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Fire-Rated Floor Doors: Know the Distinctions, Know the Codes

While they are easy to overlook, fire-rated floor doors play an important role in protecting people and buildings. They are highly specialized products that are made by only a handful of manufacturers, but there are distinct differences between the various products on the market and the codes and standards that they are required to meet.

Floor doors are available with fire ratings to limit the passage of smoke and flames and to prevent heat transfer from one side of the door to the other. They designed to prevent injury and protect property by limiting the spread of fire and are typically used in commercial and institutional buildings, including office buildings, government centers, data centers, and transportation facilities to provide floor/ceiling access. Doors prevent smoke and fire from traveling throughout multiple building floors and are generally installed in computer rooms, equipment rooms, pump rooms, and elevator shafts in these facilities. Fire rated floor doors are designed to not combust over a defined period of time and are classified according to their fire rating.

While the term “Fire Rated Floor Door” has become synonymous for floor doors with a fire rating, there are two very different fire protection code distinctions for doors used in a horizontal application. This paper will examine the fire-rated floor doors currently available and how fire codes classify fire-rated floor doors and fire-rated access doors.

Fire-rated floor doors vs. Fire-rated access doors

Building codes classify two types of doors for fire-rated openings in horizontal assemblies: fire-rated floor doors and fire-rated access doors. Each of these door types meet specific fire protection requirements for the applications in which they are intended. The main difference between these products is that fire-rated floor doors have a fire resistance rating while fire-rated access doors have the more stringent fire protective rating as explained below.

Fire-rated floor doors are designed to contain the passage of smoke and flames per international building code (IBC) requirements. These products do not address exposure to excessive heat or hot gases and are only intended to confine fire for a set period. They are not tested or rated for heat transfer and are intended for installation in fire-rated floor assemblies only. They cannot be installed in fire-rated floor/ceiling assemblies per building fire protection code requirements.

Section 712.1.13.1 of the IBC states that horizontal floor fire doors shall be tested in accordance with NFPA 288, Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal in Fire-

resistance-rated Floor Systems. The IBC Commentary for Section 712.1.13.1 states as follows: “Horizontal fire doors are specifically addressed as an opening protective in horizontal floor assemblies. The code requires that these doors have a fire-resistance rating instead of a fire protection rating. By requiring a fire-resistance rating, it will restore the opening in the horizontal assembly to the same level of protection that was originally established during the fire test.”

Fire-rated access doors have a fire protective rating and are designed to prevent or retard the passage of excessive heat, hot gases, and flames over a period. Products are designed with an intumescent fireproof coating on the underside of the cover and the inside of the frame to limit heat transmission in the event of a fire. This coating seals the opening to ensure that any combustibles stored on or near the door do not ignite due to excessive flame or heat transfer. Unlike fire-rated floor doors, these products can be installed in fire-rated floor/ceiling assemblies to maintain a building’s fire code compliance.

Section 712.1.13.2 of the IBC Commentary states that “Access doors are often necessary in order to service mechanical and plumbing systems above the ceiling. This section states that if such doors are used where the ceiling provides part of the protection, they must be tested in accordance with ASTM E119 or UL 263 as a horizontal assembly. This makes it clear that the standard fire test for doors (NFPA 80 or 257) is not acceptable. This ensures that the thermal transmission through the access door and its effect on the assembly is considered.”

What do these differences in testing and labeling mean for business owners when it comes to floor access products? It means they need to know what they are purchasing, and how the differences between these doors can protect their property, employees, and customers.

Importance of Exceeding Minimum Code Requirements

Most fire doors are in a vertical plane and do not limit temperature transfer. The assumption is the door will be used for personal use and movement. The door must be clear on both sides. In a vertical assembly, temperature transfer is a secondary consideration. A twist came when builders and architects started incorporating hatches into the floor assembly for equipment access, removal, and installation in a horizontal plane. The view of building owners is that fire protection can be achieved in those applications if they place signage or barriers to prevent items being stored on top of the door, believing that fire safety risks are mitigated. However, combustibles may be placed on the upper side of the door assembly, which could lead to a dangerous situation.

It is critical to understand that building code requirements are set at the minimum life-safety standard and are not always representative of best practices. There are obvious benefits to exceeding the minimum code requirements. Some fire-rated doors are designed to limit both flame and heat for a period of two hours while others may only limit flame. To meet the heat penetration requirement, doors that limit both flame and heat are coated on the underside with an intumescent fireproof coating. The coating helps to passively increase a building’s resistance to fire. When exposed to extreme temperatures, the coating expands. The coating loses density as it expands and as a result acts as an insulator, sealing the opening in the event of a fire.

Floor doors with a fire-resistant rating are generally available in larger sizes as they do not meet the demanding ASTM or UL heat transfer test requirements required for a fire protection rating. While these larger access sizes may seem appealing to design professionals, the tradeoff is the reduced fire protection performance and the limited use in non-fire-rated floor/ceiling applications. Conversely, fire-rated access doors can be installed in both rated and non-rated floor/ceiling and roof/ceiling applications to maintain fire protection code compliance. Because of the heavy intumescent fireproof coating required to block heat transfer, these doors are commonly available in smaller sizes to ensure safe and easy operation. Products are available in sizes up to 3’-6” x 3’-6” which generally meets most personnel and equipment access requirements inside of commercial buildings.

Fire-Rated Access Door Design Requirements

Performance

The code requires that fire-rated access doors and frame assemblies be tested in accordance with ASTM E119 or UL 263. Fire-rated access doors must be listed as having a two-hour fire rating when exposed to fire from the underside. In the closed position, the temperature on the unexposed surface of the door shall not exceed 325°F (162°C) above ambient for the duration of the two-hour period. The manufacturer shall submit a test report certifying this performance. Section 716.2.6.1 requires doors to be latching and self- or automatic closing. Section 716.2.6.6 states smoke-activated closing systems will automatically start to close and latch the door leaf after smoke detection is actuated.

Cover

The cover shall be reinforced to support a minimum live load of 150 psf (732 kg/m²) with a maximum deflection of 1/150th of the span. The cover shall also have a 1" (25mm) fillable pan to receive concrete or a combination of concrete and specified flooring material, including type, thickness, and weight. Note: Finish flooring material up to 1/2" (13mm) thick can be installed in the 1" (25mm) pan. The remaining depth must be filled with concrete to maintain the fire rating of the door assembly. If finished flooring is not desired, the pan must be filled with 1" (25mm) of concrete.

Lift Assistance

The manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation throughout the entire arc of the opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" (6mm) gusset support plate. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing and not be affected by temperature.

Hardware

Hinges shall be a continuous heavy-duty Type 316 stainless steel hinge that is accessible only when the cover is in the open position. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover and a cable release handle shall be provided to open the cover from the underside. The door shall be equipped with a pneumatic hold-open system to automatically hold the door in the open position (85°). A release button for the hold-open system shall be provided and shall reset itself when the cover is closed. Note: When a door is specified without an automatic closing system, a mechanical aluminum hold-open arm is provided.

Material

1/4" (6mm) aluminum cover and extruded aluminum frame.

History of Code Requirements for Fire-rated Floor Doors and Access Doors

There have been some changes to the code language regarding floor fire doors and access doors since the 2003 IBC:

- The 2003 edition required testing for fire floor doors and access doors to ASTM E119.
- The 2006 edition required testing to NFPA 288 for floor fire doors, while there were no changes to access doors.
- The 2009 IBC added UL 263 as an alternative for testing access doors.
- In 2012 there were no changes for access doors or floor fire doors.

- In 2015 both access doors and floor fire doors are moved to vertical openings, as the IBC and NFPA now consider openings in floors to be vertical openings. This prevents the vertical movement of smoke and fire. The code does not define vertical openings, but it appears it is an opening in a floor/floor assembly that would allow the movement of smoke and fire in a vertical direction. There were no subsequent changes in either the 2018 or 2021 IBC regarding access for floor fire doors.

Summary of Applicable Fire Protection Codes for Floor Doors in Fire-rated Applications

International Building Code – IBC 712.1.13.1

Horizontal fire door assemblies used to protect openings in fire-resistance-rated horizontal assemblies shall be tested in accordance with NFPA 288 and shall achieve a fire-resistance rating not less than the assembly being penetrated. Horizontal fire door assemblies shall be labeled by an approved agency. The label shall be permanently affixed and shall specify the manufacturer, the test standard, and the fire-resistance rating.

International Building Code – IBC 712.1.13.2

Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies, provided that such doors are tested in accordance with ASTM E119 or UL 263 as horizontal assemblies and labeled by an approved agency for such purpose.

The IBC Commentary for Section 712.1.13.2 states as follows: “Access doors are often necessary to service mechanical and plumbing systems above the ceiling. This section states that if such doors are used where the ceiling provides part of the protection, they must be tested in accordance with ASTM E119 or UL 263 as a horizontal assembly. This makes it clear that the standard fire test for doors (NFPA 80 or 257) is not acceptable. This ensures that the thermal transmission through the access door and its effect on the assembly is considered. The provisions of this section are not applicable if the ceiling membrane does not provide any portion of the fire-resistive protection. Therefore, in a nonrated ceiling, this access door requirement would not apply.”

It is important to note that floor doors with a fire-resistant rating cannot be installed in fire rated floor/ceiling assemblies. Doors carrying the more stringent fire protective rating can be installed in both fire rated floor and floor/ceiling applications to meet fire protection code requirements.

NFPA 288 - Standard Methods of Fire Tests of Horizontal Fire Door Assemblies

This standard applies to horizontal fire door assemblies of various materials and types of construction that are installed in openings of fire resistance-rated floor systems or roofs to retard the passage of fire. It outlines the methods of fire tests of horizontal fire door assemblies installed in horizontal fire resistance-rated assemblies. Tests made in conformity with this test method demonstrate the performance of horizontal fire door assemblies during the test exposure; however, such tests shall not be construed as determining the suitability of horizontal fire door assemblies for use after their exposure to fire.

ASTM E119 - The standard test methods for fire tests of building construction and materials

These test methods are intended to evaluate the duration for which the types of building elements contain a fire, retain their structural integrity, or exhibit both properties during a predetermined test exposure. The test exposes a test specimen to a standard fire controlled to achieve specified temperatures throughout a specified time period. When required, the fire exposure is followed by the application of a specified standard fire hose stream applied in accordance with Practice E2226. The test provides a relative measure of the fire-test-response of comparable building elements under these fire exposure conditions. The exposure is not representative of all fire conditions because conditions vary with changes in the amount, nature, and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. Variation from the test conditions or test specimen construction, such as size, materials, and method of assembly, also affects the fire-test-response. For these reasons, evaluation of the variation is required for application to construction in the field.

UL 263

For North American building codes, American National Standards Institute (ANSI)/UL 263 is the default Standard for evaluating fire protection of structural steelwork. ANSI/UL 263, the Standard for Safety of Fire Tests of Building Construction Materials, and ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials, were developed to simulate a building fire. The CAN/ULC-S101 Standard, Standard Methods of Fire Endurance Tests of Building Construction and Materials, provides equivalent test requirements for the testing of building materials to ensure market access across North America.

These standards were developed to simulate the type of fires that occur in commercial buildings, such as offices, hospitals and schools. These are often referred to as “cellulosic fires” due to the nature of the contents typically found in a commercial office building or multi-dwelling residence.

At five minutes, the temperature within the furnace reaches 538 degrees Celsius (1,000 degrees Fahrenheit). The temperature gradually increases during the duration of the test until at four hours, the temperature within the furnace reaches 1093 degrees C (2000 degrees F). This is considered to be the standard time/temperature curve for buildings. Vertical fire resistive assemblies are also subjected to the hose stream test that is specific to these Standards.

Conclusion

It is important to understand that code requirements are set at the lowest performance levels legally allowed for construction. As has been discussed, codes require which tests fire-rated doors must be tested to as well as what performance level they must meet. If a product or assembly passes the minimum performance requirements and surpasses additional tests above and beyond what the code requires, they will offer the building owner and occupants more protection. Fire protection officials and codes can do much to help ensure safety. It is, however, up to the building owners, construction teams, architects, and specifiers to invest in and properly install the appropriate fire safety products as intended for a particular application.

This white paper was authored by The BILCO Company with support from The Hickman Group, Building and Fire Protection Code consultants.