2018 IBC Use of Fire and Smoke Separations

Based on the 2018 International Building Code® (IBC®)

Course Description

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

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.
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

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.
Fire and Smoke Separation Types

Fire-resistance-rated Separations

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

Fire Walls

- Most complex and protective fire separation.
  - Typically selected by the designer to provide an alternative solution to code compliance. A 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.
Components of Fire and Smoke Separations

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.
Vertical/Horizontal Combination

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

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.

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.
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

Fire and Smoke 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
Building Size, Use and Components

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
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.

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.

Fire Wall Ratings – Table 706.4

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

<table>
<thead>
<tr>
<th>TABLE 706.4</th>
<th>FIRE WALL FIRE-RESISTANCE RATINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP</td>
<td>FIRE-RESISTANCE RATING (hours)</td>
</tr>
<tr>
<td>A, B, E, R-4, I, R-1, R-2, U</td>
<td>3'</td>
</tr>
<tr>
<td>F-3, H-3, M, S-4</td>
<td>3</td>
</tr>
<tr>
<td>H-1, H-2</td>
<td>2</td>
</tr>
<tr>
<td>F-2, S-2, R-3, R-4</td>
<td>2</td>
</tr>
</tbody>
</table>

- In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.
- For Group R-1, H-2, and H-3 buildings, also see Sections 410.7 and 415.8.
Separated Occupancies – Table 508.4

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>S</th>
<th>NS</th>
<th>N</th>
<th>NP</th>
<th>F</th>
<th>R</th>
<th>M</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, 4</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
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<tr>
<td>6</td>
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<tr>
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<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>B, C, M, S</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Table 508.4 requires separation of occupied areas identified in Table 508.4.

Incidental Uses – Table 509

- 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, waste 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, waste 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.
Horizontal Separation - 510.2

1. Type A construction
2. Type B construction
3. Fully sprinklered horizontal assembly and protection for all occupants within Group R
4. Single building or horizontal in feet
5. Stair, stairway, through-hallway assembly to be considered separate buildings for
   number of stories
6. Fire-rated assembly

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

- 9 stories, 100 feet
- 2-hour
- 1 ½-hours
- ≥ 50 feet
- Plan View
- Elevation View

Buildings on Same Lot – 503.1.2

A: separate buildings
B: single building

For Walk-Up Code, 100% foot, 1 story feet = 0.039 ft

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TABLE 602

For resistance rating requirements for exterior walls based on the separation distances:

<table>
<thead>
<tr>
<th>FIRE SEPARATION DISTANCE (feet)</th>
<th>TYPE OF CONSTRUCTION</th>
<th>OCCUPANCY GROUP</th>
<th>FIRE-RESISTANCE RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>X &lt; 5</td>
<td>IA</td>
<td>OCCUPANCY GROUP H e</td>
<td>F-1, M, S-1 f</td>
</tr>
<tr>
<td>5 &lt; X &lt; 30</td>
<td>IA, IB, IIB, VB</td>
<td>OCCUPANCY GROUP A, B, E, F-2, I, R i, S-2, U h</td>
<td>2</td>
</tr>
<tr>
<td>X &gt; 30</td>
<td>Others</td>
<td>OCCUPANCY GROUP A, B, E, F-2, I, R i, S-2, U h</td>
<td>1</td>
</tr>
</tbody>
</table>

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating of Table 601.
b. See Section 706.1.1 for party walls.
c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
d. 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.
e. For special requirements for Group H occupancies, see Section 415.6.
f. For special requirements for Group S aircraft hangars, see Section 412.3.1.
g. 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.
h. 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.
i. For a Group R-3 building of Type II-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.

Means of Egress

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!
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.

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.

Horizontal Exits – 1026.4
Exterior Stairways and Ramps – 1027.6

- Rating comes from Section 2607.
  - ≥ 1-hr w/ ¾-hr prot. openings
- Rating comes from Section 2607.3
  - ≥ 1-hr or ≥ 2-hr w/gress door as only opening
- Rating comes from Section 2607
  - ≥ 10 ft

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.

Corridor Construction – Table 1020.1

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>OCCUPANT LOAD SERVED BY CORRIDOR</th>
<th>REQUIRED FIRE RESISTANCE RATING (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-1, 2, 3</td>
<td>All</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>H-4, 5</td>
<td>Greater than 30</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>A, B, E, F, M, S, U</td>
<td>Greater than 30</td>
<td>1</td>
</tr>
<tr>
<td>I-1, I-3</td>
<td>All</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>I-2, I-4</td>
<td>All</td>
<td>1</td>
</tr>
</tbody>
</table>

- 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 603.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted everywhere within buildings.
Corridor Continuity – 1020.6

• 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.

Areas of Refuge – 1009.6.4

Exterior Area for Assisted Rescue – 1009.7.2
Egress Courts – 1028.4.2

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

2. 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 sprinkled or separated from the egress path by construction equivalent to the stair enclosure.

3. Distance between exit access stair and exit discharge door shall be at least 30' or ¼ length of overall diagonal of building, whichever is less.

Fire Limitation Features
Fire Areas – 901.7

<table>
<thead>
<tr>
<th>TABLE NO. 10</th>
<th>FIRE RESISTANCE RATING REQUIREMENTS FOR FIRE SEPARATIONS IN THE INTERNATIONAL CODES RESPECTIVE FOR AREAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESISTANCE RATING</td>
<td>FIRE RESISTANCE RATING</td>
</tr>
<tr>
<td>1, 2, A, B, C, D</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>12</td>
</tr>
<tr>
<td>F, G, H, I, J</td>
<td>24</td>
</tr>
</tbody>
</table>

Fire Pump Rooms – 913.2.1

Special Building Types
Mall Separations – 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.
- 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.
- 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.

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

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.
Special Occupancies and Uses

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.

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.
2018 IBC Use of Fire and Smoke Separations

Special Building Features

Stages- Section 410.3

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.
Hazardous Uses

Control Areas – Table 414.2.2

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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