
**Carbonaceous materials used in the
production of aluminium — Baked
anodes and cathode blocks —**

**Part 1:
Determination of apparent density
using a dimensions method**

*Produits carbonés utilisés pour la production de l'aluminium —
Anodes cuites et blocs cathodiques —*

*Partie 1: Détermination de la masse volumique apparente par une
méthode de mesurage dimensionnel*





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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 226, *Materials for the production of primary aluminium*.

This second edition cancels and replaces the first edition, ISO 12985-1:2000, of which it constitutes a minor revision.

A list of all parts in the ISO 12985 series can be found on the ISO website.

Carbonaceous materials used in the production of aluminium — Baked anodes and cathode blocks —

Part 1: Determination of apparent density using a dimensions method

1 Scope

This document specifies a dimensions method for the determination of the apparent density of carbonaceous products used in the production of aluminium.

This method is applicable to samples with a simple or well-defined geometry (for example cylindrical, rectangular parallelepipedal or cubic) and a smooth surface profile. The accuracy of measurement is strongly influenced by the equipment used for sampling, i.e. the drilling and sawing machines.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8007-1, *Carbonaceous materials used in the production of aluminium — Sampling plans and sampling from individual units — Part 1: Cathode blocks*

ISO 8007-2, *Carbonaceous materials used in the production of aluminium — Sampling plans and sampling from individual units — Part 2: Prebaked anodes*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

The geometry of the test specimen and its mass are measured and the apparent density is calculated.

5 Apparatus

5.1 Balance, capable of weighing to the nearest 0,1 g for test specimens with a mass of 100 g or more and capable of weighing to the nearest 0,01 g for test specimens of a mass of less than 100 g.

5.2 Callipers, for measuring the sample dimensions, capable of measuring to the nearest 0,05 mm for dimensions of 30 mm or more and capable of measuring to the nearest 0,01 mm for dimensions of less than 30 mm.

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6 Sampling

Sample the cathode blocks and baked anodes in accordance with ISO 8007-1 and ISO 8007-2, respectively.

To ensure that the precision given in [Clause 8](#) is achieved, a minimum sample volume of 100 cm³ is necessary.

7 Procedure

7.1 Measurement of dimensions

Measure each dimension four times as follows:

- for a cylindrical test specimen: measure along the test specimen's length at positions on the circumference which are 90° apart and determine the diameter from measurements taken at each end and at 1/3 and 2/3 of the way along the test specimen's length;
- for a rectangular parallelepipedical test specimen: measure the length in a similar manner to that described for a cylinder and measure the major and minor axes in a similar manner to that described for the measurement of the diameter of a cylinder.

EXAMPLE Cylinders: the area is calculated from the mean of square diameters.

7.2 Determination of dry mass

Dry the test specimen until it maintains a constant mass by heating at (110 ± 5) °C for a minimum of 2 h or until consecutive weighings at 5 min intervals differ by less than 0,1 %. Cool the test specimen in a desiccator until it reaches room temperature and weigh the mass m_1 .

8 Calculation

Calculate the volume V of the test specimen according to its geometrical formula and by using the mean values of each dimension; round off to 0,1 cm³ for volumes larger than 100 cm³ and to 0,01 cm³ for smaller volumes.

Calculate the apparent density ρ_a , expressed in grams per cubic centimetre, of the test specimen using the formula:

$$\rho_a = \frac{m_1}{V}$$

where

m_1 is the dry mass, expressed in grams;

V is the calculated volume, expressed in cubic centimetres.

Report the results to the third decimal place.

9 Precision

9.1 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 limit, r , as follows:

$$r = 0,004 \text{ g/cm}^3$$

9.2 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 , as follows:

$$R = 0,008 \text{ g/cm}^3$$

10 Test report

The test report shall include the following information:

- a) an identification of the sample;
- b) the International Standard used (including its year of publication);
- c) the method used (if the standard includes several);
- d) the date of the test;
- e) the result(s), including a reference to the clause which explains how the results were calculated;
- f) any deviations from the procedure;
- g) any unusual features observed.

Bibliography

- [1] ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*
- [2] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*
- [3] ISO 5725-3, *Accuracy (trueness and precision) of measurement methods and results — Part 3: Intermediate measures of the precision of a standard measurement method*
- [4] ISO 5725-4, *Accuracy (trueness and precision) of measurement methods and results — Part 4: Basic methods for the determination of the trueness of a standard measurement method*
- [5] ISO 5725-5, *Accuracy (trueness and precision) of measurement methods and results — Part 5: Alternative methods for the determination of the precision of a standard measurement method*
- [6] ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

