

Fire Doors: From Testing to Field Inspections

Justin Hendricks, Intertek Mark Rudie, Block Iron & Supply Co.

May 11, 2023



AGENDA





BIOGRAPHY





Justin Hendricks

Technical Manager, Openings

University of Wisconsin-Madison B.S. Materials Science & Engineering 2006

<u>Intertek</u>

2008 – Present

Primary Focus: Fire Doors and Other Opening Protectives NAAMM, SDI, NASFM, and CSDMA Representative for Intertek

NFPA 80 Committee Member

UL STP10 Member

DHI Magazine Media & Editorial Board Member

FDAI Credentials through DHI

Mark Rudie Outside Sales, Block Iron & Supply Co.

Started in the commercial door and hardware industry as a fabricator and installer; moved into sales and service in 1985. With Block Iron since 2003. 40 Years experience in the door industry.

IMPORTANCE OF TESTING, FIELD INSPECTION & LABELING

WHY ARE FIELD INSPECTIONS AND ANNUAL INSPECTIONS NEEDED?

During 2010-2014, NFPA statistics show an average annual 498,400 commercial structural fires in the US.^[1]

And these same NFPA statistics show fire sprinklers were present in only 10% (49,840) of these fires.

Of the almost 449,000 fires in non-sprinklered facilities, fire spread beyond the room of origin in nearly 30% (130,000) of these cases, resulting in substantial property loss.

Failure to properly <u>inspect and maintain</u> fire door assemblies and other opening protectives, especially in non-sprinklered buildings, could result in jeopardizing the safety of building occupants as well as substantial property damage and liability claims in the event of fire.

[1] M. Ahrens, "U.S. Experience with Sprinklers," National Fire Protection Association, July 2017.

IMPLICATIONS TO END USERS

If something is labeled wrong, damaged, or not fire rated, what are the consequences?

- Risk and Liability
 - Loss of life and/or property
- Industry / Community Reputation



FIRE DOOR STANDARDS & TESTING

NORTH AMERICAN FIRE DOOR STANDARDS

Side Hinged Swinging Doors

- □ UL 10C (R2021) Positive Pressure
- **Multiple Door Types**
- □ UL10B (R2020) Neutral Pressure
- □ NFPA 252 (2022) Positive or Neutral Pressure
- □ CAN/ULC S104 (R2020) Neutral Pressure
- The IBC (International Building Code) references: UL 10B, UL 10C, and NFPA 252.
- □ The NBC (National Building Code of Canada) references: CAN/ULC S104.

TIME-TEMPERATURE (WITHIN FURNACE)



FURNACE PRESSURE

Neutral vs. Positive Pressure



EDGE SEALING

Edge Construction - Positive Pressure Intumescent Materials

- Expands under heat FILLS THE GAPS
- Activation Temperature
 - Typically from 250 450 degrees (dependent on type)





HOSE STREAM TEST

Performed directly after the fire endurance test; exposed (fire side) of test sample is impacted and exposed to cooling/erosion effects of hose stream.

30psi (205kPa) for 20 – 120 Min Fire Endurance 45psi (310kPa) for 180 Min or above

Duration Multiplier dependent on fire endurance rating

20 Minute without Hose Stream rating recognized in the U.S. and parts of Mexico only.



CODE REFERENCES

IBC (2021) References:

Chapter 7 – Fire and Smoke Prevention Features

Section 716 – Opening Protectives

Section 716.2.1.1 – Side Hinged or Pivoted Swinging Doors

 "Fire door assemblies with side hinged or pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C. For tests conducted in accordance with NFPA 252, the fire test shall be conducted using the positive pressure method specified in the standard."

Section 716.5.2 – Other Types of Assemblies

"Fire door assemblies with other types of doors, including swinging elevator doors, horizontal sliding fire door assemblies, rolling steel fire doors, fire shutter assemblies, bottom and side hinged chute intake doors, and top-hinged chute discharge doors, shall be tested in accordance with NFPA 252 or UL 10B. For tests conducted in accordance with NFPA 252, the neutral pressure plane in the furnace shall be maintained as nearly equal to atmospheric pressure as possible at the top of the door, as specified in the standard."



2021 International Building Code (IBC)

Hose Stream Requirements

Section 716.2.2.1 - Door Assemblies in Corridors and Smoke Barriers

• Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke barrier walls having a fire resistance rating in accordance with Table 716.1(2) shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

Section 716.2.2.2 - Door Assemblies in Other Fire Partitions

• Fire door assemblies required to have a minimum fire protection rating of 20 minute where located in other fire partitions having a fire resistance rating of 0.5 hour in accordance with Table 716.1(2) shall be tested in accordance with NFPA 252, UL 10B, or UL 10C with the hose stream test.

Table 716.1(2) is a great resource to match up wall assembly type, wall assembly rating, fire door assembly rating, and glazing allowances.

TABLE 716.1(2) OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY		MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE ^a	FIRE-RATED GLAZING MARKING	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDE- LIGHT/TRANSOM PANEL	
	ASSEMBLT RATING (Hours)			DOOR VISION PANEL ^{b,c}	Fire protection	Fire resistance	Fire protection	Fire resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4	3	See Note a	D-H-W-240	Not Permitted	4	Not Permitted	W-240
	3	3 ^d	See Note a	D-H-W-180	Not Permitted	3	Not Permitted	W-180
	2	1 ¹ / ₂	100 sq. in.	≤100 sq. in. = D- H-90 >100 sq. in.=D-H- W-90	Not Permitted	2	Not Permitted	W-120
	1 ¹ / ₂	1 ¹ / ₂	100 sq. in.	≤100 sq. in. = D- H-90 >100 sq. in.= D- H-W-90	Not Permitted	1 ¹ / ₂	Not Permitted	W-90

Other fire barriers	1	3/4	Maximum size tested	D-H	3/4 ^h		D-H ^h	
Fire partitions: Corridor walls	1	1/3 ^a	Maximum size tested	D-20	3 _{/4} a		D-H-OH-45	
	0.5	1/3 ^a	Maximum size tested	D-20	1/ ₃		D-H-OH-20	
Other for and lines	1	3/4 ⁱ	Maximum size tested	D-H-45	3/4		D-H-45	
Other fire partitions	0.5	1/ ₃	Maximum size tested	D-H-20	1/ ₃		D-H-20	
Exterior walls				≤100 sq. in. = D- H-90				
	3	1 ¹ / ₂	100 sq. in.ª	> 100 sq. in = D- H-W-90	Not Permitted	3	Not Permitted	W-180
	2	1 ¹ / ₂	Maximum size tested	D-H 90 or D-H-W- 90	$1^{1}/_{2}^{h}$	2	D-H-OH-90 ^h	W-120
		Fire protection						
	1	3/4	Maximum size tested	D-H-45	3 ₇₄ h		D-H-45 ^h	
						Fire protection		
Smoke barriers	1	1/3	Maximum size tested	D-20	³ / ₄		D-H-OH-45	

Fire-Resistance Rating - The time that materials or assemblies have withstood a fire exposure as established in accordance with ASTM E119 or UL 263.

Fire-Protection Rating - The time that a fire door assembly or fire window assembly was exposed and which it successfully met all acceptance criteria as determined in accordance with fire door standards (i.e. UL 10B, UL 10C, or NFPA 252) or fire window standards (UL 9, NFPA 257).

Considerations between both ratings: transmitted temperature resistance and hose stream

For door and frame assemblies, where does this primarily come into play?

Glazing, Sidelights, Transom Assemblies

Section 716.2.5.1.2 - Fire Protection Rated Glazing in Door Assemblies in Fire Walls and Fire Barriers Rated Greater than 1 Hour

- Fire-protection rated glazing shall be prohibited in fire walls and fire barriers except:
 - Fire-protection rated glazing shall be permitted as vision panels in self-closing swinging fire door assemblies serving as horizontal exits in fire walls where limited to 100 sq. in.
 - Fire-protection rated glazing shall be permitted in fire doors having a 1-1/2 hour fire protection rating intended for installation in fire barriers, where limited to 100 sq. in.

Section 716.2.5.4 - Fire Door Frames with Transom Lights and Sidelights

Fire-protection rated glazing shall be permitted in door frames with transom lights, sidelights or both, where a ³/₄ hour fire protection rating or less is required in 2 hour fire resistance rated exterior walls in accordance with Table 716.1(2). Fire door frames with transom lights, sidelights or both, installed with fire resistance rated glazing tested as an assembly in accordance with ASTM E119 or UL 263 shall be permitted where a fire protection rating exceeding ³/₄ hour is required in accordance with Table 716.1(2).

Temperature Rise Rating

Section 716.2.2.3 - Doors in Interior Exit Stairways and Ramps and Exit Passageways

- Fire door assemblies in interior exit stairways and ramps and exit passageways shall have a minimum transmitted temperature rise of not more than 450°F (250°C) above ambient at the end of 30 minutes of standard fire test exposure.
 - Exception Not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.

Section 716.2.2.3.1 - Glazing in Doors

Fire-protection rated glazing in excess of 100 sq. in. is not permitted. Fire-resistance rated glazing in excess of 100 sq. in. shall be permitted in fire doors. Listed fire-resistance rated glazing in a fire door shall have a maximum transmitted temperature rise in accordance with the section above when the fire door is tested in accordance with NFPA 252, UL 10B, or UL 10C.

NFPA 80 REQUIREMENTS & FIELD EXAMPLES

FIELD INSPECTION

Understand the 13 points of inspection in Chapter 5 of NFPA 80! [Same for 2013 - 2022.]

Knowing the 13 points of inspection may help reduce the need for follow-up visits, and will save time and money in the long run.

- Many items that will be flagged during an annual inspection for field labeling visit are easily correctable (i.e. open fastener holes - methods for repair stated in Section 5.5.7 of NFPA 80.) This may prevent a reinspection visit by the Listing Agency or AHJ.
- Get in the habit of keeping and maintaining good records in regard to annual fire door inspections and maintenance.

5.2.3.5 Swinging Doors with Builders Hardware or Fire Door Hardware.

5.2.3.5.1 Fire Door assemblies shall be visually inspected from both sides to assess the overall condition of the door assembly. 5.2.3.5.2 As a minimum, the following items shall be verified:



NFPA 80 INSPECTION GUIDELINES

COMMON FIELD ISSUES



COMMON FIELD ISSUES







INSTALLATION CONSIDERATIONS

Unused Fastener Hole Repair – Section 5.5.7

- Install steel fasteners that completely fill the holes
- Fill the screw or bolt holes with the same material as the door or frame
- Fill holes with material listed for this use and installed in accordance with the manufacturer's procedures

Holes other than unused fastener holes are treated as a field modification.





COMMON FIELD ISSUES



INSTALLATION CONSIDERATIONS

We consistently see assemblies having clearance issues in the field.

- Max. ¾" under bottom of door.
- Door to Frame Interface
 - Hollow Metal 1/8" +/- 1/16"
 - Wood Depends on fire protection duration and door construction allowances were redefined in 2016 Version of NFPA 80 to allow +1/16" for 20 minute applications.
 2013 version of NFPA 80 states max. 1/8" (no +) for all wood applications.
- Taken from pull side of assembly.

INSTALLATION CONSIDERATIONS

Results of Excessive Gaps:

- Reduced latch engagement into the frame strike (limits the ability of the latch to keep the door closed during a fire).
- For door and frame assemblies that require intumescent edge seals or smoke and draft gaskets increased area that the intumescent or gasket material must fill in order to seal the gap.
- If the intumescent material fails to completely fill the gap, flame penetration and the formation of through openings between the door and frame interface or between the meeting edge interface can occur, resulting in a failure of the opening to contain and prevent the spread of fire.
- The opening protective may allow for an excessive amount of leakage (smoke).



COMMON FIELD ISSUES





WHAT IS ALLOWED IN THE FIELD?

Consult Section 4.1.3 of NFPA 80 (2013, 2016, and 2019 Versions). Now moved to Chapter 5 in 2022 version.

- 1. Holes for surface-applied hardware, functional holes for mortise locks, and holes for labeled viewers. **Round holes!**
 - Max. 1" diameter with the exception of cylinders.
- Maximum ¾" undercutting for wood/wood-composite doors.
 Undercutting of other doors is not permitted in the field.
- 3. Installation of protection plates.

WHAT IS ALLOWED IN THE FIELD?

Additional allowances from newer versions of NFPA 80 (2016 - 2022).

- Round holes > 1" diameter for surface-applied hardware in accordance with door manufacturer's listing and hardware manufacturer's listing.
- Drilling raceways for wires in accordance with door manufacturer's listing and when permitted by the third-party certification agency that lists the door.
 - Intertek Raceway Installers IQP Program
- 2019 and 2022 versions also have a provision for preparation of fire pins in the field in accordance with manufacturer's listing and when permitted by the lab that certifies the door (Listing Agency).

All other items are considered field modifications and need to be addressed by the Listing Agency.

- Evaluation and/or Additional Testing
- Then Field Inspection and/or Field Labeling

OTHER COMMON QUESTIONS

NFPA 80 – Chapter 4 - General Requirements

• Except where restricted by individual listings, a fire door assembly is permitted to consist of labeled, listed, or classified components of different organizations that are acceptable to the AHJ.

NFPA 80 - Chapter 6 - Swinging Doors with Builders Hardware

- Louvers are not permitted in side panels or transom panels.
- Thresholds shall be non-combustible or listed. (Also, different than a sill!)
- Fire exit hardware shall be installed only on fire doors bearing a label stating "Fire Door to Be Equipped with Fire Exit Hardware"
- Labeling of protection plates is not required where the top of the protection plate is not more than 16 inches above the bottom of the door.

OTHER COMMON QUESTIONS

NFPA 80 - Chapter 6 - Swinging Doors with Builders Hardware

 Table 6.4.3.1 (Hinges) lists most common applications; consult door and hardware manufacturers' listings for other applications/allowances.

	N	faximum	Door S	ize	e Minimum Hinge Size				
Maximum Door	Wi	Width		Height		Height		ness	
Rating (hr)	ft	m	ft	m	in.	mm	in.	mm	Hinge Type
For 1 ³ / ₄ in. (44.5 mm) or Thicker Doors									
3 or less	4	1.22	10	3.05	$4\frac{1}{2}$	114.3	0.180	4.57	Steel, mortise or surface
3 or less	4	1.22	8	2.44	41/2	114.3	0.134	3.40	Steel, mortise or surface
1½ or less	31/6	0.96	8	2.44	6	152.4	0.225	5.72	Steel, olive knuckle or paumelle
3 or less	4	1.22	10	3.05	4	101.6	0.225	5.72	Steel pivots (including top, bottom, and intermediate)
1½ or less	3	0.91	5	1.52	4	101.6	0.130	3.30	Steel, mortise or surface
$1\frac{1}{2}$ or less	2	0.61	3	0.91	3	76.2	0.092	2.34	Steel, mortise or surface
3 or less	3	0.91	7	2.13	41/2	114.3	0.134	3.40	Steel, mortise or surface (labeled, self-closing, spring type)
3 or less	3	0.91	7	2.13	4	101.6	0.105	2.67	Steel, mortise or surface (labeled, self-closing, spring type)
For 1 ³ / ₈ in. (34.93 mm) Doors									
3 or less	3	0.91	7	2.13	31/2	88.9	0.123	3.12	Steel, mortise or surface
3 or less	23	0.81	7	2.13	31/2	88.9	0.105	2.67	Steel, mortise or surface (labeled, self-closing, spring type)

Table 6.4.3.1 Builders Hardware: Hinges, Spring Hinges, and Pivots

Note: Table 6.4.3.1 lists the most common applications of hinges, spring hinges, and pivots. Consult the door and hardware manufacturer's specific listings for applications not addressed in this table.

FIRE DOOR LABELING GUIDELINES

NFPA 80 -2016 defines minimum label requirements:

- Older versions of NFPA 80 (2013 and prior) did not include specific labels verbiage
- Starting with NFPA 80-2016, specific labeling requirements for doors, frames, glazing, oversized assemblies, and field labeled products.
- Going back to the 2009 IBC, the following were the minimum label requirements for doors and frames:
 - Doors: Manufacturer name or traceable code, name or trademark of Third Party inspection agency, fire protection rating, temperature rise rating (where required), and 'S' if for Smoke & Draft.
 - Frames: Manufacturer name or traceable alternate, name or trademark of Third Party inspection agency.



FIRE DOOR LABELING GUIDELINES



NFPA 105 & SMOKE DOORS

NFPA 105 INSPECTION REQUIREMENTS – CHAPTER 5

18 Points of Inspection for Swinging Doors:

- Door frames comply with NFPA 105 Chapter 6
- Gasketing materials, where required, are intact and close the gaps between the door and frame
- Doors installed in pressurized applications have a bottom seal, where required
- Doors equipped with bottom seals do not interfere with swinging or closing of the door.
- Glazing materials, vision light kits, glazing beads are continuously sealed.

SMOKE DOOR HOSPITAL STOPS

NFPA 105 (2022) – Section 6.3.2.2

 Door frames with terminated (aka hospital) stops shall be permitted provided that the lowest portion of the terminated stops is not greater than 6 inches above the bottom of the frame.

For fire protection applications, UL Subject 63 permits terminated stops for 20 minute to 3 hour fire protection applications (steel door frames).

Not allowed in elevator lobby or elevator opening applications per the IBC.



SMOKE DOOR IBC EXCEPTIONS

IBC (2021) - Section 709.5

Openings in a smoke barrier shall be protected in accordance with Section 716 (opening protectives).

Exception 1: In Group I-1, Condition 2, Group I-2, and ambulatory care facilities, a pair of opposite swinging (double egress) doors installed in a corridor the doors shall not be required to be protected in accordance with Section 716. Positive-latching is not required for this application.



SMOKE DOOR NFPA 101 EXCEPTIONS

NFPA 101 (2021) – Chapter 19 Existing Healthcare (Similar Sections for Chapter 18 New Healthcare)

- Section 19.3.7.8 Doors in smoke barriers shall comply with 8.5.4 and all of the following:
 - The doors shall be self-closing or automatic closing
 - Latching hardware shall not be required
 - The doors shall not be required to swing in the direction of egress travel

Found in Section 19.3.7 – Subdivision of Building Spaces



FIELD LABELING



FIELD LABELING

If your already-installed fire doors and/or frames are missing a proper certification mark, a Listing Agency's field labeling services (i.e. Intertek) may be able to help you avoid removal and replacement of unlabeled openings.

Field labeling may become necessary for a variety of reasons, such as field modifications, doors leaving factories without labels, incorrect labeling, or labels that have been painted over or removed.

FIELD LABELING

Process:

- Conduct a comprehensive review of all components in question.
- Provide an inspection report including any deficiencies observed.
- Offer support for modifications and corrections.
- Re-inspection services if necessary.
- Apply the fire door or fire door frame label (when appropriate). [Intertek WH]

http://www.intertek.com/field-labeling

HOW WE DETERMINE COMPLIANCE?

- Product Certification Listing Database and Historical Fire Test Data
- Industry Standard Construction Guidelines (i.e. UL Subject 63)
- Stamps, barcodes, or markings on the door and/or frame may identify a manufacturer or distributor; however, they do not identify what type of hardware can be installed on the door, maximum door sizes, or other component allowances (i.e. cladding, faces, intumescent use, etc.)
 - Listing Agency stamp is not equal to a fire label! Stamp is often a 'further processing' mark placed on the door or frame before finishing.
 - Avoid drilling into a door or frame to check material type! This can
 potentially affect the fire protection performance of the door or frame.

ONLINE CERTIFICATION DIRECTORIES

• <u>www.spec-direct.com_and_https://bpdirectory.intertek.com</u>



FIELD LABELING



Field Label Example:

Requirements defined by NFPA 80 (2016 and Beyond - Chapter 5), and Listing Agency.

Mylar (shown) or metal labels are most common substrates.

CLOSING THOUGHTS

Many issues are preventable and ensuring that a facility follows the requirements of NFPA 80 and NFPA 101 in addition to maintaining a regular maintenance schedule for opening protectives will ensure building integrity and safety of building occupants in the event of a fire.



Justin Hendricks Technical Manager, Openings, Intertek



608.844.4597



justin.hendricks@intertek.com



www.intertek.com/field-labeling_

Mark Rudie

Outside Sales, Block Iron & Supply Co.



920.420.3625



markr@blockiron.com



www.blockiron.com_

