Designation: D6413/D6413M – 15

Standard Test Method for Flame Resistance of Textiles (Vertical Test)[1]

This standard is issued under the fixed designation D6413/D6413M; 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 is used to measure the vertical flame resistance of textiles.

1.1.1 As a part of the measure of flame resistance, afterflame and afterglow characteristics are evaluated.

1.2 This standard shall be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled laboratory conditions and shall not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions.

1.3 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.

1.4 *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]

D123 Terminology Relating to Textiles

D1776 Practice for Conditioning and Testing Textiles

D3776/D3776M Test Methods for Mass Per Unit Area (Weight) of Fabric

D4391 Terminology Relating to The Burning Behavior of Textiles

3. Terminology

3.1 For terms relating to the burning behavior of textiles, see Terminology D4391.

3.1.1 The following terms are relevant to this standard.

3.1.1.1 *afterflame, n*—persistent flaming of a material after the ignition source has been removed.

3.1.1.2 *after-flame time, n*—the length of time for which a material continues to flame after the ignition source has been removed.

3.1.1.3 *afterglow time, n*—the time afterglow continues after the removal of the ignition source and the cessation of flaming.

3.1.1.4 *char length, n—in measuring flame resistance of textiles*, the distance from the fabric edge, which is directly exposed to the flame to the furthest point of visible fabric damage after a specified tearing force has been applied.

3.1.1.5 *flame application time, n*—the time interval for which the ignition flame is applied to a material.

3.1.1.6 *melting, n*—a liquification of material under the influence of heat.

3.2 For all terminology related to textiles, refer to Terminology D123.

4. Summary of Test Method

4.1 A specimen is positioned vertically above a controlled flame and exposed for a specified period of time. The flame then is removed, and afterflame time and afterglow time are measured.

4.2 Char length is measured under a specified force.

4.3 Any evidence of melting or dripping is noted.

5. Significance and Use

5.1 This test method determines the response of textiles to a standard ignition source, deriving measurement values for afterflame time, afterglow time, and char length.

5.2 The vertical flame resistance, as determined by this test method, only relates to a specified flame exposure and application time.

5.3 This test method maintains the specimen in a static, draft-free, vertical position and does not involve movement except that resulting from the exposure.

5.4 Test Method D6413 has been adopted from Federal Test Standard No. 191A method 5903.1, which has been used for many years in acceptance testing. The between-laboratory

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.52 on Flammability.

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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.

precision of this test method has not been established. Refer to Section 14 for single-laboratory precision.

5.4.1 If there are differences or practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, the test samples used should be as homogeneous as possible, that are drawn from the material from which the disparate test results are obtained, and that are assigned randomly in equal numbers to each laboratory for testing. Other materials with established test values may be used for this purpose. The test results from the two laboratories should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a bias is found, either its cause must be found and corrected, or future test results must be adjusted in consideration on the known bias.

6. Apparatus

6.1 *Test Cabinet and Accessories,* fabricated in accordance with the requirements specified in Figs. 1-6. Galvanized sheet metal or other suitable metal can be used. The entire inside back wall of the cabinet shall be painted black to facilitate the viewing of the test specimen and pilot flame.

6.1.1 The test cabinet shall be set up in a laboratory hood or with comparable equipment so that combustion gases can be removed from the test lab environment. Precautions must be taken to minimize the draft through the laboratory hood while

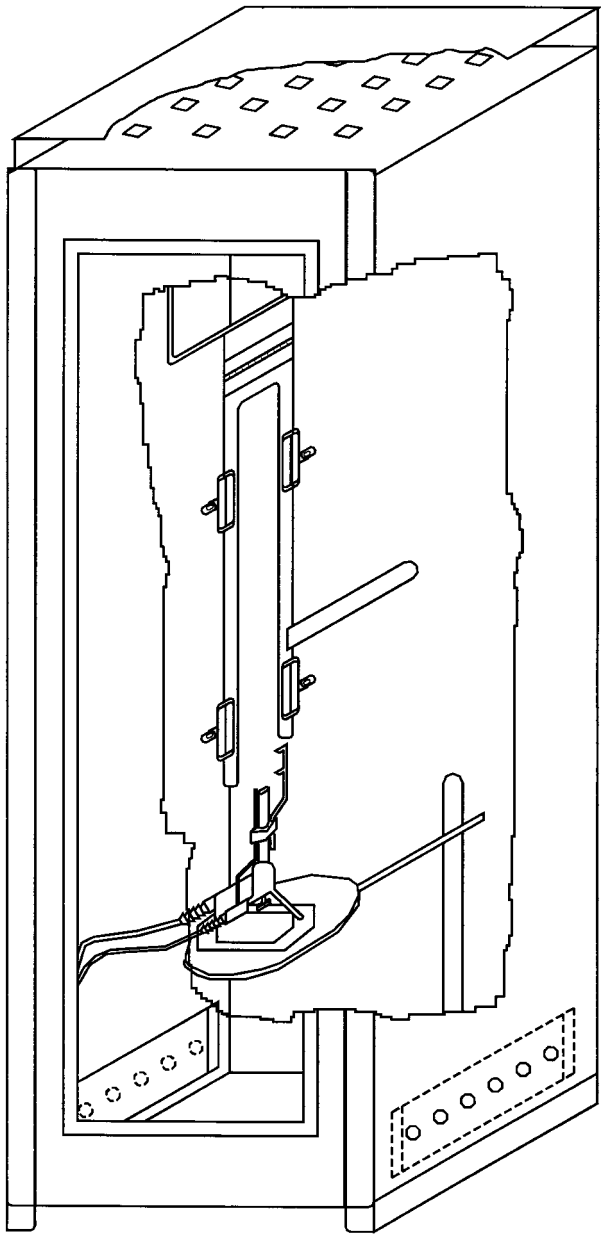

FIG. 1 Test Apparatus

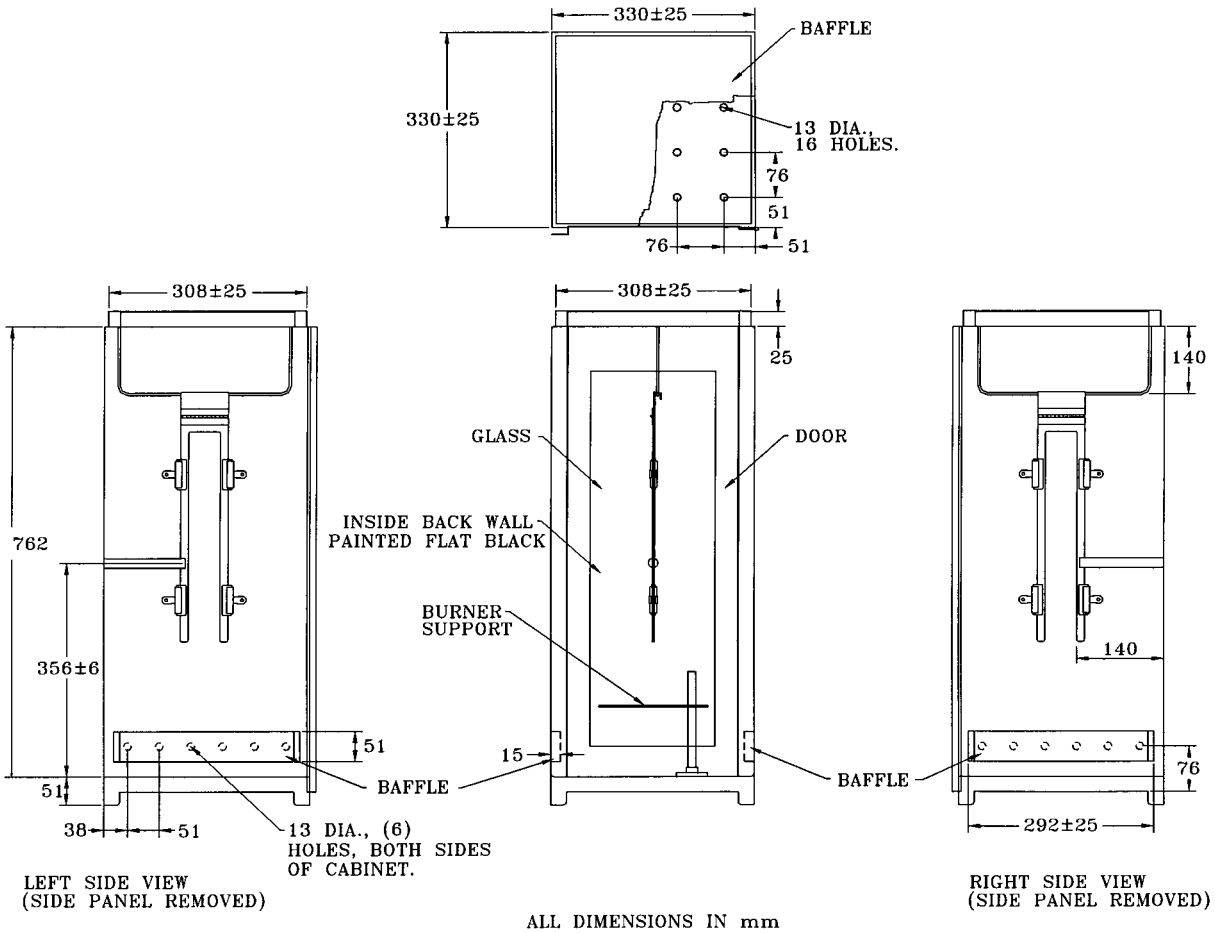

FIG. 2 a Test Apparatus Construction Details

testing. Open doors or windows are examples of unnecessary causes of drafts and must be avoided. A ventilation smoke tube kit[3] may be used to check for the presence of drafts.

6.2 *Burner,* equipped with a needle valve to adjust flame height (see Fig. 4).

6.2.1 The burner shall be constructed by combining a 10 mm [0.38 in.] inside diameter barrel 76 ± 6 mm [3 ± 0.25 in.] long with a base from an adjustable valve burner. A Tirrill burner is recommended, but a Bunsen burner modified to conform to this test method also will suffice.

6.2.2 The pilot light tube shall have an inside diameter of approximately 1.5 mm [0.06 in.] and shall be spaced 3 mm [0.12 in.] away from the burner edge.

6.2.2.1 The pilot light tube shall be located vertically next to the burner as shown in Fig. 4.

6.2.3 Gas controls and connections shall be as specified in Fig. 5. The solenoid valve shall be capable of being fully opened or fully closed in less than 0.2 s and activated by an adjustable timer. Position the solenoid valve as close to the burner as possible using a 50 ± 13 mm [2 ± 0.5 in.] length of 6.5 mm [0.25 in.] inside diameter, 13 mm outside diameter [0.5 in. outside diameter] methane safe hose (Fig. 6). In older cabinets where the solenoid valve is located outside the test chamber a retrofit can be done to accommodate this change. (See Fig. 5 and Fig. 6.)

6.2.4 On the side of the barrel of the burner, opposite the burner pilot light there shall be a flame height gage constructed of metal spaced approximately 13 mm [0.50 in.] from the barrel and extending above the burner. The gage shall have two prongs approximately 8 mm [0.32 in.] long marking the distances of 19 mm [0.75 in.] and 38 mm [1.50 in.] above the top of the burner.

6.2.5 The burner shall be movable when placed in the cabinet and capable of adjustments to center the burner directly below the center bottom edge of the specimen when performing the tests.

6.3 *Gas Regulator Valve System,* a control system with a delivery rate designed to furnish gas to the burner under a pressure of 17.2 ± 1.7 kPa [2.5 ± 0.25 lbf/in.^{2}] at the burner inlet. The manufacturer's recommend delivery rate for the valve system shall include the required pressure.

6.4 *Gas Mixture,* methane, 99 % pure.

6.5 *Test Specimen Holder,* constructed as shown in Fig. 3. The assembly is shown in Figs. 1 and 2.

6.6 *Specimen Holder Clamps,* capable of firmly holding the test specimen in the test specimen holder.

[3] A ventilation smoke tube kit is available from A-Line Safety Appliance Company, Pittsburgh, PA 15230.