



Standard Guide for Sampling Plan and Core Sampling of Carbon Cathode Blocks Used in Aluminum Production¹

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1. Scope

1.1 This guide covers sampling of carbon cathode blocks used in the production of aluminum, and details procedures for taking test samples from single cathode blocks. It covers equipment and procedures for obtaining samples from cathode 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 cathode blocks. Preferred locations for taking samples from single units of cathodes 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. Cathode blocks used in the production of aluminum have specific requirements of 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 standard. No other units of measurement are included in this 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 [C559](#), [C611](#), [C651](#), [C747](#), [C1025](#), [C1039](#), and [C1225](#).

2. Referenced Documents

2.1 ASTM Standards:²

[C559](#) Test Method for Bulk Density by Physical Measure-

ments of Manufactured Carbon and Graphite Articles

[C611](#) Test Method for Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature

[C651](#) Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Four-Point Loading at Room Temperature

[C747](#) Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance

[C1025](#) Test Method for Modulus of Rupture in Bending of Electrode Graphite

[C1039](#) Test Methods for Apparent Porosity, Apparent Specific Gravity, and Bulk Density of Graphite Electrodes

[C1225](#) Specification for Fiber-Cement Roofing Shingles, Shakes, and Slates

2.2 ISO Standards:³

ISO 8007-1 Carbonaceous materials used in the production of aluminum - Cathodic blocks - Sampling plan and sampling from single cathodic blocks

[ISO 5022](#) Shaped refractory products - Sampling and acceptance testing

3. Terminology

3.1 Definitions:

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

3.1.2 *sample*—the portion of carbon obtained from a cathode.

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

4. Significance and Use

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

4.1.1 Test specimens obtained by this guide can be used by producers and users of cathode blocks for the purpose of conducting the tests in [Note 1](#) to obtain comparative physical properties.

4.2 Sampling shall not weaken the cathode or increase the likelihood of premature failure. Extreme care shall be exercised when taking vertically drilled samples.

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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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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 Sampling locations for cathode blocks that were vibrated, pressed, or extruded without a collector bar slot will differ from those blocks that were formed with collector bar slots.

6.1.1 For cathode blocks without collector bar slots, samples shall be drilled from the part of the block that will be machined out for the slot, as shown in Fig. 2. Care is to be taken to ensure that cores drilled vertical to the slot do not penetrate beyond the depth of the slot.

6.1.2 For cathode blocks with collector bar slots, samples shall be drilled from the block, as shown in Fig. 3. If the user

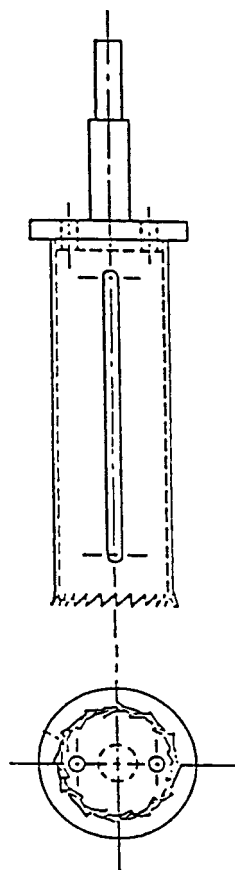


FIG. 1 Typical Core Drill Bit

determines that cathode blocks with sample holes drilled in them cannot be used in the electrolysis process, then it will be necessary to obtain a number of cathode blocks with the extra length, as shown in Fig. 3. The extra length will then have to be removed prior to block use.

6.2 Dimensions of a cored test sample will depend upon the test that is to be performed on the sample. The minimum dimension (usually the diameter) shall be at least three times the maximum particle size of the dry aggregate used in the manufacture of the cathode block. Reference should be made to the standards relating to the tests to be performed to ensure that the samples taken are to suitable dimensions.

6.2.1 The specific dimensions of the test specimens to be tested are normally given in the appropriate ASTM standard. Where a standard does not specify the dimensions of the test specimen, a diameter of 30 or 50 mm is recommended. The length of the test specimens should be at least one and a half times the diameter.

6.3 Place the core drill bit firmly against the cathode block. Take care to maintain the bit level and true. Do not stop until the bit is embedded its full length. Compressed air can be used to cool the drill bit and remove dust while drilling. Do not use water or other liquids to cool the drill bit.

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

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 cathode blocks being sampled,
- 7.1.3 Reference to this guide,
- 7.1.4 Date and place of sampling,
- 7.1.5 If extra length cathode blocks were available for sampling, the proportion and number are to be noted,
- 7.1.6 Sketches, similar to those in Fig. 2 and Fig. 3, showing the location of the sampling locations and the direction of sampling (horizontally or vertically),
- 7.1.7 The dimensions of the tests samples,
- 7.1.8 Identification of the people doing the sampling, and
- 7.1.9 Complete details of sampling plan being followed.

8. Keywords

8.1 anthracite; carbon; cathodes; core; graphite; sample; sampling; test specimens

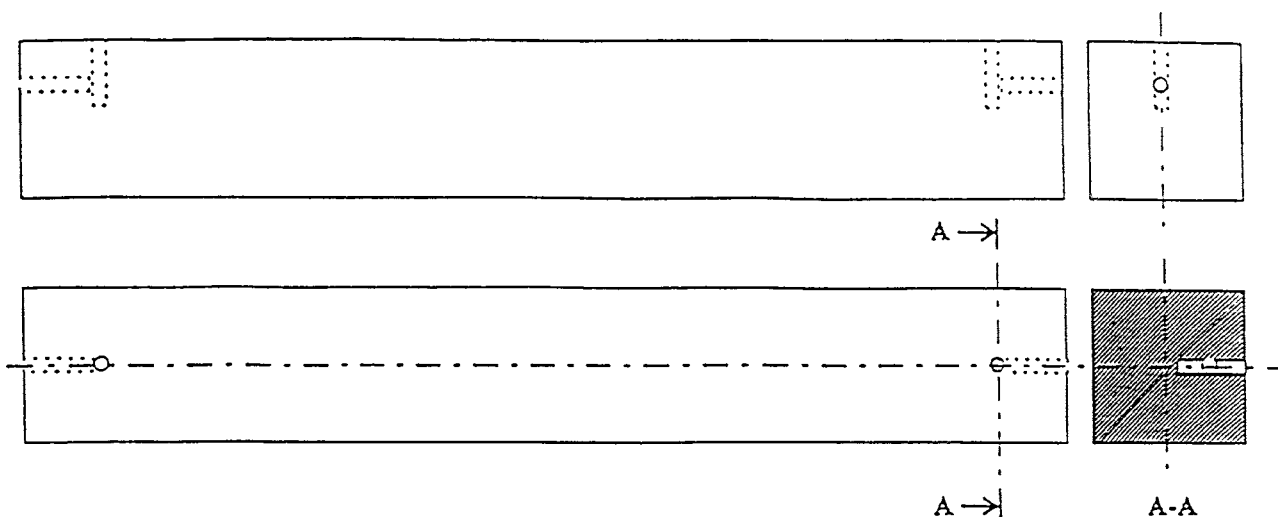


FIG. 2 Sampling from Single Units Produced Without Slot

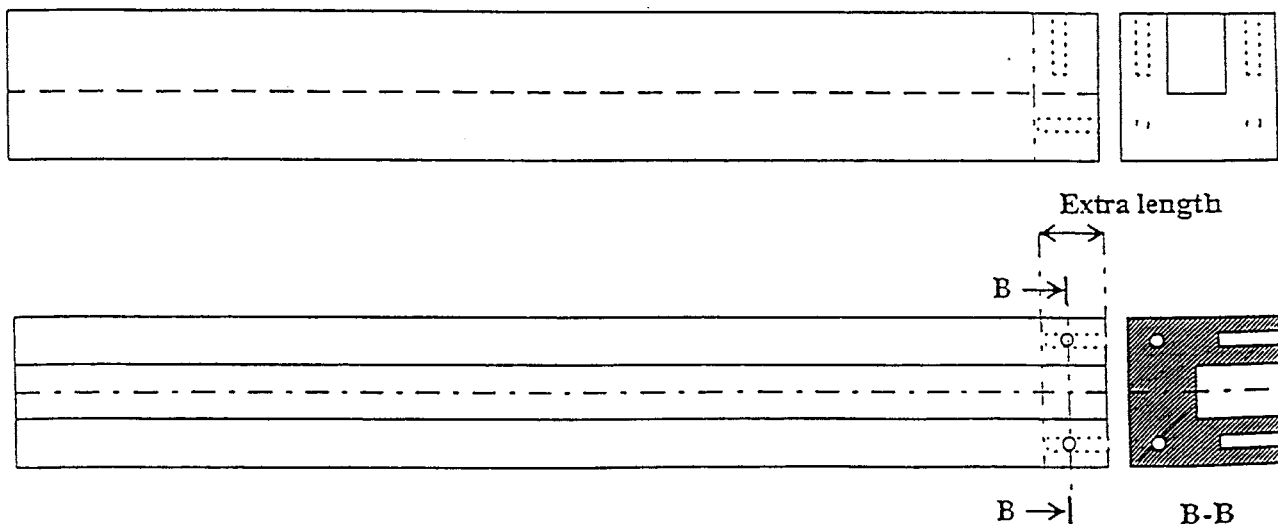


FIG. 3 Sampling from Single Units Produced with Slot

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