International Standard 5464

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Iron ores — Determination of bulk density for ores of maximum particle size larger than 40 mm

Minerais de fer — Détermination de la masse volumique apparente pour les particules de dimension granulométrique maximale supérieure à 40 mm

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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.

International Standard ISO 5464 was developed by Technical Committee ISO/TC 102, *Iron ores*, and was circulated to the member bodies in September 1979.

It has been approved by the member bodies of the following countries :

Australia	Germany, F. R.	South Africa, Rep. of
Austria	India	Sweden
Brazil	Italy	USA
Canada	Japan	USSR
Czechoslovakia	Korea, Dem. P. Rep. of	Venezuela
Egypt, Arab Rep. of	Poland	
France	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

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Iron ores — Determination of bulk density for ores of maximum particle size larger than 40 mm

1 Scope and field of application

This International Standard specifies a method for the determination of the bulk density or unit mass of run-of-mine ores, sized iron ores and agglomerates including sintered products.

This method is applicable to samples having a maximum particle size greater than 40 mm.

NOTE — The method of determining the bulk density of samples having a maximum particle size of 40 mm or smaller is specified in ISO 3852, *Iron ores (maximum particle size 40 mm or smaller) — Determination of bulk density.*

2 References

ISO 3081, *Iron ores — Increment sampling — Manual method.*

ISO 3087, *Iron ores — Determination of moisture content.*

3 Definitions

For the purpose of this International Standard the following definitions apply :

3.1 maximum particle size : The size of aperture of the sieve on which approximately 5 % (*m/m*) of an iron ore is retained.

3.2 bulk density : The mass in air of a unit volume of an iron ore, including the voids within and between the particles.

4 Apparatus

4.1 Container, such as a truck or railway wagon, of regular geometrical shape, with smooth inner surfaces of the walls and bottom, and in good general condition. The container shall have sufficient capacity to hold, when filled, a minimum of 10 t of sample and a minimum height of the sample bed of 500 mm.

The minimum length, width, or height of the containers should be 10 times the maximum particle size of the sample.

4.2 Weighing device, preferably of the platform type, having a relative accuracy of 1/200 or better and a capacity adequate for the masses to be determined.

5 Sample

5.1 The sample for the bulk density test shall be representative of the material and shall be taken in accordance with the procedure specified in ISO 3081[1].

5.2 The quantity of sample shall be sufficient to fill the container three times, with a small overflow, and to provide for determination of size distribution and moisture content, the two main factors which affect bulk density.

5.3 The sample shall have a minimum quantity of 35 t, the recommended quantity being 50 t.

NOTE — The 35 t mass of sample has a volume of approximately 14 to 23,6 m^3, according to the material.

6 Procedure

6.1 Measure the length, width and height of the container within an error of 0,5 % and calculate its volume. Weigh the empty container (4.1).

6.2 With the container on a level surface, discharge the sample into it manually or by mechanical means, taking care to avoid disintegration or segregation of particles. Level off the upper surface across the top of the container, verifying by visual inspection and removing or pushing down any particles which would appear to obstruct the passage of a straight-edge if it were pulled across the top of the container.

6.3 Weigh the filled container.

1) A further International Standard now in preparation (ISO 3082) will specify methods for mechanical sampling and mechanical preparation of samples.

6.4 Calculate the bulk density according to the formula in 7.1.

6.5 Repeat the test using the same or a second container of similar capacity, which also has been determined according to 6.1.

6.6 Determine the size distribution of the sample[1].

6.7 Determine the moisture content of the sample according to ISO 3087.

7 Expression of results and number of tests

7.1 Calculation

The bulk density, Z, expressed in tonnes per cubic metre[2], is given by the formula

$$Z = \frac{m_1 - m_0}{V}$$

where

m_0 is the mass, in tonnes, of the empty container;

m_1 is the mass, in tonnes, of the container plus sample;

V is the volume, in cubic metres, of the container.

Round off the result to the second decimal place.

7.2 Number of tests

The test shall be made in duplicate according to clause 6. If the two results do not meet the permissible tolerance specified in clause 8, a single third test shall be made. If any two results of the three tests comply with the tolerance requirement, the respective two values together with their mean value shall be reported. If any two results do not comply, all three values together with their mean value shall be given to the first decimal place.

8 Permissible tolerance

The results of duplicate determinations, on samples from the same consignment, shall not differ by more than 0,10 t/m^3.

9 Test report

The test report shall include the following information :

a) reference to this International Standard;

b) the accepted measured values of bulk density of all tests and their mean value;

c) indications necessary for the identification of the sample;

d) a statement of the condition of the sample as tested; i.e., natural or air dried;

e) the date and the method of calibration of the container;

f) a statement of the capacity and accuracy of the weighing device used;

g) the percentage moisture content of the sample;

h) the size distribution of the sample;

i) the mean bulk density, in tonnes per cubic metre, related to dry material, calculated according to the following formula :

$$\text{Mean bulk density (dry material)} = \bar{Z} \times \frac{100 - M}{100}$$

where

M is the moisture content of the sample, expressed as a percentage;

$\bar{Z}$ is the mean of the bulk density determinations as reported in b) above.

1) The determination of the size distribution of iron ores will form the subject of a future International Standard (ISO 4701).

2) 1 t/m^3 = 1 000 kg/m^3