



Standard Practice for Drip Slag Testing Refractory Materials at High Temperature¹

This standard is issued under the fixed designation C 768; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes a procedure for comparing the behavior of refractories to the action of molten slag dripped onto test specimens within a heated furnace. No numeric results are obtained from this practice. Numeric evaluation of test results is the responsibility of the test operator.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

2. Significance and Use

2.1 This practice outlines a procedure which, when appropriate evaluation methods are added, can be useful in the development of new products or in the selection of products to be used in contact with a particular slag composition.

2.2 Since the entire test specimen is at the test temperature, penetration of the slag into the sample is promoted and may exceed that observed when the temperature gradient, typical of most refractory applications, is present. The test slag is constantly renewed so that a high rate of corrosion is maintained.

2.3 Oxidation of carbon-containing materials may occur as the entire sample is not covered by slag. A reference refractory specimen should be used for comparison.

3. Apparatus

3.1 The apparatus shall consist of a suitable electrically heated furnace which is capable of attaining and holding temperatures up to 2950°F (1620°C). A furnace chamber 15 by 20 by 12-in. (381 by 510 by 305-mm) deep is suggested.

3.1.1 As an alternative, a furnace of suitable size using gas or oil as a fuel may also be used. Care should be exercised in designing the burners and their placement to avoid excessive turbulence and velocity of gases across the test specimens.

3.2 The furnace should be equipped with water-cooled feed tubes of approximately 5/8-in. (16-mm) inside diameter positioned so the melting slag will be directed onto the inclined faces of the test specimens. The tubes should be located a minimum of 5½ in. (140 mm) apart, terminate about 1 in. (25 mm) inside the furnace wall, and be mounted at an angle of approximately 10° with the horizontal (low ends inside the furnace) (Fig. 1).

3.3 The bottom of the furnace should be constructed to provide a base for the specimen supports and a sand pit to receive the spent slag.

3.4 A device, with a variable-speed drive, should be provided to feed slag in the form of preformed rods at a constant rate. The rate of feed for each slag composition should be established so that melting takes place beyond the end of the mullite tubes.

3.5 Above a furnace temperature of 1470°F (800°C), the furnace atmosphere within the test furnace shall contain a minimum of 0.5 % oxygen with 0 % combustibles.

NOTE 1—If reducing conditions within electrically heated furnaces are desired, coke breeze can be used in the furnace bottom instead of sand.

3.6 It is recommended that the furnace temperature be controlled with a platinum-rhodium/platinum thermocouple connected to a program controller-recorder. The thermocouple should be located as near as possible to the specimens but positioned to avoid being contaminated by slag. If desired, a radiation pyrometer sighted on an unslagged surface of a specimen may be used.

4. Test Specimens and Support

4.1 Prepare two specimens for each test run.

4.2 The test specimen should have a thickness of 2½ or 3 in. (64 or 76 mm) and an original 4½ by 4½-in. (114 by 114-mm) surface that will receive the molten slag. The thickness of one end of the specimen shall be cut at a 30° angle to permit mounting it near the furnace wall (Fig. 2). If the tester desires to test a cut surface of a specimen, this fact should be reported under Section 8.

4.3 A support brick, compatible with the test specimen, shall be provided for each specimen. The top of the support shall also be cut on an angle of 30°. The side of the support opposite the wall shall be provided with a V-shaped notch about 3 in.

¹ This practice is under the jurisdiction of ASTM Committee C-8 on Refractories and is the direct responsibility of Subcommittee C08.04 on Chemical Behaviors.

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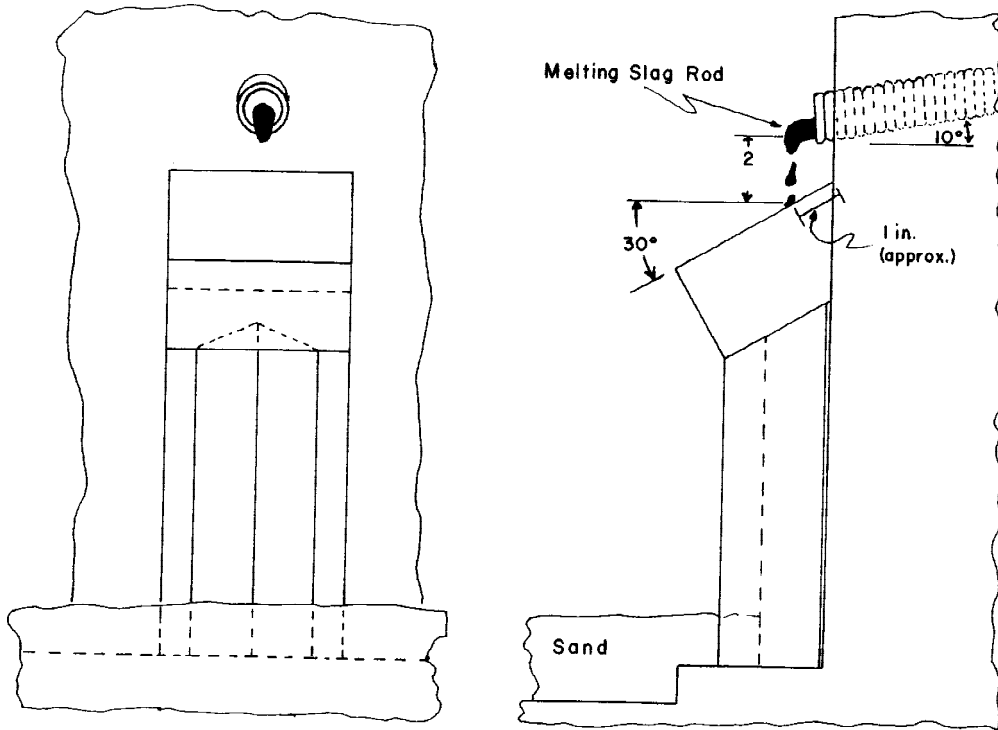
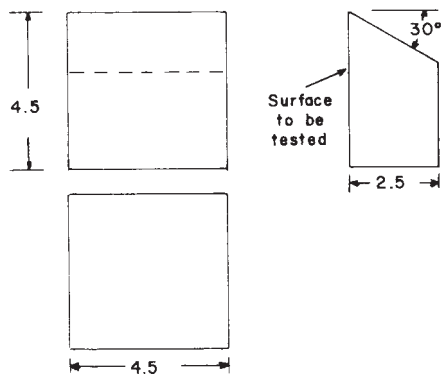


TABLE 1 SI Equivalents

| in. | 1 | 2 | 2.5 | 3 | 4.5 | 9 |
|-----|----|----|-----|----|-----|-----|
| mm | 25 | 51 | 64 | 76 | 114 | 228 |

NOTE 1—Dimensions are in inches.

FIG. 1 Typical Placement of Specimens

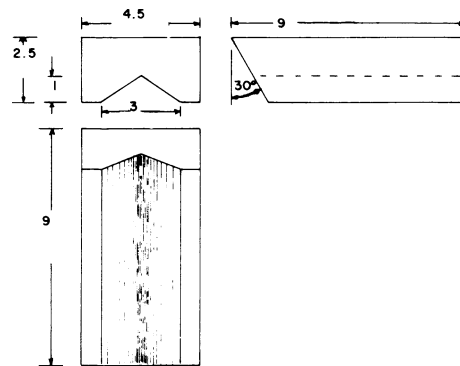


NOTE 1—Dimensions are in inches.

NOTE 2—See Fig. 1 for SI equivalents.

NOTE 3—Specimen may be 3 in. (76 mm) thick.

FIG. 2 Test Specimen



NOTE 1—Dimensions are in inches.

NOTE 2—See Fig. 1 for SI equivalents.

FIG. 3 Specimen Support

(76 mm) wide and 1 in. (25 mm) deep cut into its length to minimize slag attack of the support (Fig. 3).

5. Slag Rods

5.1 The material used for producing slag rods may be a furnace slag, furnace charge materials, a mixture of materials designed to duplicate a slag, etc.

5.2 The slag to be used for each test shall be ground to pass an ASTM No. 30 (600- μ m) sieve (equivalent to a 28-mesh Tyler Standard Series), and organic plasticizers, suspending agents or binders such as lignin liquor, dextrine, or starches shall be added to facilitate the manufacture of rods by casting, extruding, or tamping. The rods should be 1/2 in. (13 mm) in diameter and 10 to 12 in. (254 to 305 mm) long.

6. Setting Test Specimens

6.1 Mount the test specimens by mortaring or keying to the support brick. Position the specimens within the furnace so the test surfaces are at an angle of 30° from the horizontal, position centrally under the water-cooled tubes, and mount so the slag will drip about 1 in. (25 mm) from the top edges. Mount the specimens so the top surfaces are vertically 2 in. (51 mm) below the bottom inside of the tubes.

7. Procedure

7.1 *Heating*—Any heating rate that is not damaging to the test specimens can be used to heat the furnace to the prescribed test temperature (established by tester depending on slag used). Hold the maximum temperature for at least 15 min to establish equilibrium before the slag is fed. Maintain the furnace temperature within $\pm 10^{\circ}\text{F}$ ($\pm 5.5^{\circ}\text{C}$) from that specified. Allow not more than 10°F difference in temperature between specimens being tested.

7.2 *Length of Test*—The length of the test will be dependent on the amount and type of slag specified to be used; 300 to 800 g of slag usually produces the desired amount of erosion for effective evaluation. Two to seven hours is the usual range of time required for slag feeding.

7.2.1 One or more exploratory runs may be required to determine the amount of slag to be used for any given type of slag, test temperature and type of brick being tested.

7.3 *Slag Feed*—After the hold temperature has been maintained for 15 min, start the slag flow and feed the slag continuously at a rate that will allow for consistent melting and dripping onto the specimens. Adjust the rate of feed so the slag melts outside the mullite tubes.

7.3.1 In any comparative set of tests using a given slag composition and furnace temperature, keep the rate of slag feed the same as determined by 7.2.1.

7.4 *Completion of Test*—After all the slag has been melted onto the test specimen, maintain the hold temperature for an additional 15 min to permit drainage of excess slag.

7.4.1 After cooling, remove the specimens from their supports and examine them for irregular or improper slag flow.

8. Report

8.1 Report the following information:

8.1.1 Surface tested (cut or original),

8.1.2 Test temperature,

8.1.3 Weight of slag in grams,

8.1.4 Time taken to feed slag,

8.1.5 Slag analysis,

8.1.6 Observations as to the condition of the specimens after testing. It may be desirable to cut the specimens in half and expose a cross-sectional view.

8.1.6.1 These observations may be, but are not limited to: photographs, written comments, depth or volume of slag cut, depth or volume of slag penetration, change of mineralogy, and development of cracks in the specimens. Procedures used to obtain numerical results involving slag cut or penetration, or both, of the specimens need to be included in the report.

8.1.7 Appearance of specimens.

8.2 If it is impossible to obtain any of the items to be reported, this should be noted in the report.

9. Keywords

9.1 corrosion; drip; penetration; refractories; slag

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