

ADVANCED, FBC 7TH EDITION (2020)

# Five Walls of the FBC

A Guide To Fire-Resistance & Fire Protection

*A Continuing Education Seminar presented by*

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# Five Walls of the FBC

## 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 period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.



UL 263

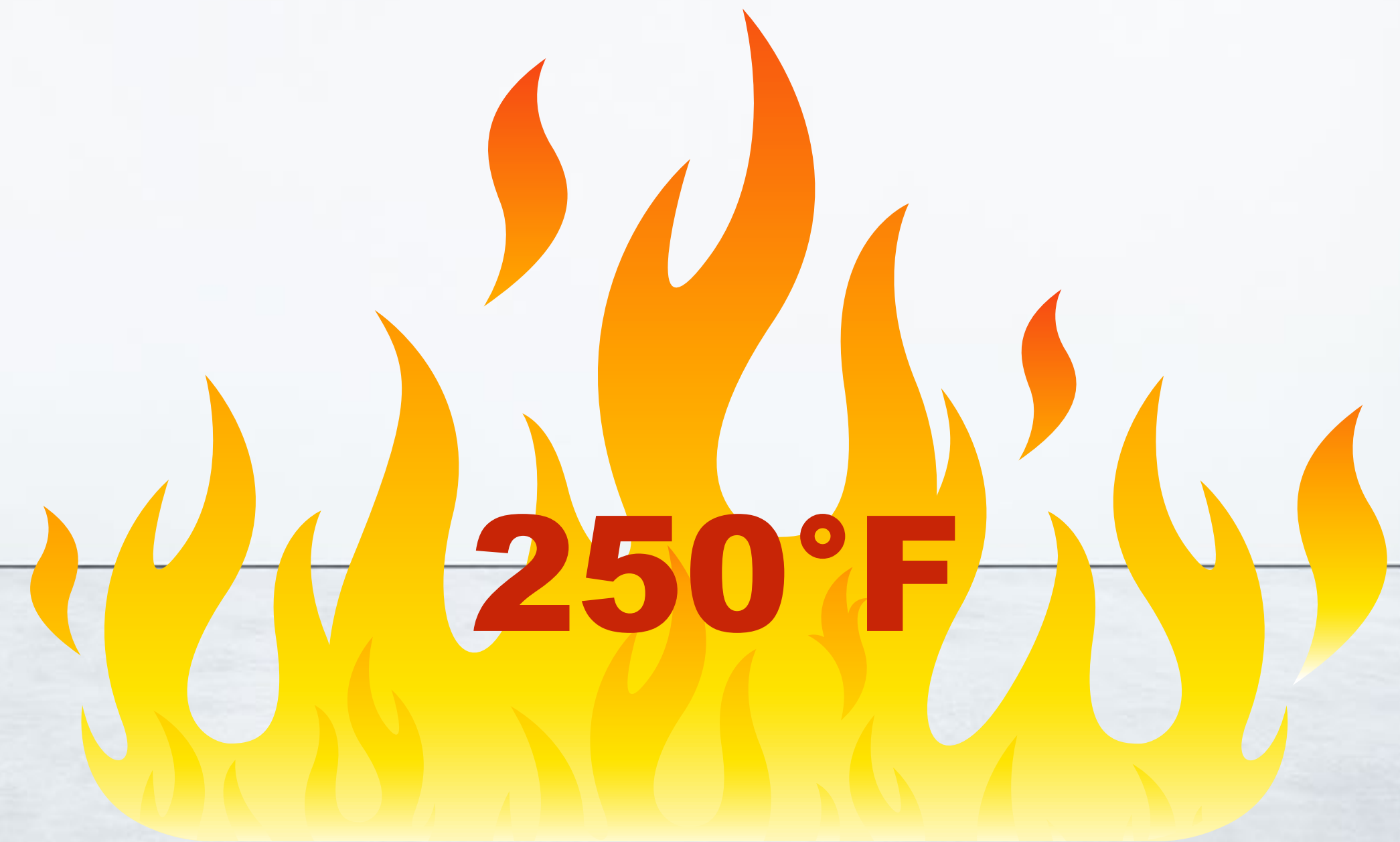


NFPA 251



ASTM INTERNATIONAL

ASTM E-119



# 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.





# Opening Protectives

## Section 716

**Table 716.5 (partial): Opening Fire Protection Assemblies, Ratings and Markings**

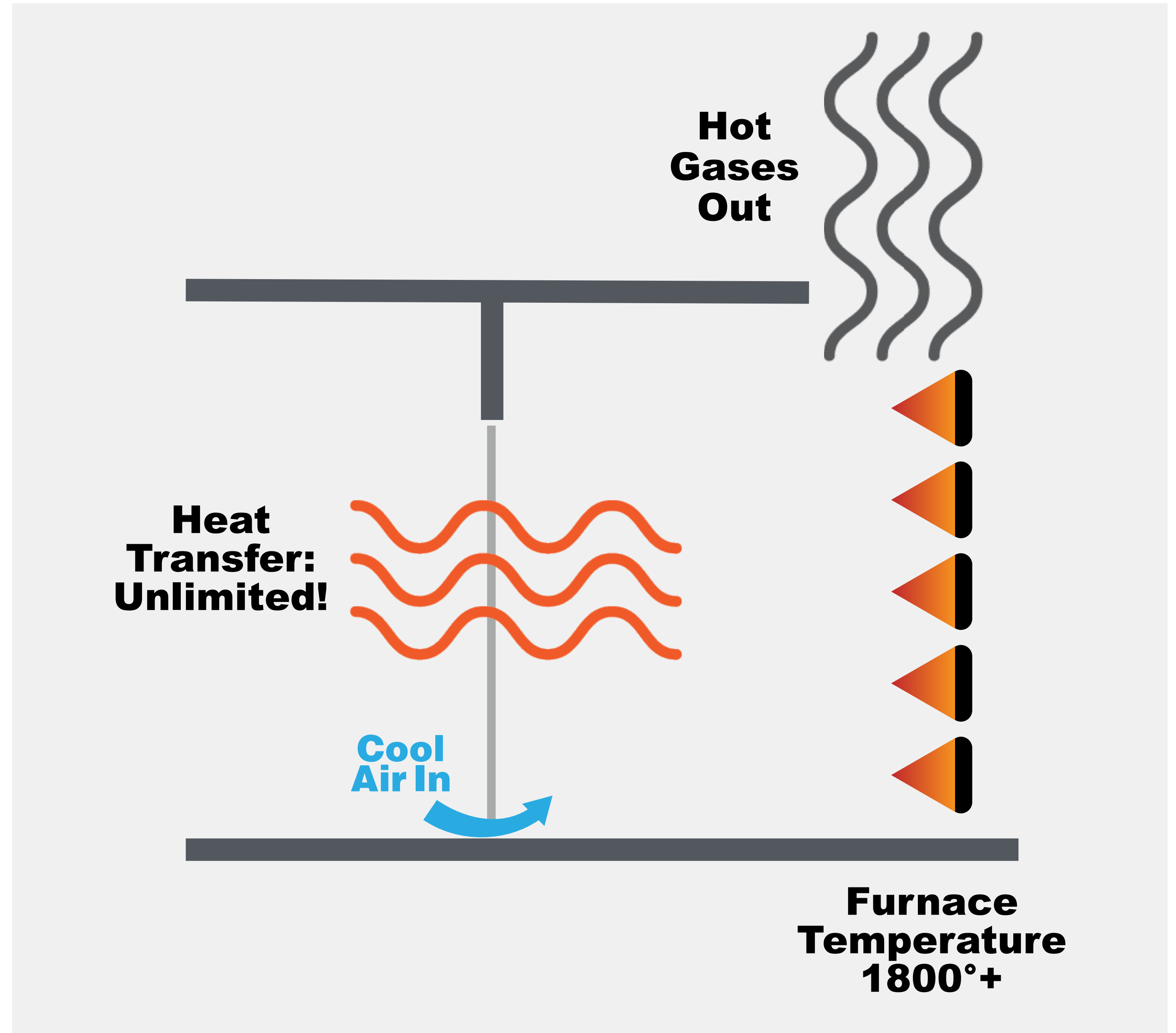
Type of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door Shutter Assembly Rating (Hours)
<b>FIRE WALLS</b> and <b>FIRE BARRIERS</b> having a required fire-resistance rating greater than 1 hour.	4	3
	3	3
	2	1 1/2
	1 1/2	1 1/2
Shaft, exit enclosures and exit passageways	2	1 1/2
<b>FIRE BARRIERS</b> having a required fire-resistance rating of 1 hour:	1	1
Other fire barriers	1	3/4
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**



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:

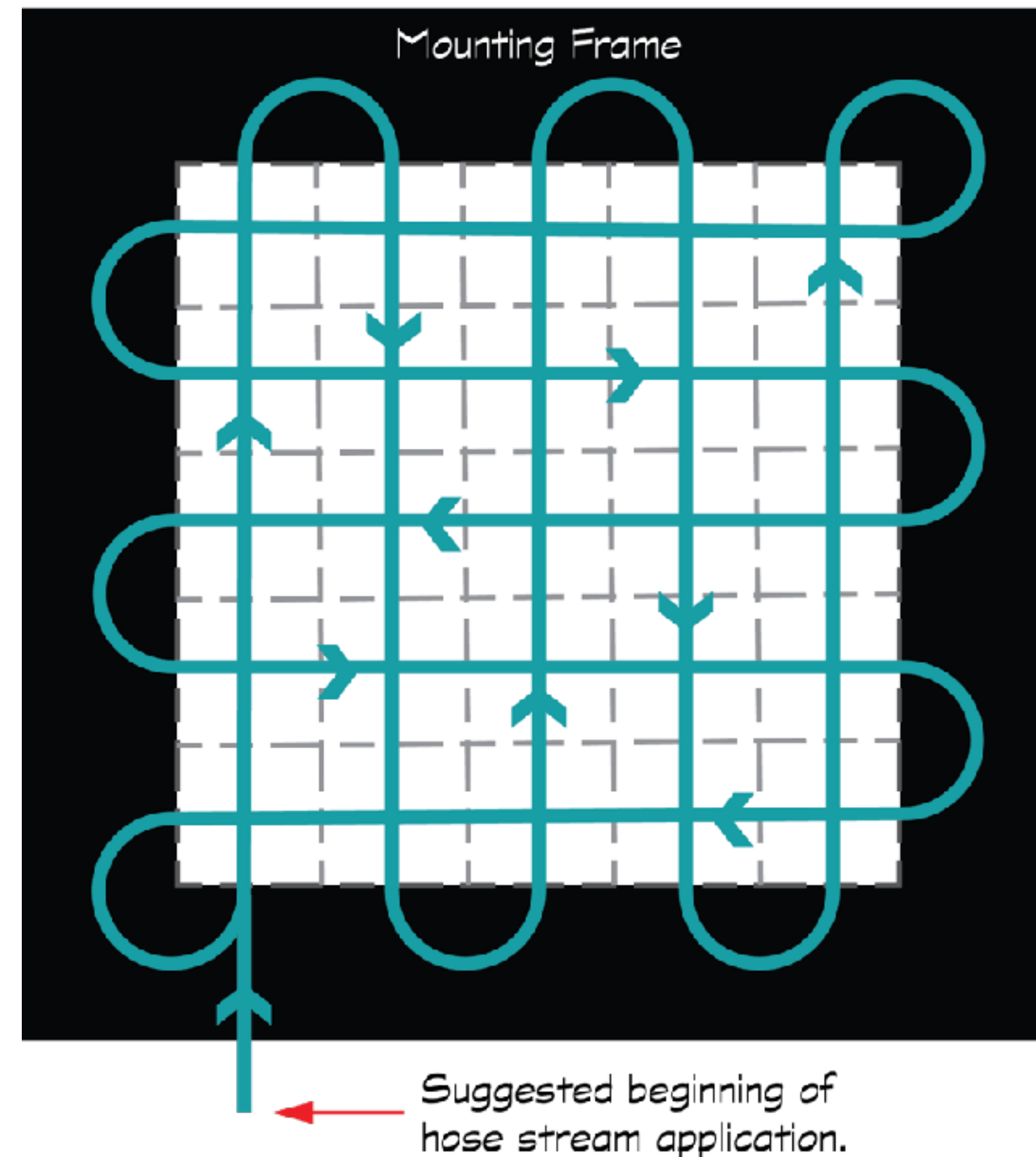
1. the structural integrity of fire door assembly during fire exposure and
2. the overall reliability of the material of which the assembly is constructed to perform its intended function.

## 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**



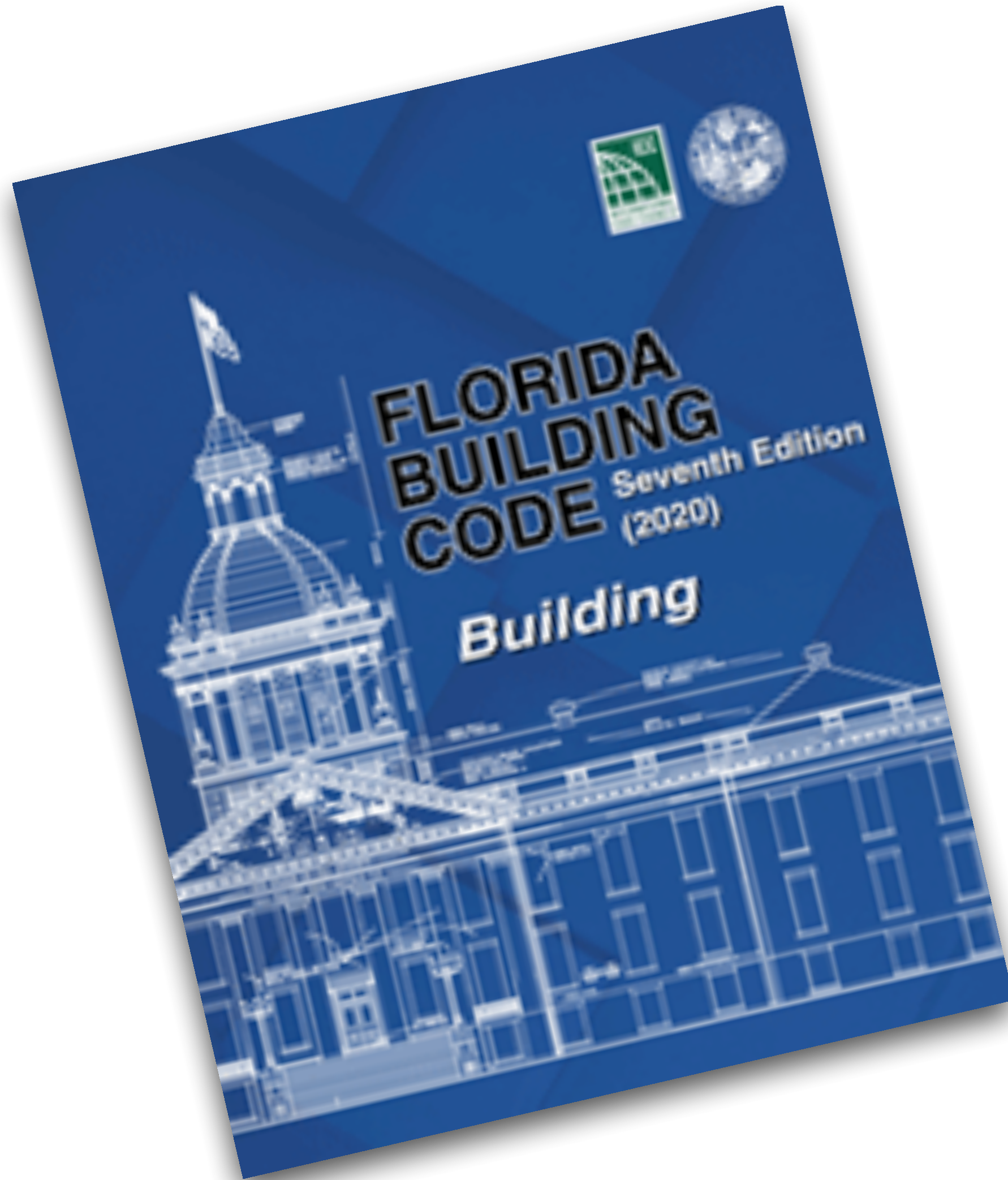
## TEST CRITERIA

# Hose Stream

ASTM E2226

**Structural Integrity Test**





## 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.



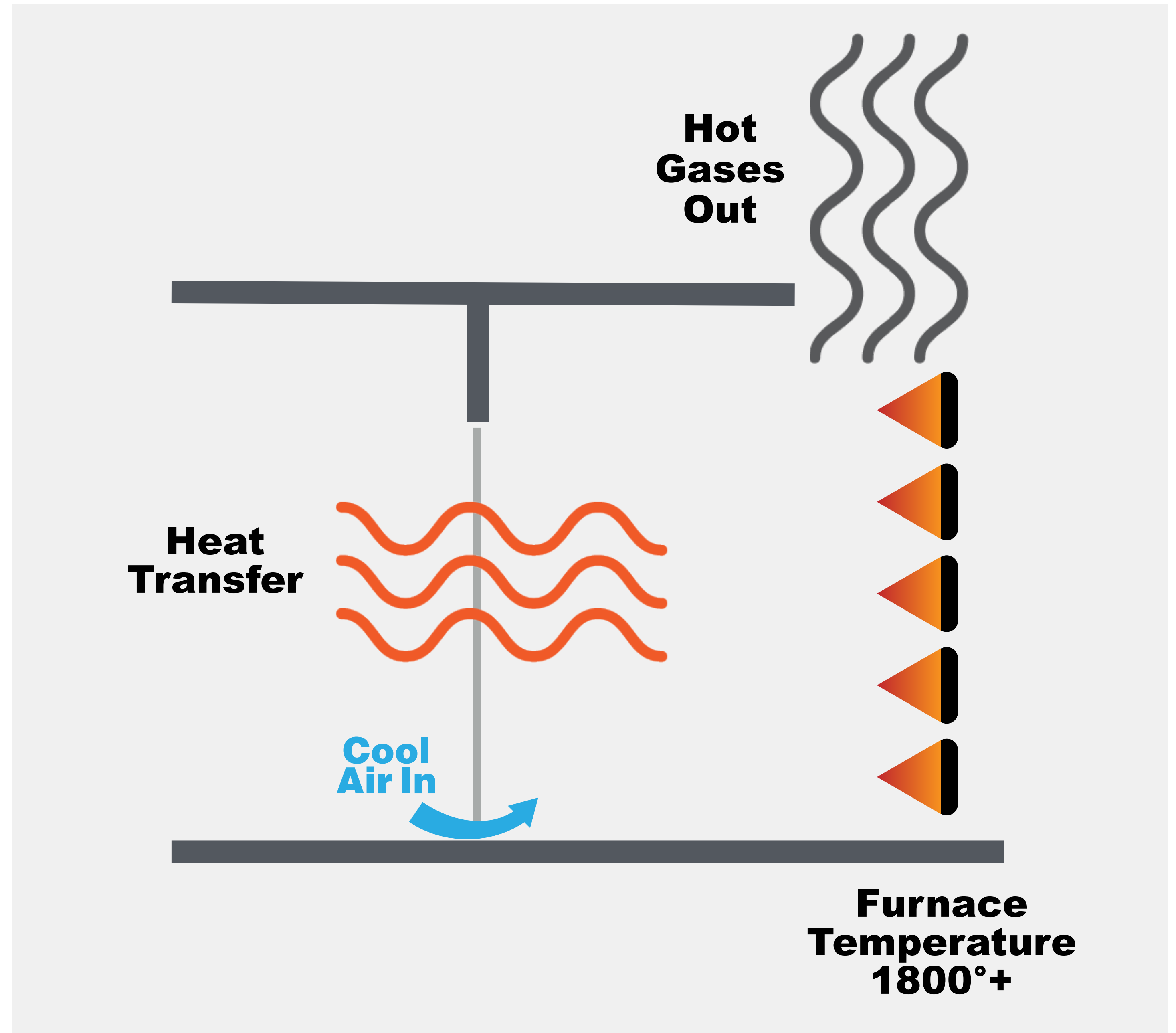
## TEST CRITERIA

# 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

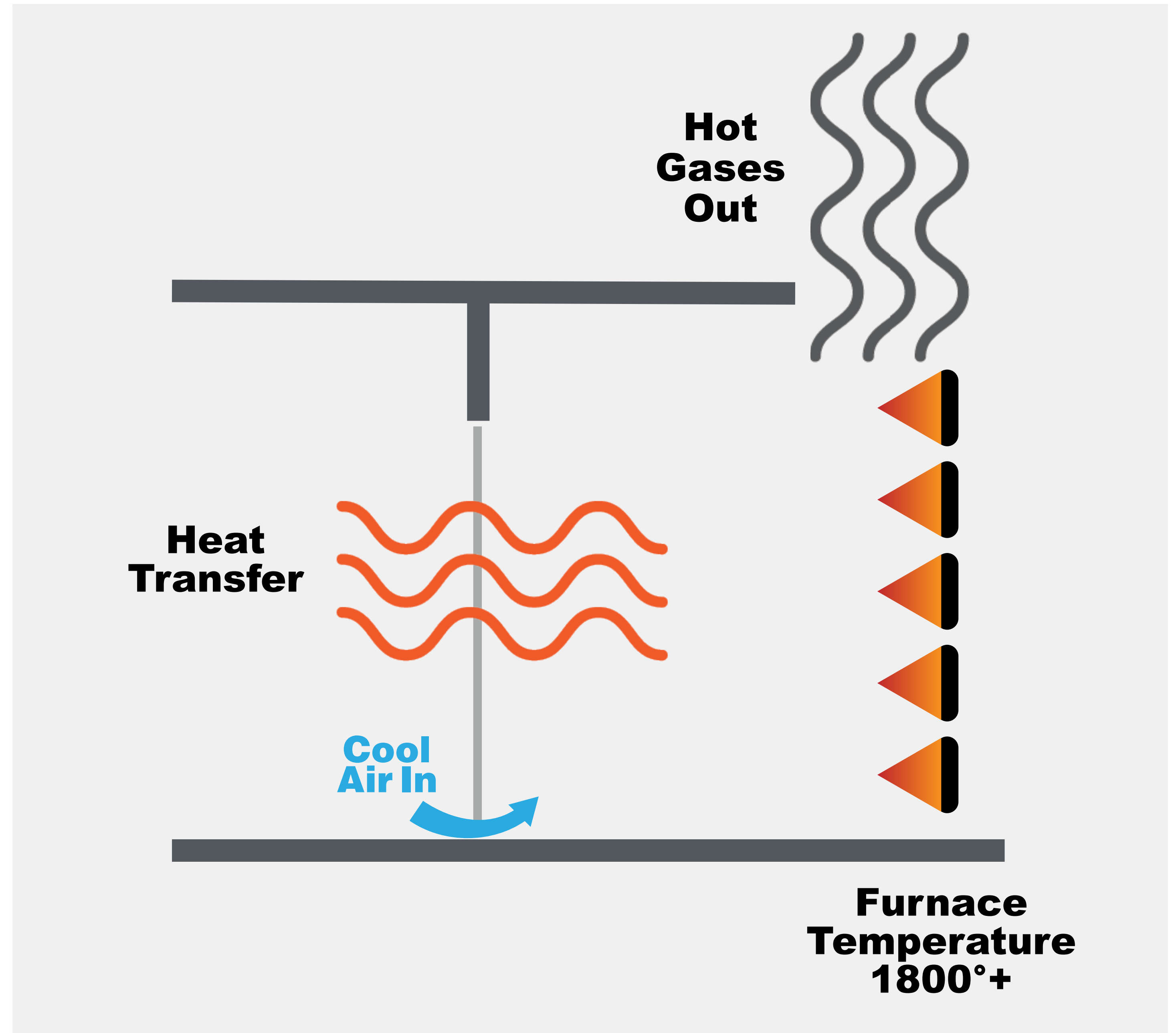
(Fire Resistance Rating)

### Heat Transfer:

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



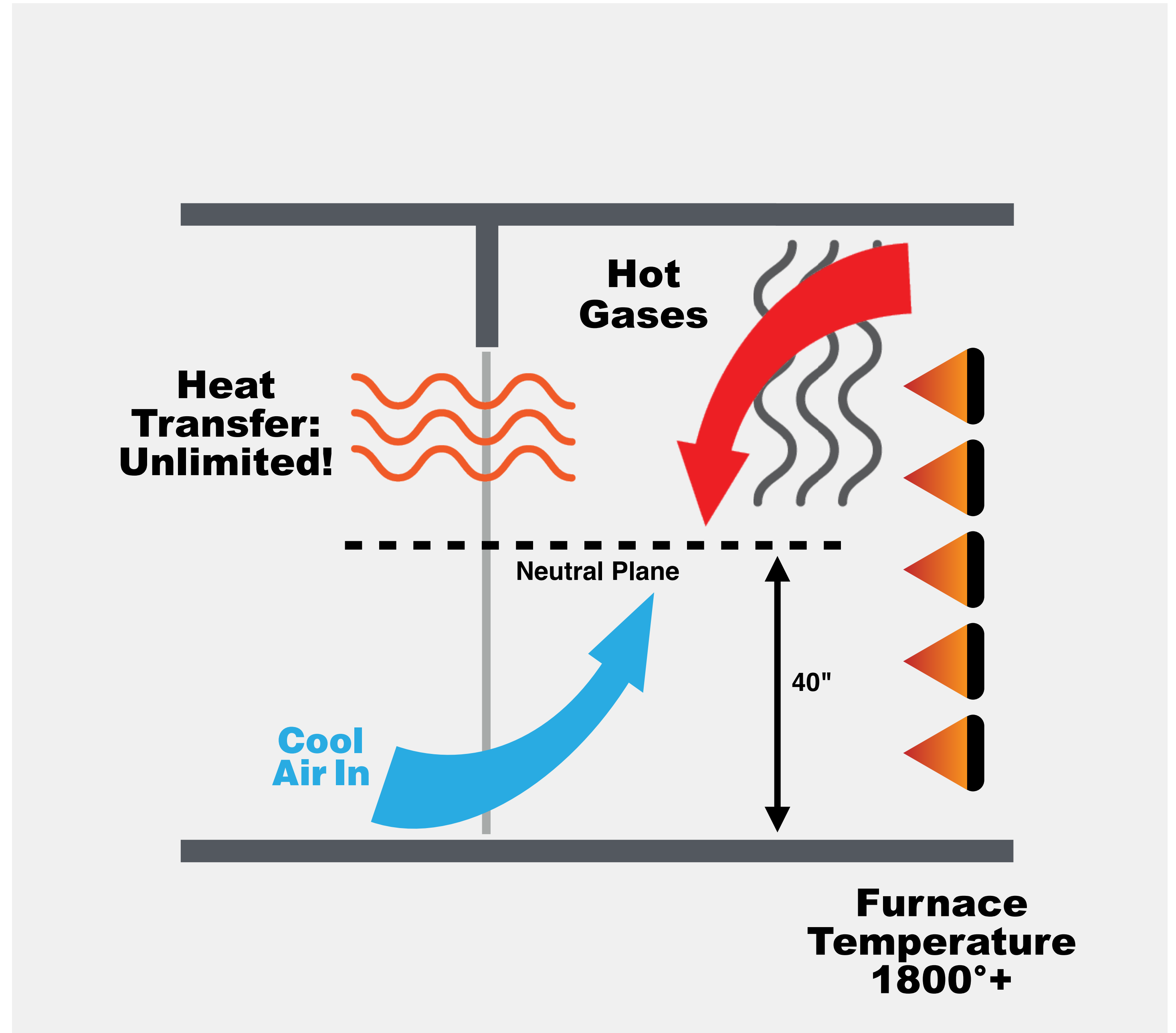
ASTM INTERNATIONAL



TEST CRITERIA

# Positive Pressure Test

40" Neutral Plane  
(Fire Protection Rating)



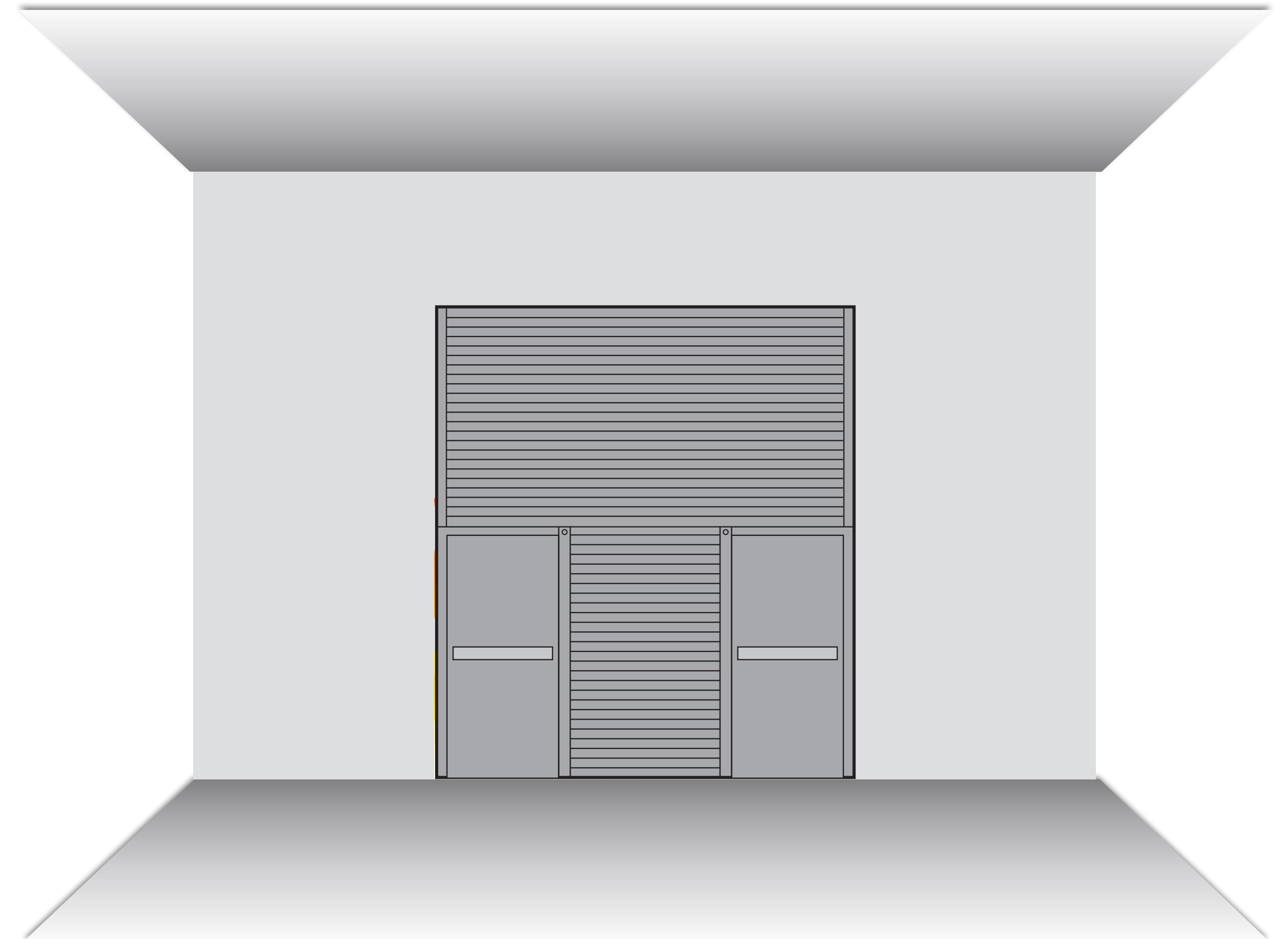
## DEFINITIONS

# 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 m<sup>2</sup>). 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 m<sup>2</sup>) where both buildings are equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1.

# TEST CRITERIA



## Test Furnace

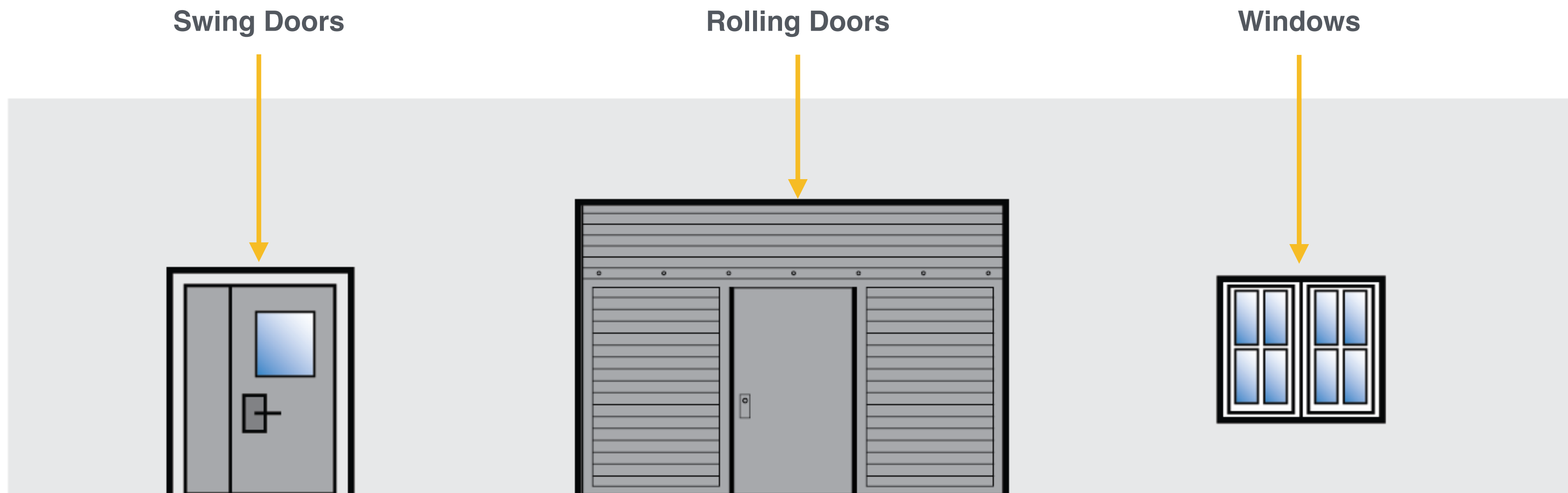
Maximum Size: 156  
Square Feet



# 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 m<sup>2</sup>). 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

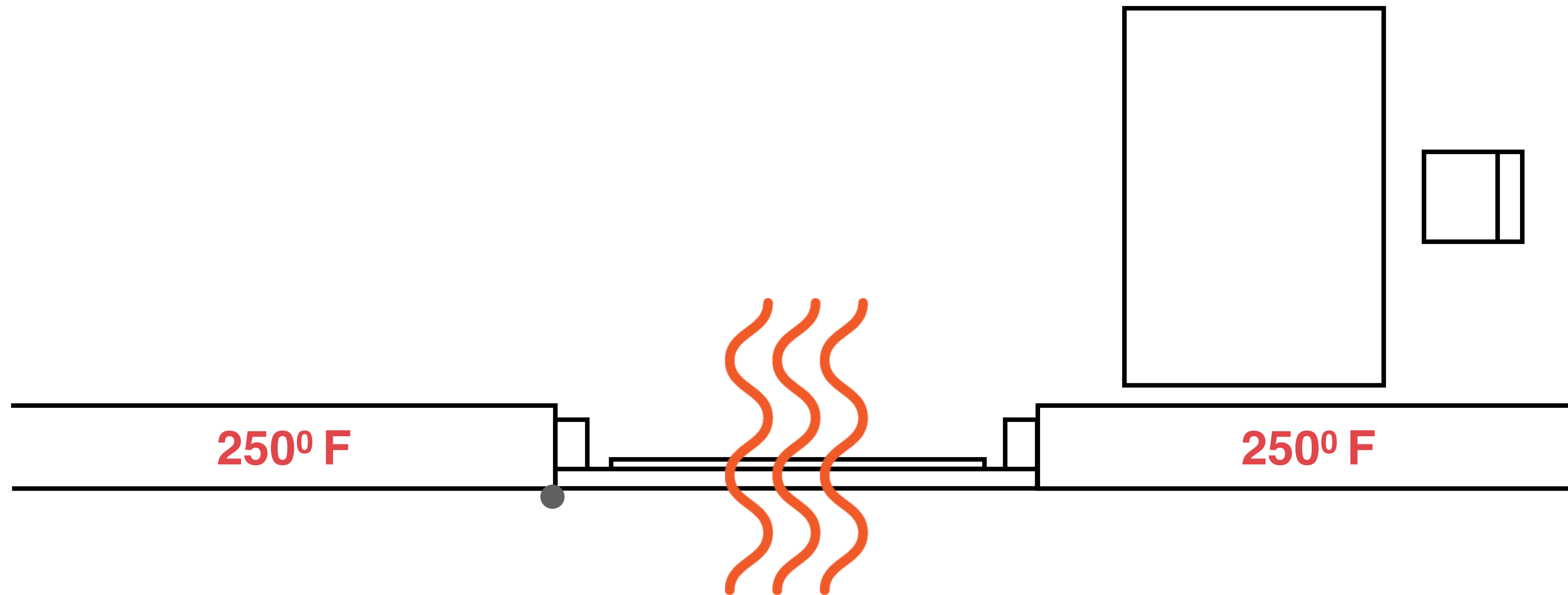
## Section 716

**Table 716.5 (partial): Fire Door and Fire Shutter Fire Protection Ratings**

Type of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door Shutter Assembly Rating (Hours)
<b>FIRE WALLS</b> and <b>FIRE BARRIERS</b> having a required fire-resistance rating greater than 1 hour.	4	3
	3	3
	2	1 1/2
	1 1/2	1 1/2
Shaft, exit enclosures and exit passageways	2	1 1/2
<b>FIRE BARRIERS</b> having a required fire-resistance rating of 1 hour:	1	1
Other fire barriers	1	3/4
Fire partitions: Corridor walls	1	1/3
	0.5	1/3
Other fire partitions	1	3/4
	0.5	1/3

# Opening Protectives in Fire Walls

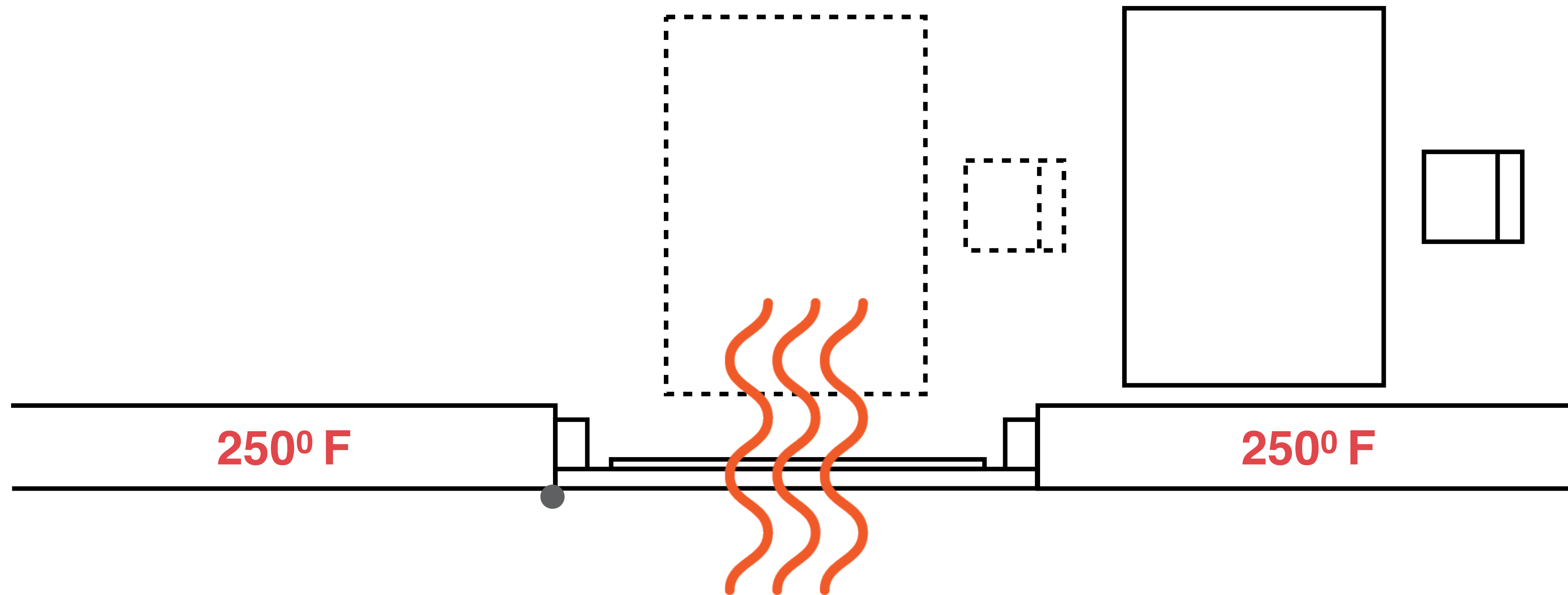
Section 706.8 Openings – Heat Transfer



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

# Opening Protectives in Fire Walls

Section 706.8 Openings – Heat Transfer



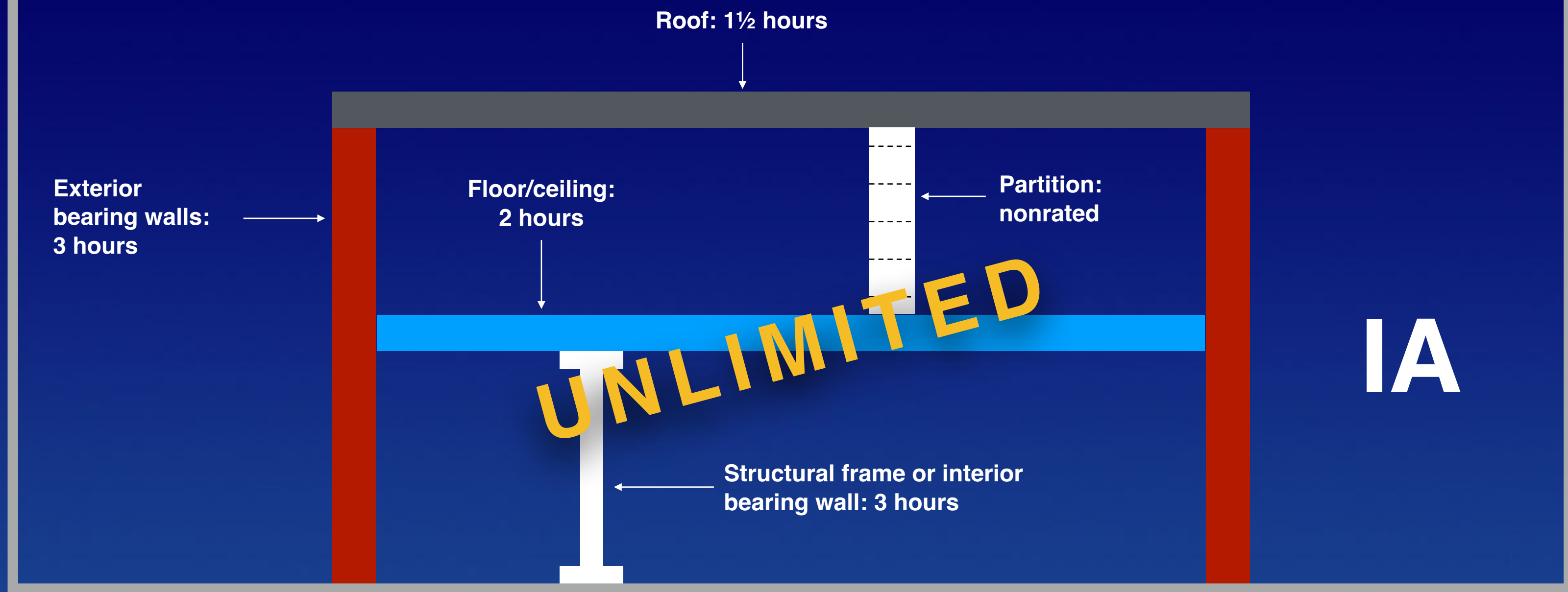
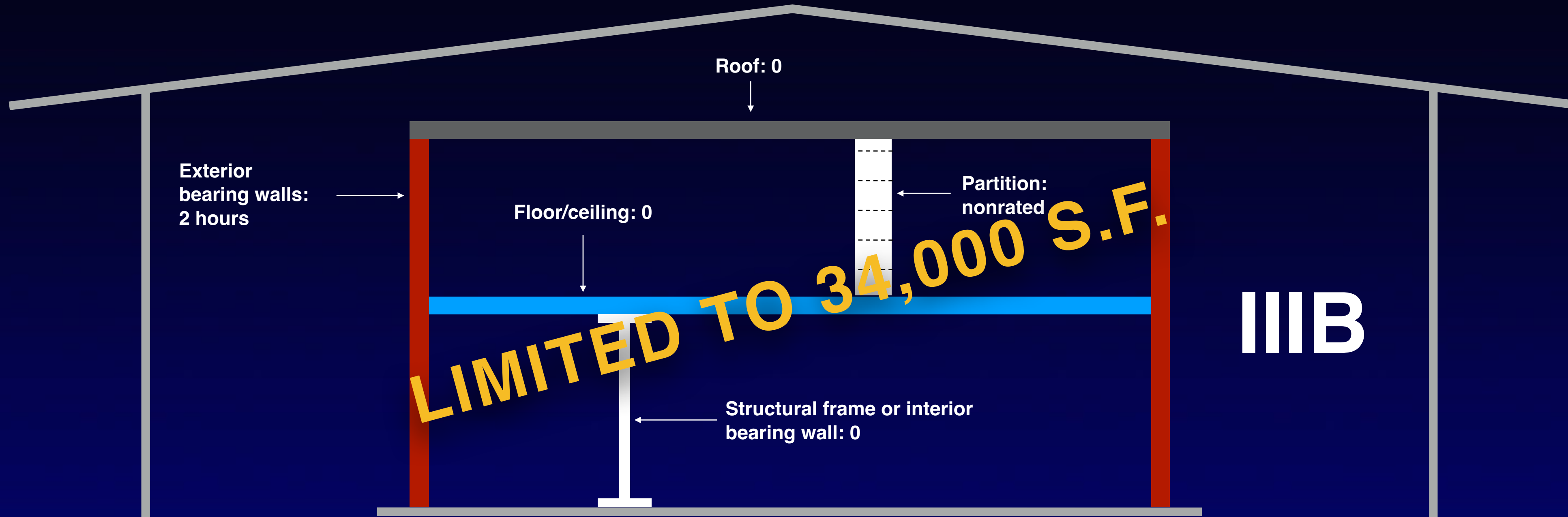
**Fire-rated Doors** – Tested for Flame-through and Flash-through ONLY

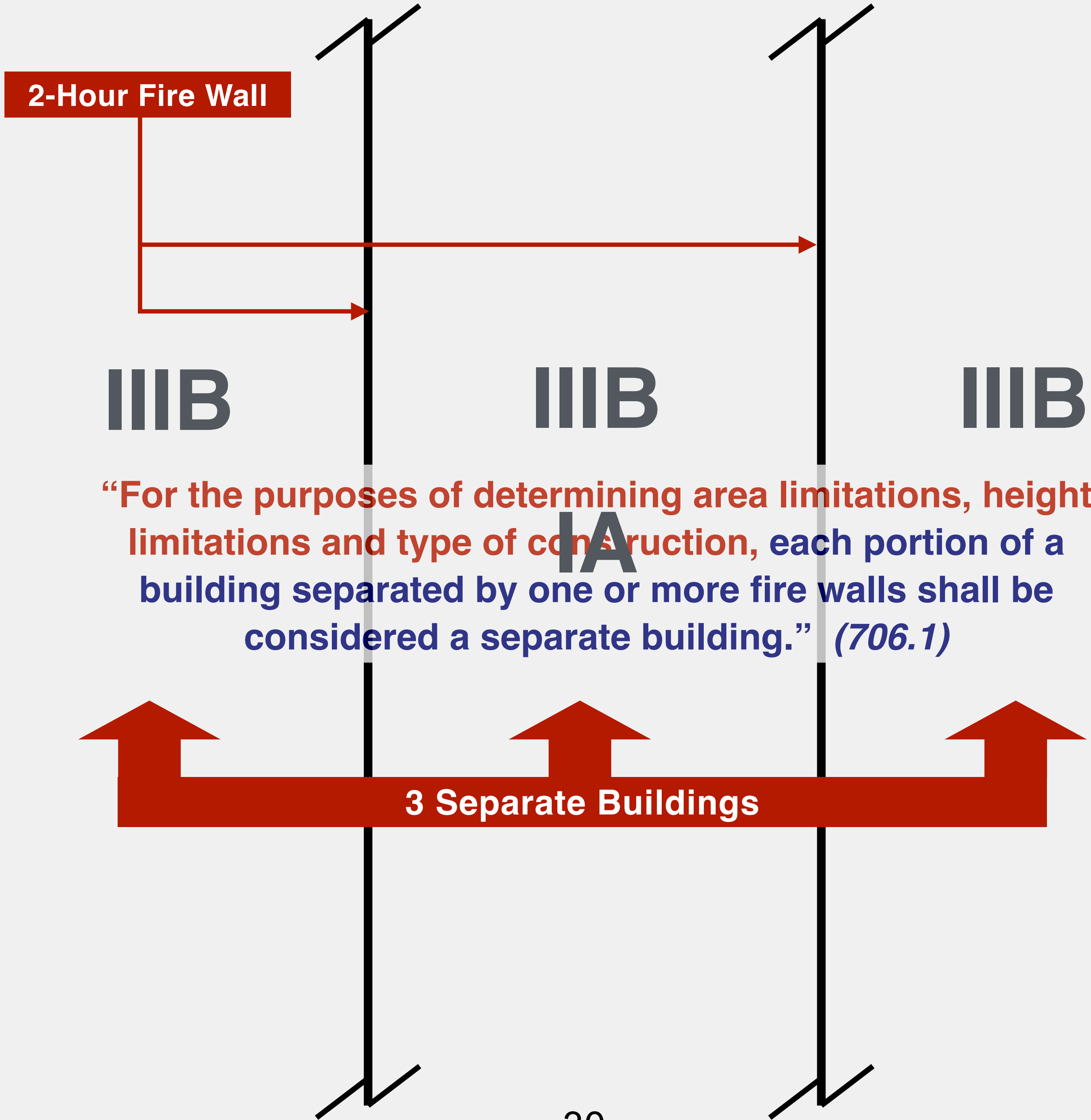
**Occupancy – A-1 (multiplex theater)**

**Building Type – IIIB (rated, single story)**

**Area Allowance – 34,000 sq. ft. (Sprinklered, Table 506.2)**

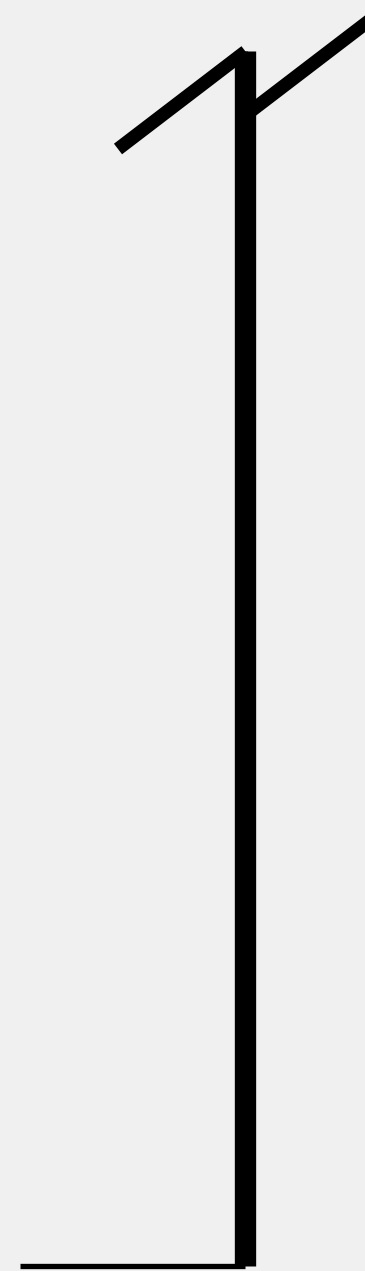
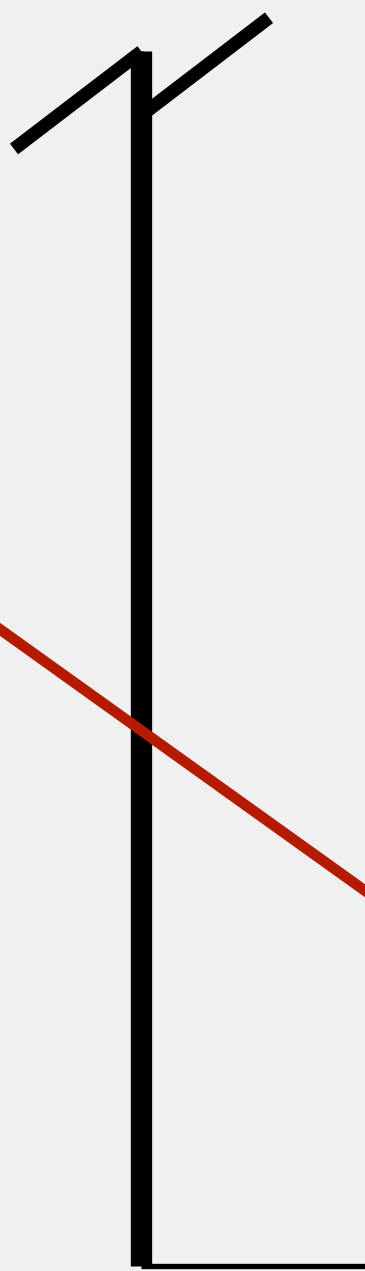
**Actual Building Area – 39,000+ sq. ft. (exceeds allowable area)**

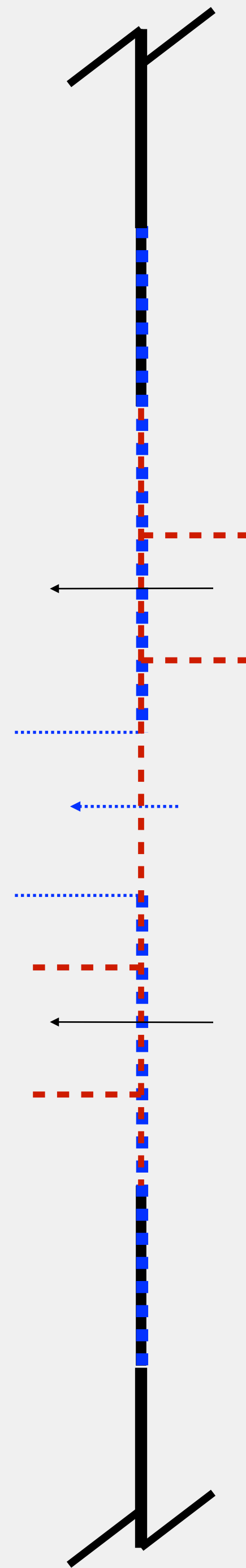
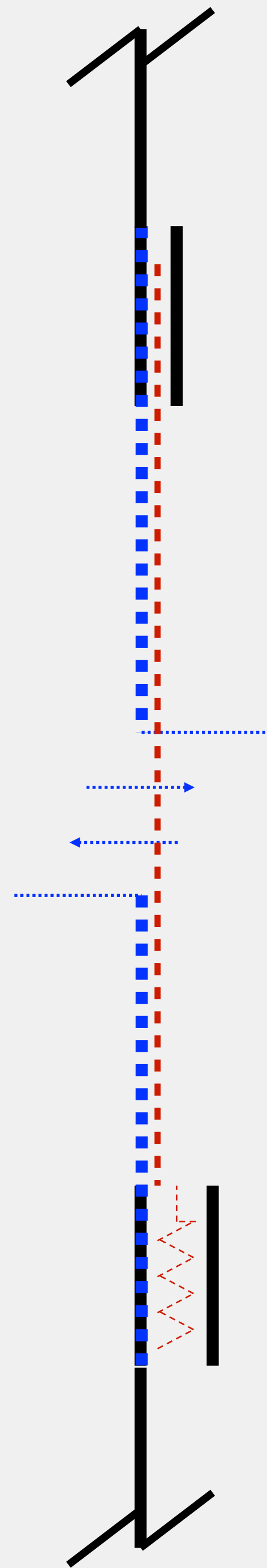




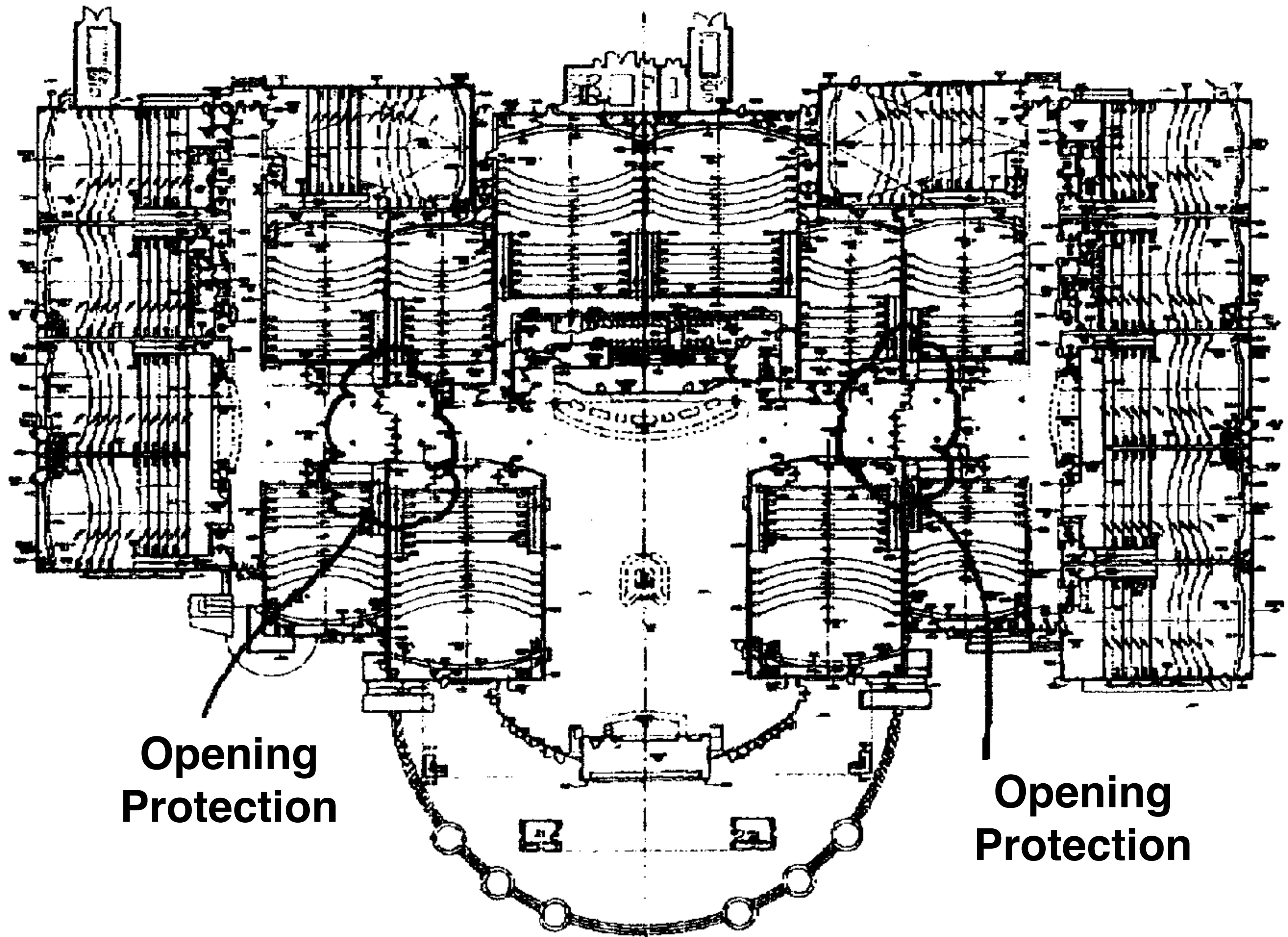
**IA**  
“For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more fire walls shall be considered a separate building.” (706.1)

**1 ½ hr. Opening  
Protectives**









**Opening  
Protection**

**Opening  
Protection**

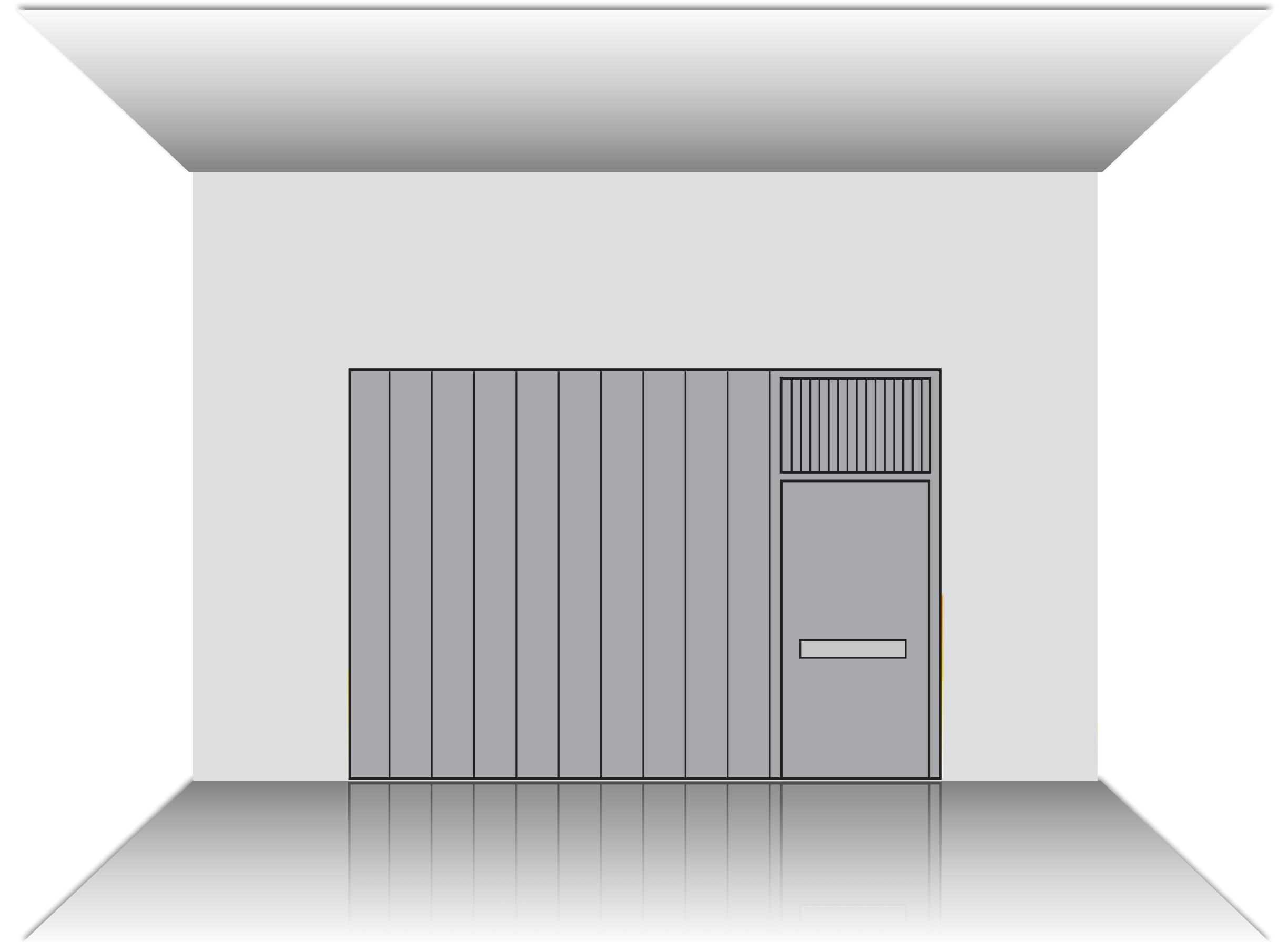
## DEFINITIONS

# 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 716.5*)
  - 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 (Exception 1)

**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 (15m<sup>2</sup>). 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:

1. Openings shall not be limited to 156 square feet (15m<sup>2</sup>) 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)

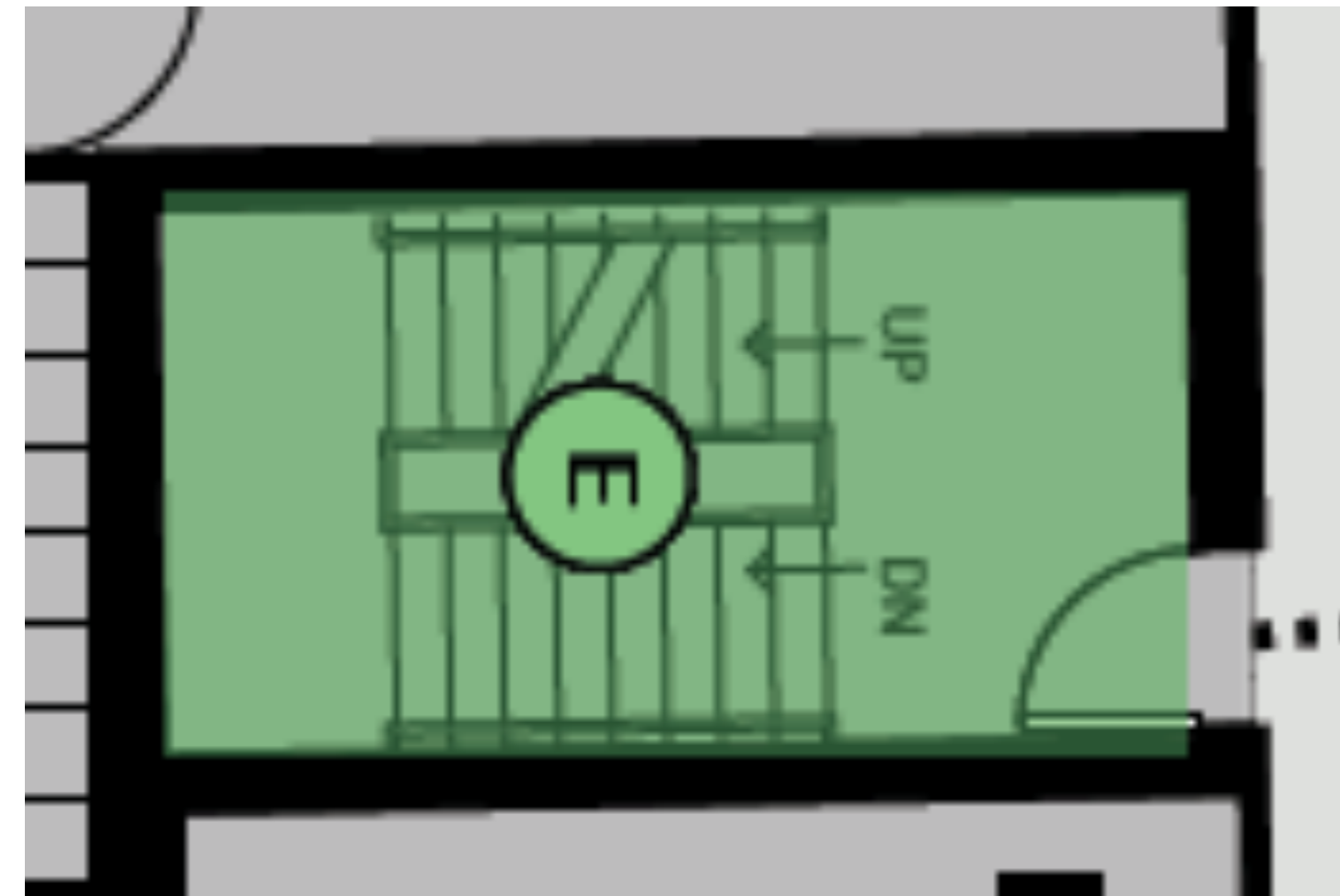
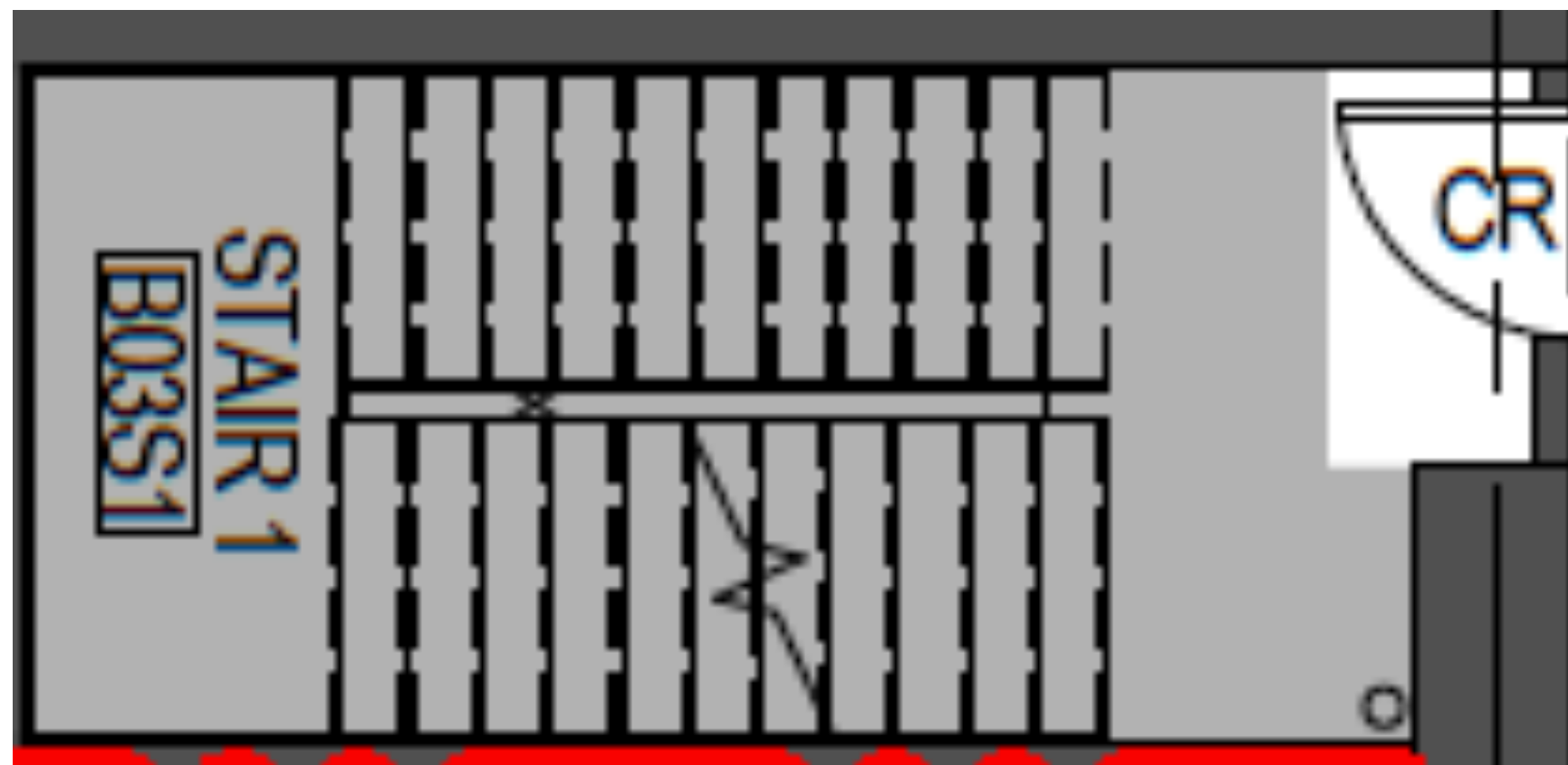
2. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) or an aggregate width of 25 percent of the length of the wall where the opening protective is a *fire door* serving enclosures for exit access stairways and ramps, and interior exit stairways and ramps.

# Opening Protectives in Fire Barrier Walls

## Section 707.6 Openings (Exception 2)

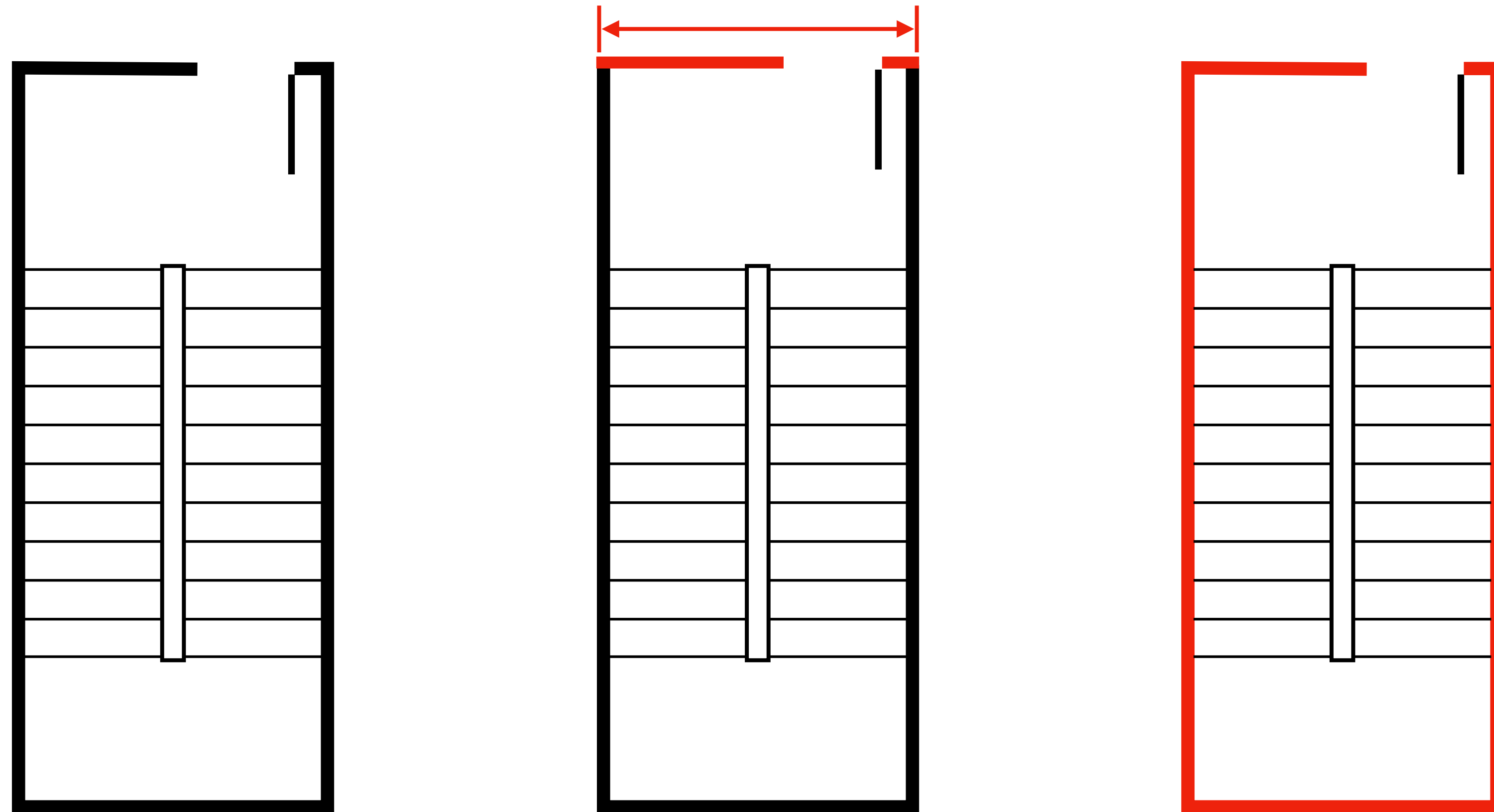
Code Commentary:

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.

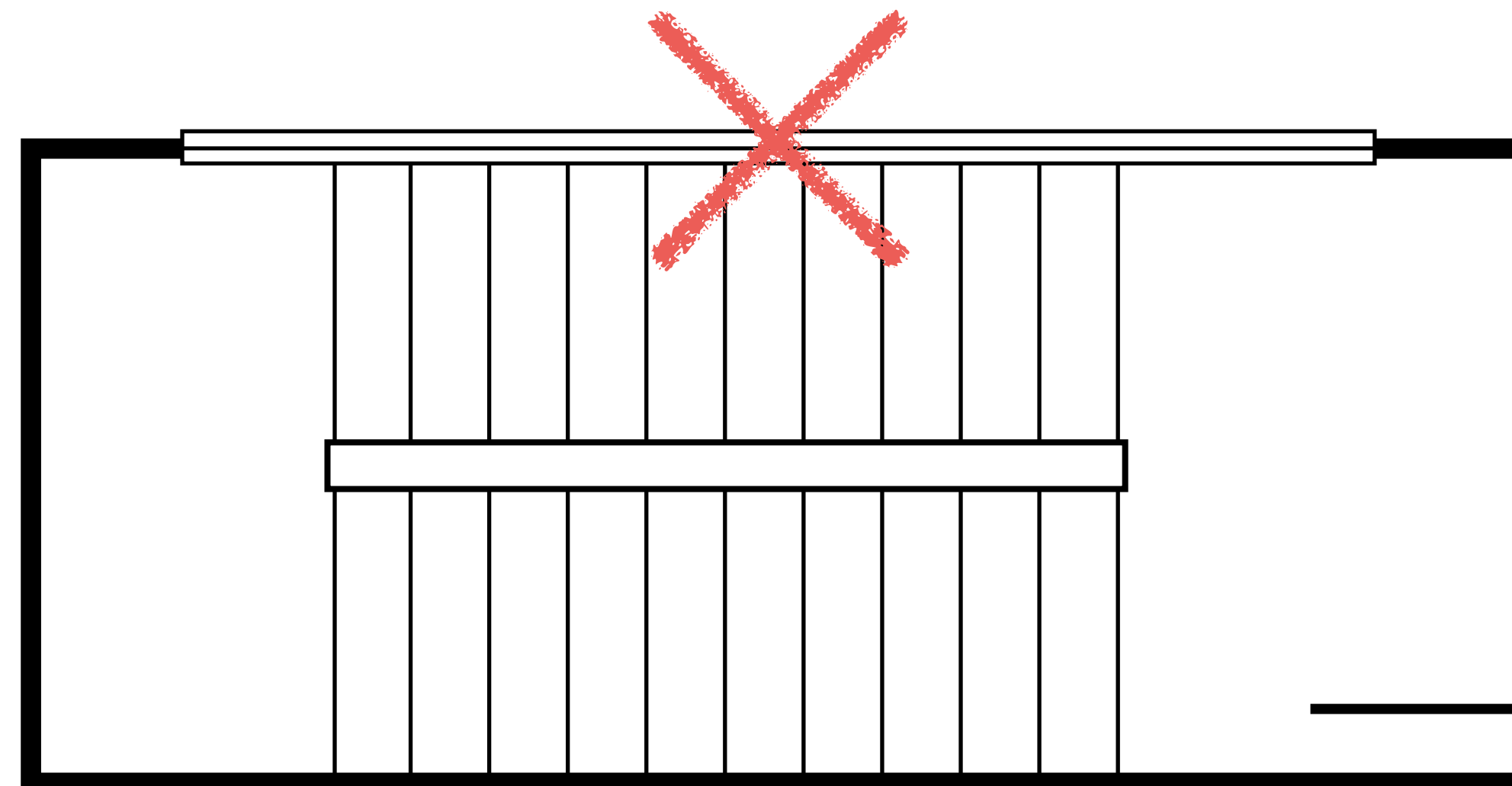
Elevators shall not open into *interior exit stairways* and *ramps*.

# 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.*



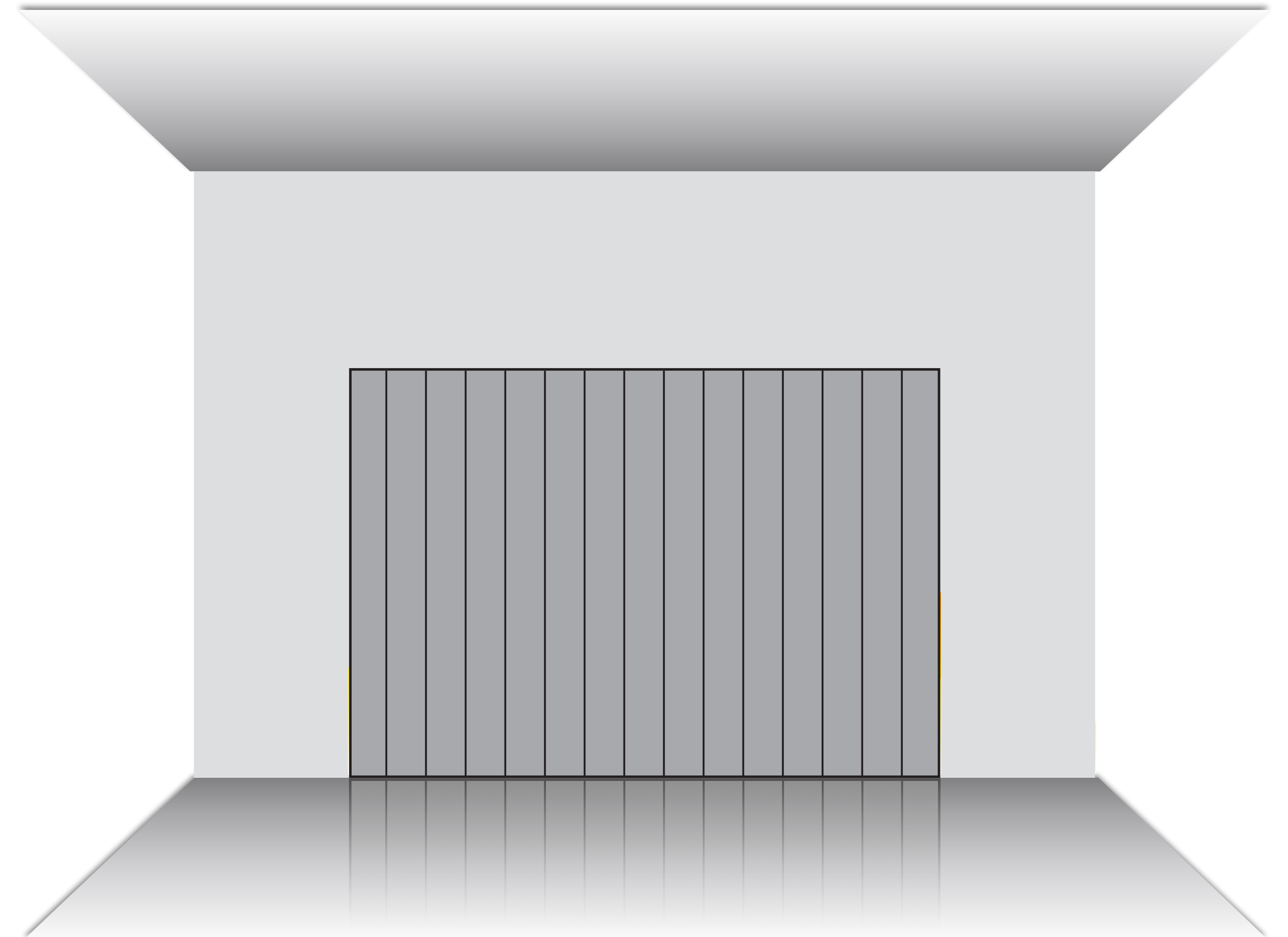


# Fire Partitions

## Section 708

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

- **Fire Ratings (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

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

**716.5.3.1 Smoke and draft control** ... “S” labeled ... louvers prohibited.



# Opening Protectives

## Section 716

**Table 716.5 (partial): Fire Door and Fire Shutter Fire Protection Ratings**

Type of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door Shutter Assembly Rating (Hours)
<b>FIRE WALLS</b> and <b>FIRE BARRIERS</b> having a required fire-resistance rating greater than 1 hour.	4	3
	3	3
	2	1 1/2
	1 1/2	1 1/2
Shaft, exit enclosures and exit passageways	2	1 1/2
<b>FIRE BARRIERS</b> having a required fire-resistance rating of 1 hour:	1	1
Other fire barriers	1	3/4
Fire partitions: Corridor walls	1	1/3
	0.5	1/3
Other fire partitions	1	3/4
	0.5	1/3



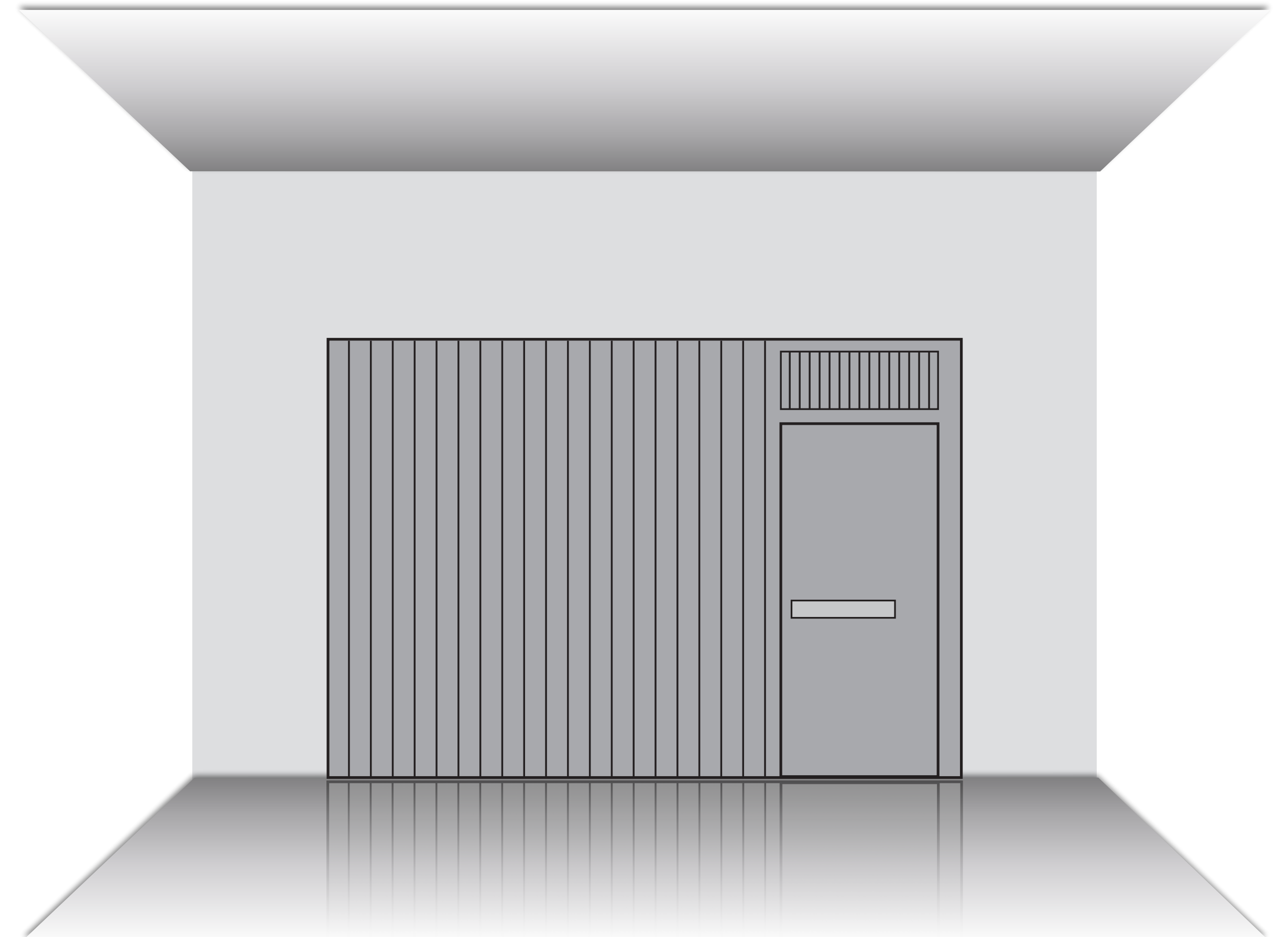
## DEFINITIONS

# 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

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

**716.5.3.1 Smoke and draft control ...** “S” labeled ... louvers prohibited.

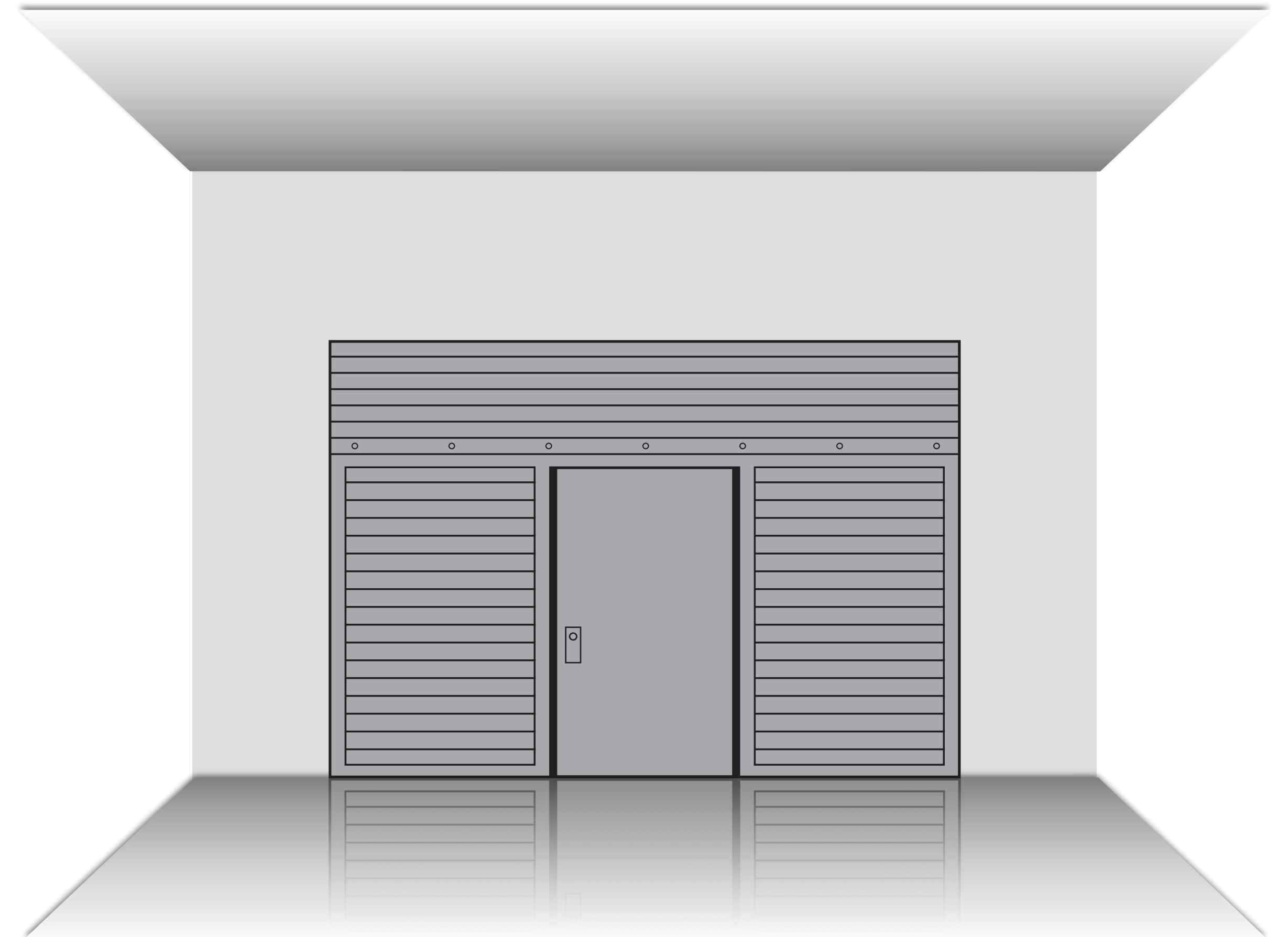


# Smoke Partitions

## Section 710

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

- **Fire Ratings** (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.

