



Designation: D7936 – 20

Standard Test Method for Flammability of Electrical Insulating Materials Intended for Wires or Cables When Burning in Horizontal Configuration¹

This standard is issued under the fixed designation D7936; 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 is a fire-test-response standard.

1.2 This fire test method is applicable to the electrical insulation materials contained in wires or cables.

1.3 The ignition source is a gas burner fueled by methane or natural gas.

1.4 Use the values stated in SI units in referee decisions; see IEEE/ASTM SI-10. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.5 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.6 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.17 on Fire and Thermal Properties.

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2. Referenced Documents

2.1 *ASTM Standards:*²

D470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable

D1711 Terminology Relating to Electrical Insulation

D5025 Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials

D5207 Practice for Confirmation of 20-mm (50-W) and 125-mm (500-W) Test Flames for Small-Scale Burning Tests on Plastic Materials

E176 Terminology of Fire Standards

2.2 *ISO Standard:*³

ISO 13943 Fire Safety – Vocabulary

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms relating to electrical and electronic insulating materials, the definitions in this test method are in accordance with Terminology D1711. For terms relating to fire, the definitions in this test method are in accordance with Terminology E176 and ISO 13943. In case of conflict, the definitions given in Terminology E176 shall prevail.

4. Summary of Test Method

4.1 In this test method, the electrical insulation material test specimen is mounted horizontally and ignited with a small burner, applying a 500 W flame, for a period of 30 s.

4.2 The burner gas is methane or natural gas (see 6.4).

4.3 A cotton mat is placed under the test specimen to capture droplets falling from the test specimen and determine whether flaming ignition of the cotton occurs.

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 International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

4.4 The report records the distance the flame travels, the duration of flaming after removal of the igniter flame and whether flaming material has dropped from the test specimen and ignited the cotton mat.

5. Significance and Use

5.1 This horizontal flame test method measures the ability of the material to cease flaming when the source of ignition used is removed.

5.2 This test method also provides a measure of the capability of the material to spread flame by dripping of flaming particles.

5.3 This test method is used to assess the horizontal flame test performance of electrical insulation materials in Test Methods **D470**.

5.4 In this test method, the test specimens are subjected to one or more specific sets of laboratory test conditions. If different test conditions are substituted or the end-use conditions are changed, it is not always possible by or from this test to predict changes in the fire-test-response characteristics measured. The results are therefore valid only for the fire-test-exposure conditions described in this test method.

6. Apparatus

6.1 Test Chamber:

6.1.1 The test chamber shall have an inside volume of at least 0.5 m³ (17.7 ft³).

6.1.2 The test chamber shall be provided with a heat-resistant glass window for observing the test and an exhaust fan for removing the products of combustion after the tests.

6.2 *Support Block*—A support block shall be provided for mounting the burner so that the burner is able to be tilted to an angle of 20° from the vertical.

6.3 Burner:

6.3.1 The burner shall meet the requirements of Specification **D5025**.

6.3.2 The burner shall be designed to provide a flame that is 125 ± 10 mm (4⁷/₈ ± 0.4 in.) long, with an intensity of 500 W (1700 BTU/h).

6.3.3 The burner shall be mounted at a 20° angle to the vertical by mounting it on a support block in accordance with **6.2**.

6.4 Gas:

6.4.1 The burner shall be provided either with methane gas, technical grade, 98.0 % minimum purity, or with natural gas. The heating value of either gas shall be 37 ± 1 MJ/m³ or 8.9 kcal (thermochemical) per m³ or 1000 BTU (thermochemical) per ft³, at 25 ± 1 °C (77 ± 2 °F) and 101 kPa (14.7 psi).

NOTE 1—The test method originally contained in Test Methods **D470** used methane gas, but the use of natural gas with the same heating value is included here to facilitate the work of laboratories.

6.4.2 Adjust the burner barrel height, as indicated in Practice **D5207** to confirm that the overall height of the gas flame is 125 ± 10 mm (4⁷/₈ ± 0.4 in.) and that the blue inner cone is 40 ± 2 mm (1¹/₁₆ ± 0.08 in.) high. Use the same procedure for methane and for natural gas. A gas supply gauge pressure of 69

to 138 kPa (10 to 20 lbf/in.²) has been found to be adequate to maintain the required flame. A cylinder shall not be used when this range of pressure is no longer sustainable at room temperature.

6.4.3 Ensure that the burner flame does not change from blue to luminous without any change of the settings. If this occurs, it is an indication that the fuel-gas content of the cylinder is exhausted and that the gas cylinder is to be labeled as empty and returned for refilling.

6.5 *Flame*—Ensure that the overall flame remains blue and that the height of the blue inner cone is 38 ± 2 mm (1.50 ± 0.08 in.). If the height of the flame is lower without any change in settings, it is likely that the contents of the gas cylinder are at low pressure and the cylinder shall be replaced.

6.6 *Timing Device*—The timing device shall be a stopwatch or other suitable timing device capable of time measurements to within 0.5 s.

6.7 *Cotton Mat*—The cotton mat shall consist of long-fiber, pure, dry, untreated, surgical grade cotton not more than 6 mm (0.25 in.) and not less than 4 mm (0.16 in.) thick. The cotton shall be kept in a desiccator containing anhydrous calcium chloride or another drying agent, maintained at a relative humidity not exceeding 20 %, for a minimum of 24 h at a temperature of 23 ± 3 °C (73 ± 5 °F), until just prior to use.

7. Tests Specimen

7.1 The test specimens shall consist of sections of insulated wire. The test specimen shall have a length of 250 mm (10 in.).

8. Procedure

8.1 *Conditioning*—The test specimens, the apparatus, and the surrounding air shall be maintained at a temperature in the range of 15 to 35 °C (27 to 63 °F) and a relative humidity of 45 to 75 % throughout the test.

8.2 *Test Environment*—Conduct the test in a chamber, enclosure, or laboratory hood free of induced or forced draft. If a ventilated hood is used, ensure that the air currents do not affect the test flame.

8.3 *Cotton Mat*—Cover the floor of the test chamber with a cotton mat so that the upper surface of the cotton is 229 to 241 mm (9 to 9¹/₂ in.) below the axis of the sample. The cotton mat shall cover an area at least 300 mm (12 in.) wide and 350 mm (14 in.) deep, centered under the test specimen.

8.4 *Test Specimen Placement*—Center the test specimen in a horizontal position on supports 200 mm (8 in.) apart.

8.5 Burner Application:

8.5.1 Open the valve supplying the gas to the burner proper thereby applying the flame to the test specimen.

8.5.2 Adjust the height of the flame, with the burner vertical, to 125 ± 10 mm (4⁷/₈ ± 0.4 in.) with an inner blue cone of 38 ± 2 mm (1.50 ± 0.08 in.) in height.

8.5.3 Tilt the burner 20° from the vertical by mounting it on the support block (in accordance with **6.2**).

8.5.4 Move the burner up to the test specimen so that the tip of the inner blue cone just touches the test specimen at a point midway between the supports.