SLOVENSKI STANDARD
SIST ISO 8833:1998

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Uporaba magnetita pri separiranju premoga - Preskusne metode

Magnetite for use in coal preparation -- Test methods

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

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73.040 Premogi Coals

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INTERNATIONAL 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

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.

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.

International Standard ISO 8833 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels.*

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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

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.

Dimensions in millimetres

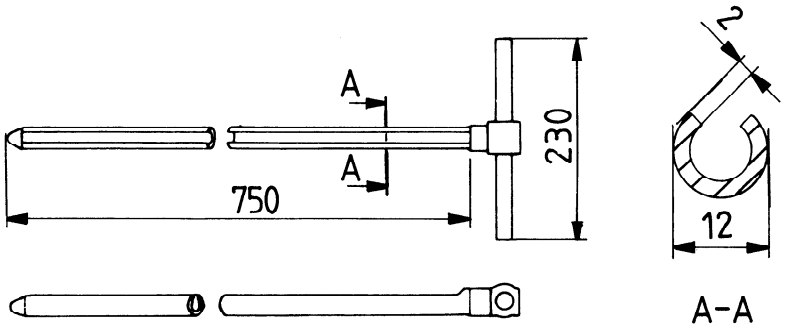
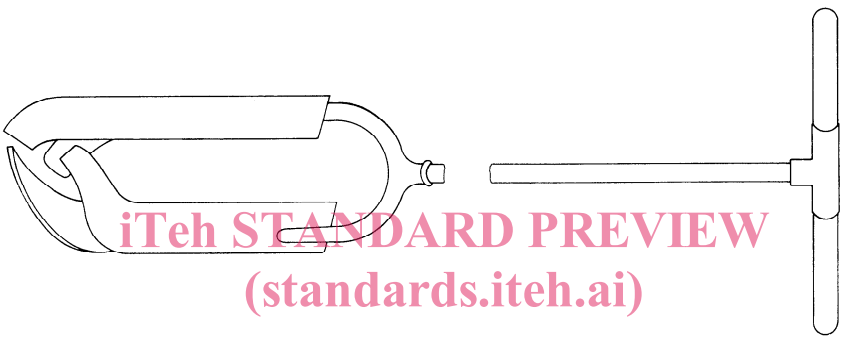


Figure 1 — Sampling spear (typical dimensions)



NOTE — Various diameters and lengths will be needed for specific pile sizes.

Figure 2 — Sampling auger

3.2 Preparation of samples

The gross sample, subsamples or increments obtained in accordance with ISO 3081 shall be prepared in accordance with ISO 3083 subject to the following provisions.

a) If it proves difficult to carry out sample division because the sample is too wet, pre-dry the sample sufficiently to overcome this difficulty. If necessary, determine the moisture content before drying.

b) If the maximum particle size of the magnetite is such that grinding of the material is necessary in order to comply with the preparation procedures, then take separate samples for moisture determination, size analysis and physical/chemical analysis. The mass of sample for a particular test shall be that specified in ISO 3083.

Magnetite used in coal preparation is usually in a finely divided form. Therefore, it will generally not be necessary to grind the material and it will be sufficient to provide a single sample for all analytical purposes. This sample shall have a mass of not less than 1 kg and be stored in an airtight container to ensure that it is protected from any alteration.

c) If sampling is for comparative purposes between contracting parties, at least four samples shall be prepared. Three of the samples are intended for the seller, the purchaser and arbitration, and one is held in reserve.

d) Further sample division to obtain test portions for a particular analytical test shall preferably be carried out using the increment division method specified in ISO 3083. Sample division using riffle dividers, or other similar equipment, or random spot sampling may be used provided that these methods can be shown to be free of significant bias.

4 Determination of moisture content

4.1 General

The total moisture content of a consignment may be required for both commercial and safe shipment purposes. A knowledge of the total moisture content of samples prepared for laboratory analysis may also be required for subsequent conversion of the analytical results to the dry basis.

The total moisture content of a consignment is often required in order to comply with various maritime regulations as, when moisture is present in excess, it may result in stability problems during shipping.

The total moisture content shall be determined either in one stage or in two stages, where the free moisture and air-dried moisture contents are separately determined. This latter method is used when large quantities are involved or if predrying is necessary in order to carry out the sample preparation (see 3.2).

In both methods the aim is to determine the total moisture content only, but it has been found that loosely-bound sulfur compounds which may be present in the magnetite matrix may also be released. In general, errors from this source will be insignificant.

The determination shall be carried out on a mass of approximately 1 kg for a consignment sample and a mass of 100 g for a sample prepared for laboratory analysis.

When a gross sample is taken from a consignment, at least four moisture samples shall be prepared and tested. Where possible, duplicate determinations should be carried out on laboratory analysis samples.

4.2 Apparatus

4.2.1 Drying trays of non-corrodible material

NOTE — A minimum loading area of 9 dm^2 is recommended for 1 kg test portions and of 1,5 dm^2 for 100 g test portions.

4.2.2 Balances

a) A balance capable of weighing up to 5 kg to an accuracy of ± 0,1 g.

b) A balance capable of weighing up to 200 g to an accuracy of ± 0,01 g.

4.2.3 Laboratory air-oven, capable of being maintained at a temperature in the range 105 °C to 110 °C and of accommodating the drying trays.

4.2.4 Desiccator.

4.3 Weighings

All weighings described in 4.4 and 4.5 shall be carried out using the appropriate balance (4.2.2) to an accuracy of ± 0,1 g if a 1 kg test portion is taken or to an accuracy of ± 0,01 g if a 100 g test portion is taken.

4.4 Method 1: One-stage method

4.4.1 Test portion

Take a test portion of approximately 1 kg or approximately 100 g, as appropriate (see 4.1 and 4.3), from the sample, in accordance with 3.2.

4.4.2 Procedure

Weigh a clean, dry drying tray (4.2.1) (m_1), spread the test portion uniformly onto the tray and reweigh (m_2).

Place the uncovered tray in the air oven (4.2.3) maintained at a temperature in the range 105 °C to 110 °C, and dry to constant mass (m_3). Weigh it after minimum cooling in the case of a 1 kg test portion or after allowing the tray and sample to cool in the desiccator (4.2.4) in the case of a 100 g test portion.

4.4.3 Expression of results

The total moisture content of the sample, expressed as a percentage by mass, is calculated from the formula

$$\frac{m_2 - m_3}{m_2 - m_1} \times 100$$

where

m_1 is the mass, in grams, of the drying tray;

m_2 is the initial mass, in grams, of the drying tray with the test portion;

m_3 is the final mass, in grams, of the drying tray with the test portion after oven drying.

Report the result to one decimal place.

4.5 Method 2: Two-stage method

4.5.1 Free moisture

The mass of the test portion and the test procedure are essentially as laid down for the one-stage method, except that the test portion is allowed to attain constant mass by exposure to air at ambient temperature rather than by drying in the heated air oven.

In this determination it is only necessary for the test portion to reach an approximate equilibrium state, as any remaining moisture will be included in the second stage determination of air-dried moisture content.

The free moisture content of the sample, expressed as a percentage by mass, is calculated from the equation

$$\text{FM} = \frac{m_2 - m_3}{m_2 - m_1} \times 100$$

where

m_1 is the mass, in grams, of the drying tray;

m_2 is the initial mass, in grams, of the drying tray with the test portion;

m_3 is the final mass, in grams, of the drying tray with the test portion after air drying.