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**Coal preparation plant — Assessment  
of the liability to breakdown in water  
of materials associated with coal seams**

*Ateliers de préparation du charbon — Évaluation de la fiabilité de  
la fragmentation dans l'eau de matériaux associés aux gisements  
de charbon*

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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.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 1, *Coal preparation. Terminology and performance*.

This second edition cancels and replaces the first edition (ISO 10753:1994), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

- editorial corrections throughout the document.

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](http://www.iso.org/members.html).

## Introduction

In this document, the materials associated with coal seams are collectively referred to as “shale”, although they may contain a variety of rocks and minerals. This document describes a method of assessing the liability of these materials to breakdown on agitation with water. Future activity on this subject could involve a method for simulating the breakdown that is likely to occur, in practice, in different types of coal preparation plants, to generate samples for further testing.

The liability of the shale to breakdown is measured by the proportion of the degraded material passing through a test sieve having a nominal size of openings of 500 µm.

The method described in this document also enables the liability of the shale to form slimes to be assessed, by determining the proportion that is below a nominal particle size of 10 µm, using a simplified sedimentation technique. This technique is based on the assumption that in the size range being examined, all the particles are spherical, have a relative density of 2,5, and fall freely through the suspending liquid according to Stokes's Law. These conditions are not entirely fulfilled in practice and the particle size is, therefore, referred to as a nominal value. The extent of breakdown, as measured by this method, will be affected by whether the shale exhibits any self-flocculation. In the described test, distilled water (or the equivalent) is used to avoid possible flocculation of the shale by any soluble salts in the water. The test may be adapted to assess the relative tendencies of shales to break down in a particular plant, by using the same water as is used in that plant. However, it is emphasized that the results of such tests, using plant water, have to be treated with caution because the extent of breakdown that will occur in practice is influenced by the interaction of all the components present during the washing process, including, for example, any accumulation of soluble salts in the circuit, and by other factors, such as the residence time in the plant.

The relationship between the proportion of degraded material passing a 500 µm test sieve and the proportion of slimes provides useful information on the character of the breakdown, and is therefore included in the results that are reported. [ISO 10753:2019](https://standards.iteh.ai/catalog/standards/sist/182fc5b6-4d20-4a28-aa34-1bc103cc3437/iso-10753-2019)

The amount of breakdown occurring in practice and in the test will be affected by the history of the sample. For this reason, the sample is placed in a sealed container as soon as is practicable after being taken.

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# Coal preparation plant — Assessment of the liability to breakdown in water of materials associated with coal seams

## 1 Scope

This document specifies a method for assessing the liability of materials associated with coal seams to breakdown on agitation with water.

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

## 3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Principle

Degradation of a test portion of shale in the size range 5,6 mm to 2,8 mm, by controlled agitation in water. Determination of the proportion of degraded material passing through a 500 µm sieve, and determination of the proportion of degraded material of nominal top size less than 10 µm by sedimentation.

## 5 Reagent

During the test, use only distilled water or water of equivalent purity.

## 6 Apparatus

**6.1 Rigid cylindrical jar**, of non-corrodible material and of capacity 1,0 l ± 0,1 l, with an internal height of approximately 170 mm (internal diameter approximately 85 mm) and a height/diameter ratio 2,0 ± 0,1.

The jar shall have a hard lid which can be secured to form a watertight seal.

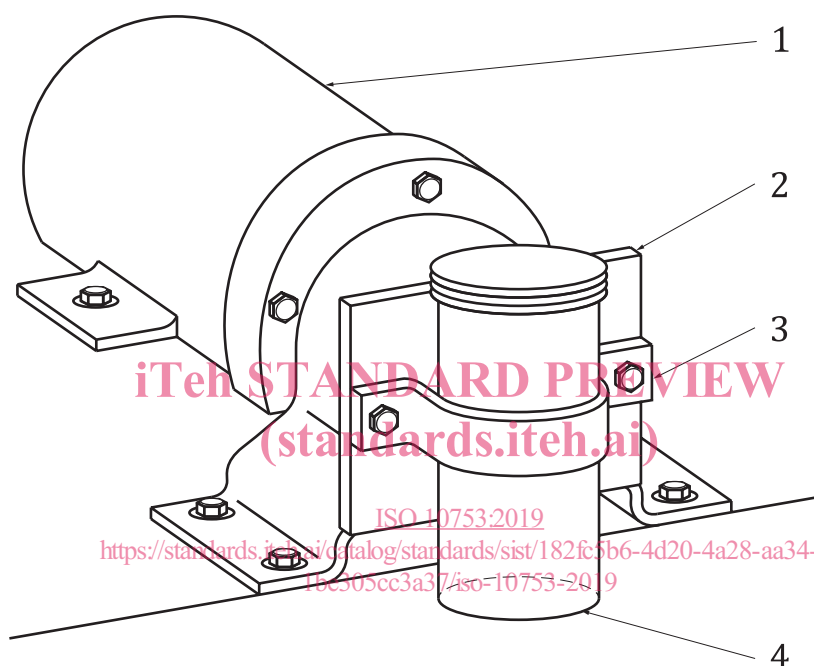
**6.2 Rotation machine**, capable of rotating the jar about a transverse axis at a rotational frequency of  $40 \text{ min}^{-1} \pm 1 \text{ min}^{-1}$  (speed of  $40 \text{ r/min} \pm 1 \text{ r/min}$ ).

A typical assembly is shown in [Figure 1](#).

NOTE A suitable drive can be provided by a 0,1 kW single-phase motor running at 1 500 r/min, geared down to 40 r/min.

**6.3 Test sieve**, having nominal size of openings  $500 \mu\text{m}$ , which shall comply with ISO 3310-1.

This sieve is liable to suffer minor distortion when heated to  $105 \text{ }^\circ\text{C}$  (see [8.5](#)) and should therefore be reserved exclusively for use in this test. Furthermore, it is important to ensure that the sieve is constructed of materials that are stable at the temperature of drying.



**Key**

- 1 electric motor geared to 40 r/min
- 2 rotating base plane
- 3 clamp for jar
- 4 litre jar

**Figure 1 — Typical apparatus for the determination of breakdown characteristics in water**

**6.4 Funnel**, into which the  $500 \mu\text{m}$  test sieve ([6.3](#)) will fit.

**6.5 Heat-resistant tray**, of non-corrodible material, large enough to accommodate the  $500 \mu\text{m}$  test sieve.

**6.6 Container**, of capacity approximately 100 ml, fitted with a cover.

**6.7 Two test sieves**, having nominal sizes of openings 5,6 mm and 2,8 mm, which shall comply with ISO 3310-1.

**6.8 Two measuring cylinders**, of capacity 1 l each, fitted with stoppers.



**6.9 Modified Andreasen sedimentation apparatus**, comprising (see [Figure 2](#)) a measuring cylinder, having a pipette connected to a 10 ml reservoir via a three-way stopcock. The neck of the flask is fitted with a ground-glass stopper which has a small opening to allow air to enter the flask when a sample is withdrawn, by applying suction as shown in [Figure 2](#); an outlet allows the sample to be run off. The Andreasen sedimentation apparatus is modified by reducing the length of stem of the pipette, so that the sample is withdrawn at the 100 mm mark. The apparatus shall be protected from all sources of vibration during the test.

**6.10 Suction device**, capable of applying a steady, controlled suction to the sedimentation pipette ([6.9](#)).

NOTE An aspirator is preferred for this purpose.

**6.11 Evaporating dish**, of nickel or stainless steel, having a diameter of 50 mm.

**6.12 Flask**, of capacity at least 2 l.

**6.13 Thermostatically-controlled bath**, capable of being maintained at approximately ambient temperature, to within  $\pm 0,2$  °C, and of suitable dimensions to contain the sedimentation apparatus ([6.9](#)), a measuring cylinder ([6.8](#)) and the flask ([6.12](#)).

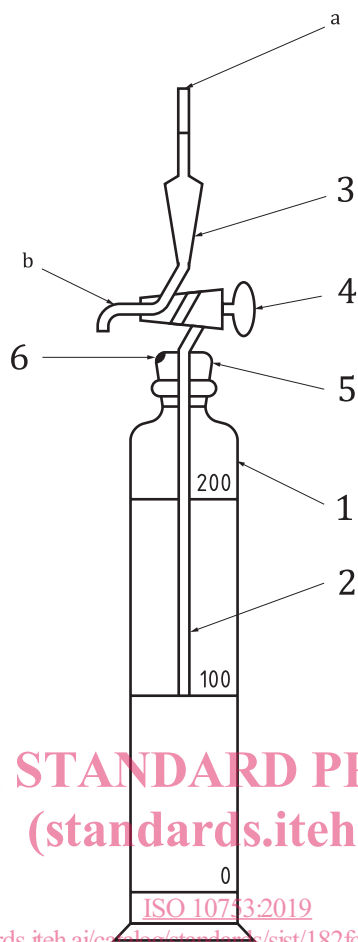
The bath shall operate without causing significant vibration or disturbance of the measuring cylinder and its contents, when placed in the bath.

NOTE If a thermostatically controlled bath is not available, a large container filled with water that has been allowed to attain room temperature can be used instead.

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**Key**

- 1 graduated cylindrical flask
- 2 pipette
- 3 10 ml reservoir
- 4 three-way stopcock
- 5 ground-glass stopper
- 6 small opening in stopper (to allow air to enter)
- a Suction application point.
- b Outlet.

**Figure 2 — Modified Andreasen sedimentation apparatus**

**6.14 Drying oven**, well ventilated and capable of being maintained in the temperature range 105 °C to 110 °C.

**6.15 Stop clock.**

**6.16 Analytical balance(s)**, capable of weighing up to 20 g to the nearest 0,000 1 g and up to 200 g to the nearest 0,01 g.

**6.17 Wash bottle**, of capacity at least 400 ml, fitted with a fine spray-jet outlet.

**6.18 Desiccator.**

## 6.19 Vibration-free bench.

## 7 Sampling and preparation of test sample

If sufficient material is available, take a representative sample containing a minimum of 1 kg in the 5,6 mm to 2,8 mm size fraction. If there is insufficient material to provide the required amount in this size fraction, crush all the larger shale and add the 5,6 mm to 2,8 mm size fraction of the crushed product to that size fraction in the original material. If neither of these measures provides sufficient material, a size fraction of 5,6 mm to 1,0 mm shall be used instead. Full details of the sample taken shall be included in the test report (see [Clause 11](#)).

NOTE 1 It can be useful to prepare and test separate representative samples from the floor, roof and dirt bands for each seam.

NOTE 2 If the test sample is obtained from raw coal by means of float and sink separation, this can affect the results of the test.

Remove the dust from the test sample by gentle blowing with air and store the test sample, until required for testing, in a secure, sealed container.

NOTE 3 If the sample needs to be crushed use either a roll crusher or jaw crusher to minimize the amount of fine material generated.

## 8 Procedure

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### 8.1 Determination of initial moisture content

Determine the moisture content of the shale “as-received” (see [Clause 6](#)) by weighing a 10 g portion, to an accuracy of  $\pm 0,000$  1 g, drying in the oven ([6.14](#)) for 2 h at 105 °C to 110 °C and then reweighing.

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### 8.2 Preparation of test portion

Dry for 2 h in the oven ([6.14](#)), at 105 °C to 110 °C enough of the test sample to provide a mass of 120 g, when dried, and place it in a sealed container.

### 8.3 Determination of residual moisture content

Determine the residual moisture in the test portion by taking 10 g of the dried test sample (see [8.2](#)), weighed to an accuracy of  $\pm 0,000$  1 g, drying in the oven ([6.14](#)) to constant mass at 105 °C to 110 °C and then reweighing.

### 8.4 Agitation of test portion

Weigh, to an accuracy of  $\pm 0,01$  g, 100 g of the dried test sample ([8.2](#)), place in the cylindrical jar ([6.1](#)) and add 500 ml of water ([Clause 5](#)). Seal the jar securely, place it in the rotation machine ([6.2](#)) and rotate it about a transverse axis (i.e. “end over end”) at a rotational frequency of  $40 \text{ min}^{-1} \pm 1 \text{ min}^{-1}$  (speed of 40 r/min  $\pm$  1 r/min) for 30 min.

### 8.5 Sieving of suspension

Locate the funnel ([6.4](#)) in the neck of one of the measuring cylinders ([6.8](#)) and mount the 500  $\mu\text{m}$  test sieve ([6.3](#)) in the funnel. Sieve the suspension resulting from the agitation ([8.4](#)) through the test sieve, taking care to ensure that the solids are distributed evenly over the surface of the sieve. Use 250 ml of water ([Clause 5](#)) to rinse out the jar and wash the residue on the sieve, applying the water by means of the wash bottle ([6.17](#)).