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## INTERIOR WALL AND CEILING FINISH AND TRIM

The IFC requirements for interior finish materials installed on walls and ceilings are based on its rate of flame spread and smoke production, or its ability to contribute to flashover. Different fire test methods are permitted by the IFC, and each test has its own criteria for assessing the relative fire risks of materials being evaluated. [Ref. 803.1]

A fire test that has been used for over 50 years is ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*. ASTM E 84 is also known as the Steiner Tunnel Test, named after Edward Steiner, who was an engineer at Underwriters Laboratories who developed the test apparatus. The test involves comparing the performance of the material being evaluated to two materials which have predictable and reproducible test results. The test results are reported as a material's Flame Spread Index (FSI) and Smoke Developed Index (SDI). FSI and SDI are a comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame or smoke obscuration versus time for a material tested in accordance with ASTM E 84 or UL Standard 723. (See Figure 7-3) [Ref. 802.1]

Flame spread is assessed visually by the progression of the flame front, while measurements of optical smoke density at the tunnel outlet determine the smoke obscuration. This information is used to plot time-based graphs of flame-spread distance and of optical density. FSI and SDI are then calculated based on the ratio between the duration for the material being tested and those for asbestos cement board (assigned



**FIGURE 7-3** ASTM E84 test apparatus for measuring material's flame spread and smoke development indexes (Courtesy of Underwriter's Laboratories, Northbrook IL)

FSI and SDI values of 0) and for red oak flooring (assigned FSI and SDI values of 100). Based on the FSI and SDI values, the IFC assigns a Class rating for interior finish materials:

Interior finish material classifications in accordance with ASTM E 84

Material class	Flame spread index	Smoke development index
Class A	0–25	0–450
Class B	26–75	0–450
Class C	76–200	0–450

The class ratings are used to assign minimum interior finish requirements inside buildings. [\[Ref. 803.1.1\]](#)

Although the E84 test provides a reasonable basis for comparing surface flame-spread characteristics of “traditional” building materials, such as wood, the results of this test may not predict actual fire behavior for many contemporary materials, particularly textiles and plastics. Melting and dripping of these materials during the test and the use of a ceiling-mounted sample configuration can skew test results for contemporary materials, discrediting the E84 test results.

Because of these recognized weaknesses with the E84 test, the IFC references a more-current test method, classified as “room-corner tests,” which is prescribed by NFPA Standards 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*. Tests conducted in accordance with this standard are recognized by the IFC as alternatives to the ASTM E84 approach to flame-spread testing, because room corner tests do a better job of simulating actual fire conditions. In a room corner test, materials are mounted to the walls and/or ceiling of a test room, and the fire exposure is generated by a gas burner that simulates a trash can fire extending to a chair in the corner of the room. (See Figure 7-4) [\[Ref. 803.1.2\]](#)



**FIGURE 7-4** A room corner fire test apparatus



**FIGURE 7-5** A room corner fire test of a wall and ceiling finish material

## Code Basics

Interior wall and ceiling finish requirements were developed so that selected materials contribute little fuel to a fire. The requirements in the IFC are based on the FSI and SDI of a material. As an alternate to the ASTM E 84 test, the IFC allows the use of a room-corner test, which offers a realistic assessment of a material's fire behavior. ●

The burner flame in the NFPA 286 test contacts the ceiling surface in the latter portion of the test, providing a substantial fire exposure to ceiling-mounted materials. Because the burner flame exposes both the wall and the ceiling in the NFPA 286 test, this test can be used for evaluation of both wall and ceiling finishes. To successfully pass the room-corner test, the material being tested must withstand certain fire exposure and, depending on if the material will be installed on walls, ceilings, or both, the flames must not extend beyond either the walls or boundary of the test compartment. (See Figure 7-5) The acceptance criterion is:

1. During the 40 kilowatt (KW) exposure, flames do not spread to the ceiling.
2. During the 160 KW exposure, the flames do not spread to the outer extremity of the sample on any wall or ceiling and flash-over, as defined in NFPA 286, does not occur.
3. The total smoke released throughout the duration of the fire test does not exceed 1,000 square meters. [\[Ref. 803.1.2.1\]](#)

Requirements for interior finish materials are set forth in Table 803.3 of the IFC and IBC (see Table 7-2). Table 803.3 establishes these requirements based on the occupancy classification of the building and where the interior finish material will be installed within the means of egress system. Consider a Group A-2 occupancy. If the building is not protected by an automatic sprinkler system, Class A interior finish materials are required in all exit enclosures, exit passageways, and corridors while all rooms or enclosed spaces would require the use of interior finish materials with a Class B rating. If the building is protected throughout by an automatic sprinkler system, the interior finish materials with a higher FSI can be used.

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