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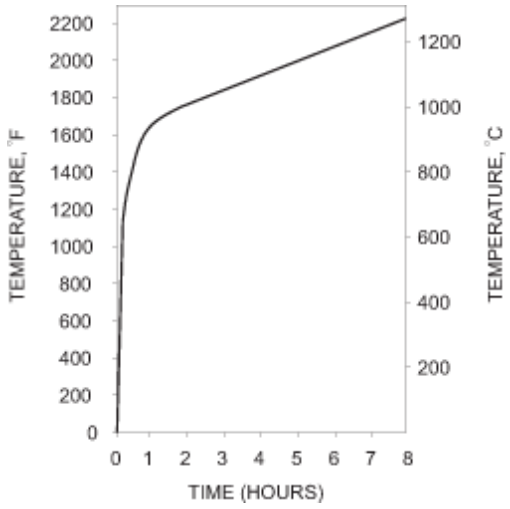
TechTALK

"What makes a Flammable Liquids Safety Cabinet Safe?"

When you look up the design and performance specifications of a Flammable Liquid Safety Cabinet, whether you reference OSHA 1910.106 or NFPA 30 or FM Approval Standard, you will virtually find the same criteria:

Design, construction, and capacity of storage cabinets.

- *Maximum capacity. Not more than 60 gallons of Class I or Class II liquids, nor more than 120 gallons of Class III liquids may be stored in a storage cabinet (most stringent per OSHA; NFPA differs slightly).*
- *Fire resistance.* ***Storage cabinets shall be designed and constructed to limit the internal temperature to not more than 325 °F (162°C). when subjected to a 10-minute fire test using the standard time-temperature curve as set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969, which is incorporated by reference as specified in §1910.6. All joints and seams shall remain tight and the door shall remain securely closed during the fire test.*** *Cabinets shall be labeled in conspicuous lettering, "FLAMMABLE — KEEP FIRE AWAY."*
- *Metal cabinets constructed in the following manner shall be deemed to be in compliance. The bottom, top, door, and sides of cabinet shall be at least No. 18 gage sheet iron and double walled with 1 1/2-inch air space. Joints shall be riveted, welded, or made tight by some equally effective means. The door shall be provided with a three-point lock, and the door sill shall be raised at least 2 inches above the bottom of the cabinet.*



Note: The time temperature curve as defined by ASTM E119, UL 263 and NFPA 251 are virtually all the same: The curve starts at 68°F (20°C) at 0 minutes, continues to 1000°F (537°C) at 5 minutes, and for safety cabinets finishes at 1300°F(704°C) at 10 minutes as measured on the outside above the flame. The actual flame touching the cabinet can measure ≈1600°F (871°C).

Q: What is significant about the 10 minute duration?

A1: To give personnel 10 minutes of safe egress from the area.

A2: To give the sprinkler system (if available) 10 minutes to extinguish the fire.

Q: So where does the maximum 325ºF (162°C) internal temperature gain come from?

A: In surveying some of the typical flammable and combustible liquids; their auto ignition temperatures ranged from: 347°F (175°C) for Acetaldehyde, to 1139° F (615°C) for Aniline, with an outlier* of Carbon Disulfide at 194°F (90°C).

Statistically speaking, 325°F (162°C) should safely cover the auto ignition point of well over 99% of flammable and combustible liquids. It would logically make sense, what the original framers of this test standard were trying to accomplish is; **to keep the flammable and combustible fluids stored inside a Flammable Safety Cabinet from reaching spontaneous combustion for at least a minimum of 10 minutes.**

Note: Typical auto ignition temperatures of flammable & combustible liquids: ethanol = 689°F, gasoline = 475°F (246°C), jet fuel = 410°F (210°C) , kerosene 428°F (220°C), methyl alcohol = 867°F (462°C) etc…

In conclusion, the safety cabinet burn test is conservative, representing a worst case scenario:

1. The test is conducted with pressurized fuel to reach the test's specified heat within 10 minutes and the heat is applied on all four sides of the cabinet.
2. With the exception of the auto ignition outlier* of Carbon Disulfide at 194°F (90°C), the maximum allowable internal temperature gain of 325°F (162°C) is conservative as compared to the auto ignition temperature of most flammable and combustible liquids.

Note: Regardless of these observations, use all urgency to evacuate an area on fire.

* In statistics, an **outlier** is an observation that is numerically distant from the rest of the data. (Barnett, & Lewis, 1994)