

Standard Guide for Sampling Plan and Core Sampling for Prebaked Anodes Used in Aluminum Production¹

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1. Scope

1.1 This guide covers sampling for prebaked carbon anodes used in the production of aluminum, and details procedures for taking test samples from anode blocks. It covers equipment and procedures for obtaining samples from anode blocks in a manner that does not destroy the block or prevent its subsequent use as originally intended. However, the user must determine the subsequent use of the sampled anode blocks. Preferred locations for taking samples from single units of anodes are covered in this guide.

1.1.1 Information for sampling of shaped refractory products, in general, is given in ISO 5022. This standard details the statistical basis for sampling plans for acceptance testing of a consignment or lot. Anodes used in the production of aluminum have specific requirements for sampling and while the statistical basis for sampling given in ISO 5022 applies, further or modified requirements may also apply.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—The following ASTM standards are noted as sources of useful information: Test Methods C 559, C 611, C 651, C 747, C 1025, C 1039, and C 1225.

2. Referenced Documents

2.1 ASTM Standards:²

- C 559 Test Method for Bulk Density by Physical Measurements of Manufactured Carbon and Graphite Articles
- C 611 Test Method for Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature

- C 651 Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Four-Point Loading at Room Temperature
- C 747 Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance

- C 1025 Test Method for Modulus of Rupture in Bending of Electrode Graphite
- C 1039 Test Methods for Apparent Porosity, Apparent Specific Gravity, and Bulk Density of Graphite Electrodes

- C 1225 Test Method for Thermal Conductivity of Solids by Means of the Guarded-Comparative-Longitudinal Heat Flow Technique

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

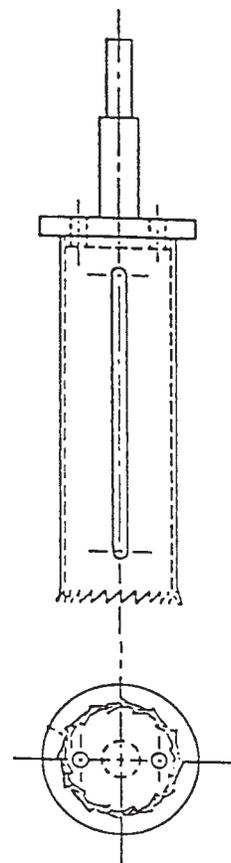


FIG. 1 Typical Core Drill Bit

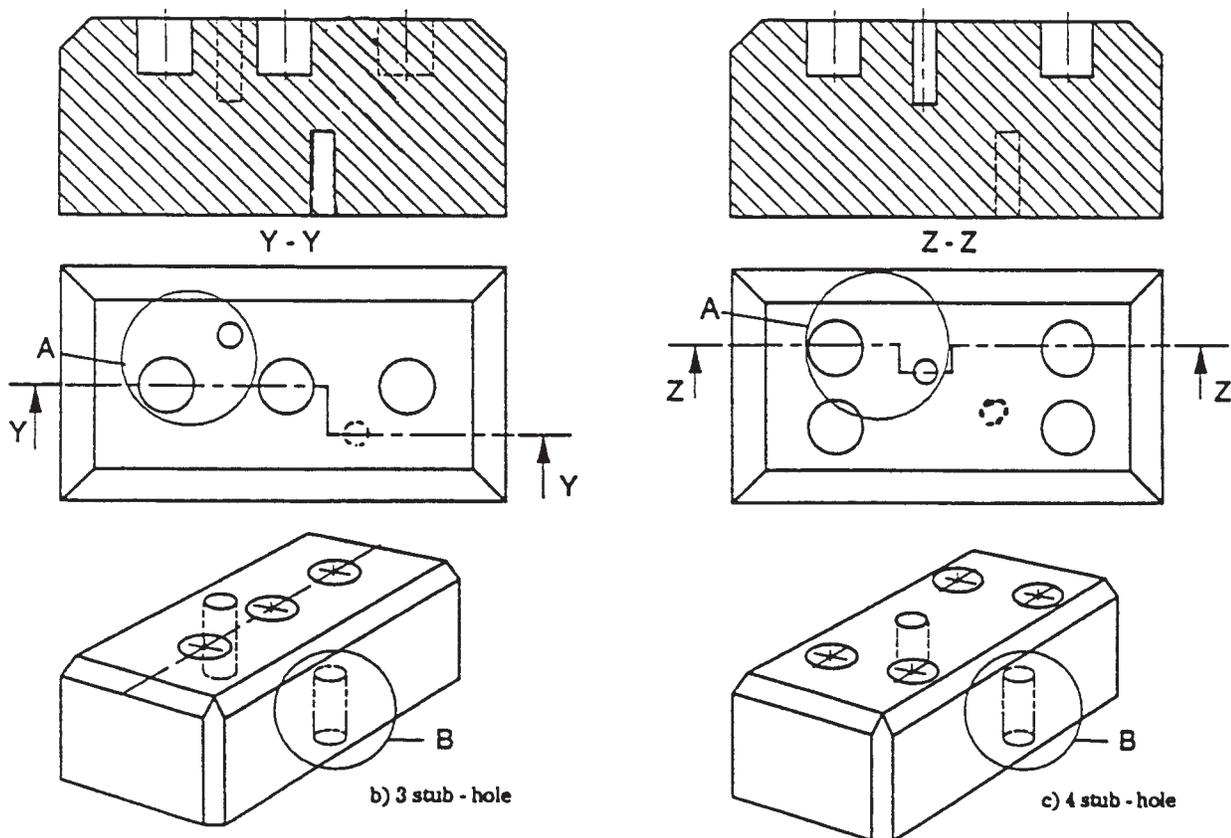
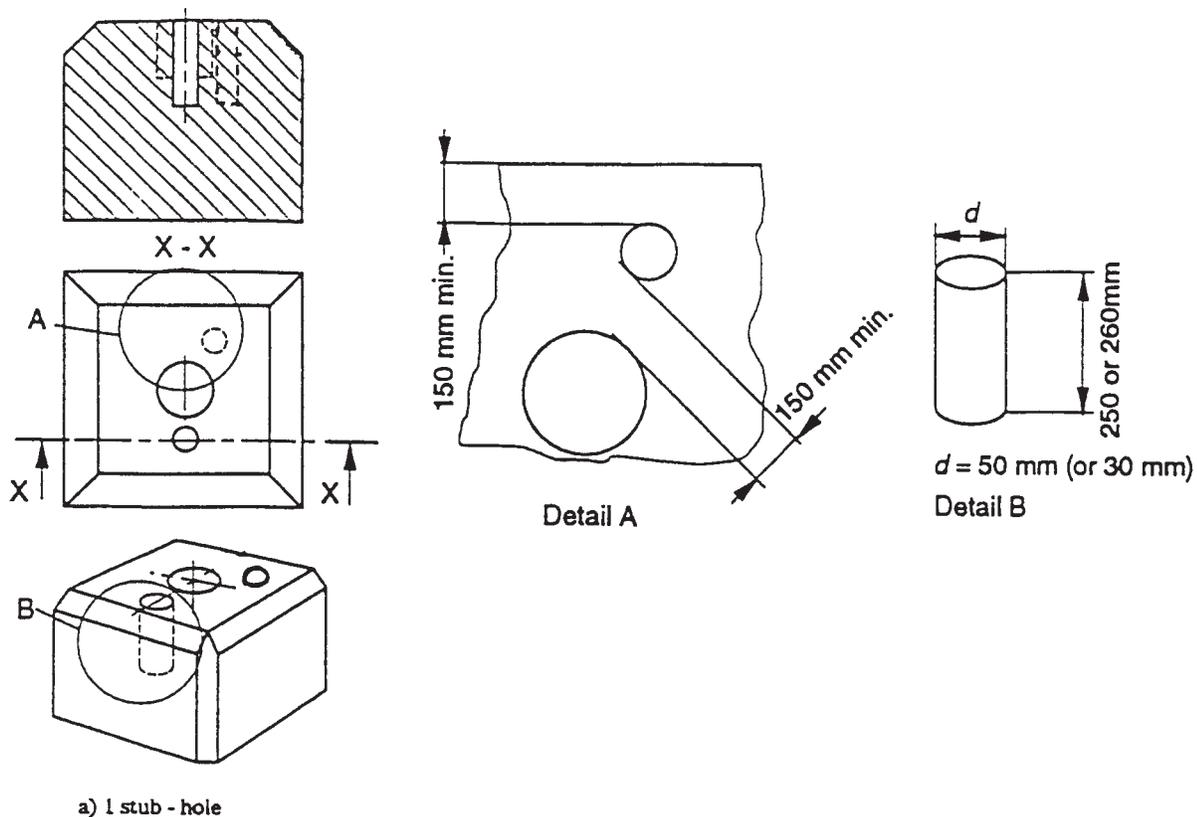


FIG. 2 Examples of the Location and the Direction of Sampling for Different Sizes and Designs of Anode Blocks

2.2 ISO Standards:³

ISO 8007-2 Carbonaceous materials used in the production of aluminum - Prebaked anodes - Sampling plan and sampling from single units

ISO 5022 Shaped refractory products - Sampling and acceptance testing

3. Terminology

3.1 Definitions:

3.1.1 *block*—a carbon anode, a single unit.

3.1.2 *sample*—the portion of carbon obtained from an anode.

3.1.3 *test specimen*—an article prepared from a sample.

3.1.4 *prebaked*—a baked carbon article or block.

4. Significance and Use

4.1 Core sampling is an acceptable way of obtaining a test specimen without destroying the usefulness of an anode block.

4.1.1 Test specimen obtained by this guide can be used by producers and users of carbon anodes for the purpose of conducting the tests in Note 1 to obtain comparative physical properties.

4.2 Sampling shall not weaken the anode or increase the likelihood of premature failure.

5. Apparatus

5.1 *Core Drill Bit*, similar to that shown in Fig. 1, driven by suitable equipment. Use bits with cutting teeth coated with diamond or other extremely hard material.

6. Procedure

6.1 Examples of sampling locations for anode blocks of different sizes and designs are shown in Fig. 2.

6.2 Dimensions of a cored test sample will depend upon the test that is to be performed on the sample. Reference should be made to the standards relating to the tests to be performed to ensure that the samples taken are of suitable dimensions. The minimum dimension (usually the diameter) should be at least

three times the maximum particle size of the dry aggregate used in the manufacture of the anode block. The dimensions of the sample shall also allow for the provision of parallel sides.

6.2.1 The specific dimensions of the test specimens to be tested are normally given in the appropriate standard. Where a standard does not specify the dimensions of the test specimen, a diameter of 50 mm is recommended. The length of the test specimen should be at least one and a half times the diameter.

6.3 Place the core drill bit firmly against the anode block. Take care to maintain the bit vertical or horizontal and true. Do not stop until the bit is embedded to its full length. Compressed air can be used to cool the drill bit and remove dust during drilling. Do not use water or other liquid lubricants.

6.3.1 To remove the bit, pull and twist it out by hand, or carefully withdraw the drill bit while it is rotating. To remove the core sample, insert a wedge between it and the anode block until the core snaps off at the bottom of the hole.

7. Report

7.1 The sampling report shall include the following:

7.1.1 Names of producer and customer,

7.1.2 Manufacturer's identification of the lot or batch of anode blocks being sampled,

7.1.3 Reference to this guide and to the standards describing the tests to be carried out on the samples,

7.1.4 Date and place of sampling.

7.1.5 If sampling according to a plan described in ISO 5022 or other standard, complete details of the sampling plan being followed should be given,

7.1.6 Sketches, similar to those in Fig. 2, showing the location on the anode block from which samples were taken and the direction of sampling (vertical or horizontal),

7.1.7 The dimensions of the test samples,

7.1.8 Identification of the people doing the sampling,

7.1.9 Any unusual features noted during the sampling, and

7.1.10 Any procedures or operations not included in this guide or in the standards to which reference is made or that are regarded as optional.

8. Keywords

8.1 anode; anthracite; carbon; core; graphite; prebaked; sample; sampling; test specimens

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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