INTERNATIONAL STANDARD

**ISO 13909-4**

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# Hard coal and coke — Mechanical sampling —

## Part 4:
## Coal — Preparation of test samples

*Houille et coke — Échantillonnage mécanique —*

*Partie 4: Charbon — Préparation des échantillons pour essai*



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 13909 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13909-4 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 4, *Sampling*.

ISO 13909 cancels and replaces ISO 9411-1:1994, *Solid mineral fuels — Mechanical sampling from moving streams — Part 1: Coal* and ISO 9411-2:1993, *Solid mineral fuels — Mechanical sampling from moving streams — Part 2: Coke*, of which it constitutes a technical revision. It also supersedes the methods of mechanical sampling of coal and coke given in ISO 1988:1975, *Hard coal — Sampling* and ISO 2309:1980, *Coke — Sampling*.



ISO 13909 consists of the following parts, under the general title *Hard coal and coke — Mechanical sampling*:



— *Part 1: General introduction*

— *Part 2: Coal — Sampling from moving streams*

— *Part 3: Coal — Sampling from stationary lots*

— *Part 4: Coal — Preparation of test samples*

— *Part 5: Coke — Sampling from moving streams*

— *Part 6: Coke — Preparation of test samples*

— *Part 7: Methods for determining the precision of sampling, sample preparation and testing*

— *Part 8: Methods of testing for bias*

## Introduction

The objective of sample preparation is to prepare one or more test samples from the primary increments for subsequent analysis. The requisite mass and particle size of the test sample depend on the test to be carried out.

The process of sample preparation may involve constitution of samples, reduction, division, mixing and drying, or all or a combination of these.

Primary increments may be prepared individually as test samples or combined to constitute samples either as taken or after having been prepared by reduction and/or division. Samples may either be prepared individually as test samples or combined on a weighted basis to constitute a further sample.

When difficulty in handling the coal or coals being sampled is expected at a particular stage in sample preparation, or if there is a likelihood of losing moisture by evaporation, it is necessary to withdraw the sample or increment from the on-line system at the stage immediately prior to the point of difficulty and proceed off-line.

# Hard coal and coke — Mechanical sampling —

## Part 4:
## Coal — Preparation of test samples

## 1 Scope

This part of ISO 13909 describes the preparation of samples of coal from the combination of primary increments to the preparation of samples for specific tests.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13909. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13909 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.



ISO 589:1981, *Hard coal — Determination of total moisture*.

ISO 3310-1:2000, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*.

ISO 13909-1:2001, *Hard coal and coke — Mechanical sampling — Part 1: General introduction*.

ISO 13909-2:2001, *Hard coal and coke — Mechanical sampling — Part 2: Coal — Sampling from moving streams*.

ISO 13909-3:2001, *Hard coal and coke — Mechanical sampling — Part 3: Coal — Sampling from stationary lots*.

ISO 13909-7:2001, *Hard coal and coke — Mechanical sampling — Part 7: Methods for determining the precision of sampling, sample preparation and testing*.

ISO 13909-8:2001, *Hard coal and coke — Mechanical sampling — Part 8: Methods of testing for bias*.

## 3 Terms and definitions

For the purposes of this part of ISO 13909, the terms and definitions given in ISO 13909-1 apply.

## 4 Precision of sample preparation

From the equations given in ISO 13909-7, the estimated absolute value of the precision of the result obtained for the lot at the 95 % confidence level, $P_L$, for continuous sampling is given by:

$$P_{\mathrm{L}} = 2\sqrt{\frac{\frac{V_{\mathrm{I}}}{n} + V_{\mathrm{PT}}}{m}} \quad (1)$$

where

$V_I$ is the primary increment variance;

$n$ is the number of increments per sub-lot;

$V_{PT}$ is the preparation and testing variance for both off-line and on-line systems;

$m$ is the number of sub-lots.

The procedures given in this part of ISO 13909 are designed to achieve levels of $V_{PT}$ of 0,2 or less for both ash and moisture tests. Better levels are expected when using mechanical dividers.

For some preparation schemes, however, practical restrictions may prevent the preparation and testing variance being as low as this. Under these circumstances, the user will have to decide whether to achieve the desired overall precision by improving the preparation scheme or by dividing the lot into a greater number of sub-lots.

The errors occurring in the various stages of preparation and analysis, expressed in terms of variance, may be checked by the method given in ISO 13909-7.

## 5 Constitution of a sample

### 5.1 Introduction



Primary increments shall be taken in accordance with the procedures specified in ISO 13909-2 and ISO 13909-3.

Individual increments are usually combined to form a sample. A single sample may be constituted by combination of increments taken from a complete sub-lot or by combining increments taken from individual parts of a sub-lot. Under some circumstances, e.g. size analysis or bias testing, the sample consists of a single increment which is prepared and tested. Examples of the constitution of samples are shown in Figure 1.



The procedures for increment combination (5.2) may vary according to whether the primary increments were taken using a time-basis (5.2.1) or a mass-basis (5.2.2) sampling scheme.

Samples may also be prepared by the combination of other samples (see 5.3).

### 5.2 Combination of increments

#### 5.2.1 Time-basis sampling

The mass of the primary increments shall be proportional to the flow rate at the time of sampling. The primary increments may be combined into a sample, either directly as taken or after having been prepared individually to an appropriate stage by fixed-ratio division (see clause 6).

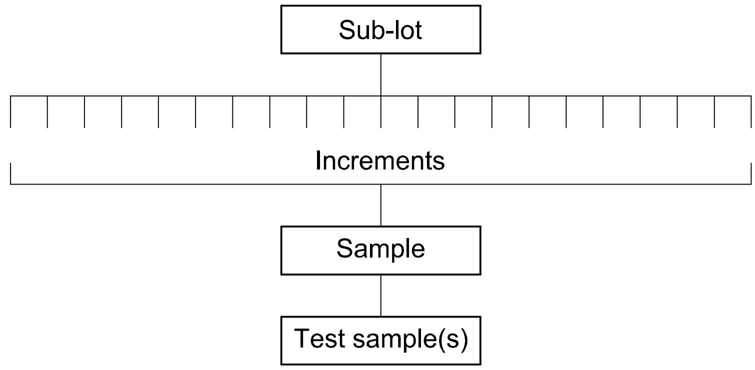
#### 5.2.2 Mass-basis sampling

If the primary increments are of almost uniform mass (see note), they may be combined into a sample, either directly as taken or after having been prepared individually to an appropriate stage by fixed-ratio division (see clause 6).

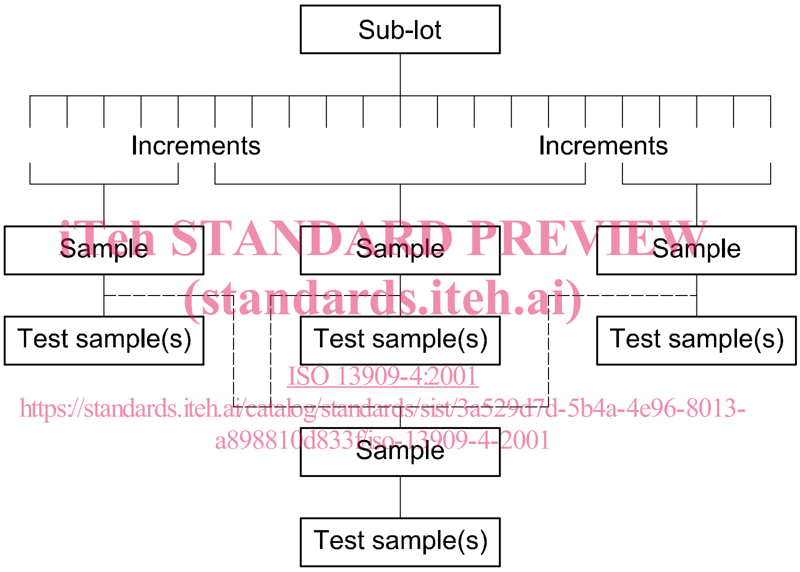
NOTE Almost uniform mass has been achieved if the coefficient of variation of the increment masses is less than 20 % and there is no significant correlation between the flow rate at the time of taking the increment and the mass of the increment (see ISO 13909-2:2001, annex B).

If the primary increments are not of almost uniform mass, they may only be combined into samples after having been divided individually by fixed-mass division (see clause 7).




**a) Example 1**






**b) Example 2**

**Figure 1 — Examples of the constitution of samples**

## 5.3 Combination of samples

When combining samples, the mass of the individual samples shall be directly proportional to the mass of the coal from which they were taken in order to obtain a weighted mean of the quality characteristic for the sub-lot. Prior to combination, division shall be by fixed-ratio division (see clause 6).

# 6 Division

## 6.1 General

Division can be

— on-line mechanically, or

— off-line mechanically or manually.

Whenever possible, mechanical methods are preferred to manual methods to minimize human error. Examples of dividers are shown in Figure 2.

Mechanical dividers are designed to extract one or more parts of the coal in a number of cuts of relatively small mass. When the smallest mass of the divided sample that can be obtained in one pass through the divider is greater than that required, further passes through the same divider or subsequent passes through further dividers may be necessary.

Coal which is visibly wet may not run freely through or may tend to adhere to the surfaces of a sample divider. In such circumstances, it may be necessary to air-dry the sample as described in clause 10 before sample division is undertaken.

Manual division is normally applied when mechanical methods would result in loss of integrity, e.g. loss of moisture or size degradation. Manual methods may themselves result in bias, particularly if the mass of coal to be divided is large.



## 6.2 Mechanical methods

### 6.2.1 General



Mechanical sample division may be carried out on an individual increment or a sample which has been crushed, if necessary, to an appropriate nominal top size. Division shall be either by fixed-mass division or by fixed-ratio division subject to the conditions set out in 6.2.3.

NOTE The procedures described for fixed-ratio division are the simplest to implement. Other procedures may be used, however, provided that the mass of the divided sample is proportional to the mass of the feed, e.g. the number of cuts could be kept constant by making the feed rate of each division proportional to the mass of coal to be divided.

### 6.2.2 Mass of cut

The cuts shall be of uniform mass throughout the division of an increment. In order to achieve this, the flow of coal to the divider shall be uniform and the cutting aperture shall be constant. The method of feeding the divider shall be designed to minimize any segregation caused by the divider.

The cutting aperture shall be at least three times the nominal top size of the coal to be divided.

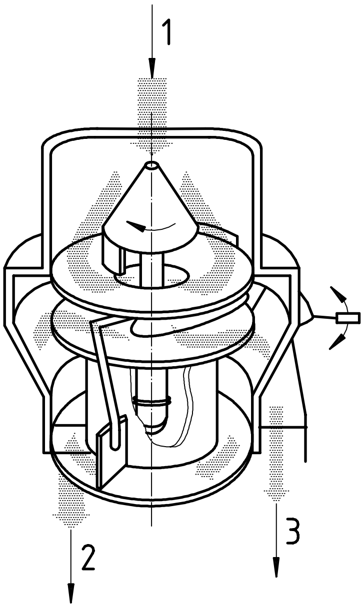
### 6.2.3 Interval between cuts

In order to minimize bias, the first cut for each mass to be divided shall be made at random within the first cutting interval. For secondary and tertiary dividers, the cycle time shall not be evenly divisible into the cycle time of the cutter which precedes it.

For fixed-mass division, the interval between taking cuts shall be varied proportionally to the mass of coal to be divided so that divided samples having almost uniform mass are obtained.

For fixed-ratio division, the interval between taking cuts shall be constant, irrespective of the variations of masses of coal to be divided, so that the divided-sample masses are proportional to the mass of the feed.




**Key**

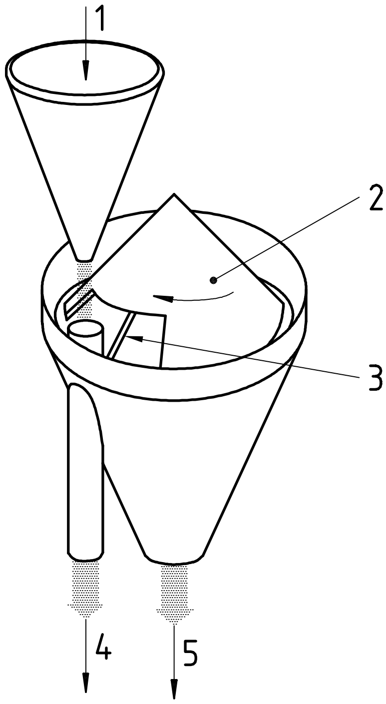
1 Feed

2 Reject

3 Divided sample

The material from a mixing container is fed by scrapers to the centre of the dividing disc. From there it is discharged over the range of the disc via special clearing arms. The sample falls through adjustable slots into chutes; the reject is carried away via a cleaning conduit. The whole interior space is cleaned by scrapers.

**a) Rotating disc type**




**Key**

1 Feed

2 Rotating cone

3 Adjustable slot

4 Divided sample

5 Reject

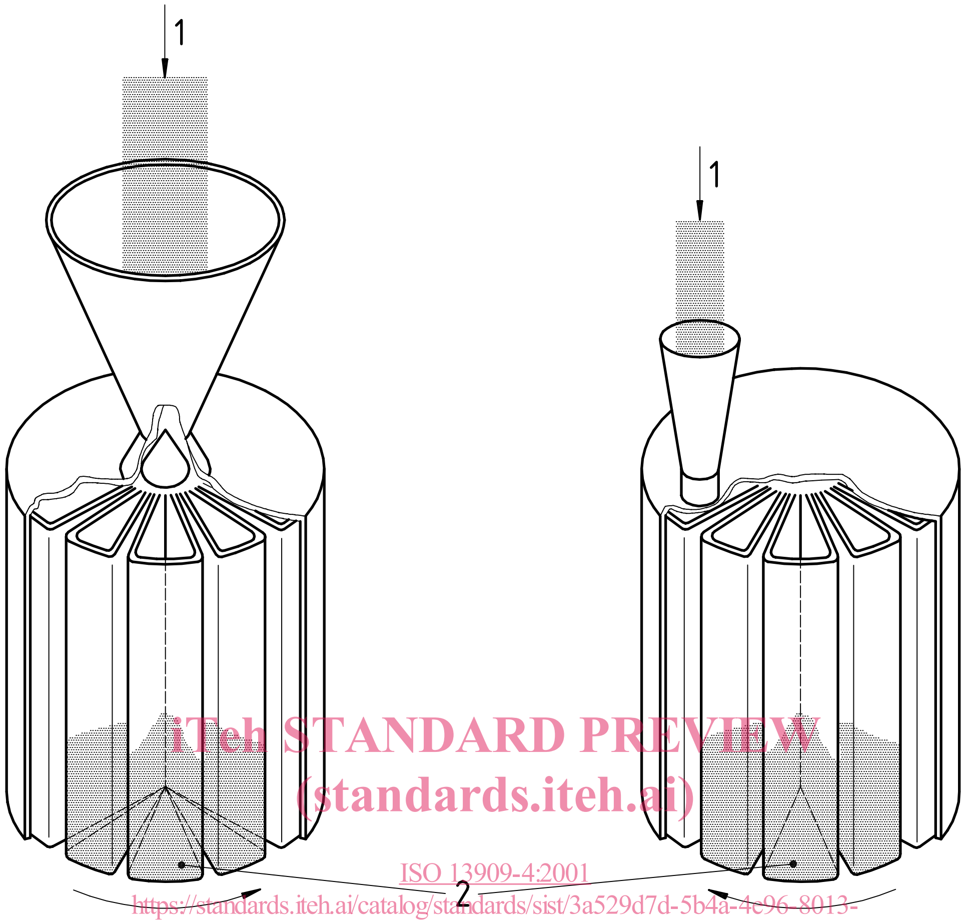
A stream of coal is allowed to fall onto a rotating cone; the adjustable slot with lips in the cone allows the stream to fall directly onto the sample receiver for part of each revolution.

**b) Rotating cone type**

**Figure 2 — Examples of dividers**








**Key**

1 Feed

2 Divided sample in rotating receivers

The coal stream flows to the hopper and this flow is intercepted by the top edge of a number of sector-shaped containers dividing the flow into equal parts. Either the hopper or the containers may rotate. The machine can be controlled for the following operations:
1) for dividing;
2) for collecting duplicates;
3) for collecting replicates.

**c) Container type**

**Figure 2 — Examples of dividers** (*continued*)