Candle Flame Test for ITE and CE Equipment

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Purpose of this Presentation

• Present Technical Factual Information about the proposal
• Present the published rationale
Disclaimer

• I am presenting this as a technical presentation. I am representing myself and not my employer or any other interest.

• This is a very politically charged issue; my intent is not to take sides or present an angle; only to present non-biased factual information.
Overview: What is it?

• Product safety standards are generally written from the perspective of the individual product not being the cause of a fire.

• This proposal looks at a product as fuel loading in a room and addresses the issue of a product as not the source of the fire, but as the primary fuel source in an externally caused fire, specifically by an open flame.
Why?

- Introduction of more flammable furnishings, specifically plastic materials has dramatically decreased the time for egress for occupants of a dwelling from an estimated 17 minutes estimated from 1975-1976 full scale fire tests to 3 minutes in 2000-2001 full scale fire tests*

- The benefits of smoke detectors seems to have leveled off, ending the steep decline in loss of life in fires **
• Proposed by the National Association of State Fire Marshals

• Mission Statement: “Our mission is to protect human life, property, and the environment from fire”
What products are affected?

- Audio Video Equipment, covered by UL/EN/IEC 60065
- ITE (Information Technology Equipment) covered by UL/EN/IEC 60950-1
Two Different Proposals

• One proposal in TC108 committee
• One proposal being worked in STP (Standards Technical Panel)
• Different requirements in each proposal--differences are substantial
The proposed requirements (IEC)

• A product ‘having a candle flame accessible area’ covered by either standard shall comply if:

• The total mass of combustible materials located at the outer surface does not exceed 300 g; or
• The exterior enclosure/outer housing materials used are flammability class V-1 or better; or

• The exterior enclosure/outer housing materials used do not exhibit sustained flaming (more than 3 minutes); or
Differences between the IEC and STP proposals

- STP proposal applies to ALL surfaces of all products (not just products with candle flame accessible areas)
- STP proposal replaces V-1 preselection criteria with more stringent V-0 minimum.
Differences between the IEC and STP proposals (cont.)

- STP proposal includes the following verbiage in a): The total mass of combustible materials does not exceed 300 g, excluding combustible materials inside a metal fire enclosure.

- The IEC version includes a warning requirement for products made of combustible material and having a candle flame accessible area:
Differences between the IEC and STP proposals (cont.)

- “Warning: To prevent the spread of fire, keep candles or other open flames away from this product at all times.”

- The text or a symbol may be marked on the equipment or be provided with the equipment (user guide, etc.)
Differences between the IEC and STP proposals (cont.)

• STP proposal requires conditioning time of 48 h, IEC version requires condition time of 24 h.

• STP proposal specifies max. 30 s burning time after removal of the flame whereas IEC version allows 3 minutes.

• STP proposal includes heat release test option (previously included but now deleted from IEC version) as follows:
Heat Release:

• This option provides for a test to be carried out in the event flaming continues for more than 30 s (in the STP proposal only)

• The sample is ignited according to the candle flame test and the heat release is measured.

• If during the test, the maximum peak heat release is <50 kW, the product is considered to comply
Heat Release (cont.)

- This option was deleted from the IEC version because testing on identical samples was carried out in laboratories in the US, Germany, and Japan with very different results. The test methodology and results are not considered consistent enough.
Rationale for the Specific Requirements:

• Mass: Tests show burning 350 g of plastic mass resulted in a peak heat release rate (HRR) of 50 kW. This level of heat release or below is considered to have a low risk of igniting nearby objects by radiant heat.
Rationale (cont.)

• Preselection criteria: Materials rated V-1 or V-0 or better are demonstrated not to drip flaming particles and more likely to self-extinguish after removal of flame. Scientific rationale for V-1 vs V-0 unknown.

• Sustained flaming of 30s or 3 min: If there is no burning beyond some period of time, it is considered unlikely that other items will be ignited. Scientific rationale for 30 s vs 3 min. unknown.
Rationale (cont.)

- Peak heat release rate <50 kW: provides a test alternative for products with flammable material mass exceeding 300 g and sustained flaming beyond 30 s. Similar rationale as the 300 g limit: if heat release <50 kW, less likely to ignite nearby items.
The Test: Burner

- From 60695-2-2 (or 60695-11-5)
- 12 mm flame (approx. 50 W)
- Burner is a tube at least 35 mm in length, bore of 0.5 mm +/- 0.1 mm and outer diameter not exceeding 0.9 mm (or Hypodermic needle 20HV gauge)
The Test: Fuel

- Propane or Butane, >95% purity
- Test can be performed with ordinary 1 lb can of propane commonly available at hardware stores. A call to Bernzomatic confirmed their propane >95% pure.
The Test: Method

- Sample conditioned for min. (24 or 48 h at 23 deg. C (+/- 2) and 50% (+/- 5%) relative humidity (essentially normal controlled office environment conditions)
- EUT not energized
- Consumable media removed
- Tested on flat, non combustible surface
The Test: Method (cont.)

- Flame adjusted to 12 mm
- Burner held horizontally (+/- 5 deg)
- Flame held in contact with sample
- Position maintained for 3 minutes
- Flame position not adjusted during test
The Test: Where to apply the flame?

- STP: Any and all Surfaces
- IEC: Candle Flame accessible surfaces only
- What is a Candle Flame accessible surface?
5.2 Determination of candle flame accessible areas

Candle flame accessible areas are considered to be the following external surfaces of an INDIVIDUAL ITEM:

a) Peripheral surfaces that are vertical or overhanging the supporting surface, and between 10 mm and 150 mm directly above the supporting surface [see Figure 1a]]; or
b) Surfaces that are more than 20 mm but less than 150 mm above the supporting surface;

c) For overhanging surfaces that are between 10 mm and 20 mm above the supporting surface, the bottom surface up to 25 mm from the outer edge of the overhang [see Figure 1c]]; or

d) Up to 25 mm on a raised (stepped) horizontal surface, where the wick of a 20 mm diameter fallen candle on the lower step can be closer than 8 mm from the upper step [see Figure 1d]]; or

e) Areas of a surface that have a shape that could entrap a fallen candle that is 20 mm in diameter by 10 mm to 250 mm in length. From each position where the fallen candle may be captured, the candle flame accessible area extends as shown in Figure 1e).

The bottom of the EUT is not considered a candle flame accessible area provided the bottom is located less than 10 mm from the supporting surface in its normal position of use.

The picture worth a thousand words...
Figure 1 - Candle flame accessible parts (crosshatched areas), examples.
Video of actual tests

- This video footage taken at UL during an experimental test intended to actually carry out the test requirements as written. The IEC version of the test was performed. At that time, the heat release option was still part of the IEC test. It was later removed and is not a part of the proposal at this time.
What should you do?

- Assess your products now according to the proposal to see where your products stand and whether modifications would be required.
- If you have in-house fire test capabilities, perform pretests on products requiring it.
- Stay involved and up to date on the status of the proposal as it moves through the standards process.
Acknowledgments

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• ***Data from http://smokealarm.nist.gov/