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Standard Specification for Fire Safety for Candle Accessories¹

This standard is issued under the fixed designation F2601; 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 specification prescribes minimum safety requirements for candle accessories to help ensure a reasonable degree of safety for normal use with candles, thereby improving personal safety and reducing fires, deaths, and injuries.

1.2 This specification is not intended to replace other safety practices such as adult supervision, close monitoring of product when in use, and fire detection, alarm, or suppression systems.

1.3 The values stated in SI inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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.*

1.5 *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~~ safety, health, and ~~health~~ 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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester](#)

[E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C](#)

[E176 Terminology of Fire Standards](#)

[F1972 Guide for Terminology Relating to Candles and Associated Accessory Items](#)

[F2417 Specification for Fire Safety for Candles](#)

3. Terminology

3.1 ~~Definitions—~~ Certain candle-related terminology ~~has already been~~ is addressed in Guide [F1972](#). ~~Certain additional fire-related terminology is found in Terminology~~, and the [E176](#). The reader is directed to ~~those standards that guide~~ for definitions not found in [3.2](#) and [3.3](#). For definitions of terms associated with fire issues, see Terminology [E176](#).

3.2 *Definitions: Candle Accessory Classification Terms:*

3.2.1 *candle accessory, n—object designed, intended, or marketed for use with a candle.*

3.2.2 *candle burner, n—a candle holder that restricts the free flow of exiting combustion gases.*

3.2.2.1 *Discussion—*

Candle burners include, but are not limited to, lanterns, potpourri burners, and food warmers. Does not include the item known as a “candle follower”, also referred to by the term “candle burner” in the liturgical industry.

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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.

3.2.3 candle holder, n—candle accessory onto which a candle is placed.

3.2.3.1 Discussion—

It may support, hold or contain a candle when in use.

3.2.3.2 Discussion—

Filled candles are not candle holders.

3.2.4 candle ring, n—candle accessory intended to surround the candle with decorative materials in proximity to a candle, including, but not limited to, a continuous ring or loose fill material.

3.2.5 food warmer, n—a vessel intended to hold food that is heated by one or more candles; it is a type of candle burner.

3.2.6 potpourri burner, n—candle burner designed to provide a source of heat to warm a reservoir of extraneous material.

3.2.7 shade, n—a candle accessory placed above the candle, whose function is to modify light from the flame and change the appearance of the candle.

3.2.8 topper, n—vented candle accessory, which is placed directly on top of a container candle, to modify airflow.

3.3 Definitions of Terms Specific to This Standard: Definitions:

3.2.1 burn time, n—time interval a test specimen supports sustained flaming combustion after removal of the ignition source until all flaming ceases.

3.2.2 candle accessory, n—object designed, intended, or marketed for use with a candle. General Terms:

3.3.1 candle burner, barrier technology, n—a candle holder that restricts the free flow of exiting combustion gases. functional design element of a candle accessory that minimizes the risk of ignition of the combustible components of the candle accessory as a result of foreseeable misuse or failure of the candle.

3.3.1.1 Discussion—

Does not include the item known as a candle follower also referred to by the term candle burner in the liturgical industry. Candle burners also include, but are not limited to, lanterns, potpourri burners, and food warmers. Precautions should be taken in barrier technology designs to prevent ignition of combustible components. During intended use, the candle should not be capable of igniting combustible components from either heat transfer or direct flame impingement. Accessories should also be designed to prevent ignition of combustible components in reasonable and foreseeable situations such as in drafts or the candle falling over. Examples include a durable, noncombustible wall, or space absent of combustible objects.

3.3.2 candle holder, burn cycle, n—candle accessory onto which a candle is placed. It may support, hold or contain a candle when in use. the length of time a candle burns from when it is lit to when it is manually extinguished or from when it is lit until it extinguishes on its own at end of useful life.

3.2.4.1 Discussion—

Filled candles are not candle holders.

3.3.3 candle ring, burn time, n—candle accessory intended to surround the candle with decorative materials in proximity to a candle, including, but not limited to, a continuous ring or loose fill material. time a material supports sustained flaming combustion after removal of the ignition source until all flaming ceases.

3.3.4 consumption rate, n—rate at which a candle is consumed measured in grams of fuel consumed per hour. consumed.

3.3.4.1 Discussion—

In this specification, consumption rate is measured in ounces (grams) of fuel consumed per hour.

3.3.4.2 Discussion—

Consumption rate is determined by weighing a candle prior to burning and then again at the end of the life or burn cycle of the candle. The weight consumed in grams—ounces (grams) is then divided by the burn time in hours to arrive at a consumption rate in grams—ounces (grams) per hour.

3.3.5 diffusion flame, n—a type of flame where the fuel is not premixed with air or other oxygen source.

3.3.5.1 Discussion—

Diffusion flames are typically red, yellow, or orange in color.

3.3.6 flame height, n—the length of the candle flame from the base to the tip.

3.3.7 ignition, n—initiation of flaming combustion.

3.3.7.1 Discussion—

The combustion is typically evidenced by glow or flame. The combustion may be sustained or transient.

3.3.8 noncombustible, adj—not capable of igniting and burning when subjected to a fire under specified conditions.

3.3.8.1 Discussion—

Materials that pass Test Method **E136** are considered noncombustible.

3.2.9 potpourri burner, n—candle burner designed to provide a source of heat to warm a reservoir of extraneous material.

3.2.10 shade, n—a candle accessory placed above the candle, whose function is to modify light from the flame and change the appearance of the candle.

3.3.9 sustained flaming, n—existence of flame on or over the surface of the specimen for periods of 4 s or more.

3.3.9.1 Discussion—

Sustained flaming starts at the beginning of the period when a flame is found on or over the surface.

3.2.12 topper, n—vented candle accessory, which is placed directly on top of a container candle, to modify airflow.

4. Safety Requirements

4.1 Safety Requirements for Candle Rings—This safety requirement applies to all candle rings with the following exceptions: rings constructed exclusively of noncombustible materials, rings constructed exclusively of live plants or fresh cut flowers, or both; that remain hydrated during their intended life, or items which include rings that incorporate barrier technology (see **5.2.4.14 – 5.2.4.16**): <https://standards.iteh.ai/catalog/standards/sist/38e48d94-3d3d-40f6-a094-217f3ad2885b/astm-f2601-18>

4.1.1 Rationale:

4.1.1.1 Candle rings are used in proximity to a known source of ignition (candle flame).

4.1.1.2 Flammable components of candle rings increase the risk of fires when using candle products.

4.1.2 Performance Requirement:

4.1.2.1 A candle ring shall pass the flammability requirements for candle rings if, when tested according to **5.2**, it does not ignite or has a burn time less than or equal to an average of 30 s for three tests per component and the burn time for any one test shall not exceed 60 s. During any test, flaming shall not spread over the entire candle ring. The test shall be conducted on all applicable components of the ring.

4.1 Safety Requirements for Candle Holders, Shades, and Toppers—Flammability: This safety requirement applies to all candle holders, including candle burners and potpourri burners, and candle shades and toppers, with the following exceptions: items constructed exclusively of noncombustible materials (see **Note 1**) or which incorporate barrier technology. (See **5.2.4.15**.)

NOTE 1—Observations indicate that some porous materials which are otherwise considered to be noncombustible, for example, unglazed ceramics and terra cotta, absorb molten wax or other combustible liquids and can support sustained flaming combustion. This note has been provided for informational purposes only.

4.1.1 Rationale: This safety requirement applies to candle accessories intended to be used in direct contact with burning candles. See **X1.1**.

4.2.1.1 Candle holders, shades, and toppers are used with burning candles placed directly under, on, or in them.

4.2.1.2 A buildup of heat or direct flame impingement from the candle flame onto candle holders, shades, or toppers is possible during use, resulting in the candle holder, shade, or topper igniting.

4.1.2 Specifically this safety requirement applies to candle rings, candle holders, candle shades, candle toppers, and candle burners.

4.1.3 Accessories exempted from this requirement include:

4.1.3.1 Accessories constructed exclusively of noncombustible materials,

4.1.3.2 Accessories constructed exclusively of live plants or fresh cut flowers, or both, that remain hydrated during their intended life.

4.1.3.3 Birthday candle holders that can hold only one candle, do not contain pyrotechnics, and are not intended to move.

4.1.3.4 Accessories that incorporate barrier technology (see 5.2.3.13).

4.1.4 *Performance Requirement*—A candle holder, shade, or topper shall pass the flammability requirements for candle holders, shades, or toppers if, when tested according to—When tested in accordance with the test method in 5.2, it does not ignite or has a burn time less than or equal to an average of 30 s for three tests per component and the burn time for any one test shall not exceed 60 s. During any test, flaming shall not spread over the entire candle holder, shade, or topper. The test shall be conducted on all applicable components of the holder, shade, or topper.:

4.1.4.1 The accessory shall have a burn time less than or equal to an average of 30 s for three tests per component and the burn time for any one test shall not exceed 60 s.

4.1.4.2 During any test, flames shall not spread over the entire accessory.

4.1.4.3 The test shall be conducted on all applicable components of the accessory.

4.2 *Safety Requirements for Candle Burners and Potpourri Burners—Performance*: This safety requirement applies to all types of burners designed to use a candle as a source of heat or light, or both. Candle accessories marketed as food warmers must be assessed to determine whether the item qualifies as a candle burner, a candle holder, or other type of accessory and evaluated accordingly. Candle burners and potpourri burners are also subject to the requirements of 4.2.

4.2.1 *Rationale*—This safety requirement applies to all candle burners. See X1.2.

4.3.1.1 Candle burners and potpourri burners can contribute to secondary ignition, excessive flame heights, or end-of-useful life problems, or a combination thereof. These are often associated with the buildup of heat or soot or both from candles placed in these types of products:

4.3.1.2 Candle burners and potpourri burners meeting the performance requirement listed in 4.3.2 will reduce the risk of fires initiated by candles used with these types of products.

4.2.2 *Performance Requirement—Requirement*—When tested in accordance with 5.3:

4.2.2.1 All candle burners which have the capability of accepting multiple types of candles shall be labeled for use with, or multiple quantities of candles, maximum candle size and the candle type(s), (including number of wicks if pertinent). The label must have the following warning message or its practical equivalent, “or both, WARNING: For use with quantity, size, # wicks, type candle(s)” Example: “WARNING: For use with one, single wick container candle up to 22 ounces.” The minimum height of the safety alert symbol () and the warning message shall be 1.8 mm (0.07 in.) based on the height of an upper case letter. This warning shall be directly affixed, engraved or attached to the accessory shall be labeled as directed in 6.1 such a way that it is likely to remain on the item throughout its useful life (for example an adhesive label placed on the bottom or other surface of the item). If sold with external packaging, this warning shall also appear on the external packaging.

4.3.2.2 A candle burner shall pass the performance requirements if there is no secondary ignition, excessive flame height, or end-of-useful life problems as detailed in Sections 4.1 through 4.3 in Specification F2417 and the burner does not ignite, crack, or break when the candle burner is tested with an appropriate candle(s) according to the candle burning performance test method found in Section 5.2.4 of Specification F2417. If the appropriate candle is a tealight, it must meet the requirements found in 5.3.1. If the unit can be used with multiple candles, the unit is to be tested with the largest candle and the maximum number of candles specified on the label of the burner as found in 4.3.2.1.

4.2.2.2 ~~All~~The candle burners shall be tested using the prescribed candles in shall exhibit no secondary ignition.4.3.2.1 and 4.3.2.2. Three identical samples (burners) shall be tested using at least 8 candle burn cycles each. If the candle reaches end-of-life prior to the 8th burn cycle, continue the test with a new candle until 8 cycles are completed. For burners requiring tealight candles, or candles that reach end-of-life in less than 4 hours, each candle is burned to end-of-life which constitutes a complete cycle. Thus, each burner shall be tested 8 times.

NOTE 2—Research³ indicates that candle burners with a small internal volume, low ceiling height, and limited ventilation are especially at risk to fail the flame height, end-of-useful life, and secondary ignition requirements of Specification F2417.

4.2.2.3 The candle shall have no flame height greater than 3.0 in. (7.6 cm).

4.2.2.4 The burner shall not catch fire.

4.2.2.5 Neither the burner nor the candle container shall break or crack as a result of the test.

4.3 *Safety Requirements for Tealight and Taper Candle Holders*:

4.3.1 This safety requirement applies to candle holders not tested in accordance with 5.3 that are intended to use tealight or taper candles. See X1.3.

4.3.2 *Performance Requirement*—When tested in accordance with 5.4:

4.3.2.1 All holders which have the capability of accepting multiple types or multiple quantities of candles, or both, shall be labeled as directed in 6.1.

4.3.2.2 The candle shall exhibit no secondary ignition.

4.3.2.3 The candle shall have no flame height greater than 3.0 in. (7.6 cm).

4.3.2.4 The holder shall not catch on fire.

4.3.2.5 Neither the holder nor the candle container shall break or crack as a result of the test.

4.4 *Safety Requirements for Stability—Stability:* This safety requirement applies to all accessories intended to be used in direct contact with burning candles.

4.4.1 *Rationale*—This requirement minimizes the hazards of candle accessory/ensemble tip over; safety requirement applies to all accessories intended to be used in direct contact with burning candles. See X1.4.

4.4.2 *Performance Requirement*—The candle accessory must not tip over when placed at a minimum 10.0° incline when tested with the candle specified in When tested in accordance with 5.4.15.5.:

4.4.2.1 The accessory shall not tip over when placed at a minimum 10.0° (–0.0° / +0.5°) incline from horizontal when tested with the candle specified in 5.5.3.2.

4.4.2.2 Asymmetrical accessories shall not tip over at any position when rotated around the vertical axis.

4.4.2.3 Holders labeled in accordance with 6.2 shall be tested with the maximum size candle(s) specified on the label.

5. Test Methods

5.1 Candle fire safety issues addressed by these test methods include candle ring, shade, topper, and holder flammability, candle burner and potpourri burner accessories burn performance and stability. *General:*

5.1.1 *Safety Hazards—Warning*—There is an inherent risk of working with and around open flames.

5.1.1.1 Use appropriate personal protective equipment and practices that ensure a safe work environment.

5.1.1.2 Keep fire suppression equipment nearby that is capable of mitigating fires associated with candle accessory fire safety testing.

5.1.2 *Precision and Bias*—No information is presented about the precision or bias for any of the test methods in Section 5.

5.2 *Flammability of Candle Rings, Shades, Toppers, or Holders: Accessory Flammability Test Method:*

5.2.1 *Summary of Test Method—Method:* Components of candle rings, shades, toppers, or holders are tested on a flat noncombustible surface for sustained flaming combustion. Components of the ring, shade, topper, or holder are tested for flammability through contact with the flame source for up to 60 s. Each test is monitored for sustained flaming combustion of the component. Three separate tests are performed on each type of component of the candle ring, shade, topper, or the candle holder. The burn time is measured.

5.2.1.1 Components of candle accessories are tested on a flat, noncombustible surface through contact with the flame source for up to 60 s.

5.2.1.2 Each test is monitored for sustained flaming combustion of the component. Three separate tests are performed on each type of component of the accessory. The burn time of each test is measured and recorded.

5.2.2 *Apparatus:*

5.2.2.1 Large, flat, noncombustible surface.

5.2.2.2 *Flame Source*—A butane diffusion flame intended to represent a candle flame. The burner tube consists of a stainless steel tube with an outside diameter of nominally $8\frac{5}{16}$ mm-in. (8 mm) and a wall thickness of $1\frac{5}{128}$ mm-in. (1 mm). The gas supply system consists of a pressure gauge, flow meter, fine-control valve, and cylinder regulator providing an outlet pressure of 28.5 mbar (0.4 psi)–0.4 psi (28.5 mbar). The flow meter supplies butane gas at a constant rate of $452\frac{3}{4}$ mL/min³ at 25°C./min (45 mL/min) at 77°F (25°C). Under the specified conditions, the flame height is approximately $351\frac{3}{8}$ mm-in. (35 mm).

NOTE 3—An alternative flame source is permissible provided that it can be demonstrated by testing identical specimens with both the alternative flame source and the flame source specified in this test method that the tests using the alternative flame source yields failing results as often as, or more often than tests using the specified flame source.

5.2.2.3 An alternative flame source is permissible provided that it can be demonstrated by testing identical specimens with both the alternative flame source and the flame source specified in this test method that the tests using the alternative flame source yields failing results as often as, or more often than tests using the specified flame source. See X2.1 for further information.

5.2.2.4 Ring stand/clamp assembly.

5.2.2.5 Stopwatch.

5.2.2.6 ~~Ruler.~~ Noncombustible measuring device graduated in inches (millimeters), such as a ruler.

5.2.2.7 Thermometer.

5.2.2.8 Hygrometer.

5.2.3 *Safety Hazards*—(Warning—There is an inherent risk of working with and around open flames. Appropriate personal protective equipment shall be used and safe work practices shall be followed. Fire suppression equipment capable of mitigating fires associated with candle accessory fire safety testing shall be readily available during testing.)

5.2.3 *Procedure:*

5.2.3.1 The candle ring, shade, topper, or holder under test shall be conditioned—Condition the accessory before testing for at least 4 h at a temperature between 20 to 30°C (68 to 86°F) 68 and 86°F (20 and 30°C) and a relative humidity of less than or equal to 55 %. All candle rings, shades, toppers, or holders shall be tested in a burn test area that will be environmentally controlled to between 20 to 30°C (68 to 86°F) and less than or equal to 70 % relative humidity. Once removed from the conditioning atmosphere, the candle rings, shades, toppers, or holders shall be tested within 1 h.

5.2.3.2 The test shall be carried out with minimal disturbance of the flame source in a test area of sufficient size to accommodate the candle ring, shade, topper, or holder and prevent oxygen starvation of the flame source. The test surface shall be constructed of a noncombustible material and shall be cleaned before conducting each test, removing charred and molten materials or other debris from previous tests. Test the accessory:

(1) In a burn test area that will be environmentally controlled to between 68 and 86°F (20 and 30°C) and a relative humidity of less than or equal to 70 %.

(2) Within 1 h of being removed from the conditioning atmosphere.

(3) In an area with minimal disturbance of the flame source and sufficient size to accommodate the accessory and prevent oxygen starvation of the flame source.

(4) On a surface constructed of a noncombustible material that is cleaned before conducting each test, removing charred and molten materials or other debris from previous tests.

5.2.3.3 The finished product is to be tested. Test the accessory in an orientation typical of the product's intended use. The candle ring or holder shall be placed on the test surface such that it lays flat to simulate normal use with no free-flowing air space under the candle ring unless that is how the candle ring is designed:

(1) Place the candle rings on the test surface such that it lays flat to simulate normal use with no free-flowing air space under the accessory unless that is how the candle ring is designed.

(2) Position candle shades and toppers like they would be used on a candle.

5.2.3.4 The candle shades and toppers are positioned like they would be used on a candle. If a candle ring, shade, topper, or holder. Test the accessory in all orientations and configurations that it is designed or advertised to be used in several orientations or configurations, it shall be tested in every orientation/configuration for which it was designed or advertised. If the candle ring, shade, topper, or holder in. The accessory fails the performance requirement if it fails in any of the orientations tested, it will be considered a failure. tested.

5.2.3.5 Ignite and apply the flame source to each unique component, piece, and material on the accessory. See X2.2 for further information.

5.2.3.6 The flame source is to be applied to each unique component on the candle ring, shade, topper, or holder for a period of up to 60 s. The flame source shall remain. Keep the flame source stationary during the ignition period. The period with the flame source shall be positioned at an at a downward angle between 15 and 45° (nonburning end of flame source higher than the flame end) from horizontal. See Fig. 1.

5.2.3.7 Position the flame source such that its tip is stationary. The tip of the flame source shall be stationary and positioned approximately one half of the normal flame height away from the ring, shade, topper, or holder accessory component to be tested. See Fig. 1.

NOTE 1—For example, if the flame source produces a flame approximately $35\frac{1}{8}$ mm (1.4 in.) in. (35 mm) in height, the tip of the flame source would be positioned approximately $17\frac{5}{8}$ mm (0.7 in.) in. (17.5 mm) away from the test component. This will put the midpoint of the flame in contact with the edge of the component to be tested.

5.2.3.8 Ignite the flame source allowing the flame to make contact with the candle ring, shade, topper, or holder component. Remove the flame source from the test component as soon as the test component exhibits sustained flaming combustion. combustion or after 60 s, whichever occurs first.

5.2.3.9 Record the time from when the test component first ignites with sustained flaming combustion until flaming ceases. If the test component fails to ignite after 60 s, remove the flame source and ignite, record the burn time as 0 s.

5.2.4.9 Each candle ring, shade, topper, or holder shall be exposed to the flame at each unique component, piece, and material.

NOTE 5—For example, a simple circular candle ring or holder made of a single material with a uniform thickness would only have to be tested three times. A candle ring, shade, topper, or holder that has several different components (such as a candle ring that contains pinecones, berries, leaves, flowers, or a candle holder that has multiple types of materials) would be tested three times at each component. In addition, if there is a single flower and a grouping of flowers, the candle ring would be tested both at the single flower and the flower cluster since they have the potential to exhibit different flammability characteristics. A large flower and a small flower would each need to be tested even if they are made of the same material since it is possible for size and thickness of the item to affect test results.

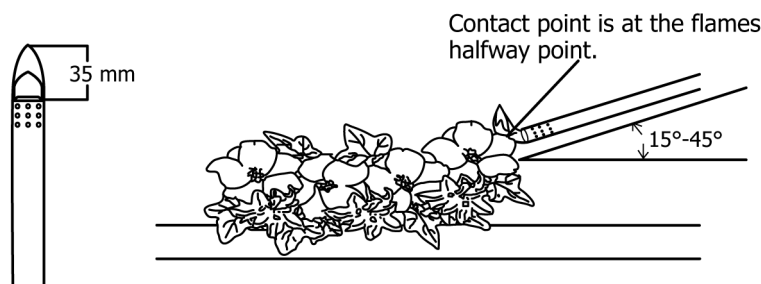


FIG. 1 Flame Source Positioning