

ADVANCED, FBC 7TH EDITION (2020)

Five Walls of the IBC

A Guide To Fire-Resistance & Fire Protection

A Continuing Education Seminar presented by



Creative Solutions Innovative Designs Proven Products

ADVANCED, FBC 7TH EDITION (2020)

Five Walls of the IBC

A Guide To Fire- Resistance & Opening Protection

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Learning Objectives

- Develop an understanding and working knowledge of the five walls and their specific purposes as defined in the IBC
- Know the difference between a fire-resistance rating and a fire protection rating
- Explore the test provisions for wide-span opening protectives
- Investigate the reasoning behind the opening protective requirements for all five walls
- Develop a solid familiarity with where to apply each of the five walls in project designs

Definitions

Fire Walls – Section 706

Fire Barriers – Section 707

Fire Partitions – Section 708

Smoke Barriers – Section 709

Smoke Partitions – Section 710

DEFINITIONS

Fire-Rated Walls

Section 202

Fire-Resistance Rating

The property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.



DEFINITIONS

Fire-Rated Walls

Passive Redundancy

A combination of passive and active systems.



DEFINITIONS

Opening Protectives

Section 202

Fire Protection Rating

The period of time that an opening protective will maintain the ability to confine a fire as determined by tests specified in Section 716. Ratings are stated in hours or minutes.



BUILDING CODE REQUIREMENTS

Opening Protectives

Section 716.1(2) (2018)

Table 716.1(2): Opening Fire Protection Assemblies, Ratings and Markings

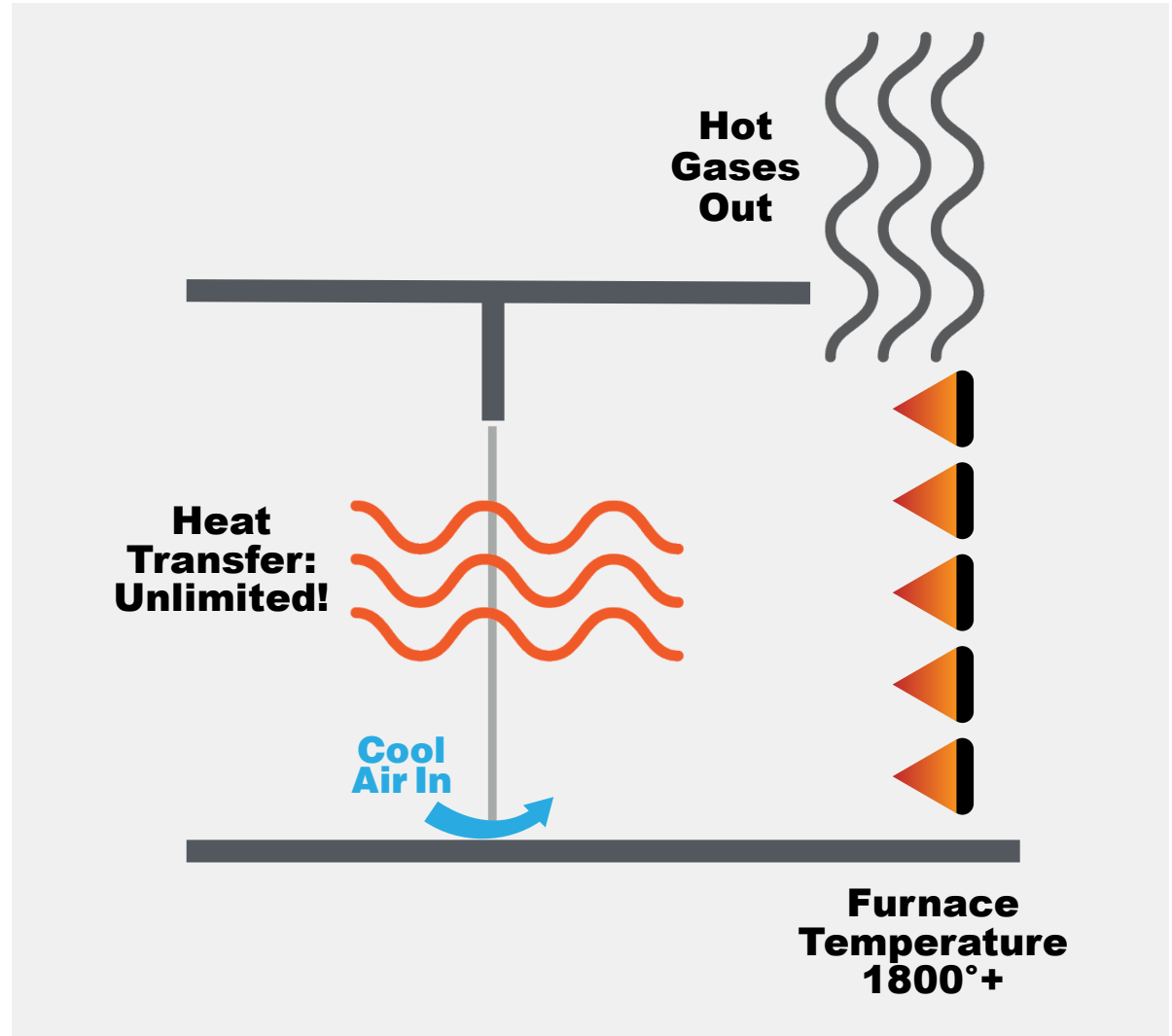
Type of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door Shutter Assembly Rating (Hours)	Fire Rated Glazing Marking Door Vision Panel		Minimum Sidelight/Transom Assembly Rating (Hours)		Fire-Rated Glazing Marking Sidelight/Transom Panel	
			Fire Protection	Fire Resistance	Fire Protection	Fire Resistance		
FIRE WALLS and FIRE BARRIERS having a required fire-resistance rating greater than 1 hour.	4	3	Not Permitted	4	Not Permitted	W-240		
	3	3	Not Permitted	3	Not Permitted	W-180		
	2	1 1/2	Not Permitted	2	Not Permitted	W-120		
	1 1/2	1 1/2	Not Permitted	1 1/2	Not Permitted	W-90		
Shaft, exit enclosures and exit passageways	2	1 1/2	Not Permitted	1 1/2	Not Permitted	W-90		
FIRE BARRIERS having a required fire-resistance rating of 1 hour:	1	1	Not Permitted	1	Not Permitted	W-60		
Fire Protection								
Other fire barriers	1	3/4	D-H-NT-45	3/4	D-H-NT-45			
			D-20	3/4 1/3	D-H-NT-45 D-H-NT-20			
			D-H-45 D-H-20	3/4 1/3	D-H-45 D-H-20			
Fire partitions: Corridor walls	1	1/3						
	0.5	1/3						
Other fire partitions	1	3/4						
	0.5	1/3						

TEST CRITERIA

NFPA 252

UL 10B

Fire Protection Rating



TEST CRITERIA

Hose Stream

ASTM E2226

Structural Integrity Test



TEST CRITERIA

ASTM E2226
Standard Practice for
Application of Hose
Stream



What Is the Intent of the Hose Stream?

The hose stream serves as an indicator for two important attributes:

1. the structural integrity of fire door assembly during fire exposure and
2. the overall reliability of the material of which the assembly is constructed to perform its intended function.

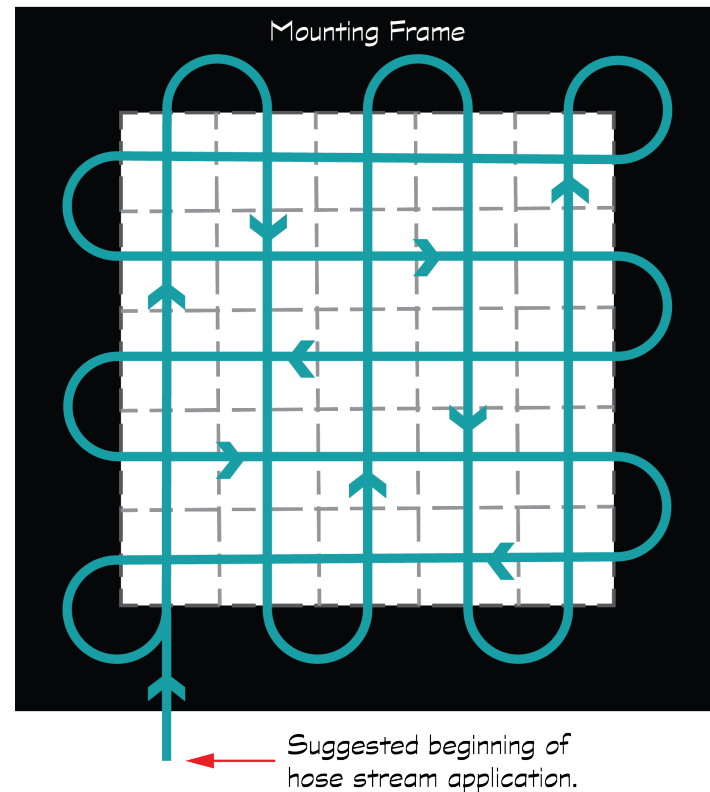
TEST CRITERIA

Basic Test Criteria

Minimum 30 psi for 2.5 minutes in a basic zig-zag style

10' x 10' Wall Test Specimen
Mounted in Test Furnace Frame

ASTM E2226
Standard Practice for
Application of Hose
Stream



TEST CRITERIA

Hose Stream

ASTM E2226

Structural Integrity Test



TEST CRITERIA

Hose Stream

ASTM E2226

Structural Integrity Test



TEST CRITERIA



Fire Label w/o Hose Stream

The building code allows an opening protective rating of 20 minutes for door assemblies that cannot pass an integrity test (hose stream).

716.5.3 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 ... shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

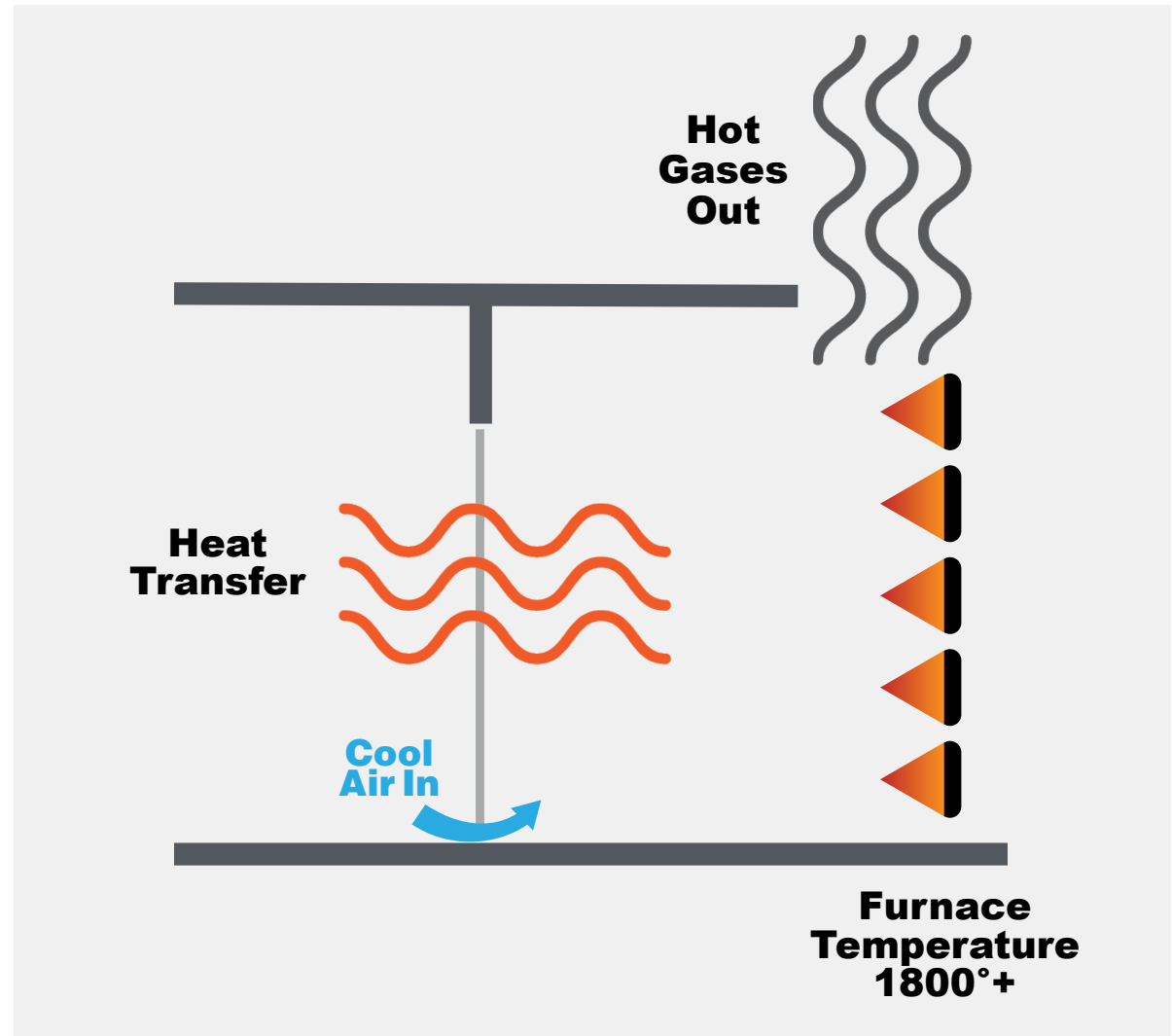
TEST CRITERIA

NFPA 252 (Fire Protection)

Temperature Rise
(Fire Protection Rating)

Heat Transfer:

After the first 30 minutes the unexposed side of the assembly cannot exceed 450 degrees for the duration of the test.



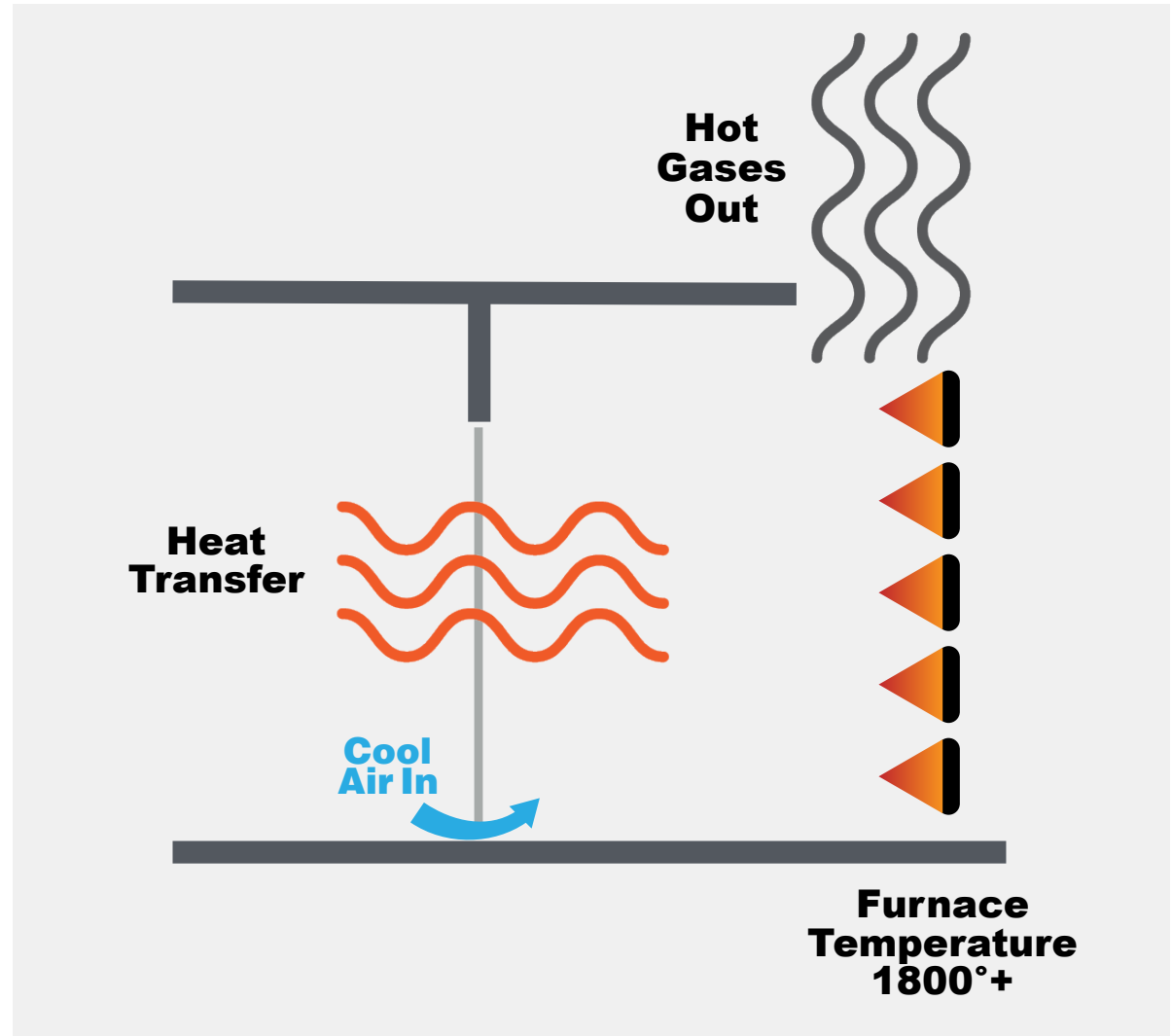
TEST CRITERIA

ASTM E-119

UL 263
(Fire Resistance Rating)

Heat Transfer:

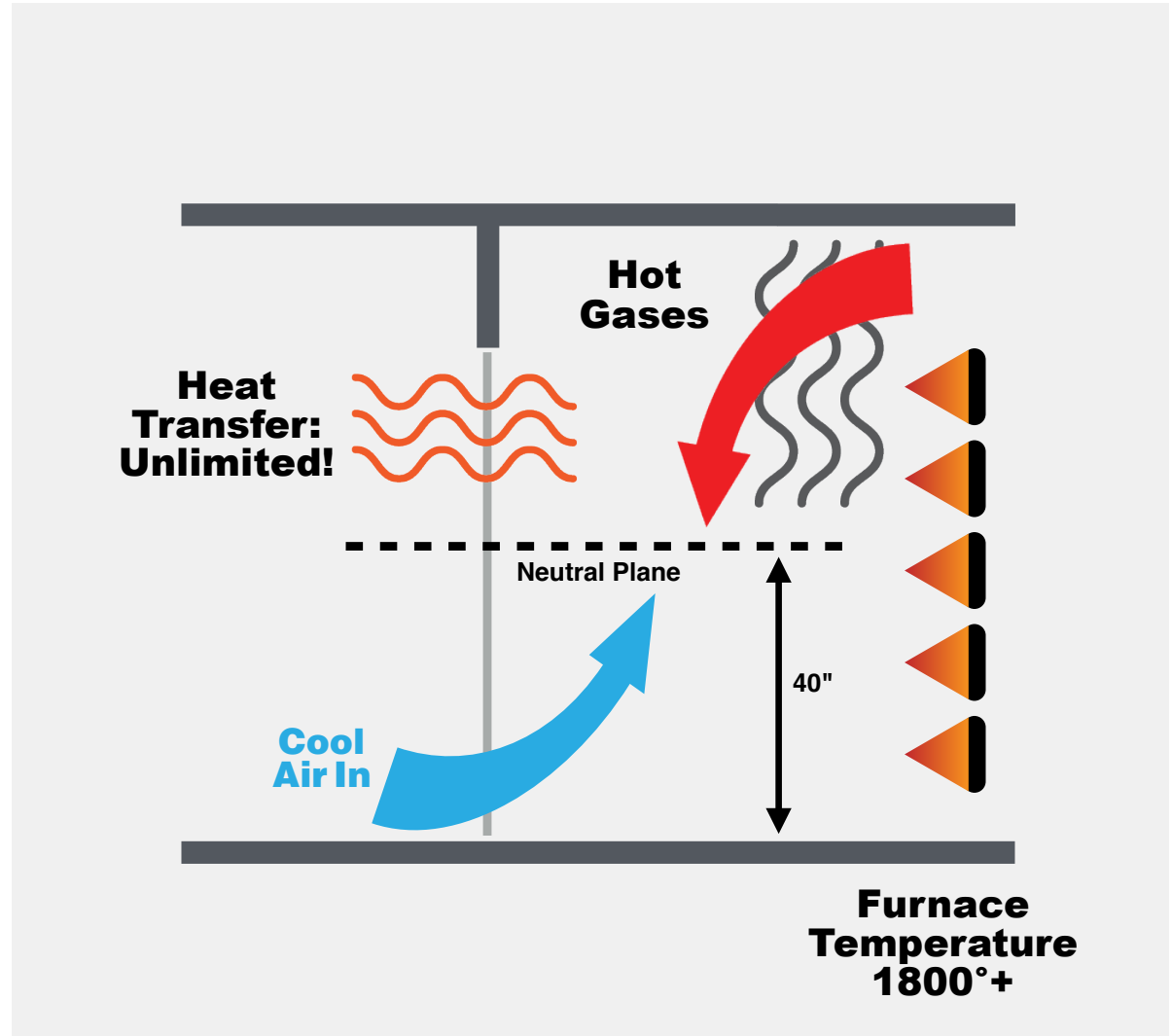
The unexposed side of the assembly cannot exceed 250 degrees for the duration of the test.



TEST CRITERIA

Positive Pressure Test

40" Neutral Plane
(Fire Protection Rating)



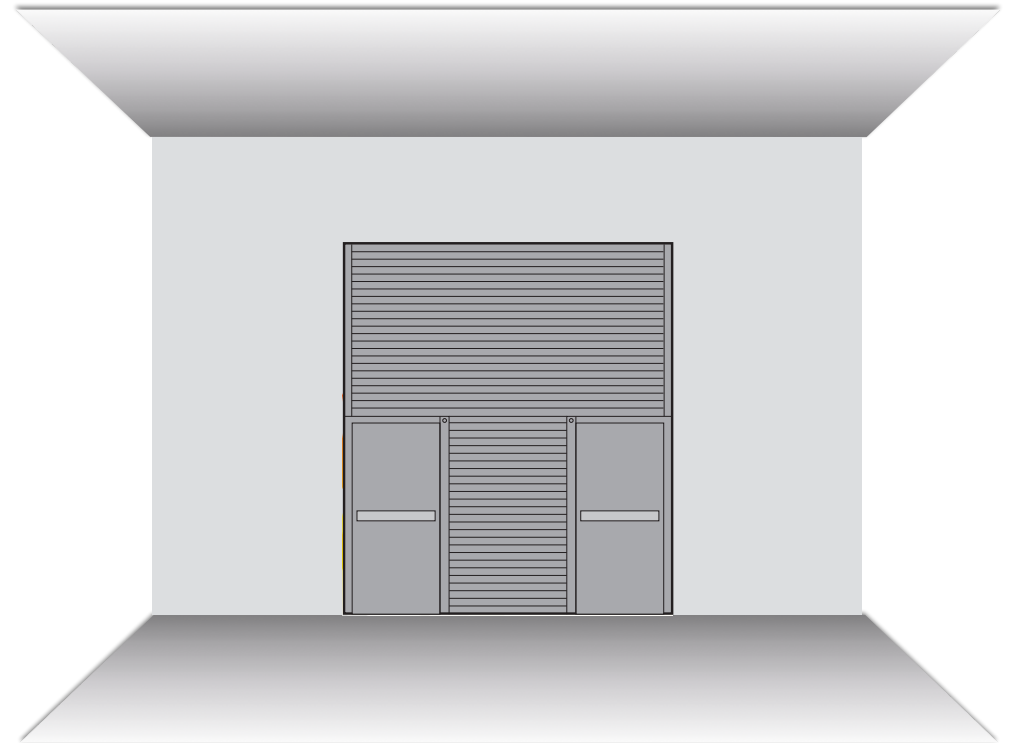
DEFINITIONS

Fire Walls

Section 706

A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. (202)

- **Fire Ratings** (*Table 706.4*)
 - 2-hour
 - 3-hour
 - 4-hour
- **Opening Protection** (*706.8*)
- **Design Notes**
- **Applications**



Opening Protectives in Fire Walls

Section 706.8 Openings

706.8 Openings. Each opening through a *fire wall* shall be protected in accordance with Section 716 and shall not exceed 156 square feet (15 m²). The aggregate width of openings at any floor level shall not exceed 25 percent of the length of the wall.

Exceptions:

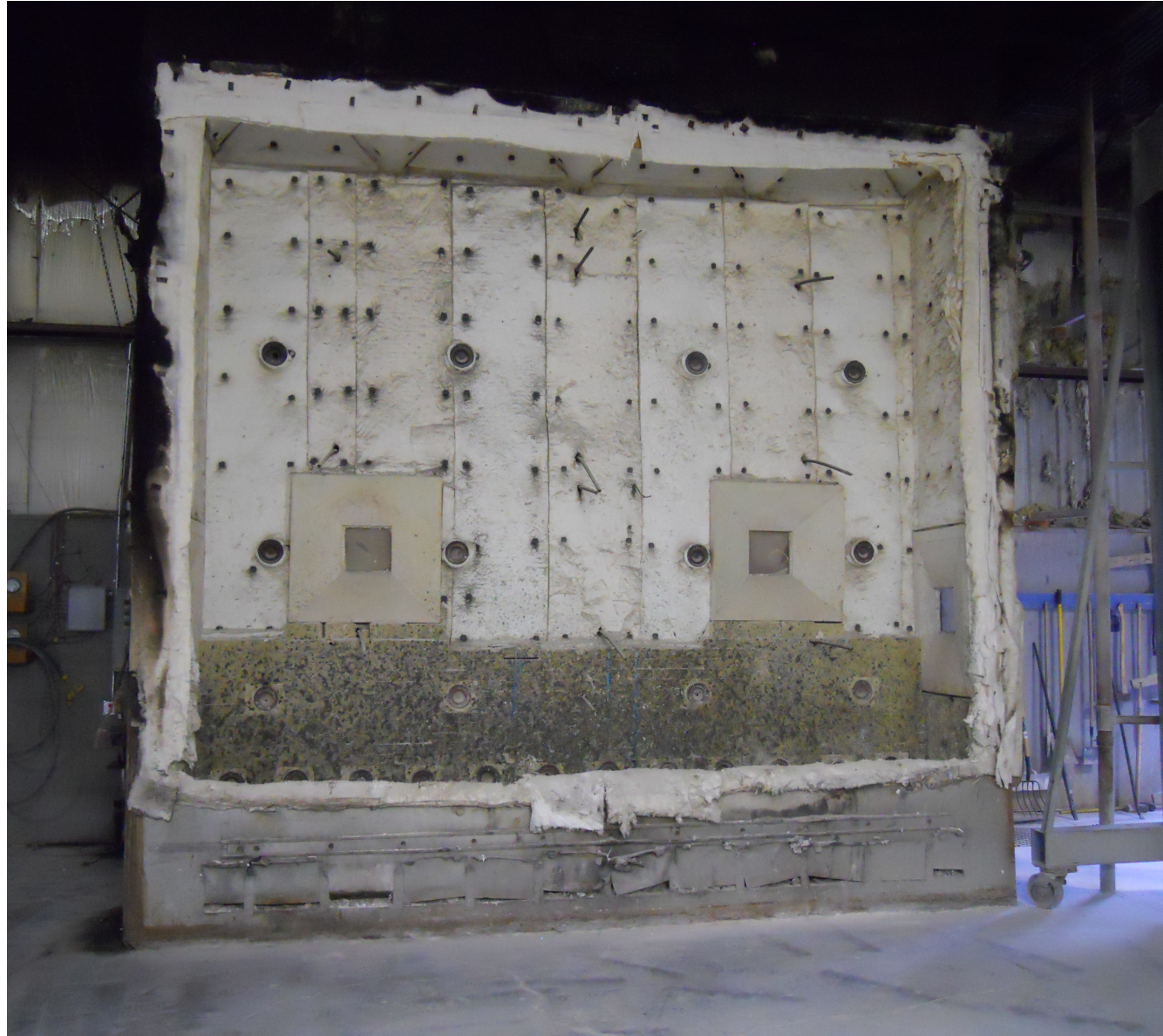
1. Openings are not permitted in party walls constructed in accordance with Section 706.1.1.
2. Openings shall not be limited to 156 square feet (15 m²) where both buildings are equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.

TEST CRITERIA



Test Furnace

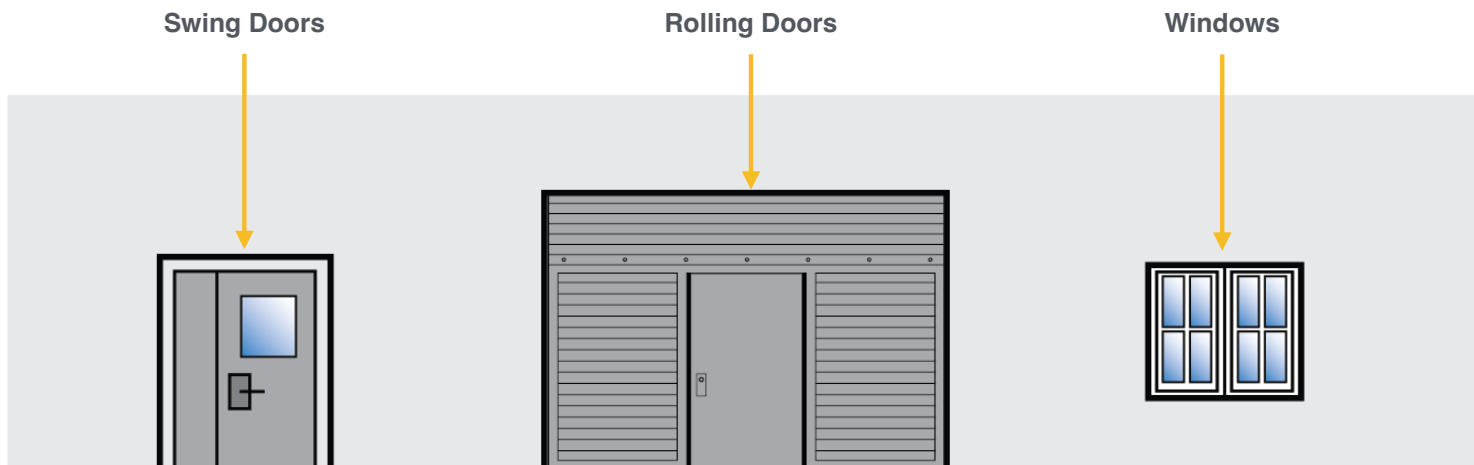
Maximum Size: 156
Square Feet



Opening Protectives in Fire Walls

Section 706.8 Openings – 25% Rule

706.8 Openings. Each opening through a *fire wall* shall be protected in accordance with Section 716 and shall not exceed 156 square feet (15 m²). The aggregate width of openings at any floor level shall not exceed 25% of the length of the wall.



Opening Protectives in Fire Walls

Section 706.8 Openings – Swing Door Failures



Fire-rated Swing Doors – In fire events, 86% failure rate!

Opening Protectives

Section 715 (2009) or 716 (2012, 2015)

Table 715.4 / 716.5: Fire Door and Fire Shutter Fire Protection Ratings

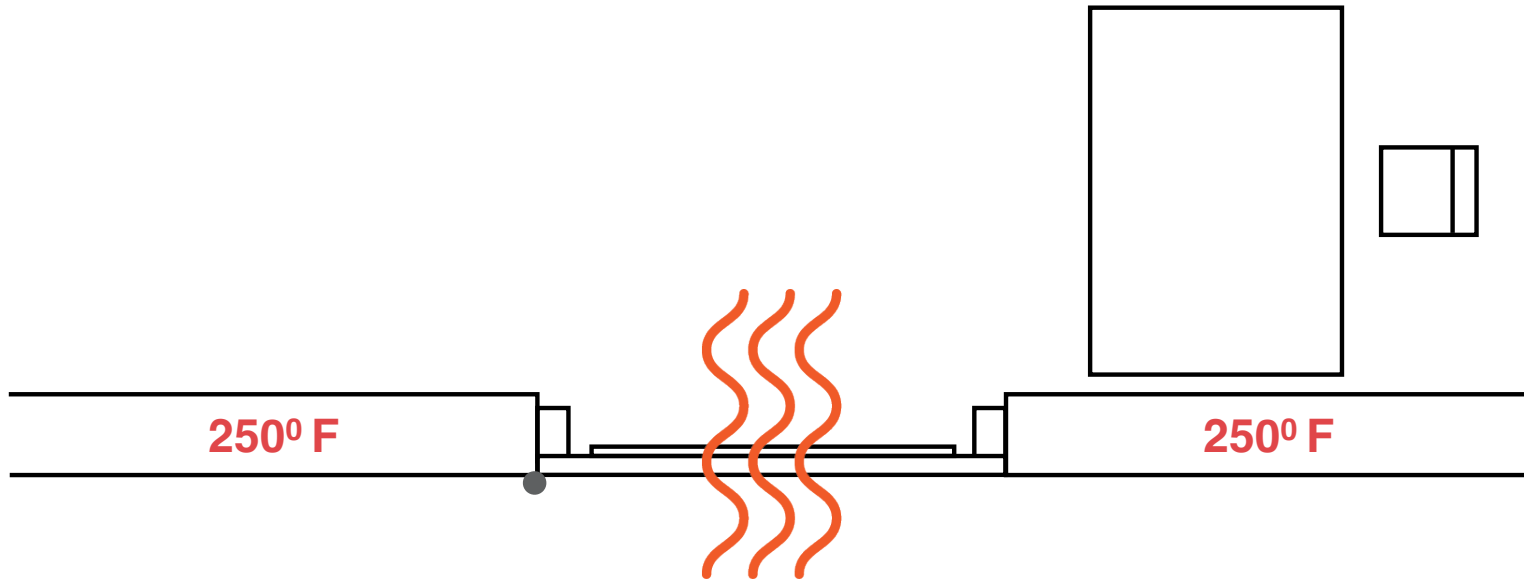
Type of Assembly		Required Assembly Rating (Hours)	Minimum Fire Door & Fire Assembly Fire Rating (Hours)
FIRE WALLS and FIRE BARRIERS having a required fire-resistance rating greater than 1 hour.		4	3
		3	3 ^a
		2	1 1/2
		1 1/2	1 1/2
FIRE BARRIERS having a required fire-resistance rating of 1 hour.	Shaft, exit enclosure and exit passageway walls	1	1
	Other fire barriers	1	3/4
FIRE PARTITIONS	Corridor walls	1 0.5	1/3 ^b 1/3 ^b
	Other fire partitions	1 0.5	3/4 1/3
EXTERIOR WALLS		3	1 1/2
		2	1 1/2
		1	3/4
SMOKE BARRIERS		1	1/3 ^b

a. Two doors, each with a fire protection rating of 1 1/2 hours, installed on opposite side of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour door.
 b. For testing requirements, see Section 715.4.3.



Opening Protectives in Fire Walls

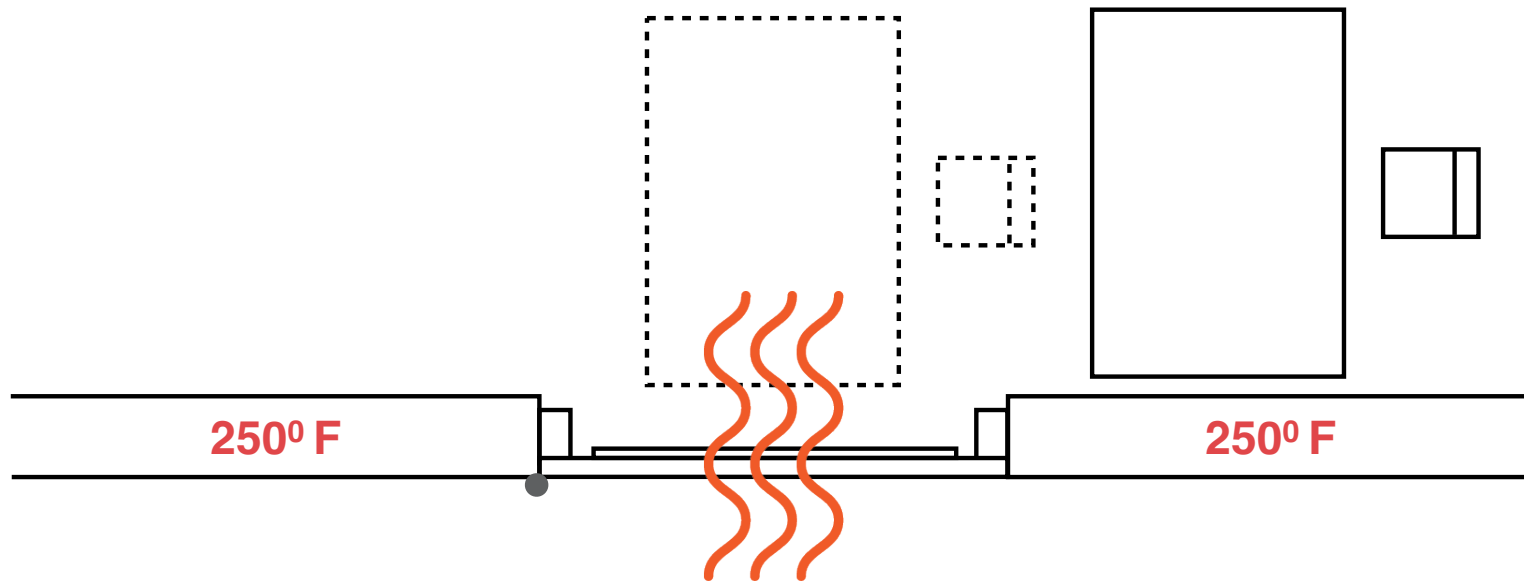
Section 706.8 Openings – Heat Transfer



Fire-rated Doors – Tested for Flame-through and Flash-through ONLY

Opening Protectives in Fire Walls

Section 706.8 Openings – Heat Transfer



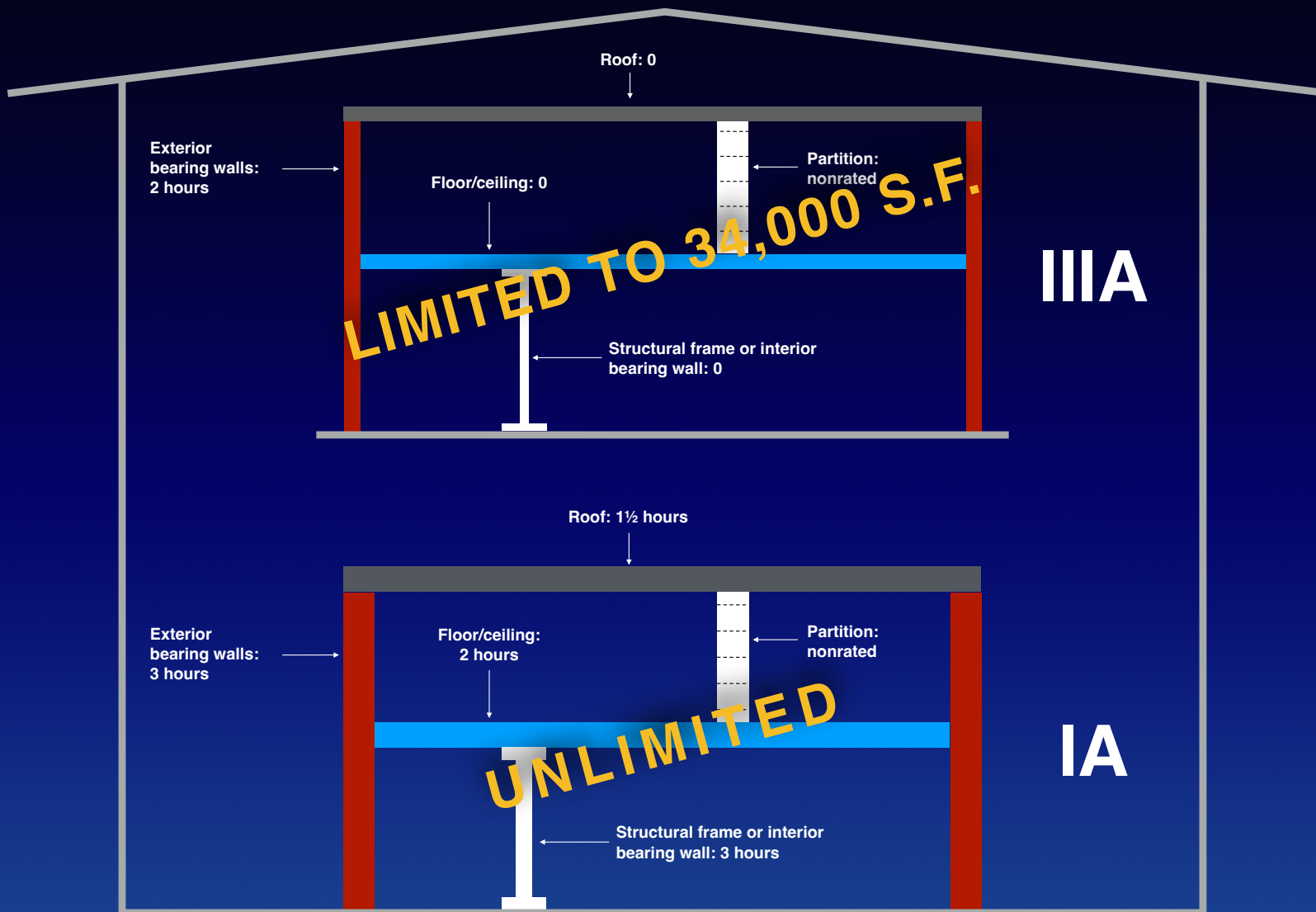
Fire-rated Doors – Tested for Flame-through and Flash-through ONLY

Occupancy – A-1 (multiplex theater)

Building Type – IIIB (rated, single story)

Area Allowance – 34,000 sq. ft. (Table 506.2, 2018 IBC)

Actual Building Area – 39,000+ sq. ft. (exceeds allowable area)



2-Hour Fire Wall

IIIB

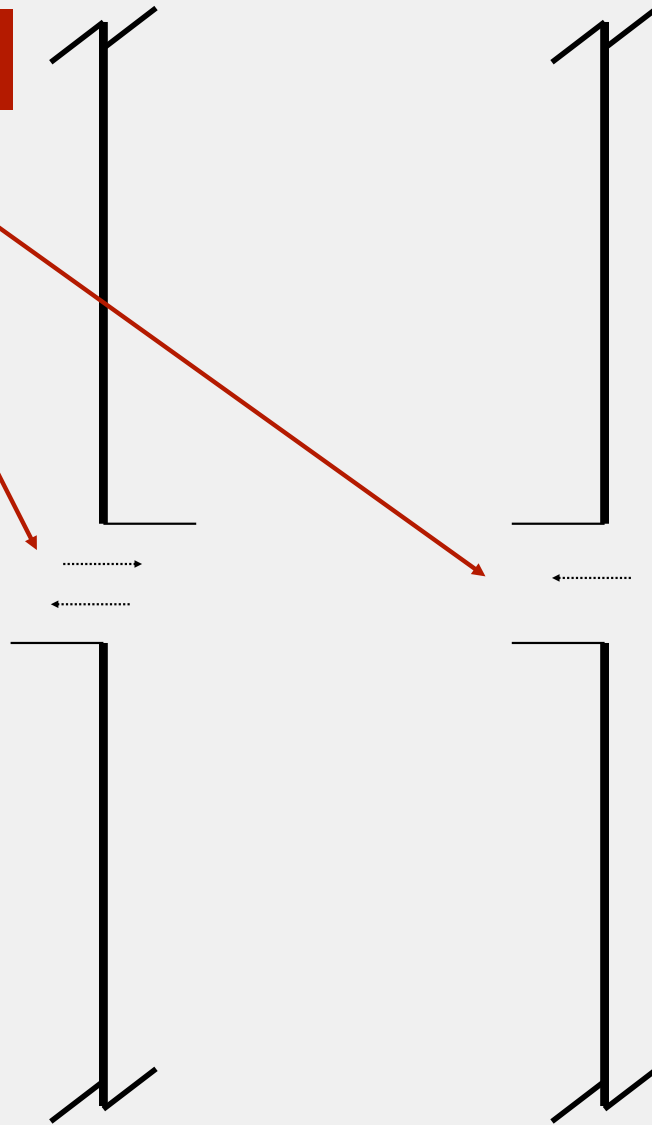
IIIB

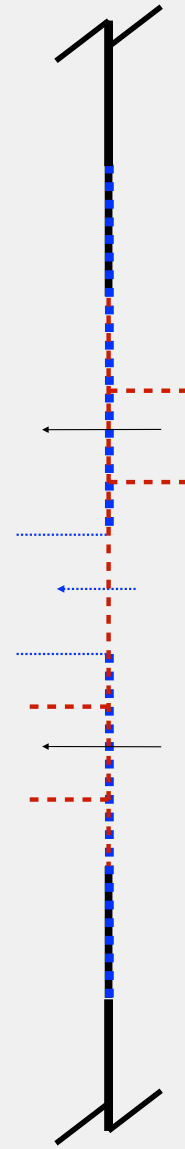
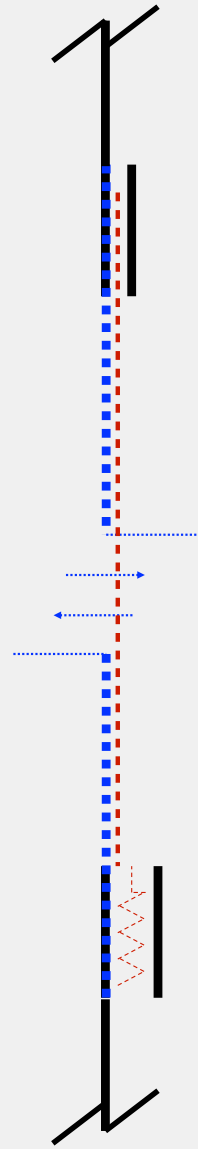
IIIB

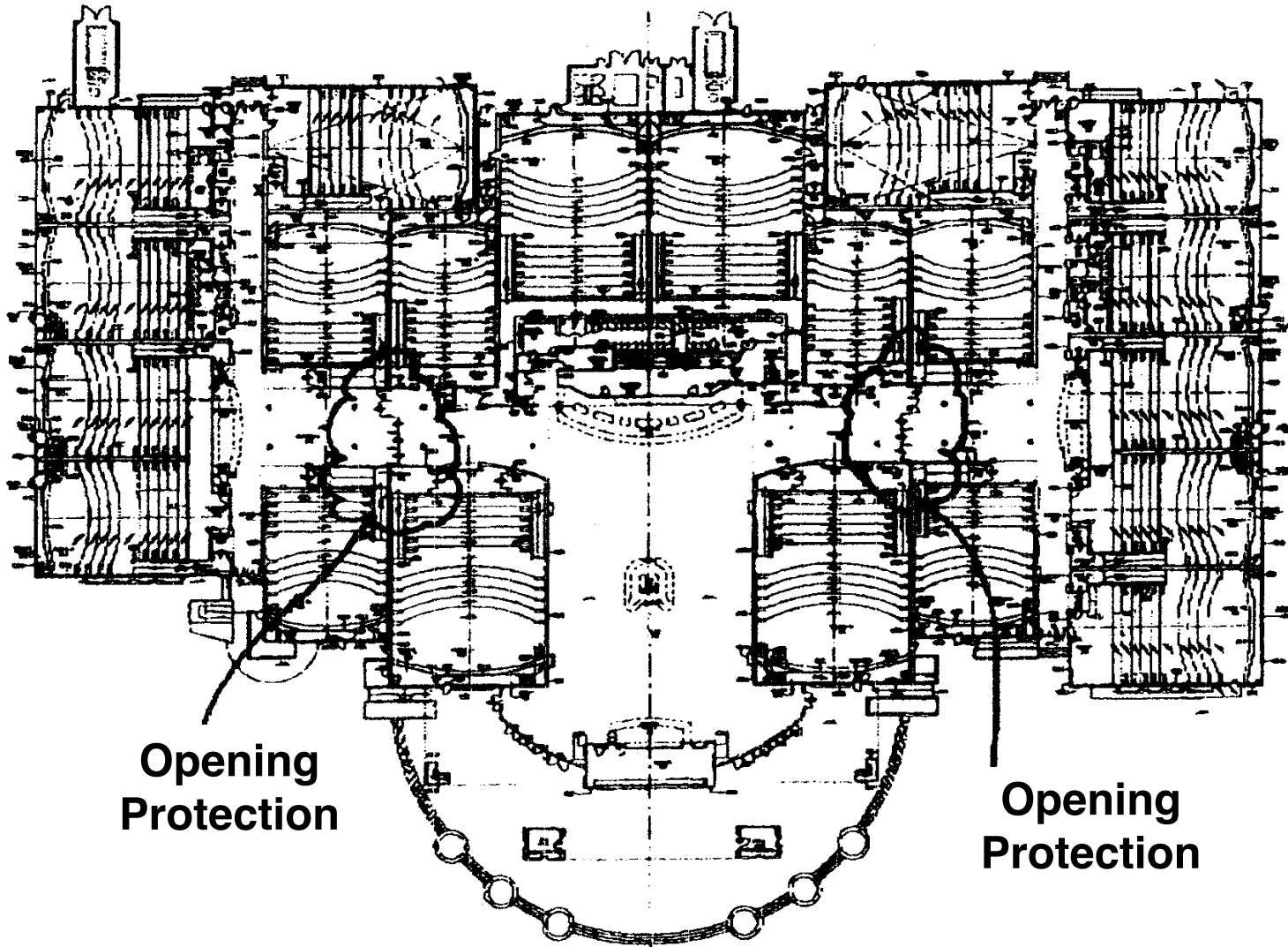
IA
“For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more fire walls shall be considered a separate building.” (706.1)

3 Separate Buildings

**1 ½ hr. Opening
Protectives**







**Opening
Protection**

**Opening
Protection**

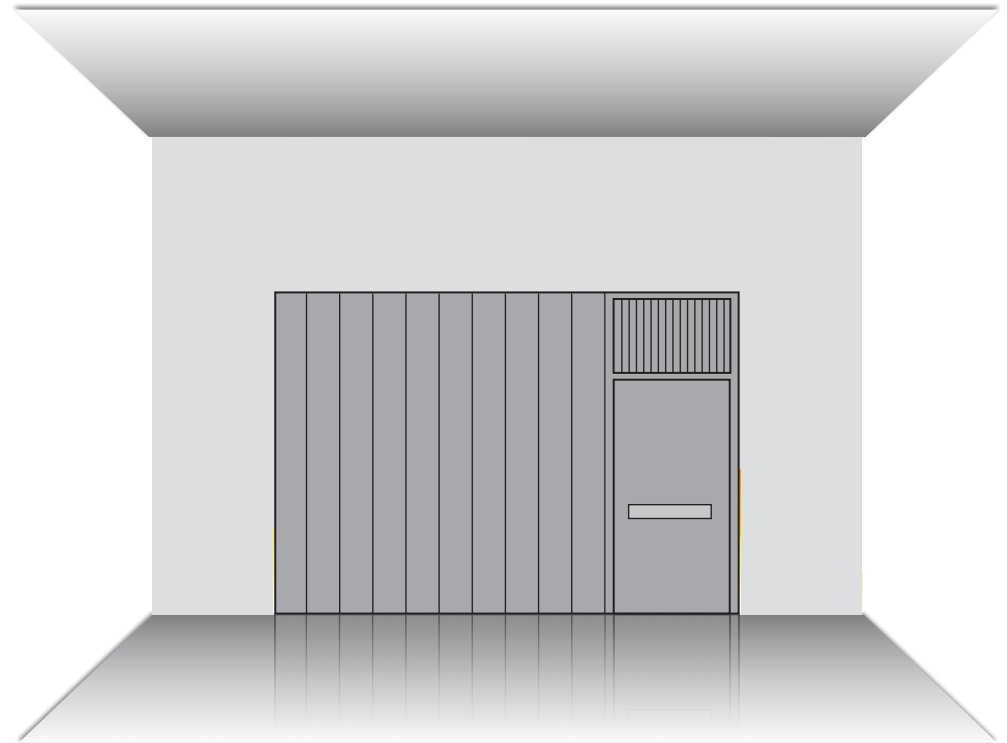
DEFINITIONS

Fire Barriers

Section 707

A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained. (202)

- **Fire Ratings** (*Table 716.1(2); 707.3.10*)
 - 1-hour
 - 2-hour
 - 3-hour
 - 4-hour
- **Opening Protection** (*707.6*)
- **Design Notes**
- **Applications**



Opening Protectives in Fire Barrier Walls

Section 707.6 Openings

707.6 Openings. Openings in a *fire barrier* shall be protected in accordance with Section 716. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet (15m²). Openings in enclosures for *exit access stairways* and *ramps*, *interior exit stairways* and *ramps* and *exit passageways* shall also comply with Sections 1019, 1023.4 and 1024.5, respectively.

Exceptions:

Openings shall not be limited to 156 square feet (15m²) where adjoining floor areas are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

Opening Protectives in Fire Barrier Walls

Section 707.6 Openings (Exception 2)

2. Openings shall not be limited to 156 square feet (15 m²) or an aggregate width of 25 percent of the length of the wall where the opening protective is a *fire door* serving enclosures for exit access stairways and ramps, and interior exit stairways and ramps.

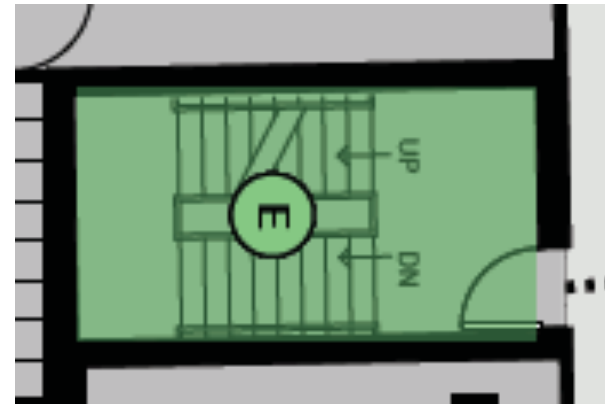
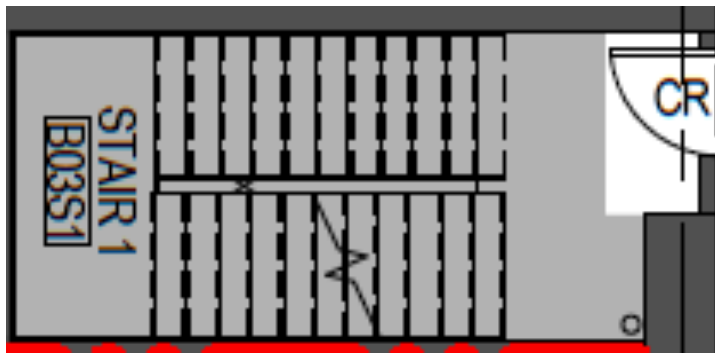


Opening Protectives in Fire Barrier Walls

Section 707.6 Openings (Exception 2)

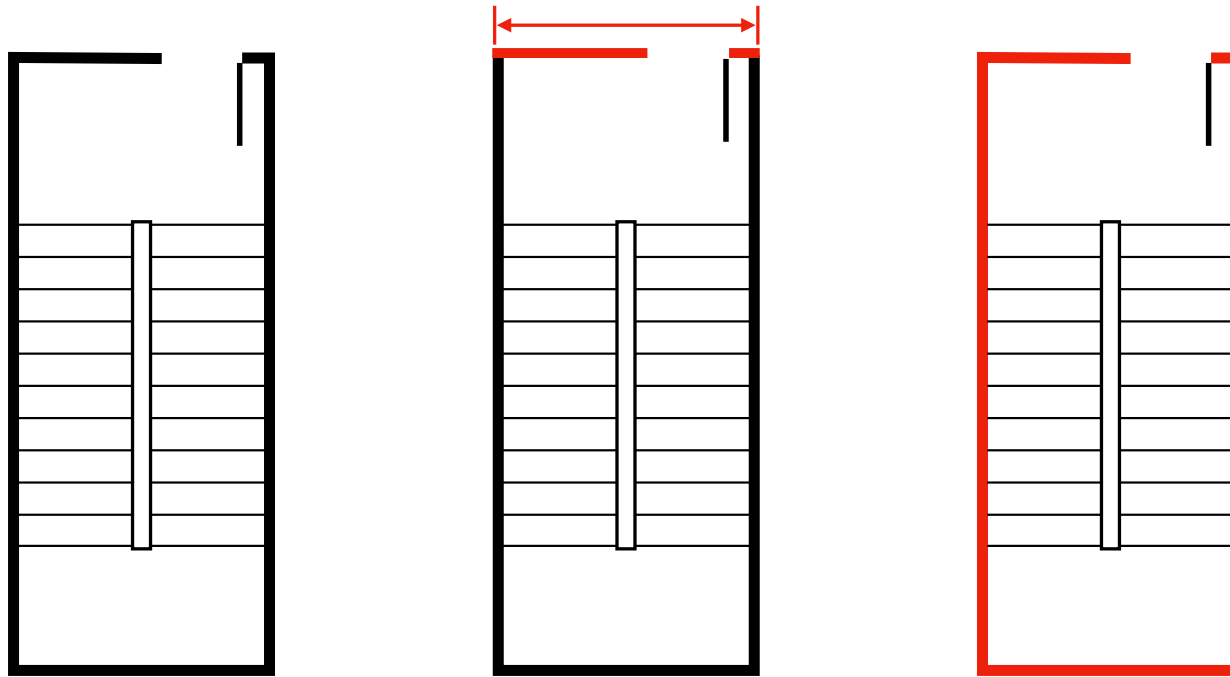
Code Commentary:

Exception 2 acknowledges the practicality of the 25-percent limitation for walls enclosing interior exit stairways and ramps, and exit access stairways and ramps. Most enclosures are of such limited size that the placement of the fire door in the wall of the enclosure often exceeds 25 percent of the wall.



Opening Protectives in Fire Barrier Walls

Section 707.6 Openings (Exception 2)



Opening Protectives in Fire Barrier Walls

Section 1023 Interior Exit Stairways and Ramps

1023.4 Openings. Interior exit stairway and ramp opening protectives shall be in accordance with the requirements of Section 716.

Openings in *interior exit stairways* and *ramps* other than unprotected exterior openings shall be limited to those required for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

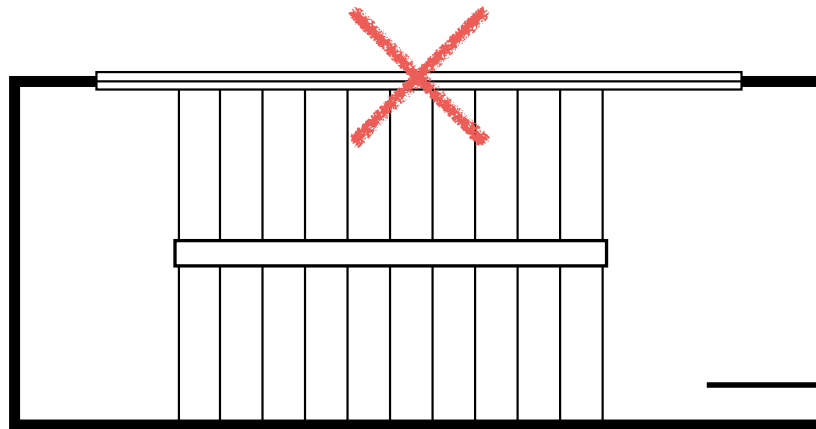
Elevators shall not open into *interior exit stairways* and *ramps*.

Opening Protectives in Fire Barrier Walls

Section 1023 Interior Exit Stairways and Ramps

A code change was introduced and adopted into the 2003 edition of the IBC to limit openings to those required for “exit access to the enclosure.” The following is a portion of the reason statement by the proponent:

This restriction on openings essentially prohibits the use of windows in an exit enclosure except for those exterior windows or doors that are not exposed to any hazards.



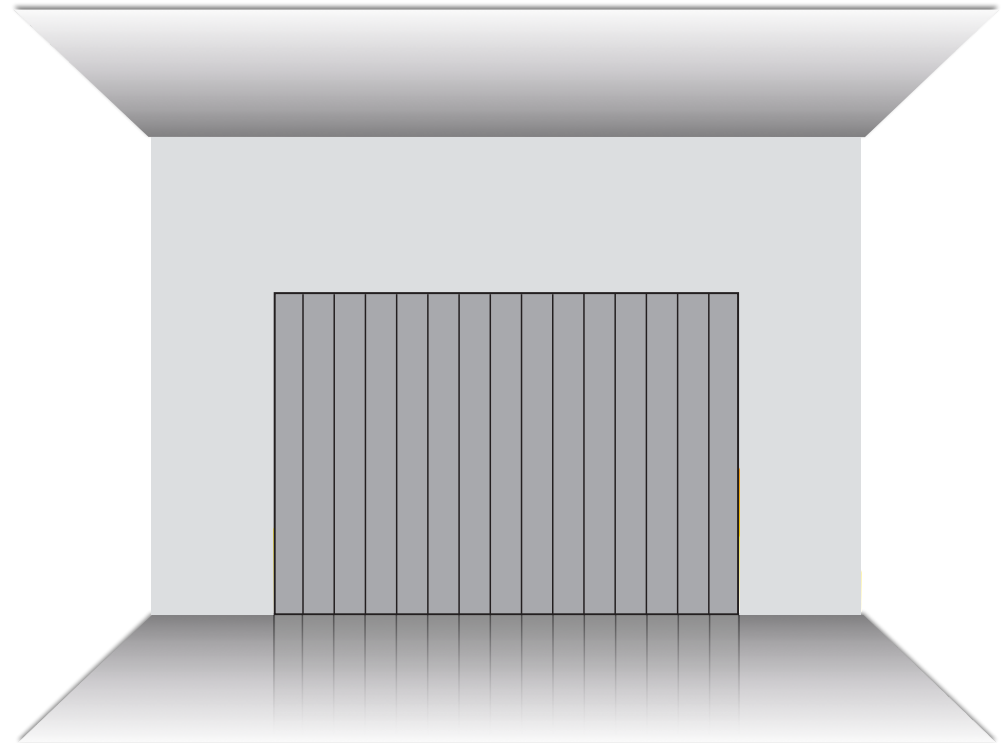
DEFINITIONS

Fire Partitions

Section 708

A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. (202)

- **Fire Ratings** (*Table 708.3*)
 - 1-hour
 - 1/2-hour (*708.3, Exceptions #1 & #2*)
- **Opening Protection**
- **Design Notes**
- **Applications**



Opening Protectives in Fire Partition Walls

Section 708.6 Openings

708.6 Openings. Openings in a *fire partition* shall be protected in accordance with Section 716.



Opening Protectives in Fire Partition Walls

Section 708.6 Openings

716.2.2.1 Door assemblies in corridors and smoke barriers ... minimum fire protection rating of 20 minutes ... without the hose stream test.

716.2.2.1 Smoke and draft control ... “S” labeled ... louvers prohibited.



Opening Protectives

Section 715 (2009) or 716 (2012, 2015)

Table 715.4 / 716.5: Fire Door and Fire Shutter Fire Protection Ratings

Type of Assembly		Required Assembly Rating (Hours)	Minimum Fire Door & Fire Assembly Fire Rating (Hours)
FIRE WALLS and FIRE BARRIERS having a required fire-resistance rating greater than 1 hour.		4 3 2 1 1/2	3 3 ^a 1 1/2 1 1/2
FIRE BARRIERS having a required fire-resistance rating of 1 hour.	Shaft, exit enclosure and exit passageway walls	1	1
	Other fire barriers	1	3/4
FIRE PARTITIONS	Corridor walls	1 0.5	1/3 ^b 1/3 ^b
	Other fire partitions	1 0.5	3/4 1/3
EXTERIOR WALLS		3 2 1	1 1/2 1 1/2 3/4
SMOKE BARRIERS		1	1/3 ^b

a. Two doors, each with a fire protection rating of 1 1/2 hours, installed on opposite side of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour door.

b. For testing requirements, see Section 715.4.3.



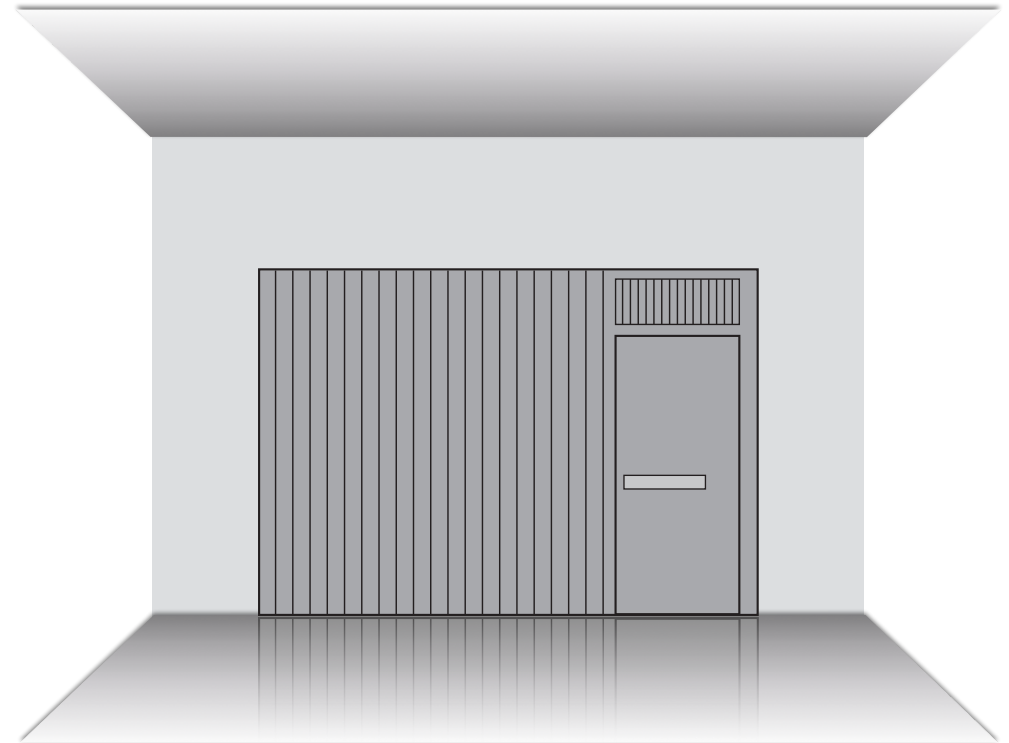
DEFINITIONS

Smoke Barriers

Section 709

A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly that is designed and constructed to restrict the movement of smoke. (202)

- **Fire Ratings** (709.3)
1-hour
- **Opening Protection**
- **Design Notes**
- **Applications**



Opening Protectives in Smoke Barrier Walls

Section 709.5 Openings

709.5 Openings. Openings in a *smoke barrier* shall be protected in accordance with Section 716.



Opening Protectives in Smoke Barrier Walls

Section 709.5 Openings

716.2.2.1 Door assemblies in corridors and smoke barriers ... minimum fire protection rating of 20 minutes ... without the hose stream test.

716.2.2.1 Smoke and draft control ... “S” labeled ... louvers prohibited.



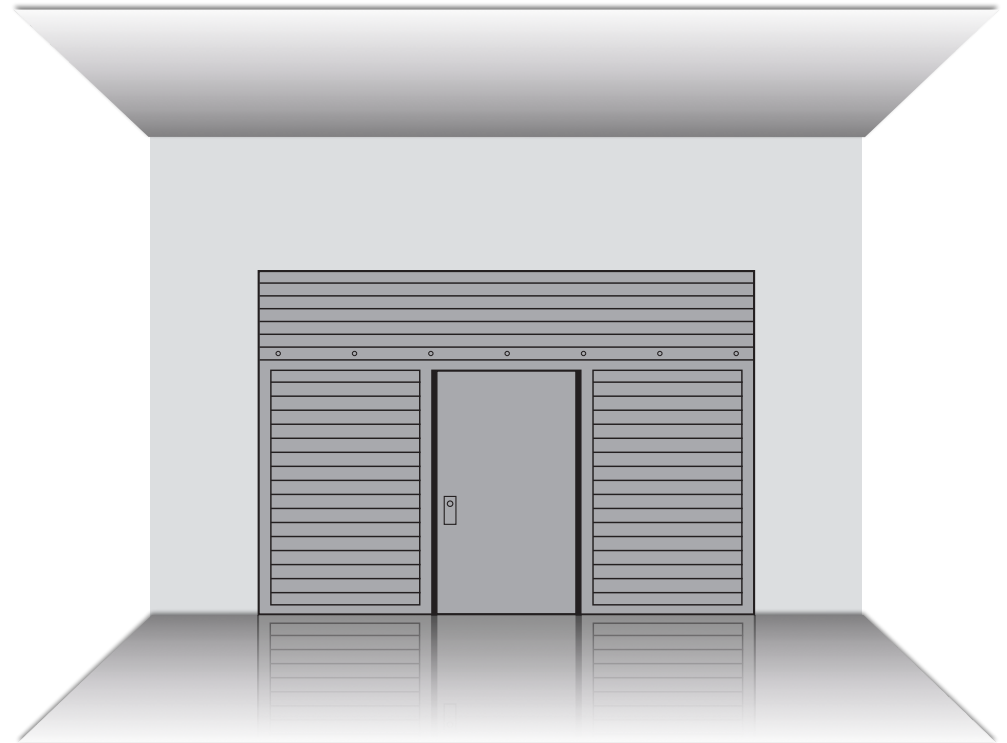
DEFINITIONS

Smoke Partitions

Section 710

A partition constructed to limit the transfer or passage of smoke. (710.4)

- **Fire Ratings** (*Table 710.3*)
Non-rated
- **Opening Protection**
- **Design Notes**
- **Applications**



Opening Protectives in Smoke Partition Walls

Section 710.5 Openings

710.5 Openings. Openings in smoke partitions shall comply with Sections 710.5.1 and 710.5.2.

Opening Protectives in Smoke Partition Walls

Section 710.5 Openings

710.5.1 Windows.

710.5.2 Doors.

710.5.2.2 & 2.2.1 Smoke and draft control doors ... UL 1784 listed and labeled.

710.5.2.3 Self- or automatic-closing doors ... Automatic closing by smoke detection.

