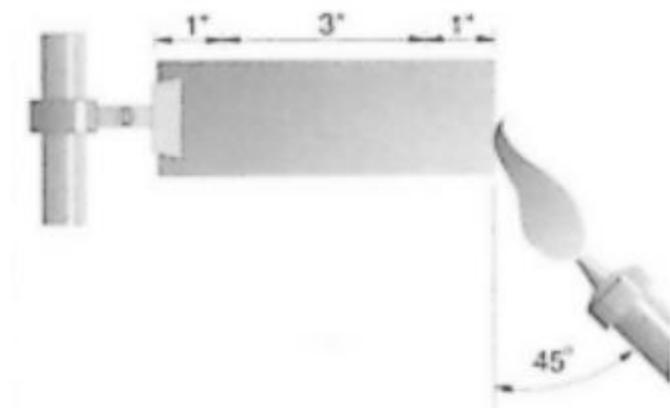


FLAMMABILITY CLASSIFICATION - UL 94

UL 94 FLAMMABILITY CLASSIFICATION TESTS FOR PLASTIC MATERIALS

UL 94 is the standard applied by the American Underwriters Laboratories for the testing of the flammability and fire safety of plastic materials used in devices and appliances. In the UL 94 HB (Horizontal Burning) test the burning of a horizontal plastic specimen is tested and in the most demanding UL 94V (Vertical Burning) tests the burning of a vertical test specimen. Precise details of the equipment, conditions and test systems to be used can be found in the UL 94 standard.

UL 94 HB: Horizontal burning test

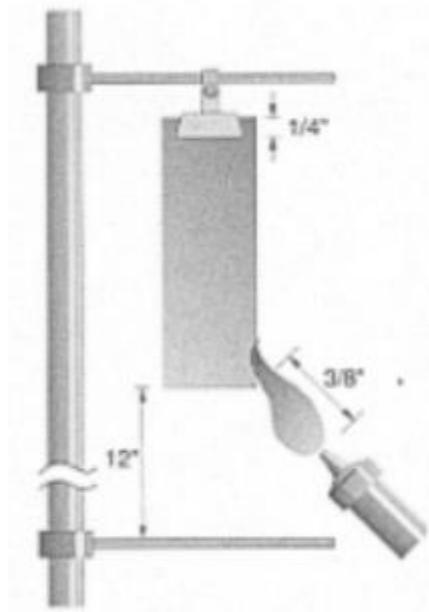


The length of the test specimen is 5" (127 mm) and width 0.5" (12.7 mm). The test sheet cannot be more than 0.5 (12.7 mm) thick. Lines are marked on the sheet at the 1" and 4" locations. The sheet is fixed horizontally at one end and tilted 45 degrees in the direction of the width, as shown in the diagram. The burner used is adjusted so that it forms a 1" long blue flame. The flame is directed at an angle of 45 degrees to the front edge of the plastic sheet so that about 1/4 of the test specimen's front edge is in the flame. The flame is applied for 30 seconds, after which it is removed. If the test specimen burns to the 1" line before 30 seconds have passed the flame is removed immediately. The test is carried out on three test sheets.

The material under investigation is classified as UL 94 HB if, after the removal of the flame:

- A) The speed of burning does not exceed 1.5" (38.1 mm) per minute when the test specimen thickness is 0,120-0,500" (3,05-12,7 mm)
- or
- B) The speed of burning does not exceed 3,0" (76.2 mm) per minute when the thickness of the specimen is less than 0,120" (3,05 mm)
- or
- C) Burning finishes before the flame reaches the 4" line

UL 94 V-0, V-1, V-2: Vertical burning tests



The test specimen length is 5" (127 mm) and width 0.5" (12.7 mm). The sheet to be tested can not be more than 0.5" (12.7mm) thick. The sheet is fixed 1/4" from the upper end in the vertical position. A metal mesh covered with surgical cotton is positioned 12" (305 mm) beneath the test sheet. The flame of the burner used is adjusted so that it forms a 3/4" blue flame. The flame is directed from below at the lower edge of the plastic sheet at a distance of 3/8" (9.5 mm). The flame is applied for 10 seconds, after which it is removed. The burning time of the test specimen is recorded. Immediately the burning stops the flame is reapplied for 10 seconds. After removal of the flame the burning time and afterglow time is again noted. The entire test is carried out on five different test specimens.

The material tested is UL 94 V-0 classified if:

- A) None of the five test specimens burn for over 10 seconds at any time when the burner flame is removed.
- B) The total burning time of the 10 ignition test does not exceed 50 seconds.
- C) No test specimen burns either with a flame or afterglow to the clamp.
- D) No burning drops should fall which would cause the cotton underneath to ignite from any test specimen.
- E) The afterglow burning of no test specimen exceeds 30 seconds.

The material tested is UL 94 V-1 classified if:

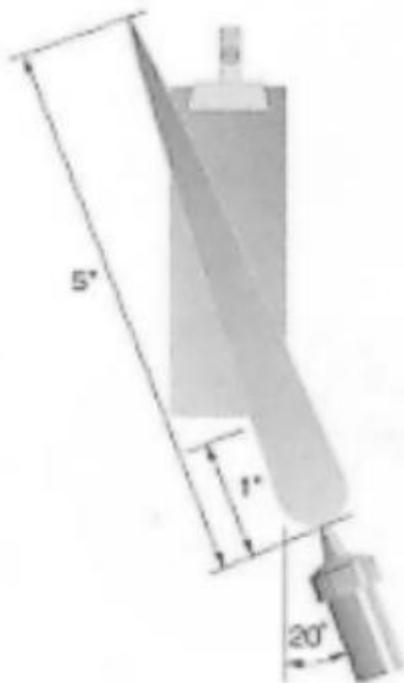
- A) None of the five test specimens burn for over 30 seconds at any time when the burner flame is removed.
- B) The total burning time of the 10 ignition test does not exceed 250 seconds.

- C) No test specimen burns either with a flame or afterglow to the clamp.
- D) No burning drops should fall which would cause the cotton underneath to ignite from any test specimen.
- E) The afterglow burning of no test specimen exceeds 60 seconds.

The material tested is UL 94 V-2 classified if:

- A) None of the five test specimens burn for over 30 seconds at any time when the burner flame is removed.
- B) The total burning time of the 10 ignition test does not exceed 250 seconds.
- C) No test specimen burns either with a flame or afterglow to the clamp.
- D) Only such burning pieces may fall from the test specimen, which burn only momentarily, and of which some ignite the cotton underneath.
- E) The afterglow burning of no test specimen exceeds 60 seconds.

UL 94 5V: Vertical burning test



The length of the test specimen is 5" (127 mm) and the width 0.5 (12.7 mm). The test sheet shall not be more than 0.5" (12.7 mm) thick. Flammability classification is granted for specific thickness intervals, for which both the maximum thickness and minimum thickness sheet must be tested. The test sheet is fixed 1/4" from the upper end in the vertical position. The flame of the burner used is adjusted so that it forms a 5" flame whose blue heart is 1,57" (40mm) long. The flame is directed from below at the corner of the plastic sheet at a distance of 1". The flame is applied for 5 seconds, after which it is removed for 5 seconds. This is repeated five times. The entire test is carried out on

five test specimens.

The material tested is UL 94 5V classified if:

A) No test specimen burns with a flame or afterglow for more than 60 seconds after the fifth ignition.

B) No material drops from the test specimen.