-evolve a system of size grading of coal and coke. It was, therefore, felt necessary to again revise the standard.

0.3 Coal as mined is termed as 'run-of mine'. It has to be graded by screening or crushing and screening on the basis of size ranges. Similarly, coke as produced in various plants has an unspecified size distribution and has to be suitably size graded. For a rational and economic use of these important materials it is necessary to grade them and assign suitable nomenclature linked with popular trade names and based on size fractions so that it may be possible to market them with maximum advantage both to the producers and the consumers.

0.4 In the formulation of this standard, due weightage has been given to international coordination among the standards and practices prevailing in different countries, in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from ISO 1953 'Hard coals — size analysis' issued by the International Organization for Standardization (ISO), and information provided by the various undertakings of the Government of India, private sector organizations and the Central Fuel Research Institute, Dhanbad.

0.5 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes standard nomenclature and size ranges of coal and coke for marketing and the methods of sampling and test for their size grading.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 3810 (Part I)-1977† and IS : 3810 (Part III)-1977‡, shall apply.

3. SIZE ANALYSIS AND SIZE RANGES OF COAL AND COKE

3.1 The size analysis and the corresponding size ranges of coal and coke for marketing shall be as given in Tables 1 and 2.

3.2 Optional Requirements — For use in railways, the requirements of nominal size of coal, large (steam coal) shall be 200 to 50 mm with ex-colliery tolerance on oversize and undersize limits of 5 percent each.

4. SAMPLING

4.1 Samples for tests for size analysis of coal and coke shall be drawn as prescribed in Appendix A.

5. TEST PROCEDURE FOR SIZE ANALYSIS OF COAL AND COKE

5.0 General — The sample for testing shall be taken as prescribed in Appendix A. Tests for specific size ranges shall be carried out on square mesh sieves. It is important that the apertures of the sieves are checked from time to time to ensure that the dimensions lie within the tolerance limits prescribed for them (*see* IS : 460-1968§).

NOTE — Approximate conversion from circular to square apertures can be achieved by multiplying the diameter by 0·8, but such a conversion is only valid for rough comparison purposes only and its use shall be clearly indicated in the results.

*Rules for rounding off numerical values (*revised*).
†Glossary of terms relating to solid mineral fuels: Part I Coal and its preparation.
‡Glossary of terms relating to solid mineral fuels : Part III Coke.
§Specification for test sieves (*revised*).

TABLE 1 SIZE ANALYSIS OF COAL (UNWASHED) FOR MARKETING

(*Clauses* 3.1 *and* 5.1.1)

Sl No.	Standard Nomenclature	Nominal Size Range (IS Sieve) (PS)	Ex-Colliery Tolerance, Percent by Mass, *Max*		Remarks (Trade-Name)
			On Oversize	On Undersize	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Unscreened coal	500* to 0	15	—	Run-of-mine coal
ii)	Coal, large	250 to 25	10	15	Steam coal, *round coal*
iii)	Coal, medium	50 to 25	10	15	Rubble, *separated nut*
iv)	Coal, small	25 to 12·5	10	15	Smithy, *nut coal*
v)	Coal, slack (50)	50 to 0	10	25†	Slack, *rough slack*
vi)	Coal, slack (25)	25 to 0	10	30†	Slack, *fine slack*
vii)	Coal, slack (12·5)	12·5 to 0	10	70†	Dust

NOTE 1 — Use of trade names which are italicized is deprecated.

NOTE 2 — Normally no top size is prescribed for the bulk of production of run-of-mine coal, however, in practice this ranges between 500 to 0 mm.

*These sieves are not covered by IS : 460-1962 Test sieves (*revised*).

†Undersize passing through 3·35-mm IS Sieve.

TABLE 2 SIZE ANALYSIS OF HARD COKE FOR MARKETING

(*Clauses* 3.1 *and* 5.1.1)

Sl No.	Standard Nomenclature	Nominal Size Range (IS Sieve) (PS)	Ex-Plant Tolerance, Percent by Mass, *Max*		Remarks (Trade-Name)
			On Oversize	On Undersize	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Coke, extra large	+100	—	10	Foundry coke
ii)	Coke, large	−100 to +25	5	10	BF coke
iii)	Coke, medium	−40 to +25	5	10	Nut coke
iv)	Coke, small	−25 to +10	5	10	Pearl coke
v)	Coke, fine	−10	5	—	Breeze

NOTE — Size ranges other than these may be specified for special uses.

5.1 Test Equipment

5.1.1 *Sieves and Perforated Plates* — of required aperture sizes (*see* Tables 1 and 2).

5.1.2 *Receivers*

5.1.3 *Lids*

5.1.4 *Weighing Machine* — sensitive to 0·05 percent of the mass of the sample being sieved.

5.2 Procedure for Size Analysis of Coal — Accurately weigh the sample before screening. Starting with the largest screen, sieve the sample in such increments as will allow the pieces to be in direct contact with the openings on the completion of the screening of each increment. Determine the smallest screen through which the whole of the sample passes, by actual test as given in **5.2.2** to **5.3.1.**

5.2.1 *Coal, Large* — Try by hand to see if pieces of coal not passing readily through 50-mm or larger IS Sieves, pass through the openings in any position. Do not shake the screen except for whatever jigging may be necessary to clear the screen of fine coal.

5.2.2 *Coal, Medium and Small* — Test the coal passing through 50-mm IS Sieve with screens down to and including 12·5-mm IS sieve. Move the screen horizontally through a distance of about 200 mm (with the side of the square sieve holes parallel to the direction of the sieving motion) in such a manner that the pieces of coal are caused to tumble or roll on the sieve taking precaution that the motion of sieve is not stopped by impact. Screening of any increment shall be considered complete after ten such 'to' and 'fro' motions (five in each direction).

NOTE — In case arrangements for mechanical screening are not possible, medium and small coal, shall be sieved normally using a series of sieves one sieve at a time in decreasing order of apertures. In doing so, place the coal on the screen and try by hand to assess the oversize. Coal passing through the screen shall be similarly tested on the next sieve having smaller apertures. The test shall be continued up to the 12·5-mm IS Sieve.

5.2.3 *Coal, Slack* — Weigh the coal passing through 50-mm, 25-mm or 12·5-mm IS Sieve, reduce the gross sample, as prescribed in Appendix A; drying if necessary and carry out the screening as prescribed in **5.2.2.**

5.3 Procedure for Size Analysis of Coke — Select appropriate sieves so that no size fraction exceeds 25 percent by mass of the sample. Arrange them in a stack in a decreasing order of size apertures so that the sieve with the smallest aperture is at the bottom. Accurately weigh the sample and screen it in small increments at a time so that undersize passes to the next sieve and the apertures are not choked. Hand place

the pieces of coke remaining on the screen and transfer the oversize to a suitable container. Remove the top sieve and repeat the operation on the next sieve. Continue this procedure using hand shaking only until the oversize on each sieve has been placed in a separate container.

5.3.1 If necessary, re-stack the set of sieves and repeat the process for successive quantities until the entire sample has been graded.

NOTE 1 — At the end of each sieving operation, the oversize remaining on the sieve should not cover more than 75 percent of the sieving area.

NOTE 2 — Mechanical sieving equipment may be used if it is found to be free from bias.

NOTE 3 — Any error due to moisture content is usually very small and may be ignored except in the case of coke smaller than 25 mm in size, in which case the coke shall be dried before sieving.

6. EXPRESSION OF RESULTS

6.1 Calculate the mass of the size fractions retained on different sieves as a percentage of the total mass of sample taken for the test. Record the percentages fractionally or cumulatively as required.

6.2 Adjust the mass of the smallest size fraction to take into account any loss or gain in the total mass of the sample. If, however, in any test the loss or gain in mass exceeds one percent of the total mass of the gross sample, the results of the test shall be rejected.

6.3 If during the course of test for size grading the mass of undersize is reduced (*see* **5.2.3**), the mass of each of the subsequent fractions shall be recalculated as a percentage of the total mass of undersize at the time of reduction.

6.4 The mass of the gross sample together with the sieve series and sieving procedure used shall be recorded.

APPENDIX A

(*Clauses* 4.1, 5.0 *and* 5.2.3)

SAMPLING OF COAL AND COKE FOR SIZE ANALYSIS

A-1. SAMPLING OF COAL

A-1.1 Time of Sampling — The coal shall be sampled when it is being loaded into railway wagons, ships, barges, or when discharged from supply bins, or from grab buckets, or from any coal-conveying equipment. It is not feasible to collect representative samples for screen analysis from the surface of coal in piles or from loaded railway wagons or bins.

A-1.2 Collection of Gross Sample — Increments shall be regularly and systematically collected so that the entire quantity of coal sampled is represented proportionately in the gross sample, and with such frequency that a gross sample of the required quantity is collected. The number of increments collected shall be not less than 20. When the coal is passing over a conveyor or down a chute, increments from the full width and thickness of the stream of coal shall be taken either by stopping the conveyor and removing all coal from a transverse section of it or by momentarily inserting a suitable container into the stream. If it is impracticable to collect increments from the full width and thickness of the coal stream, increments shall be systematically collected from all portions of the stream.

A-1.3 Mass of Gross Sample — The minimum mass of the gross sample collected shall be as given in Table 3.

TABLE 3 MASS OF GROSS SAMPLE

Sl No.	Nomenclature	Mass
(1)	(2)	(3)
		kg
i)	Unscreened coal and coal, large	1 800
ii)	Coal, medium	900
iii)	Coal, small	225
iv)	Coal, slack (50)	450
v)	Coal, slack (25)	225
vi)	Coal, slack (12·5)	50

A-1.4 Reduction of Gross Sample — Reduction of the quantity of the gross samples shall be carried out as described under **A-1.4.1** to **A-1.4.3**.

A-1.4.1 *Coal Larger Than 25 mm* — Coal larger than 25 mm shall be screened without mixing or reducing.

A-1.4.2 *Coal Smaller Than 25 mm* — Coal smaller than 25 mm may be reduced in amount to not less than 55 kg by (a) sample dividers or (b) arranging it in a long, flat pile and successively halving it by the alternate shovel method [IS : 436 (Part I/Sec 1)-1964*] or (c) quartering it by taking every fourth shovelful from the pile.

A-1.4.3 *Coal Smaller Than 12·5 mm* — Coal smaller than 12·5 mm may be reduced to not less than 11 kg by passing it through a sample divider or by coning and quartering [IS : 436 (Part I/Sec 1)-1964*].

*Methods for sampling of coal and coke: Part I Sampling of coal, Section 1 Manual sampling (*revised*).

A-1.5 Drying — In case the coal is wet, the sample may be tested on 25 mm or larger screen without drying, but the sample of coal smaller than 25 mm (reduced in mass to about 55 kg as described under **A-1.4.2**) shall be dried in air sufficiently to remove surface moisture which causes small particles to cling to the larger pieces thereby rendering it easily screenable. In the case of sub-bituminous and high-natural moisture bituminous coals, care shall be taken not to overdry and cause weathering of the coal.

A-2. SAMPLING OF COKE

A-2.0 General — The coke shall be sampled, wherever possible, in motion while it is being loaded into wagons, barges or trucks or from any coke-conveying equipment. Samples collected from the surface of coke in the stacks are, in general, unreliable, because of size segregation. It is essential that the sample should be taken by not less than the specified number of increments regularly and systematically collected, so that the entire quantity of coke sampled, is represented proportionately in the gross sample.

A-2.1 Lot — The quantity of coke arising from the same source or known to be of same quality and size not exceeding 250 tonnes, shall constitute a lot. For ascertaining the conformity of the material to the requirements of the specification, a gross sample shall be taken from each lot separately.

A-2.2 Collection of Gross Samples

A-2.2.1 When the coke is going over a conveyor or coming down a chute, the sample shall be selected by inserting a container or scoop into the stream of coke at required intervals so as to take increments of the full width and thickness.

A-2.2.2 In case it is necessary to collect a sample of coke from the surface of the stack, nine equal increments shall be taken about 30 cm below the surface. The nine sampling points shall be located as shown in Fig. 1 [*see* **2.1.1** of IS : 436 (Part II)-1965*]. The total mass of the gross sample and the number of increments by which the sample should be collected, shall be in accordance with Table 4.

The minimum mass of increments shall be 1 kg (the actual increment has often to be considerably larger, as will be seen from Table 4) and the increments shall be approximately of equal mass.

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*Methods for sampling of coal and coke: Part II Sampling of coke.

TABLE 4 MINIMUM MASS OF GROSS SAMPLE FOR COKE

(*Clause* A-2.2.2)

STANDARD NOMENCLATURE	MINIMUM NUMBER OF INCREMENTS	MINIMUM MASS OF GROSS SAMPLE
(1)	(2)	(3)
		kg
Coke, extra large	50	240
Coke, large	50	240
Coke, medium	50	120
Coke, small	50	120
Coke, fine	25	60

A-2.2.3 Whenever the coke is loaded manually through baskets, a separate gross sample shall be taken for each lot. The minimum mass of increments, the minimum number of increments and minimum mass of the gross sample shall be same as given in **A-2.2.2.**

(*Continued from page* 2)

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