Designation: D 6194 – 04

An American National Standard

Standard Test Method for Glow-Wire Ignition of Materials[1]

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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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 or 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. (See IEEE/ASTM SI-10 for further details.)

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 9.*

1.7 Fire testing of products and materials is inherently hazardous, and adequate safeguards for personnel and property shall be employed in conducting these tests. Fire testing involves hazardous materials, operations, and equipment.

NOTE 1—Although this test method and IEC 60695-2-13 differ in approach and in detail, data obtained using either are technically equivalent.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1711 Terminology Relating to Electrical Insulation

E 176 Terminology of Fire Standards

E 220 Test Method for Calibration of Thermocouples by Comparison Techniques

E 230 Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples

IEEE/ASTM SI-10 International System of Units (SI), The Modernized Metric System

2.2 *IEC Standard:*

IEC 60695-2-13: Fire Hazard Testing—Section 20: Glowing/Hot-Wire Based Test Methods—Glow-Wire Coil Ignitability Test Method for Materials[3]

IEC 60695-4: Fire Hazard Testing—Part 4: Terminology Concerning Fire Tests[3]

2.3 *ISO Standard:*

ISO 13943: Fire Safety—Vocabulary[4]

3. Terminology

3.1 *Definitions*:

3.1.1 Use Terminology E 176, ISO 13943, and IEC 60695-4 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.

[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 D09.21 on Fire Performance Standards.

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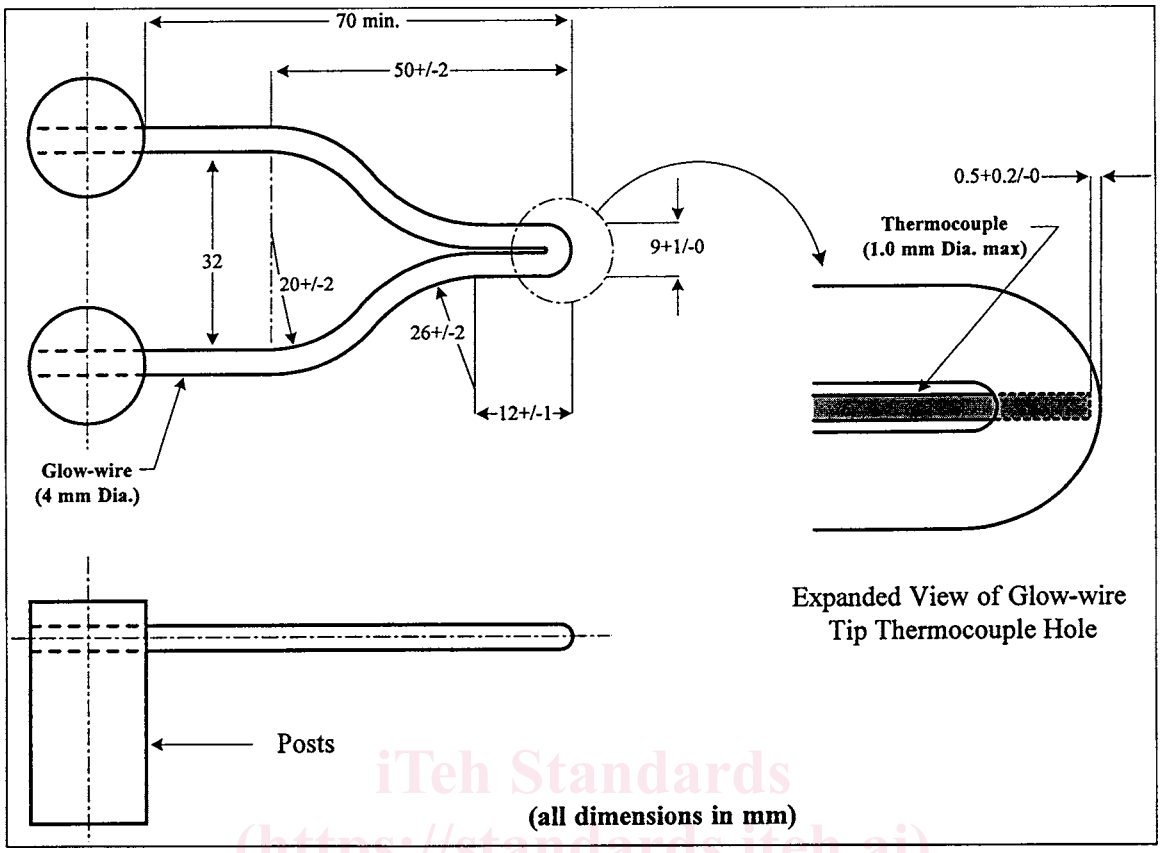
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from International Electrotechnical Commission (IEC), 3 Rue de Varembe, Geneva, Switzerland.

[4] Use undyed, soft, strong, lightweight tissue paper weighing between 12 and 30 g/m^2.



NOTE 1—All dimensions in millimetres.

FIG. 1 Glow-Wire and Positioning of the Thermocouple

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. Summary of Test Method

4.1 In this test method, a standardized test specimen (either square or round), is supported vertically and is exposed to electrical heating from a glow-wire set at pre-determined temperatures. The minimum temperature for glow-wire ignition is assessed through testing at incremental temperatures.

5. Significance and Use

5.1 During operation of electrical equipment, including wires, resistors, and other conductors, it is possible for overheating to occur under certain conditions of operation, or when malfunctions occur. When this happens, a possible result is ignition of the adjacent insulation material.

5.2 This test method assesses the susceptibility of electrical insulating materials to ignition as a result of exposure to a glowing wire.

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

5.4 This method is suitable, subject to the appropriate limitations of an expected precision of ±15 %, to categorize materials.

5.5 In this procedure, the specimens are subjected to one or more specific sets of laboratory 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. Therefore, the results are valid only for the fire test exposure conditions described in this procedure.

6. Apparatus

6.1 *Glow-Wire*—The glow-wire shall be a Nichrome (Nickel-Chrome) wire, that is iron free, with the following nominal properties: a wire composition of 20 % chromium-80 % nickel, a diameter of 4 mm, and it shall be formed to the dimensions shown in Fig. 1.

6.2 *Thermocouple*—Use Type K sheathed fine-wire thermocouple, having an overall diameter of 1.0 mm max, and wires suitable for continuous operation at temperatures up to 960 °C, with the welded point located inside the sheath, for measuring the temperature of the glow-wire. Examples of suitable wire compositions are Nickel-Chromium (NiCr) and Nickel-Aluminum (NiAl).

6.2.1 Construct the thermocouple sheath of a metal that will allow the thermocouple to perform its function in air at sheath temperatures of at least 1050 °C. Arrange 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