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Coke — Size analysis (Nominal top size 20 mm or less)

Coke — Analyse granulométrique (Dimension supérieure nominale égale ou inférieure à 20 mm)

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2325 was developed by Technical Committee ISO/TC 27, *Solid mineral fuels*. The first edition (ISO 2325-1972) had been approved by the member bodies of the following countries :

Australia	Iran	Switzerland
Austria	Ireland	Turkey
Belgium	New Zealand	United Kingdom
Canada	Poland	U.S.A.
Czechoslovakia	Portugal	U.S.S.R.
Denmark	Romania	Yugoslavia
Egypt, Arab Rep. of	South Africa, Rep. of	
India	Sweden	

The member body of the following country had expressed disapproval of the document on technical grounds :

France

This second edition, which supersedes ISO 2325-1972, incorporates the modifications which were circulated as draft Amendment 1 to the member bodies in October 1977. This draft amendment has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	South Africa, Rep. of
Austria	India	Spain
Belgium	Iran	Turkey
Canada	Japan	United Kingdom
Chile	Mexico	U.S.A.
Czechoslovakia	Netherlands	U.S.S.R.
Egypt, Arab Rep. of	Poland	Yugoslavia
France	Romania	

No Member body expressed disapproval of the document.

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Coke — Size analysis (Nominal top size 20 mm or less)

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the method of determining the particle size distribution of a sample of coke having a nominal top size of 20 mm or less. Two methods of operation are described :

a) where a restricted size analysis is required, using two sieves only;

b) where a complete size analysis is required.

2 REFERENCES

ISO 565, *Test sieves — Woven metal wire cloth and perforated plate — Nominal sizes of apertures.*

ISO 579, *Coke — Determination of total moisture.*

ISO 1953, *Hard coals — Size analysis.*

ISO 2309, *Coke — Sampling.*

ISO 2591, *Test sieving.*

ISO 3310/I, *Test sieves — Technical requirements and testing — Part I : Metal wire cloth.*

ISO 3310/II, *Test sieves — Technical requirements and testing — Part II : Metal perforated plate.*

3 PRINCIPLE

The sample of coke is subjected to a process of size analysis by a specified procedure, and the results are expressed in terms of the cumulative percentages by mass of the coke remaining on sieves of different sized apertures.

4 APPARATUS

4.1 Perforated plate sieves of round aperture size respectively 20 mm and 10 mm, or **wire mesh test sieves** of the nearest equivalent square aperture (16 mm and 8 mm side respectively).

4.2 Wire cloth test sieves of the following aperture sizes :

16, 8, 4, 2 and 1 mm;

500, 250, 125 and 63 μm.

These sieves are conveniently shaken by means of an appropriate mechanical shaking machine.

The sieves (4.1 and 4.2) shall comply, when selected and during use, with ISO 565, ISO 3310/I and ISO 3310/II.

4.3 Lightweight containers of metal or plastic material, for the sample and the fractions sieved from it. The largest container shall be capable of holding 20 kg of sample.

4.4 Weighing machines suitable for weighing a mass of up to 30 kg, such that the weighing error does not exceed 0,1 % of the maximum mass of sample or 10 g, whichever is the smaller.

5 SAMPLE

The sample shall be representative of the coke and shall be taken as described in ISO 2309. For coke containing appreciable quantities (over 20 %) above 10 mm, the mass of the sample shall be 20 kg and the whole of this sample shall be used for size analysis. For samples where the nominal maximum size is 2,8 mm or less, the mass of sample used for size analysis shall be not less than 0,3 kg and preferably not more than 0,5 kg. This quantity shall be taken from the primary sample using one of the following methods of sample division :

— cone divider;

— riffle splitter;

— coning and quartering.

Intermediate masses for the test sample shall be taken according to the upper particle size of the coke.

6 PROCEDURE

6.1 Restricted size analysis on two sieves

Before commencing the test, dry the coke sample at a temperature of 200 °C (see note 1).

Weigh the sample to the nearest 0,01 kg. Place the two sives (4.1) or two of the sieves (4.2) one above the other in a suitable frame, with the sieve of larger aperture size uppermost. Place the receiving tray below the sieve of smaller aperture.

Transfer a quantity of the dry coke to the upper sieve, such that it is not choked by the coke. In general, this will mean that not more than 75 % of the sieve is covered by the coke. Shake the sieve by hand (see note 2) until no more coke passes through the apertures. Remove the top sieve, transfer the oversize to a container of known mass, and carry out the same procedure with the coke remaining on the lower sieve. Replace the empty sieves in the frame. Repeat the process until the whole sample has been treated in this manner, transferring the coke to the appropriate containers after each operation.

Weigh each container with its contents to the nearest 0,01 kg and calculate the total mass of coke which remains on each sieve after the sieving operations.

Transfer the coke which has passed through the lower sieve into the tray to a container of known mass, and weigh.

6.2 Complete size analysis (using a mechanical sieving machine – see note 3)

Before commencing the test, dry the coke sample at a temperature of 200 °C (see note 1).

Weigh the sample to an accuracy of 0,1 %. It will probably be advisable to carry out the size analysis in two stages if a complete range of apertures is to be covered, namely :

– using sieves with 16, 8, 4 and 2 mm apertures;

– using sieves with 1 000, 500, 250, 125 and 63 µm apertures.

The diameter of the sieves having apertures of 2 mm or over will generally be larger than that of sieves with smaller apertures.

When transferring from larger to smaller diameter sieves, it may be necessary to reduce the mass of material to a known proportion and to sieve this known reduced mass on the smaller diameter sieves, repeating the same sieving procedure (see note 4).

Assemble the appropriate sieves in a nest in descending order of size, and fit the receiver. Transfer the sample to the top sieve, fit the lid, and shake the nest of sieves for 5 min.

At the end of this period, clean each sieve in turn, starting with the coarsest mesh sieve, by inverting it over a paper or tray, tapping the side and carefully brushing the uppermost surface of the sieve. Add any loose particles dislodged during brushing to the oversize on the tray or on the paper.

Replace the sieve in the nest, and transfer the material in the tray or on the paper back to the sieve.

Repeat the process of sieving for 5 min, transfer the oversize from each sieve to a container of known mass, adding any material dislodged by brushing, and determine the mass of each fraction.

NOTES

1 See ISO 579.

2 Mechanical shaking may be used provided that its action does not break the coke and that the results are known to be not biased with respect to the results obtained by hand shaking.

3 Where a mechanical sieving machine is not available, the procedure specified in ISO 1953 shall be adopted.

4 The loading of sieves is dealt with in ISO 2591.

7 EXPRESSION OF RESULTS

7.1 Calculation

Record the mass of each size fraction. Calculate the cumulative mass on each sieve, starting with the sieve of largest aperture.

The apparent loss, i.e. the difference between the total mass of the sample before and after the size analysis, shall be recorded. Loss in mass means loss of sample, and should not occur. If the loss is not more than 1 % of the original sample mass, it shall be added to the mass of the fraction of smallest size. If the loss is greater than 1 % of the original sample mass, the results of the size analysis shall be rejected.

Convert each cumulative mass to a percentage of the total mass.

If the sample of coke has been sub-divided during the size analysis, the results obtained on the sub-samples shall be multiplied by the ratio of the respective masses in order to relate these results to the original sample of coke. The results shall be reported to the nearest 0,01 kg and 0,1 %.

For all methods of sieving, the arithmetic mean size may be calculated using the results of the size analysis of the coke in the following way :

sieve apertures : $a, b, c, d, \ldots, h, j, k$

cumulative percentages : $A, B, C, D, \ldots, H, J, K$

the symbols being allocated so that $A = 0$ % and $K = 100$ % (i.e. $k = 0$ mm).

Then

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

This formula is greatly simplified when a sieve series of constant interval is used. It is essential that the apertures of the sieves in any series be all round or all square. If apertures of 1 mm and above are sufficient for the size analysis, a series with either round or square apertures may be used. If apertures smaller than 1 mm are necessary, only a series of woven wire sieves with square apertures shall be used.

Alternative methods of calculation, or graphical methods, may lead to slightly different results; therefore, when comparing test results from different samples, it is important to adhere to the same method of calculation.

7.2 Repeatability

The results of duplicate determinations of size analysis carried out at different times in the same laboratory, by the same operator, with the same apparatus on samples obtained by taking alternate increments from the same consignment of coke, shall not differ by more than the tolerances given in the table below. The precision is expressed in the table in terms of standard deviation and 95 % confidence limits of a single determination, together with an indication of the tolerance limit of duplicate determinations.

7.3 Reproducibility

No tolerance is quoted for determinations carried out in different laboratories because the transport of a coke sample involves the risk of breakage and thus alteration of the size distribution.

Cumulative percentage mass retained on sieve	< 5	5-10	10-20	20-40	40-50	50-60	60-70	70-80	80-90	90-95	> 95
Standard deviation	1,75	2,00	2,25	2,50	2,25	2,00	1,75	1,50	1,25	0,75	0,50
95 % limits	3,5	4,0	4,5	5,0	4,5	4,0	3,5	3,0	2,5	1,5	1,0
Tolerance	4,9	5,6	6,3	7,0	6,3	5,6	4,9	4,2	3,5	2,1	1,4