INTERNATIONAL STANDARD

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Hard coal — Determination of abrasiveness

Houille — Détermination de l'abrasivité

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 5, *Methods of analysis*.

This second edition cancels and replaces the first edition (ISO 12900:1997), of which it constitutes a minor revision.

Introduction

The abrasiveness of coal is recognized as a factor in coal operations, from mining to utilization, requiring a standard method of measurement and evaluation, as some coals are more abrasive than others.

The interaction between coal and conveying, storage, and crushing equipment results in component wear. In particular, higher contact pressures in some coal pulverizers result in significant wear.

For the ranking or relative comparison of the abrasiveness of coals, a test was developed[1] which standardized the following equipment variables:

a) test equipment dimensions and tolerances;

b) speed of rotation of wearing components;

c) properties of the wearing components;

d) mass of the test portion;

e) top particle size of the test portion;

f) duration of the test.

The abrasiveness of coal is generally a function of two factors: the physical properties of the coal, in particular, moisture content, mineral content, and mineral characteristics;[1] [2] [3] [4] [5] [6] the mechanics of the operations to which the coal is subjected.

NOTE Moisture contents over 10 % in the test sample after air-drying and laboratory equilibration might give anomalous results; the reason for this has not been established.

Wear on coal-pulverizing elements in industrial mills is influenced by the physical characteristics of the coal and its mineral constituents, the mechanical characteristics of the mill, including the milling pressures, alloy material properties and coal feed flow, and the operation of the mill. Abrasiveness as determined by this International Standard has been demonstrated to provide initial empirical estimates of specific wear rates in certain types of industrial tube-ball mills, vertical spindle mills, and high-speed hammer mills,[3] [6] with different coefficients for each mill type.

Abrasiveness as determined by this International Standard might be of value in providing an initial estimate of the likely wear in other applications, giving the relative effect of different coals.

Hard coal — Determination of abrasiveness

1 Scope

This International Standard describes a method for determining the abrasiveness of hard coal.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 589, *Hard coal — Determination of total moisture*

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

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 13909-2, *Hard coal and coke — Mechanical sampling — Part 2: Coal — Sampling from moving streams*

ISO 13909-3, *Hard coal and coke — Mechanical sampling — Part 3: Coal — Sampling from stationary lots*

ISO 13909-4, *Hard coal and coke — Mechanical sampling — Part 4: Coal —Preparation of test samples*

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

3 Principle

Four standard steel blades are rotated under specified conditions in a 2 kg mass of prepared coal in a test machine. The abrasiveness is calculated from the mass of steel lost during the test.

4 Apparatus

4.1 Abrasion test machine, comprising the following components:

4.1.1 Blades, of the following types:

a) **A set of four reference blades**[1)], having a Vickers hardness of 160 ± 15 when tested in accordance with ISO 6507-1. When new, the blades, machined with the bar rolling direction parallel to the line of the bolt holes, from a bar of carbon steel, shall have the shape, dimensions, and surface finish shown in Figure 1. To reduce the extent of varying hardness near the surface, care should be taken during machining to minimize surface distortion and heating of the blades. The blades shall be marked for identification.

A new set of blades shall be “run in” by carrying out a number of abrasiveness determinations on 2 kg test portions of the same coal until constant results (within the limits of repeatability, see Clause 9) are obtained.

When blades are not in use, they should be wrapped in a cloth containing a rust-preventive solution and stored in a desiccator. Immediately prior to use, the blades should be cleaned with a suitable solvent, e.g. methylated spirits, and allowed to air-dry in a desiccator.

1) Suitable blades are available from Mitsui Babcock Energy Ltd., Technology Centre, Renfrew, U.K.

The reference set of blades shall be discarded when any of the following conditions occurs:

— the wear on the leading edge or corners is greater than 3 mm;

— the blades cannot be correctly adjusted in the jig.

After a number of tests, the wearing surface of the blades might become rough, in which case each blade should be gently polished with a finegrained emery paper and reconditioned prior to further use.

Dimensions in millimetres

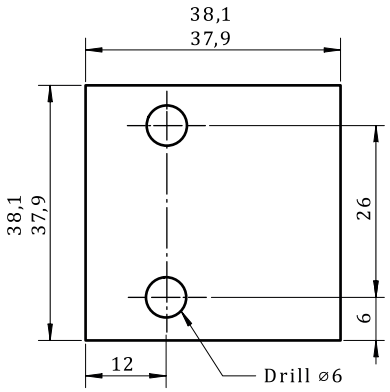


Figure 1 — Blades

b) **A set of four working blades**, conforming to the requirements of 4.1.1 and checked successively against the reference blades when their original mass has decreased by 2 %, 3 %, 4 %, or more frequently if required.

The working set of blades shall be discarded when the results obtained on a sample using the working set differ, after a minimum of three determinations, by more than the limit of repeatability from the value obtained using the reference set.

After a number of tests, the wearing surface of the blades might become rough, in which case each blade should be gently polished with a finegrained emery paper and reconditioned prior to further use.

4.1.2 Mill mortar, having dimensions as shown in Figure 2 and fitted with a dust-tight cover. The lower sections of the walls may be recessed to accommodate a replaceable liner. Hardened metal or hard metal plate is recommended for the mill mortar (or liner if fitted). The mill mortar shall be discarded (or a new liner fitted) when the tolerance shown in Figure 2 is exceeded.

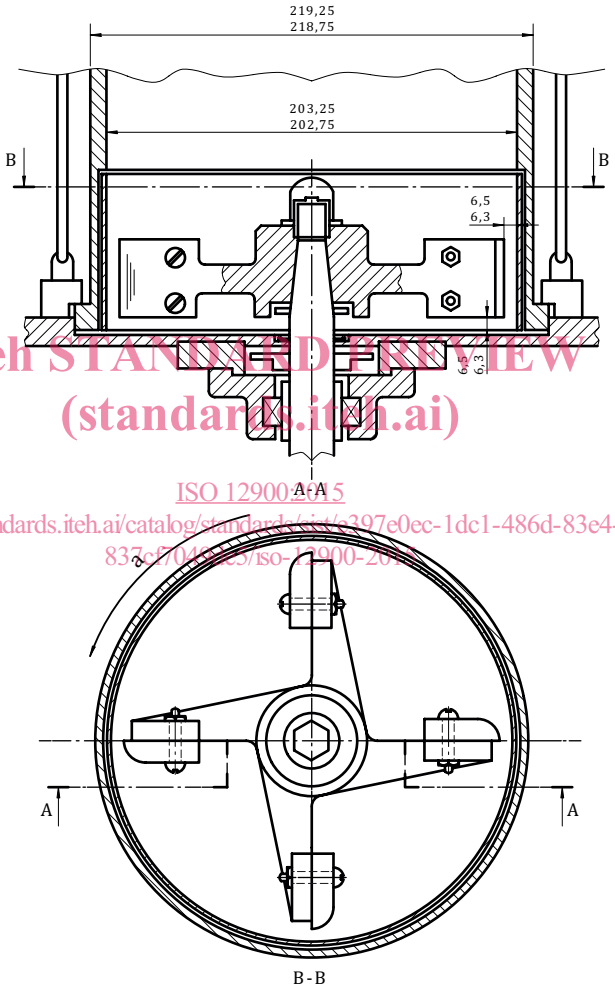
4.1.3 Quadrant, having four arms with elongated bolt holes for attachment and adjustment of the blades using round-head bolts, nuts, and spring washers. The quadrant shall be capable of being removed from the mill mortar (see Figure 2).

Some test machines have quadrants which are not removable. For these machines, the blades should be adjusted using suitable gauges so that the trailing and bottom edges are positioned (6,4 ± 0,1) mm from the wall and bottom of the mill mortar.

4.1.4 Drive, for driving the quadrant at 24,5 s^{-1} ± 0,5 s^{-1} either directly or indirectly by a constant-speed electric motor. The shaft shall be fitted with a revolution counter and automatic cut-off switch.

NOTE A 2,5 kW motor is suitable. The drive can be above or below the mill mortar.

Dimensions in millimetres



Key

a Direction of rotation.

Figure 2 — Mill mortar and quadrant assembly

4.1.5 Jig, metal, (see Figure 3) to assist in attaching and adjusting the blades to the quadrant arms. The jig dimensions shall be such that, when the blades are secured on the quadrant arms so that they are touching the walls and bottom of the jig, they will have the correct clearances when the quadrant is replaced in the mill mortar. The clearance (6,3 mm to 6,5 mm) between the blades and the mill mortar shall be checked periodically using a limit gauge.