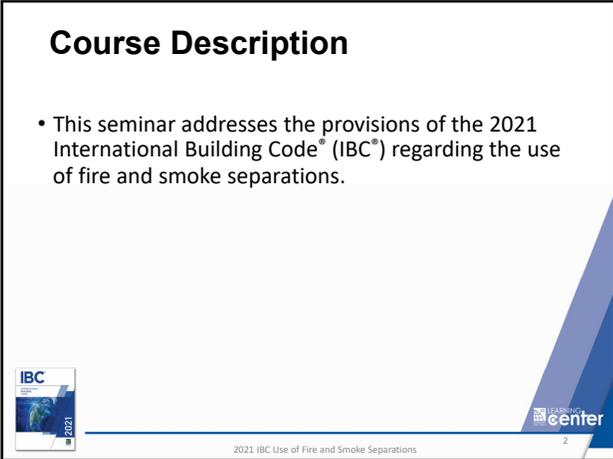
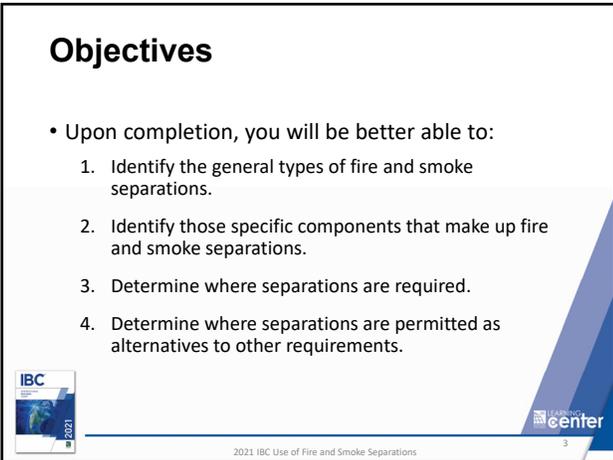




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Course Overview



- 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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2021 IBC Use of Fire and Smoke Separations 4

4

Fire and Smoke Protection Concepts

Module 1

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5

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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6

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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7

Structural Fire Resistance

- Structural fire resistance is 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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8

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.
 - Vertical and/or horizontal separations typically require opening protectives and other components to achieve full separation.




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9

Protection of Exitways

- As means of egress systems become more complex, 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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10

Radiant Heat Protection

- As a means to address the spread of fire from building to building due to radiant heat transfer, fire-resistance-rated exterior walls required based on proximity to lot lines and other buildings on the same site.
 - The concept of “fire separation distance” is selectively applied to regulate exterior wall fire resistance and opening prohibition or protection.





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11

Restriction of Smoke Movement

- Smoke-resistant construction often mandated where occupants are incapable of self preservation and protect-in-place methods are employed.
 - Institutional occupancies (health care, areas of restraint)
 - Ambulatory care facilities
 - Refuge areas (accessibility; horizontal exits)
- Other conditions require separation that includes both smoke- and fire-resistance.




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12

13

14

15

Fire Walls

- A *fire wall* is the most complex and protective fire separation.
 - Selected by the designer to provide an alternative solution to code compliance, a fire wall creates separate buildings in the same structure for purposes of allowable height and area (type of construction)
 - Also selectively permitted to create fire areas, horizontal exits, etc.
 - *Fire walls* required to be 2-, 3- or 4-hour assemblies, based on construction type(s) and occupancy classification(s).




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16

Fire Barriers

- A *fire barrier* is the 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.
 - *Fire barriers* are limited to “vertical” assemblies.
 - *Fire barriers* are selectively required to be 1-, 2-, 3- or 4-hour assemblies.




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17

Fire Partitions

- A *fire partition* is required where a limited degree of fire and smoke protection is warranted.
 - The use of *fire partitions* is typical in locations where fire separation is important in the initial stages of building evacuation.
 - *Fire partitions* are required to be minimum 1-hour assemblies, with allowances for ½-hour assemblies under specified conditions.




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18

Smoke Barriers

- A *smoke barrier* is 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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19

Exterior Walls

- Fire-resistance-rated *exterior walls* provide separation from internal fire, and in some cases, external fires.
- While commonly rated due to the wall's proximity to a lot line, *exterior walls* also can provide for the protection of outdoor egress travel.
- *Exterior walls* are selectively required to be minimum 1-, 2-, or 3-hour fire-resistance-rated assemblies.




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20

Horizontal Assemblies

- *Horizontal assemblies* are 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.
 - Horizontal assemblies are selectively required to be minimum ½-, 1-, 2-, 3-, or 4-hour fire-resistance-rated assemblies.




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21

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* are 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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22

Prescriptive Separations

- *Prescriptive separations* can also be mandated where a limited degree of separation is desired.
- Although not required to be tested and listed assemblies, these separation elements adequately serve a specific need.
- Applications include the use of:
 - Gypsum board.
 - Nonrated floor construction.
 - Construction capable of restricting smoke migration.



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23

Components of Fire and Smoke Separations

Module 3



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24

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.




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25

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 throughout the IBC and are required based on the intended purpose of the separation.




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26

Vertical Elements

- *Partial assemblies based on listed assemblies* are recognized in limited applications, typically where the potential hazard is assumed to exist only on one side of the separation element.
- *Prescriptive separation elements* are also occasionally mandated, where a specific material is identified as the minimum level of separation required.
- Examples of both conditions are found in the protection of enclosures under interior stairways




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27

Horizontal Elements

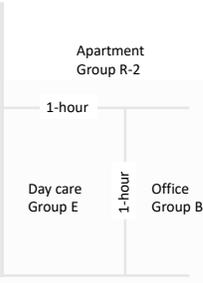
- *Horizontal assemblies* are tested and listed assemblies that resist the spread of fire vertically.
- Fire-resistance-rated floors and floor/ceiling assemblies can provide varying degrees of fire-resistance.
- Non-rated horizontal elements also provide a significant level of separation and are regulated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




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28

Vertical/Horizontal Combination



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

Elevation View: Fully sprinklered




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29

Doors

- Typically, door 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.
- Although 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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30

Doors

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




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31

Windows

- Windows and other glazed openings are typically regulated similar to doors, needing to be fire-protection-rated.
- Fire-resistance-rated glazing is also addressed, regulated in much the same manner as fire-resistance-rated wall assemblies, including testing in accordance with ASTM E119 or UL 263.

Window/Door Test
FIRE-PROTECTIVE
NFPA 257/252



Contains flame and smoke
45 minutes and under

Wall Test
FIRE-RESISTIVE
ASTM E119/UL 263



Contains flame and smoke AND blocks radiant heat for applications
over 45 minutes




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32

Windows

- There are situations in the code where nonrated windows are permitted in fire and/or 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
 - where fire-resistance-rated exterior walls are permitted with unprotected openings.




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33

Penetrations

- Penetrations must typically be protected by firestop systems rated to the same level as the element penetrated.
 - Through penetration or membrane penetration systems
- Prescriptive methods of penetration protection are also established.



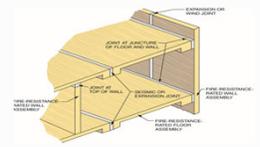
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34

Joints

- Fire-resistant joint systems are mandated where joints occur in separation elements requiring opening protection.
- Joint protection is also often required at the voids between curtain wall assemblies and:
 - Nonfire-resistance-rated horizontal assemblies
 - Fire-resistance-rated horizontal assemblies



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35

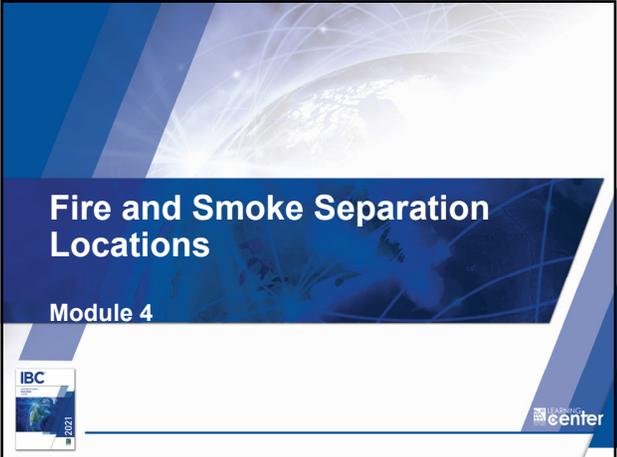
Air Movement

- 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 damper protection at duct penetrations

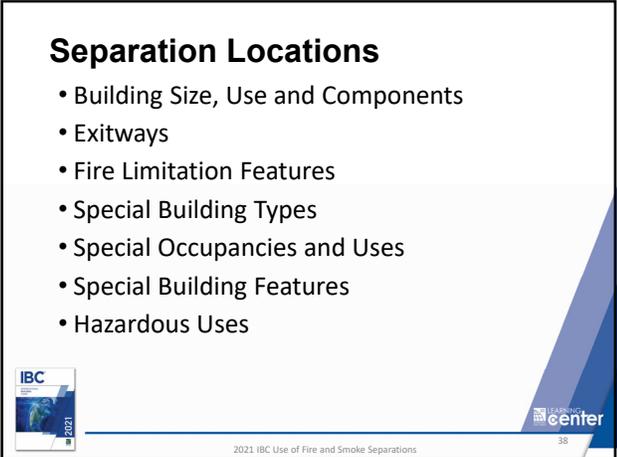
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36



37



38



39

Building Height & Area – 503.1

- Each portion of a building separated by a *fire wall* to be considered a separate building in the determination of permissible types of construction, allowable building height and area, and number of control areas .
- The use of fire wall is selectively determined by the designer as a means to reduce building size, thus increasing the available types of construction.

Fire wall creates separate buildings for purposes of:

- allowable height
- allowable area
- type of construction
- number of control areas

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40

Building Height & Area – 503.1

Plan View

Building "A"
Group B
VB construction
9,000 sq ft
2 stories
40 ft
(nonsprinklered)

Building "B"
Group B
IB construction
23,000 sq ft
3 stories
55 ft
(nonsprinklered)

Both buildings "A" and "B" considered separate buildings for purposes of allowable height and area

Also serves as a "type of construction" separation as only one construction type can be assigned to a building

Fire wall complying with Section 706

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

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41

Party Walls – 706.1.1, Exc. 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 not required where:
 - 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
 - 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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42

Party Walls – 706.1.1, Exc. 2

- Applicable where building is divided by one or more party walls (fire walls) for ownership purposes.

Example:

Regulated as a single unlimited area building

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43

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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44

Fire Walls

- In addition, fire walls provide variety of other alternative solutions to the designer:
 - Allows increased height in feet and number of stories in Groups R-1 and R-2 for buildings of Types IIA and IIIA
 - In Appendix B of IFC, fire walls may be used to reduce fire flow requirements (create separate fire-flow calculation areas).
 - As one of two methods used to create a horizontal exit

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45

Horizontal Separation- 510.2

4. Interior exit stairways in Type IA building permitted to be of combustible materials where two conditions met.

5. Occupancies can include Groups A (OL <300), B, M, R, and/or S in upper building

7. Single building for height limit in feet

3. Shaft, stair, ramp through horizontal assembly to have not less than 2-hour fire rating (exception for 3 hr/1 hr condition)

2. Type IA construction

1. 3-hour horizontal assembly

6. Fully sprinklered below horizontal assembly and permitted to be all occupancies except Group H.

Grade plane

Portions above and below 3-hour horizontal assembly to be considered separate buildings for:

- Allowable area
- Number of stories
- Type of construction
- Fire wall continuity

Elevation View

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52

Parking Beneath Group R Section 510.4

- Where maximum of one story above grade plane Group S-2 parking garage is provided under building of Group R, the number of stories used to determine type of construction to be measured from floor above parking area.
 - Floor assembly between garage and Group R above to be of:
 - Type I construction (or Type IV for open parking garage)
 - Provided with a minimum fire separation based on Table 508.4:
 - 1 hour if fully sprinklered above and below separation
 - 2 hours if not fully sprinklered

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53

Parking Beneath Group R Section 510.4

Number of stories for determining minimum type of construction

One story

Group R

Group R

Group R

Group R

Group S-2 Parking garage

Grade entrance

Floor assembly based on garage type of construction, but not less than Table 508.4

Type I construction if enclosed Type I or IV if open

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54

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

- Where special height increases are applied for Type IIIA Group R-1 and R-2 buildings:
 - minimum 2-hour *fire walls* are required to create areas of 3,000 square feet maximum, and
 - first *floor assembly* over basement to have minimum 3-hour fire-resistance rating.
- Allows height increase of 10 feet and one story over Tables 504.3 and 504.4, respectively.

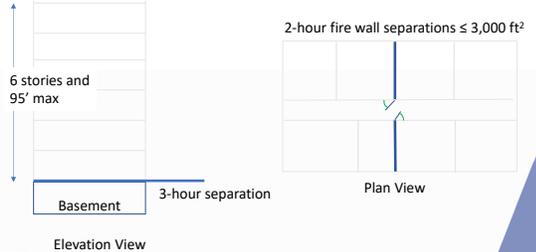


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55

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

- Increase to 6 stories and 95 feet



6 stories and 95' max

Basement 3-hour separation

2-hour fire wall separations ≤ 3,000 ft²

Plan View

Elevation View



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56

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 exits,
 - first *floor assembly* over basement to have minimum 1½-hour fire-resistance rating, and
 - minimum 50-foot separation required from lot lines and other buildings on the same lot.
- Allows height increase to nine stories and 100 feet.
 - General requirement of 85 feet and five stories maximum in sprinklered building.



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57

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

- 9 stories, 100 feet

Plan View: 2-hour

Elevation View: 9 stories and 100' max., 1 1/2 - hours, ≥ 50 feet

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58

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 *horizontal assemblies or fire barriers*.

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59

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 and exits must be separated by a minimum 2-hour *horizontal assembly*.

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60

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

3 Group S-2 parking garage

5 Area not to exceed limits of Section 503

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

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

1 Minimum 2-hour horizontal separation

Grade plane

Elevation View

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61

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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62

Buildings on Same Lot – 503.1.2

Plan View

A: separate buildings

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

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

Assumed imaginary line

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

For SI: 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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63

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 705.5.
- The primary concern is radiant heat transfer from one building involved in a fire event to an adjacent building.




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64

Exterior Walls – Table 705.5

TABLE 705.5
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^{a, b, c}

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP I ^d	OCCUPANCY GROUP F-1, M, S-1 ^e	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U ^f
X < 5 ^g	All	3	2	1
5 ≤ X < 10	IA, IVA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IVA, IVB	2	1	1 ^h
	IBB, VB	1	0	0
	Others	1	1	1 ^h
X ≥ 30	All	0	0	0

^a For SI, 1 foot = 304.8 mm.
^b Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
^c See Section 706.1.1 for party walls.
^d Open parking garages complying with Section 4101 shall not be required to have a fire-resistance rating.
^e 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.
^f For special requirements for Group II occupancies, see Section 413.6.
^g For special requirements for Group S aircraft hangars, see Section 412.1.1.
^h Where Table 705.5 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
ⁱ 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 (1524 mm) or greater.
^j For a Group I-3 building of Type I-B or Type V-0 construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1524 mm) or greater.




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65

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*.




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66

Exterior Walls – 705.5

2021 IBC Use of Fire and Smoke Separations 67

67

Exterior Walls - 705.5

EXTERIOR WALLS	PROPRIETARY ¹	1 HOUR FIRE
GA FILE NO. WP 8124 GYPSUM WALLBOARD, POLYETHYLENE FILM, WOOD STUDS, GLASS FIBER INSULATION, FOAM PLASTIC BOARDS, PLYWOOD SIDING EXTERIOR SIDE: One layer 1/2" proprietary aluminum foil faced, glass reinforced isocyanurate foam plastic sheathing applied parallel to 2 x 4 wood studs 16" o.c. with 11 gage galvanized roofing nails, 1 1/2" long, 0.125" 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 16d galvanized common nails, 3" long, 0.135" shank, 0.307" head 4" o.c. at perimeter and 12" o.c. at intermediate studs. Rating based on the lesser of loading to 2327 lb/ft ² or 873 lb of full design load. 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. Underlaid 3/8" glass fiber insulation, 0.97 psf friction 8 in stud spacings. (LIMITED LOAD-BEARING) PROPRIETARY GYPSUM BOARD Certain Teed Gypsum, Inc. 5/8" ProFlocc™ Type X Gypsum Panels	Thickness: 7 3/8" Approx. Weight: 6 psf Fire Test: CBS/6534, S-12-79	

¹Contact the manufacturer for more detailed information on proprietary products.

2021 IBC Use of Fire and Smoke Separations 68

68

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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69

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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70

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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71

Hoistway Opening Protection – 3006.3, #1 and #2

- Where elevator lobbies are required by Sections 3006.2 and 3006.2.1, 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.

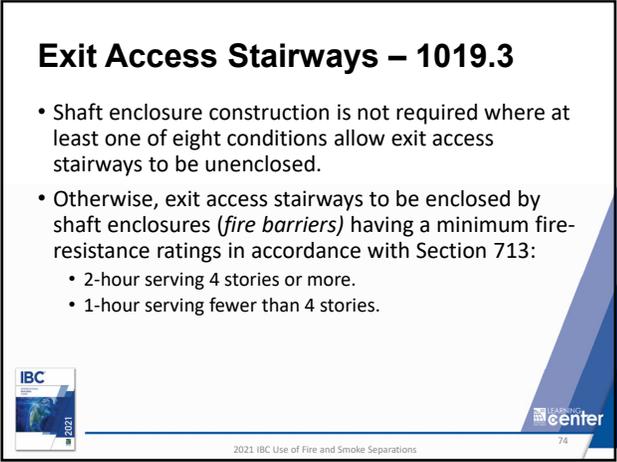



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72



73



74



75

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.




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76

Extension of Interior Exit Stairways and Ramps - 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.

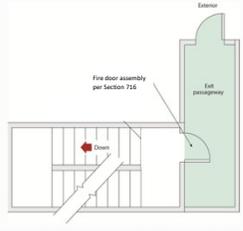



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77

Extension of Interior Exit Stairways and Ramps - 1023.3.1

- There shall be a fire barrier with a rating equivalent to the interior exit enclosure and fire door assembly between the exit passageway and exit stairway.
 - See two exceptions





2021 IBC Use of Fire and Smoke Separations 78

78

Smokeproof Enclosures and Pressurized Stairways and Ramps – 1023.12.1

- 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.





2021 IBC Use of Fire and Smoke Separations 79

79

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.




2021 IBC Use of Fire and Smoke Separations 80

80

Horizontal Exits – 1026.2

- Horizontal exits, where provided, shall be constructed with *fire walls* or *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 selectively required.




2021 IBC Use of Fire and Smoke Separations 81

81

Horizontal Exits – 1026.4

Area A: Two exits required
Area B: Two exits required
Minimum 2-hour fire-resistance-rated fire barrier or fire wall

Area E: Three exits required
Area D: One exit required
Area C: Two exits required
Minimum 2-hour fire-resistance-rated fire barrier or fire wall

Complying fire wall or fire barrier may be utilized as horizontal exit from both sides, provided door size and swing are adequately addressed.

When two or more exits are required, not more than one-half the total number of exits and one half of the exit width may be horizontal exits.
Horizontal exit shall not serve as the only exit from an area.

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82

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.
 - In addition, fire-resistance-rated construction is required for those exterior walls adjacent to the exterior stairway or ramp.

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83

Exterior Exit Stairways and Ramps – 1027.6

Rating comes from Section 1023.7: $\geq 1\text{-hr w/ } \frac{3}{4}\text{-hr prot openings}$

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

Rating comes from Section 1023.7: $\geq 1\text{-hr w/ } \frac{3}{4}\text{-hr prot openings}$

< 10 ft

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84

Spaces under Grandstands and Bleachers – 1030.1.1.1

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

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85

Corridors – 1020.2

- Corridors shall be fire-resistance rated in accordance with Table 1020.2.
- 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.

2021 IBC Use of Fire and Smoke Separations 86

86

Corridor Construction – Table 1020.2

TABLE 1020.2 CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system
H-1, H-2, H-3	All	Not Permitted	1 ^a
H-4, H-5	Greater than 30	Not Permitted	1 ^a
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5 ^b /1 ^d
I-2 ^a	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1 ^{b,c}
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 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.

2021 IBC Use of Fire and Smoke Separations 87

87

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

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2021 IBC Use of Fire and Smoke Separations 88

88

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.

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2021 IBC Use of Fire and Smoke Separations 89

89

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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2021 IBC Use of Fire and Smoke Separations 90

90

Exterior Area for Assisted Rescue – 1009.7.2

Maneuvering clearance ICC A117.1

Provide signs - Sections 1009.9 & 1009.11

30" x 48" Wheelchair space - Section 1007.6.1

1-HR fire-resistant construction w/ ½-hr opening protectives (nonsprinklered condition)

60" MIN. PER ALCOVE PROVISIONS IN ICC A117.1

GUARD RAIL SECTION 1013.1

10" MIN. CLEARANCE

10" MIN. CLEARANCE

EXTERIOR AREA OF RESCUE ASSISTANCE

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2021 IBC Use of Fire and Smoke Separations 91

91

Egress Courts – 1029.3

- 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.
 - Exception for an egress court that:
 - serves an occupant load less than 10, or
 - serves a Group R-3 occupancy.

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92

Egress Courts – 1029.3

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 ¾-hour fire-protection rating

Less than 10 ft

10 ft in height wall and opening protection

Section A-A

10 ft in height wall and opening protection

For SI: 1 foot = 304.8 mm.

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2021 IBC Use of Fire and Smoke Separations 93

93

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.




2021 IBC Use of Fire and Smoke Separations 94

94

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 *½-inch gypsum board*.




2021 IBC Use of Fire and Smoke Separations 95

95

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*.



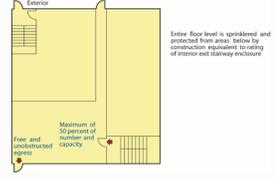


2021 IBC Use of Fire and Smoke Separations 96

96

Interior Exit Discharge – 1028.2, Exception 1

- 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*.



2021 IBC Use of Fire and Smoke Separations

97

97

Interior Exit Discharge – 1028.2, Exception 2

- Where an interior exit stairway is permitted to egress through a discharge level vestibule, as one condition the discharge level must be separated from areas below by *construction conforming to the fire-resistance rating of the enclosure*.
- In addition, the vestibule must be separated from the remainder of the level of exit discharge by *fire partitions*.

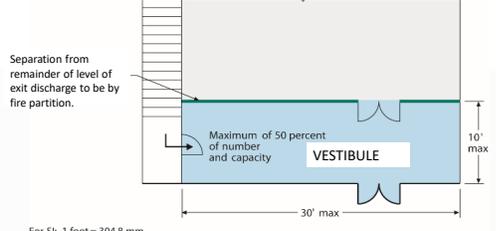


2021 IBC Use of Fire and Smoke Separations

98

98

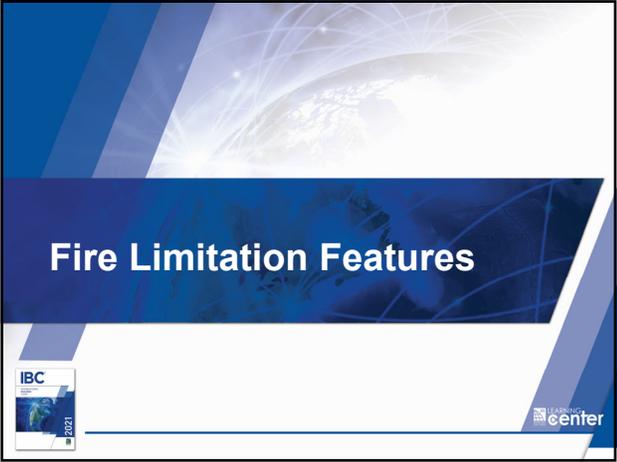
Interior Exit Discharge – 1028.2, Exception 2



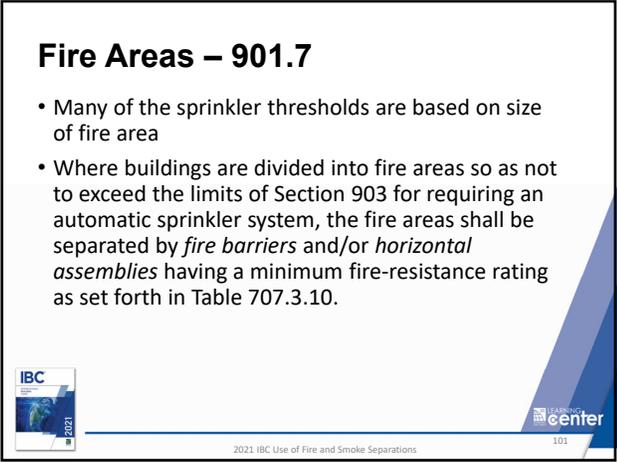
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99

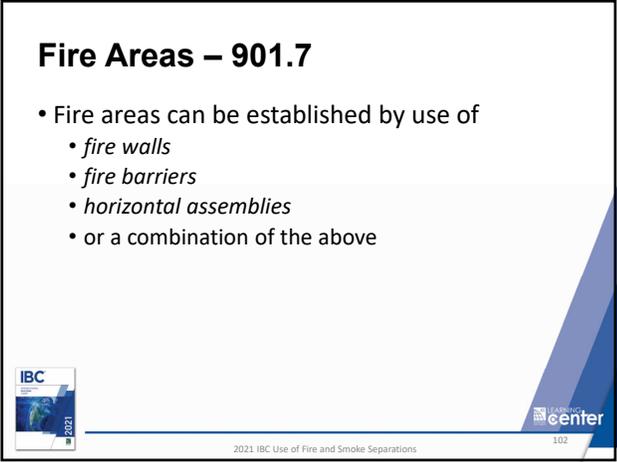
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100



101



102

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

Fire wall per Table 706.4 or fire barrier per Table 707.3.10

Exterior walls

Fire area "B"

Fire area "A"

Horizontal assembly per Table 707.3.10

Exterior walls

Fire area "B"

Fire area "A"

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2021 IBC Use of Fire and Smoke Separations 103

103

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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2021 IBC Use of Fire and Smoke Separations 104

104

Smokeproof Enclosures – 909.20.2

Fire door assembly per Section 716.2 (minimum 1 1/2-hour fire assembly)

2-hour fire barriers

Vestibule

72" min

44" min

Stairway

Minimum 20-minute smoke- and draft-control door per Section 909.20.3.2

For SI: 1 inch = 25.4 mm.

Mechanical ventilation alternative

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2021 IBC Use of Fire and Smoke Separations 105

105

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.




2021 IBC Use of Fire and Smoke Separations 106

106

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*.




2021 IBC Use of Fire and Smoke Separations 107

107

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.




2021 IBC Use of Fire and Smoke Separations 108

108

Fire Pump Rooms – 913.2.1

The diagram shows a fire pump room with an exterior wall and a ceiling. A 'Minimum 1-hour fire barrier*' is indicated for the ceiling. A note states '* 2-hour fire barrier required if high-rise building'. The room contains fire pump equipment. The caption below the diagram reads 'Fire pump room in sprinklered building'. Logos for IBC 2021 and the International Code Center are present at the bottom of the slide.

2021 IBC Use of Fire and Smoke Separations 109

109

Fire Alarm Systems in Group R Occupancies – 907.2.8.1 & 907.2.9.1

- In select Group R occupancies not exceeding two 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*.
 - In addition, all units must exit directly to a public way, egress court or yard.

2021 IBC Use of Fire and Smoke Separations 110

110

Smoke Control Systems – 909.5

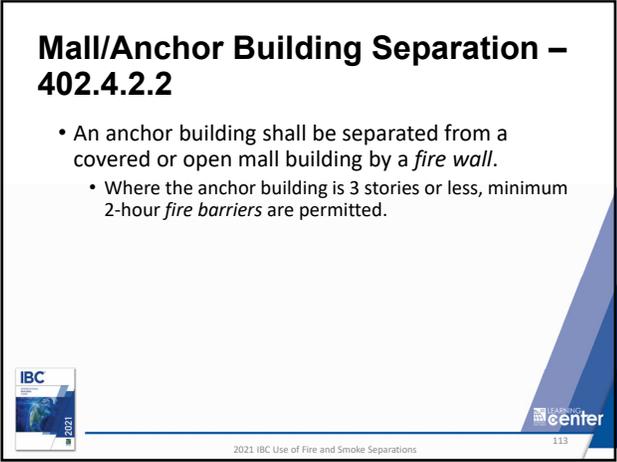
- Where construction elements are used as a part of a smoke control system, *smoke barriers* shall be provided.
 - The maximum allowable leakage area is to be calculated and reviewed for compliance.
- Smoke barriers required for:
 - Passive smoke control
 - Smoke control system using pressurization method

2021 IBC Use of Fire and Smoke Separations 111

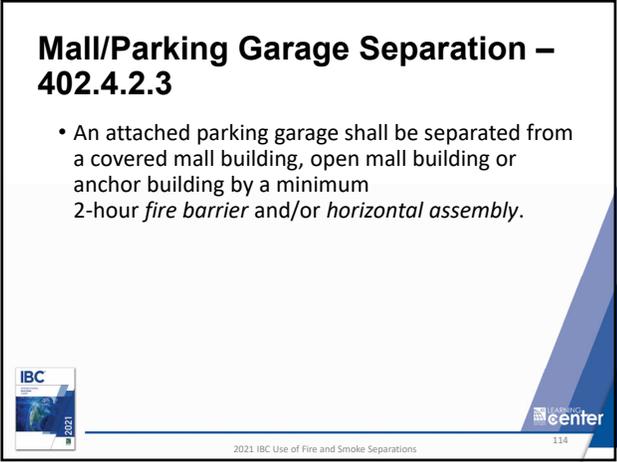
111



112



113



114

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.

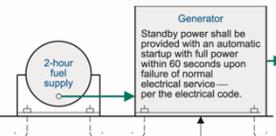



2021 IBC Use of Fire and Smoke Separations 115

115

Standby Power Protection in High-rise Buildings – 403.4.8.1

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



Generator
Standby power shall be provided with an automatic startup with full power within 60 seconds upon failure of normal electrical service—per the electrical code.

Power to:

1. Fire command center
2. Electrically powered fire pumps
3. Ventilation and automatic fire detection equipment for smokeproof enclosures

Note: if generator used for standby power and located within building, minimum 2-hour fire barrier separation required.

Note: system supervision—manual start and transfer override controls at fire command center per Section 911.




2021 IBC Use of Fire and Smoke Separations 116

116

Atrium Sprinkler Protection Section 404.3, Exception 1

- The sprinkler required for a building containing an atrium is not required for those areas adjacent and above the atrium space provided that portion is separated from the atrium by minimum 2-hour *fire barriers* and/or *horizontal assemblies*.




2021 IBC Use of Fire and Smoke Separations 117

117

Atrium Separation – 404.6

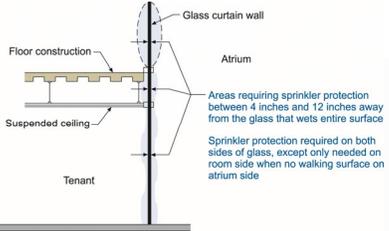
- Atrium spaces shall be separated from adjacent spaces by a minimum 1-hour *fire barrier and/or horizontal assembly*.
- The 1-hour separation is not required under one of six exceptions,
 - where glazed atrium enclosure is protected by an automatic sprinkler system,
 - ¼ hour glass block is utilized as the enclosure, or
 - atrium open to not more than 3 stories
 - atrium not required to have a smoke control system
 - openings for escalators complying with Section 712.1.3
 - openings for exit access stairways complying with Section 1019.3, Item 4




2021 IBC Use of Fire and Smoke Separations 118

118

Atrium Separation – 404.6, Exception 1



For SI: 1 inch = 25.4 mm.




2021 IBC Use of Fire and Smoke Separations 119

119

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*.

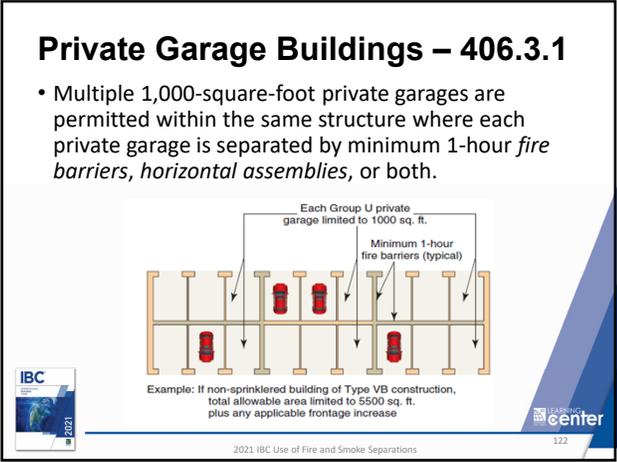



2021 IBC Use of Fire and Smoke Separations 120

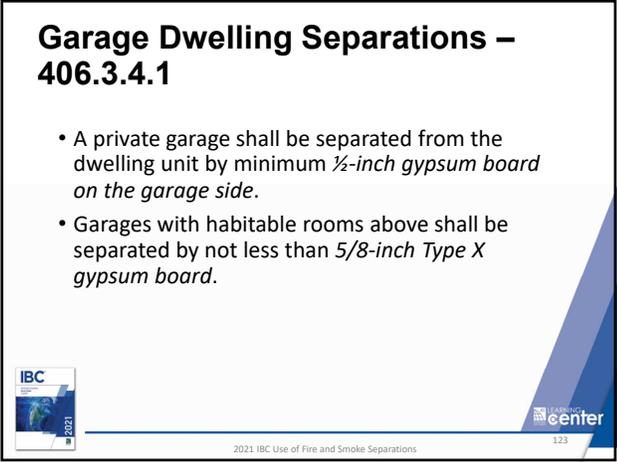
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121



122



123

Group I-1, Condition 2 and I-2 Smoke Compartments – 407.5, 420.6

- Every story in a Group I-1, Condition 2 or 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*.




2021 IBC Use of Fire and Smoke Separations 124

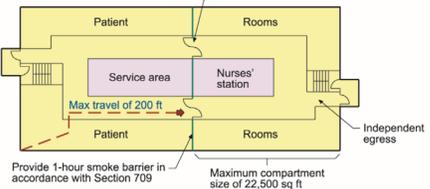
124

Group I-2 Smoke Compartments – 407.5

Refuge area sized at:

- 30 sq ft/patient where confined to beds
- 6 sq ft/patient where not confined to beds

20-minute opening protectives per Sections 709.5 and 716.5.3 (see exception for cross-corridor doors)
4 1/2 in. min clear doorways per Section 1008.1.1



For SI: 1 inch = 25.4 mm, 1 square foot = 0.093 m².




2021 IBC Use of Fire and Smoke Separations 125

125

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




2021 IBC Use of Fire and Smoke Separations 126

126

Group I-2 Corridors – 407.3

Smoke partitions per Section 710

Waiting area permitted to be open to corridor where complying with Section 407.2.1

Gift shop < 500 sq ft

Corridor

Care providers' station

Corridor

Waiting area

Corridor doors:

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

For SI: 1 square foot = 0.093 m².

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2021 IBC Use of Fire and Smoke Separations 127

127

Group I-2 Care Suites – 407.4.4.2

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

Staffing

Staffing

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128

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 have an occupant load of 50 or more

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2021 IBC Use of Fire and Smoke Separations 129

129

Group I-3 Interior Exit Stairways – 408.3.8

- One interior exit stairway in each Group I-2 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 (maximum 1,296 square inches per panel).
 - Sprinkler protection is required to wet the glazing completely.




2021 IBC Use of Fire and Smoke Separations 130

130

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.
- In Occupancy Condition 5, each sleeping area shall be separated from adjacent sleeping areas, corridors and common areas by *smoke-tight partitions*.




2021 IBC Use of Fire and Smoke Separations 131

131

Aircraft Hangar Fire Areas – 412.4.6.2

- When determining the fire suppression requirements for aircraft hangars, established fire areas shall be separated by minimum 2-hour *fire walls*.
 - Creates fire areas established in accordance with hangar classification and construction type per Table 412.3.6.




2021 IBC Use of Fire and Smoke Separations 132

132

Aircraft Hangar Fire Areas – 412.4.6.2

- 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.

Minimum 1-hour fire barrier

Storage

Maintenance shop

Offices

Floor area to be considered as fire area in application of Table 412.4.6

Aircraft hangar fire area

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133

133

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*.

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134

134

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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2021 IBC Use of Fire and Smoke Separations

135

135

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*.
- Minimum required fire rating of 1-hour may be reduced to ½-hour in buildings of Type IIB, IIIB and VB construction provided building is fully-sprinklered with NFPA 13 system (Section 708.3).




2021 IBC Use of Fire and Smoke Separations 136

136

Residential Unit Floor Separations – 420.3

- In Group I-1, R-1, R-2, R-3 and R-4 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*.
- Minimum required fire rating of 1-hour may be reduced to ½-hour in buildings of Type IIB, IIIB and VB construction provided building is fully-sprinklered with NFPA 13 system (Section 711.2.4.3).




2021 IBC Use of Fire and Smoke Separations 137

137

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*.




2021 IBC Use of Fire and Smoke Separations 138

138

Ambulatory Care Facilities Smoke Compartments – 422.3

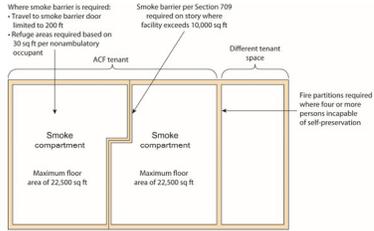
- Where the aggregate area of one or more ambulatory care facilities exceeds 10,000 square feet, *smoke barriers* are required to create smoke compartments.
 - No individual compartment is permitted to exceed 22,500 square feet.




2021 IBC Use of Fire and Smoke Separations 139

139

Ambulatory Care Facilities – 422



Where smoke barrier is required:

- Travels 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

Fire partitions required where four or more persons incapable of self-preservation

• 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 systems required (Section 907.2.2.1)
- Alarm boxes not required where building is fully sprinklered and notification appliances activate upon sprinkler water flow




2021 IBC Use of Fire and Smoke Separations 140

140

Special Building Features





2021 IBC Use of Fire and Smoke Separations

141

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.

2021 IBC Use of Fire and Smoke Separations 142

142

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.

2021 IBC Use of Fire and Smoke Separations 143

143

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.

2021 IBC Use of Fire and Smoke Separations 144

144

Stages Sections 410.2.5, 410.5

Minimum 2-hour separation between stage and other portions of the building when stage height is > 50 feet; 1-hour < 50 feet

Minimum 1-hour separation between backstage rooms

Accessory rooms: dressing rooms, workshops, store rooms

Smoke control or roof vents required when stage area > 1,000 square feet or when stage is > 50 feet in height

Proscenium curtain

Proscenium wall 2-hour fire-resistance rating when stage height > 50 feet

Exit

Finished floor of all stages may be wood
Stage required to be constructed as required for the building

For SI: 1 square foot = 0.093 m²

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2021 IBC Use of Fire and Smoke Separations 145

145

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.

STORAGE FOR SET MATERIALS, OTHER STAGE REQUIREMENTS, WIRING, PLUMBING

PLATFORM FLOOR ASSEMBLY NOT LESS THAN ONE-HOUR CONSTRUCTION

CHAIR STORAGE

FLOOR

AREA ONLY USED FOR EQUIPMENT, WIRING, PLUMBING

PLATFORM FLOOR NEED NOT BE PROTECTED FROM BELOW

FLOOR

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2021 IBC Use of Fire and Smoke Separations 146

146

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.

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2021 IBC Use of Fire and Smoke Separations 147

147

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.




2021 IBC Use of Fire and Smoke Separations 148

148

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.




2021 IBC Use of Fire and Smoke Separations 149

149

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*.





2021 IBC Use of Fire and Smoke Separations 150

150

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*.




2021 IBC Use of Fire and Smoke Separations 151

151



Hazardous Uses




152

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* with
 - ✓ openings protected by self-closing non-combustible or 1 3/4" thick solid wood core door

Exceptions: Fire-resistance construction and opening protectives not required in:

1. sprinklered spaces
2. Group R-3 and U occupancies




2021 IBC Use of Fire and Smoke Separations 153

153

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-hour or 2-hour).
- The floor assemblies separating control areas shall be minimum 2-hour *horizontal assemblies*, including supporting construction.
 - Exception for IIA, IIIA and VA construction permits 1-hour assemblies in sprinklered buildings no more than three stories above grade plane.




2021 IBC Use of Fire and Smoke Separations 154

154

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	1	2
	7-9	2	2
	6	2	2
	5	2	2
	4	2	2
	3	2	1
	2	3	1
Below grade plane	1	4	1
	75	3	1
	2	2	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 these 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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155

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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156

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*.




2021 IBC Use of Fire and Smoke Separations 157

157

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*.




2021 IBC Use of Fire and Smoke Separations 158

158

Group H-5 Fabrication Areas – 415.11.1.2

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




2021 IBC Use of Fire and Smoke Separations 159

159

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*.




2021 IBC Use of Fire and Smoke Separations 160

160

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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161

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162

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163

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164

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165
