

STANDARD

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**Magnetite for use in coal preparation —
Test methods**

Magnétite à utiliser dans la préparation des charbons — Méthodes d'essai



Reference number
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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland

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Introduction

The basic requirements for a material to be used in dense medium suspension are that it should be inert, have a high relative density and be easy to recover. In coal preparation, the mineral magnetite (FeO , Fe_2O_3) has become the most commonly used material, not only because it fulfils all the above criteria, but also because of its worldwide occurrence either as an iron ore or as a by-product of mining operations for other minerals. Like any mineral, magnetite rarely occurs in the pure state and the presence of gangue minerals may lower the relative density and affect the ferromagnetic properties. In addition, like other minerals in the spinel group, there may be substitution of either or both the divalent and/or trivalent ions by ions of other metals (e.g. Mg^{2+} , Mn^{2+} , Al^{3+} , Cr^{3+} , Mn^{3+}). These variations may seriously affect the efficiency of recovery operations and it is important when designing a coal preparation plant that the manufacturer of the magnetic separators be informed of the source of magnetite to be used and if possible be provided with a sample.

The purpose of this International Standard is to provide a basis for the testing of magnetite for use in coal preparation. It is intended for use by contracting parties in the sale and purchase of magnetite and for coal preparation engineers engaged in the design and quality control fields.

The tests specified in this International Standard will assist the user in the selection of magnetite for use in dense medium suspension and provide a basis for quality control testing. No attempt is made to formulate the requirements for particular plant applications.

The specified tests should ensure that the properties which make magnetite suitable for coal preparation purposes are simply and adequately tested.

These properties are

- a) moisture content;
- b) particle size distribution;
- c) total magnetics content;
- d) relative density;
- e) total iron content;
- f) iron(II) content;
- g) fundamental magnetic properties.

All the above tests may be required for the assessment of magnetite from a new source, but for routine checking of regular supplies, moisture, particle size distribution, total magnetics content and relative density should be sufficient.

Tests for fundamental magnetic properties are not described because the determination of suitable parameters requires very specialized apparatus and techniques and is probably best undertaken by a University or Research Institute whose staff are experienced in making such measurements. There is a lack of consensus as to which

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magnetic parameters are relevant in the context of this international standard. Therefore, it is left open for the interested parties to decide which property to measure. However, there is some evidence to suggest that the coercivity is a guide to the ease of recovery of a magnetite and that the saturation magnetic moment is a measure of the purity of the actual magnetite grains.

This International Standard applies exclusively to the testing of magnetite and no attempt is made to recommend specific tests for the dense medium suspensions of which magnetite forms the solid phase.

Magnetite for use in coal preparation – Test methods

1 Scope

This International Standard specifies methods for the sampling and testing of magnetite for use in coal preparation.

The test methods are intended primarily for the testing of milled magnetite, the largest particle size of which is usually less than 250 µm. However, the tests are also applicable to unmilled magnetite with an upper particle size limit of about 500 µm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 648 : 1977, *Laboratory glassware – One-mark pipettes.*

ISO 2591 : 1973, *Test sieving.*

ISO 2597 : 1985, *Iron ores – Determination of total iron content – Titrimetric methods.*

ISO 3081 : 1986, *Iron ores – Increment sampling – Manual method.*

ISO 3083 : 1986, *Iron ores – Preparation of samples – Manual method.*

ISO 3310-1 : 1982, *Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth.*

3 Sampling

3.1 General

Sampling shall be carried out in accordance with ISO 3081, which specifies the procedures for taking samples of iron ores loaded onto and discharged from conveyors, railway wagons, bunkers, ships and stockpiles, by the manual increment method, subject to the following provisions.

If possible, carry out sampling during material transfer, using a conventional manual increment shovel conforming to the requirements of ISO 3081.

If sampling during material transfer is impracticable, use sampling spears (see figure 1) for sampling bagged materials or small piles, and screw-type augers (see figure 2) when sampling from existing stockpiles, wagons, ships, etc., or in situations where the material has compacted.

The following procedure shall be used when sampling magnetite contained in sealed bags.

- a) Select a number of bags in accordance with the requirements of table 1.
- b) Open the bags and incline them so that the sampling spear can be inserted at an angle close to the horizontal. Insert the spear fully with the slot underneath and rotate the spear through two complete revolutions.
- c) Rotate again through 180° so that the open slot is uppermost and withdraw the spear containing the increment.
- d) Place the increment in a container fitted with an airtight lid.
- e) Repeat this procedure until all the requisite bags have been sampled and a total sample mass of approximately 1 kg is obtained.

Table 1 – Minimum number of bags to be sampled

Number of bags in batch	Minimum number of bags to be sampled
<5	All bags
5 to 250	5
> 250	1 per 50 (to the nearest 50 bags)

When screw-type augers are used, the stockpile or loaded material shall be systematically sampled at various depths, including the bottom of the pile if practicable, to ensure representative sampling.