

Demand for fire-rated wood doors, with more hardware and molding options, is increasing with a greater focus on public safety.

AT THE CORE OF FIRE-RATED DOORS

Can Safety and Durability Come at a Lower Cost?

By Chris Calawerts

Your go-to specification for fire-rated doors may be costing more than it needs to. Maintain the all-important goal of safety—at a lower cost—by specifying 45-minute fire-rated doors with a particle core.

A structure fire is reported about every 63 seconds in the United States, says the latest information from the National Fire Protection Association. While the overall number of fires that local fire departments report is on a downward trend, including vehicle and outside fires, the number of structure fires has remained relatively unchanged over the last 15 years.

Safety seems to have risen to new heights in the public consciousness over the same period. This is partially due, no doubt, to highly visible media reports of fire and security

threats. It can also be credited to the educational outreach of the U.S. Fire Administration and local fire departments as they work for a more fire-safe America.

Trend: More Wood Doors with Fire Safety Features

Oshkosh Door Company is one door manufacturer that has seen a resulting trend in architects and building owners specifying more wood doors with fire safety features.

Oshkosh Door's heritage in the wood door business extends back to the 1870s. Since then, the company has seen and participated in many changes in the industry. Fire-rated doors first entered the market in the early 1900s. They were metal-clad. They

weren't aesthetically pleasing, but they served their purpose.

It wasn't until the late 1940s that the industry introduced wood-faced fire-rated doors. Initially, they were very limited in size and machining options. Over the years, new and better materials for constructing the doors have been developed—allowing for larger opening sizes, more hardware options, and other features. This has increased the demand for fire-rated wood doors. Research into new and better fire door options still continues, driven by increasing concerns about public safety.

Reminder on Fire Ratings

You're likely familiar with fire-resistant doors, but over time, it's good to recall

Photos courtesy of Oshkosh Doors

exactly how and why the doors are rated—so you can best plan for building occupants' needs.

Fire-resistant doors are rated by the number of minutes a door will withstand fire. They may be rated at 20, 45, 60 or 90 minutes. Currently, 90 minutes is the highest fire rating available for a wood door. The type of core material, as well as the stile and rail material, usually varies with the minute rating.

To establish the fire rating for a door, independent test labs perform burn tests in strictly controlled conditions. The independent test labs must follow specific procedures for these tests as prescribed by agencies such as Underwriters Laboratories (UL), the National Fire Protection Association (NFPA) and the Standards Council of Canada (CAN4), as well as by the Uniform Building Code (UBC).

Temperature Rise Ratings

Doors are rated not only by the number of minutes they will withstand fire but also by how hot they will become on the non-fire side of the door. This is called the "temperature rise rating," and it is categorized at 250, 450 or 650 degrees Fahrenheit. The rating indicates the number of degrees above the ambient temperature that the door reaches on the non-fire side during the first 30 minutes of the burn test. The lower the number, the cooler the door face is.

The temperature rise rating is important, because by limiting the heat transfer from one side of a door to the other, building occupants can safely pass by the door without being exposed to intense heat from a fire on the other side. Picture, for example, building occupants walking past doors as they leave a building down a stairwell. Wood fire-rated doors with standard construction meet the safest, 250-degree temperature rise rating, making them an excellent choice in areas building occupants would use as a means of egress.

How Doors Are Fire Tested

A large variety of hardware, vision kits, and louvers are listed and labeled for wood doors, so the number of potential configurations for fire-rated wood doors is endless. As a result, a single door construction for a given fire rating such as 90 minutes needs to be fire tested multiple times to incorporate all possible configurations customers might request. This includes testing doors as singles and pairs with various combinations of hardware, vision lights, louvers, applied molding, and more.

The 5 Steps of Fire Testing

1. The door is installed in a fire-rated door frame, which is mounted inside a concrete block wall built on a rolling platform.
2. Once the door is installed, the wall is connected to a gas-fired furnace.



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In the mid-2000s, door manufacturers introduced a particle core with additives, allowing it to achieve a 45-minute fire rating.

categories. For example, if a door passes the fire test for a period of 90 minutes, that's the best news, because it is then fire-rated for 90 minutes, as well as 60, 45 and 20 minutes.

The Core May Mean More Than You Know

Along with an official fire rating, the core of a fire-resistant door makes a difference in performance and also cost.

Particle core is the most common core in wood doors. However, until 11 years ago, these doors have only met a 20-minute fire rating. They have been popular because they're structurally sound for most applications, as well as cost-effective when compared with other core options.

Historically, 45-, 60- or 90-minute rated doors have had some type of mineral core. In the mid-2000s, a particle core was introduced with additives that allowed it to achieve a 45-minute rating. But like early fire doors when they were introduced, sizes and machining options were very limited for the higher-rated particle core.

Since then, testing and improvements have continued, and today many of the same options are available for 45-minute rated particle core doors as for the mineral core alternative. Most, although not all, hardware options

3. The furnace blows flames on the wall and door, maintaining a prescribed temperature for the length of time for which the door is being tested. During the first 30 minutes, the door also has a heat sensor attached to record the temperature of the door face, for the temperature rise rating.
4. Once the burn portion of the test is complete, testing technicians disconnect the wall from the furnace and wheel the wall off to the side.
5. Finally, technicians spray the door with water from a fire hose at a specified pressure in a

specified pattern for a specified number of seconds to if see if the door stays in the opening.

A door fails the burn portion of the test if a flame escapes around the door and maintains a consistent flare. A door fails the fire hose portion of the test if any part of the door, or its glass, breaks away. The importance of the hose stream is to ensure that doors will stay in their openings in real life as firefighters attempt to extinguish flames—thus preventing further spread of the fire.

Any door tested is fire-rated for the longest period that it could withstand the test, as well as for any lesser rating

➤ Positive Pressure vs. Negative Pressure Test Methods

Negative pressure testing was the accepted method for all fire testing of doors in the United States until 1997, when the UBC adopted the positive pressure method. This was an important change for safety.

In a negative pressure test, the gas-fired furnace used for testing is vented, so pressure created by super-heated gases escapes and does not affect the door's performance.

During a positive pressure test, the furnace is not vented. This allows

pressure to build and possibly force super-heated gases out around the edges of the door. If gases can escape around the door, there is then the potential, in real-life situations, for the gases to ignite and start a fire outside of the room containing the fire—thereby negating the purpose of the fire door.

To prevent flames from escaping around the edges of the doors, an intumescent—a substance that expands—is used to seal off the

space between the door edge and the frame. The intumescent may be embedded in the door construction (referred to as category A) or applied to the surface of the frame during installation (category B). In either application, the intumescent is activated by fire and expands to fill the space where gases would otherwise escape.

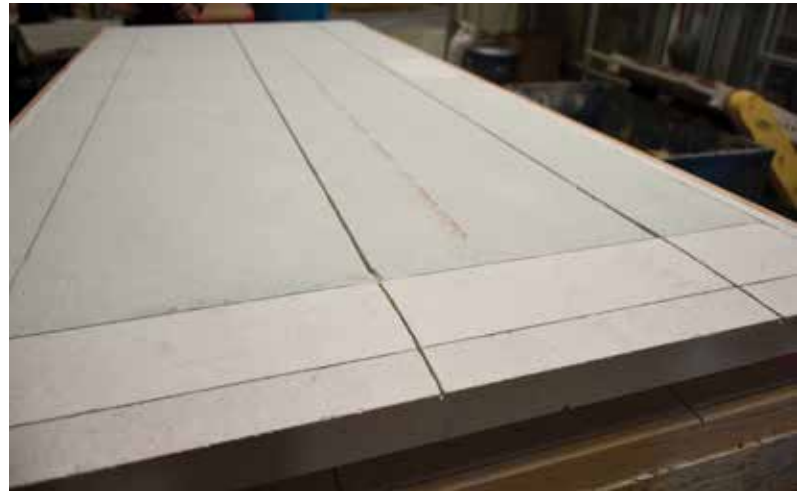
approved for 45-minute rated mineral core doors are approved for 45-minute rated particle core doors, as well as most vision kits and applied molding.

Mineral Core Doors: Some Drawbacks

Before the advancements in the fire rating of particle core doors fire-rated at 45, 60 or 90 minutes typically had a mineral core material, a common type being calcium silicate. The inside of this type of door looks similar to the inside of a piece of sheet rock. The mineral core doesn't burn, but it's soft—with no structural strength. This poses two problems for construction.

Fire-rated doors with a mineral core have no screw-holding capacity, making it a challenge to attach hardware. The options are either to thru-bolt surface-applied hardware, such as closers or exit devices, onto the door, or to add, to the inside of the door, internal blocking made from high-density non-combustible material. Thru-bolts are usually not considered aesthetically pleasing, so architects and owners opt to add internal blocking and attach hardware by screws rather than bolts.

The problem is, adding internal blocking can add significant cost to the door. For example, adding a five-inch wide top rail on a 45-minute rated mineral core door adds approximately 17 percent to the cost of the door. With a top rail and one lock block, the cost can go up 27 percent.



The material inside mineral core doors won't burn, but it has little structural strength. This causes issues when attaching hardware and shortens the lifetime of the door.

Finally, with a fully blocked door for an exit device, the added cost can be a whopping 55 percent more than the usual cost of the door.

Mineral core doors also lack the durability of particle core doors. Due to the soft nature of mineral core and its lack of any structural integrity, it is more susceptible to damage that can result in costly replacements. Unfortunately, doors are often abused in applications such as hospitals, schools,

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Particle core doors fire rated for 45 minutes can withstand more impact in high-traffic areas and can save buyers 7 percent or more over mineral core.

Molding can be applied to the face of 45-minute rated particle core doors as well. It just cannot be molding that would increase the burn rate on the doors or extend too close to the edge of the door or near locks or other hardware. A conversation with a knowledgeable representative of a door manufacturer can spell out the do's and don'ts of molding.

Another Option to Mineral Core: Structural Composite Lumber Core

Sometimes fire-resistant door specifications indicate 45-minute rated doors with a structural composite lumber core, or SCL, especially for locations where doors will be opened by pushing carts into them or will repeatedly be forced against closers with overhead stops.

SCL core is made of manufactured wood product—wood strands aligned and joined by a moisture-resistant adhesive. It creates an extremely strong door that can withstand aggressive daily abuse. SCL core doors offer even greater screw-holding capability than 45-minute rated particle core doors.

However, SCL core doors cost more than particle core doors, thereby eliminating the pricing advantage a 45-minute particle core door has on the base door.

Best Practice: Ask the Core Question

At the most basic level, every architect or building owner wants to buy the safest door for building occupants—at the lowest cost. Understanding performance and options in fire-resistant doors is important. So is asking yourself the core question *each time* you specify doors.

The best service an architect or building owner can provide for a building's future occupants is always to ask, "Is the best fire-rated door being specified for this job? More specifically, is the right core inside that door?" ■

SOURCE:

National Fire Protection Association. "Fires in the United States During 2015 Fact Sheet." <http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/fire-loss-in-the-united-states>.



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hotel ballrooms, and so on, where carts may be used to push the doors open. Repeatedly running into a mineral core door can cause the core to break up and separate from the door facing, eventually causing the door to delaminate or, if hit hard enough, actually poking a hole in the door.

45-Minute-Rated Particle Core Doors: Performance at a Lower Cost

Oshkosh Door sees a trend toward requests for 45-minute rated doors with a particle board core. This is a winning option for two reasons:

- Doors fire-rated for 45 minutes and with a particle core can withstand much more impact from daily use in high-traffic surroundings.
- Particle core is a solid core material. Because it's rigid, no blocking is needed to attach hardware with screws for most applications.
- With that, the particle core fire-rated doors, in the end, cost less than a mineral core door. The base price difference between a 45-minute rated mineral core door and a 45-minute rated particle core door is approximately a seven percent savings. Add this to the savings of not needing blocking, the structural advantages, and now the benefits become more significant.
- Particle core doors are available in both negative-pressure-approved and positive-pressure categories A and B.

Many architects and owners simply indicate a 45-minute rated door and may not go as far as to specify a core. But by being specific and requesting 45-minute rated particle core doors, you can reduce overall costs and also ensure the doors last with daily use.

Aesthetically, particle core doors can also do the job of other 45-minute rated doors. For fire-rated doors, in general, aesthetic options are pretty well defined. All glass and other accents must be part of the fire testing. But manufacturers of particle core doors can produce the doors with virtually any veneer species, high-pressure plastic laminate or medium-density overlay.