

Carpet Flammability Test Methods and Requirements

Awareness of the flammability characteristics of interior materials, including carpet, is essential since these materials can affect the behavior of a fire. The less these materials contribute to spreading a fire, the less threat to life and property they pose in the presence of a fire, and the easier the fire is to control and extinguish. Carpet is one of the least likely interior materials that contribute to spreading a fire.

Prior to 1971 there was no widely accepted test method to determine the flammability characteristics of carpet. Because of this, the National Fire Protection Agency recommended that the Steiner Tunnel Test (ASTM E 84-Standard Test Method for Surface Burning Characteristics) as the accepted standard. This test was originally developed to evaluate the flammability characteristics of wall and ceiling materials by comparing the flame spread along the material and comparing the measurement obtained to the flame spread along a select red oak and fiber cement board. The measurement obtained is used to determine the flame spread potential and fuel contribution of a material based on the premises that the higher the number obtained from the test, the greater the flame spread potential of that material. At the time when the Steiner Tunnel Test was used to evaluate and rate a carpets flame spread potential the spread limit was set at 75. A rating of 0-25 is reported as a Class A rating, and a rating of 26-75 is reported as a Class B rating.

Because the Steiner Tunnel Test evaluated carpet mounted on a wall and ceiling, the flame spread results obtained in this test is not comparable to that of carpet installed on a floor. As a result, fire fighting authorities agreed that because the Steiner Tunnel Test was incapable of providing the data needed to determine the flammability characteristics of carpet in an actual fire, a more realistic carpet flammability test was required. Although the Steiner Tunnel Test remains the primary test method used to evaluate the flammability characteristics of wall and ceiling materials, the carpet industry no longer relies on the Steiner Tunnel Test for purposes other than testing textile wallcovering materials.

At the time when the Steiner Tunnel Test was still used to evaluate the flammability characteristics of carpet The U.S. Fire Administration determined that the most common source of household fires was due to the ignition of upholsteries and mattresses by items such as a dropped match, a lit cigarette, or a burning ember from a fire place. As a result, by 1971 the Department of Commerce (DOC) enacted the Flammability Fabrics Act FF1-70 into law for carpet, and FF2-70 for rugs measuring no greater in size than 24 sq ft. This act requires all carpets and rugs manufactured for sale in the United States to pass the Methenamine Pill Test (ASTM D 2859, NFPA 101).

The Methenamine Pill Test subjects a carpet test specimen to a "first to ignite" scenario by placing a white, crystalline methenamine pill in the center of a 9" x 9" carpet specimen, which is then ignited and allowed to burn for two minutes. If the flame spread is more than three inches from the point of ignition before the carpet self-extinguishes the carpet test specimen fails. If more than one out of eight carpet test specimens fail, that carpet cannot be legally manufactured for sale in the United States until such time that the necessary changes or modifications are made to enable the carpet to pass the Pill Test. As of November 12, 2008, The Consumer Product Safety Improvement Act (CPSI) requires carpet manufactures to provide a CPSI Certificate of Compliance in some form to their dealers with each carpet shipment, and to have their products Pill Test documents readily available to The Consumer Product Safety Commission upon their request.

As the use of carpet increased in commercial facilities, the need to have a dependable test method capable of determining the tendency of a carpet to spread flame to other parts of a building when exposed to a stage 3 fire (full involvement,

or flashover from room to room) became apparent. By 1978 the carpet industry began using the Flooring Radiant Panel Test (ASTM E 648, NFPA 253) for this purpose. By 1980, members of the National Fire Protection Agency (NFPA) adopted this test as a new standard for carpet. Although the Flooring Radiant Panel Test has been adopted by virtually all federal agencies, and is often required by Fire Marshalls for carpet installed in commercial facilities, it is not a required test for carpet flammability under federal law, and its use is left to the discretion of the carpet manufacturer.

The Flooring Radiant Panel Test measures the lowest level of radiant energy necessary for a fire to continue to burn. The distance a carpet test specimen burns to extinguishment is measured and converted into watts per square centimeter (i.e. the heat energy radiated onto the surface of a material), which is referred to as critical radiant flux. The higher the critical radiant flux number yielded by a carpet in this test, the more resistant it is to spreading flame. Based on this test, flammability ratings of carpet are reported as either Class I (a minimum of 0.45 watts/sq cm), or Class II (a minimum of 0.22 watts/sq cm). Typically, a carpet with a Class I Radiant Panel rating is required in corridors, entrances and exits of commercial facilities, and a Class II Radiant Panel rating is required for all other areas.

While state Fire Marshalls set the standard for flammability testing and requirements of materials, the local Fire Marshall has the same authority, as well as the final say in this matter. Normally, a Fire Marshal will abide by the Life Safety Code, which is provided by the NFPA, which recognizes the Flooring Radiant Panel as their carpet flammability test requirement. For this reason, it is essential for specifiers, builders, facility managers, and carpet dealers to know what the local fire codes are for carpet for it to be considered to be suitable for a particular commercial end-use. When used in a commercial facility that is equipped with an automatic sprinkler system, carpets that have a Flooring Radiant Panel Classification rating are considered to be suitable for almost all commercial end-use applications, as well as for marine craft seventy five feet in length or less, and with less than 150 occupants.

The smoke emitted by burning materials poses a major threat to building occupants because it can hinder their ability to vacate a building in the event of a fire, and because it is toxic. For this reason, the Smoke Chamber Test (ASTM E 662, NFPA 258) is used to measure the flammability characteristics of a carpet relative to the smoke density it produces in a flaming mode, as well as a non-flaming mode. Using this test, three carpet test specimens are tested and rated using a photometric system with a vertical light path to measure the reduction in light transmission during the duration of the test. The photometric scale used to measure the smoke generated by a burning and a smoldering material is similar to the optical density scale used to evaluate human vision. The regulatory limit for carpet is a maximum specific optical density of 450 based on the results obtained from a carpet in the burning mode.

Fire experts agree that minimizing the threat of a fire requires the fire to be suppressed while it is still small. Although studies have demonstrated that because carpet is installed on the floor it will not likely become involved in a fire until a room reaches flashover (the point in which a room becomes fully involved in a fire), use of the Methenamine Pill Test and, when required, the Flooring Radiant Panel Test, coupled with the use of smoke detectors and automatic sprinkler systems helps assure that carpet provides consumers with a flammability safe floorcovering.

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