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Manganese ores — Determination of size distribution by sieving

Minerais de manganèse — Détermination de la distribution granulométrique par tamisage

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Contents

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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 6230 was prepared by Technical Committee ISO/TC 65, *Manganese and chromium ores.*

Annex A of this International Standard is for information only.

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Manganese ores — Determination of size distribution by sieving

1 Scope

This International Standard specifies the methods to be employed for determination of size distribution by sieving of manganese ore, whether natural or processed (such as pellets, sinters and other agglomerated ores).

In this International Standard the terms "manganese ore" or "ore" refer to all the above-mentioned types of materials.

The methods described in this International Standard are equally applicable to size determination utilizing one or more sieves.

The purpose of this International Standard is to provide a basis for any testing of manganese ore involving size determination and for use by contracting parties in the sale and purchase of this material.

When this International Standard is used for comparative purposes, agreements should be reached between the producer and the consumer in respect of the detailed method to be employed in order to eliminate sources of controversy.

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 565 : 1983, *Test sieves — Woven metal wire cloth, perforated plate and electroformed sheet — Nominal sizes of openings.*

ISO 2591 : 1973, *Test sieving.*

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

ISO 3310-2 : 1982, *Test sieves — Technical requirements and testing — Part 2: Test sieves of metal perforated plate.*

ISO 4296-1 : 1984, *Manganese ores — Sampling — Part 1: Increment sampling.*

ISO 4296-2 : 1983, *Manganese ores — Sampling — Part 2: Preparation of samples.*

ISO 4299 : 1989, *Manganese ores — Determination of moisture content.*

ISO 8541 : 1986, *Manganese and chromium ores — Experimental methods for checking the bias of sampling and sample preparation.*

ISO 8542 : 1986, *Manganese and chromium ores — Experimental methods for evaluation of quality variation and methods for checking the precision of sampling.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 lot : A definite quantity of an ore, processed or produced under conditions which are presumed uniform.

3.2 consignment : A quantity of an ore delivered at one time. The consignment may consist of one or more lots or parts of lots.

3.3 increment :

1) A quantity of an ore taken by a sampling device at one time from a consignment.

2) A quantity of ore taken by the increment division method.

3.4 subsample :

1) A quantity of an ore consisting of two or more increments taken from a consignment.

2) An aggregation of two or more increments each of which may have been individually crushed and/or divided as necessary.

3.5 gross sample :

1) The quantity of an ore consisting of all the increments taken from a consignment.

2) An aggregation of all the increments or all the subsamples each of which may have been individually crushed and/or divided as necessary.

3.6 test sample : Any sample for the determination of size distribution, moisture content, chemical composition or other physical properties, which is prepared from each increment, each subsample, or from the gross sample in accordance with the specified method for that type of sample.

3.7 size sample : The sample taken for the determination of size distribution of the consignment or part of the consignment.

3.8 particle : A discrete coherent body of the ore regardless of size.

3.9 particle size (in sieve analysis) : The size of the smallest sieve aperture through which the particle has passed and the size of the largest sieve aperture on which the particle has been retained.

3.10 nominal top size : The smallest sieve in the range included in the R 20 Series (in table 1 of ISO 565, square hole) such that not more than 5 % of the ore is retained.

3.11 size distribution : The quantitative grouping of particles in the sample according to size. It is expressed in terms of percentage mass, passed or retained on selected sieves in relation to the total mass of the sample.

3.12 size fraction : The portion of the sample separated by one or two sieves of different apertures.

3.13 oversize fraction : The portion of the sample not passing the coarsest sieve in the test, e.g. $+ x$ mm (or µm).

3.14 undersize fraction : The portion of the sample passing the finest sieve in the test, e.g. $- z$ mm (or µm).

3.15 size fraction yield : The ratio of the mass of a given size fraction to the total mass of the sample as a percentage by mass.

3.16 intermediate size fraction : The portion of the sample specified by the smallest sieve aperture, x mm (or µm), through which the fraction has passed together with the size of the largest sieve aperture, y mm (or µm), on which the fraction has been retained in the test, e.g. $- x + y$ mm (or µm).

3.17 specification size : Any sieve size (or sizes) selected by the interested parties to define the limit (or limits) of the fraction considered by them to be significant.

3.18 sieving : The process of separating a mixture of particles, according to their size, by means of one or more sieves.

3.19 dry sieving : Sieving without the application of water.

3.20 wet sieving : Sieving with the application of water.

3.21 hand sieving : A sieving operation in which the sieve or sieves are supported and agitated manually.

3.22 assisted hand sieving : A sieving operation in which the sieve or sieves are supported mechanically but are agitated manually.

3.23 mechanical sieving : A sieving operation in which the sieves are supported and agitated by mechanical means. This operation may be either batch or continuous sieving.

3.24 continuous sieving : A sieving operation in which the ore is fed continuously into one or several consecutive sieving surfaces, over which it travels. The products are continuously discharged.

3.25 batch sieving : A sieving operation in which the resulting products are retained on the sieving surfaces until the end of the operation.

3.26 hand placing : A sieving operation in which particles are presented individually and by hand to the sieve apertures and orientated until either they can be passed through without force being applied, or they can be clearly classified as oversize.

3.27 sieve : An apparatus for the purpose of sieving consisting of a sieving medium mounted in a frame.

3.28 nest of test sieves : A set of test sieves mounted together with the lid and receiver pan.

3.29 charge : A quantity of ore to be treated at one time on an individual sieve or nest of test sieves.

3.30 sieving medium : A surface containing regularly arranged apertures of uniform shape and size.

3.31 sieve analysis : A method for determination of size distribution of an ore by sieving.

4 Principle

The sample of manganese ore is subjected to sieving procedures for the purpose of determining the size distribution of the constituent particles. The size distribution is to be expressed in terms of percentage mass, passed or retained on selected sieves.

5 Apparatus

5.1 Sieve media

5.1.1 Shape of aperture

The sieve media shall have square apertures in accordance with ISO 565.

5.1.2 Size of aperture

The nominal size of aperture to be used shall be selected in accordance with ISO 565.

5.1.3 Construction of sieve media

The sieve media shall be in accordance with ISO 565, ISO 3310-1 and ISO 3310-2. It is recommended that indiscriminate mixing of perforated plate and woven wire sieves should be avoided within any determination in order to ensure continuity of results.

In cases where woven wire sieves are used, particularly in the +4 mm range, it should be recognized that

a) with round frame sieves, partial apertures are unavoidable, thus increasing the risk of accidental retention of undersized particles which may become wedged in the partial apertures;

b) tolerances on aperture size are wider than for perforated plate and this may influence results;

c) this type of sieve medium is prone to distortion.

In cases where perforated plate is used as the medium, all incomplete apertures in the floor of the sieve should be blanked off. Omission of this blanking off is permissible, provided that it is recognized that the particles retained in these partial apertures are removed without breakage and correctly sized before the size fractions are weighed.

5.2 Sieve frames

5.2.1 Shape and size

Sieves used for hand or mechanical nest sieving shall have frames in accordance with ISO 2591. Frames may be either round or rectangular.

5.2.2 Construction

The sieve frames shall nest snugly with each other and with the lid and receiver pan of the same type. The frame should be smooth and the seals of the sieves so constructed as to avoid lodging of the material and loss of fines.

5.3 Preparation and maintenance of sieves

5.3.1 Preparation

Preparation of sieves shall be carried out in accordance with the recommendations of ISO 2591 along with the procedure given below.

Before use, the sieve medium and frame shall be degreased and cleaned. The cleaning of a sieve should be carried out with great care so that the sieve medium is not damaged. For sieves with apertures equal to or greater than 500 µm, cleaning should be undertaken by the application of a soft brass wire brush to the underside of the sieve; for fine sieves with apertures less than 500 µm, cleaning shall not entail brushing of the sieve media. The frame should be tapped gently to assist in freeing trapped particles. At times it may be necessary to wash fine sieves in a warm soft soap and water solution. After washing or after cleaning the sieves should be dried thoroughly.

5.3.2 Maintenance (including verification procedure)

The accuracy of the sieve medium should be verified initially and verification should be repeated regularly during use. Factors such as the frequency of use and type of manganese ore sieved will influence the frequency of verification. It is recommended that a record card be kept for each sieve.

Verification may be carried out using the procedure specified in ISO 3310-1 and ISO 3310-2.

Another method of verification is to compare the performance of the sieve with the performance of a reference sieve using a sample material similar to the one for which the test sieve is to be used.

When a sieve medium no longer complies with the tolerances specified in ISO 3310-1 and ISO 3310-2, the marking on the label should be cancelled and the sieve discarded.

5.4 Sieving machines

Any type of apparatus is acceptable, provided that the results obtained with reference to the specification size selected or other aperture size as agreed upon, are within ± 2 % (absolute) of those of hand placing or hand sieving methods carried out under closely controlled conditions in accordance with ISO 2591.

Each type of sieving machine should be tested for bias in accordance with the procedures given in ISO 8541 and will be acceptable if no significant bias is proven.

5.5 Drying equipment

Any form of ventilated equipment is acceptable for drying provided that it is fitted with a temperature control apparatus capable of maintaining the temperature in the equipment within 105 °C ± 5 °C. Loss of dust from the equipment should be avoided.

5.6 Weighing device

Each weighing device for the determination of mass shall have a sensitivity of at least 0,1 % of its rated capacity and a level of accuracy to permit the mass of the test sample and of each size fraction to be determined to a precision of ± 0,1 % or better of the test sample mass.

Equipment should be chosen in a suitable range of capacities to meet these requirements and to ensure that the final reporting can be made to the first decimal place.

5.7 Accessories for wet sieving

When wet sieving is carried out it is necessary to have available, in addition to the apparatus previously mentioned, a controllable supply of water, a spray nozzle and, where appropriate, a collecting tank. A simple arrangement is shown in figure 1.

When wet sieving on sieves having apertures less than 125 µm it is preferable that

a) the sieve be constructed of stainless steel;

b) the medium has a backing to prevent possible sagging and distortion caused by water pressure. This backing may typically consist of a sieve media having 2 mm square apertures.

5.8 Chronometer, or time relay.

5.9 Sample container and sample delivery means
(trays, buckets, pots, polyethylene bags)

5.10 Shovels, scoops, brushes

6 General principles of sieving

Prior to commencing a size determination, it is necessary to plan the entire sequence of procedures to be followed. The sequence of procedures will depend on

- the manganese ore being evaluated;
- the form in which it is received (i.e. as separate increments, subsamples or a combined size sample);
- the available equipment;
- the purpose of the analysis.

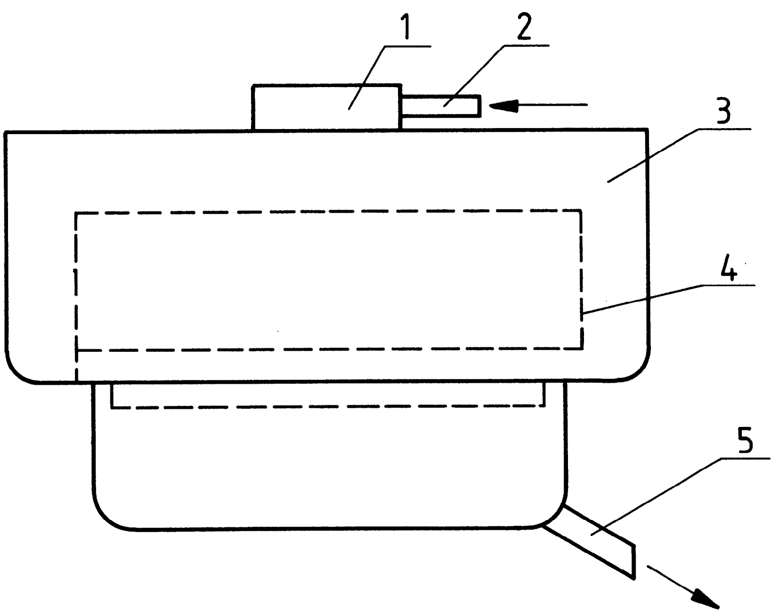
A typical decision tree to enable the sequence of procedures to be formulated is given in figure 2.

Sieving shall be carried out under controlled conditions strictly in accordance with ISO 2591.

For manganese ores subject to considerable degradation, it is essential that the organization responsible for the size determination agree to utilize similar equipment and the same procedure so that the results of their analyses are comparable.

Due to the difference in physical properties of manganese ores, sieving analysis should be carried out by two methods for two size fractions : +5 mm and −5 mm.

Nominal top size is defined either by prior sieving or on the basis of results of the previous analysis.



1 hydrocyclonic sprayer
2 regulating valve for water supply
3 body of the attachment
4 sieve
5 branch pipe for the discharge of the undersize product

Figure 1 — Diagram of the arrangement for wet sieving

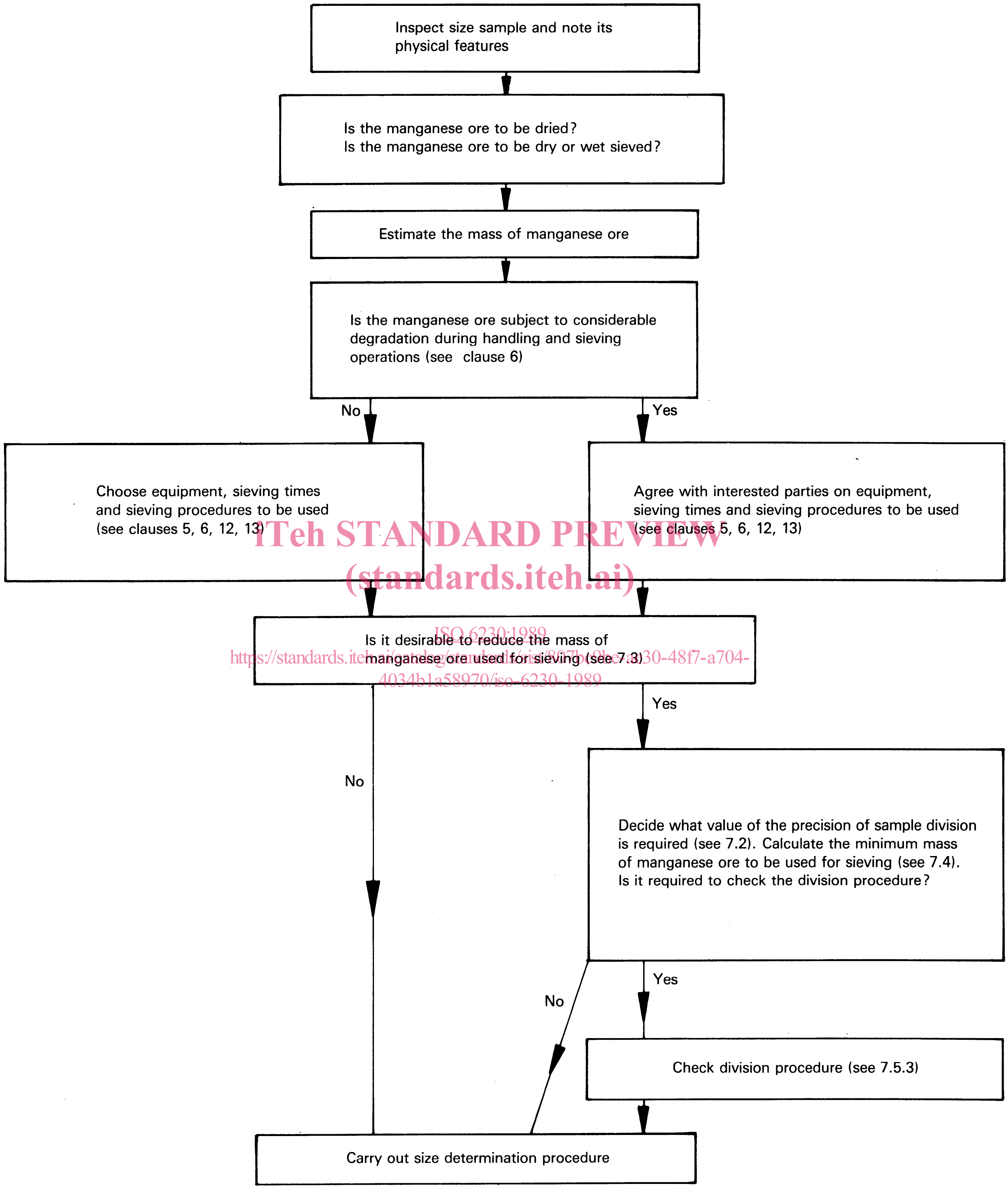


Figure 2 — Typical decision tree for selecting size determination procedure