



Designation: D 5207 – 98

## Standard Practice for Confirmation of 20 and 125 mm Test Flames for Small-Scale Burning Tests on Plastic Materials<sup>1</sup>

This standard is issued under the fixed designation D 5207; 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 ( $\epsilon$ ) 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 D 5025. 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 should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and should not be used to describe or appraise the fire-hazard or fire-risk of materials, products, or assemblies under actual fire conditions. Results, however, of the test may be used as elements of a fire-hazard assessment or a fire-risk assessment, which takes into account all of the factors, which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.*

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/CDV 695-11-3 and IEC/CDV 695-11-4.

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:

D 883 Terminology Relating to Plastics<sup>2</sup>

D 3195 Practice for Rotameter Calibration<sup>3</sup>

D 5025 Specification for a Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials<sup>4</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 11.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.03.

E 176 Terminology of Fire Standards<sup>5</sup>

E 220 Test Method for Calibration of Thermocouples by Comparison Techniques<sup>6</sup>

E 230 Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples<sup>6</sup>

E 608 Specification for Metal-Sheathed Base-Metal Thermocouples<sup>6</sup>

#### 2.2 IEC Standards:

IEC/CDV 695-11-3: Fire Hazard Testing-Part 11: Test Flames-Section 3: 500 W Flames: Apparatus and Confirmational Test Methods<sup>7</sup>

IEC/CDV 695-11-4 Ed. 2: Fire Hazard Testing-Part 11: Test Flames-Section 4: 50 W Flame: Apparatus and Confirmational Test Methods<sup>7</sup>

### 3. Terminology

3.1 Definitions—For definitions of terms used in this practice, refer to Terminology D 883.

### 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 and a 125-mm test flame, and a procedure for confirming the heat-flux profile of the test flame.

5.2 Information is provided for test flames using methane,

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 14.03.

<sup>7</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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

propane, or butane. Using this information, these supply gases can 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.

6.2 *Laboratory Burner*, constructed in accordance with Specification D 5025.

6.3 *Manometer/Pressure Gage*, capable of measuring to 800 mm of water, with increments of 5 mm.

6.4 *Flow Meter*—A rotameter calibrated in accordance with Practice D 3195, with correlation curves appropriate for the gas, or a mass flow meter with at least 2 % accuracy.

6.5 *Thermal Sensory (Copper Slug and Thermocouple)*—A slug constructed of high conductivity (electrolytic) copper with dimensions as shown in Fig. 1.<sup>8</sup> A 1.75-g slug is used for the 20-mm flame, and a 10.0-g slug is used for the 125-mm flame. A Type K thermocouple with a 0.5-mm diameter stainless steel sheath constructed in accordance with Specification E 608 should 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 E 220. The initial calibration tolerance is defined in Tables E 230.

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

6.8 *Timer*, stop watch or other suitable timing device capable of timing to the nearest 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  $37 \pm 1$  MJ/m<sup>3</sup> at 25°C. Natural gas with a certified heating value of  $37 \pm 1$  MJ/m<sup>3</sup> should provide similar results.

6.9.2 *Propane*, Natural grade, 96 % minimum purity, having a heating value of  $94 \pm 2$  MJ/m<sup>3</sup> at 25°C.

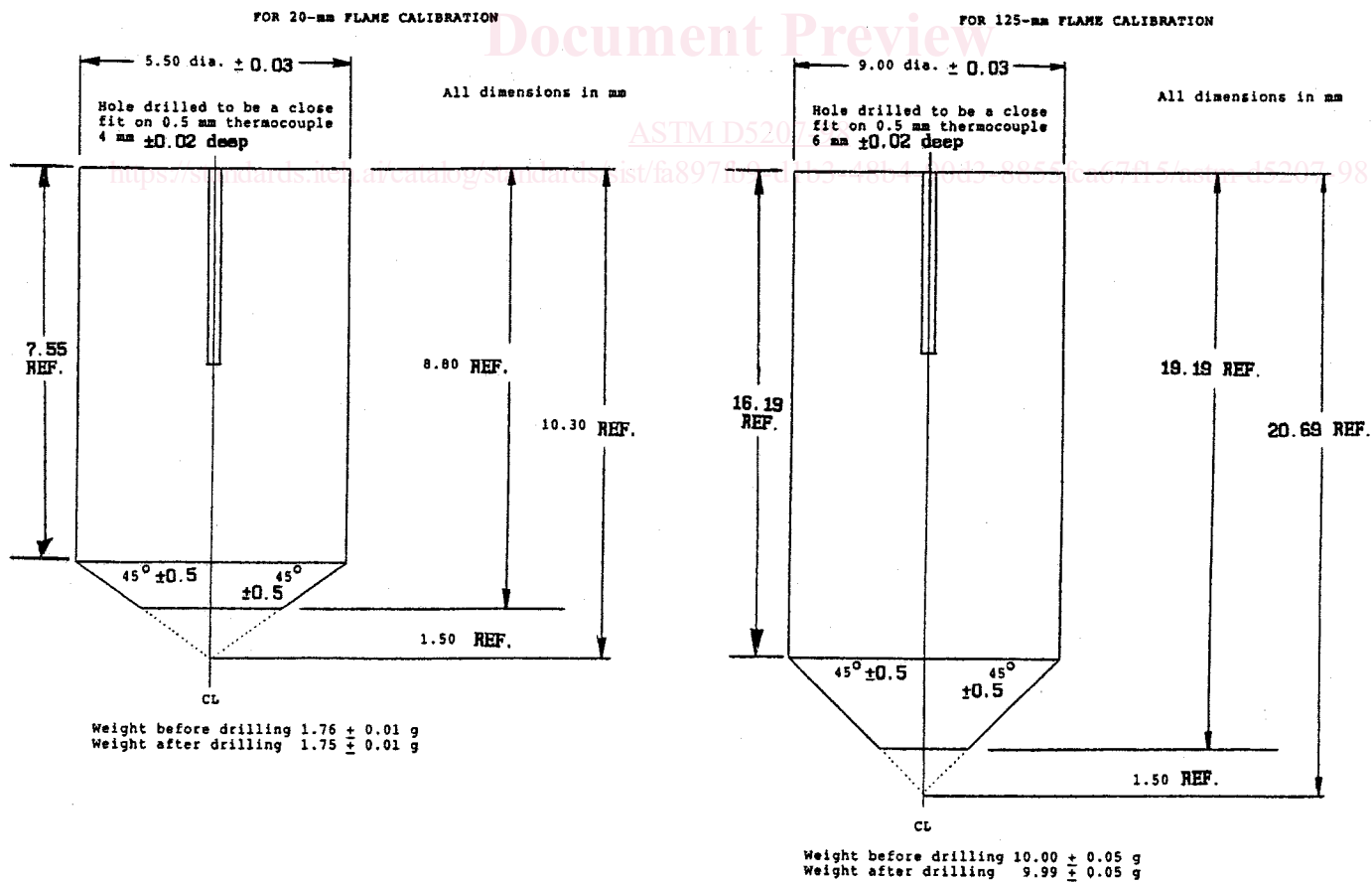
6.9.3 *Butane*, CP grade, 99 % minimum purity, having a heating value of  $120 \pm 3$  MJ/m<sup>3</sup> at 25°C.

**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.

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.

<sup>8</sup> Suitable copper slugs can be obtained from the following suppliers: Custom Scientific Instruments, Inc., 13 Wing Dr., Cedar Knolls, NJ 07927; and Westbury Precision Products, 50 Enter Lane, Hauppauge, NY 11788.



**FIG. 1 Copper Slug for Thermal Sensor**