SLOVENSKI STANDARD
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Ļrni premog - Doloļanje zrnatosti s sejalno analizo

Hard coal -- Size analysis by sieving

Houille -- Analyse granulométrique par tamisage

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INTERNATIONAL STANDARD

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Hard coal — Size analysis by sieving

Houille — Analyse granulométrique par tamisage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1953 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*.

This second edition cancels and replaces the first edition (ISO 1953:1972), which has been technically revised.

Annexes A, B and C of this International Standard are for information only.

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Introduction

Size analysis involves the separation of a sample of coal into size fractions having defined limits. In the methods described in this International Standard the results are expressed in terms of the percentage mass of coal remaining on sieves of different aperture sizes. This information can be of use in a number of applications, including the following: assessing the yields of products from run-of-mine coals; providing design data for coal preparation plants; checking that products from screening plants are within the required limits; assessing the performance of coal-crushing plants; and selecting coals for particular processes and equipment.

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Hard coal — Size analysis by sieving

1 Scope

This International Standard specifies reference methods for the size analysis of coal by manual sieving (wet or dry), using test sieves of aperture sizes between 125 mm and 45 µm. A guide to sampling is given in annex A and notes on the use of mechanical sieving are given in annex B.

This International Standard is applicable to all hard coals. It is not applicable to coke or other manufactured fuels.

In the case of pulverized coal which has been ground so that a high proportion passes through the test sieve of smallest aperture size, the methods described in this International Standard will determine only the percentage oversize.

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 1213-1:1993, *Solid mineral fuels — Vocabulary — Part 1: Terms relating to coal preparation.*

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

ISO 1988:1975, *Hard coal — Sampling.*

ISO 3310-1:1990, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

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 1213-1 and ISO 1213-2 apply.

4 Apparatus

4.1 For all methods

4.1.1 Test sieves, exclusively round-hole or exclusively square-hole, complying with ISO 3310-1 or ISO 3310-2, as appropriate.

NOTES

1 The recommended series of test sieves for general purposes is 125 mm, 90 mm, 63 mm, 45 mm, 31,5 mm, 22,4 mm, 16 mm, 11,2 mm, 8 mm, 5,6 mm and 4 mm nominal aperture sizes, square-hole, or the same sizes of round-hole sieves. If this series is inadequate for the sizing of graded coals, sieves from the supplementary sizes 100 mm, 80 mm, 50 mm, 40 mm, 25 mm, 20 mm, 12,5 mm, 10 mm and 6,3 mm may be included. For samples containing pieces having a particle size greater than 125 mm, single-hole gauges of the required dimensions may be used for the larger pieces. Test sieves of nominal aperture size 4 mm and less should be of metal wire cloth; the recommended series of nominal aperture sizes is 4 mm, 2,8 mm, 2 mm, 1,4 mm, 1 mm, 710 µm, 500 µm, 355 µm, 250 µm, 180 µm, 125 µm, 90 µm, 63 µm and 45 µm.

2 When a complete size analysis is required, it is preferable, subject to the range of sieve aperture sizes available, that the mass of coal in any size fraction does not exceed 30 % of the total mass of sample being sieved. The largest aperture size sieve should be that on which not more than

5 % mass fraction of the sample is retained and the smallest aperture size sieve should be that through which not more than 5 % mass fraction of the sample passes.

3 It is important to check the sieves from time to time, by the methods described in ISO 3310-1 and ISO 3310-2, to ensure that the aperture dimensions are within the specified tolerances. Worn or damaged sieves can give rise to serious errors in size analysis and should be discarded.

4.1.2 Receivers, for collecting material passing through the sieves.

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

4.1.4 Three trays, smooth, of noncorrodible material, at least 400 mm × 400 mm.

NOTE 4 Glazed paper may be used if trays are not available.

4.1.5 Watch- or clock-glasses.

4.2 For dry sieving

4.2.1 Lids, to fit the test sieves.

4.2.2 Flat brush, for cleaning the sieves and for brushing dust from the trays.

4.2.3 Hardwood block, about 150 mm long with a 10 mm × 10 mm cross-section, for tapping the sieves.

4.2.4 Shovel or scoop.

4.3 For wet sieving

4.3.1 Buchner funnel.

4.3.2 Buchner flask.

4.3.3 Filter paper.

4.3.4 Oven, capable of being controlled to ± 2 °C in the range 30 °C to 110 °C.

5 Preparation of test sample

5.1 General

Drying is necessary if the coal is wet and dry sieving is to be performed. The gross sample may be divided if its mass greatly exceeds the value given in table A.1. If the gross sample is to be dried and divided, the division shall be carried out first whenever practicable. If no preparation is necessary, the test sample is the gross sample.

5.2 Drying

Air-dry the sample either at ambient temperature or at an elevated temperature not exceeding 50 °C. Cool, if necessary, and allow the moisture content to come to equilibrium with the laboratory atmosphere.

NOTE 5 If caking or swelling tests are to be carried out subsequently on the sample, the drying temperature should not exceed 40 °C.

5.3 Division (other than wet coal of nominal top size less than 4 mm)

Provided that the sample does not contain pieces of particle size greater than 16,0 mm, divide the sample by means of a suitable mechanical sample divider or riffle, which will not give biased divided samples, avoiding size degradation and loss of dust. If the sample contains pieces of particle size greater than 16,0 mm, use either the flattened heap method or the strip mixing and splitting method described in ISO 9411-1. Weigh all the coal not included as part of the test sample and retain it until all analyses and calculations are complete.

5.4 Division of wet coal of nominal top size less than 4 mm

Spread the gross sample on a clean flat surface, form into a cake 15 mm to 25 mm thick and extract a 2 kg divided sample by taking not less than 50 increments, evenly spread over the cake, using an appropriate sampling scoop. If further division is necessary, air-dry the divided sample first, as described in 5.2 and then proceed as described in 5.3.

6 Procedure

6.1 General

The analysis shall be carried out by dry sieving (6.2) or by wet sieving (6.3).

If the mass of the undersize greatly exceeds the value given in table A.1, divide it by means of a suitable mechanical sample divider or riffle, which will not give biased divided products, or by the flattened heap method or the strip mixing and splitting method described in ISO 9411-1, avoiding size degradation and loss of dust.

NOTES

6 In general, dry sieving is suitable for most types of coal but wet sieving should be used if particles tend to agglomerate.

7 A combination of wet sieving (to remove fine material) and dry sieving may be appropriate and an example is given in annex C.

8 The range of sieves used will depend on the type of coal and the purpose of the test. For example, a complete size analysis may be required for a run-of-mine coal or, in the simplest case, the amount of undersize in a graded product may be required. If the results are to be presented graphically, the range of sieves should comprise at least five different aperture sizes.

9 During sieving it may be convenient either to weigh separately each container with its size fraction and to subtract the mass of the empty container or to weigh one container with the fraction corresponding to the largest aperture size and to add successively all the other fractions, noting the cumulative mass after each addition. The first technique is preferred for samples having a maximum particle size of 4 mm, so that the endpoint of sieving may be checked. The second technique is normally used for samples containing pieces having a particle size greater than 4 mm. However, if a detailed analysis of the individual size fractions is required, it is essential to use the first technique.

10 A preliminary sieving on the smallest aperture size sieve is recommended when the sample contains a large proportion of very fine material.

6.2 Dry sieving

6.2.1 Sample of maximum particle size greater than 45 mm

Weigh the sample to the nearest 0,1 %. Position the 45 mm aperture size sieve (4.1.1) over an empty receiver (4.1.2) so that the free fall of coal passing through the sieve into the receiver does not exceed 150 mm. Place the coal on the sieve and move the coal by hand until no more passes through the sieve. Hand place the particles which still remain on the sieve.

NOTE 11 "Hand placing" refers to the operation defined in ISO 1213-2:1992, 3.73.

Resieve the oversize from the 45 mm aperture size sieve, in the same fashion, on the larger aperture size sieves in the set (4.1.1), starting with the largest aperture size and working down to the smallest. Collect each size fraction in a weighed empty receiver and reweigh to obtain the mass of each individual fraction.

Sieve the undersize from the 45 mm aperture size sieve as described in 6.2.2.

6.2.2 Sample of maximum particle size between 4 mm and 45 mm

Weigh the sample to the nearest 0,1 %. Position the largest aperture size sieve in the set (4.1.1) over an empty receiver (4.1.2). Move the sieve horizontally to and fro, with the displacement not exceeding 100 mm in either direction, so as to cause the pieces of coal to tumble or roll on the sieve.

NOTE 12 When using square-hole sieves, the sides of the holes should be parallel to the direction of the sieving motion.

Continue the sieving motion until eight movements in each direction (a total of sixteen movements) have taken place after the last undersize piece passes through the sieve. Avoid any impact when stopping the motion.

Place the coal remaining on the sieve in a weighed receiver and reweigh to obtain the mass of the size fraction.

Resieve the undersize by repeating the above process for each sieve down to and including the 4 mm aperture size sieve. If analysis of the undersize from the 4 mm aperture size sieve is required, proceed as described in 6.2.3.

6.2.3 Sample of maximum particle size less than 4 mm

6.2.3.1 Weigh the sample to the nearest 0,1 %. If the sample contains a large proportion of fine dust, remove the dust by proceeding as described in 6.2.3.2 to 6.2.3.6 and then continue as described in 6.2.3.7. Otherwise, proceed as described in 6.2.3.7.

6.2.3.2 Place the smallest aperture size sieve in the set (4.1.1) on a receiver (4.1.2), brush the sample onto the sieve, fit the lid (4.2.1) and sieve continuously for 5 min, as described in 6.2.3.3, to remove the undersize. If the sample is large, sieve it as separate portions so that not more than 75 % of the area of the sieve is covered at the end of each sieving operation.

6.2.3.3 Hold the receiver, fitted with the sieve and its lid, in the left hand so that the surface of the sieve is inclined downwards towards the left at an angle of about 30° to the horizontal. Tap the higher side of the sieve frame six to eight times with the hardwood block (4.2.3). While maintaining the inclination of the sieve, shake the assembly to and fro several times, also rotating it in the plane of the sieving surface through an angle of approximately 60°.