



**International  
Standard**

**ISO 20905**

**Coal preparation — Determination of  
dust/moisture relationship for coal**

*Préparation du charbon — Détermination de la relation  
particules/humidité du charbon*

**Second edition  
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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 document 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)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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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, *Coal and Coke*, Subcommittee SC 1, *Coal preparation: Terminology and performance*.

This second edition cancels and replaces the first edition (ISO 20905:2004), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

- the title of ISO/TC 27 was changed from "Solid mineral fuels" to "Coal";
- some terminology was changed to align with ISO rules, for example the terms "percentage", "weight" and "weighing".

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

The development of the dust/moisture curve provides an indication of the likely response of different coal types to drying or water addition during mining and handling processes. The dust/moisture curve provides a good basis for comparing the response of different coal types. Understanding the dust/moisture characteristics of a coal allows minimized water addition to the product for dust suppression. This in turn assists in water conservation at mines and other handling facilities, as well as minimizing the total moisture of the product.

This document describes a reliable measurement of dustiness of coal and extends to cover the relationship between dust and total moisture utilizing the Rio Tinto Dust Tumbler Test. This test provides a quantitative measure of the dustiness of a coal that can be used to predict operational dust problems and is also suitable for the assessment of dust suppression chemicals.

The Rio Tinto Dust Tumbler Test was developed using rotating equipment in a controlled temperature and humidity environment and uses a stream of air to remove particles which become airborne during the tumbling process. It is a batch test in which dust particles ( $\sim 150 \mu\text{m}$  particles) are collected in a filter bag of known mass and their mass is determined. From this mass, a dust number, calculated as the mass yield of dust multiplied by 100 000, is determined for the test total moisture. Only 1 kg of sample is required for each dust test, but eight sample lots are required to develop the dust/moisture curve for a particular coal, i.e. approximately 10 kg is required for each coal type.

This dust test can be repeated with subsamples at different coal total moisture levels to develop a dust/moisture curve. The slope of the curve provides information on how sensitive the dustiness is to changes in total moisture and a dust number of 10 has been used to provide a comparison between coals.

The test has been successfully used for several years on many coals and other bulk materials. The results have been correlated with the operating practice. The method has been applied to the evaluation of dust-control products and the determination of dust-elimination total moisture requirements for coal-handling systems.

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# Coal preparation — Determination of dust/moisture relationship for coal

## 1 Scope

This document sets out a laboratory procedure for the dust testing of higher rank coals. The procedure defines a means of evaluating the dust/moisture relationship characteristic of a coal and a dust extinction moisture (DEM).

NOTE In this document, an experimental dust number of 10 has been used in the example given in [Annex A](#).

## 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 589, Hard coal — Determination of total moisture

ISO 7886-1, *Sterile hypodermic syringes for single use — Part 1: Syringes for manual use*

## 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

#### **dust**

particles of size 150 µm or less entrained in an air stream

### 3.2

#### **dust extinction moisture**

#### **DEM**

total moisture at which a dust number of 10 is attained on the dust/moisture curve

Note 1 to entry: DEM is a useful point for comparing different coals and the effectiveness of reagents.

## 4 Safety

The following safety precautions shall be observed:

- To prevent nitrogen build-up within the laboratory, the exhaust tube of the minimum-free-space oven shall remain clear of obstruction.
- Safety glasses shall be worn at all times.
- The exhaust tube of the minimum-head-space oven shall remain free of obstruction to prevent nitrogen build-up within the laboratory.

- A dust mask shall be worn when handling coal.
- Cloth or leather gloves shall be worn when using ovens.
- The hazards associated with a reagent shall be determined prior to use. Instructions on all relevant material safety data sheets shall be followed.

## 5 Apparatus and equipment

The following apparatus and equipment is required.

**5.1 Humidity- and temperature-controlled laboratory**, with relative humidity of  $63 \% \pm 2 \%$  and temperature of  $20 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$ .

**5.2 Dust-test apparatus**, with a rotating drum of 30 cm diameter and 30 cm effective length, as shown in [Figure 1](#). The required drum speed is 29 r/min, and the desired airflow through the drum is 175 L/min.

**5.3 Double filter bags**, single use only.

**5.4 Electronic thermohydrograph.**

**5.5 Tachometer.**

**5.6 Laminar flow differential-pressure manometer.**

**5.7 Stopwatch.**

**5.8 Capped bottles**, of capacity 250 mL, wide mouth, polypropylene.

**5.9 Top loading balance**, which has a minimum capacity of 1 g and is readable to the nearest 0,01 g.

**5.10 Laboratory trays.**

**5.11 Minimum-free-space drying oven.**

## 6 Reagent

Tap water is used in solution and sample preparation.

## 7 Sample — Initial

Before testing, remove the particles greater than 6,3 mm. Do not crush and replace this removed fraction as the sample's particle size distribution will be altered.

Prepare sufficient sample to provide 1,2 kg for each dust determination over the desired range of total moisture or reagent concentrations as well as 1,2 kg for sample characterization. Approximately eight subsamples, using a range of total moisture values, are required to develop a dust/moisture relationship.

Once the sample has been screened, it shall be representatively split down to approximately 1,2 kg portions which are then heat-sealed in plastic bags and labelled.

One of the 1,2 kg portions is used to determine the sample's total moisture mass fraction (initial total moisture), particle size distribution as specified in ISO 1953, and other relevant characteristics. The experimental details relating to these properties shall be recorded and retained.





## 8.2 Moisture adjustment

Samples are moisture adjusted to produce a range of total moisture mass fractions at approximately 1 % moisture intervals. Adjust the total moisture of each of the 1,2 kg subsamples to the required level for dust testing via the following processes:

- a) For samples requiring total moisture mass fractions greater than the initial total moisture,  $M_1$ , water is added to the samples. Determine the sample mass and calculate the mass of water required,  $W_a$ , to achieve the required total moisture mass fraction,  $M_2$ , using [Formula \(1\)](#):

$$W_a = m_2 - m_1 \quad (1)$$

where

$W_a$  is the water addition (or removal) required, expressed in g;

$m_1$  is the sample mass (at  $M_1$ ), expressed in g;

$m_2$  is the sample mass (at  $M_2$ ), expressed in g.

Add the required mass of water via a spray bottle to the subsample in the plastic bag on an electronic balance. Reseal the bag and shake the bag to assist with water distribution. Leave the sample in the temperature- and humidity-controlled room ([5.1](#)) for 24 h to equilibrate. Calculate the mass required,  $m_2$ , using [Formula \(2\)](#):

$$m_2 = m_1 \times \frac{100 - M_2}{100 - M_1} \quad (2)$$

where

$M_1$  is the initial total moisture mass fraction (as measured in [8.1](#)), expressed in per cent;

$M_2$  is the required total moisture mass fraction, expressed in per cent;

- b) For samples requiring total moisture mass fractions less than the initial total moisture,  $M_1$ , water is removed by low-temperature drying. The material shall be evenly dried. Determine the sample mass and calculate the mass of water loss required to achieve the required total moisture level, using [Formula \(1\)](#) and [Formula \(2\)](#). Place the sample in a tray in the controlled-environment laboratory and allow the sample to dry to the required mass. The mass of the tray should be determined periodically until the required mass of water is removed. Return the sample to the plastic bag, seal and leave to equilibrate for 24 h prior to dust testing. If the required mass loss cannot be achieved at the laboratory conditions, the sample may be dried to the required moisture mass fraction in a 40 °C oven, and then equilibrated in a sealed bag in the laboratory for 24 h.

## 9 Sample preparation — Reagent

Reagents can be added in addition to, or instead of, water. If the reagent is an aqueous solution, the coal sample is moisture adjusted such that the addition of a reagent increases the total moisture mass fraction to the target. Reagent doses are normally based on µg/g per mass of dry coal.

The adjusting procedure should be as follows:

- Prepare the reagent according to the manufacturer's instructions.
- Adjust the sample mass to just below the required total moisture mass fraction, using one of the methods described in [8.2](#), allowing for any water addition associated with the reagent dosing.
- Scoop and brush coal into a mixer bowl and place in a mixer.