Designation: E859/E859M – 93 (Reapproved 2015)ε1

Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members[1]

This standard is issued under the fixed designation E859/E859M; 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 U.S. Department of Defense.

ε[1] NOTE—Designation was changed to dual and units information was corrected editorially in August 2015.

1. Scope

1.1 This test method covers a procedure for determining the effect of an air stream upon sprayed fire-resistive materials (SFRMs). These SFRMs include sprayed fibrous and cementitious materials. The test method is applicable only to laboratory procedures.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E84 Test Method for Surface Burning Characteristics of Building Materials

E119 Test Methods for Fire Tests of Building Construction and Materials

E605/E605M Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

2.2 *Other Documents:*

ASHRAE Handbook, Fundamentals [3]

3. Terminology

3.1 *Definitions:*

3.1.1 *denier, n*—the number of grams per 9000 m.

3.1.2 *end (fabric), n*—an individual warp yarn (single or ply) cord.

3.1.3 *pick, n*—an individual filling yarn.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *air erosion*—the action or process of being eroded by an air stream.

3.2.2 *sprayed cementitious material*—consisting of one or more binders, aggregate, and fibers, the material is mixed with water to form a slurry and is conveyed through a hose to a nozzle where compressed air is typically used to disperse the material into a spray pattern and air directed to the substrate requiring protection.

3.2.3 *sprayed fibrous material*—consisting of one or more binders, fibers, and aggregates, the material is conveyed by low pressure air through a hose to a nozzle where it is mixed with atomized water and directed to the substrate requiring protection.

3.2.4 *sprayed fire-resistive materials*—materials that are sprayed onto substrates to provide fire-resistive protection of the substrates.

4. Summary of Test Method

4.1 This test method covers a procedure for determining the effect of an air stream upon SFRM in plenums. In this test method, the SFRM is subjected to a tangential air stream for a minimum of 24 h. Collection filters downstream from the sample are weighed at frequent intervals to determine the amount of material removed from the sample.

[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

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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 Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

5. Significance and Use

5.1 It is the intent of this test method to determine properties of SFRM that may be used to provide an indication of serviceability. Satisfactory performance of SFRM applied to structural members and assemblies depends upon its ability to withstand the various influences that may occur during construction and during the life of the structure, as well as upon its performance under fire conditions.

5.2 Air erosion tests on SFRMs are conducted to evaluate the behavior of the SFRM when subjected to plenum air streams during normal service conditions. Such tests evaluate the resistance to dusting, flaking, spalling, and delamination of the SFRM.

6. Apparatus

6.1 *Duct System,* made of galvanized steel, horizontally positioned, with one rectangular opening 0.37 m^2 [4 ft^2] in the center of the top of the duct and 50 mm [2 in.] from each vertical side.

6.2 *Pitot Tube,* used in conjunction with a suitable manometer, as described in ASHRAE Handbook, Fundamentals, under "Velocity Measurement," to measure air velocities in the duct.

6.3 *Blower,* capable of moving air through the entire cross section of the duct at a velocity sufficient to handle the test requirement.

6.4 *Filters,* upstream from the test specimen (at the blower end) and located downstream of the test specimen. These filters shall be made of 30-denier nylon. The nominal construction of the fabric shall be 37 ends per 10 mm [94 ends per in.], and 32 picks per 10 mm [81 picks per in.], or finer.

6.5 *Scale,* having a capacity of 100 g and a sensitivity of ±0.001 g.

7. Materials

7.1 This test method requires the application of SFRM in accordance with manufacturer's published instructions. The apparatus, materials, and procedures used to apply the SFRM for this test method shall be representative of application in the field.

7.2 The density of the prepared sample shall be similar to the density tested and reported during the Test Methods E119 and E84 fire exposures or as required by the sponsor of the test method.

8. Test Specimen

8.1 The test specimen shall consist of SFRM applied to an application base.

8.2 *Application Base*—Any rigid base that is capable of supporting the SFRM. The minimum area of the base shall be 0.37 m^2 [4 ft^2] with the SFRM applied at 19 ± 3 mm [¾ ± ⅛ in.] thickness.

8.3 Prepare duplicate specimens and allow to dry and cure at a temperature of 20 ± 10°C [68 ± 18°F] and a relative humidity not greater than 60 % until successive weight readings, taken at 24 h intervals, differ by less than 1 %.[4]

9. Procedure

9.1 Test one specimen to determine thickness and density in accordance with Test Methods E605/E605M.

9.2 Dry the collecting filter at 50°C [120°F] for 1 h, weigh, and place in the apparatus.

9.3 Place the second specimen into the duct opening so that the face of the specimen and the inside face of the duct are positioned flush and in the same plane. All edges shall extend at least 50 mm [2 in.] beyond the duct opening.

9.4 Place the pitot tube 100 mm [4 in.] from the upstream edge of the specimen at the center line of the duct and 50 mm [2 in.] below the top side of the duct.

9.5 With both filters and the specimen in position, maintain the blower at the velocity of 6 m/s [20 ft/s].

9.6 At elapsed times of 1, 6, and 24 h, stop the blower and carefully remove, fold, dry at 50°C [120°F], and then reweigh the collecting filter. If the collecting filter continues to show a weight gain at 24 h, continue the test, making measurements every 24 h until a constant weight is reached.

10. Report

10.1 Report the following information:

10.1.1 Report the weight of the collecting filter in grams before and after each test interval. After each interval, record the net weight gain both individually and cumulatively. Also report the total net weight gain.

10.1.2 Report the thickness in millimetres [or inches] and the density in kilograms per cubic metre [or pounds per cubic foot] of the specimen.

10.1.3 Indicate the techniques such as tamping, troweling, surface sealing, or similar finishing operations and the extent that they are made.

10.1.4 Report the date of test, date of report, and name of the person making test.

11. Precision and Bias

11.1 The precision and bias of this test method has not been determined. A statement is being developed and will be added when completed.

12. Keywords

12.1 air erosion; sprayed cementitious material; sprayed fibrous material; sprayed fire-resistive materials

[4] Although mass is being determined, the term *weigh* is used as an accepted substitute.