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Flammability and Carpet Safety
Technical Bulletin

The flammability characteristics of building materials, interior finishes, and furnishings greatly affect the speed with which a fire grows. The slower a fire grows, the less threatening to life, and the more easily the fire may be controlled.

Traditionally, interior finish restrictions contained within building and fire codes were promulgated to regulate materials placed on walls and ceilings. Historically, floorcoverings have not been identified as factors which significantly affect the spread of fire in buildings; therefore, floorcoverings were generally exempted from flammability regulations in building and fire codes.

The Pill Test

Flammability research identified two possible ways in which carpet might become involved in a fire situation. The first situation is where carpet is the first item ignited, and the possibility of propagating flame from a small igniting source; for example, where the flame from a dropped match would spread across the floor to ignite furniture, draperies, wallcoverings, etc. It is generally accepted that this situation is adequately measured and controlled by Federal Standard FF 1-70, which was enacted into law in 1970. This standard, which covers both carpet and large rugs, is now under jurisdiction of the Consumer Product Safety Commission (CPSC) and is referenced in 16 CFR 1630. An almost identical, although not exact, test standard can be found in American Society of Testing and Materials (ASTM) test method D-2859.

All carpet and rugs manufactured for sale in the United States, or imported into this country, must meet the acceptance criteria of FF1-70, i.e., that no more than one out of eight specimens shall burn a distance of three inches from the point of ignition when tested according to the prescribed method. The test method involves subjecting a 9 x 9 inch (23 x 23 cm) specimen, which has been dried in an oven, to the flame from a standard igniting source in the form of methenamine tablet. The tablet or “pill,” hence the “pill test,” is placed in the center of the specimen pile side and ignited with a match, providing a standardized flame source for a period of about two minutes. If the flame is spread by the carpet more than three inches from the point of the ignition, the specimen fails; and if more than one specimen of eight fails, the style of the carpet cannot be legally manufactured for sale. The burden of compliance to FF1-70 rests with the carpet manufacturer.

The Flooring Radiant Panel

The second flammability situation associated with carpet is the behavior of the material in the presence of a fully developed fire radiating heat down onto the carpet in conjunction with an advancing flame front. Full scale corridor fire tests showed the level

of radiant energy exposing a floorcovering significantly affected whether or not progressive flaming occurred. Work conducted by The National Bureau of Standards (National Institute of Standards and Technology) involving both laboratory and full scale fire test programs led to the development of the flooring radiant panel test.

The flooring radiant panel evaluates the tendency of a floor system to spread flame when exposed to radiant heating of a gas fired radiant panel. The method determines a material's critical radiant flux (measured in watts per square centimeter) – the lowest intensity of radiant heat which will cause a floor covering to propagate flame over its surface. The flooring radiant panel apparatus involves a 100 x 20 cm (39 x 8 inch) sample which is horizontally mounted on the floor of the test chamber. The specimen receives the radiant energy exposure from an air-gas fueled radiant panel mounted above the specimen. The gas fired radiant panel generates a radiant heat energy exposure along the length of the specimen ranging from a maximum of approximately 1.1 watts per square centimeter immediately under the radiant panel to approximately 0.1 watts per square centimeter at the far end of the test specimen remote from the panel. A gas fired pilot burner is used to initiate flaming of the sample. The test is continued until the flooring system ceases to burn. The distance the flooring system burned is noted. The radiant heat energy exposure is noted at the point the flooring system "self-extinguished." This measurement is reported as the sample's critical radiant flux. This value, critical radiant flux, is the minimum energy necessary to sustain flame propagation.

Critical radiant flux limits suggested for specific use areas where automatic sprinkler protection is not provided are:

Class I – average minimum 0.45 watts per square centimeter within exits, access to exits (corridors) of health care facilities (hospitals, nursing homes, etc.), and new construction detention and correctional facilities.

Class II – average minimum 0.22 watts per square centimeter within exits, access to exits (corridors) of day care centers, existing detention and correctional facilities, hotels, dormitories, and apartment buildings.

These limits are based upon known performance of traditionally used materials and the performance of flooring systems when subjected to full scale corridor fire tests.

The higher level of critical radiant flux, recommended within health care occupancies, is established based on the assumption that nonambulatory occupants (patients) require a higher level of protection than would be necessary in buildings where occupants are mobile and rapid escape is possible.

Today, the flooring radiant panel concept has been adopted in the Basic Building Code of Building Officials and Code Administrators International, Inc. (BOCA), the Standard Building Code of Southern Building Code Congress International, Inc. (SBCC), the Life Safety Code of the National Fire Protection Association (NFPA), and

the Uniform Fire Code of the International Conference of Building Officials (ICBO). The test method has also been accepted by the American Association of Testing and Materials (ASTM) and the National Fire Protection Association (NFPA) and is identified as ASTM E-648 and NFPA-253 respectively.

Moreover, the test method has been adopted by virtually all federal agencies.

It must be emphasized that the flooring radiant panel is applicable only to carpet installed in corridors and has no application to room installations. Carpet installed in rooms and all locations other than corridors should be regulated by FF1-70.

Carpet is manufactured for use as a floor covering, and installation on other surfaces, such as walls, is not recommended. Many carpet manufacturers will not assume any liability, real or implied, when carpet is applied on surfaces other than floors.

Note: This information is extracted from CRI's Carpet Specifier's Handbook, 1992 edition.