



# Standard Test Method for Glow-Wire Ignition of Materials<sup>1</sup>

This standard is issued under the fixed designation D 6194; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 This test method covers the minimum temperature required to ignite insulating materials using a glowing heat source. In a preliminary fashion, this test method differentiates between the susceptibilities of different materials with respect to their resistance to ignition due to an electrically-heated source.

1.2 This test method applies to molded or sheet materials available in thicknesses ranging from 0.25 to 6.4 mm.

1.3 This test method is not valid for determining the ignition behavior of complete electrotechnical equipment, since the design of the electrotechnical product influences the heat transfer between adjacent parts.

1.4 This test method measures and describes 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.

1.5 The values stated in SI units are to be regarded as the standard.

1.6 *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 specific precautionary statements, see Section 8.

NOTE 1—Although this test method and IEC 695-2-1/3 differ in approach and in detail, data obtained using either are technically equivalent.

## 2. Referenced Documents

### 2.1 ASTM Standards:

D 1711 Definitions of Terms Relating to Electrical Insulation<sup>2</sup>

E 176 Terminology of Fire Standards<sup>3</sup>

E 220 Method for Calibration of Thermocouples by Comparison Techniques<sup>4</sup>

E 230 Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples<sup>4</sup>

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

Current edition approved Nov. 10, 1997. Published January 1998.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 10.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.03.

### 2.2 IEC Standard:

IEC 695-2-1/3: Fire Hazard Testing, Part 2: Test Methods, Section 1: Glow-Wire Ignitability Test for Materials<sup>5</sup>

### 2.3 ISO Standard:

ISO/IEC Guide 52: Glossary of Fire Terms and Definitions<sup>6</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 Use Terminology E 176 and ISO/IEC Guide 52 for definitions of terms used in this test method and associated with fire issues. Where differences exist in definitions, those contained in Terminology E 176 shall be used. Use Terminology D 1711 for definitions of terms used in this test method and associated with electrical insulation materials.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *glow wire, n*—a wire of specified dimensions that can be controllably-heated electrically to determine ignitability of a material.

3.2.1.1 *Discussion*—Fig. 1 shows a glow wire and its positioning.

3.2.2 *ignition, n*—initiation of combustion.

3.2.2.1 *Discussion*—Ignition is deemed to have taken place when the first of the following occurs: sustained flaming on the test specimen surface for over 5 s or falling particles causing the appearance of flames on a tissue paper placed underneath the test specimen.

## 4. Significance and Use

4.1 Under certain conditions of operation, or when malfunctions occur, it is possible that components of electrotechnical products become overheated. When this happens, a possible result is ignition of the adjacent insulation material.

4.2 This test method assesses the susceptibility of electrical insulating materials to ignition under such conditions.

4.3 This test method determines the minimum temperature required to ignite a material by the effect of a glowing heat source, under the conditions of test.

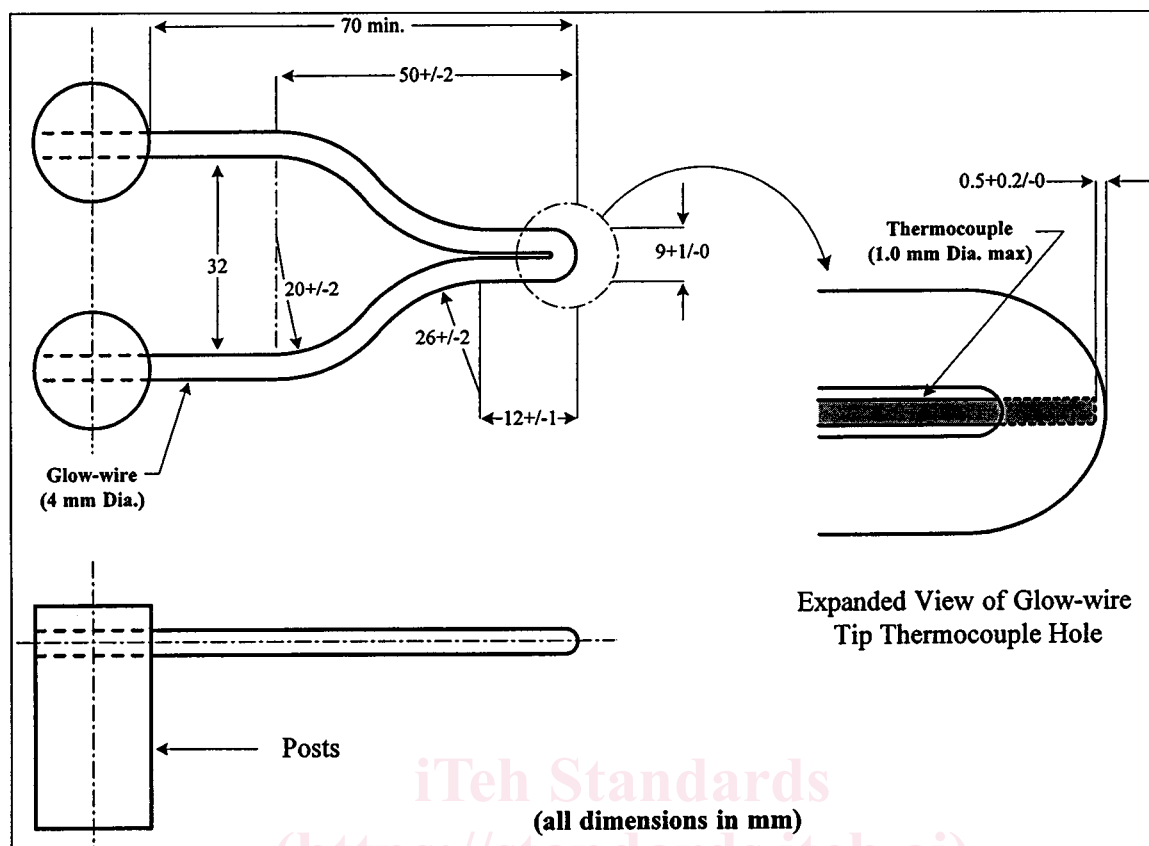
4.4 Subject to limitations in precision and bias, this test method can be used to categorize materials.

## 5. Apparatus

5.1 *Glow-Wire*—Nichrome wire (nominal 80 % nickel/

<sup>5</sup> Available from International Electrotechnical Commission (IEC), 3 Rue de Varembe, Geneva, Switzerland.

<sup>6</sup> Use undyed, soft, strong, lightweight tissue paper weighing between 12 and 30 g/m<sup>2</sup>.



NOTE 1—All dimensions in millimetres.

FIG. 1 Glow-Wire and Positioning of the Thermocouple

20 % chromium) with a nominal 4.0 mm diameter formed to the dimensions shown in Fig. 1.

5.2 *Thermocouple*—A sheathed fine-wire thermocouple, having an overall diameter of 1.0 mm max, and wires (Type K) of, for example, NiCr and NiAl suitable for continuous operation at temperatures up to 960°C, with the welded point located inside the sheath, is used for measuring the temperature of the glow-wire.

5.2.1 The sheath is made of a metal that will allow the thermocouple to perform its function in air at sheath temperatures of at least 1050°C. The thermocouple is arranged in a pocket hole, drilled in the tip of the glow-wire, as shown in Fig. 1. Maintain the thermal contact between the walls of the bored hole in the glow-wire by pinning the sheathed thermocouple in place. The thermocouple must follow the movement of the tip of the glow-wire resulting from elongation caused by thermal heating.

5.3 *Temperature Indicator*—A temperature indicator for Type K thermocouples capable of reading to 1000°C. Calibrate the combination thermocouple and temperature indicator in accordance with the general procedures outlined in Test Method E 220. The initial calibration tolerance is defined in Tables E 230.

5.4 *Supply Circuit*—A circuit capable of supplying up to 150 A at 2.1V, with smooth continuous adjustment of voltage to provide the required current as needed to maintain the desired glow-wire tip temperature.

5.5 *Test Fixture*—A fixture which will hold the glow-wire in a horizontal plane and move it against the vertical test specimen, maintaining a force of  $1.0 \pm 0.2 N$  over a distance of at least 7 mm (see Fig. 2).

NOTE 2—A weight of  $100 \pm 20g$  as shown in Fig. 2 will provide the required force.

5.6 *Indicator Board*—A flat pine wood board with a smooth finish, approximately 10 mm thick, and in close contact with a single layer of tissue paper,<sup>6</sup> located at a distance of  $200 \pm 5$  mm below the glow-wire tip.

5.7 *Test Chamber*—A closed draft-free chamber that permits observation of the specimen and has a volume of at least  $0.3m^3$ . Provide a means for positive venting of the test chamber to the outside atmosphere before and after the test and for closing of the vent during the test.

## 6. Test Specimen

6.1 Prepare square specimens that are approximately  $60 \times 60$  mm or round specimens that are approximately 60 mm in diameter, and of a thickness commonly encountered in practice. Thicknesses less than 0.25 mm or greater than 6.4 mm are not valid for this test method. Generally, ten specimens will suffice to complete the procedure specified in Section 8.

## 7. Conditioning

7.1 Condition specimens, test board and tissue paper at 23