

Fire Engineering®

Construction Concerns: Fire Resistance of Doors **Article by Gregory Havel**

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Since we were in elementary school, public fire education programs informed us that closed doors are better than open doors in protecting firefighters from fire and from the products of combustion. Since we were in Firefighter I class, we have known that some doors are listed as fire-rated and need to be kept closed (or held open by a smoke-operated door holder) and that other doors are not fire-rated.

The standard to which fire-rated door and frame assemblies are tested is National Fire Protection Association (NFPA) Station 252, *Standard Methods of Fire Tests of Door Assemblies*, 2012 edition (also referenced as UL 10B and formerly as ASTM E152 or ASTM E2074). The door and frame assemblies are rated according to the length of time they can withstand the furnace test within the test parameters. The fire door ratings under NFPA 252 (2012 edition) are 20 minutes, 30 minutes, ¾ hour, 1 hour, 1½ hours, and 3 hours. Doors are also rated in hourly increments over three hours, but these ratings are not often used because of their cost. See NFPA 252 Chapter 8 and Section 8.1.3.1 for detailed information on the test and ratings.



Photo 1 shows a sample of the construction of a wooden panel door commonly used in residential and business occupancies. This type of door cannot meet the test for fire rating under NFPA 252 because of the thin cross-sections of its panels where they join the rails and stiles. A modern door such as this one will be made up of many pieces of

wood laminated together with the grain running in different directions so that it is less likely to warp. Older doors will be made up of solid wood rails and stiles with thin wood panels in between.

Another type of door that cannot meet the test for fire rating under NFPA 252 is the honeycomb core (hollow-core) wood door, commonly used in residential and business occupancies. This door is made up of two thin veneers of wood separated by a honeycomb of thin wood or fiberboard strips.



Photo 2 shows the construction of a slab door with a particle-board core. This type of door is made of a slab of particle board (wood fibers and adhesive) with a wood veneer glued to both faces. This type of door can meet the test for fire ratings up to one hour according to NFPA 252 and is frequently used in fire-rated assemblies in residential and business occupancies.



Photo 3 shows the construction of a wooden slab door with a gypsum (kalamein) core. This type of door appears similar to a slab door with a particle-board core except that the core is gypsum material like that used in drywall board. This type of door can meet the test for higher levels of fire rating under NFPA 252 than the particle-board core. This

door type is frequently used in fire-rated assemblies in schools, patient-care facilities, and commercial buildings. It is also manufactured of steel instead of wood veneer and is filled with gypsum material.

Some older kalamein doors had a core of asbestos cement instead of gypsum. Although the asbestos core is no longer used because of the health hazard of asbestos, many of these doors are still present in structures built before 1980.

All of these doors, when closed, are good barriers to products of combustion. The gypsum core fire-rated door provides more resistance to fire than the particle-board core fire-rated door. The nonfire-rated wood door provides minimal resistance to fire and will burn through during its testing before the minimum time required for any fire rating.

We must remember during firefighting operations that any door can provide the building's occupants (and firefighters) with some protection against smoke and heat. Close doors that you find open unless they are needed for your exit, the passage of hoselines, or for ventilation.

We must also remember that the tests for fire resistance are based on the time-temperature curve for cellulose-based materials; today's furnishings of plastics and synthetic materials, with higher energy content and a higher rate of heat release than cellulose, may cause fire-rated door and frame assemblies to fail before their rated time.

Door and frame assemblies with fire door listing labels indicate the presence of fire-rated wall assemblies which divide a building into sections for fire protection purposes. This information deserves a note on our preincident plan for the building. During a serious fire, these fire-rated wall assemblies can become defensive lines: the part of the building on one side of the wall might have to be sacrificed to protect the larger or more valuable part of the building on the other side of the wall.

Other types of fire-rated doors and those with higher fire ratings are used in commercial and industrial occupancies, including tin-clad wood, vertical rolling, and steel slab doors. They are a topic for another article.



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