

INTERNATIONAL STANDARD

ISO
10236

First edition
1995-11-15

Carbonaceous materials for the production of aluminium — Green coke and calcined coke for electrodes — Determination of bulk density (tapped)

*Produits carbonés utilisés pour la production de l'aluminium — Coke cru et
coke calciné pour électrodes — Détermination de la masse volumique
apparente (après tassement)*



Reference number
ISO 10236:1995(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10236 was prepared by Technical Committee ISO/TC 47, *Chemistry*, Subcommittee SC 7, *Aluminium oxide, cryolite, aluminium fluoride, sodium fluoride, carbonaceous products for the aluminium industry*.

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

Printed in Switzerland

Carbonaceous materials for the production of aluminium — Green coke and calcined coke for electrodes — Determination of bulk density (tapped)

1 Scope

This International Standard specifies a method for the measurement of the bulk density of granular carbon and graphite materials used in the manufacture of carbon electrodes for the production of aluminium.

Bulk density depends on the size, shape and porosity of the granules. For samples with similar grain size and shape, comparison of the real density with the bulk density (tapped) allows the porosity to be assessed. Coke porosity is an important quality parameter which can affect the quality and performance of the carbon electrodes.

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 indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3310-1:1990, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*.

ISO 6375:1980, *Carbonaceous materials for the production of aluminium — Coke for electrodes — Sampling*.

3 Principle

The volume of a known mass of material is determined after tapping. The bulk density (tapped) is calculated by division of the known mass by the measured volume.

4 Apparatus

Ordinary laboratory apparatus, plus the following:

4.1 Bulk density measuring device, as shown in figure 1, comprising the elements specified in 4.1.1 to 4.1.3.

4.1.1 Measuring cylinder, having a mass of $190 \text{ g} \pm 15 \text{ g}$, with a scale reading from 0 to 250 ml, capable of measuring to $\pm 1,0 \text{ ml}$.

4.1.2 Cylinder holder, having a guided plunger with a mass of $450 \text{ g} \pm 5 \text{ g}$.

4.1.3 Tapping device, capable of raising and dropping the plunger (see 4.1.2) 250 ± 15 times per minute from a height of $3 \text{ mm} \pm 0,1 \text{ mm}$, fitted with a counter to record the number of taps.

4.2 Test sieves, complying with the requirements of ISO 3310-1.

4.3 Oven, capable of being maintained at $120 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$.

4.4 Feeder, capable of filling the measuring cylinder in a controlled manner.

Dimensions in millimetres

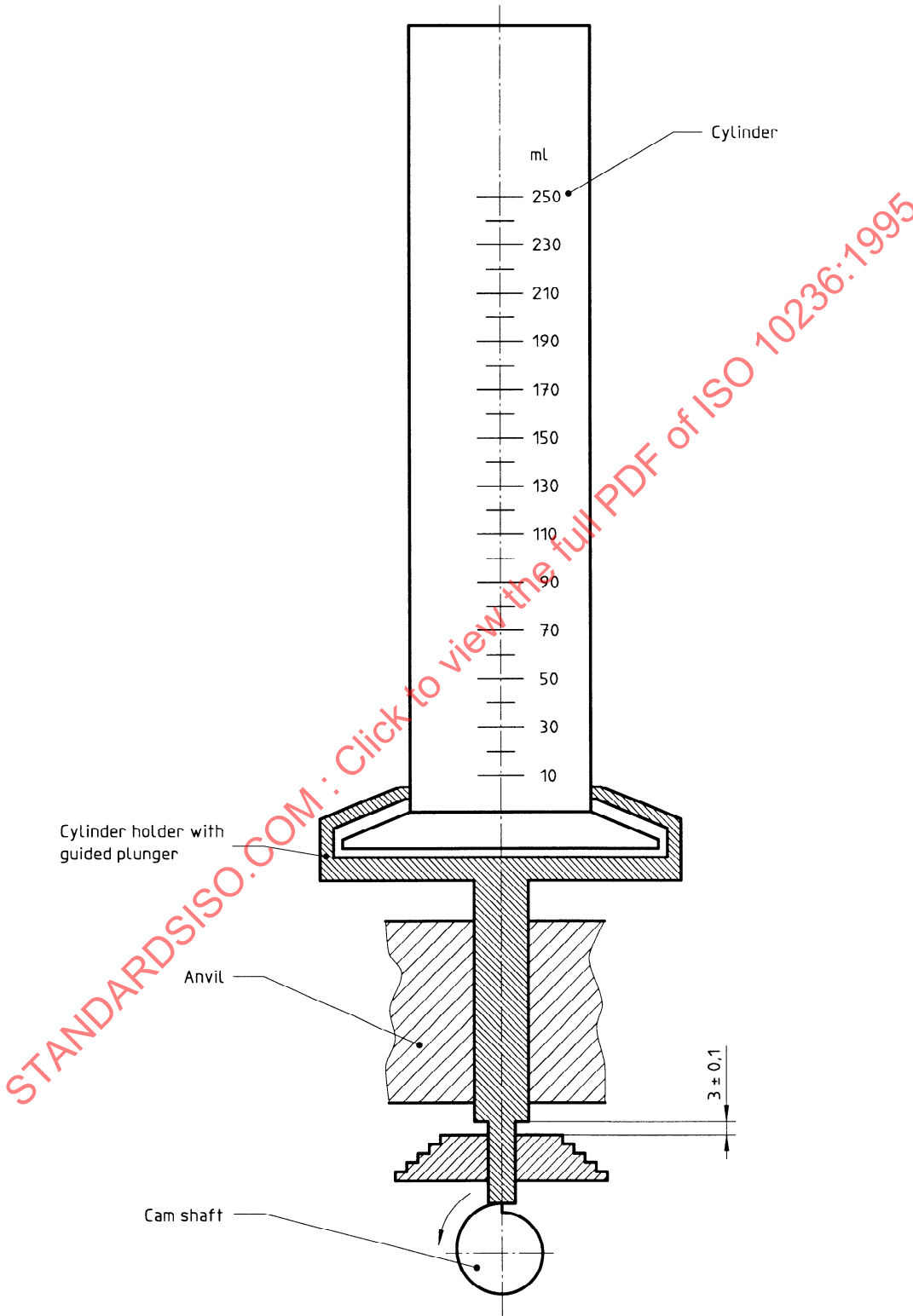


Figure 1 — Bulk density measuring device

5 Sampling and sample preparation

5.1 Sampling

Sample the coke in accordance with ISO 6375.

5.2 Sample preparation

Heat the sample to $120\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ for 30 min using the oven (4.3), allow to cool in a desiccator and weigh. Repeat the operations of heating, cooling and weighing until the difference between two successive weighings does not exceed 0,1 % of the original sample mass.

Divide the sample, by screening through sieves (4.2), into fractions as follows:

4,0 mm to 8,0 mm

2,0 mm to 4,0 mm

1,0 mm to 2,0 mm

0,5 mm to 1,0 mm

0,25 mm to 0,5 mm

The bulk density (tapped) may be determined using any of these fractions, provided that the fraction is detailed in the test report. The fraction is normally decided by prior agreement.

6 Procedure

6.1 Test portion

Weigh out $100\text{ g} \pm 5\text{ g}$ of the sample to the nearest 0,1 g.

6.2 Determination

Assemble the bulk density measuring device (4.1), ensuring that the measuring cylinder (4.1.1) is vertical, and pour the test portion into the feeder (4.4).

Start the feeder and the tapping device (4.1.3) simultaneously. Transfer the test portion evenly to the measuring cylinder in a time of $45\text{ s} \pm 15\text{ s}$ and continue tapping for a total of 1 500 taps.

Flatten the surface of the test portion in the measuring cylinder with a spatula and note the volume to the nearest 1 ml.

6.3 Number of determinations

Carry out two determinations, using a fresh test portion for each determination.

6.4 Ambient temperature

Measure and note the ambient temperature of the time of the test.

7 Expression of results

Calculate the bulk density (tapped) ρ_t , expressed in grams per millilitre, of the material using the following equation:

$$\rho_t = \frac{m}{V}$$

where

m is the mass, in grams, of the test portion;

V is the volume, in millilitres, of the test portion.

Express the result as the arithmetic mean of two determinations to the nearest 0,01 g/ml.

8 Precision¹⁾

8.1 Repeatability

The difference between the values of duplicate determinations, carried out in rapid succession by the same operator using the same apparatus on the same test sample, shall not exceed the repeatability $r = 0,01\text{ g/ml}$.

8.2 Reproducibility

The difference between the values of the average of duplicate determinations obtained by two laboratories using this method for the analysis of the same laboratory sample is not expected to exceed the reproducibility limit $R = 0,02\text{ g/ml}$.

1) ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests* (now withdrawn), was used to obtain the precision data.

9 Test report

The test report shall include the following information:

- a) all details necessary for complete identification of the sample;
- b) a reference to this International Standard;
- c) the size distribution of the grain fraction or fractions used;
- d) details of oil treatment of the coke during manufacture (if known) and whether the oil had been removed prior to the test;
- e) the results, expressed in accordance with clause 7;
- f) the ambient temperature;
- g) details of any unusual features noted during the determination;
- h) details of any operation not included in this International Standard or in the International Standards to which reference is made, as well as any operation regarded as optional.

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