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Coke — Determination of shatter indices

Coke — Détermination des indices de chute

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 3, *Coke*.

This third edition cancels and replaces the second edition (ISO 616:1995), which has been technically revised.

The main changes are as follows:

— general and technical revision;

— inclusion of references to ISO 13909-6 and ISO 18283 in Clause 6;

— provision of an example of an apparatus and a modernized mechanism that can raise the sample box to the standard height is permitted.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The shatter index of coke is the percentage of test sample (initially plus 63 mm) that remains on a test sieve of stated size of openings after the sample has been subjected to a specified dropping test.

The shatter index of coke can be determined for one test sieve or for each of a number of test sieves of different sizes of holes (e.g. 80 mm and 40 mm). The higher the shatter index, the greater the resistance of the coke to breakage into pieces which are smaller than the stated size.

The mean size of the coke before and after the shatter test may also be determined to give additional information about the strength of the coke.

Coke — Determination of shatter indices

1 Scope

This document specifies a method for determining the strength of coke by the shatter test.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 579, *Coke — Determination of total moisture*

ISO 728, *Coke — Size analysis by sieving*

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

ISO 13909-6, *Hard coal and coke — Mechanical sampling — Part 6: Coke — Preparation of test samples*

ISO 18283, *Hard coal and coke — Manual sampling*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
shatter index
percentage of a specially prepared sample of coke remaining on a test sieve of stated size of openings after the sample has been subjected to a specified dropping test

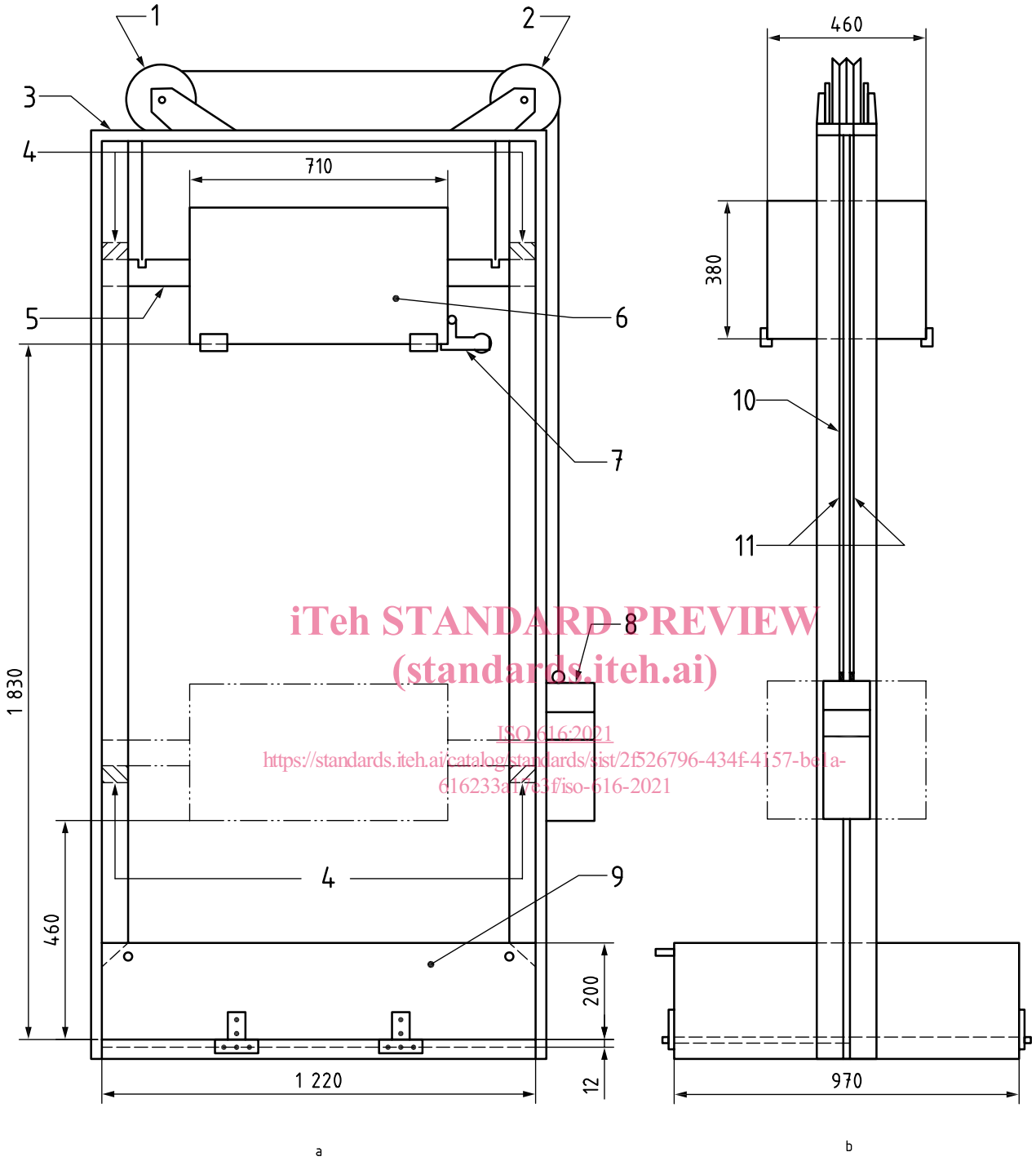
4 Principle

A test portion taken from the coke above a specified size is dropped under standard conditions. The mass of coke which is then retained on a test sieve, or on each of two or more test sieves of different sizes of holes, is determined.

5 Apparatus

5.1 Shatter test apparatus (see Figure 1), mounted on a solid base and consisting of the following parts.

Dimensions in millimetres



Key

1 single – sheave pulley
2 double – sheave pulley
3 top plate
4 stops
5 box guide
6 box
7 latch
8 counterweight
9 base unit
10 guide channel
11 wire ropes
a Front elevation.
b Side elevation.

Figure 1 — Example of shatter test apparatus

5.1.1 Base unit, comprising a steel base plate with further plates fitted on all sides to prevent loss of coke during the test. The base plate shall be not less than 12 mm thick, 1 220 mm long and 970 mm wide. Each of the vertical plates shall be not less than 200 mm high and 10 mm thick. The back plate and the side plates shall be rigidly fixed and the front plate shall be removable, so as to facilitate shovelling the coke from the base unit into the sample box (5.1.3) after each drop.

5.1.2 Support frame for winding up, or other appropriate mechanism are provided so the sample box may be readily raised and lowered to fixed or reproducible upper and lower positions. No part of the supporting frame is to impede the free fall of coke nor protrude into the 1 220 mm by 970 mm area of the base plate. When in the upper position, the inside surface of the bottom of the box shall be 1 830 mm above the base plate. When in the lower position, the distance between the bottom of the sample box and the base plant is 460 mm. The sample box may be constrained to only vertical movement by suitable lateral guides and may be conveniently supported by wire rope passing over pulleys. Counterweighting will reduce labour.

5.1.3 Sample box, of internal dimensions 710 mm long, 460 mm wide and 380 mm deep. The bottom of the sample box shall consist of two doors, hinged lengthwise and provided with a latch or other fastening capable of rapid opening. The doors shall be made of 6 mm steel plate and shall swing open rapidly, so as not to impede the fall of the coke. The fastening shall be designed so that it can be released without causing the sample box to move (see, for example, the arrangement shown in Figure 1).

The sides of the sample box shall be made of steel plate not less than 3 mm thick.

5.2 Test sieves, square hole, of nominal sizes of holes 125 mm, 100 mm, 80 mm, 63 mm, 50 mm, 40 mm, 25 mm and 12,5 mm, shall comply with ISO 3310-2.

NOTE For the larger sizes of foundry coke, single-hole gauges can be used instead of test sieves.

5.3 Scale, with a capacity of not less than 25 kg, capable of determining mass weighing to the nearest 10 g.

6 Sampling and size analysis

Take two gross samples for physical testing in accordance with ISO 18283 or ISO 13909-6. Prepare one of these samples for the determination of moisture mass fraction in accordance with ISO 18283 and carry out the determination in accordance with ISO 579. If the moisture mass fraction is higher than 5 %, dry the other sample sufficiently to reduce the moisture mass fraction to lower than 5 %. Use this second sample for the remainder of the test.

Carry out a size analysis in accordance with ISO 728 on the sample using a set of test sieves (5.2) of successive nominal size of holes, the sieve with the largest size of holes being that on which not more than 5 % of the sample remains. Place the coke by hand on the sieves of nominal size of holes down to and including 40 mm. For the smaller hole sizes, carry out sieving manually by holding the sieve in the hands, or suspending it freely, and shaking it horizontally to and fro with a displacement of about 75 mm. Complete 50 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.

Determine the mass of each size fraction, to the nearest 0,01 kg, and place each fraction in a separate pile or container. Record the masses retained on the individual sieves as cumulative percentages.

7 Preparation of test portion

Reconstitute a 25 kg ± 0,1 kg test portion containing all fractions of coke greater than 63 mm in size, in approximately the same proportions as they are present in the gross sample. Prepare the test portion by taking at random from each of the separate size fractions of coke (see Clause 6), down to and including

the 63 mm to 80 mm fraction, an appropriate mass, determined to the nearest 0,01 kg using the scale (5.3).

The simplest way of achieving this proportional representation is to calculate the cumulative mass of coke required in each of these size fractions in the test portion, so as to correspond to the proportions in the gross sample. Then, starting with the fraction with the largest particle size, select pieces of coke and place them in a tared container of known mass until the required cumulative mass for each size fraction has been obtained.

8 Procedure

8.1 Determination

Transfer the test portion of coke, greater than 63 mm in size (see Clause 7), carefully (to avoid breakage of any fractions) into the sample box (5.1.3) of the shatter test apparatus (5.1), by either inserting the container into the box and allowing the coke to slide out or by removing the coke and placing it into the box by hand. Do not empty the container by tipping out the contents because doing so is likely to cause fractions to break.

Raise the sample box to the standard height. Close and fasten the front plate of the base unit (5.1.1). Release the bottom doors of the sample box to allow the coke to fall onto the base plate.

Lower the sample box to the lower position. Drop the front plate of the base unit and carefully shovel (to avoid breakage of any fractions of) the coke from the base plate into the sample box. Return all the coke to the sample box in this manner but without sweeping the base plate at this stage. Do not stand on the coke to perform this operation.

Repeat the process until a total of four drops have been made.

NOTE Some form of indicator is helpful to avoid an error in the number of drops.

If the mean size before and after the test is to be determined, assemble a set of test sieves (5.2) so that a full-size analysis can be carried out. Otherwise, use only the sieves corresponding to the shatter indices to be determined. Transfer all the coke, sweeping the dust from the base plate, to the top sieve (with the largest size of holes) and sieve it by placing the coke by hand on the sieves of nominal size of holes down to and including 40 mm and by shaking manually for the smaller hole sizes. Cumulatively, determine the mass of the size fractions, to the nearest 10 g, noting the mass corresponding to each size.

8.2 Validity of determination

For the determination to be valid, the total mass of the size fractions (see 8.1) shall not differ from the original mass of the test portion by more than 100 g. If the difference exceeds this limit, reject the test and redo it.

9 Expression of results

The shatter index, S_x, expressed as a percentage and corresponding to a sieve of nominal size of holes x mm, is given by Formula (1):

$$S_x = \frac{m_1}{m_2} \times 100 \quad (1)$$