Designation: E 514 – 90 (Reapproved 1996)ε1

Standard Test Method for Water Penetration and Leakage Through Masonry[1]

This standard is issued under the fixed designation E 514; 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.

This standard has been approved for use by agencies of the Department of Defense.

ε[1] NOTE—Keywords were added editorially in June 1996.

1. Scope

1.1 This laboratory test method[2] provides a procedure for determining the resistance to water penetration and leakage through unit masonry subjected to wind-driven rain.

1.2 *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.* For a specific hazard statement see Section 5.

2. Referenced Documents

2.1 *American Concrete Institute Standard:*[3]

ACI 531 Building Code Requirements for Concrete Masonry Structures

2.2 *Brick Institute of America Standard:*[4]

Construction of Brick Masonry, *Building Code Requirements for Engineered Brick Masonry*

3. Significance and Use

3.1 This test method allows obtaining information that aids in evaluating the effect of four principal variables: the quality of materials, coatings, wall design, and workmanship.

3.2 Water penetration and leakage through masonry is significantly affected by air pressure in the test chamber. Data from tests made at different pressures are not comparable.

3.3 In applying the test method results, it should be noted that the performance of a masonry wall is the function of materials, construction, and wall design. In service the performance will also depend on the rigidity of supporting structure and on the resistance of components to deterioration by various causes, such as corrosion, vibration, thermal expansion and contraction, curing, and others. It is impossible to simulate the complex conditions encountered in service, such as variations in wind velocity, negative pressure, and lateral or upward moving air and water. Factors such as geographical location, topographic exposure, and wall openings should be fully considered also.

3.4 Given the complexity of variables noted above, this test method is of primary use to establish comparative behavior between various masonry wall constructions in a given laboratory.

3.5 In fact, even when two laboratories test the same wall design utilizing the same wall materials and the same construction practices, variables such as the level of skill of the mason building the specimen, the temperature and humidity in the laboratory at the time of construction and curing of the specimen, the moisture contents of the materials used to build the specimen and even the use or lack of use of a lime and water wash on the back of the specimen can affect the results of the test making reliable comparisons between laboratories dubious. For these reasons and the multi-variables listed in 3.1, 3.2, and 3.3, a meaningful, useful, absolute wall leakage rating standard is impractical and discouraged by this test method.

4. Apparatus

4.1 *Test Chamber*—The test chamber shall be similar to that shown in Fig. 1 and Fig. 2 and may be constructed of metal, wood, or plastic. It shall provide an opening with a minimum area of 1.08 m^2(12 ft^2). For example, 900 mm (36 in.) wide and 1200 mm (48 in.) high is suitable. Edges of the chamber in contact with the specimen shall be lined with a closed-cell compressible gasket material. An observation port shall be provided in the face of the chamber. The 19.0-mm (¾-in.) diameter corrosion-resistant spray pipe shall have a single line of 1.0-mm (0.04-in.) diameter holes spaced 25.0 mm (1 in.) apart.

4.2 *Fixtures and Appurtenances to Chamber*—Fixtures and appurtenances to the chamber shall consist of an air line with manometer, a water line with valves, an orifice meter and

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[2] This test method is based upon those used by the National Bureau of Standards and described in *NBS Report BMS7*, "Water Permeability of Masonry Walls," 1933, and *NBS Report BMS82*, "Water Permeability of Walls Built of Masonry Units," 1942.

[3] Available from American Concrete Inst., P. O. Box 19150, Detroit, MI 48219.

[4] Available from Brick Institute of America, 11490 Commerce Park Dr., Suite 300, Reston, VA 22091.

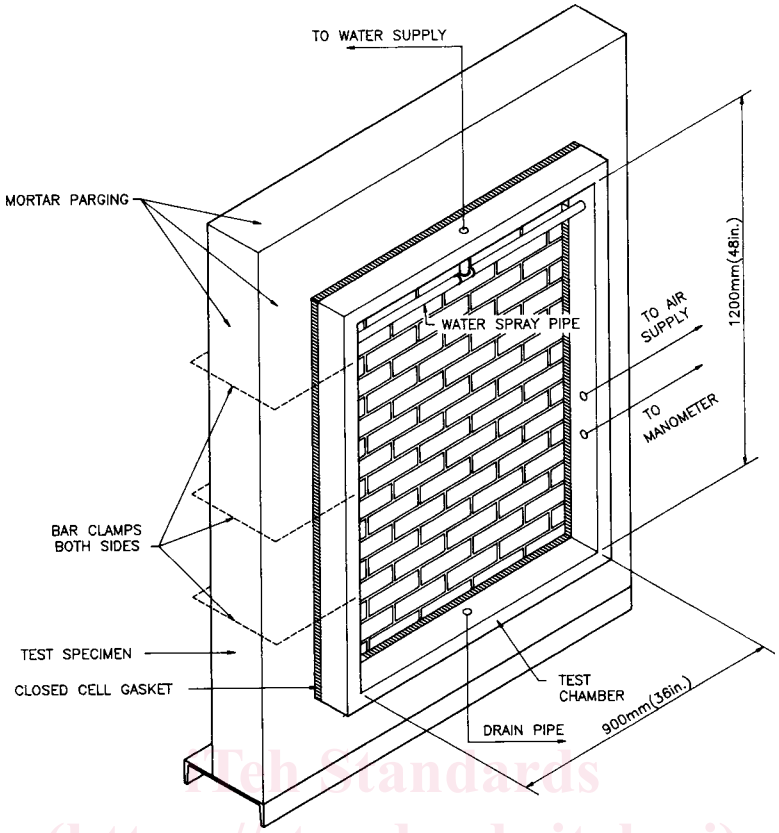

FIG. 1 Isometric Projection of Testing Chamber

manometer and a water drain pipe at the bottom of the chamber. The water spray pipe shall be positioned so that the water impinges the specimen not more than 75.0 mm (3.00 in.) below the top of the test chamber. The drain pipe may discharge into a container equipped with an adjustable depth air outlet pipe and top baffles to reduce surge.

4.3 Other equipment shall consist of devices for handling the specimen and measuring time, water quantities, temperature, humidity, and air pressure within the test chamber.

5. Hazards

5.1 The user is cautioned that the use of this test method will require careful design consideration of both air chamber and support of the wall system in order to avoid possible injury due to equipment or specimen failure.

6. Temperature and Humidity Conditions

6.1 The air in the laboratory shall be maintained at a temperature of 24 ± 8°C (75 ± 15°F) and a relative humidity of not less than 30 % and not more than 80 %.

7. Test Specimens

7.1 *Masonry Materials*—Masonry and associated materials shall be representative of the construction or the materials that are being considered for the construction. Precondition all materials to a stable condition by storing in laboratory environment for not less than 5 days before use.

7.2 *Size of Test Walls*—The height and length of the specimen shall provide a minimum of 1.08 m^2 (12 ft^2) exposed to the test, plus at least a 200-mm (8-in.) overlap on all edges. The minimum height or length of the specimen shall be 1.22 m (4 ft). The length of the specimen shall be such that at least one head joint in each course of masonry is exposed to the test.

7.3 *Building Wall Specimens*—Methods and workmanship used in the construction of the specimen shall be representative of the construction (Note 1). Build the wall specimen on an inverted steel channel section so that the face of the wall to be exposed to test is flush with the outside face of one flange of the channel. As shown in Fig. 3 attach to, or build flashing into masonry forming a trough to collect water that may pass through to the back side of the wall.

NOTE 1—Standards for masonry construction are contained in the following documents: Construction of Brick Masonry (Building Code Requirements for Engineered Brick Masonry, Section 5) and ACI Standard 531-81.

7.4 *Number of Specimens*—The test shall consist of at least 3 specimens.

7.5 *Storage of Specimens*—Specimens shall be retained in the laboratory during storage and shall be enclosed in an impervious plastic wrap immediately after construction and cured in this manner for 7 days. After 7 days, the wrap shall be removed and aging shall continue for at least 7 more days in laboratory air as stated in 6.1.

8. Procedure

8.1 *Mounting Chamber*—Position the test chamber on the specimen and clamp firmly in place, compressing the gasket to form a seal.