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AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Test Method for Corrosion Resistance of Refractories to Molten Glass Using the Basin Furnace¹

This standard is issued under the fixed designation C 622; 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 test method measures the attack on refractories by molten glass under conditions intended to simulate glass-contact service by exposing one face of the refractory to be tested to molten glass while a temperature gradient is maintained through the refractory.

NOTE 1—Since the test method is intended primarily for soda-lime-silica glasses, some modification of the conditions, procedure, or apparatus may be required for other compositional systems.

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. Referenced Documents

2.1 ASTM Standards:

C 154 Test Method for Warpage of Refractory Brick and Tile, or Deviation from a Plane Surface²

E 220 Method for Calibration of Thermocouples by Comparison Techniques³

3. Significance and Use

3.1 This test method utilizes block sections of refractories that are exposed to molten glass on only one face, and a thermal gradient that simulates actual service conditions is maintained through the wall thickness.

3.2 This procedure is suitable for comparing simultaneously the corrosion behavior of two or more refractories.

3.3 The reactant glass is not replaced and does become contaminated with refractory solution products which can modify the degree of refractory attack. Because of the geometry of the test furnace, refractories positioned at the ends may show a different degree of attack than those located at the sides.

Results from this test cannot be used to predict refractory life in service since the operational and demand aspects for production furnaces vary widely.

4. Apparatus

4.1 The apparatus shall consist of the test furnace⁴ and means for evaluating the amount of attack as illustrated in Fig. 1.

4.2 Furnace:

4.2.1 The furnace shall consist of (1) a test basin whose walls are constructed of the test specimens, and (2) a superimposed burner chamber. For convenience in setting and removing the test specimens, the two furnace elements shall be separable by raising or lowering one from the other.

4.2.2 The furnace shall be fired with gas. The temperature control system shall be capable of maintaining a desired holding temperature with a tolerance of $\pm 0.3\%$.

4.3 Evaluation Equipment:

4.3.1 The evaluation apparatus is illustrated in Fig. 1 and is described as follows:

4.3.1.1 *Surface Plate*—A suitable flat (0.005 in. (0.13 mm) maximum deviation measured across diagonals) plate, 24 by 24 by $\frac{1}{2}$ in. (610 by 610 by 13 mm) to be used as a base for the measuring equipment.

4.3.1.2 *Specimen-Leveling Device*—A fabricated metal box, inside dimensions 11 by 6 by 1 in. (279 by 152 by 25 mm) deep, mounted on a metal plate equipped with three leveling screws. The box shall be filled with sand, which forms a bed for the brick specimen to be measured.

4.3.1.3 *Movable Pedestal*—A flat metal block, 6 by 3 by 1 in. (152 by 76 by 25 mm) equipped with an upright steel rod $\frac{3}{4}$ in. (19 mm) in diameter by 12 in. (305 mm) high, to which a movable clamp and extension rod shall be attached that allows both a horizontal and vertical movement over the specimen. At the end of the 9-in. (229-mm) long extension rod shall be a clamp that provides for the attachment of the dial indicator.

4.3.1.4 *Dial Indicator*—A good quality dial indicator with a range from 0.001 to 1.000 in. (0.03 to 25.40 mm) to attach to the extension rod.

4.3.1.5 *Spirit Level*—To level specimen.

¹ This test method is under the jurisdiction of ASTM Committee C-8 on Refractories and is the direct responsibility of Subcommittee C08.10 on Refractories for Glass.

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² Discontinued. See 1984 *Annual Book of ASTM Standards*, Vol 15.01.

³ Discontinued. See 1994 *Annual Book of ASTM Standards*, Vol 14.03.

⁴ A detailed drawing of this apparatus, Schematic of ASTM Corrosion Test Furnace, is available from ASTM Headquarters. Request Adjunct No. 12-306220-00.

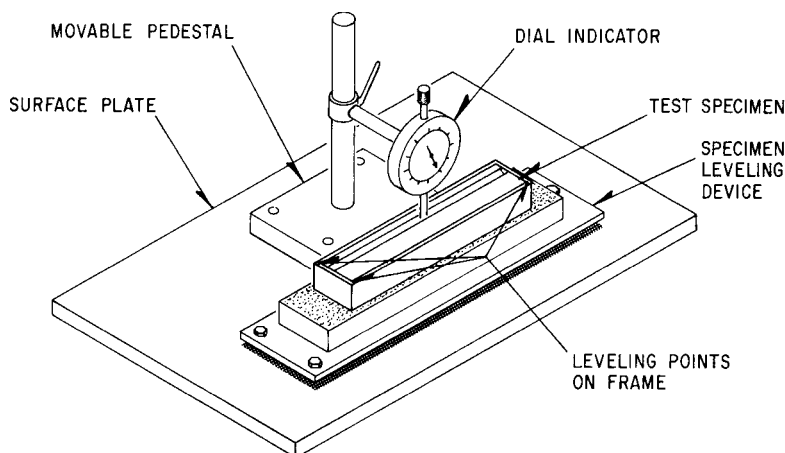


FIG. 1 Corrosion Evaluation-Apparatus

4.3.1.6 *Rule*—A good quality steel rule 12-in. (305-mm), to strike off the sand and determine volume loss.

5. Test Specimens

5.1 Test specimens shall have the following characteristics:

5.1.1 *Dimensions*:

5.1.1.1 *Length*— $9 \pm \frac{1}{16}$ in. (230 ± 2 mm).

5.1.1.2 *Width*— $2\frac{1}{2} \pm \frac{1}{16}$ in. (65 ± 2 mm).

5.1.1.3 *Height*— $4\frac{1}{2} \pm \frac{1}{16}$ in. (114 ± 2 mm).

5.1.2 *Flatness*—The 9 by $4\frac{1}{2}$ -in. (230 by 114-mm) surfaces should be flat to $\frac{1}{32}$ in. (0.8 mm), using Test Method C 154.

5.1.3 *Orientation*—Depending on the particular material(s) being tested, the section of the parent material from which the hot face or corrosion face is cut should be specified. This is particularly necessary where the material is not homogeneous throughout its cross section.

5.1.4 *Selection*—Only samples that are free of defects such as cracks, fissures, voids, etc., should be used. Where obvious defects in the specimen appear after testing is completed, the results should be disregarded and testing repeated.

6. Preparation of Apparatus

6.1 *Test Basin*—The test basin shall be constructed in the manner described below:

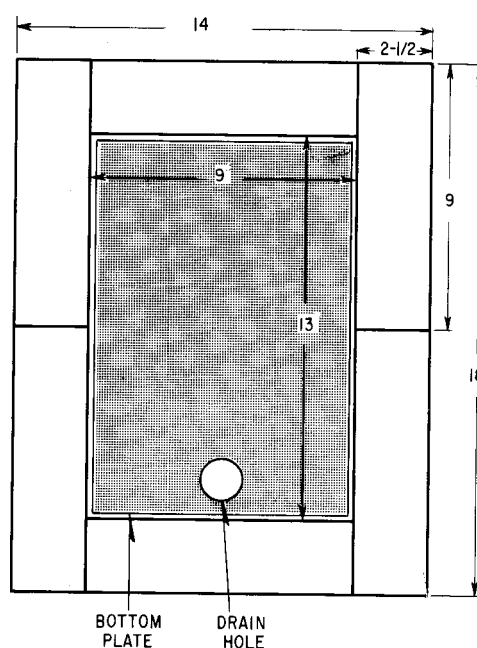
6.1.1 The test-basin side walls shall be constructed from six test specimens set on edge as shown in Fig. 2. The four test specimens shall be set on edge, occupying the four side positions of the test basin.

6.1.2 When more than one type of material is tested, the relative position of each should be planned and recorded.

6.1.3 The maximum distance between adjacent test specimens or between the test specimens and the bottom paver should not exceed $\frac{1}{32}$ in. (0.8 mm) including mortar.

6.1.4 If test specimens are cemented together or to the bottom, a bonding mortar physically and chemically compatible with the joined materials should be used.

6.1.5 The bottom paver should be made from a solid piece of vacuum-cast clay flux block that is compatible with most glasses, easily cut and shaped, not a serious contaminant, and sufficiently resistant to glass corrosion when used as a bottom paver. It should be of proper dimension to just fit inside the opening made by the basin walls according to the $\frac{1}{32}$ -in.



NOTE 1—Dimensions are in inches.

	SI Equivalents				
in.	2½	9	13	14	18
mm	65	230	330	356	457

FIG. 2 Plan View of Specimen Setting

(0.8-mm) gap tolerance specification. The approximate bulk density of suitable material is 135 lb/ft³ (2.16 g/cm³) and the chemical make-up is approximately 65 % silica (SiO₂) and 33 % aluminum oxide (Al₂O₃). The thermal conductivity curve is given in Fig. 3.

6.1.6 The previously mentioned described walls and bottom shall be backed up with $\frac{3}{4}$ in. (19 mm) of mullite ramming mix packed to a density of approximately 152 lb/ft³ (2.43 g/cm³). This shall be backed with $4\frac{1}{2}$ in. (114 mm) of bubble alumina (Group 33) insulating brick of approximately 86 lb/ft³ (1.38 g/cm³) bulk density and approximate chemical composition of 81 % Al₂O₃ and 17 % SiO₂. The insulating brick shall be backed with an insulating ceramic fiber board. The typical thermal conductivity curves for the ramming mix, the bubble alumina insulating brick, and the insulating board are given in