The Five Walls of the IBC

- David Dodge, CSI, CDT

Definitions

- Fire Walls – Section 706
- Fire Barriers – Section 707
- Fire Partitions – Section 708
- Smoke Barriers – Section 709
- Smoke Partitions – Section 710
DEFINITIONS

Fire Walls
Section 706

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

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

BUILDING CODE REQUIREMENTS

Opening Protectives
Section 715 (2009)

Table 715.4: Fire Door and Fire Shutter Fire Protection Ratings

<table>
<thead>
<tr>
<th>Type of Assembly</th>
<th>Required Assembly Rating (Hours)</th>
<th>Minimum Fire Door &amp; Fire Assembly Rating (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Walls and Fire Barriers having a required fire-resistance rating greater than 1 hour.</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>1 1/2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Fire Barriers having a required fire-resistance rating of 1 hour.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Other fire barriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Fire Partitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft, exit enclosure and exit passageway walls</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1/2</td>
</tr>
<tr>
<td>Other fire barriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1/3</td>
</tr>
<tr>
<td>Fire Partitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corridor walls</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1/2</td>
</tr>
<tr>
<td>Other fire partitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1/3</td>
</tr>
<tr>
<td>Exterior Walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Smoke Barriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1/2</td>
</tr>
</tbody>
</table>

4. * For doors, each with a fire protection rating of 1 1/2 hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour door.
6. For testing requirements, see Section 716.4.3.
## Table 716.5: Opening Fire Protection Assemblies, Ratings and Markings

| Type of Assembly                                      | Required Assembly Rating (Hours) | Minimum Fire Door & Fire Shutter Assembly Rating (Hours) | Door Vision Panel Size | Fire-Rated Glazing Marking (Door Vision Panel) | Fire-Rated Glazing Marking (Sidelight/Transom Panel) | Fire Protection | Fire Resistance | Fire Protection | Fire Resistance |
|-------------------------------------------------------|----------------------------------|----------------------------------------------------------|------------------------|-----------------------------------------------|------------------------------------------------|---------------|----------------|----------------|----------------|---------------|
| Fire Walls and Fire Barriers having a required fire-resistance rating greater than 1 hour | 4                                | Not Permitted                                            | Not Permitted           | Not Permitted                                 | W-240                                          | 4             | Not Permitted   | W-240          |                 |
|                                                       | 3                                | Not Permitted                                            | Not Permitted           | Not Permitted                                 | W-360                                          | 3             | Not Permitted   | W-360          |                 |
|                                                       | 2                                | 1 1/2                                                    | 100 sq. in.             | Not Permitted                                 | W-120                                          | 2             | Not Permitted   | W-120          |                 |
|                                                       | 1 1/2                            | 1 1/2                                                    | 100 sq. in.             | Not Permitted                                 | W-90                                           | 1             | Not Permitted   | W-90           |                 |
| Fire Barriers having a required fire-resistance rating of 1 hour | 1                                | 1                                                       | 100 sq. in.             | Not Permitted                                 | W-60                                           | 1             | Not Permitted   | W-60           |                 |
|                                                       | 1 1/2                            | 1 1/2                                                    | 100 sq. in.             | Not Permitted                                 | W-360                                          | 1 1/2         | Not Permitted   | W-360          |                 |
| Fire Barriers having a required fire-resistance rating of 1 hour | 1                                | 1 1/2                                                    | Maximum size tested     | D-H-45                                         | D-H-45                                         | 1 1/2         | D-H-45         | D-H-45         |                 |
| Fire Barriers having a required fire-resistance rating of 1 hour | 1                                | 1 1/2                                                    | Maximum size tested     | D-H-NT-45                                      | D-H-NT-45                                      | 1 1/2         | D-H-NT-45      | D-H-NT-45      |                 |
| Other fire barriers                                   | 1                                | 1 1/2                                                    | Maximum size tested     | D-H-20                                         | D-H-20                                         | 1 1/2         | D-H-20         | D-H-20         |                 |

### Notes:
- Fire walls, each with a fire protection rating of 1 1/2 hours, installed on opposite side of the same opening in a fire wall, shall be deemed equivalent to fire protection rating to one 3-hour door.
- For testing requirements, see Section 716.4.3.
TEST CRITERIA

NFPA 252
UL 10B (Fire Protection Rating)

- Heat Transfer: Unlimited!
- Cool Air In
- Hot Gases Out
- Furnace Temperature 1800°+ (Fire Protection Rating)

TEST CRITERIA

Hose Stream
UL 10B (Fire Protection Rating)
Hose Stream
UL 10B (Fire Protection Rating)
TEST CRITERIA

NFPA 252 (Fire Protection)
Temperature Rise (Fire Protection Rating)

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

TEST CRITERIA

ASTM E-119
UL 263 (Fire Resistance Rating)

Heat Transfer:
The unexposed side of the
assembly cannot exceed
250 degrees for the duration
of the test.
TEST CRITERIA

Positive Pressure Test
40" Neutral Plane (Fire Protection Rating)

UL 10C

DEFINITIONS

Fire Barriers
Section 707

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

- Fire Ratings (Table 707.3)
  - 1-hour
  - 2-hour
  - 3-hour
  - 4-hour
- Opening Protection (707.6)
- Design Notes
- Applications
DEFINITIONS

Fire Partitions
Section 708

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

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

BUILDING CODE REQUIREMENTS

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

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

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<th>Required Assembly Rating (Hours)</th>
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<tr>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>1 1/2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Fire Barriers having a required fire-resistance rating of 1 hour.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shaft, exit enclosure and exit passageway walls</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Other fire barriers</td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Fire Partitions</td>
<td>1</td>
<td>1/29</td>
</tr>
<tr>
<td>Corridor walls</td>
<td>1/29</td>
<td>1/29</td>
</tr>
<tr>
<td>Other fire partitions</td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Exterior Walls</td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3/4</td>
</tr>
<tr>
<td>Smoke Barriers</td>
<td>1</td>
<td>1/29</td>
</tr>
</tbody>
</table>

* For doors, each with a fire protection rating of 1 1/2 hours, installed on opposite side of same opening in a fire wall, shall be deemed equivalent to fire protection rating to one 3-hour door.
* For testing requirements, see Section 716.4.3.
DEFINITIONS

Smoke Barriers
Section 709

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

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

DEFINITIONS

Smoke Partitions
Section 710

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

• Fire Ratings (Table 710.3)
  Non-rated
• Opening Protection
• Design Notes
• Applications
BUILDING CODE REQUIREMENTS

Types of Construction
Chapter 6

<table>
<thead>
<tr>
<th>Level of Protection</th>
<th>Construction Type</th>
<th>Most Elements Protected</th>
<th>Most Elements Unprotected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-combustible</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Combustible</td>
<td>III</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>HT (Heavy Timber)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>A</td>
</tr>
</tbody>
</table>

Vertical Opening Separation

- Fundamental Guidelines
- Exit Access Stairs
- Vertical Openings – Escalator
- Interior Exit Stairs
- Atriums
- Vertical Compartmentation
Fundamental Guidelines (2009)
Sections 708, 1016 & 1022

Vertical openings between floors – in various shapes, heights and uses – are a frequently-used design element in multi-story buildings. For the purposes of code enforcement the following general categories are described in the building code:

1. Shaft Enclosures (708)
   a. Escalators (708.2, Exception #2)
   b. Mezzanines (708.2, Exception #9)
   c. Stairs or ramps (708, 1020)
   d. Elevators & dumbwaiters (708.14)
2. Atriums (404)
3. Vertical Exit Enclosures (Section 1022)
4. Non-egress and/or communicating stairs (708.2, Exception #11 & 1016.1, Exception #3 & #4)

Exception #7
7. In other than Groups I-2 and I-3, a shaft enclosure is not required for a floor opening or an air transfer opening that complies with the following:
   7.1. Does not connect more than two stories.
   7.2. Is not part of the required means of egress system.
   7.3. Is not concealed within the construction of a wall or a floor/ceiling assembly.
   7.4. Is not open to a corridor in Group I and R occupancies.
   7.5. Is not open to a corridor on nonsprinklered floors in any occupancy.
   7.6. Is separated from floor openings …
   7.7. Is limited to the same smoke compartment.

Non-Egress Stairs (2009)
Sections 708.2; 1016.1; 1021.1; 1022.1

Exception #7
7. In other than Groups I-2 and I-3, a shaft enclosure is not required for a floor opening or an air transfer opening that complies with the following:
   7.1. Does not connect more than two stories.
   7.2. Is not part of the required means of egress system.
   7.3. Is not concealed within the construction of a wall or a floor/ceiling assembly.
   7.4. Is not open to a corridor in Group I and R occupancies.
   7.5. Is not open to a corridor on nonsprinklered floors in any occupancy.
   7.6. Is separated from floor openings …
   7.7. Is limited to the same smoke compartment.
Exception #11
11. A shaft enclosure shall not be required for floor openings created by unenclosed stairs or ramps in accordance with Exception 3 or 4 in Section 1016.1

1016.1 Travel distance limitations.
Exceptions:
3. In other than Groups H and I, the exit access travel distance to a maximum of 50 percent of the exits is permitted to be measured from the most remote point within a building to an exit using unenclosed exit access stairways or ramps when connecting a maximum of two stories. The two connected stories shall be provided with at least two means of egress. Such interconnected stories shall not be open to other stories.
1016.1 Travel distance limitations.

Exceptions:
4. In other than Groups H and I, the exit access travel distance to a maximum of 50 percent of the exits is permitted to be measured from the most remote point within a building to an exit using unenclosed exit access stairways or ramps in the first and second stories above grade plane in building equipped throughout with an automatic sprinkler system ... The first and second stories above grade plane shall be provided with at least two means of egress. Such interconnected stories shall not be open to other stories.
1021.1 Exits from stories.
Exceptions:
3. Exit access stairways and ramps that comply with Exception 3 or 4 of Section 1016.1 shall be permitted to provide the minimum number of approved exits required by Table 1021.1 on each story.
Chapter 7 Shuffle

2009

701 General
702 Definitions
703 Fire-resistance Ratings and Fire Tests
704 Fire-resistance Rating of Structural Members
705 Exterior Walls
706 Fire Walls
707 Fire Barriers
708 Shaft Enclosures
709 Fire Partitions
710 Smoke Barriers
711 Smoke Partitions
712 Horizontal Assemblies
713 Penetrations
714 Fire-resistant Joint Systems
715 Opening Protectives
716 Ducts and Air Transfer Openings
717 Concealed Spaces
718 Fire-resistance Requirements for Plaster
719 Thermal- and Sound-insulating Materials
720 Prescriptive Fire Resistance
721 Calculated Fire Resistance

2012

701 General
702 Definitions
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714 Fire-resistant Joint Systems
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721 Calculated Fire Resistance

BUILDING CODE REQUIREMENTS

Shaft Enclosures
Section 708.2 (2009) Exceptions Shuffle

Section 708 has been divided into two separate sections:

1. Section 713 Shaft Enclosures - this section addresses the basic provisions of shaft construction and elevator lobby.
2. Section 712 Vertical Openings - this section addresses the previous 16 exceptions located in Section 708.2.
Section 712.1.12 Unenclosed stairs and ramps. Vertical floor openings created by unenclosed stairs or ramps in accordance with Sections 1009.2 and 1009.3 shall be permitted.

Section 1009.2 Interior exit stairways.

Section 1009.2.2 Enclosure. All interior exit stairways shall be enclosed in accordance with the provisions of Section 1022.

Section 1009.3 Exit access stairways. Floor openings between stories created by exit access stairways shall be enclosed.

Exceptions:

1. In other than I-2 and I-3 occupancies, exit access stairways that serve, or atmospherically communicate between, only two stories are not required to be enclosed.
BUILDING CODE REQUIREMENTS

Number of Exits & Exit Configuration
Section 1021

2012 Edition
Section 1021.1 General. Each story and occupied roof shall have the minimum number of exits, or access to exits as specified in this section. The required number of exits, or exit access stairways or ramps providing access to exits, from any story shall be maintained until arrival at grade or a public way … Each story above the second story of a building shall have a minimum of one interior or exterior exit stairway … at each story above the second story that requires a minimum of three or more exits, or access to exits, a minimum of 50 percent of the required exits shall be interior exit stairways …

2015 Edition
Section 1006.3 Egress from stories or occupied roofs … Each story above the second story of a building shall have not less than one interior or exterior exit stairway …
### BUILDING CODE REQUIREMENTS

**Number of Exits & Exit Configuration**  
Section 1006

<table>
<thead>
<tr>
<th>Story</th>
<th>Occupancy</th>
<th>Maximum Occupants Per Story</th>
<th>Maximum Common Path of Egress Travel Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First story above or below grade plane</td>
<td>A, Br, E, F, M, U, S</td>
<td>49</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>H-2, H-3</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>H-4, H-5, I, R-1, R-2, R-4</td>
<td>10</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>29</td>
<td>75</td>
</tr>
<tr>
<td>Second story above grade plane</td>
<td>B, F, M, S</td>
<td>29</td>
<td>75</td>
</tr>
<tr>
<td>Third story above grade plane and higher</td>
<td>NP</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 1021.2(2): Stories with One Exit or Access to One Exit for Other Occupancies