BRITISH STANDARD

BS 1016-110.1:
1996
ISO 728:1995

Methods for

Analysis and testing of coke —

Part 110: Size analysis of coke —

Section 110.1 Nominal top size greater than 20 mm

ICS 75.160.10

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee SFI/3, Analysis and testing of coal and coke, upon which the following bodies were represented:

British Cement Association
British Coal Corporation
British Gas plc
British Steel Industry
Electricity Association
GAMBICA (BEAMA Ltd.)
Power Generation Contractors' Association (PGCA) (BEAMA Ltd.)

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on
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The following BSI references relate to the work on this standard:
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Contents

National foreword

This British Standard has been prepared by SFI/3 and is identical with ISO 728:1995 *Coke (nominal top size greater than 20 mm) — Size analysis by sieving* published by the International Organization for Standardization (ISO) and in the preparation of which the United Kingdom played a full part.

In conjunction with BS 1016-110.2 this British Standard is a revision of BS 1016-18:1981 which is withdrawn. The main changes in this revision are separation of the methods for "small" and "large" coke, and a more precise description of the sieving procedure.

BS 1016-110.1 is part of a rationalized and restructured BS 1016. The Parts numbered from 1 to 21 are gradually being withdrawn and replaced by Parts in the new series. The full list of Parts in the new series, together with corresponding numbering of the old series and related ISO standards, is given in BS 1016 *Analysis and testing of coal and coke* — Part 100:1994 *General introduction and methods for reporting results*.

Cross-references

International standard	Corresponding British Standard
ISO 579:1981	BS 1016 *Methods for analysis and testing of coal and coke* Part 2:1973 *Total moisture of coke* (Technically equivalent)
ISO 1213-2:1992	BS 3323:1992 *Glossary of terms relating to sampling, testing and analysis of solid mineral fuels* (Identical)

The Technical Committee has reviewed the provisions of ISO 2309 and ISO 3310-2, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard related to ISO 2309:1980 is BS 1017 *Sampling of coal and coke* — Part 2:1994 *Methods for sampling of coke*. ISO 2309 is being revised in conjunction with ISO 1988 *Hard coal — Sampling*, ISO 9411 *Solid mineral fuels — Mechanical sampling from moving streams*, Part 1: *Coal* and Part 2: *Coke*. This revision will be published in eight Parts, and it is intended to implement these Parts as identical British Standards, superseding BS 1017.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This International Standard specifies a method for the size analysis of coke, of nominal top size greater than 20 mm, by manual sieving.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 579:1981, *Coke — Determination of total moisture content.*

ISO 1213-2:1992, *Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis.*

ISO 2309:1980, *Coke — Sampling.*

ISO 3310-2:1990, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 1213-2 apply.

4 Apparatus

4.1 *Test sieves*, complying with ISO 3310-2. The set of sieves used shall have exclusively round holes or exclusively square holes.

NOTE 1 The test sieves should be selected according to the requirements of the test and the characteristics of the sample. If possible, the series of sieves should be selected so that the mass of coke in any size fraction does not exceed 25 % of the total mass of sample being sieved. For ungraded coke, a series of test sieves of nominal hole sizes 125 mm; 100 mm; 80 mm; 71 mm; 63 mm; 50 mm; 40 mm; 31,5 mm; 20 mm and 10 mm may be suitable. For samples containing pieces with a particle size greater than 125 mm, single-hole gauges may be used instead of test sieves. For graded coke, a series of test sieves of nominal hole sizes 50 mm; 45 mm; 40 mm; 35,5 mm; 31,5 mm; 25 mm; 20 mm; 16 mm; 10 mm; 5,6 mm and 2,8 mm may be suitable.

It is important to check the sieves from time to time, using the methods described in ISO 3310-2, to ensure that the hole dimensions are within the specified tolerances. Worn or damaged sieves can give rise to serious errors in size analysis and should be discarded.

4.2 *Weighing machine*, capable of measuring the mass of the sample to be sieved to the nearest 0,1 %.

5 Sampling and preparation of test sample

Take two gross samples for physical testing in accordance with ISO 2309[1)]. Prepare one of these samples for the determination of moisture content in accordance with ISO 2309 and carry out the determination in accordance with ISO 579.

If the moisture content is higher than 5 % (*m*/*m*), dry the other sample sufficiently to reduce the moisture content to lower than 5 % (*m*/*m*). Use this second sample for the remainder of the test.

6 Procedure

6.1 Arrange the set of sieves (**4.1**) in a stack in order of nominal hole sizes, with the smallest size at the bottom.

Weigh the test sample, in several portions if necessary, using the weighing machine (**4.2**).

6.2 Place on the top sieve a portion of the test sample small enough that not more than 75 % of the sieve area is covered, and shake to allow most of the undersize to pass. Manually place the remaining coke on the sieve and transfer the oversize to a suitable container. Remove the top sieve and repeat these operations for sieves of nominal hole sizes down to and including 40 mm.

6.3 Continue the process described in **6.2** for sieves of nominal hole sizes less than 40 mm, but using manual shaking. Carry out manual shaking by holding the sieve in the hands, or suspending it freely, and moving it horizontally to and fro with a displacement of about 75 mm. Complete fifty such oscillations (each consisting of one movement to and fro) in a period of about 30 s. If the amount of coke remaining on the sieve is then such that it covers more than 75 % of the sieve area, divide it into two or more portions and manually shake each portion separately. Otherwise, transfer the oversize to a suitable container.

NOTE 2 Mechanical sieving may be carried out if it can be demonstrated that the method is free from bias when compared to the manual sieving method described in this International Standard.

6.4 If necessary, re-stack the sieves and repeat the steps described in **6.2** and **6.3** for successive portions until the entire test sample has been sized and each size fraction has been collected in a separate container.

[1)] In due course, ISO 2309 will be replaced by ISO 13909-6, *Hard coal and coke — Sampling — Part 6: Coke — Preparation of test samples.*

6.5 Either weigh each container separately with its size fraction and subtract the respective tare mass, or, after weighing the first fraction, successively add the other fractions and note the cumulative mass after each addition.

NOTE 3 Cumulative weighing is preferable because it reduces the weighing error for the cumulative fractions. Depending on how the results are to be expressed (see clause **7**), cumulative weighing should be in descending order of size fractions (cumulative oversize) or in ascending order of size fractions (cumulative undersize).

7 Expression of results

If necessary, calculate the cumulative mass on each sieve starting with the sieve with the largest size of holes, or the cumulative mass passing through each sieve starting with the sieve with the smallest size of holes, from the masses of the individual size fractions.

Calculate the apparent loss, i.e. the difference between the total mass of the test sample before sieving and the total mass of coke collected afterwards. If the loss is greater than 0,4 % of the original mass of the test sample, reject the results and carry out a further test. Otherwise, add the apparent loss to the mass of the smallest size fraction.

Convert each cumulative mass to a percentage of the total mass of the test sample. Report the cumulative masses to the nearest 0,1 kg and the cumulative percentages to the nearest 0,1 %.

NOTE 4 An example of the calculation of the results of a size analysis of coke, in terms of the cumulative oversize, is given in Table 1.

NOTE 5 If the mean size is required, it may be determined in accordance with Annex A.

8 Test report

The test report shall include the following:

a) the method used by reference to this International Standard;

b) a complete identification of the sample;

c) whether the sieves used had round or square holes;

d) the date of the test;

e) the results expressed in accordance with clause **7**;

f) any unusual features noted during the determination;

g) any operation not included in this International Standard, or regarded as optional.

Table 1 — Example of size analysis of coke

Nominal size of hole (round hole) mm	Mass of fraction kg	Cumulative mass kg	Cumulative percentage oversize %
140	4,9	4,9	1,1
125	9,4	14,3	3,2
100	41,3	55,6	12,4
80	113,4	169,0	37,7
71	78,5	247,5	55,2
63	67,7	315,2	70,3
50	51,5	366,7	81,8
40	37,2	403,9	90,1
31,5	17,9	421,8	94,1
20	9,9	431,7	96,3
10	8,1	439,8	98,1
passing 10	7,4 + 1,1 = 8,5	448,3	100,0

Sum	447,2
Original mass	448,3
Loss in mass	1,1
0,4 % of original mass	1,8

The loss in mass, being less than 0,4 % of the original mass, is added to the fraction of smallest size (< 10 mm).

Annex A (informative)
Determination of mean size

The mean size of the coke may be calculated from the following formula:

$$\frac{B(a-c)+C(b-d)+\ldots+J(h-k)+100\,j}{200}$$

where

a, b, c, d ... h, j, k are the hole sizes, in millimetres, of successive sieves;

A, B, C, D ... H, J, K are the cumulative percentage oversizes for each of the sieves.

NOTE 6 The sieve with hole size a is the smallest size through which all the coke passes (i.e. $A = 0$ %). The sieve with hole size k is a hypothetical sieve through which no coke will pass (i.e. $k = 0$ mm, $K = 100$ %).

Alternative methods of calculation or graphical methods of determination may lead to slightly different results and the same method should, therefore, be used for comparative tests.

The precision of a determination of mean size can be expressed in terms of the repeatability limit, as follows.

The results of duplicate determinations of mean size, carried out at different times in the same laboratory, by the same operator with the same apparatus, on representative test samples taken from the same lot of coke, should not differ by more than 2,5 mm.

No value for reproducibility can be quoted for determinations carried out in different laboratories, since the transport of coke samples involves the risk of breakage and thus alteration of the size distribution.

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List of references

See national foreword.

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