

**FIRE-RESISTANCE-RATED
CONSTRUCTION**
A Primer on IBC Chapter 7



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**Fire resistance rated
construction**

- ◆ How to know where it is required
- ◆ How to select appropriate assemblies
- ◆ How to detail and specify
- ◆ How to construct
- ◆ How to inspect

Table 503

Type of construction determined from occupancy classification & desired size of building

**TABLE 503
ALLOWABLE HEIGHT AND BUILDING AREAS
Height limitations shown in stories and feet above grade plane.
Area limitations are governed by the addition of "Area, limiting, per floor."**

GROUP	TYPE	TYPE OF CONSTRUCTION															
		TYPE I				TYPE II				TYPE III				TYPE IV			
		A	B	A	B	A	B	A	B	A	B	A	B	A	B		
GROUP 1	TYPE I	24	36	36	36	36	36	36	36	36	36	36	36	36	36	36	
A-2	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
A-3	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
A-4	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
A-5	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
A-6	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B	TYPE I	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-1	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-2	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-3	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-4	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-5	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-6	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-7	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-8	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-9	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-10	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-11	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-12	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-13	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-14	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-15	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-16	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-17	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-18	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-19	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-20	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-21	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-22	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-23	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-24	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-25	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-26	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-27	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-28	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-29	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-30	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-31	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-32	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-33	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-34	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-35	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-36	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-37	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-38	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-39	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-40	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-41	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-42	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-43	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-44	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-45	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-46	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-47	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-48	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-49	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
B-50	TYPE II	12	18	18	18	18	18	18	18	18	18	18	18	18	18	18	

Table 601 – Building Elements

Some of the required fire-resistance ratings are found here, based on type of construction.

**TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	
	A	B	A ¹	B	A ¹	B	A ¹	B
Structural frame ^a	2	2	1	0	1	0	1	0
Including columns, girders, trusses	2	2	1	0	1	0	1	0
Roofing walls	1	1	1	0	1	0	1	0
Exterior ^b	1	1	1	0	1	0	1	0
Interior	0	0	0	0	0	0	0	0
Nonbearing walls and partitions	See Table 602							
Exterior	0	0	0	0	0	0	0	0
Including walls and partitions	See Sections 602.4-6							
Roofing walls and partitions	0	0	0	0	0	0	0	0
Interior ^c	0	0	0	0	0	0	0	0
Flare constructions	2	2	1	0	1	0	1	0
Including supporting beams and joists	2	2	1	0	1	0	1	0
Roof constructions	1 1/2	1	1	0	1	0	1	0
Including supporting beams and joists	1 1/2	1	1	0	1	0	1	0

- Note 1:** 1 hour = 204.3 mm.
- a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connections to the columns shall be considered secondary members and not a part of the structural frame.
 - b. Roof supports. Fire resistance ratings of structural frame and bracing walls are permitted to be reduced by 1 hour where supporting a roof only.
 - c. 1. Except as Factory Industrial (F-1), Warehouse (W), Mercantile (M), and Moderate Hazard Storage (S-1) occupancies, fire protection of structural members shall not be required, including protection of steel framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire resistant treated wood members shall be allowed to be used for such unprotected members.
 - 2. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire resistance rating is required.
 - 3. In Type I and II construction, fire-retarded treated wood shall be allowed in buildings including girders and beams as part of the roof construction where the building is:
 - i. Two stories or less in height.
 - ii. Type II construction over two stories, or
 - iii. Type I construction over two stories and the vertical distance from the upper floor to the roof is 20 feet or more.
 - d. An approved automatic sprinkler system as conditions with Section 503.2.1 shall be allowed to be substituted for a lower fire-resistance rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase as outlined with Section 506.3 or an allowable height increase as outlined with Section 504.2. The 1-hour substitution for fire resistance of exterior walls shall not be permitted.
 - e. Not less than the fire resistance rating required by other sections of this code.
 - f. Not less than the fire resistance rating based on fire separation distance (see Table 602).

Table 602 – Exterior Walls

Fire separation distance:
Distance measured from the building face to the closest interior lot line, centerline of a street, alley or public way, or to an imaginary line between two buildings on the lot. Distance measured at right angles from the face of the wall.

**TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^a**

FIRE SEPARATION DISTANCE (feet)	TYPE OF CONSTRUCTION	GROUP H	GROUP F-1, M, S-1	GROUP A, B, E, F-2, I, R ^b , S-2, U
< 5'	All	3	2	1
≥ 5'	IA	3	2	1
≥ 10'	Others	2	1	1
≥ 15'	IA, IB	2	1	1
≥ 30'	IB, VB	1	0	0
≥ 30'	Others	1	1	1
≥ 80'	All	0	0	0

- Note 1:** 1 foot = 204.3 mm.
- a. Land-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
 - b. Group R-3 and Group U when used as accessory to Group R-3, as applicable in Section 101.2 shall not be required to have a fire-resistance rating where the fire separation distance is 3 feet or more.
 - c. See Section 502.2 for party walls.

**Chap 4 –
Special Requirements**

402 – Covered Malls

- Fire barrier between mall & open parking garage: 2 hours
- Fire partitions between tenants – see 708 - 1 hour
- Fire wall separating anchor buildings – 3 hrs or exception w/ 2 hr fire-barrier

**Chap 4 –
Special Requirements**

403 – High-Rise

- Possible reductions in construction type & fire ratings based on type of sprinkler system
- Shafts down from 2 to 1 hr – sprinklers in shafts
- Fire wall separating anchor buildings – 3 hrs or exception w/ 2 hr fire-barrier

**Chap 4 –
Special Requirements**

404 – Atriums

- Enclosure in 1 hour fire barrier

Chap 4 – Special Requirements

405 – Underground Buildings

- Type I construction
- Compartmentation w/ 1 hr fire barriers

Chap 4 – Special Requirements

406 – Motor-Vehicle-Related

- Separate private garage from dwelling w/ 5/8" type X gyp bd
- Separate parking garages from other occupancies per 302.3
- Open parking garages have their own height & area reqmts for const type

Chapter 4 – Special Requirements

- 407 – Group I-2
- 408 – Group I-3
- 410 – Stages & Platforms
- 412 – Aircraft Related Occupancies
- 414 – Hazardous Materials
- 415 – High Hazard
- 416 – Spray Rooms – 1 hr fire barrier
- 418 – Nitrocellulose Storage
- 419 – Group E compartmentation
- 420 – Group B Medical

Chapter 7: Fire-Resistance-Rated Construction

Materials & assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire & smoke with a building & the spread of fire to or from buildings.

A.K.A. – Passive Fire Protection

Chapter 7: Fire-Resistance-Rated Construction

703 – Fire-resistance ratings & fire tests	714 – Fire-resistance rating of structural members
704 – Exterior walls	715 – Opening protectives
705 – Fire walls	716 – Duct & transfer openings
706 – Fire barriers	717 – Concealed spaces
707 – Shaft enclosures	718 – Plaster
708 – Fire partitions	719 – Thermal & sound insulation
709 – Smoke barriers	720 – Prescriptive fire resistance
710 – Smoke partitions	721 – Calculated fire resistance
711 – Horizontal assemblies	
712 – Penetrations	
713 – Fire-resistant joint assemblies	

703 Fire-resistance ratings & fire tests

Fire-resistance ratings of building elements are determined 2 ways:

- ASTM E 119 (or UL 263)
- Alternative methods in 703.3

703 Fire-resistance ratings & fire tests



Designation: E 119 – 00a

An American National Standard

Standard Test Methods for Fire Tests of Building Construction and Materials¹

INTRODUCTION

The performance of walls, columns, floors, and other building members under fire exposure conditions is an item of major importance in securing constructions that are safe, and that are not a menace to neighboring structures nor to the public. Recognition of this is registered in the codes of many authorities, municipal and other. It is important to secure balance of the many units in a single building, and of buildings of like character and use in a community; and also to promote uniformity in requirements of various authorities throughout the country. To do this it is necessary that the fire-resistive properties of materials and assemblies be measured and specified according to a common standard expressed in terms that are applicable alike to a wide variety of materials, situations, and conditions of exposure.

Such a standard is found in the methods that follow. They prescribe a standard exposing fire of controlled extent and severity. Performance is defined as the period of resistance to standard exposure elapsing before the first critical point in behavior is observed. Results are reported in units in which field exposures can be judged and expressed.

The methods may be cited as the "Standard Fire Tests," and the performance or exposure shall be expressed as "2-h," "6-h," "1/2-h," etc.

When a factor of safety exceeding that inherent in the test conditions is desired, a proportional increase should be made in the specified time-classification period.

703 Fire-resistance ratings & fire tests



Designation: E 119 – 00a

An American National Standard

Standard Test Methods for Fire Tests of Building Construction and Materials¹

The vertical furnace shown in this photograph is used to evaluate the fire performance of wall assemblies



703 Fire-resistance ratings & fire tests

703.2 Fire-resistance ratings. The fire-resistance rating of building elements, components or assemblies 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. 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 officials show that the required fire-resistance rating is not reduced. 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.



703 Fire-resistance ratings & fire tests

GA FILE NO. WP 3441	PROPRIETARY*	1 HOUR FIRE	40 to 44 FSTC SOUND
GYPSUM WALLBOARD, MINERAL FIBER INSULATION, CEMENTITIOUS BACKER UNITS, CERAMIC TILE, WOOD STUDS One layer 1/2" thick proprietary cementitious backer unit applied parallel or at right angles to 2 x 4 wood studs 16" o.c. with 1/2" gypsum wallboard on 1/4" water-tight cementitious mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. CERAMIC TILE: One layer 1/4" proprietary type X gypsum wallboard applied parallel or at right angles to back with 1/2" cementitious mortar, 1/4" Type I SHEETROCK 40' boards, 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.			
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: UL 1907 (F), 4-19-05, UL 263 (S), 10-11-06, UL 263 (S), 10-11-06, UL 263 (S), 10-11-06 Field Sound Test: UL 263 (S), 10-11-06, UL 263 (S), 10-11-06	
GA FILE NO. WP 3310			
GYPSUM WALLBOARD, WOOD STUDS One layer 1/2" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 2 x 4 wood studs 16" o.c. with 1/2" Type X 40' boards, 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.			
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: UL 1907 (F), 4-19-05, UL 263 (S), 10-11-06, UL 263 (S), 10-11-06, UL 263 (S), 10-11-06 Field Sound Test: UL 263 (S), 10-11-06, UL 263 (S), 10-11-06	

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

703 Fire-resistance ratings & fire tests

GA FILE NO. FC 5487	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND
WOOD JOISTS, GYPSUM WALLBOARD Base layer 1/2" type X gypsum wallboard applied at right angles to wood joists 24" o.c. with 1/2" Type W or S 5/8 strand gypsum or Gypsum Veneer base applied at right angles to joists with 1/2" Type W or S 5/8 strand gypsum on 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.			
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: FM FC 172, 2-25-72, ITS 5-4-98 Sound Test: Estimated	
GA FILE NO. FC 5488			
WOOD TRUSSES, GYPSUM WALLBOARD Base layer 1/2" type X gypsum wallboard applied at right angles to parallel chord wood trusses 24" o.c. with 1/2" Type W or S 5/8 strand gypsum or Gypsum Veneer base applied at right angles to trusses with 1/2" Type W or S 5/8 strand gypsum on 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.			
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: FM FC 172, 2-25-72, ITS 5-4-98 Sound Test: Estimated	

703 Fire-resistance ratings & fire tests

GA FILE NO. RC 2001	GENERIC	1 HOUR FIRE
GYPSUM WALLBOARD, WOOD JOISTS, ROOF COVERING Base layer 1/2" type X gypsum wallboard applied at right angles to 2 x 4 wood joists 24" o.c. with 1/2" Type W or S 5/8 strand gypsum or Gypsum Veneer base applied at right angles to joists with 1/2" Type W or S 5/8 strand gypsum on 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.		
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: FM FC 172, 2-25-72, ITS 5-4-98
GA FILE NO. RC 2002		
WOOD TRUSSES, GYPSUM WALLBOARD Base layer 1/2" type X gypsum wallboard applied at right angles to parallel chord wood trusses 24" o.c. with 1/2" Type W or S 5/8 strand gypsum or Gypsum Veneer base applied at right angles to trusses with 1/2" Type W or S 5/8 strand gypsum on 1/4" backer units, 1/4" thin, joint grout, installed with latex-modified polymer cement mortar or ANGLIBLOC 1 Type I organic adhesive. 1/4" mineral fiber insulation, 2.0 and 3.0 inches in total space. *As a fire-resistance-rated assembly, this assembly must be tested in accordance with ASTM E 119 or E 1363.		
PROPRIETARY GYPSUM BOARD American Gypsum Company : 1/2" FireBlock Type X Lath and Mortar Systems : 1/4" FireBlock Type X Sheetrock : 1/4" FireBlock Type X United States Gypsum Company : 1/4" SHEETROCK Brand FIREBLOCK Core Gypsum Panels		Thickness: 4 1/2" Applied Weight: 13 psf Fire Test: FM FC 172, 2-25-72, ITS 5-4-98

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14. **Support Board** – (As an alternate to Item 2, see above). Minimum 5/8 in. thick, 4 1/8 inch studs, spaced vertically to studs and bearing plates on one side of the enclosure and 1/8 in. long. Type 4 concrete 12 in. (30 1/2 in. concrete) and 8 in. (20 1/2 in. in the field) minimum girth of vertically applied insulation and be tested by UL. (Note: Items are tested with open top and the bottom of each component is tested on Item 40. See reference for use with Steel Framing Members, Furring Channels or Filler, Channels).

PARCO BUILDING PRODUCTS L.L.C. 600 PARCO SYSTEM – Type 100 Series 500 (Sheet using 1/8 inch).

15. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick gypsum panels, with screw edges, tested in accordance with UL. (Note: Items are tested with open top and the bottom of each component is tested on Item 40. See reference for use with Steel Framing Members, Furring Channels or Filler, Channels).

GEORGIA PACIFIC SYSTEM L.L.C. 600 PARCO SYSTEM – Type 100 Series 500 (Sheet using 1/8 inch).

16. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick, 4 1/8 inch, water-released coated vertically and secured as described in Item 2.

GEORGIA PACIFIC SYSTEM L.L.C. 600 PARCO SYSTEM – Type 100 Series 500 (Sheet using 1/8 inch).

NATIONAL SYSTEM – Non-fireproof Type 5 Support Board

17. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick, 4 1/8 inch, water-released coated vertically and secured as described in Item 2.

PARCO BUILDING PRODUCTS L.L.C. 600 PARCO SYSTEM – Type 100 Series 500.

18. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick, 4 1/8 inch, water-released coated vertically and secured as described in Item 2.

GEORGIA PACIFIC SYSTEM L.L.C. 600 PARCO SYSTEM – Type 100 Series 500.

NATIONAL SYSTEM – Type 100

19. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick, 4 1/8 inch, water-released coated vertically and secured as described in Item 2.

GEORGIA PACIFIC SYSTEM L.L.C. 600 PARCO SYSTEM – Type 100 Series 500.

NATIONAL SYSTEM – Type 100

20. **Support Board** – (As an alternate to Item 2) – 5/8 in. thick, 4 1/8 inch, water-released coated vertically and secured as described in Item 2.

GEORGIA PACIFIC SYSTEM L.L.C. 600 PARCO SYSTEM – Type 100 Series 500.

NATIONAL SYSTEM – Type 100

21. **Wall and Partition Facing and Accessories** – (As an alternate to Item 2) – Minimum 5/8 in. thick, 4 1/8 inch panels, tested vertically and secured as described in Item 2.

PARCO BUILDING PRODUCTS L.L.C. 600 PARCO SYSTEM – Type 100 Series 500.

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3. **Joints and Halfheads** – Halfhead joints covered with gasket tape and joint compound. Halfheads covered with joint compound. Gypsum plaster not more than 1/2 in. thick may be applied over the halfhead in addition to the specified joint treatment.

4. **Batts and Blankets** – (Not Shown) – Optimal glass fiber insulation.

KERTANTHEED CORP. JOHN P. WILLE INTERNATIONAL INC. CHRYSLER CORP.

40. **Fiber, sprayed** – As an alternate to Batts and Blankets (Item 4) – Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product with a minimum dry density of 2.0 lbs/ft³. (Note: Minimum Application Method): The fiber is applied without water or additive at a minimum dry density of 2.0 lbs/ft³ in accordance with the application instructions supplied with the product. When Item 3 is used, fiber, sprayed shall be 190779, 190746, 190750 or 190752.

41. **GREENFIBER L.L.C.** – 190779 & 190746 for use with wet or dry application. 190750, 190752, 190753, 190754, 190755, 190756, 190757 and 190758 may be used for dry application only.

42. **Fiber, sprayed** – As an alternate to Batts and Blankets (Item 4) and Item 40 – Spray applied cellulose insulation material. The fiber is applied with water to completely fill the enclosed cavity. Minimum dry density of 2.0 pounds per cubic ft.

MI-WOOD CO. INC. – Cellulose Insulation

43. **Batts and Blankets** – Reserved for use with resistant channels, Item 6, 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 4 in. face of the studs with staples placed 24 in. OC.

THERMAFIBER INC. – Type SAF5

44. **Glass Fiber Insulation** – (As an alternate to Item 40) – 3 in. thick glass fiber batts bearing the UL Classification Marking as a Surface Burning and/or Fire Resistance, placed to fill the interior of the wall, attached to the 4 in. face of the studs with staples placed 24 in. OC. Use **Batts and Blankets (Batts or Blanks)** categories for names of classified companies.

45. **Batts and Blankets** – Reserved for use with Wall and Partition Facing and Accessories, Item 20 – Glass fiber insulation, min 3-1/2 in. thick, min. density of 2.00 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less. Applied to completely fill the stud spaces. See Batts and Blankets Category (Batts) for names of manufacturers.

46. **Fiber, sprayed** – As an alternate to Batts and Blankets (Item 4) – Spray applied cellulose fiber. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. The minimum dry density shall be 4.30 lbs/ft³.

INTERNATIONAL CELLULOSE CORP. – Cellulose

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7. **Steel Framing Members (Optional, Not Shown)** – Furring channels and Steel Framing Members as described below:

a. **Furring Channels** – Formed of No. 20 HSS galv steel, 2-1/4 in. x 2-1/2 in. wide by 1/8 in. deep. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item 3. Studs of additional channels are connected to studs and together with double end of No. 18 HSS galv steel are one end and of center to end alternate, ends of adjoining channels may be overlapped 6 in. and secured together with one self-tapping #8 framing screw, min. 7/16 in. long at the end of the overlap, with one screw at each end of length of the channel. Halfhead attached to furring channels as described in Item 2.

b. **Steel Framing Members** – Used to attach furring channels (Item a) to studs (Item 1) – Clips spaced 48 in. OC, and secured to studs with No. 8 x 2-1/2 in. screws drawn tight through the entire assembly. Furring channels are spaced 24 in. apart. 6500-1 clip for use with 2-1/4 in. wide furring channels. 6500-2 (2.75) clip for use with 2-1/2 in. wide furring channels.

PAR INTERNATIONAL INC. – Types 6500-1, 6500-1 (2.75).

8a. **Steel Framing Members (Optional, Not Shown)** – Furring channels and Steel Framing Members as described below:

a. **Furring Channels** – Formed of No. 20 HSS galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item 3. Studs of additional channels are connected to studs and together with double end of No. 18 HSS galv steel are one end and of center to end alternate, ends of adjoining channels may be overlapped 6 in. and secured together with one self-tapping #8 framing screw, min. 7/16 in. long at the end of the overlap, with one screw at each end of length of the channel. Studs secured attached to furring channels as described in Item 2.

b. **Steel Framing Members** – Used to attach furring channels (Item a) to studs. Clips spaced 48 in. OC, and secured to studs with No. 8 x 2-1/2 in. screws drawn tight through the entire assembly. Furring channels are spaced 24 in. apart. 6500-1 clip for use with 2-3/8 in. wide furring channels. 6500-2 (2.75) clip for use with 2-1/2 in. wide furring channels.

PAR INTERNATIONAL INC. – Type 6500-1, 6500-1 (2.75).

8b. **Steel Framing Members (Optional, Not Shown)** – Furring channels and resistant insulation clip as described below:

a. **Furring Channels** – Formed of No. 20 HSS galv steel, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item 3. Studs of additional channels are connected to studs and together with double end of No. 18 HSS galv steel are one end and of center to end alternate, ends of adjoining channels may be overlapped 6 in. and secured together with one self-tapping #8 framing screw, min. 7/16 in. long at the end of the overlap, with one screw at each end of length of channel. Both Uppon Boards at side joints fastened into channel with screws spaced 6 in. OC, approximately 1/2 in. from joint edge.

b. **Steel Framing Members** – Resistant sound insulation clip used to attach furring channels (Item 8a) to studs. Clips spaced 24 in. OC, and secured to studs with No. 10 x 2-1/2 in. screws drawn tight through the entire assembly. Furring channels are spaced 24 in. apart.

WINDCO BUILDING SYSTEMS – RESOUNDUM Sound Insulation Clip – Type A2374



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6. **Furring Channel** – (Optional - Not Shown) - For use on one side of the wall - Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Items 4C or 4D is required.

6A. **Steel Framing Members*** – (Optional - Not Shown) - Used as an alternate method to attach resilient channels (Item 6) to one side of studs only. Clips attached at each intersection of the resilient channel and the wood studs (Item 1). Resilient channels are friction fitted into clips, and then clips are secured to the wood stud with min. 1-3/4 in. long diamond shaped point, double lead Phillips head steel screws through the center hole of the clip and the resilient channel flange.

7. **Wall and Partition Facings and Accessories*** – (Optional, Not shown) – Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-512 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L.L.C. DBA PABCO GYPSUM – Type QuietRock QR-510.

8. **Cementitious Backer Units*** – (Optional Item Not Shown) - For Use On Face Of 1 Hr With All Standard Items Required) – 1/8 in., 3/8 in., 3/4 in. or 1 in. thick, min. 32 in. wide. Applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with cement based screws of adequate length to penetrate stud by a minimum of 3/8 in. for steel framing members, and a minimum of 3/4 in. for wood framing members spaced a max of 8 in. OC. When 4 ft. wide boards are used, horizontal joints need not be backed by framing.

NATIONAL GYPSUM CO – Type DuraBacker, FemaBase, DuraBacker Plus, or FemaBase Plus

9. **Non-Bearing Wall Partition Intersection** – (Optional) Two nominal 2 by 4 in. stud or nominal 2 by 6 in. stud nailed together with two 3in. long 10d nails spaced a max. 16 in. OC, vertically and fastened to one side of the minimum 2 by 4 in. stud with 3 in. long 10d nails spaced a max. 16 in. OC, vertically. Intersection between partition wood studs to be flush with the 2 by 4 in. studs. The wall partition wood studs are to be framed by with a second 2 by 4 in. wood stud fastened with 3 in. long 10d nails spaced a max. 16 in. OC, vertically. Maximum one non-bearing wall partition intersection per stud cavity. Non-bearing wall partition stud depth shall be at a minimum equal to the depth of the bearing wall.

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10. **Mineral and Fiber Board*** – (Optional, Not shown) – For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with 2 in. long Type W steel screws, spaced 12 in. OC. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO – Homasote Type 440-32

10A. **Mineral and Fiber Board*** – (Optional, Not shown) – For use with Items 10B-10E) – For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-1/8 in. long long shank nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC along board edges and 24 in. OC in field of board along intermediate framing. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO – Homasote Type 440-32

10B. **Glass Fiber Insulation** – (For use with Item 10A) – 3-1/2 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall. See Batts and Blankets (BIBW or BIZB) categories for names of Classified companies.

10C. **Batts and Blankets*** – (As an alternate to Item 10B, For use with Item 10A), 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 3-1/2 in. face of the studs with staples placed 24 in. OC.

THERMAFIBER INC – Type SAFB

10D. **Adhesive** – (For use with Item 10A) - Construction grade adhesive applied in vertical, serpentine, nominal 3/8 in. wide beads along the length of both vertical edges of Mineral and Fiber Board (Item 10A).

10E. **Gypsum Board*** – (For use with Item 10A) - 5/8 in. thick, 4 ft wide, applied vertically over Mineral and Fiber Board (Item 10A) with vertical joints located anywhere over stud cavities. Secured to mineral and fiber boards with 1-1/2 in. Type G Screws spaced 8 in. OC along edges, each vertical joint and 12 in. OC intermediate field of the Mineral and Fiber Board (Item 10A). Secured to outermost studs and bearing plates with 2 in. long Type S screws spaced 8 in. OC. Gypsum Board joints covered with paper tape and joint compound. Screw heads covered with joint compound. Finish Rating 30 Min.

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703.3 Alternative methods for determining fire resistance.

The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E 119 or UL 263. The required *fire resistance* of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures:

1. Fire-resistance designs documented in sources.
2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 720.
3. Calculations in accordance with Section 721.
4. Engineering analysis based on a comparison of building element, component or assemblies designs having *fire-resistance ratings* as determined by the test procedures set forth in ASTM E 119 or UL 263.
5. Alternative protection methods as allowed by Section 104.11.

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1. Sources

- HUD Fire Ratings of Archaic Materials & Assemblies
- USG Fire Resistant Assemblies
- GA Fire Resistance Design Manual
- FM Global Data Sheet – Fire Resistance of Building Assemblies

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2. Prescriptive designs per Section 720 Table 720.1 – 20 pages of assemblies

TABLE 720.1 (2)-continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS 4.4.3

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE* (INCHES)			
			4 HOUR	2 HOUR	1 HOUR	1 HOUR
15. Exterior or interior walls (continued)	15-1.12a	2" x 6" wood studs at 16" with double top plates, single bottom plate, interior and exterior sides covered with 3/8" Type X gypsum wallboard, 4" wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/2" Type 5 drywall screws, spaced 12" on center. Cavity to be filled with 5/8" mineral wool insulation.	-	-	-	5/8"
	15-1.12b	2" x 6" wood studs at 16" with double top plates, single bottom plate, interior and exterior sides covered with 3/8" Type X gypsum wallboard, 4" wide, applied vertically with all joints over framing or blocking and fastened with 2 1/2" Type 5 drywall screws, spaced 12" on center. R-19 mineral fiber insulation installed in stud cavity.	-	-	-	5/8"
		2" x 6" wood studs at 16" with double top plates, single bottom plate, interior and				

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3. Calculations per Section 721

SECTION 721 CALCULATED FIRE RESISTANCE

721.1 General. The provisions of this section contain procedures by which the *fire resistance* of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used. 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/AF&PA *National Design Specification for Wood Construction (NDS)*.

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3. Calculations per Section 721

TABLE 721.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANE^{a,b,c,d}

DESCRIPTION OF FINISH	TIME ^e (minutes)
5/8-inch wood structural panel bonded with exterior glue	5
1 1/2-inch wood structural panel bonded with exterior glue	10
1 1/2-inch wood structural panel bonded with exterior glue	15
3/8-inch gypsum wallboard	10
1/2-inch gypsum wallboard	15
5/8-inch gypsum wallboard	30
1/2-inch Type X gypsum wallboard	25
5/8-inch Type X gypsum wallboard	40
Double 3/8-inch gypsum wallboard	25
1/2-inch + 3/8-inch gypsum wallboard	35
Double 1/2-inch gypsum wallboard	40

- These values apply only when membranes are installed on framing members which are spaced 16 inches o.c.
- Gypsum wallboard installed over framing or sheathing shall be installed so that all edges are supported, except 1/2-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported for finished.
- On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.
- The membranes on the unexposed side shall not be included in determining the fire-resistance of the assembly. Where dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weakest) side.
- The time assigned is not a finished rating.

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3. Calculations per Section 721

TABLE 721.6.2(2)
TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME^{a,b,c}

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	20
Wood floor and roof joists 16 inches o.c.	10

For SI: 1 inch = 25.4 mm.

a. This table does not apply to studs or joists spaced more than 16 inches o.c.

b. All studs shall be treated 2 x 4 and all joists shall have a nominal thickness of at least 2 inches.

c. Allowable spans for joists shall be determined in accordance with Sections 2308.8.2.308.10.2 and 2308.10.3.

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3. Calculations per Section 721

TABLE 721.6.2(3)
MEMBRANES ON EXTERIOR FACE OF WOOD STUD WALLS

SHEATHING	PAPER	EXTERIOR FINISH
5/8-inch T & G lumber		Lumber siding
5/8-inch exterior glue wood structural panel	Sheathing paper	Wood shingles and shakes
1/2-inch gypsum wallboard		1/2-inch wood structural panels-exterior type
3/8-inch gypsum wallboard		1/4-inch hardboard
1/2-inch fiberboard		Metal siding
		Stucco on metal lath
		Masonry veneer
		Vinyl siding
None		3/4-inch exterior-grade wood structural panels

For SI: 1 pound/cubic foot = 16.0185 kg/m³.

a. Any combination of sheathing, paper and exterior finish is permitted.

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4. Engineering analysis

4. Engineering analysis based on a comparison of building element, component or assemblies designs having *fire-resistance ratings* as determined by the test procedures set forth in ASTM E 119 or UL 263.

- Computer modeling
- Fire protection engineering

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4. Engineering analysis



Glass/Steel Bridge, Seattle City Hall

Early in 2003, the City of Seattle completed construction of a new City Hall building. One of the more striking architectural features of the new building is a bridge spanning the public lobby space. The bridge floor and rails are constructed of glass panels with steel supports, and the entire structure is stabilized laterally with steel rods. Given the type of construction of the building, the prescriptive provisions of the SBC require any structure supporting floor loads to be protected by three-hour fire-rated construction. For most steel structures, this protection is provided by spray-applied fireproofing. However, that method would have destroyed the architecture of the bridge. Instead, the fire protection engineer was able to demonstrate that an "expected" fire, uncontrolled by sprinklers and placed in the "worst" location, would not raise the temperature of the steel to the point where the bridge would collapse.

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5. Alternative protection methods as allowed by Section 104.11

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety.

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5. Alternative protection methods as allowed by Section 104.11

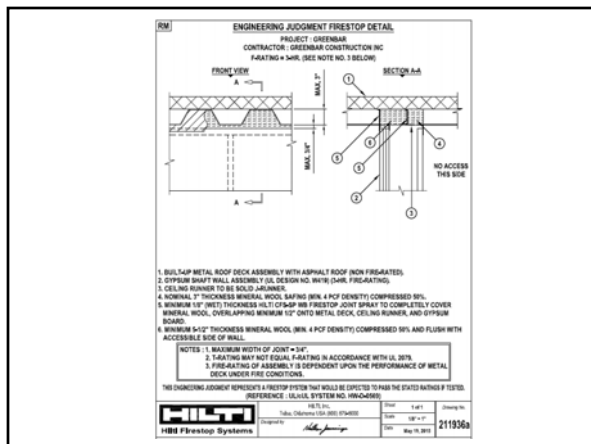
104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

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5. Alternative protection methods as allowed by Section 104.11

- Engineering Judgements from manufacturer's technical or engineering staff



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704.2 Column Protection

- Per Table 601
- Types I-A, I-B, II-A, III-A, V-A construction
- Individually wrapped in all conditions

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704.4 Secondary Members

- Structural members with no direct connection to columns
- Floor construction with no direct connection to columns
- Other than primary structural frame
- Protection per Table 601
- Membrane within horizontal ceiling assemblies, individual encasement per 712 or combination of both

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Wood Construction

- Column & primary frame protection not typically applied to wood construction
- Type IV Heavy Timber construction not included.
- Fire resistance in wood columns in Types III-A, III-B or V-A construction can be tested or use 5 methods in 703.3.
- "Primary structural frame" is not referring to heavy timber or light frame construction

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Light-Frame Construction

LIGHT-FRAME CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

704.4.1 Light-frame construction. King studs and boundary elements that are integral elements in *load-bearing walls* of light-frame construction shall be permitted to have required *fire-resistance ratings* provided by the membrane protection provided for the *load-bearing wall*.

704 Fire-resistance ratings of structural elements

704.10 Exterior Structural Members

704.10 Exterior structural members. 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. As required by Table 601 for the type of building element based on the type of construction of the building;
2. As required by Table 601 for exterior bearing walls based on the type of construction; and
3. As required by Table 602 for *exterior walls* based on the *fire separation distance*.

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704.10 Exterior Structural Members

**TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS GROUPS**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV		TYPE V	
	A	B	A ₁	B ₁	A ₂	B ₂	A ₃	B ₃	A ₄	B ₄
Primary structural frame ^a (see Section 202)	3 ^b	2 ^b	1	0	1	0	HT		1	0
Bearing walls Exterior ^c Interior	3 2 ^b	2 1 ^b	1 0	0 1	2 1	2 0	2 HT		2 1	0 0
Nonbearing walls and partitions Exterior	See Table 602									
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	See Section 602.4.4		0	0
Fire construction and secondary members (see Section 202)	2	2	1	0	1	0	HT		1	0
Roof construction and secondary members (see Section 202)	1 ^e , 2 ^f	1 ^e , 2 ^f	1 ^e , 2 ^f	0	1 ^e , 2 ^f	0	HT		1 ^e , 2 ^f	0

For SI, 1 foot = 0.3048 m.
^a Except for Group I, II, III and V-1 occupancies, the protection of structural members shall not be required, including protection of steel framing and decking where steel joist and composite deck is 20 feet or more above and from immediately below. For structural-treated wood members shall be allowed to be used for such unprotected members.
^b In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
^c An approved automatic sprinkler system in accordance with Section 903.2.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other portions of the code or used for an allowable area approved in accordance with Section 206.1 as an alternative single increase in accordance with Section 704.2. The 1-hour substitution for the fire-resistance of exterior walls shall not be permitted.
^d Not less than the fire-resistance rating required by other sections of this code.
^e Not less than the fire-resistance rating based on the separation distance (see Table 602).
^f Not less than the fire-resistance rating as referenced in Section 704.10.

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704.10 Exterior Structural Members

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^a

FIRE SEPARATION DISTANCE ^a X ^b (ft/0)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP ^c	OCCUPANCY GROUP ^c F-1, M, S-1 ^d	OCCUPANCY GROUP ^c A, B, E, F-2, I, R, S-2 ^e , UP ^f
X < 5 ^g	All	3	2	1
5 < X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1 ^h
	III, VB	1	0	0
	Others	1	1	1 ^h
X ≥ 30	All	0	0	0

^a For SI, 1 foot = 304.8 mm.
^b Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
^c For special requirements for Group U occupancies, see Section 406.1.2.
^d See Section 706.1.1 for party walls.
^e Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
^f The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
^g For special requirements for Group II occupancies, see Section 413.3.
^h For special requirements for Group S aircraft hangars, see Section 412.4.1.

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704.13 Sprayed Fire Resistant Materials – SFRM

- Applied per fire resistance rating & listing
- Manufacturer's installation instructions
- Clean substrate
- Compatible primers, paints, encapsulants
- Temp 40 deg F
- Finished condition – no cracks, voids, spalls, delamination or exposure

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- 704.13 Sprayed Fire Resistant Materials – SFRM



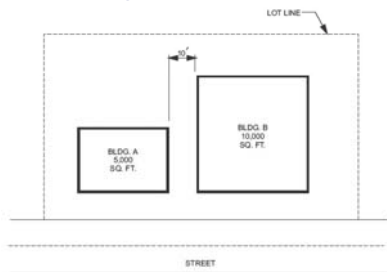
705 Exterior Walls

705.3 Buildings on same lot

- Imaginary line between bldgs
- Existing bldgs not made non-compliant
- Option to treat as one building

705 Exterior Walls

704.3 Buildings on same lot



705 Exterior Walls

705.4 Materials

705.4 Materials. *Exterior walls* shall be of materials permitted by the building type of construction.

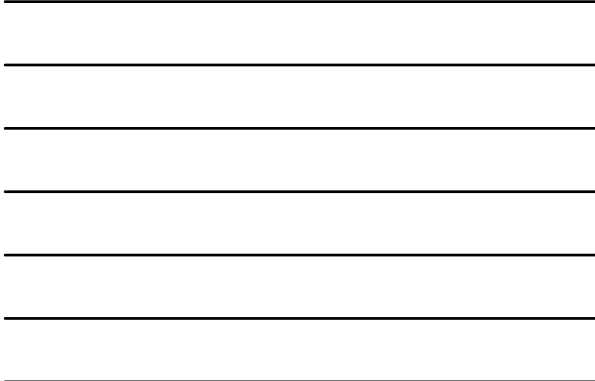
705 Exterior Walls

705.5 Fire resistance

TABLE 601
FIRE RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV		TYPE V	
	A	B	A	B	A	B	HT	HT	A	B
Primary structural frame ^a (see Section 302)	3 ^b	2 ^c	1	0	1	0	HT	HT	1	0
Beaming walls Exterior ^d	3	2	1	0	2	2	2	1	1	0
Exterior ^e	3 ^b	2 ^c	1	0	1	0	1-HT	1	1	0
Nonbearing walls and partitions Exterior ^f	See Table 602									
Nonbearing walls and partitions Interior ^g	0	0	0	0	0	0	See Section 602.4.6	0	0	0
Floor construction and secondary members (see Section 302)	2	2	1	0	1	0	HT	HT	1	0
Roof construction and secondary members (see Section 302)	1 ^{h,i}	N/A	N/A	0	N/A	0	HT	N/A	0	0

For SI: 1 foot = 304.8 mm.
 a. Steel joists: For resistance ratings of primary structural frames and beaming walls see permitted to be reduced by 1 hour where supporting a roof only.
 b. Except in Group F-1, F-2, F-3 and S-1 occupancies, the protection of structural members shall not be required, including protection of steel framing and decking where any of the roof construction is 30 feet or more above any floor immediately below. For protection needed beyond members shall be allowed to be used in such supplemental members.
 c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
 d. An approved automatic sprinkler system in accordance with Section 909.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 706.3 or an allowable height increase in accordance with Section 706.2. The 1-hour substitution for the fire-resistance of exterior walls shall not be permitted.
 e. Not less than the fire-resistance rating required by other sections of this code.
 f. Not less than the fire-resistance rating based on the separation distance (see Table 602).
 g. Not less than the fire-resistance rating as referenced in Section 704.10.
 h. Not less than the fire-resistance rating as referenced in Section 704.10.
 i. Not less than the fire-resistance rating as referenced in Section 704.10.



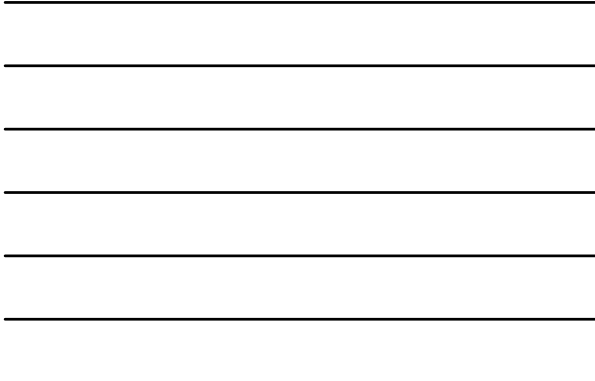
705 Exterior Walls

705.5 Fire resistance

TABLE 602
FIRE RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE*

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP ^b	OCCUPANCY GROUP F-1, M, S-1 ^c	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2 ^d , U ^e
X < 3'	III	3	2	1
3 < X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 20	IA, IB	2	1	1 ^f
	IIA, IIB	1	0	0
	Others	1	1	1 ^f
X ≥ 30	III	0	0	0

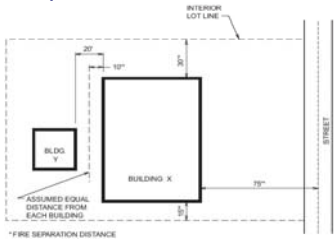
For SI: 1 foot = 304.8 mm.
 a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
 b. For special requirements for Group U occupancies, see Section 406.1.2.
 c. See Section 706.1.1 for party walls.
 d. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
 e. The fire-resistance rating of the exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
 f. For special requirements for Group H occupancies, see Section 411.3.
 g. For special requirements for Group S aircraft hangars, see Section 412.4.1.



705 Exterior Walls

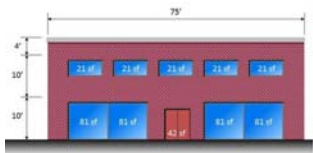
705.5 Fire resistance

- Fire separation distance



705 Exterior Walls

705.8 Openings



705 Exterior Walls

705.8 Openings

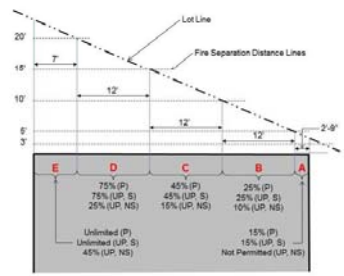
TABLE 705.8
 MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIVE SEPARATION DISTANCES AND HEIGHT OF OPENING RESTRICTIONS

TYPE OF WALL SYSTEM	HEIGHT OF OPENING RESTRICTIONS	RESTRICTIONS	MAXIMUM AREA*
8 in. concrete masonry	10'	Openings Separated (O.P.S.)	Not Permitted
		Openings Separated (O.P.S.)	Not Permitted
8 in. concrete masonry	12'	Openings Separated (O.P.S.)	Not Permitted
		Openings Separated (O.P.S.)	Not Permitted
14 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
14 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
20 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
20 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
24 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
24 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
30 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
30 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
48 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
48 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
60 in. concrete masonry	10'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%
60 in. concrete masonry	12'	Openings Separated (O.P.S.)	10%
		Openings Separated (O.P.S.)	10%

* See Table 705.8.1 for notes.
 1. O.P.S. = Openings Separated.
 2. Openings separated by a fire-rated wall system shall be treated as fire-rated walls.
 3. Openings separated by a fire-rated wall system shall be treated as fire-rated walls.
 4. Openings separated by a fire-rated wall system shall be treated as fire-rated walls.
 5. The maximum height of openings shall not exceed the height of the wall.
 6. The maximum height of openings shall not exceed the height of the wall.
 7. The maximum height of openings shall not exceed the height of the wall.
 8. The maximum height of openings shall not exceed the height of the wall.
 9. The maximum height of openings shall not exceed the height of the wall.
 10. The maximum height of openings shall not exceed the height of the wall.

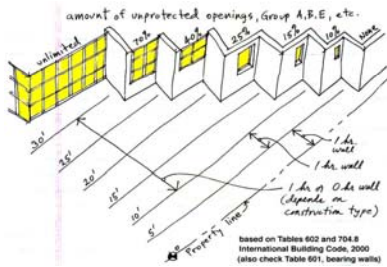
705 Exterior Walls

705.8 Openings



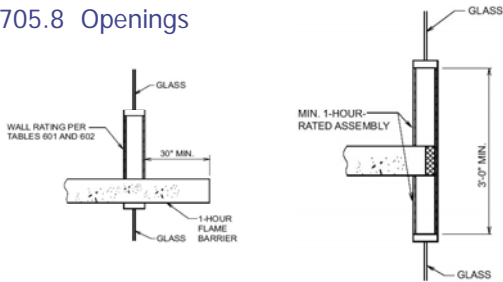
705 Exterior Walls

705.8 Openings



705 Exterior Walls

705.8 Openings



706 Fire Walls

706.3 Materials. *Fire walls* shall be of any approved noncombustible materials.

Exception: Buildings of Type V construction.

706.4 Fire-resistance rating. *Fire walls* shall have a fire-resistance rating of not less than that required by 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-3 ^b , H-S, 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 3-hour fire-resistance rating.
^b For Group H-1, H-2 or H-3 buildings, also see Sections 415.4 and 415.5.

706 Fire Walls

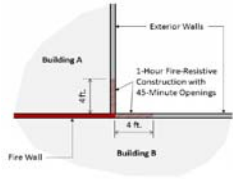


Figure 1 – Termination of fire wall at exterior walls less than 180° apart using Option 1 simple prescriptive method



Figure 2 – Example of terminating fire wall at exterior walls less than 180° apart using Option 2 fire separation distance method.

706 Fire Walls

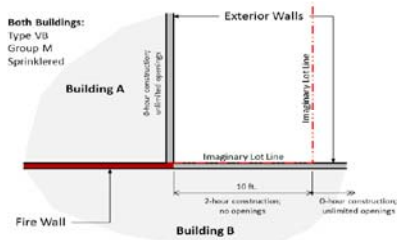


Figure 3 – Another Option 2 example using a different imaginary lot line location.

706 Fire Walls

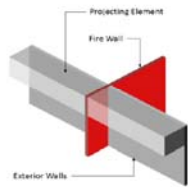


Figure 4 – Requirement for fire wall through projecting element.

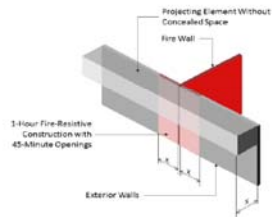


Figure 5 – Requirement for fire wall through projecting elements without concealed space.

706 Fire Walls

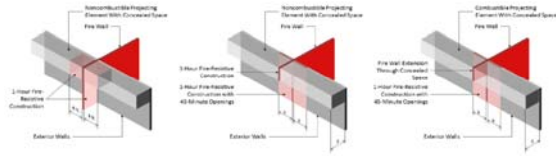


Figure 6 – Requirement for fire wall through noncombustible projecting element with concealed space.

Figure 7 – Alternate requirement for fire wall through noncombustible projecting element with concealed space.

Figure 8 – Requirement for fire wall through combustible projecting element with concealed space.

706 Fire Walls

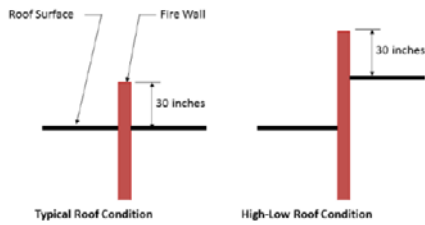


Figure 9 – Vertical extension of fire wall through roof.

706 Fire Walls

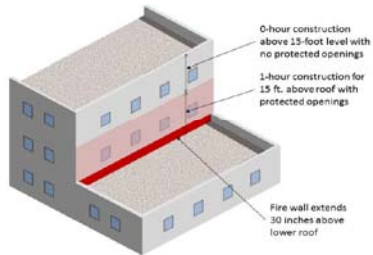


Figure 10 – Fire wall extension through roof for stepped buildings.

707 Fire Barriers & 709 Fire Partitions

Fire Barrier	Fire Partition
Fire Resistance Rated	
Protected Openings, limited to 25% wall length	Protected Openings, no limit
Extends from top of floor to underside of floor above	Extends from top of floor to underside of floor above or rated ceiling
Example: Stairway Enclosures	Example: Corridor Walls
Supporting construction requires same fire rating	Supporting construction often does not require same fire rating

- Fire Wall: Fire barrier that separates building into two structurally independent buildings.

707 Fire Barriers

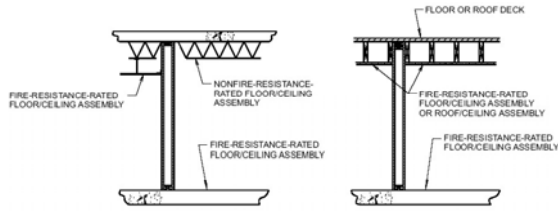
- Shaft enclosures
- Exit enclosures
- Exit passageway
- Horizontal exit
- Atriums
- Incidental accessory occupancies
- Control areas
- Separated occupancies
- Fire areas (along w/ horizontal assemblies)

707 Fire Barriers

TABLE 707.3.9
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE
BARRIER ASSEMBLIES OR HORIZONTAL ASSEMBLIES
BETWEEN FIRE AREAS

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

707 Fire Barriers



709 Fire Partitions

- Dwelling unit separation
- Sleeping unit separation
- Tenants in covered mall buildings
- Corridor walls
- Required elevator lobby

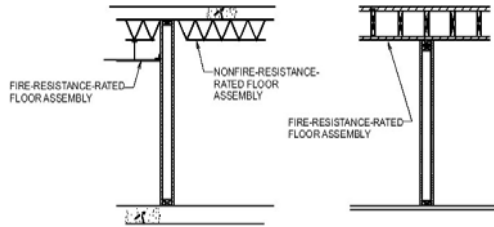
709 Fire Partitions

709.3 Fire-resistance rating. Fire partitions shall have a fire-resistance rating of not less than 1 hour.

Exceptions:

1. Corridor walls permitted to have a 1/2 hour fire-resistance rating by Table 1018.1.
2. Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB and VB construction shall have fire-resistance ratings of not less than 1/2 hour in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

709 Fire Partitions



710 Smoke Barriers & 711 Smoke Partitions

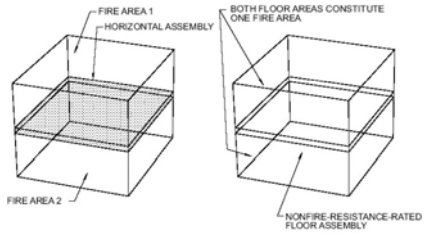
Smoke Barrier	Smoke Partition
Fire Resistance Rated (1-hour)	No Fire Rating
Rated, Protected Openings (smoke dampers)	Openings must resist passage of smoke (smoke dampers)
Extends from top of floor to underside of floor above or rated, smoke-resistant ceiling	Extends from top of floor to underside of floor above or smoke-resistant ceiling
Example: Hospital Smoke Compartments	Example: Hospital Corridors

712 Horizontal Assemblies

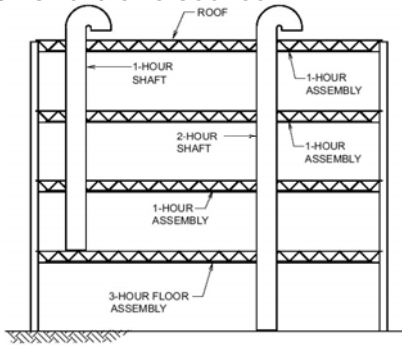
712.3 Fire-resistance rating. The *fire-resistance rating* of floor and roof assemblies shall not be less than that required by the building type of construction. Where the floor assembly separates mixed occupancies, the assembly shall have a *fire-resistance rating* of not less than that required by Section 508.4 based on the occupancies being separated. Where the floor assembly separates a single occupancy into different *fire areas*, the assembly shall have a *fire-resistance rating* of not less than that required by Section 707.3.9. *Horizontal assemblies* separating *dwelling units* in the same building and *horizontal assemblies* separating *sleeping units* in the same building shall be a minimum of 1-hour fire-resistance-rated construction.

Exception: *Dwelling unit* and *sleeping unit* separations in buildings of Type IIB, IIIB and VB construction shall have *fire-resistance ratings* of not less than 1/2 hour in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

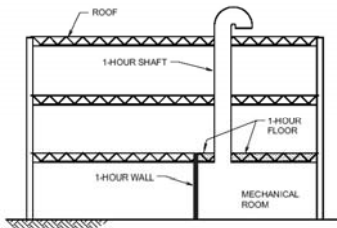
712 Horizontal Assemblies



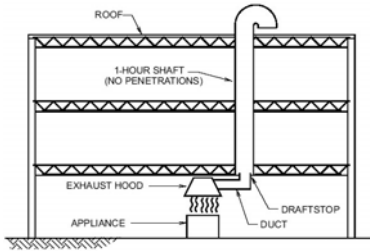
708 Shaft enclosures



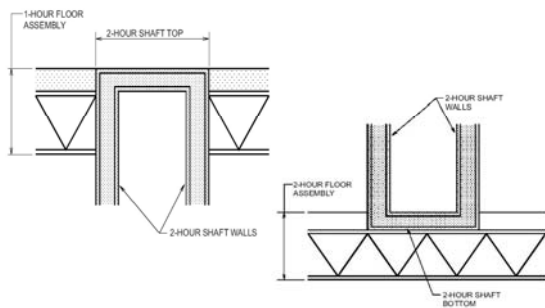
708 Shaft enclosures



708 Shaft enclosures



708 Shaft enclosures



708 Shaft enclosures

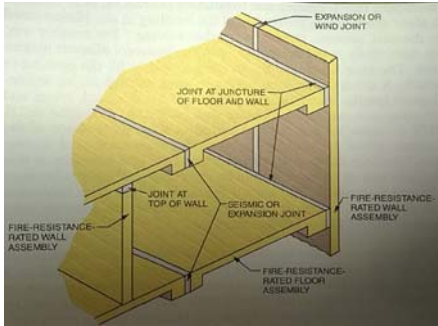
When rated shaft enclosure is required: Self-supporting shaft

-OR-

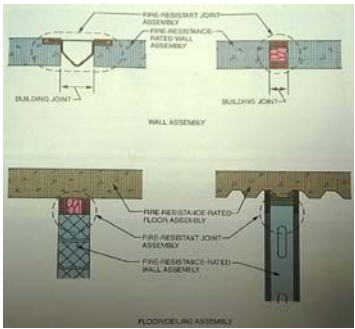
Supporting construction must have same rating as shaft (1 bay around shaft in steel frame construction)



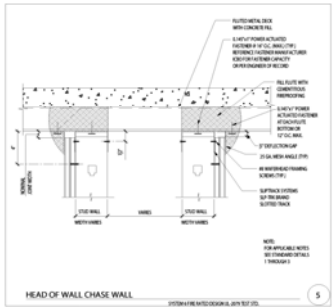
Examples of Joints

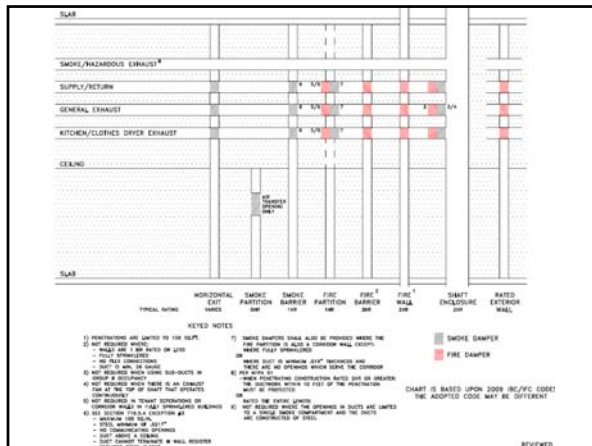


Types of Joints

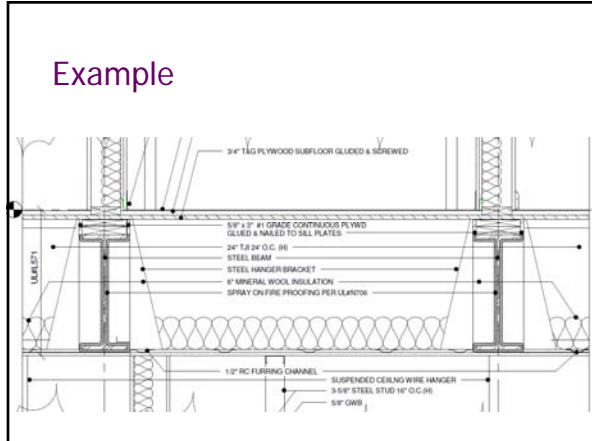


Head of Wall

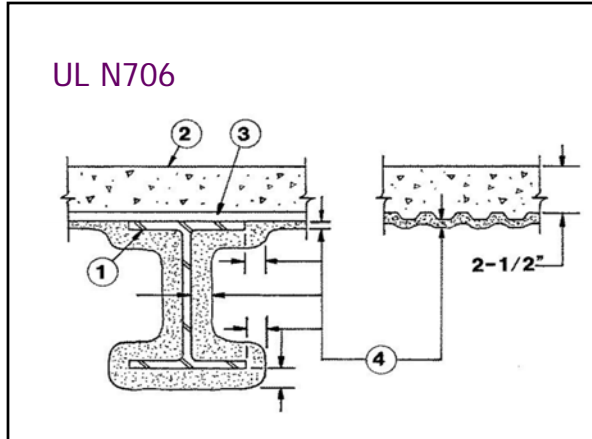




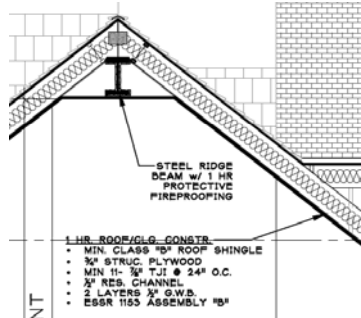
Example



UL N706



Example



Example

