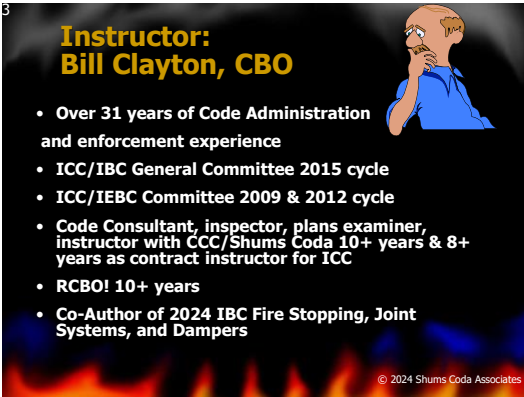




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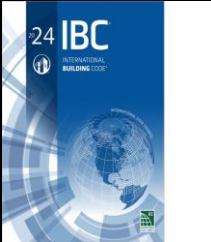
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3

Agenda


- Explore the various types of rated assemblies
- Discuss penetrations and joint systems
- Look at some common issues with Multi-family projects related to today's subject



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4

- Thank you to Brice Miller and Rich Walke for contributing slides to this program.

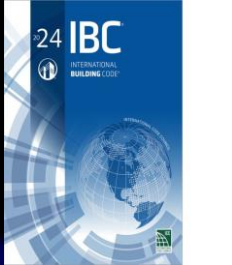


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5

Class Summary

- Different Types of Fire-Resistance Rated Assemblies
- Fire Protected Openings & Penetrations
- Joint Treatment Systems
- Types of Dampers
- Effective use of the code
- Inspection and plan review tips!



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Why Fire-Resistive Rated Construction?



Chicago Fire
October 8, 1871
250 Deaths



Cocoanut Grove Nightclub
November 28, 1942
491 Deaths

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Why Fire-Resistive Rated Construction?



Beverly Hills Supper Club
May 28, 1977
164 Deaths




MGM Fire
November 21, 1980
84 deaths and 679 injured

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8

Fire and Smoke Protection Features 701.1 - Scope

- The provisions of this chapter shall govern the materials, systems and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.




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Fire-Resistant Ratings & Fire Tests – 703.3.1

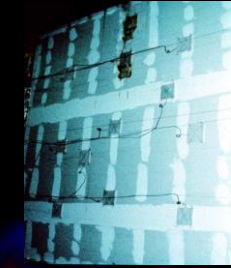
- The fire-resistance rating of building elements shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263 or in accordance with Section 703.3.



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ASTM E119




- “fire-resistive properties of materials and assemblies be measured and specified to a common standard”
- “prescribe a standard exposing fire of controlled extent and severity”

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Fire-Resistance Ratings 703.2


- Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced.



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Fire-Resistance Ratings 703.2



- Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements, components or assemblies shall not reduce the required fire-resistance rating .
- Exception for Exterior Walls

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ASTM E 119 or UL 263 Documentation



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Gypsum Association

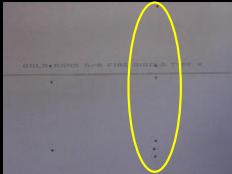
- Phone: 800-323-3471
- Fax: 708-957-1101
- www.gypsum.org
- American Technical Publishers
- 10100 Orland Parkway, Suite 200
- Orland Park, IL 60467-5756

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GA Explanatory Notes

- 3. Screws meeting ASTM C 1002 shall be permitted to be substituted for the prescribed nails, one for one, when the length and head diameter of the screws equal or exceed those of the nails specified in the tested system and the screw spacing does not exceed the spacing specified for the nails in the tested system.



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GA Explanatory Notes

- 6. Unless otherwise specified, the face layers of all systems, except those with predecorated or metal covered surfaces, shall have joints taped (minimum Level 1 as specified in GA-214, Recommended Levels of Gypsum Board Finish) and fastener heads treated. Base layers in multi-layer systems shall not be required to have joints taped.



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GA Explanatory Notes

- 10. Water-resistant gypsum backing board shall be installed over or as part of the fire-resistance rated system in shower and tub areas to receive ceramic or plastic finished wall panels. When fire or sound ratings are necessary, the gypsum board required for the rating shall extend down to the floor behind fixtures so that the construction will equal that of the tested system.

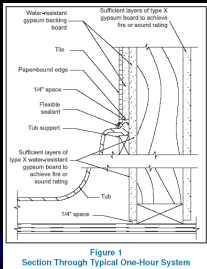


Figure 1
Section Through Typical One-Hour System


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21

21

GA Explanatory Notes

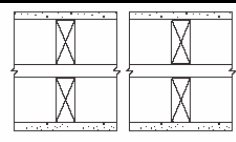
- 19. Specified floor-ceiling and roof-ceiling framing sizes or truss dimensions are minimums. Greater joist or truss sizes (depths) shall be permitted to be used in metal- or wood-framed systems. Indicated joist and truss spacings are maximums.



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GA Explanatory Notes



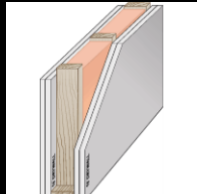
- 20. Within design limitations, the distance between parallel rows of studs, such as in a chase wall, shall be permitted to be increased beyond that tested.
- When stud cavities in walls constructed of parallel rows of steel studs exceed 9 1/2 inches and cross bracing is required the cross bracing shall be fabricated from steel studs.

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GA Explanatory Notes

- 24. Additional layers of type X or regular gypsum board shall be permitted to be added to any system.



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GA Explanatory Notes

- 25. When not specified as a component of a fire-resistance rated wall or partition system, wood structural panels shall be permitted to be added to one or both sides. Such panels shall be permitted to be applied either as a base layer directly to the framing (under the gypsum board), as a face layer (over the face layer of gypsum board) or between layers of gypsum board in multi-layer systems. When such panels are applied under the gypsum board or between layers of gypsum board the length of the fasteners specified for the attachment of the gypsum board applied over the wood structural panels shall be increased by not less than the thickness of the wood structural panels. Fastener spacing for the gypsum board and the number of layers of gypsum board shall be as specified in the system description.

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Exterior Wall Fire Ratings 705.5

- Exterior walls shall be fire-resistance rated in accordance with Tables 601 and 705.5.

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


FIRE SEPARATION DISTANCE, X (ft/m)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP 1 ^c	OCCUPANCY GROUP F-1, H, S-1 ^d	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U ^e
X < 5 ^f	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 ^g
	IB, VB	1	0	0
X ≥ 30	Others	1	1	1 ^g
	All	0	0	0

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Exterior Wall 705.5

GA FILE NO. WP 8105	GENERIC	1 HOUR FIRE
---------------------	---------	-------------

GYPSUM WALLBOARD, GYPSUM SHEATHING, WOOD STUDS




EXTERIOR SIDE: One layer 48" wide 5/8" type X gypsum sheathing applied parallel to 2 x 4 wood studs 24" o.c. with 1/4" galvanized roofing nails 4" o.c. at vertical joints and 7" o.c. at intermediate studs and top and bottom plates. Joints of gypsum sheathing may be left untreated. Exterior cladding to be attached through sheathing to studs.

INTERIOR SIDE: One layer 5/8" type X gypsum wallboard, water-resistant gypsum backing board, or gypsum veneer base applied parallel or at right angles to studs with ed coated nails, 19" long, 0.0615" shank, 1/4" heads, 7" o.c. (LOAD-BEARING)

Thickness: Varies
Approx. Weight: 7 psf
Fire Test: See WP 3510 (UL F5501-47, -48, 9-17-65, UL Design 1030), UL R1319-129, 7-28-70, UL Design 10314)

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Exterior Wall 705.5

GA FILE NO. WP 8006	PROPRIETARY*	1 HOUR FIRE																								
GYPSUM WALLBOARD, GLASS MAT GYPSUM SUBSTRATE, STEEL STUDS, MINERAL OR GLASS FIBER INSULATION																										
<p>EXTERIOR SIDE: One layer #4 proprietary type X glass mat gypsum substrate (sheathing) applied parallel to 2x4" 20 gage steel studs 24" o.c. with 1" Type S-12, self-drilling, corrosion resistant, bugle head, drywall screws 12" o.c. Studs attached to both vertical legs of floor and ceiling runners either by welding or with 1/2" Type S-12 pan head screws. Mineral or glass fiber insulation friction fit into the stud space. Exterior cladding to be attached through glass mat gypsum panel to studs.</p>																										
<p>INTERIOR SIDE: One layer #4 proprietary type X gypsum board applied parallel to studs with 1" Type S-12 drywall screws 12" o.c.</p>																										
<p>Bracing: Lateral bracing spaced not over 40' o.c. shall be 1" by 18 gage steel straps attached to each side or channel bracing attached to each stud with a clip angle. For studs with holes or punch-outs in the web the "W" factor shall be determined by means of stub column tests. Tested at 100 percent of design load. (LOAD-BEARING)</p>																										
<p>PROPRIETARY GYPSUM PANEL PRODUCTS</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">CertainTeed Gypsum Inc.</td> <td style="width: 40%;">#4 ProFlo® Type X Gypsum Panels</td> <td style="width: 30%;"></td> </tr> <tr> <td></td> <td>#4 GlasFlo® Sheathing Type X Gypsum Panels</td> <td></td> </tr> <tr> <td>CertainTeed Gypsum Canada Inc.</td> <td>#4 ProFlo® Type X Gypsum Panels</td> <td></td> </tr> <tr> <td>Georgia-Pacific Gypsum LLC</td> <td>#4 ToughFlo® Fireguard®</td> <td></td> </tr> <tr> <td></td> <td>#4 DuraClass Gold® Fireguard®</td> <td></td> </tr> <tr> <td>National Gypsum Company</td> <td>#4 ePRO® FIRE-SHELD® Gypsum Sheathing</td> <td></td> </tr> <tr> <td></td> <td>#4 Gold Bond® Brand FIRE-SHELD® Gypsum Board</td> <td></td> </tr> <tr> <td>Temple-Inland</td> <td>#4 GreenGlass Type X #4 Type X</td> <td></td> </tr> </table>			CertainTeed Gypsum Inc.	#4 ProFlo® Type X Gypsum Panels			#4 GlasFlo® Sheathing Type X Gypsum Panels		CertainTeed Gypsum Canada Inc.	#4 ProFlo® Type X Gypsum Panels		Georgia-Pacific Gypsum LLC	#4 ToughFlo® Fireguard®			#4 DuraClass Gold® Fireguard®		National Gypsum Company	#4 ePRO® FIRE-SHELD® Gypsum Sheathing			#4 Gold Bond® Brand FIRE-SHELD® Gypsum Board		Temple-Inland	#4 GreenGlass Type X #4 Type X	
CertainTeed Gypsum Inc.	#4 ProFlo® Type X Gypsum Panels																									
	#4 GlasFlo® Sheathing Type X Gypsum Panels																									
CertainTeed Gypsum Canada Inc.	#4 ProFlo® Type X Gypsum Panels																									
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	#4 DuraClass Gold® Fireguard®																									
National Gypsum Company	#4 ePRO® FIRE-SHELD® Gypsum Sheathing																									
	#4 Gold Bond® Brand FIRE-SHELD® Gypsum Board																									
Temple-Inland	#4 GreenGlass Type X #4 Type X																									
																										
		<p>Thickness: 4 1/2" Approx. Weight: 8 pcf File Test: UL R360/R15187, DTMC1103, 34-422, ULF9837, OTNKG079, 8-18-08, UL Design U425</p>																								

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TABLE 705.9
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA ^a
0 to less than 2 ^b 1/4	Unprotected, Nonsprinklered (LP, NS)	Not Permitted ^c
	Unprotected, Sprinklered (LP, S)	Not Permitted ^c
	Protected (P)	Not Permitted ^c
3 to less than 5 ^b 1/4	Unprotected, Nonsprinklered (LP, NS)	Not Permitted
	Unprotected, Sprinklered (LP, S)	15%
	Protected (P)	15%
5 to less than 10 ^b 1/2	Unprotected, Nonsprinklered (LP, NS)	10% ^d
	Unprotected, Sprinklered (LP, S)	25%
	Protected (P)	25%
10 to less than 15 ^b 1/4	Unprotected, Nonsprinklered (LP, NS)	15% ^d
	Unprotected, Sprinklered (LP, S)	45%
	Protected (P)	45%
15 to less than 20 ^b 1/2	Unprotected, Nonsprinklered (LP, NS)	25%
	Unprotected, Sprinklered (LP, S)	75%
	Protected (P)	75%
20 to less than 25 ^b 1/2	Unprotected, Nonsprinklered (LP, NS)	45%
	Unprotected, Sprinklered (LP, S)	No Limit
	Protected (P)	No Limit
25 to less than 30 ^b 1/2	Unprotected, Nonsprinklered (LP, NS)	70%
	Unprotected, Sprinklered (LP, S)	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (LP, NS)	No Limit
	Unprotected, Sprinklered (LP, S)	No Limit
	Protected (P)	No Limit

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Ducts And Air Transfer Openings - 705.10

- Penetrations by air ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings shall comply with Section 717.5.6
- EXCEPTION: Foundation vents




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Structural Stability 706.2

- Fire walls shall be designed and constructed to allow collapse of the structure on either side without collapse of the wall under fire conditions. Fire walls designed and constructed in accordance with NFPA 221 shall be deemed to comply with this section.



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Fire wall Rating requirement: Table 706.4

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-30, 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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NFPA 221 Fire wall rating 706.4 & 716.1

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-30, 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


Double fire walls constructed in accordance with NFPA 221	Single-wall assembly rating (hours) ^a	Each wall of the double-wall assembly (hours) ^b	See NOTE a	D-H-W-180		D-H-W-90		D-H-W-60	
				≤ 100 sq. in. = D-H-90	> 100 sq. in. = D-H-180	≤ 100 sq. in. = D-H-90	> 100 sq. in. = D-H-180	≤ 100 sq. in. = D-H-60	> 100 sq. in. = D-H-120
4	3	3	Not Permitted	3	Not Permitted	3	Not Permitted	3	Not Permitted
3	2	1 ^{1/2}	100 sq. in.	Not Permitted	2	Not Permitted	2	Not Permitted	W-120
2	1	1	100 sq. in.	Not Permitted	1	Not Permitted	1	Not Permitted	W-60

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Materials 706.3


- Noncombustible materials except Type V



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Horizontal Continuity 706.5



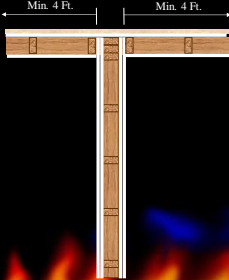
- Fire walls shall be continuous from exterior wall to exterior wall and shall extend at least 18 inches beyond the exterior surface of exterior walls.

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Horizontal Continuity 706.5, Exception 1

- Shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided the exterior wall has a fire-resistance rating of at least 1 hour for a horizontal distance of at least 4 feet on both sides of the fire wall.
- Openings within such exterior walls shall be protected by fire assemblies having a fire-protection rating of not less than 3/4 hour.



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Horizontal continuity exception 2

- Same as exception but1 but dealing with non-combustible exterior sheathing and openings are not regulated

Min. 4 Ft. Min. 4 Ft.

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Horizontal continuity exception 3

- Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the fire wall is protected by an NFPA 13 or 13R fire sprinkler system.

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Vertical continuity 706.6

- Fire walls shall extend from the foundation to a termination point at least 30 inches above both adjacent roofs.

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Fire Wall Openings 706.8

- Section 716 for rating requirements
- Each opening limited to 156 square feet unless both buildings are sprinklered with NFPA 13 system.
- No opening permitted in party walls in accordance with 706.1.1
- Aggregate width at any floor limited to 25 % of length of wall

TYPE OF ASSEMBLY	REGULATED WALL PERMITTED OPENING (FOOT)	MINIMUM FIRE RATING AND FIRE RESISTANCE PERIOD (HOURS)	OTHER WALLS PERMITTED OPENING (FOOT)	FIRE RATING		FIRE RESISTANCE PERIOD (HOURS)	
				MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Fire walls and fire partitions having an aggregate area greater than 100 sq. ft.	0	0	0	1	2	0	0
	0	0	0	1	2	0	0
Fire walls and fire partitions having an aggregate area less than 100 sq. ft.	0	0	0	1	2	0	0
	0	0	0	1	2	0	0

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Ducts and Air Transfer Openings – 706.11



- Ducts and air transfer openings shall not penetrate fire walls.
- Exception: walls **not** located on a lot line provided the penetrations comply with 717
Limited 25% of length of wall

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Fire Barriers 707



- Shaft enclosures
- Interior exit stairways
- Exit access stairway enclosures
- Exit passageways
- Horizontal exits
- Atrium separations
- Incidental use areas
- Control areas
- Separation of mixed occupancies
- Fire areas

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IBC Chapter 7 Cont. Fire Barriers Section 707

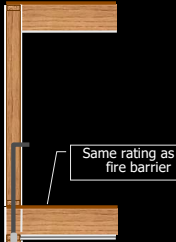
- Fire Barrier used to separate
 - Exits, shafts, incidental use areas, hazardous material control areas and fire areas
- Table 707.3.10
- Continuity
- Voids at Intersections

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

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Fire Barrier Continuity 707.5



- Fire barriers shall extend from the top of the floor/ceiling assembly below to the underside of the floor sheathing, slab or deck above
- Continuous through concealed spaces such as suspended ceilings
- Balloon framed, or platform if interruption is of same fire rating

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Supporting construction 707.5.1

- The supporting construction for a fire barrier shall be protected to afford the required fire-resistance rating of the fire barrier supported.
- Hollow vertical spaces within a fire barrier shall be fireblocked in accordance with Section 718.2 at every floor level.

Exceptions:

1. The maximum required fire-resistance rating for assemblies supporting fire barriers separating tank storage as provided for in Section 415.9.1.2 shall be 2 hours, but not less than required by Table 601 for the building construction type.
2. Supporting construction for 1-hour fire barriers required by Table 509.1 in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

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707.6 Openings in Fire barriers

- Max aggregate width of 25% of the wall length, and any single opening max. 156 SQ ft.
- (8 exceptions)

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Fire Partitions 708




- Dwelling separations
- Sleeping unit separations
- Tenant separations in mall buildings
- Corridor walls
- Elevator lobby separations
- Egress Balconies

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Fire Partitions Continuity 708.4

- From the top of the foundation or floor/ceiling assembly below to the underside of the floor/roof sheathing, slab or deck above, or
- to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above
- must be securely attached thereto.
- If not continuous to the deck, in combustible construction, the space between the ceiling and the deck above shall be fire-blocked or draft stopped at the partition line in accordance with 708.4.3.



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Fire Partitions Continuity 708.4.1

- Supporting construction shall be protected to afford the required fire-resistance rating of the wall supported,
- except for tenant and sleeping room separation walls and exit access corridor walls in buildings of Types IIB, IIIB, and VB construction.

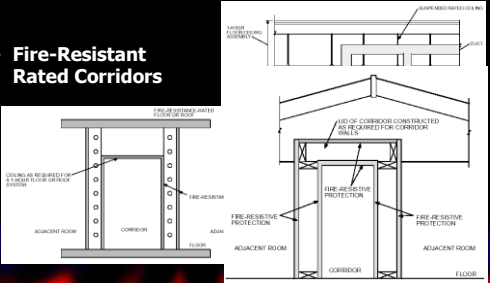


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Fire Partition Continuity Exceptions

- Fire-Resistant Rated Corridors



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Smoke Partitions 710

- Glass atrium separation
- I-2 corridor walls
- Elevator lobbies in sprinklered buildings



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Smoke Partitions 710.4 Continuity



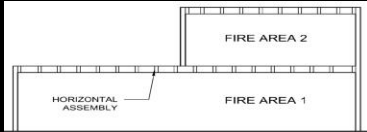
- Not required to have fire-resistive rating
- Must extend from the floor to the underside of the floor or roof deck above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke

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IBC Horizontal Assemblies Section 711 (floor & roof assemblies)



Definition Horizontal Assembly

– A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

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Fire Resistance Rating 711.2

- Type of Construction
- Type of Separation, occupancy, dwelling or sleeping units, fire areas,
- I-1, R-1, R-2
 - One-hour fire-resistive




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Continuity 711.2.2

- Assemblies shall be continuous without vertical openings, except as permitted by this section and Section 712.



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Vertical Openings thru horizontal assemblies 712



- The provisions of this section shall apply to the vertical opening applications listed in Sections 712.1.1 through 712.1.16.

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I-Joist Floor System

GA FILE NO. FC 5407	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND
---------------------	---------	-------------	--------------------

WOOD I-JOISTS, GYPSUM WALLBOARD

Base layer 1/2" Type X gypsum wallboard applied at right angles to wood I-joists 24" o.c. with 1 1/4" Type W or S drywall screws 24" o.c. Face layer 1/2" Type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1 1/4" Type W or S drywall screws 12" o.c. at joints and intermediate I-joists and 1 1/2" Type D drywall screws 12" o.c. placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Wood I-joists supporting 1/2" wood structural panels applied at right angles to joists with 8d nails.




Approx. Ceiling Weight: 2 pcf
Fire Test: FM FC 172, 2-25-72; ITS, 04-0-06
Sound Test: Estimated

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UL Penetrations

- Penetrations through all or a portion of an assembly can significantly affect the rating.
- Firestop systems developed to protect openings created by penetration items are covered in UL Solutions Product IQ




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Gypsum Board Joint Treatment (Fire Taping)

- Unless otherwise specified in the specific design all gypsum board systems except those with predecorated or metal covered surfaces have joints taped and joints and fastener heads covered with one coat of joint compound (fire taped).
- Base layers in multi layer systems are not required to have joints or fastener heads taped or covered with joint compound.




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Gypsum Board

- Gypsum board thicknesses specified in specific designs are minimums.
- Greater thicknesses of gypsum board are permitted as long as the fastener length is increased to provide penetration into framing that is equal to or greater than that achieved with the specified gypsum board thickness and fasteners.
- Additional layers of gypsum board are permitted to be added to any design.



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UL Fire Resistance Directory

NUMBERING SYSTEM FOR FIRE RATED ASSEMBLIES

Structure or Construction	Membrane Protection					Direct Applied Protection		Unprotected
	100-120	130-150	160-180	190-210	220-240	250-270	280-300	
Reinforced Concrete A, B, or C*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Concrete and Steel Frame D, E, or F*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Concrete and Steel Joists G, H, or I*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
1" or 1 1/2" Thick Cast or Cast-in-place Wood and Steel Joists	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Beams 16" or 18" Floor Ceiling	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Steel Ceiling P, Q, or R*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Beams 24" or 30" Floor Ceiling	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Steel Ceiling S, T, or U*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Steel & Reinforced Concrete V, W, or X*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected
Concrete Y, Z, or AA*	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Concrete Slab Sys.	Unprotected

The prefix numbers with an asterisk () and the design numbers indicated as "Reserved" in the above table are for future expansion and to cater to new types of systems developed in the future.

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•UL V401, 1 hr. nonbearing

- Floor and Ceiling Runners** Steel channels, 1 in. deep by 2-1/2 in. wide, fabricated from No. 25 MSG galv steel, attached to concrete or masonry with fasteners 24 in. on centers.
- Steel Studs** 2-1/2 in. wide with 1-3/8 in. legs, 1/4 in. flange in legs, fabricated from No. 25 ga galv steel, 1-1/2 in. wide by 1-3/4 in. high conduit cutouts spaced 24 in. OC. Studs 1/2 in. less in length than assembly height.
- Gypsum Board*** 1/2 in. thick, paper or vinyl surfaced. Wallboard sheets applied vertically or horizontally with vertical joints located over studs attached to studs with 1 in. self-drilling, self-tapping steel screws located 12 in. OC in the field and 8 in. OC at joints. Joints covered with paper tape and joint compound. Exposed screw heads covered with joint compound. **NATIONAL GYPSUM CO** — Types FSW-1, FSW-G and FSW-C.
- Batts and Blankets*** 2 in. thick batts, supplied in 24 in. widths, placed to fill interior of wall. Any mineral wool batt bearing the UL Classification Marking as to Fire Resistance. See Batts and Blankets (BZIZ) Category For Names of Classified Companies.
- 4A. Fiber, Sprayed*** As an alternate to Batts and Blankets (Item 4) — Spray applied cellulose insulation material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lb/ft³.

U S GREENFIBER L L C — Cocoon stabilized cellulose insulation.

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Design No. U336

Exposed to fire from separation Wall side only
Nonbearing Wall Rating — 2 Hr
Finish Rating — 120 Min

CONFIGURATION A
REQUIRED TO FIRE FROM SEPARATION WALL SIDE ONLY

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Prescriptive Fire Resistance 721

- The provisions of this section contain prescriptive details of fire-resistance-rated building elements, components or assemblies.
- The materials of construction listed in Table 721.1(1), Table 721.1(2), and Table 721.1(3) shall be assumed to have the fire-resistance ratings prescribed therein.
- Where materials that change the capacity for heat dissipation are incorporated into a fire-resistance-rated assembly, fire test results or other substantiating data shall be made available to show that the required fire-resistance rating time period is not reduced.

Table 721.1(2)

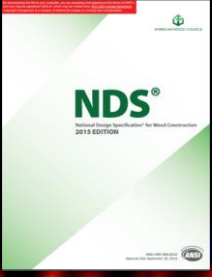
13-1.1	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with one full-length layer of 1/2" Type X gypsum wallboard ^a applied vertically attached with 1" long No. 6 drywall screws to each stud. Screws are 8" on center around the perimeter and 12" on center on the intermediate stud. Where applied horizontally, the Type X gypsum wallboard shall be attached to 3/4" studs and the horizontal joints shall be staggered with those on the opposite side. Screws for the horizontal application shall be 8" on center at vertical edges and 12" on center at intermediate studs.					2 1/2
13-1.2	13 Horizontalizable studs interior 0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with two full-length layers of 1/2" Type X gypsum wallboard ^a applied vertically each side. First layer attached with 1" long No. 6 drywall screws, 8" on center around the perimeter and 12" on center on the intermediate stud. Second layer applied with vertical joints offset one stud space from first layer using 1 1/2" long No. 6 drywall screws spaced 8" on center along vertical joints, 12" on center at intermediate studs and 24" on center along top and bottom runners.					3 1/2
13-1.3	0.050" (No. 16 carbon sheet steel gage) approved nailable metal studs ^b , 24" on center with full-length 1/2" Type X gypsum wallboard ^a applied vertically and nailed 7" on center with 6d cement-coated common nails. Approved metal fastener gips used with nails at vertical end joints along studs.					4 1/2

Table 721.1(2) various walls and partitions

14-1.1h	2" x 4" wood studs 16" on center with two layers of 1/2" regular gypsum wallboard ^a each side, 6d cooler [®] or wallboard [®] nails at 8" on center first layer, 6d cooler [®] or wallboard [®] nails at 8" on center second layer with laminating compound between layers, joints staggered. First layer applied full length vertically, second layer applied horizontally or vertically.					5
14-1.2	2" x 4" wood studs 16" on center with two layers 1/2" regular gypsum wallboard ^a applied vertically or horizontally each side, joints staggered. Nail base layer with 5d cooler [®] or wallboard [®] nails at 8" on center face layer with 6d cooler [®] or wallboard [®] nails at 8" on center.					5 1/2
14-1.3	2" x 4" wood studs 24" on center with 1/2" Type X gypsum wallboard ^a applied vertically or horizontally nailed with 6d cooler [®] or wallboard [®] nails at 7" on center with end joints on nailing members, stagger joints each side.					4 1/4
14-1.4	2" x 4" fire-retardant-treated wood studs spaced 24" on center with one layer of 1/2" Type X gypsum wallboard ^a applied with face paper grain (long dimension) parallel to studs. Wallboard attached with 6d cooler [®] or wallboard [®] nails at 7" on center.					4 1/4
14-1.5	2" x 4" wood studs 16" on center with two layers 1/2" Type X gypsum wallboard ^a each side. Base layers applied vertically and nailed with 6d cooler [®] or wallboard [®] nails at 8" on center. Face layer applied vertically or horizontally and nailed with 6d cooler [®] or wallboard [®] nails at 7" on center. For nail-adhesive application, base layers are nailed 8" on center. Face layers applied with coating of approved wallboard adhesive and nailed 12" on center.					6

722 Calculated Fire Resistance

- The calculated fire resistance of concrete, concrete masonry and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 0216.
- The calculated fire resistance of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29.
- The calculated fire resistance of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AWC National Design Specification for Wood Construction (NDS).

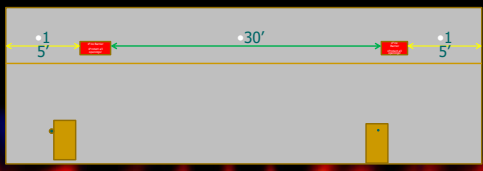


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703.5 – ID of Fire and Smoke Separation Walls

- "Fire and/or Smoke Barrier – Protect All Openings"
- Within 15' from end walls, 30' maximum spacing
- 3" high with 3/8" stroke
- Within accessible above ceiling spaces




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Fire-Resistance Rating of Structural Members – 704.1


- The fire-resistance ratings of structural members and assemblies shall comply with this section and the requirements for the type of construction as specified in Table 601.
- The fire-resistance ratings of supporting members shall not be less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.
 - Exception: Fire barriers, fire partitions, smoke barriers and horizontal assemblies as provided in Sections 707.5, 708.4, 709.4 and 711.2, respectively.



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Secondary Frame Definition 202




- The following structural members shall be considered secondary members and not part of the primary structural frame:
 - Structural members not having direct connections to the columns;
 - Members of the floor construction not having direct connections to the columns; and
 - Bracing members other than those that are part of the primary structural frame.

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Column protection 704.2


- Members of the Primary structural frame that are required to have protection to achieve a FRR shall be provided individual encasement protection by protecting them on all sides for the full length including connections to other structural members....
- Where a column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.
- Exception: column that meets the limitations of Section 704.3.1 (light frame construction—boundary elements located entirely between the top and bottom plates)



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Light-Frame Construction 704.3.1



- Studs and boundary elements that are integral elements in load-bearing walls of light-framed construction shall be permitted to have required fire-resistance rating provided by the membrane protection provided for load-bearing walls.

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Section 704.2



- **Exception:**
 1. Individual encasement protection on all sides shall be permitted on all exposed sides provided the extent of protection is in accordance with the required fire-resistance rating , as determined in Section 703.

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Protection of the Primary Structural Frame Other Than Columns - 704.2

Exception 2.

Primary structural members other than columns that do not support more than two floors or one floor and roof, or a load-bearing wall or a non-load-bearing wall more than two stories high, are permitted to be protected by the membrane of a fire-resistance rated wall or Horizontal assembly where the membrane provides the required FRR



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Protection of Secondary Members 704.3

- Secondary structural members that are required to have protection to achieve a fire-resistance rating shall be protected by individual encasement protection, or by the membrane of a FRR wall or horizontal assembly where the membrane provides the required FRR.




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Exterior Structural Members 704.10



- Load-bearing structural members located within the exterior walls or on the outside of a building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:
 1. Table 601 for the type of building element based on the type of construction of the building;
 2. Table 601 for exterior bearing walls based on the type of construction; and
 3. Table 705.5 for exterior walls based on the fire separation distance.

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Spray-applied Fire Resistive Materials – 704.12




- The application of SFRM shall be consistent with the fire-resistance rating and the listing, including, but not limited to, minimum thickness and dry density of the applied SFRM, method of application, substrate surface conditions and the use of bonding adhesives, sealants, reinforcing or other materials.

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Surface Conditions 704.12.3.1



- Substrates to receive SFRM shall be free of dirt, oil, grease, release agents, loose scale and any other condition that prevents adhesion.
- The substrates shall also be free of primers, paints and encapsulants other than those fire tested and listed by a nationally recognized testing agency.
- Primed, painted or encapsulated steel shall be allowed, provided that testing has demonstrated that required adhesion is maintained (with specific conditions)

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Temperature 704.12.4

- A minimum ambient and substrate temperature of 40°F shall be maintained during and for a minimum of 24 hours after the application of the SFRM, unless the manufacturer's installation instructions allow otherwise.



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Finished Condition 704.12.5

- The finished condition of SFRM applied to structural members or assemblies shall not, upon complete drying or curing, exhibit cracks, voids, spalls, delamination or any exposure of the substrate.
- Surface irregularities of SFRM shall be deemed acceptable.

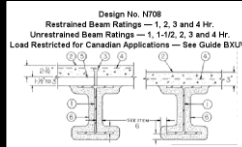


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UL Listings



1. Steel Beam — W8x28 min size.
2. Normal Weight or Lightweight Concrete — Compressive strength, 3000 psi.
3. Steel Connector — (Optional) — Studs, 3/4 in. diam headed type or equivalent per AISC specifications. Welded to the top flange of beam through the steel floor units.
4. Welded Wire Fabric — (Optional) — 6x6-10/10 SWG.
5. Steel Floor and Form Units* — 1-5/16 in. deep corrugated units; or 1-1/2 to 3 in. deep fluted or cellular units, welded to beam.

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Sprayed Fire-resistant Materials

- Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the beam to the final thicknesses shown below.
- When fluted or corrugated steel floor units are used, crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam.
- Beam surfaces must be clean and free of dirt, loose scale and oil. Minimum avg. and minimum indicated density of 15/14 pcf respectively.


Rating Hr	Restrained Beam Rating Hr	Unrestrained Beam Rating Hr
1	1/2	1/2
1 ½	11/16	13/16
2	15/16	1-1/16
3	1-7/16	1-9/16
4	1-15/16	2

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Sprayed Fire-resistant Materials - 1705.15

- Special inspections for sprayed fire-resistant materials applied to structural elements and decks shall be in accordance with Sections 1705.15.1 through 1705.15.6.
- Special inspections shall be based on the fire-resistance design as designated in the approved construction documents.




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Physical and Visual Tests 1705.15.1

- The special inspections shall include the following tests and observations to demonstrate compliance with the listing and the fire-resistance rating:
 - Condition of substrates.
 - Thickness of application.
 - Density in pounds per cubic foot
 - Bond strength adhesion/cohesion.
 - Condition of finished application.




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**Thickness
1705.15.4**

- No more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.15.4.1.



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•Containment In Construction
• Through-Penetrations



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•Containment in Construction
•Membrane-Penetrations
•Section 714

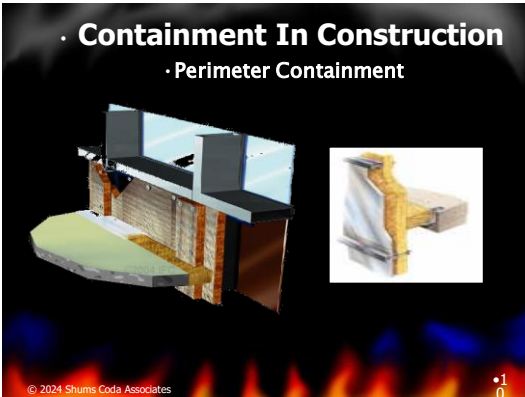


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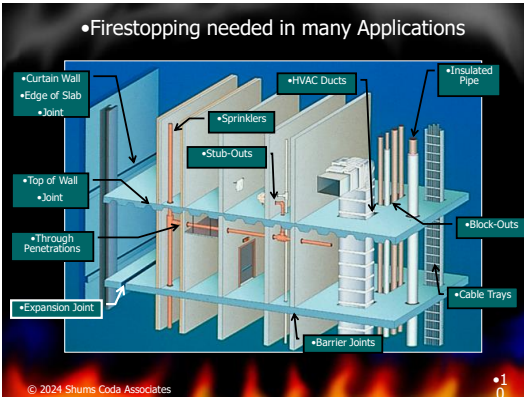
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Penetrations 714.1

- The provisions of this section shall govern the materials and methods of construction used to protect through penetrations and membrane penetrations of horizontal assemblies and fire-resistance-rated wall assemblies.



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Code Requirements - IBC


- International Building Code Firestop
- Test Standards

	IBC
Through Penetration	ASTM E814 UL 1479
Joints	UL 2079 ANSI 2079
Perimeter Barriers	ASTM E2307



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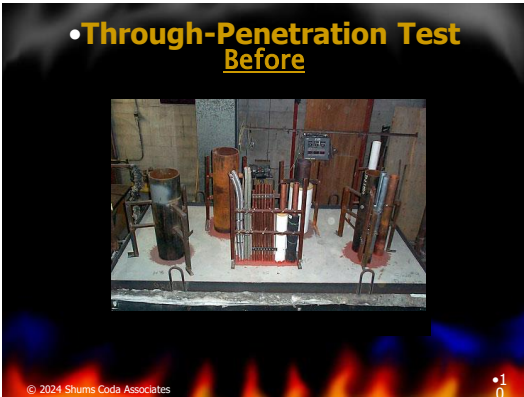
Third Party Testing Labs

- Underwriters Laboratories Inc.
- Intertek (Warnock Hersey & ETL)
- FM Global (Factory Mutual)
- Southwest Research Institute

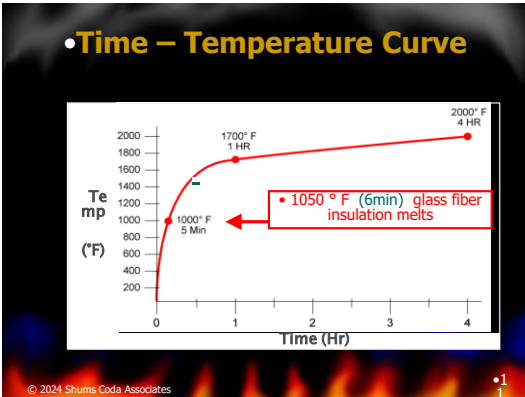
Labs Test to Standards

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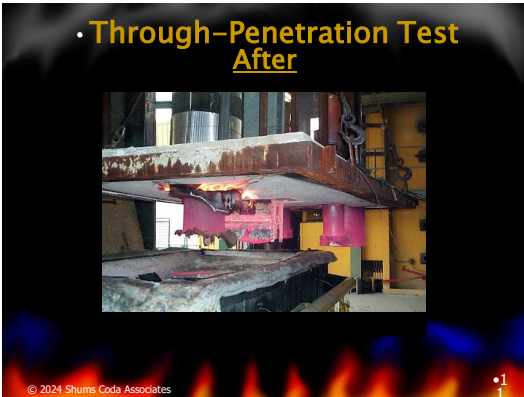
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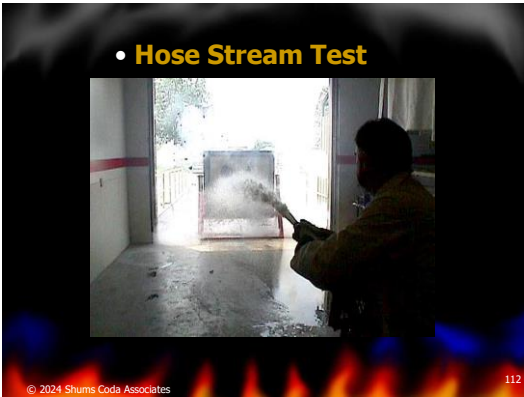
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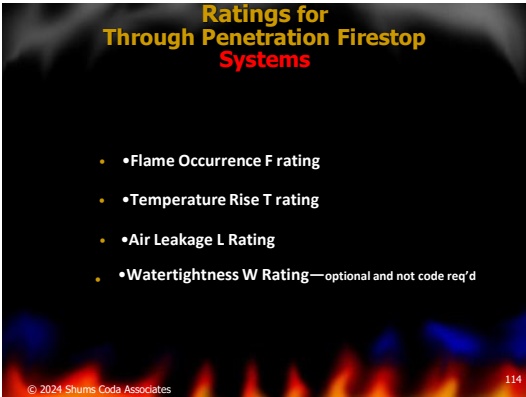
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•ASTM E 814 / UL 1479 Test Standards for
•Through Penetration Firestop **Systems**

- **E-Rating**
- The duration of time in which flames must not pass through the system
- **T-Rating**
- The time it takes for the non-fire side to reach 325°F

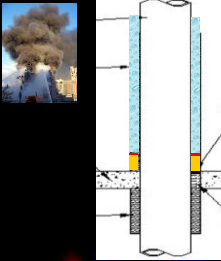


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•ASTM E 814 / UL 1479 Test Standards for
•Through Penetration Firestop **Systems**

- **L-Rating**
- Amount of air leakage through the system at ambient and 400°F
- Measured in CFM/sq. ft. The lower the number, the better.
- **W-rating** (currently optional)
- the ability of a system to restrict the flow of water
- Class 1-rated systems resist a 3 foot water column for 72 hours



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What assemblies require F, T, or L Ratings? All found in Section 714....

- Through penetrations of fire-resistance-rated wall assemblies require an F rating...(714.4.1.2)
- Through penetrations of Fire-resistance-rated horizontal assemblies require an F and T rating---some exceptions for the T rating...(714.5.1.2)
- Through penetrations of Smoke barriers require an L rating (714..5.4)
- Through penetrations of a fire wall or fire barrier used for a horizontal exit must meet the requirements for an F, T and L rating. (714.4.1 through 714.4.3 & 714.5.4)

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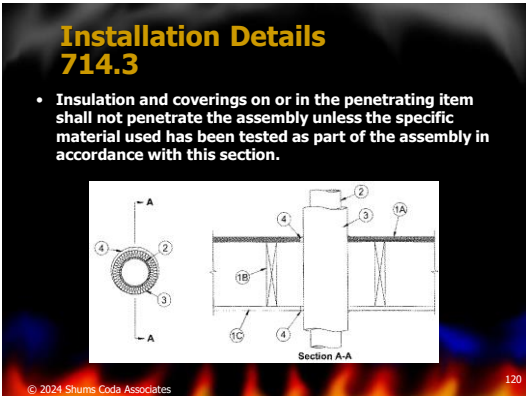
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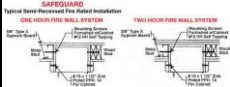
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Membrane Penetrations 714.4.2

- Membrane penetrations shall comply with Section 714.4.1.
- Where walls or partitions are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.



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Membrane Penetration Exceptions

- Steel electrical boxes
 - Maximum 2 hours
 - do not exceed 16 square inches
 - total area of 100 square inches for any 100 square feet of wall area.
- Outlet boxes on opposite sides of the wall shall be separated as shown:
 - Horizontal distance of not less than 24 inches;
 - Horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rock wool or slag mineral wool insulation;
 - By solid fireblocking per Section 718.2.1;
 - Protect both boxes by listed putty pads; or
 - Other listed materials and methods.



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Membrane Penetration Exceptions

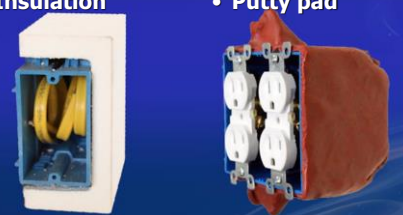
- Listed electrical outlet boxes tested for use in fire-resistance- rated assemblies and installed in accordance with the listing instructions
 - By the horizontal distance specified in the listing of the electrical boxes;
 - By solid fireblocking in accordance with Section 718.2.1;
 - By protecting both boxes with listed putty pads; or
 - By other listed materials and methods.
- Electrical boxes of any size or type, which have been listed as part of a wall opening protective material system and installed in accordance with the listing instructions.
- by boxes other than electrical boxes, provided such penetrating items and the annular space between the wall membrane and the box, are protected by an approved membrane penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479
- Sprinkler metal escutcheon plate

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Added protection required for plastic boxes unless listed without protection.

- Insulation
- Putty pad




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Dissimilar materials 714.3.3

- Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the wall is maintained.



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Horizontal assemblies Through Penetrations 714.5.1

- Penetrations of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a shaft shall be protected

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or masonry items through a single fire-resistance-rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 or UL 263



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Horizontal assemblies 714.5

Exceptions

- 2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch nominal diameter, provided the concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire-resistance rating.
- 3. Penetrations by listed electrical boxes of any material



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Membrane Penetration Exceptions

- 16 sq. in. steel electrical boxes
 - Max. 100 sq. in. in every 100 sq. ft.
- Ceiling membrane penetrations
 - Max. 2-hour
 - Max. 16 sq. in.
 - Max. 100 sq. in. in every 100 sq. ft.
- Listed electrical outlet boxes as a part of the assembly
- Listed electrical outlet boxes tested for use in fire-rated assembly.
- Sprinkler metal escutcheons

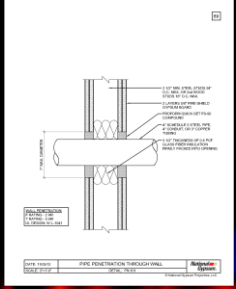


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714.5.1.2 Through-penetration firestop system

- Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water.
- The system shall have an F rating/T rating of not less than 1 hour but not less than the required rating of the floor penetrated.
- Floor penetrations of max. 4-inch diameter metal conduit or tubing penetrating directly into metal enclosed race power switchgear do not require a T-rating.




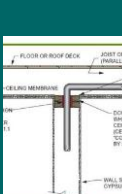


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714.5.1.2 Through-penetration firestop system

- Exceptions:
 1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a T rating.
 2. Floor penetrations by floor drains, sub drains or shower drains contained and located within the concealed space of a horizontal assembly do not require a T rating.
 3. Floor penetrations of maximum 4-inch nominal diameter penetrating directly into metal-enclosed electrical power switchgear do not require a T rating.

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Nonfire-Resistance-Rated Assemblies. - 714.6.1


- **Noncombustible penetrating items**
 - not more than five stories are permitted, provided that the annular space is filled to resist the free passage of flame and the products of combustion with an approved noncombustible material or with a fill, void or cavity material that is tested and classified for use in through-penetration firestop systems.
- **Penetrating items**
 - Not more than two stories provided that the annular space is filled with an approved material to resist the free passage of flame and the products of combustion.

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Conditions of Acceptance for a T Rating

- **No Passage of Flame**
- **Not to exceed 325°F Temperature Rise**
- **Hose Stream**



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2024 IBC – T Rating

- The time period that the penetrating fire-stop-system, including the penetrating item or continuity head-of-wall system, limits the maximum temperature rise to 325 degrees F above its initial temperature through the penetration or void on the non-fire side. when tested in accordance with ASTM E814 or UL 1479.

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There are 3 parts to a Listed Firestop System



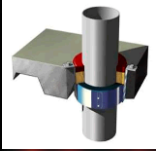
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Penetration Firestop System

Consists of:

- Assembly being penetrated
- Penetrating item
- Fill, void or cavity materials (firestopping materials)



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- **1st Part of a Listed Firestop System:**

The slide features a 3D perspective diagram of a firestop assembly on the left, showing a concrete wall with a firestop block. On the right, there are two photographs: the top one shows a firestop installed in a concrete wall opening, and the bottom one shows a firestop installed in a wall opening with a door frame.

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- **1st Part of a Listed Firestop System:**

The slide contains two technical diagrams. The top diagram is a cross-section showing a slab on top of an open steel beam. Labels include 'Slab', 'Insulation', 'Open beam', and 'Rebar channel (Spaced @ 400 mm o.c.)'. Dimensions shown are '1.2m' and '50mm (2 in.)'. The bottom diagram is another cross-section showing a 'LOWER FLUTE' and an 'UPPER FLUTE' with a 'MIN. 30 GANGLY STEEL DECK'. Dimensions include '114"', '71"', and '431"'. The text '© 2024 Shums Coda Associates' is at the bottom left, and '•140' is at the bottom right.

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- **2nd Part of a Listed Firestop System:**

The slide displays a collage of six photographs showing various firestop installations in a complex, industrial or commercial structure. The photos show firestop materials being applied to pipes, ducts, and structural elements.

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• 3rd Part of a Listed Firestop **System**:

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Firestop System Materials

- Sealants
 - Silicone, Latex, Intumescent
- Wrap Strips
 - “Thick, Thin, Wide, Less Wide”
- Putties
- Pillows
- Composite Sheets
- Bricks / Plugs
- Pre Fabricated Kits
- Mortar
- Spray Products

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• **Firestop System Materials**
Firestop Devices

- **Preformed Devices – Cast in Place, Bathtub**

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- **Firestop System Materials**
Firestop Composite Sheets
- Sheet metal laminated to intumescent material with foil and metal scrim on the other side



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- **Firestop System Materials**
Steel Collars



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- **Firestop System Materials**
Firestop Pre-formed Devices
- "Pre assembled, preformed molding kits in stainless steel frames, mechanically sealed"
- "Pre-assembled Open Pathway Devices"



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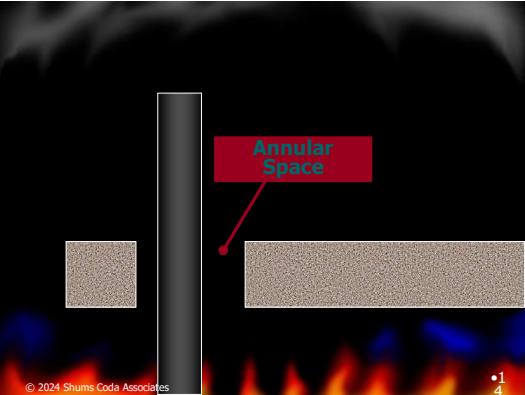
•So, what is the rating of the firestop *material*?



•**ZERO!**
•Only **systems** have ratings.

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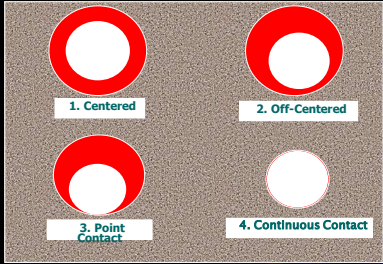


Annular Space

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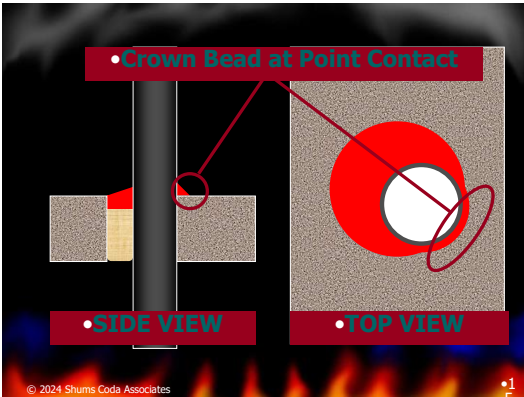
Typical Annular Space



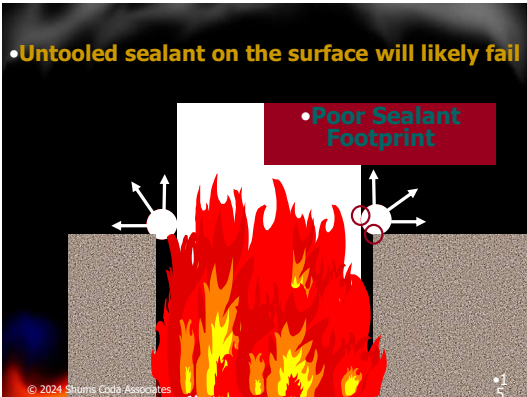
1. Centered
2. Off-Centered
3. Point Contact
4. Continuous Contact

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Properly Tooled Penetrations

- The Firestop sealant must be well bonded to penetrating item and surrounding wall or floor
- Should always inspect both sides



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Cast-in-Place Devices



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Rated Floor Ceiling Assembly



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• Steel Collars and Intumescent Wrap Strips

- Intumescent sealant expands and fills the void
- The collar expands to crush pipe



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Sleeves

Sleeves are commonly used where penetration needs to be removed or changed frequently

- The sleeve need to be securely fastened to assembly
- Both the space between penetrant and annular space needs to be firestopped



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•Evaluating a Penetration

•It is all about the

•SYSTEMS

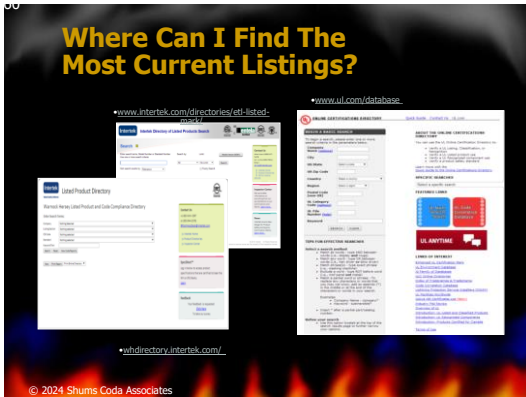
•Points to remember:

- Firestop materials are not systems
- Systems employ firestop materials
- Products do not receive ratings, "Systems Do"

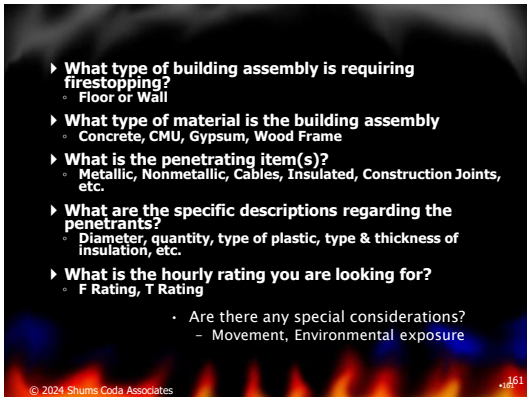
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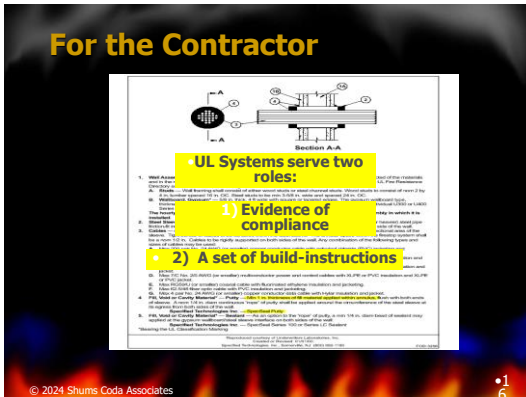
159



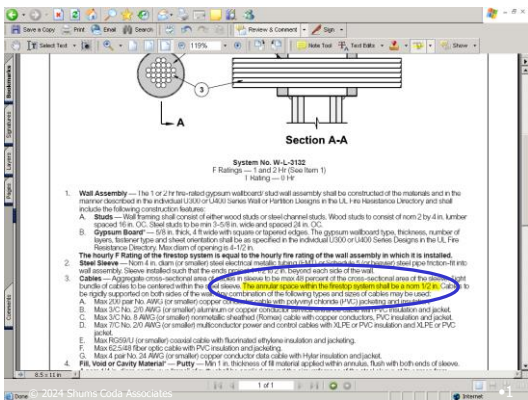
160



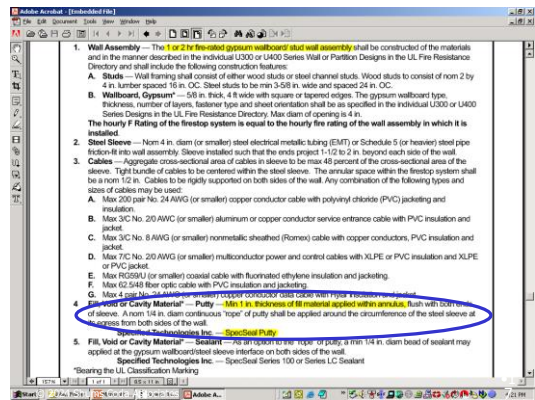
161



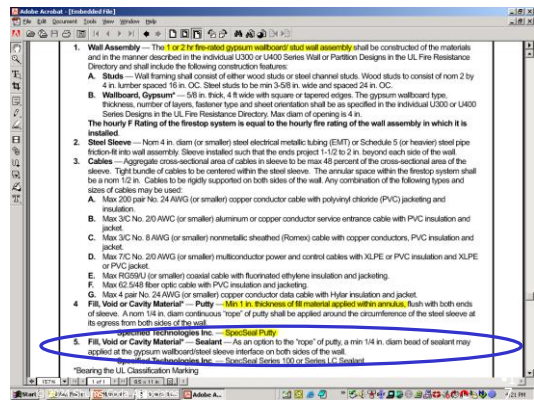
162



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International FireStop Council



- www.firestop.org
- Inspector Pocket Guide
- Evaluating Engineering Judgements
- Education Opportunities

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Special Inspections 1705.18

- In high-rise buildings or in buildings assigned to *Risk Category III or IV* or in fire areas containing Group R occupancies with an occupant load of >250 persons (50,000 SF) special inspections for through-penetrations, membrane penetration firestops, fire-resistive joint systems, and perimeter fire containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.



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Special Inspections

- More fires transfer due to poor or improper fire-stopping than any other cause.
- Unless your inspection staff is trained and certified to conduct fire-stop inspections, seriously think about requiring Special inspectors
- MGM Grand 1980 *85 killed in upper floors
- Grenfell Tower 2017 * 72 killed


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Special Inspections 1705.18.1

- Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.3.1.2 and 714.4.2 shall be conducted by an approved agency in accordance with ASTM E 2174.




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Special Inspections 1705.18.2

- Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3.1 and 715.4 shall be conducted by an approved agency in accordance with ASTM E 2393.

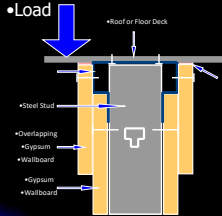


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Joint (Definition) 202.1

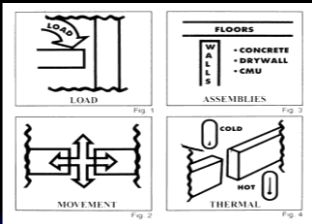
- The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.



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Forces Which Induce Movement



- Thermal
- Wind Sway
- Seismic
- Load

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Installation 715.2.2

- Approved materials protecting voids shall be securely installed in accordance with the manufacturer's installation instructions in or on the void for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gasses.



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Fire-Resistant Joint System 715.3

- Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed.
- Fire-resistant joint systems shall be tested in accordance with Section 715.3.
- 10 Exceptions



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Fire Test Criteria 715.3.1



- Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E 1966 or UL 2079.


Before Test
After Test
Hose Stream Failure

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Fire Test Criteria 715.3.1

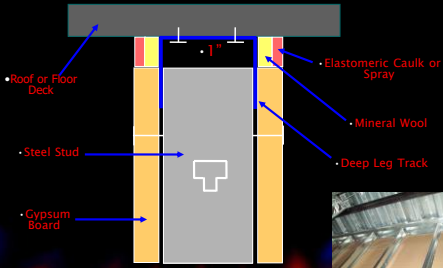
- ASTM E 1966 or UL 2079
- Building Joint Systems Including:
 - floor-to-floor
 - floor-to-wall
 - head-of-wall
 - wall-to-wall
- Report
 - Fire rating in hours, i.e., 1, 2, 3 or 4 hours



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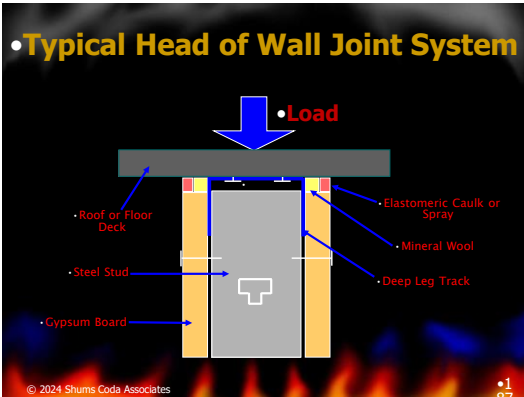
Typical Head of Wall Joint System With Nominal Joint Width



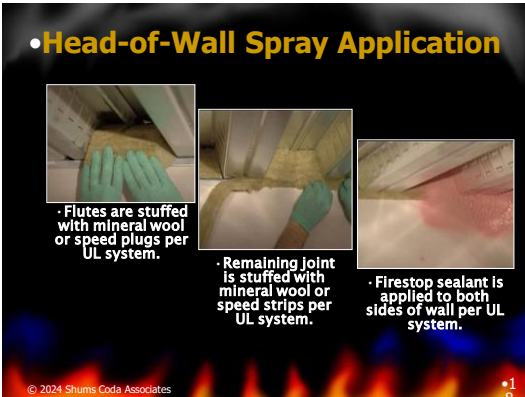
- Roof or Floor Deck
- Steel Stud
- Gypsum Board
- Elastomeric Caulk or Spray
- Mineral Wool
- Deep Leg Track

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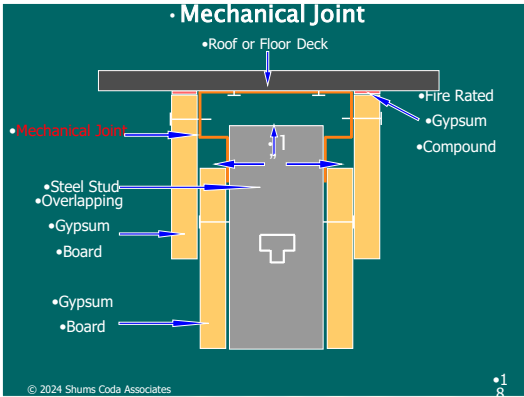
186



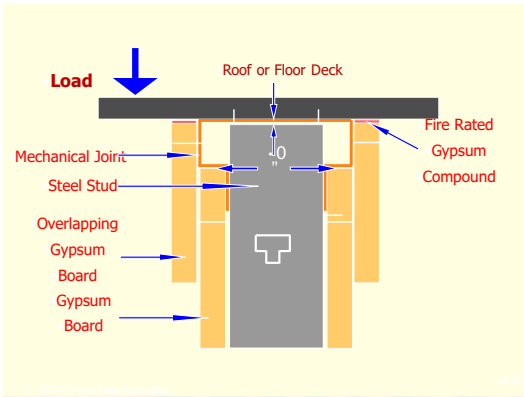
187



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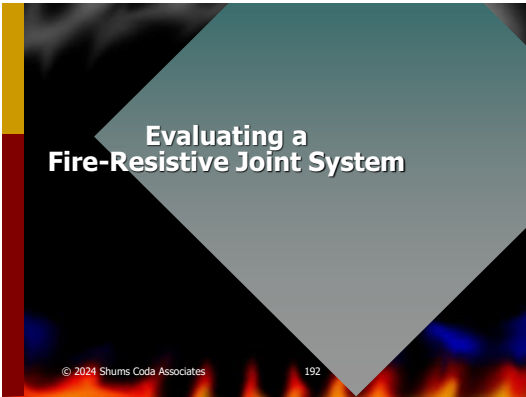
189



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Navigating the UL Directory:

JOINT SYSTEMS (XHBN) · HW - D - 0060

First Two Alpha Characters identify the type of joint system:

FF	=	Floor-to-Floor
WW	=	Wall-to-Wall
FW	=	Floor-to-Wall
HW	=	Head-of-Wall

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Navigating the UL Directory:

JOINT SYSTEMS (XHBN) · HW - D - 0060

Third Alpha Character identifies the movement capabilities of the system:

D	=	Dynamic (movement capabilities)
S	=	Static (no movement capabilities)

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Plan Review of Joint Systems

- What type of joint is being protected?
- What is the required hourly rating?
- What is the width of the joint (nominal installed width)?
- How much movement is required?
- Is an L Rating required?
- Is submitted system consistent with the above requirements?

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•What is a Curtain Wall?

- A curtain wall is an exterior building wall which carries no roof or floor loads and consists of metal, glass or stone or any combination thereof supported by a metal frame.



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Curtain Wall Spandrels 715.8



- Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.9.5.
- Where Section 705.9.5 does not require a fire-resistance-rated spandrel wall, the requirements of Section 715.4 and 715.5 shall still apply to the intersection between the spandrel wall and the floor.

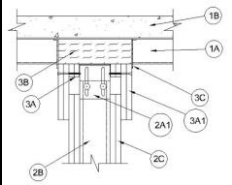
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Fire-Resistant Joint Systems In Smoke Barriers - 715.9

- Fire-resistant joint systems protecting joints in smoke barriers, and perimeter fire containment systems protecting voids at the intersection of a horizontal smoke barrier and an exterior curtain wall, shall be tested in accordance with the requirements of UL 2079 for air leakage. The L rating of the joint system shall not exceed 5 cubic feet per minute per linear foot (0.00775 m³/s m) of joint at 0.30 inch of water (74.7 Pa) for both the ambient temperature and elevated temperature tests.




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Opening Protectives 716.1

- Opening protectives required by other sections of this code shall comply with the provisions of this section and shall be installed in accordance with NFPA 80.




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Fire-Resistance-Rated Glazing 716.1.2.3

- Fire-resistance-rated glazing tested as part of a fire-resistance-rated wall or floor/ceiling assembly in accordance with ASTM E 119 or UL 263 and labeled in accordance with Section 703.4 shall not otherwise be required to comply with this section where used as part of a wall or floor/ceiling assembly.



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Marking fire-rated glazing assemblies - 716.3

- Fire-rated glazing assemblies shall be marked in accordance with Tables 716.1 (1), 716.1(2), and 716.1(3).

TABLE 716.1(3) FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF WALL ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)	FIRE-RATED GLAZING MARKING
Interior walls			
Fire walls	AJ	NP*	W-XXX*
Fire barriers	>CH1	NP*	W-XXX*
	1	NP*	W-XXX*
Alarm separations (Section 707.3.6), incidental use areas (Section 707.3.7), and mixed occupancy separations (Section 707.3.9)	1	1/4	CH-45 or W-60
Fire partitions	1	1/4	CH-45 or W-60
	0.5	1/8	CH-20 or W-30
Smoke barriers	1	1/4	CH-45 or W-60
	>1	1/2	CH-50 or W-XXX*
Exterior walls	1	3/4	CH-45 or W-60
	0.5	1/5	CH-20 or W-30
Party wall	AJ	NP*	W-XXX*

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Fire Doors and Shutter Assemblies - 716.2

TYPE OF ASSEMBLY	REQUIRED RATING	MINIMUM RATING	MINIMUM RATING	MINIMUM RATING		MINIMUM RATING		MINIMUM RATING	
				Fire protection	Fire resistance	Fire protection	Fire resistance	Fire protection	Fire resistance
Other fire barriers	1	1/2	Maximum size tested	D-H-NT-45	1/2	1/2	1/2	1/2	D-H-NT-45
Fire partitions:	1	1/2	Maximum size tested	D-20	1/2	1/2	1/2	1/2	D-H-OH-45
Corridor walls	0.5	1/2	Maximum size tested	D-20	1/2	1/2	1/2	1/2	D-H-OH-20
Other fire partitions	1	1/2	Maximum size tested	D-H-45	1/2	1/2	1/2	1/2	D-H-45
	0.5	1/2	Maximum size tested	D-H-20	1/2	1/2	1/2	1/2	D-H-20
Exterior walls	3	1 1/2	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	3	Not Permitted	3	Not Permitted	W-180
	2	1 1/2	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	2	Not Permitted	2	Not Permitted	W-120
Interior walls	4	2	100 sq. ft. ≤ 100 sq. ft. = D-H-180 100 sq. ft. > 100 sq. ft. = D-H-W-180	Not Permitted	4	Not Permitted	4	Not Permitted	W-240
	3	2	100 sq. ft. ≤ 100 sq. ft. = D-H-180 100 sq. ft. > 100 sq. ft. = D-H-W-180	Not Permitted	3	Not Permitted	3	Not Permitted	W-180
Smoke barriers	1	1	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	1	Not Permitted	1	Not Permitted	W-90

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TYPE OF ASSEMBLY	REQUIRED RATING	MINIMUM RATING	MINIMUM RATING	MINIMUM RATING		MINIMUM RATING		MINIMUM RATING	
				Fire protection	Fire resistance	Fire protection	Fire resistance	Fire protection	Fire resistance
Other fire barriers	1	1/2	Maximum size tested	D-H-NT-45	1/2	1/2	1/2	1/2	D-H-NT-45
Fire partitions:	1	1/2	Maximum size tested	D-20	1/2	1/2	1/2	1/2	D-H-OH-45
Corridor walls	0.5	1/2	Maximum size tested	D-20	1/2	1/2	1/2	1/2	D-H-OH-20
Other fire partitions	1	1/2	Maximum size tested	D-H-45	1/2	1/2	1/2	1/2	D-H-45
	0.5	1/2	Maximum size tested	D-H-20	1/2	1/2	1/2	1/2	D-H-20
Exterior walls	3	1 1/2	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	3	Not Permitted	3	Not Permitted	W-180
	2	1 1/2	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	2	Not Permitted	2	Not Permitted	W-120
Interior walls	4	2	100 sq. ft. ≤ 100 sq. ft. = D-H-180 100 sq. ft. > 100 sq. ft. = D-H-W-180	Not Permitted	4	Not Permitted	4	Not Permitted	W-240
	3	2	100 sq. ft. ≤ 100 sq. ft. = D-H-180 100 sq. ft. > 100 sq. ft. = D-H-W-180	Not Permitted	3	Not Permitted	3	Not Permitted	W-180
Smoke barriers	1	1	100 sq. ft. ≤ 100 sq. ft. = D-H-90 100 sq. ft. > 100 sq. ft. = D-H-W-90	Not Permitted	1	Not Permitted	1	Not Permitted	W-90

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Labeling Requirements 716.2.9.1

- Fire doors shall be labeled showing the name of the manufacturer or other identification readily traceable back to the manufacturer, the name or trademark of the third-party inspection agency, the fire protection rating.
 - Maximum transmitted temperature end point for exit enclosures and passageways
 - Smoke and draft control doors
 - Approved and permanently affixed.
 - Applied at the factory




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**Smoke & Draft Control Doors
716.2.9.3**

- Smoke and draft control doors complying with UL 1784 shall be labeled in accordance with Section 716.2.9.1 and shall show the letter "S" on the fire rating label of the door.
- This marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.



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**Fire Door Frames
716.2.9.4**

- Fire door frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.




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**Door Closing
716.2.6.1**

- Fire doors shall be self-closing or automatic-closing in accordance with this section.
 - Self-closing
 - Automatic closing
 - NFPA 80
 - Smoke activated closing
 - Latching required

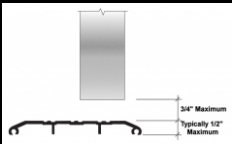


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Inspection of Doors NFPA 80

- (5) No parts are missing or broken.
- (6) Door clearances do not exceed clearances listed in 4.8.4 and 6.3.1.7.
- (7) The self-closing device is operational; that is, the active door completely closes when operated from the full open position.
- (8) If a coordinator is installed, the inactive leaf closes before the active leaf.
- (9) Latching hardware operates and secures the door when it is in the closed position.



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Inspection of Doors NFPA 80

- (10) Auxiliary hardware items that interfere or prohibit operation are not installed on the door or frame.
- (11) No field modifications to the door assembly have been performed that void the label.
- (12) Meeting edge protection, gasketing and edge seals, where required, are inspected to verify their presence and integrity.
- (13) Signage affixed to a door meets the requirements listed in 4.1.4.



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QUESTIONS?

- Thank you for attending

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