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Course Description

- This seminar addresses the provisions of the 2018 International Building Code® (IBC®) regarding the use of fire and smoke separations.

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Objectives

- Upon completion, you will be better able to:
 1. Identify the general types of fire and smoke separations.
 2. Identify those specific components that make up fire and smoke separations.
 3. Determine where separations are required.
 4. Determine where separations are permitted as alternatives to other requirements.

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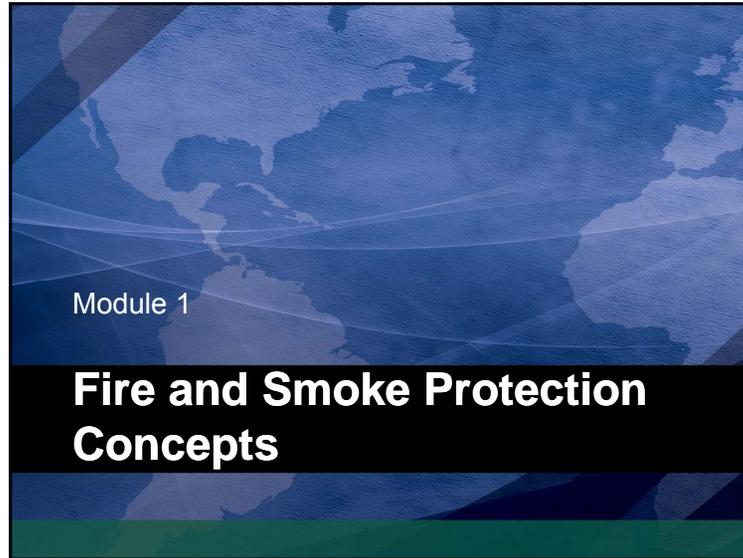
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Course Overview

- Module 1 – Fire and Smoke Protection Concepts
- Module 2 – Types of Fire and Smoke Separations
- Module 3 – Fire and Smoke Separation Components
- Module 4 – Fire and Smoke Separation Locations

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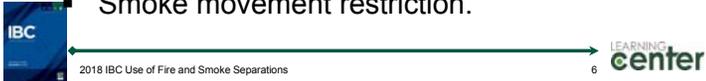
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Fire and Smoke Protection Concepts

- IBC uses fire and smoke assemblies and protectives for a variety of purposes:
 - Structural integrity maintenance.
 - Fire spread limitation.
 - Means of egress protection.
 - Radiant heat (exposure) protection.
 - Smoke movement restriction.



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Structural Integrity



- Larger and/or high-hazard occupancy buildings require specified fire-resistance levels for structural members.
- IBC Chapter 6 “Type of Construction.”



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Structural Fire Resistance

- Structural fire resistance intended to protect structural integrity of building elements during fires.
- Elements include:
 - Structural frame members.
 - Bearing walls.
 - Floor construction.
 - Roof construction.



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Fire Spread Limitation

- Multiple conditions utilize fire-resistant separations to limit fire spread.
 - Complete and partial fire separations either mandated, or provided as an alternative, to address a variety of issues: generally hazardous occupancy or operations.
 - Vertical and/or horizontal separations typically require opening protectives and other components to achieve full separation.



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Egress Protection

- Fire-resistance-rated and/or smoke-resistant construction is often mandated.
 - “Exit” portion of the means of egress is typically where such protection must be afforded.
 - Means of egress fire protection allows extended travel in large areas or multistory buildings.



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Radiant Heat Protection

- To prevent building-to-building fire spread due to radiant heat transfer.
 - Fire-resistance-rated exterior walls required based on proximity to lot lines and other buildings on the same site.
 - Fire separation distance



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Smoke Movement Restriction

- Smoke-resistant construction often mandated where occupants incapable of self preservation and protect-in-place methods are employed.
 - Institutional occupancies
 - Hospitals, nursing homes
 - Prisons, jails, reformatories
 - Other conditions require separation that includes both smoke- and fire-resistance.



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ACTIVITY

Fire Protection Concepts

- List the IBC's five primary protection concepts for fire- and smoke-resistant construction:
 - Structural integrity maintenance.
 - Fire spread limitation.
 - Means of egress protection.
 - Radiant heat (exposure) protection.
 - Smoke movement restriction.

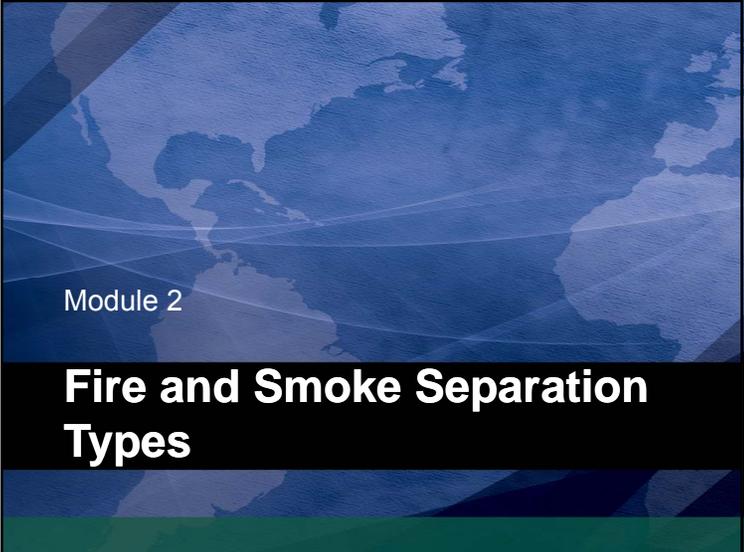


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Module 2

Fire and Smoke Separation Types

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Fire-resistance-rated Separations

- IBC has variety of fire-resistance-rated separation “types”.
- Each unique separation type serves a distinct purpose as reflected in its design details.



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Fire-resistance-rated Separations



- Fire walls.
- Fire barriers.
- Fire partitions.
- Smoke barriers.
- Exterior walls.
- Horizontal assemblies.



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Fire Walls

- Most complex and protective fire separation.
 - Typically selected by the designer to provide an alternative solution to code compliance, fire wall creates separate buildings in the same structure.
 - Oversize buildings
 - Incompatible use separations
 - A fire wall at the lot line between two adjacent buildings is permitted where a party wall was once required.
 - *Fire walls* required to be 2-, 3- or 4-hour assemblies.



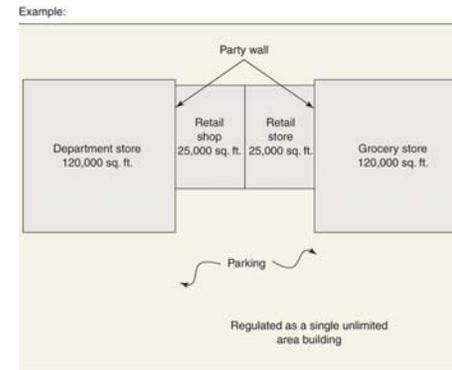
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Fire Walls – 706.1.1, Exception 2



2018 IBC Significant Changes



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Fire Barriers

- Most common means of separating portions of a building with fire-resistance-rated construction.
 - Used under both mandatory and optional conditions, *fire barriers* divide a building into separate areas for a variety of purposes where full separation is desired.
 - Are “vertical” assemblies.
 - *Fire barriers* must be 1-, 2-, 3- or 4-hour assemblies.



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Fire Partitions

- Required where a limited degree of fire and smoke protection is warranted.
 - Typical in locations where separation is important in the initial stages of building evacuation.
 - *Fire partitions* are required to be minimum 1-hour assemblies
 - Allowances for ½-hour assemblies under specified conditions.



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Smoke Barriers

- Mandated where a high degree of both fire and smoke protection is desired.
 - Used to create refuge compartments that allow occupants to safely await assistance or rescue.
 - Must be minimum 1-hour assemblies while also providing a high degree of smoke resistance.



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Exterior Walls



- Rated exterior walls provide separation from internal or external fires.
 - Also often provide for the protection of outdoor exit travel.
- Must be minimum 1-, 2- or 3-hour assemblies if within fire separation distance.



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Horizontal Assemblies

- Typically used with fire-resistance-rated wall assemblies to provide compartmentation in multistory buildings.
 - In most cases, the ceiling and floor work together, as well as independently, to provide the intended separation.
 - Required to be minimum ½-, 1-, 2-, 3-, or 4-hour fire-resistance-rated assemblies.



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Smoke-resistant Separations

- In addition to the use of *smoke barriers*, the IBC also recognizes *smoke partitions* as a means to resist the passage of smoke.
 - *Smoke partitions* required where smoke movement of is a concern; however, fire is not primary consideration.
 - *Smoke partitions* are not required to have a fire-resistance rating.



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Prescriptive Separations

- Mandated where limited degree of separation is desired. (IBC Table 721.1)
 - Not required to be tested and listed assemblies, these separation elements adequately serve a specific need.

- Applications include:
 - Gypsum board.
 - Nonrated floor construction.
 - Construction capable of restricting smoke migration.



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Separation Types

1. Horizontal assemblies required to be minimum ½-, 1-, 2-, 3-, or 4-hour fire-resistance-rated assemblies.
TRUE
2. A smoke partition must have a fire resistance rating of 0 hours.
FALSE
3. All exterior walls are required to be minimum 1-, 2- or 3-hour fire-resistance-rated assemblies.
FALSE



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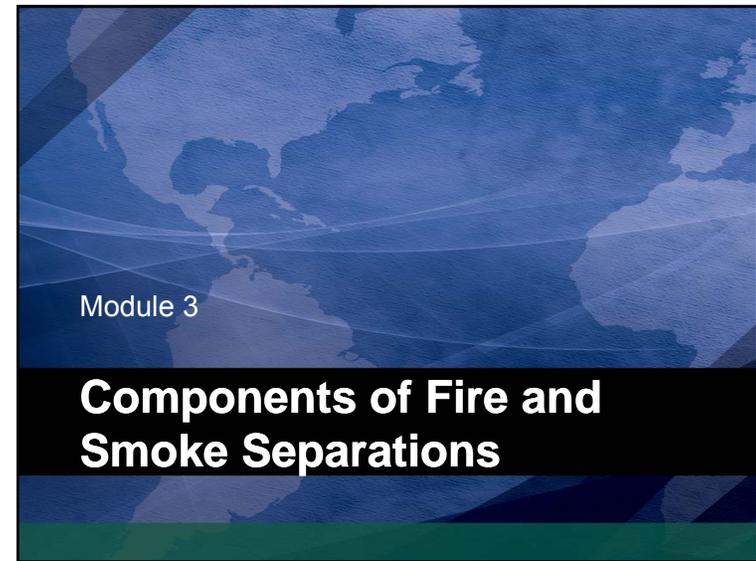


Separation Types

4. Fire walls must have a minimum fire resistance rating of 2 hours.
5. Exterior walls, if within the fire separation distance, must have a rating of 1 , 2 _ or 3 __ hours.
6. IBC Table 721.1 allows the use of prescriptive materials in lieu of listed assemblies.



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Vertical Elements

- A variety of different walls and partition assemblies are established in the IBC to provide varying degrees of fire and/or smoke separation.
- In addition to vertical assemblies that are tested and listed as fire-resistance-rated, modified assemblies and prescriptive-based separation elements are selectively addressed throughout the code. Table 721.1



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Vertical Elements



- Wall assemblies such as *fire walls, fire barriers, fire partitions, smoke barriers* and *exterior walls* must be provided with fire-resistance ratings as determined in accordance with ASTM E119 or UL 263, or meet prescriptive specifications.
 - Required fire-resistance ratings vary and are required based on the intended purpose of the separation.



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Vertical Elements

- **Partial assemblies** based on listed assemblies are also recognized in limited applications, typically where the potential hazard is assumed to exist only on one side of the separation element.
 - Control rooms
 - Areas of Refuge
 - Incidental spaces
 - Shaft enclosures
 - And more



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Horizontal Elements

- Horizontal assemblies are **also tested and listed** assemblies that resist the spread of fire vertically.
- Fire-resistance-rated floors and floor/ceiling assemblies can **provide varying degrees of fire-resistance.**
- **Non-rated horizontal elements** also provide a significant level of separation and are regulated under a variety of conditions. (See 714.5 Penetrations and 717.6.3 Ducts)



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Vertical/Horizontal Combination

Elevation View: Type IIIA, A/S

- Vertical *and* horizontal elements used to completely separate one area from another.

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Doors

- Openings require protection as part of the overall package of fire and/or smoke protection.
 - In most cases, fire-protection-rated door assemblies are mandated in fire-separation assemblies.
 - Table 716.1(2) provides the required ratings and markings for most conditions.
 - In some cases they are also individually identified based on the specific separation.

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Doors

- In a few cases, a **prescriptive** means of door protection is mandated.
 - For example, a solid-wood or honeycomb core doors of a specified thickness might be established as the minimum required door.
- At times, the code does not regulate door assemblies in a fire rated assembly.
 - The most common examples are:
 - fire-resistance-rated exterior walls **where opening protection is not required**
 - **Loadbearing walls** protected per Table 601

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Windows

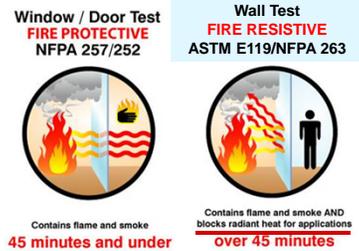
- Windows are typically regulated in the same manner as doors.
 - **Fire-protection-rated glazing,**
 - **Fire-resistance-rated glazing.**
- **Fire-resistance-rated glazing** is regulated in much the same manner as fire-resistance-rated wall assemblies

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Windows

Fire-resistance-rated glazing is regulated in much the same manner as fire-resistance-rated wall assemblies, including testing in accordance with **ASTM E 119** or **UL 263**.



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Windows

- There are situations in the code where nonrated glazing is permitted in fire/smoke separation walls, such as:
 - where security glazing is needed - **Group I-3**,
 - where smoke is the only concern - **corridor walls in Group I-2**, or
 - where **fire-resistance-rated exterior walls are permitted with unprotected openings**.

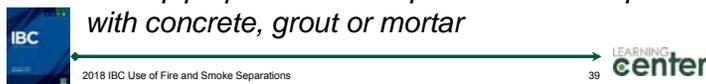


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Penetrations



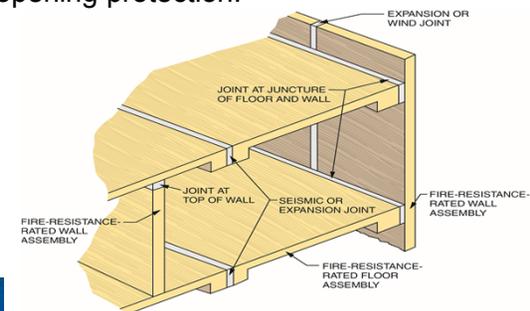
- Penetrations must typically be **protected by firestop systems** rated to the same level as the element penetrated.
 - Through penetration of Membrane Penetration systems
- Prescriptive methods of penetration protection are also established.
 - *steel pipe penetrations - protect annular space with concrete, grout or mortar*



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Joints

- Fire-resistant joint systems are **REQUIRED** where joints occur in separation walls requiring opening protection.



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Air Movement

- Fire dampers, smoke dampers, combination dampers, ceiling radiation dampers and **corridor dampers** are selectively required in ducts and air openings in separation elements.
- Dampers may be omitted in a variety of situations where their use has been determined to be unnecessary.
- Non-rated floor assemblies may still require protection of duct penetrations (Section 717.6.3)



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Components

1. All fire resistive assemblies must be listed in accordance with ASTM E119 or UL 263. **FALSE**
2. Horizontal fire resistive elements include all of the following except:

d) Fire walls



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Components

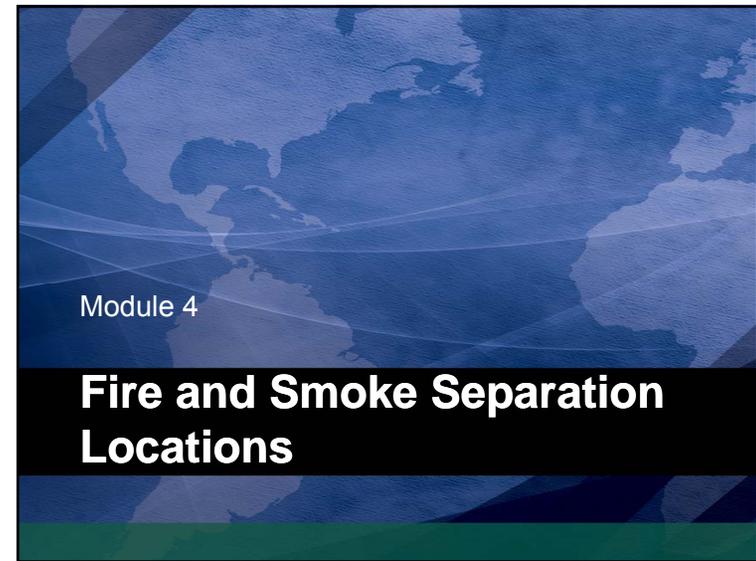
3. Name two circumstances where non-rated glazing may be installed in separation walls.
 1. where security glazing is needed,
 2. where smoke is the only concern, or
 3. where fire-resistance-rated exterior walls are permitted with unprotected opening: **TRUE**
5. Fire-resistant joint systems are mandated where joints occur in separation walls requiring opening protection. **TRUE**



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Separation Locations

- Building Size, Use and Components
- Means of Egress
- Fire Limitation Features
- Special Building Types
- Special Occupancies and Uses
- Special Building Features
- Hazardous Uses



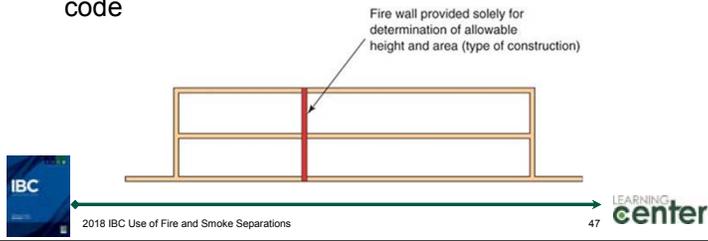
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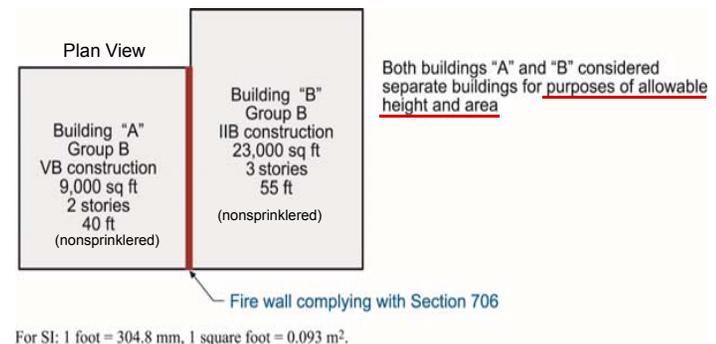
Building Height & Area – 503.1

- Use of fire wall now limited to only the determination of permissible types of construction, based upon allowable building height and area.
- Designer option
- Fire wall no longer permitted as means to create separate, smaller buildings for other purposes of the code

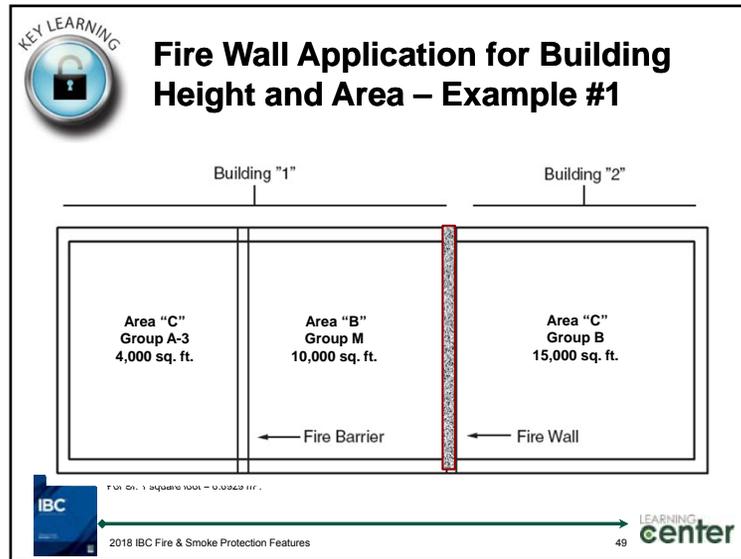


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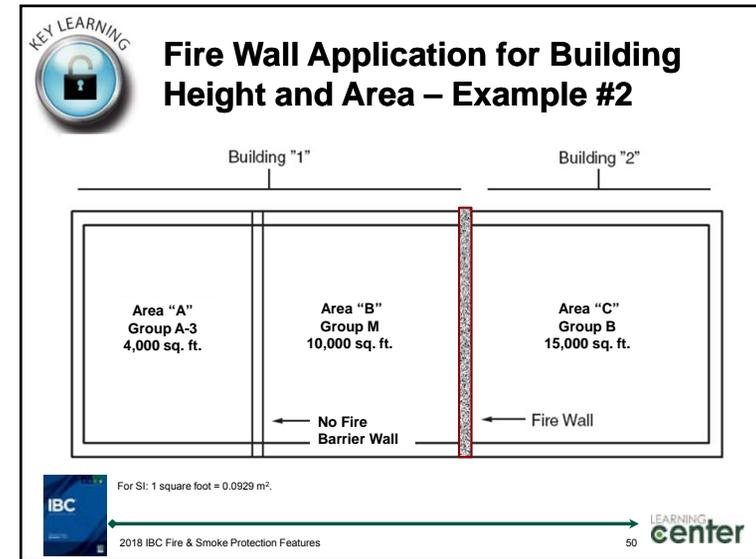
Building Height & Area – 503.1



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706.1.1 Party Walls – Exception #2

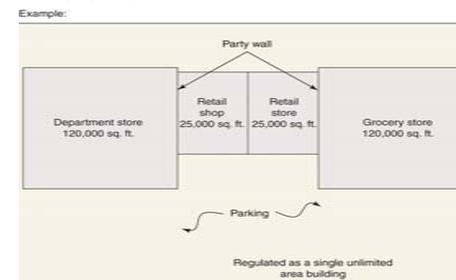
- Required use of a party wall (fire wall) at the lot line between two adjacent buildings where there is joint service between the buildings is no longer required where:
 1. The aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum allowed, and
 2. Dedicated easements and contractual agreements that allow either owner access to the other portion of the building to maintain fire and safety systems are provided to the building official.



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Building Height & Area – 706.1.1

- Fire walls nor party walls, are required to be used on lot lines dividing a building for ownership purposes.



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Fire Wall Ratings – Table 706.4

- Rating requirements based on the buildings' construction type(s) and occupancy classification(s).

**TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS**

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3 ^a
F-1, H-3 ^b , H-5, M, S-1	3
H-1, H-2	4 ^b
F-2, S-2, R-3, R-4	2

- a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.
 b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.



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Fire Walls

- Provide variety of other alternative solutions to the designer:
 - Multiple types of construction.
 - Reduction/elimination of fire protection features.
 - In IFC, fire walls may be used to reduce fire flow requirements.



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Separated Occupancies – 508.4.4.1

- In a mixed-occupancy building, *fire barriers* and/or *horizontal assemblies* are utilized under the separated occupancies method.
- Table 508.4 establishes the minimum required fire-resistance for pairs of incompatible occupancies.



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Separated Occupancies – Table 508.4

**TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)**

OCCUPANCY	A, E		I-1 ^a , I-3, I-4		I-2		R ^a		F-2, S-2 ^b , U		B ^c , F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1 ^a , I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R ^a	—	—	—	—	—	—	N	N	1 ^d	2 ^e	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2 ^b , U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B ^c , F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 ^d	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

- S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
 NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
 N = No separation requirement.
 NP = Not permitted.
 a. See Section 420.
 b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to be less than 1 hour.
 c. See Section 406.3.2.
 d. Separation is not required between occupancies of the same classification.
 e. See Section 422.2 for ambulatory care facilities.
 f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.



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Incidental Uses – 509.4.1

- Where an incidental use as listed on Table 509 is present, it must selectively be separated from other portions of the building by **fire barrier and/or horizontal assembly** as established by Table 509.
- In some cases, an alternative method of protection is permitted by the table.



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Incidental Uses – Table 509

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies 2 hours in Group A, E, I and R occupancies
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group H	2 hours; or 1 hour and provide automatic sprinkler system
In group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, wast and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, wast and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having an energy capacity greater than the threshold quantity specified in Table 1206.2 of the International Fire Code	1 hour in Group B, F, M, S and U occupancies 2 hours in Group A, E, I and R occupancies
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation



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Incidental Uses – 509.4.2

- Where Table 509 permits sprinkler protection without a fire barrier, incidental uses must be separated by **construction capable of resisting the passage of smoke**.
 - Doors/air openings regulated for smoke resistance.



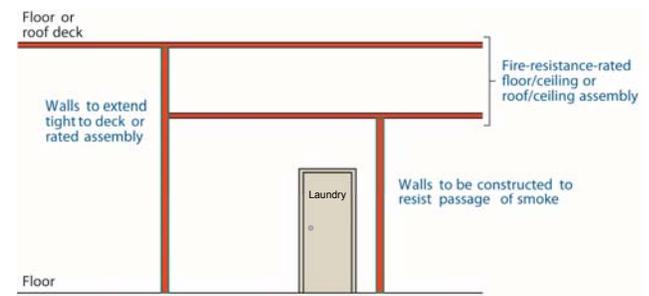
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Incidental Uses – 509.4.2



- Note: doors shall:
- be self-closing or automatic-closing by smoke
 - have no air transfer openings
 - have no excessive undercuts



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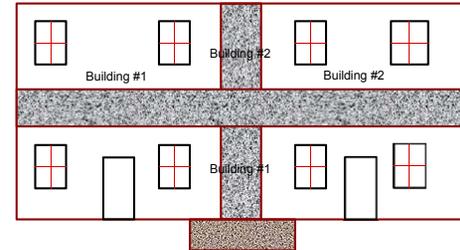
Horizontal Building Separation Section 510.2, #1

- Where separate and distinct buildings are created **one above the other**, the buildings shall be separated with a minimum 3-hour horizontal assembly. -- Podium/platform construction
- When separated and compliant with several other conditions, buildings can be regulated independently for allowable area and number of stories, and fire wall continuity.



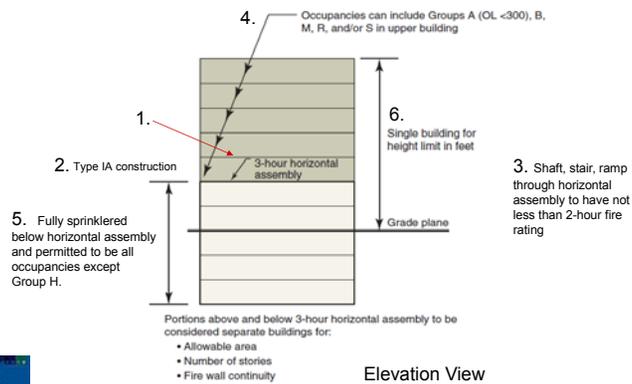
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Horizontal Building Separation Allowance Section 510.2, #1 “Platform” or “Podium” Building



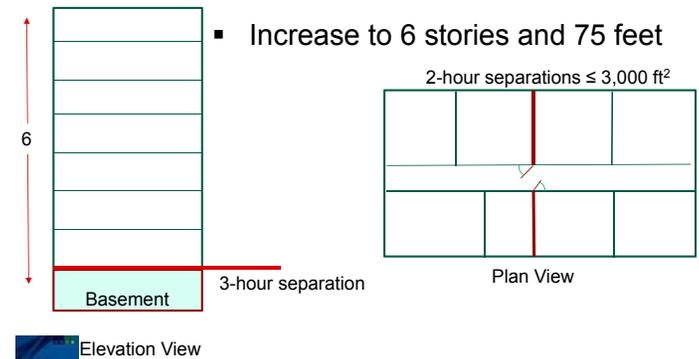
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Horizontal Separation- 510.2



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Type IIIA Group R-1 and R-2 Buildings – 510.5



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Type IIA Group R-1 and R-2 Buildings - 510.6

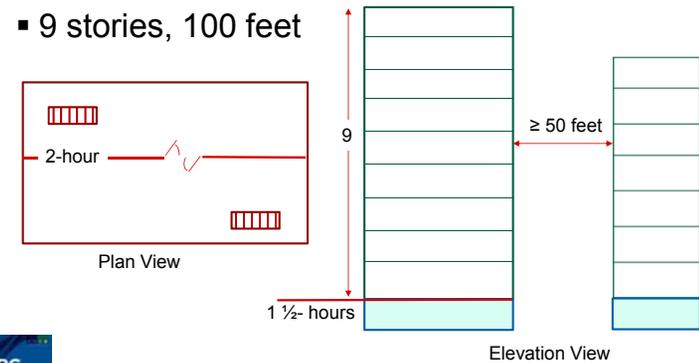
- Where special height increases are applied for Type IIA Group R-1 and R-2 buildings, minimum 2-hour *fire walls* are required to segregate the exits.
- Allows nine stories and 100 feet.



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Type IIA Group R-1 and R-2 Buildings— 510.6

- 9 stories, 100 feet



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Open Parking Beneath Groups A, I, B, M and R – 510.7.1

- Where special height and area allowances are permitted for open parking garages below Group A, I, B, M and R occupancies, means of egress for the upper occupancy shall be separated from the parking by minimum 2-hour *fire barriers*.



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Group B or M with Group S-2 Open Parking Garage – 510.8, #1 and #7

- Where a Group B or M occupancy is located above an open parking garage and considered as separate buildings for type of construction purposes, in addition to other requirements, the buildings must be separated by a minimum 2-hour *horizontal assembly*.



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Group B or M with Group S-2 Open Parking Garage – 510.8, #1 – #7

7 Exits from open parking garage to discharge directly to public way and separated from basement or first story by minimum 2-hour fire barriers and/or horizontal assemblies

6 Height and area not to exceed that allowed for open parking garage per Section 406.5

5 Area not to exceed limits of Section 503

4 Group B and/or M Type I or II construction (not less than that of open parking garage)

3 Group S-2 parking garage

2 Grade plane

1 Minimum 2-hour horizontal separation

Allowable area determined independently for open parking garage and B/M occupancy

Elevation View

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Buildings on Same Lot – 503.1.2

- Where two or more buildings are located on the same lot, they shall be regulated as separate buildings, or as portions of a single building.
 - If regulated as separate buildings, the opposing exterior walls must be evaluated based on fire separation distance.

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Buildings on Same Lot – 503.1.2

Plan View

A: separate buildings

B: single building

Group B IIB construction 23,000 sq ft 3 stories 55 ft

Group B VB construction 9,000 sq ft 2 stories 40 ft

Group B IIB construction 2 stories 40 ft

Group B VB construction 2 stories 40 ft

Assumed imaginary line

For SF: 1 foot = 304.8 mm; 1 square foot = 0.093 m².

Assuming nonsprinklered buildings, aggregate area is limited to 9,000 sf and allowable height is limited to 2 stories as both buildings must be regulated as Type VB construction

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Exterior Walls – 705.5

- For separation purposes, exterior walls near lot lines, or other buildings on the same lot, are required to be fire-resistance-rated as set forth in Table 602.
- The primary concern is radiant heat transfer from one building to another.

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Exterior Walls – Table 602

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE ^{a, d, g}

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H ^a	OCCUPANCY GROUP F-1, M, S-1 ^f	OCCUPANCY GROUP A, B, E, F-2, I, R ¹ , S-2, U ^h
X < 5 ^b	All	3	2	1
5 ≤ X < 30	IA Others	3 2	2 1	1 1
10 ≤ X < 30	IA, IB IB, VB Others	2 1 1	1 0 1	1 ^c 0 1 ^c
X > 30	All	0	0	0

- For SI: 1 foot = 304.8 mm.
- Load-bearing exterior walls shall also comply with the fire-resistance rating of Table 601.
 - See Section 706.1.1 for party walls.
 - Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
 - The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
 - For special requirements for Group H occupancies, see Section 415.6.
 - For special requirements for Group S aircraft hangars, see Section 412.3.1.
 - Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
 - For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.
 - For a Group F-3 building of Type I-B or Type V-B construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.

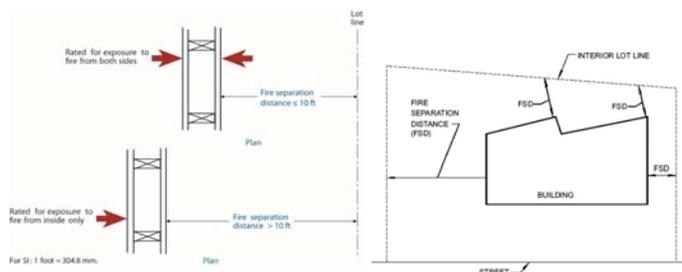


Exterior Walls – 705.5

- The required fire-resistance rating of exterior walls with a fire-separation distance of more than 10 feet shall be rated for exposure from fire *from the inside*.
- The required fire-resistance rating of exterior walls with a fire-separation distance of less than or equal to 10 feet shall be rated for exposure from fire *from both sides*.



Exterior Walls – 705.5



Exterior Walls Section 705.5

EXTERIOR WALLS	GA FILE NO. WP 8124	PROPRIETARY ¹	1 HOUR FIRE
<p>GYPHUM WALLBOARD, POLYETHYLENE FILM, WOOD STUDS, GLASS FIBER INSULATION, FOAM PLASTIC BOARDS, PLYWOOD SIDING</p> <p>EXTERIOR SIDE: One layer 1" proprietary aluminum foil faced, glass reinforced (polyurethane foam plastic sheathing applied parallel to 2.4 wood studs 16" o.c. with 11 gage galvanized roofing nails, 1 1/2" long, 0.122" shank, 0.425" head, 8" o.c. at perimeter and 12" o.c. at intermediate studs, 5/8" plywood siding panels applied parallel to studs with 10d galvanized common nails, 3" long, 0.135" shank, 0.307" head, 8" o.c. at perimeter and 12" o.c. at intermediate studs. Rating based on the lesser of loading to 2327 lbs/stud or 83% of full design load.</p> <p>INTERIOR SIDE: 5/8" proprietary type X gypsum wallboard applied over 6 mil polyethylene film and parallel to studs with 6d smooth bright nails, 2" long, 0.115" shank, 0.285" head, 8" o.c. Unfaced 3.5lb' glass fiber insulation, 0.97 pcf, friction fit in stud space. LIMITED LOAD-BEARING</p> <p>PROPRIETARY GYPHUM BOARD CertainTeed Gypsum, Inc. 5/8" ProFoc™ Type X Gypsum Panels</p>			
			<p>Thickness: 5.34" Approx. Weight: 6 pcf Fire Test: OCU 6534, 3-12-79</p>
<p>¹Contact the manufacturer for more detailed information on proprietary products.</p>			



Shaft Enclosures – 713

- Shaft enclosures are a permissible method of protecting openings and penetrations through floor/ceiling and roof/ceiling assemblies.
- Shaft enclosures shall be constructed as *fire barriers and/or horizontal assemblies*.



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Shaft Enclosure Fire Ratings – 713.4

- Shaft enclosures shall have a minimum fire-resistance rating of:
 - 2 hours where connecting 4 or more stories.
 - 1 hour where connecting 3 or fewer stories.
 - 2 hours where penetrating a floor assembly of two or more hours.



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Chute Access and Discharge Rooms – 713.13.3 and 713.13.4



- waste and linen chutes access openings must be located in rooms or compartments enclosed by not less than 1-hour *fire barriers and/or horizontal assemblies*.
- Discharge rooms shall be separated from the remainder of the building by *fire barriers and/or horizontal assemblies* having a rating equal to the shaft enclosure.



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Hoistway Opening Protection – 3006.3, #1 and #2

- Where elevator lobbies are required, they shall be constructed with *fire partitions*.
- Where the building is fully sprinklered, *smoke partitions* may be used to separate the elevator lobby at each floor.



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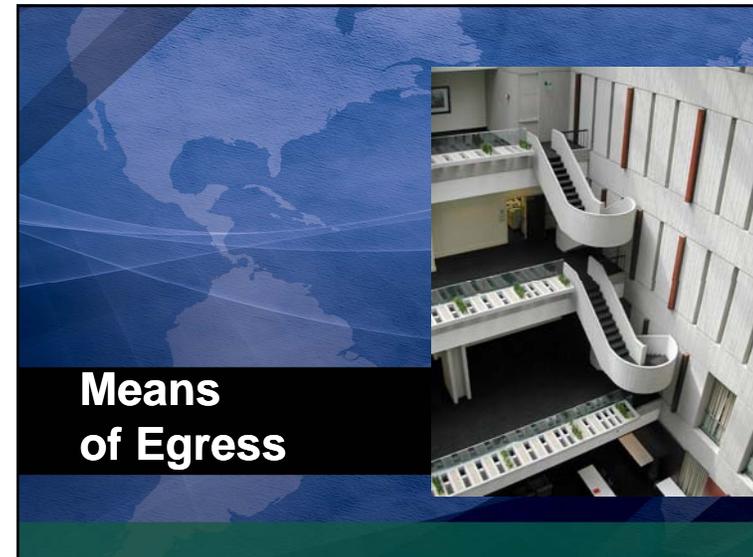
ACTIVITY

Building Use, Size & Components

1. The required fire-resistance rating of exterior walls with a fire-separation distance of more than 10 feet shall be rated for exposure from fire from the inside and outside. **TRUE**
2. Where special height increases are applied for Type IIA Group R-1 and R-2 buildings to allow nine story buildings, minimum 2-hour fire walls are required to segregate the exits.

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Means of Egress

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Exit Access Stairways – 1019.3

- *Exit access stairways* to be enclosed by shaft enclosures (*fire barriers*) having a minimum fire-resistance ratings in accordance with Section 713:
 - 2-hour serving 4 stories or more.
 - 1-hour serving 2 or 3 stories.
- There are eight exceptions to this requirement!

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Exit Access Ramps – 1019.3



- Exit access ramps are required to be enclosed with shaft enclosures (*fire barriers*) under the same conditions as for exit access stairways.
- Due to the limited use of ramps connecting 3 or more stories, the application of this provision is very limited.

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Interior Exit Stairways and Ramps – 1023.2

- Enclosures for interior exit stairways and ramps shall be *fire barriers and/or horizontal assemblies*, with a minimum rating of:
 - 2 hours where connecting 4 or more stories.
 - 1 hour where connecting 3 or fewer stories.
- The enclosure shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.



85

Extension of Interior Exit Stairways and Ramps – 1023.3.1

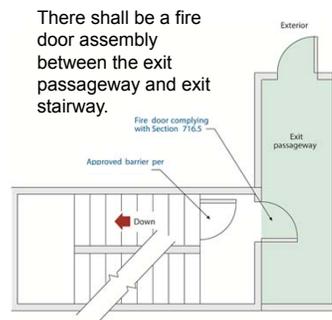
- A horizontal extension of an interior exit stairway or ramp, where required, shall be by an *exit passageway* constructed with *fire barriers and/or horizontal assemblies*.
- The exit passageway shall have a minimum fire-resistance rating equal or greater to that of the connected interior exit stairway or ramp.
- There shall be a fire door assembly between the exit passageway and exit stairway.



86

Extension of Interior Exit Stairways and Ramps Section 1023.3.1

- A horizontal extension of an interior exit stairways or ramp, where required, shall be by an **exit passageway** constructed with *fire barriers and/or horizontal assemblies*.
- The exit passageway shall have a minimum fire-resistance rating equal or greater to that of the connected interior exit stairway or ramp.



87

Smokeproof Enclosures and Pressurized Stairways and Ramps – 1023.11.1

- Where required for high-rise buildings, underground buildings or aircraft-related occupancies, smokeproof enclosures and pressurized stairways may be extended by an *exit passageway*.
- *Fire barriers and/or horizontal assemblies* must have a minimum 2-hour fire-resistance rating.



88

Exit Passageways – 1024.3

- Exit passageways, where provided, shall be enclosed by *fire barriers* and/or *horizontal assemblies* with a minimum 1-hour fire-resistance rating.
 - The rating cannot be less than that required for any connected interior exit stairway or ramp.



89

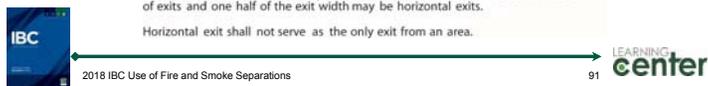
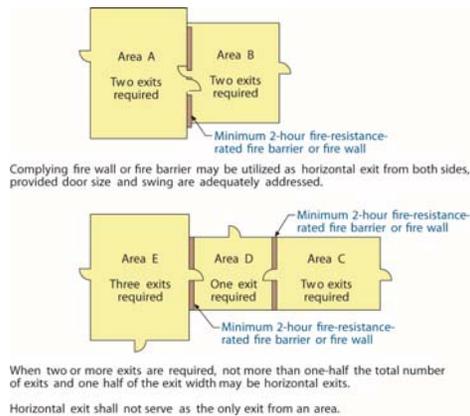
Horizontal Exits – 1026.2

- Horizontal exits, where provided, shall be constructed with *fire walls*, or by *fire barriers* with a minimum 2-hour fire-resistance rating.
 - The separation shall extend vertically through the entire building unless *floor assemblies* have a minimum 2-hour fire-resistance rating.
- A horizontal exit creates refuge areas such that smoke protectives are also required.



90

Horizontal Exits – 1026.4



91

Exterior Exit Stairways and Ramps – 1027.6

- Exterior exit stairways and ramps shall be separated from the interior of the building consistent with the protection required for interior exit stairways and ramps.
 - Fire barrier construction is required for those exterior walls adjacent to the exterior stairway or ramp.



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Exterior Stairways and Ramps – 1027.6

Rating comes from Section 1023.7
 ≥ 1-hr w/ 3/4-hr prot openings
 ≥ 10 ft

Rating comes from Section 1023.2
 1-hr or 2-hr w/egress door as only opening

Rating comes from Section 1023.7
 ≥ 1-hr w/ 3/4-hr prot openings
 ≥ 10 ft

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Spaces under Grandstands and Bleachers – 1029.1.1.1

- Usable spaces must be separated from grandstands and bleachers above by minimum 1-hour fire barriers and/or horizontal assemblies.
- Not apply to:**
 - toilet rooms
 - small ticket booths
 - Accessory area < 1000 sf.

Grandstand or bleacher
 One-hour minimum
 One-hour minimum
 Space used for any purpose other than:
 • Ticket booths < 100 sf
 • Toilet rooms
 • Accessory areas < 1000 sf and sprinklered
 International Code Council®
 Spaces under grandstands and bleachers

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Corridors – 1020.1

- Corridors shall be fire-resistance rated in accordance with Table 1020.1.
- Corridor walls are required to be constructed as fire partitions.
 - Where interrupted by a lobby, foyer or reception area, the fire partition protection shall extend behind such spaces.

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Corridor Construction – Table 1020.1

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system ^a
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 30	Not Permitted	0.5 ^b /1 ^c
I-2 ^a	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1 ^b
I-4	All	1	0

a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3.
 b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.8.
 c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
 d. Group R-3 and R-4 building equipped throughout with an automatic sprinkler system in accordance with Section 603.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.

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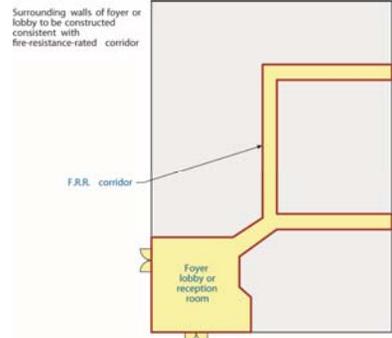
96

Corridor Continuity – 1020.6

Fire resistance continuous from point of entry to an exit and not interrupted by intervening rooms ...

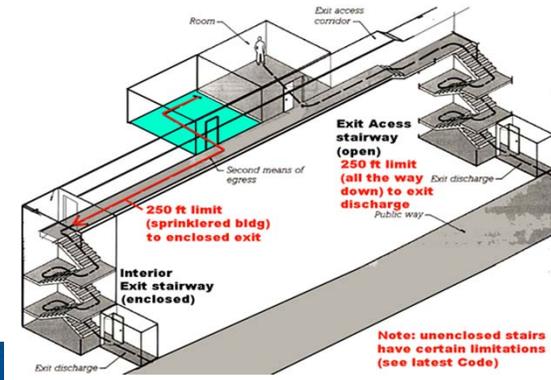
Exception:

Where interrupted by a lobby, foyer or reception area, the fire partition protection shall extend behind such spaces.



97

Corridor Continuity – 1020.6



98

Egress Balconies – 1021.2



- Exterior egress balconies shall be separated from the interior of the building by *fire partitions* and openings as required for corridors.
- Separation is not required where two specified conditions are met:
 - Two available stairways, and,
 - Dead-ends do not pass unprotected opening



99

Areas of Refuge – 1009.6.4

- Each area of refuge in an accessible means of egress shall be separated from the remainder of the story by a *smoke barrier* or horizontal exit.
 - Areas of refuge must be designed to minimize the intrusion of smoke.



100

Exterior Area for Assisted Rescue – 1009.7.2

- *Exterior walls* separating an exterior area for assisted rescue from the interior of the building shall have a minimum fire-resistance rating of 1-hour, rated for exposure from the interior.
- Wall rating and opening protectives not required where building fully sprinklered

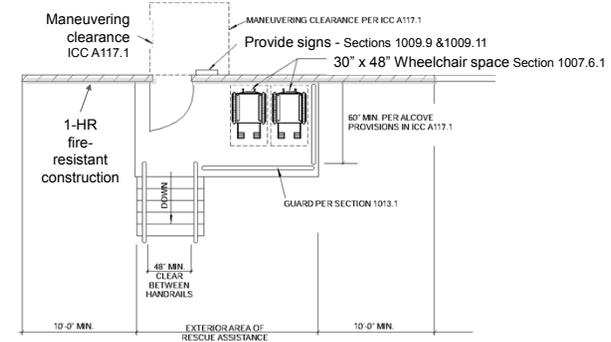


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Exterior Area for Assisted Rescue – 1009.7.2



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Egress Courts – 1028.4.2

- Exterior walls adjacent to an egress court shall have a minimum 1-hour fire-resistance rating for at least 10 feet above the walking surface where the court is less than 10 feet in width.
 - Exceptions, Egress court that:
 - serves an occupant load less than 10, and
 - serves other than a Group R-3 occupancy.



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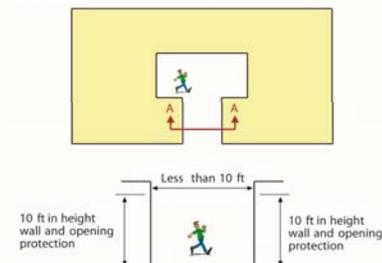


103

Egress Courts – 1028.4.2

When an egress court serving an occupant load of 10 or more is less than 10 feet in width:

- The court walls shall be protected up to 10 feet by a minimum of 1-hour fire-resistance-rated construction
- Openings in the court walls shall be protected by assemblies having a minimum 3/4-hour fire-protection rating



For SI: 1 foot = 304.8 mm.

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Enclosures under Interior Stairways – 1011.7.3

- Walls and soffits within enclosed usable spaces under enclosed and unenclosed interior stairways shall be protected by minimum 1-hour fire-resistance-rated construction, or the rating of the enclosure, whichever is greater.



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Enclosures under Residential Interior Stairways 1011.7.3, Exception

- Spaces under stairways serving an individual Group R-2 or R-3 dwelling unit are required, at a minimum, to be protected on the enclosed side of the stairway with minimum 1/2-inch gypsum board.



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106

Enclosures under Exterior Stairways – 1011.7.4

- No enclosed usable space is permitted under an exterior exit stairway unless it is completely enclosed in 1-hour fire-resistance-rated construction.



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Interior Exit Discharge – 1028.1, Exception 1.2

- Where an interior exit stairway is permitted to egress through a discharge level lobby or similar space, as one condition the discharge level must be separated from areas below by construction conforming to the fire-resistance rating of the enclosure.



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Interior Exit Discharge – 1028.1, Exception 1

1.1 Free and unobstructed egress

1.4 Distance between exit access stair and exit discharge door shall be at least 30' or $\frac{1}{4}$ length of overall diagonal of building, whichever is less

1.2 Entire area of level shall be separated from areas below by construction equivalent to the stair enclosure.

1.3 Egress path from exit stairway to discharge shall be sprinklered and all rooms and portions of the level having access to the egress path shall be sprinklered or separated from the egress path by construction equivalent to the stair enclosure.

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Interior Exit Discharge – 1028.1, Exception 2.3

1.4 Depth max. 10' Used only for means of egress and exits directly outside

1.3 Length $\leq 30'$ Separation protection by fire partitions

1 Discharge level must be separated from areas below by construction conforming to the fire-resistance rating of the enclosure

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Fire Limitation Features

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Fire Areas – 901.7

- Many of the sprinkler thresholds are based on size of **fire area**
- Where buildings are divided into fire areas so as not to exceed the limits of Section 903 for requiring an automatic sprinkler system, the fire areas shall be **separated by fire barriers and/or horizontal assemblies** having a minimum fire-resistance rating as set forth in Table 707.3.10.

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Fire Areas – 901.7

- The use of a **fire wall** to create separate, smaller buildings also creates smaller fire areas as well.
- Therefore, fire areas can be established by use of
 - Fire Wall
 - Fire Barrier
 - Horizontal Assembly
 Or a combination of the above



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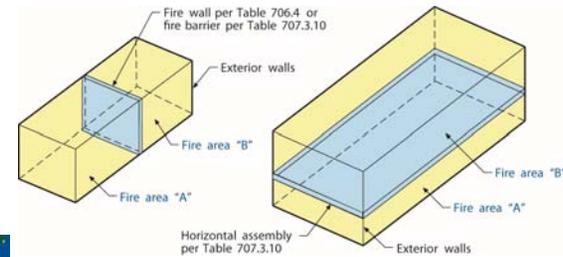


113

Fire Areas – 901.7

TABLE 707.3.10
FIRE-RESISTANCE RATING REQUIREMENTS FOR
FIRE BARRIER ASSEMBLIES OR HORIZONTAL
ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1



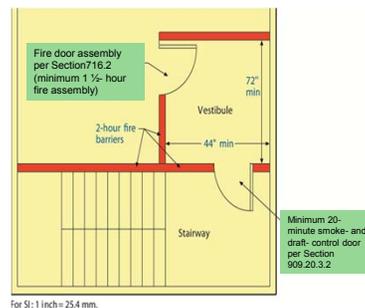
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Smokeproof Enclosures – 909.20.2

- A smokeproof enclosure shall be separated from the remainder of the building by minimum 2-hour **fire barriers and/or horizontal assemblies**.
- In addition, the vestibule must be separated from the stairway by minimum 2-hour **fire barriers and/or horizontal assemblies**.



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Stair Pressurization Alternative – 909.20.6.1

- Smokeproof enclosure ventilation systems shall be isolated from the remainder of the building by minimum 2-hour **fire barriers and/or horizontal assemblies**.
 - Protection shall be provided for equipment, control wiring, power wiring and ductwork.



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116

Fire Command Center – 911.1.2

- Fire command centers, where required, shall be separated from the remainder of the building by minimum 1-hour *fire barriers and/or horizontal assemblies*.



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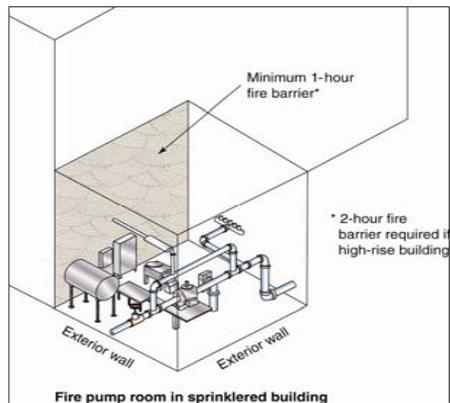
Fire Pump Rooms – 913.2.1

- Fire pumps shall be located in rooms separated from all other portions of the building by minimum 2-hour *fire barriers and/or horizontal assemblies*.
- In other than high-rise buildings, where the building is fully sprinklered, the *fire barriers and/or horizontal assemblies* must have a minimum 1-hour fire-resistance rating.



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Fire Pump Rooms – 913.2.1



119

Fire Alarm Systems in Group R Occupancies – 907.2.8.1 & 907.2.9.1

- In select Group R occupancies not exceeding 2-stories, an otherwise-mandated fire alarm system may not be required where the units are separated from each other and the public and common areas by minimum 1-hour *fire partitions*.
- Other conditions must also be met.



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Smoke Control Systems – 909.5

- Where construction elements are used as a part of a smoke control system, *smoke barriers* shall be provided.
 - The maximum allowable leakage area is to be calculated and reviewed for compliance.



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Mall/Anchor Building Separation – 402.4.2.2

- An anchor building shall be separated from a covered or open mall building by a *fire wall*.
 - Where the anchor building is 3 stories or less, minimum 2-hour *fire barriers* are permitted.



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Mall/Parking Garage Separation – 402.4.2.3

- An attached parking garage shall be separated from a covered mall building, open mall building or anchor building by a minimum 2-hour *fire barrier* and/or *horizontal assembly*.



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Mall Tenant Separations – 402.4.2.1

- Each tenant space within a mall building shall be separate from other tenant spaces by a *fire partition*.
- No separation wall is required between the tenant space and the mall.



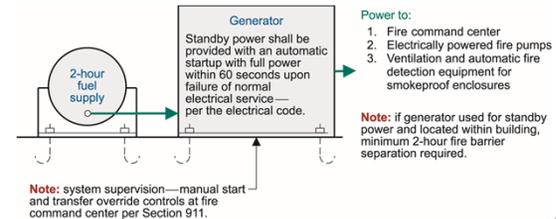
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Standby Power Protection in High-rise Buildings – 403.4.8.1

- If a generator within the building is used for standby power in a high-rise building, it shall be located in a separate room enclosed with minimum 2-hour *fire barriers and/or horizontal assemblies*.



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Atrium Sprinkler Protection Section 404.3, Exception 1

- Sprinklers are required throughout a building containing an atrium.

EXCEPTION #1: Sprinkler protection is not required for areas adjacent to and above the atrium space provided that portion is separated from the atrium by minimum 2-hour fire barriers and/or horizontal assemblies.



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Atrium Separation – 404.6

- Atrium spaces shall be separated from adjacent spaces by a minimum 1-hour *fire barrier and/or horizontal assembly*.
 - The 1-hour separation is not required under one of three exceptions,
 1. where glazed enclosure is protected by an automatic sprinkler system,
 2. ¾ hour glass block is utilized, or
 3. Open to not more than 3 stories

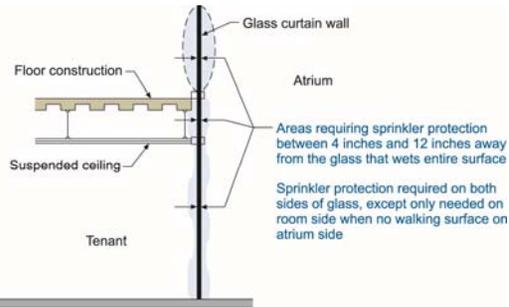


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Atrium Separation – 404.6, Exception 1



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Underground Building Compartmentation – 405.4

- A building with a floor level more than 60 feet below the lowest discharge level must be divided into at least two compartments, created through the use of *smoke barriers*.
- Elevators that serve more than one compartment shall be provided with an elevator lobby separated from each compartment by a *smoke barrier*.



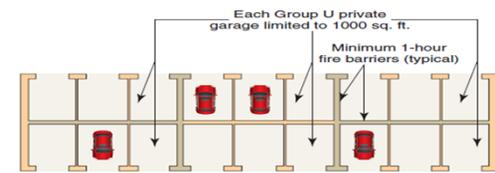
130

Special Occupancies and Uses

131

Private Garage Buildings – 406.3.1

- Multiple 1,000-square-foot private garages are permitted within the same structure where each private garage is separated by minimum 1-hour *fire barriers*, *horizontal assemblies*, or both.



Example: If non-sprinklered building of Type VB construction, total allowable area limited to 5500 sq. ft. plus any applicable frontage increase



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Garage Dwelling Separations – 406.3.4.1

- A private garage shall be separated from the dwelling unit by minimum *½-inch gypsum board on the garage side.*
- Garages with habitable rooms above shall be separated by not less than *5/8-inch Type X gypsum board.*



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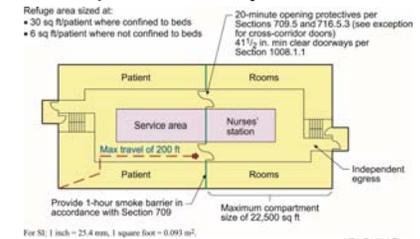


133

Group I-2 Smoke Compartments – 407.5

- Every story in a Group I-2 occupancy* where persons receive care or those having an occupant load of 50 or more shall be divided into at least two smoke compartments by *smoke barriers.*

*24-hour care for 5 or more who are incapable of self-preservation.



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Group I-2 Corridors – 407.3

- Corridor walls in a Group I-2 occupancy shall be constructed as *smoke partitions*.
- Waiting areas and similar spaces constructed as required for corridors are permitted to be open to the corridor.
- Doors require no closing device but shall be positive latching and limit smoke

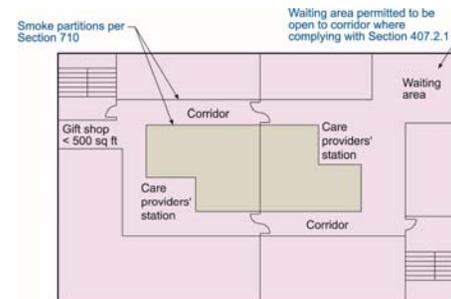


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Group I-2 Corridors – 407.3



- Corridor doors:
- Need no fire-protection rating
 - Shall limit smoke
 - Need not be self-closing or automatic-closing
 - Shall have positive latching

For SI: 1 square foot = 0.093 m².



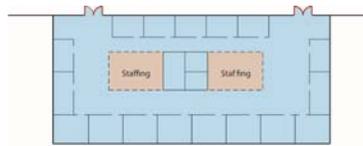
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Group I-2 Care Suites – 407.4.4.2

- Care suites shall be separated from other portions of the building by *smoke partitions*.



Suite having patient sleeping rooms
 • 5,000 sq ft max
 • Two exit-access doors if > 1,000 sq ft
 • Travel to exit access door limited to 100 ft

Suite having no patient sleeping rooms
 • 10,000 sq ft max
 • Two exit-access doors if > 2,500 sq ft

For SI: 1 foot = 304.8 mm, 1 squarefoot = 0.093 m².



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Group I-3 Smoke Compartments – 408.6

- Every story in a Group I-3 occupancy shall be divided into at least two smoke compartments by smoke barriers when:

- used by residents for sleeping or
- those stories having an occupant load of 50 or more

*Prisons, jails, correctional facilities where persons are under restraint or security



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Group I-3 Subdivision of Resident Housing Areas – 408.8

- In Occupancy Conditions 3 and 4*, each sleeping area shall be separated from adjacent common spaces by a *smoke-tight partition* where distance of travel from sleeping area to corridor exceeds 50 feet.

*3= free movement in smoke zone, 4 = free movement is restricted but occupants can be released remotely



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139

Group I-3 Interior Exit Stairways – 408.3.8

- One interior exit stairway in each building is permitted to have *glazing installed in doors and walls* at each landing providing access to the stairway.
 - The total glazing is limited to 5,000 square inches per floor level.
 - Sprinkler protection is required to wet the glazing completely.



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140

140

Aircraft Hangar Fire Areas – 412.3.6.2

- When determining the fire suppression requirements for aircraft hangars, established fire areas shall be separated by minimum 2-hour *fire walls*.



141

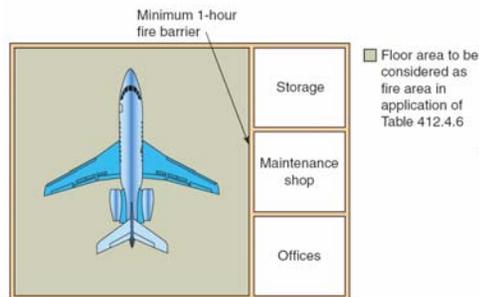
Aircraft Hangar Fire Areas – 412.3.6.2

- Support areas, such as offices, shops and storage rooms, which are separated from the aircraft servicing area by minimum 1-hour *fire barriers* are not required to be included in the determination of fire area size.



142

Aircraft Hangar Fire Areas – 412.3.6.2



143

Aircraft Hangar Heating Equipment – 412.3.4

- Heating equipment in an aircraft hangar shall be:
 - placed in a separate room and
 - separated by minimum **2-hour fire barriers and/or horizontal assemblies**.



144

Residential Aircraft Hangar Separation – 412.4.1

- An aircraft hangar attached to a dwelling must be separated by a minimum 1-hour *fire barrier*.



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145

Residential Unit Wall Separations – 420.2

- In Group I-1*, R-1, R-2 and R-3, R-4, walls separating dwelling and sleeping units in the same building, as well as separating such units from other occupancies in the building, shall be constructed as *fire partitions*.
- **Note:** If designed as separated mixed-use the separation shall be a fire barrier between occupancies

*Congregate care for more than 16 residents on 24 hour basis: assisted living, group homes, alcohol and drug centers.



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Residential Unit Floor Separations – 420.3

- In Group I-1, R-1, R-2 and R-3 occupancies, floor assemblies separating dwelling and sleeping units in the same building, as well as separating such units from other occupancies in the building, shall be constructed as *horizontal assemblies*.



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147

Ambulatory Care Facilities Separation – 422.2

- Ambulatory care facilities where there are 4 or more individuals incapable of self-preservation shall be separated from adjacent spaces, corridors and tenants by *fire partitions*.



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148

Ambulatory Care Facilities Smoke Compartments – 422.3

- Where the aggregate area of one or more ambulatory care facilities exceeds 10,000 square feet, *smoke barriers* are required to create smoke compartments.
 - No individual compartment is permitted to exceed 22,500 square feet.



2018 IBC Use of Fire and Smoke Separations



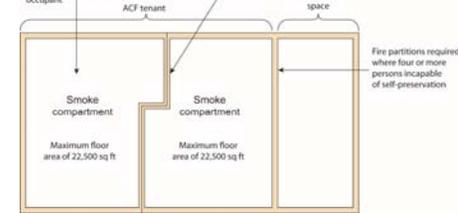
149

Ambulatory Care Facilities—422

Where smoke barrier is required:

- Travel to smoke barrier door limited to 200 ft
- Refuge areas required based on 30 sq ft per nonambulatory occupant

Smoke barrier per Section 709 required on story where facility exceeds 10,000 sq ft



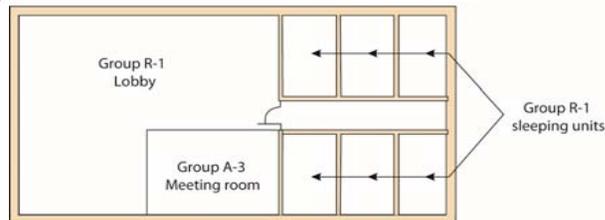
- Facility to be sprinklered where (Section 903.2.2):
 - Four or more persons are incapable of self-preservation, or
 - Any persons incapable of self-preservation are located at other than level of exit discharge
- Manual fire alarm system required (Section 907.2.2.1)
- Alarm boxes not required where building is fully sprinklered and notification appliances activate upon sprinkler water flow



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- Which walls are required to have a fire-resistance rating?
All walls, except exterior and separating Group A-3 from lobby
- What minimum type of wall is required? **FIRE PARTITION**
- What fire-resistance rating is required? **1**



2018 IBC Use of Fire and Smoke Separations



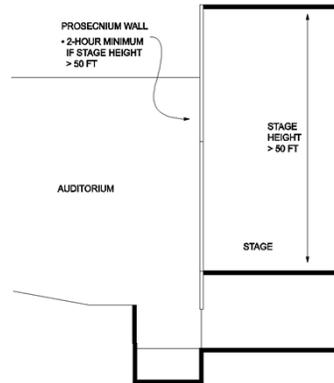
151



152

Stage Proscenium Wall – 410.2.4

- Where the stage height exceeds 50 feet, all portions of the stage shall be separated from the seating area by a proscenium wall with a minimum 2-hour rating, extending from the foundation to the roof (fundamentally a *fire barrier*).
- Proscenium opening to be protected by a fire curtain or other acceptable method.



153

Stage Support Areas Separation – 410.4.1

- The stage shall be separated from support areas, such as dressing rooms, workshops and storerooms, by *fire barriers and/or horizontal assemblies*.
 - Minimum 2-hour separation required for stage heights exceeding 50 feet.
 - Minimum 1-hour separation required for stage heights of 50 feet or less.



154

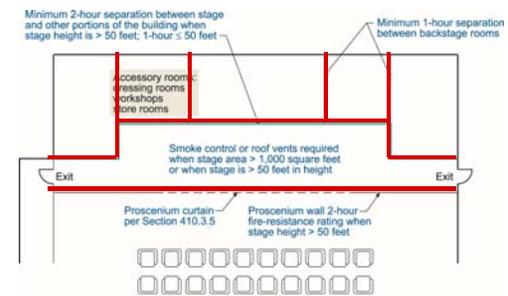
Stage Support Areas Separation – 410.5.2

- Support areas, such as dressing rooms, workshops and storerooms, shall be separated from each other by *fire barriers and/or horizontal assemblies*.
 - Minimum 1-hour separation required.



155

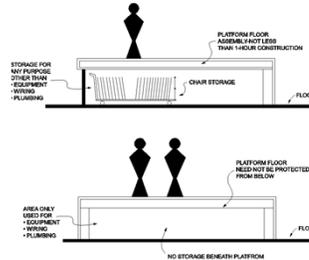
Stages Section 410.4



156

Platform Construction – 410.3

- Where space beneath a permanent platform is used for storage, or any other purpose other than equipment, plumbing or wiring, the *floor assembly shall be at least one-hour construction.*



2018 IBC Use of Fire and Smoke Separations



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Elevator Machine Rooms – 3005.4

- Elevator machine rooms and spaces shall be enclosed with *fire barriers and/or horizontal assemblies.*
 - The fire-resistance rating shall be not less than the required rating of the hoistway enclosure served by the machinery.



2018 IBC Use of Fire and Smoke Separations



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Fire Service Access Elevator Lobby – 3007.6.2

- In high-rise buildings provided with fire service access elevators, the elevator shall be provided with a lobby enclosed by a *smoke barrier.*
 - Elevator lobbies are not required at the level of exit discharge.



2018 IBC Use of Fire and Smoke Separations



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Occupant Evacuation Elevator Lobby – 3008.6.2

- In high-rise buildings provided with occupant evacuation elevators, the elevator shall be provided with a lobby enclosed by a *smoke barrier.*
 - Elevator lobbies are not required at the level of exit discharge.



2018 IBC Use of Fire and Smoke Separations



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Pedestrian Walkways – 3104.5

- Pedestrian walkways shall be separated from the interior of the attached buildings by minimum 2-hour *fire barriers and/or horizontal assemblies*.
 - An alternate separation method addresses the walkway/building connections, including the use of a *tempered, wired or laminated glass wall*.



2018 IBC Use of Fire and Smoke Separations

161 LEARNING center

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Tunnels – 3104.10

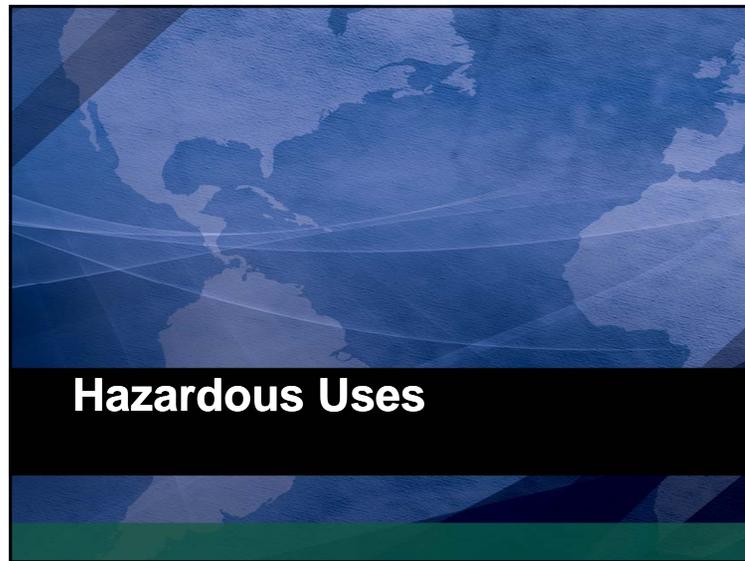
- Separation between a tunneled walkway and the building to which it is connected shall be not less than 2-hour *fire-resistant construction*.



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162 LEARNING center

162



163

Combustible Storage Section 413

- Attic, under-floor and concealed spaces used for storage of combustible materials shall be:
 - ✓ protected on the storage side as required for 1-hour fire-resistance-rated construction and
 - ✓ Openings protected by self-closing non-combustible or 1 3/4" thick solid wood core door
- EXCEPTIONS:** fire-resistance construction nor open protectives required in:
1. sprinklered spaces
 2. Group R-3 and U occupancies



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164 LEARNING center

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Control Areas – 414.2.4

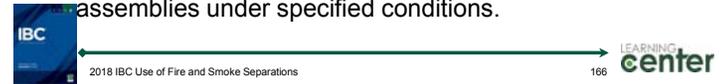
- Where control areas are provided for the use or storage of hazardous materials, they shall be separated by *fire barriers* in accordance with Table 414.2.2.
- The floor assemblies separating control areas shall be minimum 2-hour *horizontal assemblies*.
 - Exception permits 1-hour assemblies under specified conditions.



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Control Areas - Section 414.2.4

- Where control areas are provided for the use or storage of hazardous materials, they shall be separated by *fire barriers* in accordance with Table 414.2.2. (1- or 2-hour)
- The floor assemblies separating control areas shall be minimum **2-hour horizontal assemblies**. (this includes supporting construction)
 - Exception for IIA, IIIA and VA construction permits 1-hour assemblies under specified conditions.



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Control Areas – Table 414.2.2

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	2
	7-9	5	2
	6	12.5	2
	5	12.5	2
	4	12.5	2
	3	50	1
	2	75	1
Below grade plane	1	100	1
	1	75	1
	2	50	1
Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.

b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.



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Grinding Rooms – 426.1.2

- Rooms used for grinding or other operations that produce combustible dusts shall be enclosed with fire barriers and/or horizontal assemblies.
- The required fire-resistance rating is based on the floor area of the room:
 - 2 hours, where 3,000 square feet or less.
 - 4 hours, where more than 3,000 square feet.



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Group H-3 and H-4 Gas Rooms – 415.10.2

- Where Group H-3 or H-4 gas rooms are provided, they shall be separated from other areas by minimum 1-hour *fire barriers and/or horizontal assemblies*.



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Highly Toxic Solids and Liquids – 415.10.4

- Where highly toxic solids and liquids are not stored in approved hazardous materials storage cabinets, they shall be isolated from other hazardous material storage by minimum 1-hour *fire barriers and/or horizontal assemblies*.



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Group H-5 Fabrication Areas – 415.11.1.2

- Fabrication areas in Group H-5 occupancies shall be separated from:
 1. each other,
 2. from corridors and
 3. from other parts of the buildingby minimum 1-hour *fire barriers and/or horizontal assemblies*.



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Flammable Finish Spray Rooms – 416.2

- In buildings used for the application of flammable finishes, spray rooms shall be enclosed with minimum 1-hour *fire barriers and/or horizontal assemblies*.



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Manufacturing of Organic Coatings – 418

- In buildings used for the manufacture of organic coatings, a variety of fire separations are required using *fire barriers and/or horizontal assemblies*:
 - Storage areas for flammable and combustible liquid tanks: 2 hours
 - Nitrocellulose storage rooms: 2 hours
 - Storage rooms for finished products that are flammable or combustible liquids: 2 hours



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Final Reflection

This slide will help the learner to reflect on the day and what they will take back to the job and apply.

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn? What difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?



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Dampers

IBC Section 717



2015 IBC Dampers, Penetration Firestops and Joint Systems

1

Dampers

The damper requirements of the IBC are duplicated in Section 607 of the IMC

- IBC Section 717 (IMC 607) addresses both ducted and unducted (air transfer openings) systems
 - Provisions of these sections address damper test standards, types of dampers, actuation, access and where the various dampers are required



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Five general types of dampers

Each type of damper has a very specific application and is tested to show compliance with the intended application

- It is important to verify that the specified and installed damper is the correct damper for that application

- Fire damper
- Smoke damper
- Combination fire and smoke damper
- Corridor damper
- Ceiling radiation damper



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3

Five types of dampers



Fire Damper



Ceiling Radiation Damper



Smoke Damper



Combination Fire & Smoke Damper



Corridor Damper



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4

Damper test standards

- | | |
|---|---|
| Fire dampers - UL 555 | <ul style="list-style-type: none"> ▪ All dampers are listed and must have a label ▪ Must be installed in accordance with manufacturer's installation instructions ▪ Where smoke and fire damper are required, may use separate dampers or combination damper |
| Smoke dampers - UL 555S | |
| Ceiling radiation dampers – UL 555C or tested as a part of FR-rated horizontal assembly | |
| Combination damper – UL 555 and UL 555S | |



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Manufacturer's Installation Instructions

- Must be followed for installation (717.2)
- Are a requirement of the listing
- Must be available for installation and inspection since variations occur between dampers and manufacturers
- Along with listing, they can help determine orientation and whether damper is allowed in a dynamic system



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Dynamic Dampers

Intended to be installed where air may continue to move through the system

- Tested and labeled for specific airflow and pressure
- Must be capable of closing against the anticipated design conditions (airflow/pressure)
- Are allowed in "static" systems (airflow shutdown)



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Dynamic Dampers

Are marked with airflow rating and a closing pressure rating

- Airflow in 1,000 fpm increments (2,000 fpm minimum)
- Closing pressure rating in 2-inch water gage increments (4-inch WG minimum)

Installed damper must exceed maximum anticipated airflow and pressure – which can vary from normal airflow conditions



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Static vs. Dynamic Dampers

STATIC RATED: Not Tested with Airflow Through Damper

Duct

Fire Damper or FSD

No Airflow

DYNAMIC RATED: Tested with Heated Airflow Through Damper

Duct

Fire Damper or FSD

Heated Airflow
2000FPM @ 4" w.g.

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Fire damper ratings

**TABLE 717.3.2.1
FIRE DAMPER RATING
(IMC Table 607.3.2.1)**

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

Fire dampers shall have the minimum rating specified in Table 717.3.2.1

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Smoke damper ratings

- Details are primarily found in UL 555S test standard
- May be used in static or dynamic systems but are designed to operate against an airflow and pressure (in order to limit air leakage)
- UL 555S test allows listing of Class III damper but IBC and IMC only allow Class I or Class II

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Smoke damper ratings

Maximum Leakage
(CFM/ft²)

Class	4 In. WG	6 In. WG	8 In. WG	10 In. WG	12 In. WG
I	8.0	9.5	11.0	12.5	14.0
II	20.0	24.0	28.0	31.5	35.0
III	80.0	96.0	112.0	125.0	140.0

Smoke dampers are tested at elevated temperatures and must be labeled with the temperature used to determine the leakage ratings

- Temperature ratings in increments of 100°F (250°F minimum)
 - ❖ 250°F rating is generally adequate, but Section 909.10 may require a higher rating for some smoke control systems

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Remember, fire dampers and smoke dampers are tested to different standards.

Combination Fire and Smoke Dampers

UL Classification Marking

COMBINATION FIRE AND SMOKE DAMPER
FIRE RESISTANCE RATING 1-1/2 HOUR
LEAKAGE RESISTANCE CLASS I - 350°F
No. _____

Additional Marking

Airflow rating (2000 fpm minimum, and 1000 fpm increments); Closure pressure rating (4 in. WG minimum and 2 in. WG increments)

Verify by looking at the label that the correct damper is being used.

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Fire damper and ceiling radiation damper actuation

Done by one of the following:

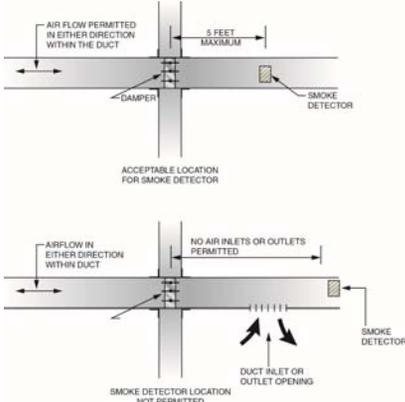
- Operating temperature approximately 50°F above normal temperature in the duct
 - But not less than 160°F
- Operating temperature up to 350°F allowed for smoke control system



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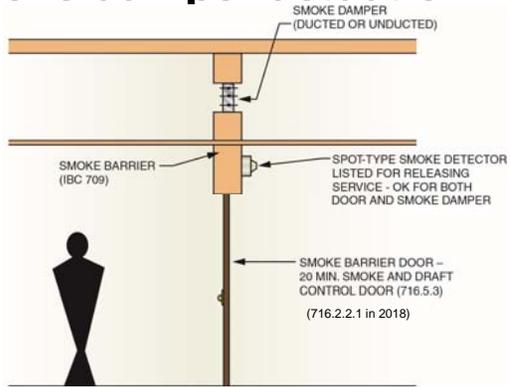
Smoke damper actuation



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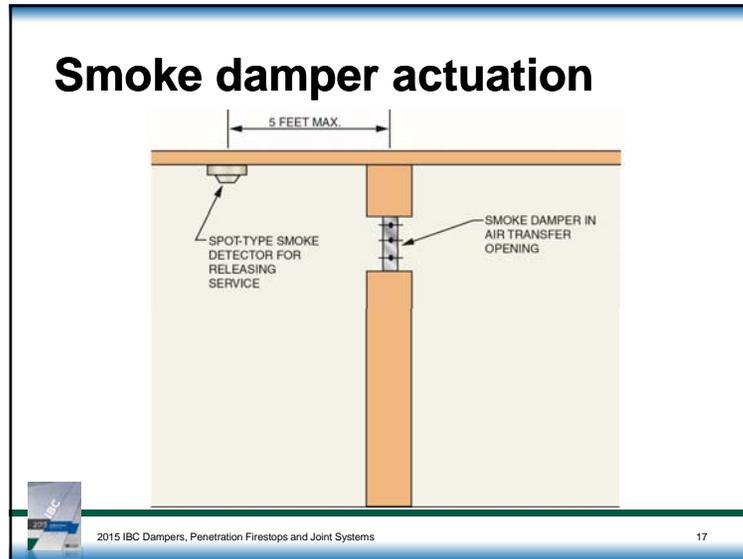
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Smoke damper actuation

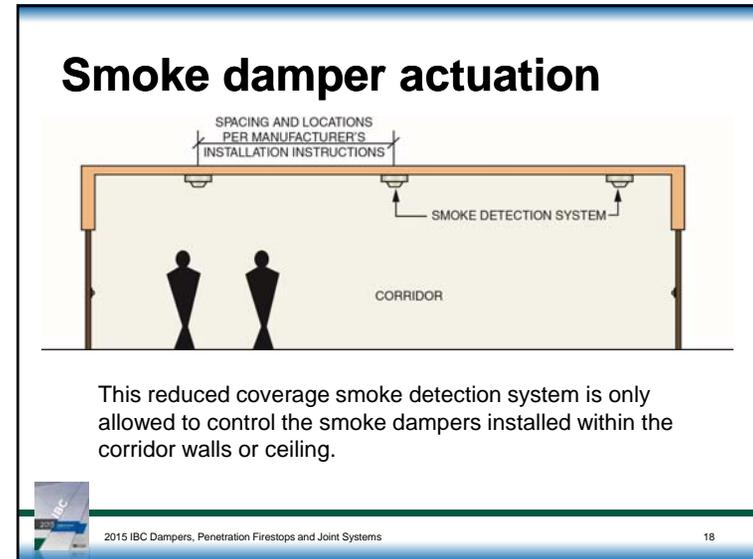


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16

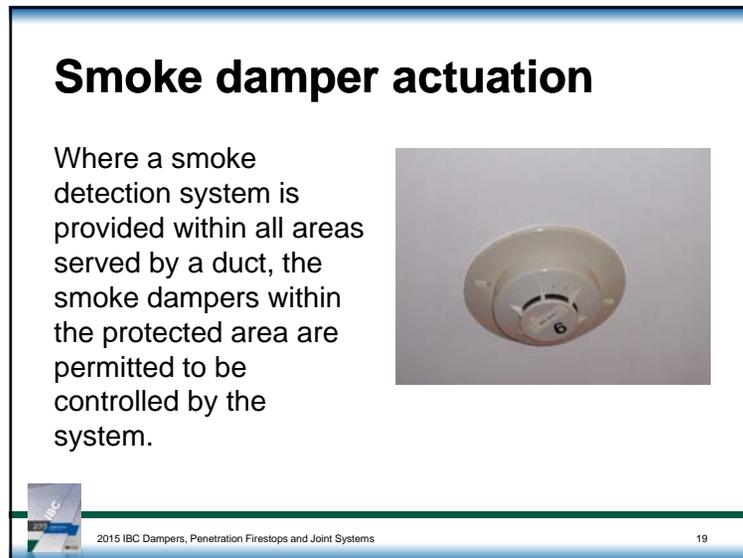
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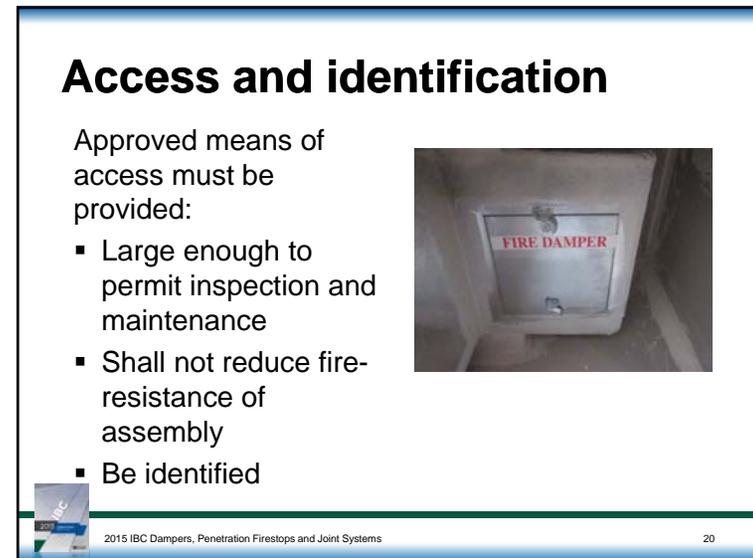
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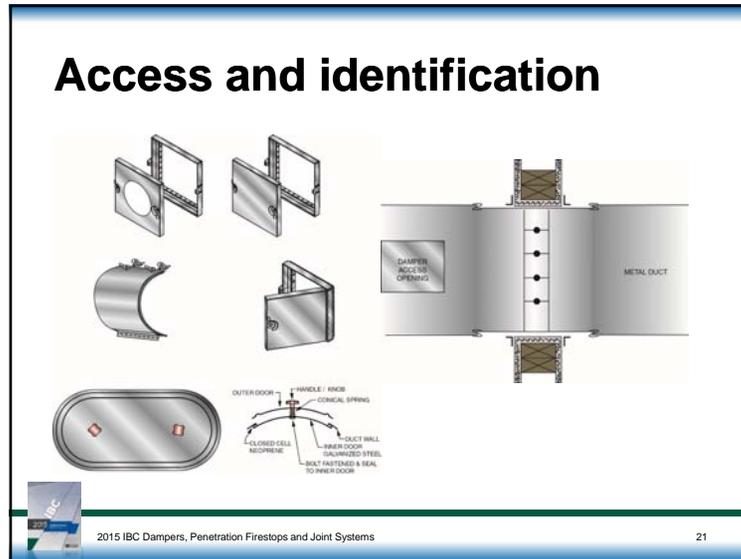
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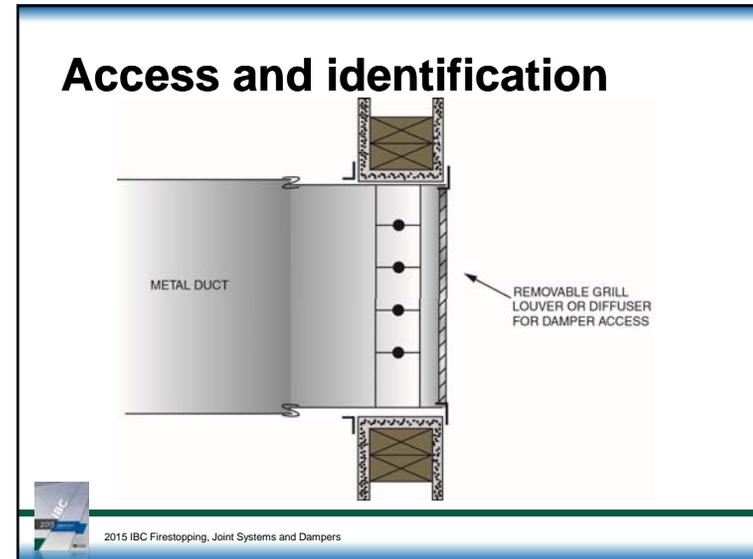
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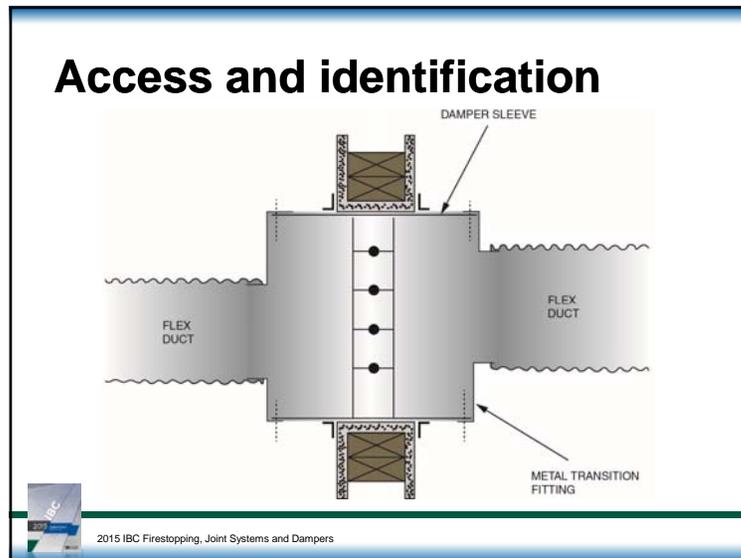
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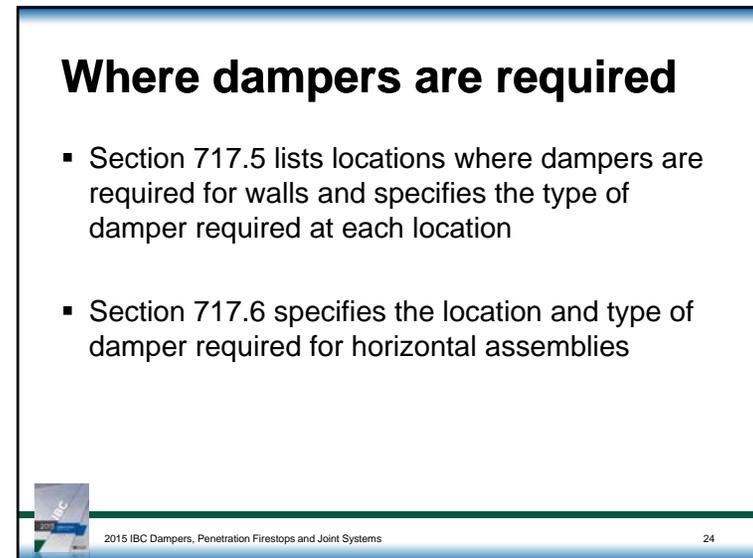
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22



23



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Where dampers are required

Plans should specify the location and type of damper to be installed. Inspector should verify correct type of damper is at each location.

- Section 717.5 says:
 - “where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be provided.”



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Quick reference – Damper requirements for walls

Section	Wall type	Referenced from	Type of damper
717.5.1 (IMC 607.5.1)	Fire walls	706.11	Fire damper
717.5.1.1 (IMC 607.5.1.1)	Fire wall – Horizontal exits	706.11	Fire damper, Smoke damper
717.5.2 (IMC 607.5.2)	Fire barriers	707.10	Fire damper
717.5.2.1 (IMC 607.5.2.1)	Fire barriers – Horizontal exits	707.10	Fire damper, Smoke damper
717.5.3 (IMC 607.5.5)	Shaft enclosures	713.10	Fire damper, Smoke damper
717.5.4 (IMC 607.5.3)	Fire partitions	708.9	Fire damper
717.5.4.1 (IMC 607.5.3 and 607.5.4)	Fire partitions - Corridors	708.9	Fire damper, Smoke damper
717.5.5 (IMC 607.5.4)	Smoke barriers	709.8	Smoke damper
717.5.6 (IMC 607.5.6)	Exterior walls	705.10	Fire damper
717.5.7 (IMC 607.5.7)	Smoke partitions	710.8	Smoke damper



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Ceiling radiation dampers

Ceiling radiation dampers (CRD) used to limit passage of fire and heat through opening in ceiling membrane of a fire-resistive assembly

- Test details in 717.3.1
 - Test to UL 555C, or
 - As part of the full horizontal assembly test

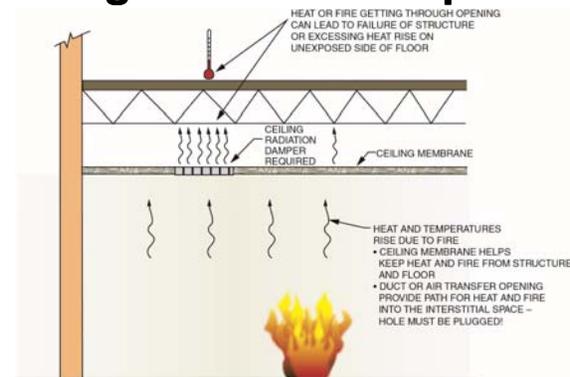
Since CRD limits amount of heat through them, cannot substitute a fire damper at this location

- CRDs don't have hourly rating
 - Tested for use in specific assemblies, or are
 - Tested as alternate to a hinged door damper from assembly test



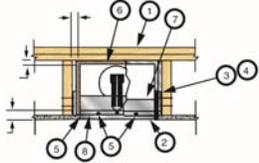
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Ceiling radiation dampers



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Ceiling radiation dampers



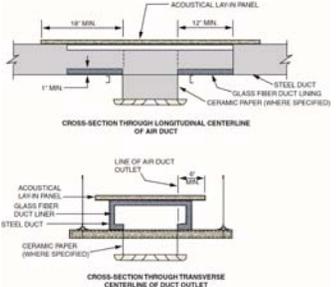
ITEM	DESCRIPTION
1.	FLOOR - CEILING UL RATED (SEE APPLICATION SECTION FOR DESIGN NUMBER).
2.	STEEL BOX MINIMUM OF 24 GAGE.
3.	1/4" x 1/4" 20 GAGE MOUNTING ANGLE.
4.	#6 NAIL OR #8 WOOD SCREW.
5.	#8 SHEET METAL SCREW OR RIVET.
6.	1/2" THICK THERMAL BLANKET (ALL SIDES).
7.	16 SWG STEEL WIRE, STEEL CLAMP OR NYLON ZIP TIE.
8.	DAMPER ASSEMBLY.

- Three items allow CRD to be exempted
 - Tested to ASTM E 119 or UL 263 showing CRD not required
 - Exhaust duct penetration within wall cavity and complying with Section 714.5.2
 - Use of duct outlet protection system

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UL 263 Duct outlet protection systems - Another way to eliminate a CRD



CROSS-SECTION THROUGH LONGITUDINAL CENTERLINE OF AIR DUCT

CROSS-SECTION THROUGH TRANSVERSE CENTERLINE OF DUCT OUTLET

System A:

- Only permitted when specified within the individual horizontal assembly's design

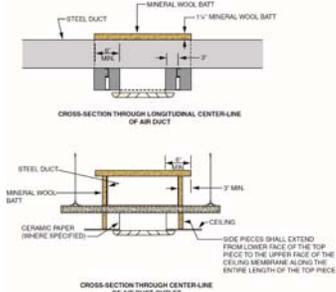
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UL 263 Duct outlet protection systems - Another way to eliminate a CRD

System B:

- May be used in any design that contains a steel duct protected by a hinged door damper in the test
 - Limited to equal or smaller size outlet than was tested with a hinged door damper

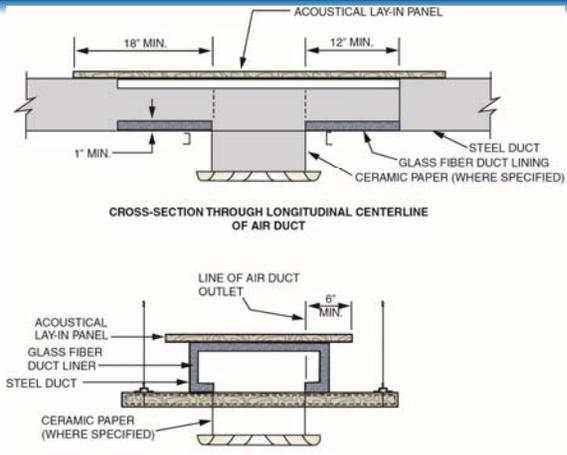


CROSS-SECTION THROUGH LONGITUDINAL CENTERLINE OF AIR DUCT

CROSS-SECTION THROUGH CENTERLINE OF AIR DUCT OUTLET

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CROSS-SECTION THROUGH LONGITUDINAL CENTERLINE OF AIR DUCT

CROSS-SECTION THROUGH TRANSVERSE CENTERLINE OF DUCT OUTLET

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Damper installation

Four aspects usually only addressed within the installation instructions are:

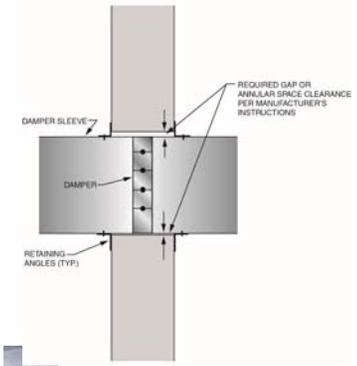
1. The space around a damper when it is installed in the opening.
2. The requirement for a sleeve if the damper is installed within a duct.
3. The attachment and potential break-away feature for any duct attached to the damper or sleeve.
4. Whether the opening through the assembly must be lined with some material such as gypsum board or may leave the framing members exposed.



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Damper installation



Installation instructions will provide minimum annular space around damper

- Space is required to allow expansion and movement
 - Example: May require 1/8 inch per foot of damper on all sides
 - Gap is OK. It is tested this way
 - Filling required gap would void listing



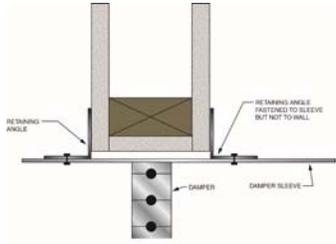
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Damper installation

Retaining angles:

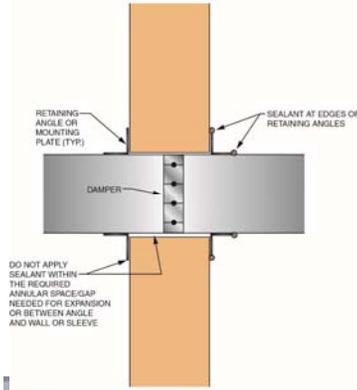
- Generally cover annular space or gap
- Hold damper or sleeve in opening but allow for movement – if attached to wall they may void listing
- Generally overlap wall by 1 inch minimum
- Attachment is covered by item 7 of SMACNA table




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Damper installation



Do not place sealants around/between retaining angles and assembly or damper unless indicated in listing or installation instructions

- Sealants could void listing
- Could restrict damper movement
- Always check listing if sealant is used/desired



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Sleeve for damper

Use of a sleeve is not a specific code requirement

- Simplifies installation and ductwork attachment
- May come from factory or be field constructed
- Manufacturer's installation instructions will address. See items 4, 5 and 6 from SMACNA table
- Thickness of sleeve generally increases based on duct size and type of connection to duct
- Manufacturer's instructions should show
 - Thickness
 - Minimum extension
 - Details of how it is held into the opening

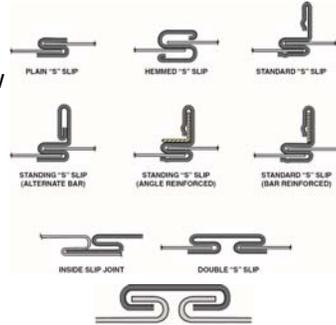


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Breakaway connections

Connection to damper or damper sleeve must allow ductwork to breakaway and not pull damper from the opening



- Types of connections and locations are specified in installation instructions
- UL 555 shows various types of connections
- Test is required by UL 555

Verify with listing. For example a flat drive may not be permitted, or may only be allowed on vertical sides of duct



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Breakaway test – UL 555



Damper remains in the rated wall after duct "breaks" away from the sleeve



Weight of sand in barrel varies. 220 pounds if duct 24 inches or less
440 pounds if duct > 24 inches



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Preparation of opening

Listing and manufacturer's instructions will include details regarding preparation of opening

- Information is from item 13 of SMACNA table and dependent on testing
- No general code requirement either exempting or requiring
- Verify with manufacturer's installation instructions
- As a general rule of thumb:
 - Many wood assemblies will require a layer of fire-resistive protection in the opening
 - Metal frame assemblies may not require protection



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Preparation of openings - Examples

Noncombustible framing

Combustible framing

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Maintenance and inspections

Once installed, dampers must be maintained to ensure they continue to function

- IFC references NFPA 80 and NFPA 105 standards
 - These are “referenced standards” and “considered part of the requirements of this code.” (IFC 102.7, IBC 102.4 and IMC 102.8)
 - NFPA 80 – Fire
 - NFPA 105 – Smoke
- IMC 102.3 requires maintenance and does reference IFC
 - Similar provision from 2012 IBC 3401.2 lost in switch to IEBC
- IFC 108, 701.5, 706.1 and 706.2 provide details

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Maintenance and inspection

Damper maintenance and testing requirement	Frequency (when testing is required)	Code sections and references
General requirements for fire and smoke dampers	<ul style="list-style-type: none"> • Commissioning • End of first year • Every 4 years except in hospitals every 6 years 	IFC Sections 108, 706.1 and 706.2 NFPA 80 (fire) NFPA 105 (smoke)
Operational testing for smoke control systems (including dampers)	Dedicated systems: <ul style="list-style-type: none"> • Commissioning • Semiannually 	IFC and IBC 909.18.3 IFC 909.20.4
	Nondedicated systems: <ul style="list-style-type: none"> • Commissioning (See IFC and IBC 909.18.3) • Annually 	IFC and IBC 909.18.3 IFC 909.20.5

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Penetrations

IBC Section 714

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Penetrations

Penetrations in fire-resistance-rated and/or smoke-resistant assemblies create breaches and potential weak points that could reduce the assembly's effectiveness if not properly protected.

- Penetrations and the materials used to protect them must not reduce the assembly rating
- Section 714 regulates both rated assemblies, and nonfire-resistance-rated horizontal assemblies



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Penetrations

No single item will work for every situation. Required systems depend on:

- Type and rating of base assembly
- Type, size and material of penetrant
- Type and thickness of any insulation on penetrant
- Material type and thickness of any sleeve
- Type of firestopping material used in firestop system

- Size and configuration of the opening (the annular space between penetrant and periphery of opening)

Systems also vary between different manufacturers and within individual product lines

- So don't get complacent and assume all systems are equal or installed in similar manner



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Topics covered in Section 714

- Fire-resistance-rated walls – Section 714.4
- Fire-resistance-rated horizontal assemblies – Section 714.5
- Smoke barriers – Section 714.5.4 (applies to both walls and horizontal assemblies)
- Nonfire-resistance-rated horizontal assemblies – Section 714.6



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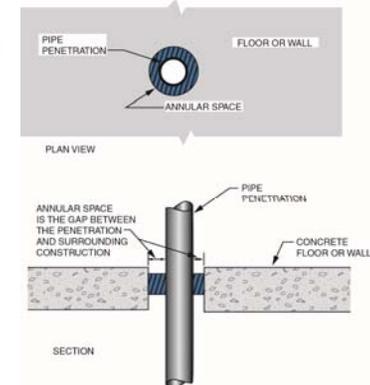
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Definition – Annular space

Important to understand terminology and test methods

- Annular space
 - “The opening around the penetrating item”
 - Many assemblies include a minimum and maximum dimension



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Annular space can vary

(A) CENTERED
(B) OFF-CENTERED
(C) POINT CONTACT

CENTERED
OFF-CENTERED
POINT CONTACT

ANNULAR SPACE
MINIMUM
MAXIMUM

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Definition

Membrane penetration

MEMBRANE PENETRATION (THROUGH ONLY ONE SIDE OF ASSEMBLY)

MEMBRANE PENETRATION FIRE STOP

MEMBRANE PENETRATION FIRESTOP SYSTEM - INCLUDES:
 • FIRE-RESISTANCE RATED WALL OR HORIZONTAL ASSEMBLY
 • PENETRATING ITEM - PASSING THROUGH ONE SIDE OF ASSEMBLY
 • MATERIALS/DEVICES INSTALLED TO RESIST SPREAD OF FIRE INTO THE ASSEMBLY

Through penetration

THROUGH PENETRATION (PASSES ENTIRELY THROUGH BOTH SIDES OF THE ASSEMBLY)

THROUGH PENETRATION FIRESTOP SYSTEM INCLUDES:
 • FIRE-RESISTANCE RATED WALL OR HORIZONTAL ASSEMBLY
 • PENETRATING ITEM - PASSING COMPLETELY THROUGH THE ASSEMBLY
 • MATERIALS/DEVICES INSTALLED TO RESIST SPREAD OF FIRE INTO OR THROUGH THE ASSEMBLY

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Definition

F RATING
 • PREVENT FLAME PASSAGE
 • MAINTAIN STRUCTURAL INTEGRITY (HOSE STREAM TEST)

T RATING
 • TEMPERATURE RISES
 • F RATING CRITERIA

THROUGH PENETRATION FIRE STOPS

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Definitions

There are a number of other definitions that code users should be familiar with:

- Penetration firestop
- Membrane-penetration firestop
- Membrane-penetration firestop system
- Through-penetration firestop system
- L Rating
- Mineral fiber
- Mineral wool

Just be certain to look at Chapter two when a term is shown in italics within the code

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Test standards

Code provides two basic methods to evaluate the performance of penetration firestop systems:

- Test as part of overall assembly (ASTM E 119 or UL 263), or
- Test penetration separately (ASTM E 814 or UL 1479)

- First option is seldom used
- Second option evaluates resistance to:
 - Development of through openings
 - Flaming on unexposed surface, and
 - Ability to limit thermal transmission through the penetration
- All four tests require hose stream test

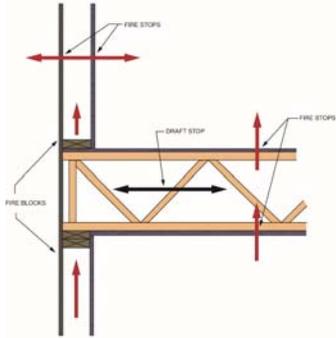


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Firestopping vs. fireblocking or draftstopping

- Section 714: firestopping for penetrations
- Section 718: fireblocking and draftstopping




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Firestopping vs. fireblocking or draftstopping

<h3>714 Penetration firestops</h3> <ul style="list-style-type: none"> ▪ Protects penetrations <i>into</i> rated assemblies ▪ Applies to both combustible and noncombustible construction ▪ Typically a tested system 	<h3>718 fireblocking or draftstopping</h3> <ul style="list-style-type: none"> ▪ Limits spread of fire <i>within</i> concealed spaces ▪ May be rated or non-rated construction ▪ Applies to combustible concealed locations ▪ Not tested, but use specific prescriptive/generic products that are deemed to be acceptable
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Where penetration protection is required

Primary requirements are found in:

- 714.4 (Fire-resistance-rated walls)
- 714.5 (Horizontal assemblies)
- 714.6 (Nonfire-resistance-rated horizontal assemblies)
- 714.5.4 (Smoke barriers)

Those code sections address not only the type of penetrations required to be protected but also the acceptable methods of protection



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Where penetration protection is required

Section 714 is referenced from a number of locations

- Sections 706.9 and 707.7 are examples – from fire wall and fire barrier provisions
- Section 712.1.4 – from the vertical openings provisions

Best to look at specific assembly section before looking at 714

- Sections 707.7.1 and 710.6 are examples
 - 707.7 does reference 714 but 707.7.1 prohibits certain penetrations or allows them in specific locations
 - 710.6 does not reference 714 for penetrations in smoke partitions

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Penetration of fire-resistance-rated walls

Section 714.4 is the starting point

- Primary sections are
 - 714.4.1 (through penetrations)
 - 714.4.2 (membrane penetrations)
- Both contain exceptions
- Both ultimately point back to 714.4.1.1 and 714.4.1.2

Sections 714.4.1.1 and 714.4.1.2 allow:

- Test penetration as part of overall assembly (ASTM E 119 or UL 263), or
- Test penetration separately (ASTM E 814 or UL 1479)
- An F rating is required for systems

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Penetration firestop systems

Are tested and listed systems

- Should be installed as tested and described in product directory and manufacturer’s instructions
- Deviations can impact performance

Tested systems help

- Demonstrate compliance with code requirements
- Provide installer with detailed installation requirements
- Provide inspector with document to use for inspection of the installation

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Through penetrations – 714.4

General requirement is for tested system

- Exception limited to steel, ferrous or copper pipes, tubes or conduits
 - Offers two methods of protection
 - Focuses on protection of annular space
- Item 1 limited to concrete or masonry walls

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Through penetrations Section 714.4.1 Exception

Item 2 provides a number of options

- Can allow virtually any material to fill annular space (if tested)
- Type of wall is not limited to concrete or masonry
- Size of penetration is not limited
- Type of penetration is still limited

- Not easy to comply with since it basically requires testing and these are not listed products – test information often not available



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Membrane penetrations

General requirement is for membrane penetrations to comply with through penetration provisions

- Six exceptions
 - Four applicable to electrical boxes
 - One for boxes other than electrical
(e.g. washing machine hose connection boxes, hose cabinets, manual fire alarm pull boxes, dryer exhaust boxes, electrical panel boards, etc.)
 - One for sprinkler penetrations



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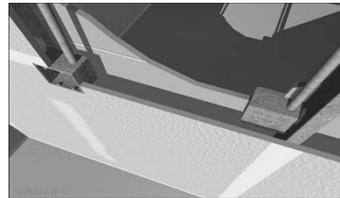
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Membrane penetrations

Three means of complying

- Tested as part of overall assembly (714.4.1.1)
- Tested separately for F rating (714.4.1.2)
- Comply with an exception (There are 6 in 714.4.2 or 2 in 714.4.1)
- Electrical boxes are one of the most common membrane penetrations



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Back-to-back membrane penetrations

Membrane penetrations are different than through penetrations

- Generally code does not address how to deal with back-to-back penetrations
 - Exceptions 1 and 2 for outlet boxes do address this
- Membrane penetration not covered by one of the exceptions will essentially require same protection as through penetration
 - Consult manufacturer & listing if concerned with back-to-back items to see if added protection is needed



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Penetrations of horizontal assemblies

IBC looks at horizontal assemblies as a means of compartmenting a building to minimize vertical spread of smoke or fire

Penetration protection requirements apply to:

- Fire-resistance-rated assemblies (714.5.1 to 714.5.4)
- Nonfire-resistance-rated assemblies (714.6)



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Penetration of horizontal assemblies

Protection requirements depend on type and location of the assembly

- Horizontal assemblies may be a floor or a roof
- May rely on some type of specific ceiling construction as integral part of rating
 - Important to protect penetrations through any part integral to the fire-resistance rating – whether floor, roof or the ceiling membrane beneath them
 - Sections 714.5 and 712.1.15 allow unprotected openings through roof deck/slab if not affecting structural integrity



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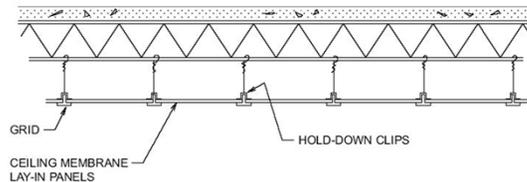
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Fire-resistance-rated assemblies Scoping

Section 714.5 is horizontal assembly's equivalent of Section 714.4 for walls

- Due to exclusions in Sections 714.5. and 712.1.15, it does not include the roof of a roof/ceiling assembly or to a roof which is rated by itself



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Horizontal assemblies – Through penetrations

Section 714.5.1 provides two basic methods for evaluating through penetrations

- Test as part of overall assembly (ASTM E 119 or UL 263), or
- Test penetration separately (ASTM E 814 or UL 1479)

These options were covered previously in Test Standard section and are the same as allowed for walls in 714.4.1

- First option is seldom used



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Horizontal assemblies – Through penetrations

In lieu of general options, can use one of three exceptions

- Exception 1 is similar to Item 2 in Exception for walls in 714.4.1
- Limited to steel, ferrous or copper conduits, pipes, tubes or vents; or to concrete or masonry items
- Limited to a single floor
- Testing per ASTM E119 or UL 263



Through penetration firestop systems – 714.5.1.2

Testing firestop systems in horizontal assemblies to ASTM E 814 or UL 1479 differs from wall provisions since testing requires both an F and a T rating

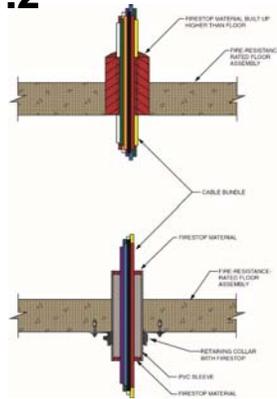
- T rating is a higher performance criteria and more difficult to achieve than F rating
- T rating limits temperature increase through the penetrant and the firestop system; and does not lessen original assembly performance



Through penetration firestop systems – 714.4.1.2

Obtaining T rating generally requires insulation of penetrant above and/or below to limit heat transmission

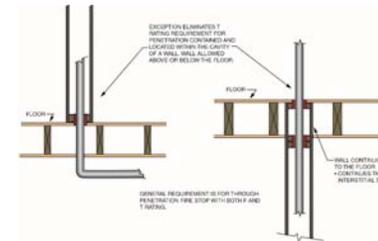
- Details are described in listing and manufacturer’s installation instructions



Through penetration firestop systems – T Rating exceptions

Three options to eliminate T rating requirement

- Exception 1 relies on “insulation” protection that the wall provides
- Allowed whether wall is rated or not
- If wall beneath, must extend to floor – to contain penetrant



Through penetration firestop systems – T rating exceptions

Exception 2 applies to floor drains, tub drains and shower drains

- Must be contained and located within concealed space of horizontal assembly
- Exceptions only eliminate T rating (Not F rating)

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Exception 2 – Eliminating T rating

Was added into code because it is conceptually similar to Exception 1 and ceiling helps shield penetrant

- Should only be used for horizontal assembly where ceiling is part of protection and rating
- Only applicable to the three specific drains. Should not use for other penetrants.

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Through penetration firestop systems – T rating exception

Exception 3 limited to use with metal-enclosed electrical switchgear

- 4” maximum diameter metal penetrant
- Must go “directly” into enclosure
- Eliminates T rating – Still needs F rating or other exception

2015 Template 75

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Membrane penetrations

As general requirement, membrane penetrations are protected the same as through penetrations

- Tested as part of overall assembly, or
- Tested to ASTM E 814 or UL 1479 as firestop system
- Eight exceptions permitted in lieu of general provisions

Code uses through penetration provisions even though these are membrane penetrations

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Smoke barriers – 714.5.4

Smoke barrier provisions of Section 709 are referenced by a number of other code sections

- Generally used where occupants are unable to evacuate (hospitals, jails, ambulatory care facility), or to compartment building for smoke control system
- May be either walls or horizontal assemblies
 - Both 714.4 and 714.5 reference 714.5.4
- Generally require a 1-hour rating for barrier



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Smoke barrier penetrations

Penetrations must be tested to UL 1479 and obtain an L rating

- L rating provides quantitative indication of system's ability to resist passage of smoke
- System must be tested and listed to have an L rating – don't assume something complies
 - Air leakage test is an optional test under UL 1479
 - ASTM E 814 test does not contain L rating test protocol



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Smoke barrier penetrations

Air leakage (L rating) cannot exceed

- 5.0 cfm per square foot of penetration opening for each system, or
- A total leakage of 50 cfm for any 100 square feet of wall or floor area.
- L rating provides measurable criteria versus subjective provisions (limit, restrict, resist)
- L rating determined at both ambient temperature and at elevated temperature

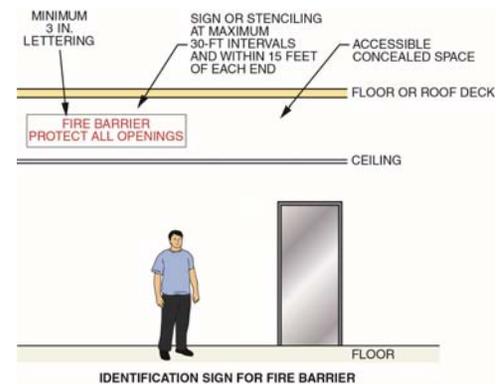


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Marking and identification Section 703.7



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Maintenance – IFC 703.1 and 704.1

Requires fire-resistance rating of construction “including...firestops...and fire-resistant joint systems” to be maintained.

- Requires visual inspection by owner on annual basis (IFC 701.5 and 701.6)
 - Not required for inaccessible concealed areas
- Repair or replaced if damaged or altered; protected if new penetration
 - Same intent as 2012 IBC 3401.2 and 3404.1 (lost these sections in 2015 IBC and IEBC)



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Fire-resistant joint systems

Section 715



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Joint - Definition

IBC defines a joint as “the opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.”

- Put another way, the joint is the breach or opening in or between adjacent assemblies
- A joint system is used to fill the opening or breach

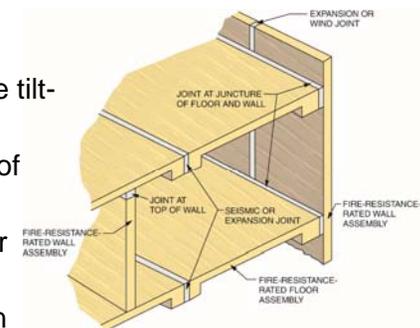


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Joints – Locations & examples

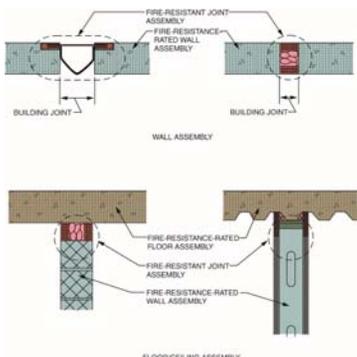
Examples:

- Gap between adjacent concrete tilt-up panels
- Head of wall/top of wall
- Floor and exterior curtain wall
- Expansion joint in floor



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Joints – Locations & examples



The diagrams illustrate various fire-resistant joint assemblies. The top row shows two types of building joints: one with a fire-resistant joint assembly and fire-resistance-rated wall assembly, and another with a fire-resistant joint assembly and fire-resistance-rated wall assembly. The bottom row shows a floor/ceiling assembly with a fire-resistance-rated floor assembly, fire-resistant joint assembly, and fire-resistance-rated wall assembly.

Test joint systems using ASTM E 1966 or UL 2079

- Neither ASTM E119 nor UL 263 evaluate performance where wall and floor assemblies connect
- ASTM E 2307 used for floor/curtain wall

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Joint firestop systems

Compliant systems

- Accommodate cyclical movement of adjacent assemblies
- Prevent the passage of flame and hot gases sufficient to ignited cotton waste on unexposed side of the assembly
- Will remain in place when subjected to the hose stream test

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Test criteria – Section 715.3

ASTM E 1966 and UL 2079 are essentially equivalent



The diagrams show a nonsymmetrical wall joint and a symmetrical wall joint. The nonsymmetrical joint has a fire-resistant joint assembly on one side and a fire-resistance-rated wall assembly on the other. The symmetrical joint has fire-resistant joint assemblies on both sides.

- Both focus on joint and ability to go through movement cycles
 - ASTM E 1966 does not evaluate smoke leakage so must use UL 2079 for L rating

Nonsymmetrical wall joint systems must be tested from both sides, or from least fire-resistant side (similar to 703.2.1 wall test)

- Exception for exterior walls with fire separation distance greater than 10 feet.

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Where required

Section 715.1 states joints “in or between fire-resistance-rated” walls or horizontal assemblies are required to be protected by approved systems

- Most locations are covered by this general requirement or the exception in 715.1
 - There are ten exempt locations in 715.1
- Sections 715.4 through 715.6 contain specific requirements for certain locations

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Exception from 715.1

The exception in 715.1 list ten locations where joint systems are not required to be installed

- Most eliminate joint protection due to fact that some other code provision would allow a fire to circumvent the joint system
- Therefore code cannot justify requiring a joint system where the fire can bypass it by another route

