

Flammability and Carpet Safety

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1.0 Introduction

- 1.1 The flammability characteristics of building materials, interior finishes, and furnishings are important in protecting human life and property from fire. Such properties greatly influence whether these materials ignite and how they affect the rate at which a fire might spread.
- 1.2 Research has identified two possible ways in which carpet might become involved in a fire. The first situation is where carpet might be the first item ignited, and the possibility of spreading flame from a small ignition source, such as a dropped match, where the small flame might spread across the floor to ignite other materials.
- 1.3 The second situation associated with carpet is its behavior in a fully developed fire, where intense heat radiates down onto the carpet surface in conjunction with advancing flames.
- 1.4 Research and experience have produced tests that clearly demonstrate carpet's inherently favorable flammability performance in the lab as well as the real world. Regulations based on those tests are much less stringent than those for other interior finish materials, thus acknowledging carpet's performance in the real world.

2.0 The Pill Test

- 2.1 The first situation described above is addressed by the Flammable Fabrics Act, which is administered by the US Consumer Product Safety Commission. The standard, CPSC FF 1-70, covers both carpet and large rugs. A similar standard, FF 2-70, addresses rugs of less than 24 square feet.
- 2.2 All carpet and rugs manufactured, imported or introduced into commerce in the United States, must meet the acceptance criteria of FF1-70, or in the case of small rugs, FF 2-70. The same test is used for both standards.
- 2.3 In this test no more than one out of eight specimens may burn a distance of three inches from the point of ignition. The eight 9-inch square specimens, which have been dried in an oven, are subjected to a flame from a standard igniting source, a methenamine tablet. The tablet or "pill," (hence the "pill test") is placed in the center of the specimen and ignited with a match. If the flame spreads more than three inches from the point of the ignition, the specimen fails. If more than one of the eight fails, the carpet cannot be legally sold. The burden of compliance rests with the carpet manufacturer. The flammability of imported products must be certified by the foreign manufacturer and the importer unless the Consumer Public Safety Commission (CPSC) exempts one or the other of the responsibility.
- 2.4 Small rugs regulated under FF2-70 that do not meet the criteria may be permanently labeled "Flammable: (Fails U.S. Consumer Products Safety Commission Standard FF 2-70)" and entered into commerce.



3.0 Flooring Radiant Panel Test

- 3.1 Research conducted by The National Bureau of Standards (National Institute of Standards and Technology) involving both laboratory and full scale fire tests led to the development of the flooring radiant panel test. Full scale corridor fire testing revealed the level of radiant energy from a fully developed fire was the significant factor in determining if a floor covering would spread a fire.
- 3.2 The flooring radiant panel test evaluates the propensity of a floor system to spread fire when exposed to intense radiant heat from a gas fired radiant panel. The method determines the minimum level of infrared (heat) energy from other sources required to promote burning of a flooring material. This property, called critical radiant flux, is measured in watts per square centimeter.
- 3.3 This test simulates conditions in a corridor with an opening into a room that is fully engulfed in flame – put simply; it measures the propensity of the flooring material to spread the fire down the corridor to the next room.
- 3.4 The critical radiant flux limits specified in the National Fire Protection Association (NFPA) 101 Life Safety Code for areas where automatic sprinkler protection is not provided are:
 - 3.4.a Class I – average minimum 0.45 watts per square centimeter
 - 3.4.b Class II – average minimum 0.22 watts per square centimeter
- 3.5 The higher level of critical radiant flux, Class I, is specified for health care facilities, assuming that occupants with limited mobility require a higher level of protection, in order to permit escape.
- 3.6 The Class II level is specified for all other facilities where the higher level of protection is not necessary.
- 3.7 These requirements are general and the NFPA Life Safety Code or local codes should be consulted for more specific guidance. It is important to understand that the flooring radiant panel is applicable only to carpet installed in corridors and has no application to room or open space installations. Carpet installed in rooms and all locations other than corridors is covered by the “pill test” mentioned above.
- 3.8 Carpet is manufactured for use as a floor covering, and installation on other surfaces, such as walls, is not recommended. Most carpet manufacturers will not assume any liability if carpet is installed on surfaces other than floors. Specific tests exist for interior finish materials installed on walls or ceilings.



4.0 Smoke Generation

- 4.1 Some regulatory agencies specify limits on smoke generated under specified conditions, although it is not referenced in the International Building Code. The most widely used test method is known as the NBS Smoke Density Chamber, American Society for Testing and Materials (ASTM) E-662.
- 4.2 In this test, a 3 inch square sample is placed in a closed chamber and exposed to a source of intense radiant heat energy, with or without open flame. A light beam is projected through the closed chamber, and any reduction in light transmittance caused by the smoke developed is measured. The property measured is called the specific optical density.
- 4.3 The regulatory limit typically mentioned is a maximum of 450 with the test conducted in the flaming mode.

5.0 Summary

- 5.1 There have been no documented incidents known to the carpet industry in more than 3 decades where carpet has contributed to a fire.
- 5.2 Specifiers must always be familiar with local requirements and any special situations.
- 5.3 There is no need to include requirements for the “pill test” in specifications, as all carpet introduced into commerce in the US must meet this standard.
- 5.4 The above tests are sometimes referred to by other designations, but the test is the same. The “pill test” may sometimes be referred to as ASTM D2859. Other designations for the flooring panel test are ASTM E648 and NFPA 253. The NBS Smoke Density test is designated as ASTM E-662 and NFPA 258.

