Designation: ~~D5207 – 14~~ D5207 – 20

Standard Practice for Confirmation of ~~20–mm (50–W) and 125–mm (500–W)~~20-mm (50-W) and 125-mm (500-W) Test Flames for Small-Scale Burning Tests on Plastic Materials[1]

This standard is issued under the fixed designation D5207; 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 practice covers the confirmation of test flames for small-scale burning tests on plastic materials using the laboratory burner described in Specification D5025. Back pressures and flow rates for methane, propane, and butane supply gases are given for specific test flames. This practice describes a procedure to confirm the heat evolution of the test flame.

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

1.3 *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.*

NOTE 1—There is no similar ISO standard. This practice is equivalent in technical content to, but not fully corresponding in presentation with, the confirmatory procedures of IEC/TS 60695-11-3, Method A and IEC/TS 60695-11-4, Method A.

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

~~1.5 *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.*~~

1.5 *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.*

1.6 *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 practice is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties.

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***A Summary of Changes section appears at the end of this standard**

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics
D3195 Practice for Rotameter Calibration
D5025 Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials
E176 Terminology of Fire Standards
E220 Test Method for Calibration of Thermocouples By Comparison Techniques
E230 Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
E608 Specification for Mineral-Insulated, Metal-Sheathed Base Metal Thermocouples

2.2 *IEC Standards:*[3]

~~IEC/TS 60695-11-3~~IEC 60695-11-3 ~~Ed. 1:~~ Fire Hazard ~~Testing-Part 11: Test Flames-Section 3: 500 W Flames:~~ Testing – Part 11-3: Test Flames – 500 W Flames – Apparatus and Confirmational Test Methods

~~IEC/TS 60695-11-4~~IEC 60695-11-4 ~~Ed. 2:~~ Fire Hazard ~~Testing-Part 11: Test Flames-Section 4: 50 W Flame:~~ Testing – Part 11-4: Test Flames – 50 W Flame – Apparatus and Confirmational Test Methods

3. Terminology

3.1 *Definitions of Terms:*

3.1.1 For definitions of terms related to plastics used in this test method, refer to Terminology D883. For definitions of terms related to fire used in this test method, refer to Terminology E176.

4. Summary of Practice

4.1 A test flame of specified height and color is obtained with gas supplied at a suggested back pressure and flow rate. A thermal sensor is then positioned over the flame, and the time for the temperature of the sensor to increase from 100 to 700°C is determined. The time is used to confirm the heat-evolution profile of the test flame.

5. Significance and Use

5.1 The flame height and color (indicative of air-to-gas ratio) for a test flame have traditionally been specified in the individual test method. The energy content of the flame has also been addressed by reference to a specific supply gas. It has been determined that the supply-gas back pressure and flow rate can be varied without affecting the height and color of the flame. However, the energy content of the flame is affected. This practice provides the back pressure and flow rate of the supply gas for a 20-mm ~~(50-W)~~(50-W) and a 125-mm ~~(500-W)~~(500-W) test flame, and a procedure for confirming the heat-evolution profile of the test flame.

5.2 Information is provided for test flames using methane, propane, or butane. Using this information, these supply gases ~~can~~ have the capability to be used interchangeably with a standardized burner to produce essentially the same test flame.

6. Apparatus

6.1 *Test Chamber*, enclosure or laboratory hood, free of induced or forced draft, having an internal volume of at least ~~0.5 m~~0.5 m^3 for the ~~20-mm (50-W)~~20-mm (50-W) flame or ~~0.75 m~~0.75 m^3 for the ~~125-mm (500-W)~~125-mm (500-W) flame.

6.2 *Laboratory Burner*, constructed in accordance with Specification D5025.

6.3 *Manometer/Pressure Gauge*, ~~capable of measuring to~~with a resolution of 5 mm H_2 ~~800 mm of water, with increments of 5 mm.~~O or less.

6.4 *Flow Meter*—A rotameter calibrated in accordance with Practice D3195, with correlation curves appropriate for the gas, or a mass flow meter with at least 2 % accuracy.

[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 National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

6.5 *Thermal Sensor (Copper Slug and Thermocouple)*—A slug constructed of high conductivity (electrolytic) copper with dimensions as shown in Fig. 1. A 1.76 ± 0.01-g slug is used for the 20-mm ~~(50-W)~~(50-W) flame, and a 10.0 ± 0.05-g slug is used for the 125-mm ~~(500-W)~~(500-W) flame. A Type K thermocouple with a 0.5-mm diameter stainless steel sheath constructed in accordance with Specification E608 shall be peened into the top of the slug.

6.6 *Temperature Indicator*—A potentiometer or temperature indicator for Type K thermocouples capable of reading to 800°C. Calibrate the combination thermal sensor and temperature indicator in accordance with the general procedures outlined in Method E220. The initial calibration tolerance is defined in Tables E230.

6.7 *Ring Stand*, with a clamp or equivalent device, adjustable for positioning of the thermal sensor.

6.8 *Timer*, ~~stop watch~~ stopwatch or other suitable timing device capable of timing to the nearest ~~0.1 s.~~ 0.1 s.

6.9 *Gas Supply*—A supply of methane, propane, or butane, with suitable regulator and meter for uniform gas flow.

6.9.1 *Methane*, Technical grade, 98 % minimum purity, having a heating value of ~~37 ± 1 MJ~~37 ± 1 MJ/m^3 at 25°C. Natural gas with a certified heating value of ~~37 ± 1~~ 37 ± 1 MJ ~~MJ/m~~/m^3 will likely provide similar results.

6.9.2 *Propane*, Technical grade, 98 % minimum purity, having a heating value of ~~94 ± 2 MJ~~94 ± 2 MJ/m^3 at 25°C.

6.9.3 *Butane*, CP grade, 99 % minimum purity, having a heating value of ~~120 ± 3~~ 120 ± 3 MJ ~~MJ/m~~/m^3 at 25°C.

7. Confirmation Procedure

7.1 Locate the burner in a draft-free enclosure or hood. Connect the burner to the gas supply, in line with a control valve, flowmeter and manometer. See Fig. 2.

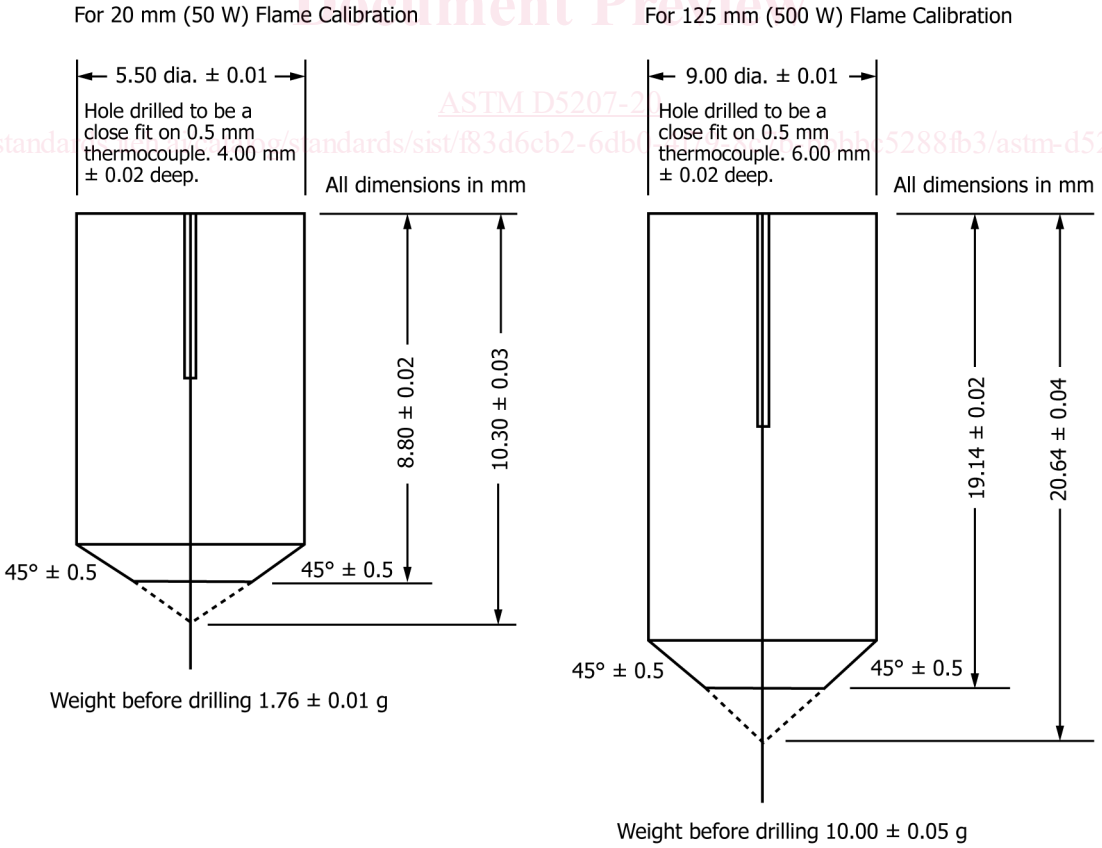

FIG. 1 Copper Slug for Thermal Sensor

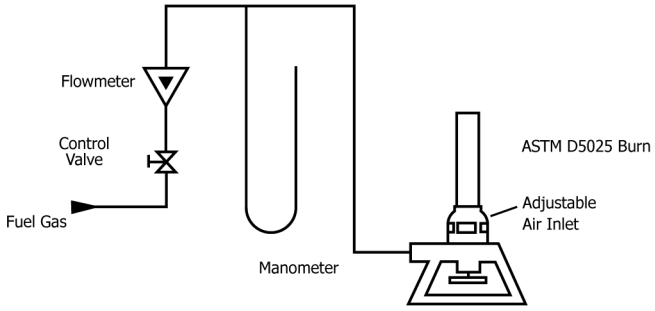

FIG. 2 Burner Supply Arrangement

7.2 Connect the leads of the Type K thermocouple to the temperature indicator. Clamp the thermocouple sheath above the burner, along its central axis, so that the copper slug is suspended 75 mm minimum from the clamp. See Fig. 3.

7.2.1 *20-mm ~~(50-W)~~(50-W) Test Flame*—Position the slug ~~10 ± 1 mm~~ 10 ± 1 mm from the top of the burner.

7.2.2 *125-mm ~~(500-W)~~(500-W) Test Flame*—Position the slug ~~55 ± 1 mm~~ 55 ± 1 mm from the top of the burner.

7.3 Move the burner away from the copper slug to ensure no influence of the flame on the slug during the preliminary adjustment of the test flame.

7.4 If the copper slug has not been used before, conduct a preliminary run to condition the surface of the slug. Discard this first result. The slug shall not be polished or cleaned for subsequent use. The presence or absence of an oxide coating affects the thermal

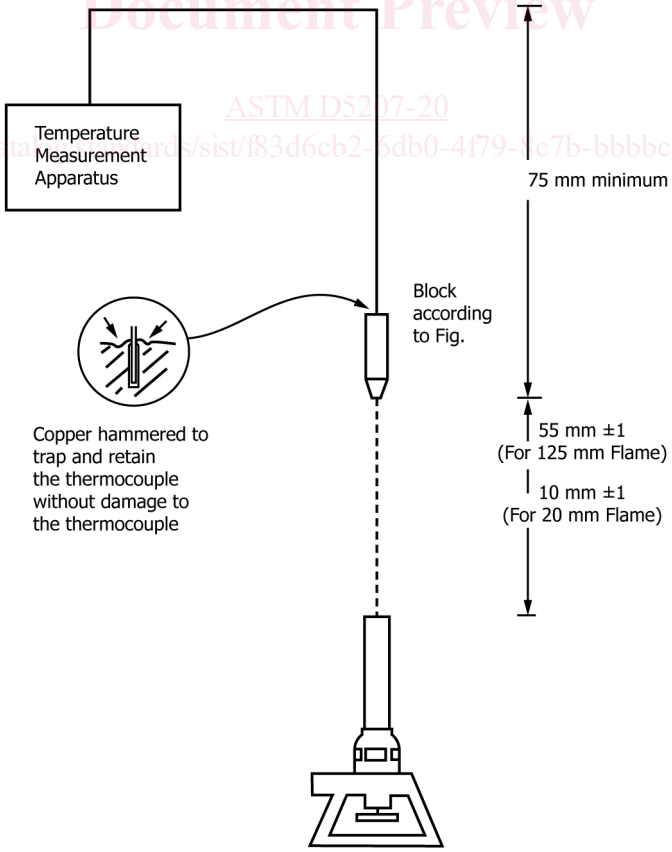

FIG. 3 Confirmatory Test Arrangement