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

D·E·S·I·G·N and TRADES CONFERENCE
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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 as stories and feet above grade plane.
Area limitations as determined by the definition of "Area, building," per floor.

GROUP	Hgt(ft)[1]	TYPE OF CONSTRUCTION									
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
		UL	160	65	55	65	55	65	50	40
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	4	5	4	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
F-1	S	UL	11	4	2	3	2	4	2	1
	A	UL	UL	25,000	15,500	19,000	12,000	33,500	14,000	8,500
F-2	S	UL	11	5	3	4	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	18,000	50,500	21,000	13,000
H-1	S	1	1	1	1	1	1	1	1	NP
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	NP
H-2	S	UL	3	2	1	2	1	2	1	1
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	3,000
H-3	S	UL	6	4	2	4	2	4	2	1
	A	UL	60,000	26,500	14,000	17,500	13,000	25,500	10,000	5,000
H-4	S	UL	7	5	3	5	3	5	3	2
	A	UL	UL	37,500	17,500	28,500	17,500	36,000	18,000	6,500
H-5	S	3	3	3	3	3	3	3	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
I-1	S	UL	9	4	3	4	3	4	3	2
	A	UL	55,000	19,000	10,000	16,500	10,000	18,000	10,500	4,500
I-2	S	UL	4	2	1	1	NP	1	1	NP
	A	UL	UL	15,000	11,000	12,000	NP	12,000	9,500	NP
I-3	S	UL	4	2	1	2	1	2	2	1
	A	UL	UL	15,000	11,000	10,500	7,500	12,000	7,500	5,000
I-4	S	UL	5	3	2	3	2	3	1	1
	A	UL	60,500	26,500	13,000	23,500	13,000	25,500	18,500	9,000
M	S	UL	11	4	4	4	4	4	3	1
	A	UL	UL	21,500	12,500	18,500	12,500	20,500	14,000	9,000
R-1	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
R-2[g]	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
R-3[g]	S	UL	11	4	4	4	4	4	3	3
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
R-4	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
S-1	S	UL	11	4	3	3	3	4	3	1
	A	UL	48,000	26,000	17,500	26,000	17,500	25,500	14,000	9,000
S-2[b,c]	S	UL	11	5	4	4	4	5	4	2
	A	UL	79,000	39,000	26,000	39,000	26,000	38,500	21,000	13,500
U[e]	S	UL	5	4	2	3	2	4	2	1
	A	UL	35,500	19,000	8,500	14,000	8,500	18,000	9,000	5,500

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	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Structural frame[a] Including columns, girders, trusses	3[b]	2[b]	1	0	1	0	HT	1	0
Bearing walls Exterior[f]	3	2	1	0	2	2	2	1	0
Interior	3[b]	2[b]	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction Including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction Including supporting beams and joists	$1^1/_2$[c]	1[c]	1[c]	0	1[c]	0	HT	1[c]	0

For SI: 1 foot = 304.8 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 connection 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 bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

c. 1. Except in Factory-Industrial (F-1), Hazardous (H), Mercantile (M) and Moderate-Hazard Storage (S-1) occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-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-retardant-treated wood shall be allowed in buildings including girders and trusses as part of the roof construction when 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 in accordance with Section 903.3.1.1 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 506.3 or an allowable height increase in accordance with Section 504.2. 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 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[c]	All	3	2	1
≥ 5	IA	3	2	1
< 10	Others	2	1	1
≥ 10	IA, IB	2	1	1
< 30	IIB, VB	1	0	0
	Others	1	1	1
≥ 30	All	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. 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 503.2 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

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

703 Fire-resistance ratings & fire tests

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

- ASTM E 119
- 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 Materials[1]

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," "½-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.

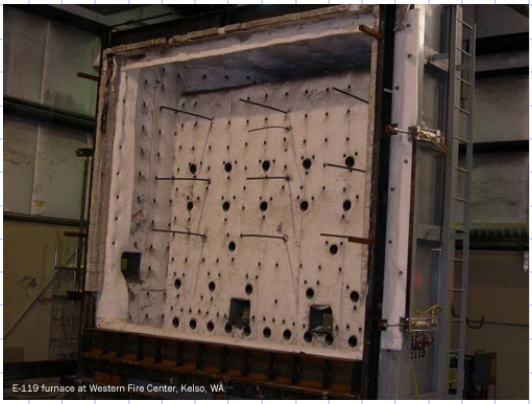
703 Fire-resistance ratings & fire tests

Designation: E 119 – 00a

An American National Standard

Standard Test Methods for Fire Tests of Building Construction and Materials[1]

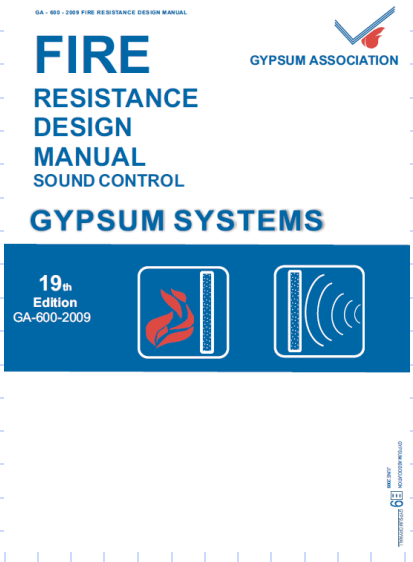
The vertical furnace shown in this photograph is used to evaluate the fire performance of wall assemblies



E-119 furnace at Western Fire Center, Kelso, WA

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 official* to 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*.



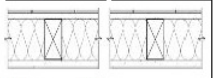
703 Fire-resistance ratings & fire tests

GA FILE NO. WP 3441	PROPRIETARY*	1 HOUR FIRE	40 to 44 FSTC SOUND

GYPSUM WALLBOARD, MINERAL FIBER INSULATION, CEMENTITIOUS BACKER UNIT, CERAMIC TILE, WOOD STUDS

One layer ½" thick proprietary cementitious backer unit applied parallel or at right angles to 2 x 4 wood studs 16" o.c. with 1½" galvanized roofing nails or 1⅝" wafer head screws 8" o.c. Ceramic tile, ¼" thick, joints grouted, installed with latex-modified portland cement mortar or ANSI A136.1 Type I organic adhesive. 3½" mineral fiber insulation, 2.0 pcf, friction fit in stud space.

OPPOSITE SIDE: One layer ⅝" proprietary type X gypsum wallboard applied parallel or at right angles to studs with 6d cement coated nails, 1⅞" long, 0.0915" shank, ¼" heads, 7" o.c. As an alternate, one layer ½" thick proprietary cementitious backer unit applied with 1½" galvanized roofing nails or 1⅝" wafer head screws 8" o.c. and faced with ceramic tile. (FSTC 37 when alternate is used.) **(LOAD-BEARING)**



Thickness: 5⅛"
Approx. Weight: 13 psf
Fire Test: UL R11270, 4-19-85, UL Design U329
Field Sound Test: USG 840314, 3-12-84; USG 840404, 4-4-84

PROPRIETARY GYPSUM BOARD

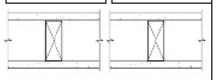
American Gypsum Company LLC	⅝" FireBloc® Type X
Lafarge North America Inc.	⅝" Firecheck® Type X
Temple-Inland	⅝" Type X
United States Gypsum Company	⅝" SHEETROCK® Brand FIRECODE® Core Gypsum Panels

GA FILE NO. WP 3510	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND

GYPSUM WALLBOARD, WOOD STUDS

One layer ⅝" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 2 x 4 wood studs 24" o.c. with 6d coated nails, 1⅞" long, 0.0915" shank, ¼" heads, 7" o.c.

Joints staggered 24" on opposite sides. **(LOAD-BEARING)**



Thickness: 4⅞"
Approx. Weight: 7 psf
Fire Test: UL R3501-47, -48, 9-17-65, UL Design U309; UL R1319-129, 7-22-70, UL Design U314
Sound Test: NGC 2404, 10-14-70

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

703 Fire-resistance ratings & fire tests

GA FILE NO. FC 5406	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND

WOOD JOISTS, GYPSUM WALLBOARD

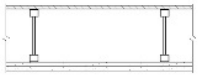
Base layer ⅝" type X gypsum wallboard applied at right angles to 2 x 10 wood joists 24" o.c. with 1¼" Type W or S drywall screws 24" o.c. **Face** layer ⅝" type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1⅞" Type W or S drywall screws 12" o.c. at joints and intermediate joists and 1⅛" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Wood joists supporting ½" plywood with exterior glue applied at right angles to joists with 8d nails. **Ceiling provides one hour fire resistance protection for framing, including trusses.**

Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 172, 2-25-72; ITS, 8-6-98
Sound Test: Estimated

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

WOOD I-JOISTS, GYPSUM WALLBOARD

Base layer ⅝" type X gypsum wallboard applied at right angles to wood I-joists 24" o.c. with 1¼" Type W or S drywall screws 24" o.c. **Face** layer ⅝" type X gypsum wallboard or gypsum veneer base applied at right angles to I-joists with 1⅞" Type W or S drywall screws 12" o.c. at joints and intermediate I-joists and 1⅛" Type G 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 ½" wood structural panels applied at right angles to joists with 8d nails. **Ceiling provides one hour fire resistance protection for I-joists.**

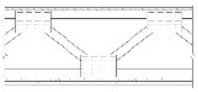


Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 172, 2-25-72; ITS, 8-6-98
Sound Test: Estimated

GA FILE NO. FC 5408	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND

WOOD TRUSSES, GYPSUM WALLBOARD

Base layer ⅝" type X gypsum wallboard applied at right angles to parallel chord wood trusses 24" o.c. with 1¼" Type W or S drywall screws 24" o.c. **Face** layer ⅝" type X gypsum wallboard or gypsum veneer base applied at right angles to trusses with 1⅞" Type W or S drywall screws 12" o.c. at joints and intermediate trusses and 1⅛" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Trusses supporting ½" wood structural panels applied at right angles to trusses with 8d nails. **Ceiling provides one hour fire resistance protection for trusses.**



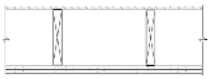
Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 172, 2-25-72; ITS, 8-6-98
Sound Test: Estimated

703 Fire-resistance ratings & fire tests

GA FILE NO. RC 2601	GENERIC	1 HOUR FIRE

GYPSUM WALLBOARD, WOOD JOISTS, ROOF COVERING

Base layer 5/8" type X gypsum wallboard applied at right angles to 2 x 10 wood joists 24" o.c. with 1¼" Type W or S drywall screws 24" o.c. **Face** layer 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1⅞" Type W or S drywall screws 12" o.c. at joints and intermediate joists and 1½" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Wood joists supporting ½" plywood with exterior glue applied at right angles to joists with 8d nails. Appropriate roof covering. **Ceiling provides one hour fire resistance protection for framing, including trusses.**

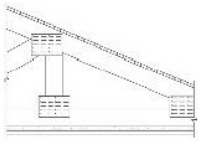


Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 172, 2-25-72; ITS, 8-6-98

GA FILE NO. RC 2602	GENERIC	1 HOUR FIRE

WOOD TRUSSES, GYPSUM WALLBOARD

Base layer 5/8" type X gypsum wallboard applied at right angles to wood roof trusses 24" o.c. with 1¼" Type W or S drywall screws 24" o.c. **Face** layer 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to trusses with 1⅞" Type W or S drywall screws 12" o.c. at joints and intermediate trusses and 1½" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Wood trusses supporting ½" wood structural panels applied at right angles to trusses with 8d nails. Appropriate roof covering. **Ceiling provides one hour fire resistance protection for trusses.**



Approx. Ceiling Weight: 5 psf
Fire Test: FM FC 172, 2-25-72; ITS, 8-6-98

703 Fire-resistance ratings & fire tests

To maintain industry-wide quality assurance standards for gypsum board defined in this Manual as "type X," the Gypsum Association requires that all companies listing proprietary tests or systems, or relying on the generic systems in this manual, shall subscribe to an on-going third-party, in-plant product inspection and labeling service. Additionally, each member company makes annual written certification to the Gypsum Association that its products manufactured for use in systems listed in this Manual continue to be inspected and labeled by an independent third-party testing service as listed on page 10.

Fire-resistance ratings, STCs, FSTCs, and IICs are the results of tests conducted on systems composed of specific materials put together in a specified manner.

Substitution of other materials or deviation from the specified construction could adversely affect performance. For example, if batt or blanket insulation is shown, then it is a required component of the system. In each system containing batt or blanket insulation the insulation is specified to be either mineral or glass fiber and, for fire resistance, the system shall be constructed using the type specified.

Mineral fiber or glass fiber shall not be arbitrarily added to floor-ceiling or roof-ceiling systems to increase either STCs or R-values. This practice has been shown to reduce the fire-resistance rating. The addition of up to 16¾ inches of 0.5 pcf glass fiber insulation (R-40), either batt or loose-fill, to any 1- or 2-hour fire resistance rated floor-ceiling or roof-ceiling system having a cavity deep enough to accept the insulation is permitted provided that one additional layer of either ½ inch or ⅝ inch type X gypsum board is applied to the ceiling. The additional layer of gypsum board shall be applied as described for the face layer of the tested system except that the fastener length shall be increased by not less than the thickness of the additional layer of gypsum board.

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Design No. U309

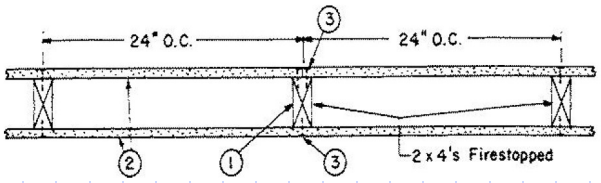
May 05, 2014

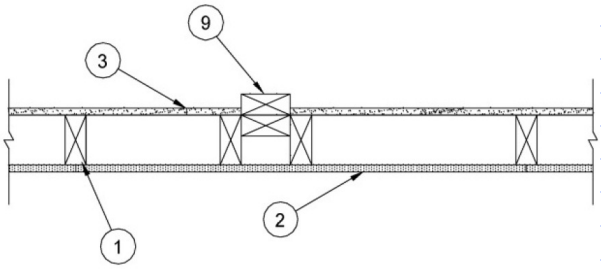
Bearing Wall Rating — 1 HR.

Finish Rating — See Items 2, 2A and 2B

Load Restricted for Canadian Applications — See Guide BXUV7

When used in Canada it is required that all materials included within the UL design are also cUL certified.





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1. **Wood Studs** — Nom 2 by 4 in., spaced 24 in. OC effectively firestopped.

2. **Gypsum Board*** — 5/8 in. thick, 4 ft wide, applied either horizontally or vertically, nailed to studs and bearing plates with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads spaced 7 in. OC. Finish Rating 27 Min. When used in widths other than 48 in., gypsum board to be installed horizontally.

When Steel Framing Members* (Item 5, 5A, or 5B) are used, wallboard attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When Item 6, resilient channels are used, 5/8 in. thick, 4 ft wide applied vertically. Screw attached furring channels with 1 in. long, self-drilling, self-tapping Type S or S-12 steel screws spaced 8 in. OC, vertical joints located midway between studs.

ACADIA DRYWALL SUPPLIES LTD — Type X, 5/8 Type X

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CERTAINTEED GYPSUM CANADA INC — Type X, Type C

CERTAINTEED GYPSUM INC — Type X, Types EGRG, GlasRoc, or Type C

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Types LGFC6A, LGFC2A, LGFC-C/A, LGCF-WD, LGLLX.

GEORGIA-PACIFIC GYPSUM L L C — Types 5, 6, 9, C, DAP, DD, DA, DAPC , DGG, DS, GPFS6, LS (finish rating 23 min), Type X, Veneer Plaster Base - Type X, Water Rated - Type X, Sheathing - Type X, Soffit - Type X, TG-C, Type LWX, Veneer Plaster Base-Type LWX, Water Rated-Type LWX, Sheathing Type-LWX, Soffit-Type LWX, Type DGLW, Water Rated-Type DGLW, Sheathing Type- DGLW, Soffit-Type DGLW, Type LW2X, Veneer Plaster Base - Type LW2X, Water Rated - Type LW2X, Sheathing - Type LW2X, Soffit - Type LW2X, Type DGL2W, Water Rated - Type DGL2W, Sheathing - Type DGL2W.

NATIONAL GYPSUM CO — Types FSK, FSK-C, FSW, FSW-3, FSW-5, FSW-C, FSW-G, FSMR-C, FSW-6 (finish rating 20 min), FSL, FSW-8.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C, PG-9, PG-11, PG-C, PGS-WRS.

PANEL REY S A — Types GREX, PRX, RHX, MDX, ETX

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2A. **Gypsum Board*** — (As an alternate to Item 2, not shown) - Nominal 5/8 in. thick, 4 ft wide panels, applied vertically to studs and bearing plates on one side of the assembly with 1-5/8 in. long Type S screws spaced 12 in. OC at perimeter of panels and 8 in. OC in the field. Horizontal joints of vertically applied panels need not be backed by studs. Panel joints covered with paper tape and two layers of joint compound. Screwheads covered with two layers of joint compound. Batts and Blankets placed in stud cavity as described in Item 4E. Not evaluated for use with Steel Framing Members, Furring Channels or Fiber, Sprayed.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 530 (finish rating 23 min).

2B. **Gypsum Board*** — (As an alternate to Item 2) — 5/8 in. thick gypsum panels, with square edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last two screws 1 and 4 in. from edge of board or nailed to studs and bearing plates with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads spaced 7 in. OC. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

GEORGIA-PACIFIC GYPSUM L L C — GreenGlass Type X (finish rating 23 min).

2C. **Gypsum Board*** — (As an alternate to Item 2) - 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically only and secured as described in Item 2.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min).

NATIONAL GYPSUM CO — SoundBreak XP Type X Gypsum Board

2D. **Gypsum Board*** — (As an alternate to Items 2 through 2C) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock ES.

2E. **Gypsum Board*** — (As an alternate to Item 2) - 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically only and secured as described in Item 2.

CERTAINTEED GYPSUM INC — Type SilentFX

2F. **Gypsum Board*** — (As an alternate to 5/8 in. Type FSW in Item 2) - 2 layers nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Horizontal joints on the same side need not be staggered. Inner layer attached with fasteners, as described in Item 2, spaced 24 in. OC. Outer layer attached per Item 2.

NATIONAL GYPSUM CO — Type FSW

2G. **Gypsum Board*** — (As an alternate to Item 2) — 5/8 in. thick, 4 ft. wide, applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 2.

CERTAINTEED GYPSUM CANADA INC — 5/8" Easi-Lite Type X

CERTAINTEED GYPSUM INC — 5/8" Easi-Lite Type X

THAI GYPSUM PRODUCTS PCL — 5/8" Easi-Lite Type X

2H. **Wall and Partition Facings and Accessories*** — (As an alternate to Item 2) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527.

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3. **Joints and Nailheads** — Wallboard joints covered with paper tape and joint compound. Nailheads covered with joint compound. Gypsum plaster not more than 1/8 in. thick may be applied over the wallboard in addition to the specified joint treatment.

4. **Batts and Blankets*** — (Not Shown) — Optional glass fiber insulation.

CERTAINTEED CORP

JOHNS MANVILLE INTERNATIONAL INC

OWENS CORNING

4A. **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 nominal dry density of 2.7 lb/ft^3. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft^3, in accordance with the application instructions supplied with the product. When Item 5 is used, Fiber, Sprayed shall be INS735, INS745, INS765LD or INS770LD.

U S GREENFIBER L L C — INS735 & INS745 for use with wet or dry application. INS510LD, INS515LD, INS541LD, INS735, INS745, INS765LD, and INS770LD are to be used for dry application only.

4B. **Fiber, Sprayed*** — As an alternate to Batts and Blankets (Item 4) and Item 4A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

NU-WOOL CO INC — Cellulose Insulation

4C. **Batts and Blankets*** — Required for use with resilient 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 SAFB

4D. **Glass Fiber Insulation** — (As an alternate to Item 4C) — 3 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, attached to the 4 in. face of the studs with staples placed 24 in. OC. See **Batts and Blankets** (BKNV or BZJZ) Catagories for names of Classified companies.

4E. **Batts and Blankets*** — (Required for use with Wall and Partition Facings and Accessories, Item 2A) — Glass fiber insulation, nom 3-1/2 in. thick, min. density of 0.80 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less, friction-fitted to completely fill the stud cavities. See Batts and Blankets Category (BKNV) for names of manufacturers.

4F. **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/ft^3.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

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

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Wallboard 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. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips. RSIC-1 clip for use with 3-9/16 in. wide furring channels. RSIC-1 (2.75) clip for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL INC — Types RSIC-1, RSIC-1 (2.75).

5A. **Steel Framing Members (Optional, Not Shown)*** — Furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG 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 b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board 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. Genie clips secured to studs with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

PLITEQ INC — Type Genie Clip

5B. **Steel Framing Members** — (Optional, Not Shown)* - Furring channels and resilient sound isolation clip as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and secured together with four self-tapping No. 8x1/2 Self Drilling screws (2 per side 1 in. and 4 in. from overlap edge). Gypsum board attached to furring channels as described in Item 4. Side joint furring channels shall be attached to studs with RESILMOUNT Sound Isolation Clips - Type A237R located approximately 2 in. from each end of length of channel. Both Gypsum Boards at side joints fastened into channel with screws spaced 8 in. OC, approximately 1/2 in. from joint edge.

b. **Steel Framing Members*** — Resilient sound isolation clip used to attach furring channels (Item 5Ba) to studs. Clips spaced 24 in. OC., and secured to studs with No. 10 x 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237R

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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-510 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) — 7/16 in., 1/2 in., 5/8 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 board 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, PermaBase, DuraBacker Plus, or PermaBase 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 1-3/8 in. long ring shanked 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 (BKNV or BZJZ) 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 down 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 of each vertical joint and 12 in. OC in 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 a,g,p

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (Inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)		[illegible] packed with mineral fiber and caulked on the exterior.				
	15-1.12q	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with *5/8"* Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. Cavity to be filled with 5 1/2" mineral wool insulation.	-	-	-	6 3/4
	15-1.13Q	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with *5/8"* Type X gypsum wallboard, 4' wide, applied vertically with all joints over framing or blocking and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. R-19 mineral fiber insulation installed in stud cavity.	-	-	-	6 3/4
		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 MEMBRANESa,b,c,d

DESCRIPTION OF FINISH	TIME[e] (minutes)
3/8-inch wood structural panel bonded with exterior glue	5
15/32-inch wood structural panel bonded with exterior glue	10
19/32-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 1/2-inch gypsum wallboard	40

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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 nominal 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, 2308.10.2 and 2308.10.3.

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3. Calculations per Section 721

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

SHEATHING	PAPER	EXTERIOR FINISH
5/8-inch T & G lumber		Lumber siding
5/16-inch exterior glue wood structural panel	Sheathing paper	Wood shingles and shakes
1/2-inch gypsum wallboard		1/4-inch wood structural panels-exterior type
5/8-inch gypsum wallboard		1/4-inch hardboard
1/2-inch fiberboard		Metal siding
		Stucco on metal lath
		Masonry veneer
		Vinyl siding
None	-	3/8-inch exterior-grade wood structural panels

For SI: 1 pound/cubic foot = 16.0185 kg/m^2.
a. Any combination of sheathing, paper and exterior finish is permitted.

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3. Calculations per Section 721

TABLE 721.6.2(5)
TIME ASSIGNED FOR ADDITIONAL PROTECTION

DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

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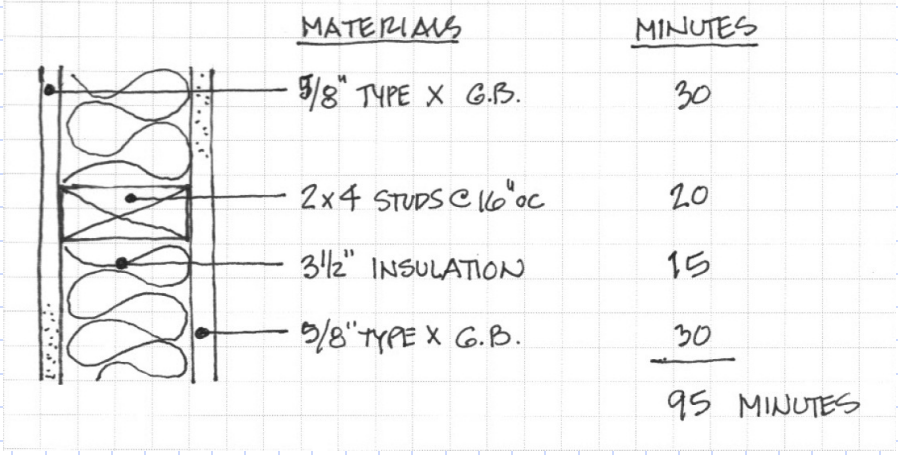
3. Calculations per Section 721



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3. Calculations per Section 721

IBC Calculated Fire Resistance Ratings And UL Fire Ratings Compared.

The International Building Code (IBC) requires that the fire rating of wall assemblies be evaluated using the procedures of ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials. Recognizing the impracticality of performing this costly test on every possible wall permutation, the code also provides alternative methods of compliance. For masonry wall systems, the code provides for a calculated fire resistance procedure in section 721 which is an adaptation of the standard ACI 216.1 / TMS 216, Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies. Section 721of the IBC and the referenced standard provide calculation methods for determining fire ratings, based on a database of E119 tests of various masonry wall configurations.

Some specifiers reference actual tested assemblies listed in the UL Fire Resistance Directory. Although this method is generally accepted, it is not referenced by the International Building Code. Further, this procedure has little room for flexibility and the wall assembly must be built virtually exactly as tested. The concrete masonry units must be tested and certified by UL.

UL also has a calculated fire resistance procedure known as UL 618 Concrete Masonry Units. It also is not referenced by IBC. UL 618 has additional requirements for compliance including a minimum unit thickness of 7-5/8", a maximum unit height of 7-5/8", a maximum cement to aggregate ratio, and a minimum compressive strength for compliance. With the IBC and TMS/ACI methods, the only requirement on the units is that they meet with the applicable ASTM standard.

The IBC and TMS/ACI calculated fire resistance methods are also much more flexible than UL. Fire ratings can be adjusted upward by increasing the equivalent thickness of hollow units or filling the cells with approved fill materials. Also, with the IBC – TMS/ ACI methods, fire resistance ratings can be increased by considering various types of finishes added to the masonry walls. The concrete masonry unit supplier can provide appropriate property documentation (aggregate type/composition and equivalent thickness) for the actual units supplied.

Due to the above complications and since the UL methods are not referenced by the International Building Code but references the ACI 216.1/TMS standard as discussed above, NCMA recommends the use of ACI 216.1 / TMS 216 or the provisions right in Chapter 721 of the IBC (which are essentially the same) for determining code compliance.

For further information on the code approved calculated fire resistance procedure, see NCMA TEK 7-1B Fire Resistance Ratings of Concrete Masonry Assemblies. This and all other NCMA TEK are available free on line courtesy of NCMA sponsoring members. A list of sponsoring members and links to their e-TEK sites is available at www.ncma.org.

Table 1 — Fire Resistance Rating Period of Concrete Masonry Assemblies (references 1, 2, 3)

Minimum required equivalent thickness, in. (mm), for fire resistance rating, hours[A, B]

Aggregate type in the concrete masonry unit[C]	4.00	3.75	3.50	3.25	3.00	2.75	2.50	2.25	2.00	1.75	1.50	1.25	1.00	0.75	0.50
Calcareous or siliceous gravel	6.2	6.0	5.8	5.5	5.3	5.0	4.8	4.5	4.2	3.9	3.6	3.2	2.8	2.4	2.0
Limestone, cinders or unexpanded slag	5.9	5.7	5.5	5.2	5.0	4.8	4.5	4.3	4.0	3.7	3.4	3.1	2.7	2.3	1.9
Expanded clay, shale or slate	5.1	4.9	4.8	4.6	4.4	4.2	4.0	3.8	3.6	3.4	3.3	2.9	2.6	2.2	1.8
Expanded slag or pumice	4.7	4.5	4.4	4.2	4.0	3.8	3.6	3.4	3.2	3.0	2.7	2.5	2.1	1.9	1.5

[A] Fire resistance rating between the hourly fire resistance rating periods listed may be determined by linear interpolation based on the equivalent thickness value of the concrete masonry assembly.
[B] Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite wall face, or between members set in from opposite sides, must be at least 93% of the thickness shown.
[C] Minimum required equivalent thickness corresponding to the hourly fire resistance rating for units made with a combination of aggregates shall be determined by linear interpolation based on the percent by volume of each aggregate used in the manufacture.

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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 firerated 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.

703 Fire-resistance ratings & fire tests

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 *approvedwhere* 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.

703 Fire-resistance ratings & fire tests

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 off1cial* 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.

703 Fire-resistance ratings & fire tests

5. Alternative protection methods as allowed by Section 104.11

- Engineering Judgements from manufacturer's technical or engineering staff

704 Fire-resistance ratings of structural elements

Start with Table 601

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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	Ad	B	Ad	B	HT	Ad	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior[f, g] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1½[b]	1[b, c]	1[b, c]	oc	1[b, c]	0	HT	1[b, c]	0

For SI: 1 foot = 304.8 mm.
a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected 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 903.3.1.1 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 506.3 or an allowable height increase in accordance with Section 504.2. 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 fire separation distance (see Table 602).
g. Not less than the fire-resistance rating as referenced in Section 704.10

704 Fire-resistance ratings of structural elements

Definitions – Section 202

PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

1. The columns;
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels;
3. Members of the floor construction and roof construction having direct connections to the columns; and
4. Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads.

704 Fire-resistance ratings of structural elements

Primary Structural Frame

704 Fire-resistance ratings of structural elements

704.2 Column Protection

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

704 Fire-resistance ratings of structural elements

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 ceilng assemblies, individual encasement per 712 or combination of both

704 Fire-resistance ratings of structural elements

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 ceilng assemblies, individual encasement per 712 or combination of both

704 Fire-resistance ratings of structural elements

Wood Construction

- Column & primary frame protection no 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

704 Fire-resistance ratings of structural elements

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*.

704 Fire-resistance ratings of structural elements

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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	Ad	B	Ad	B	HT	Ad	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior[f, g] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1½[b]	1[b, c]	1[b, c]	0[c]	1[b, c]	0	HT	1[b, c]	0

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected 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 903.3.1.1 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 506.3 or an allowable height increase in accordance with Section 504.2. 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 fire separation distance (see Table 602).

g. Not less than the fire-resistance rating as referenced in Section 704.10

704 Fire-resistance ratings of structural elements

704.10 Exterior Structural Members

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, e]

FIRE SEPARATION DISTANCE =X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[f]	OCCUPANCY GROUP F-1, M, S-1[g]	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2[g], U[b]
X< 5[c]	All	3	2	1
5< X <10	IA Others	3 2	2 1	1 1
10 ≤ X < 30	IA,IB IIB, VB Others	2 1 1	1 0 1	1[d] 0 1[d]
X ≥ 30	All	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 an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
f. For special requirements for Group H occupancies, see Section 415.3.
g. For special requirements for Group S aircraft hangars, see Section 412.4.1.

704 Fire-resistance ratings of structural elements

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

704 Fire-resistance ratings of structural elements

- 704.13 Sprayed Fire Resistant Materials – SFRM

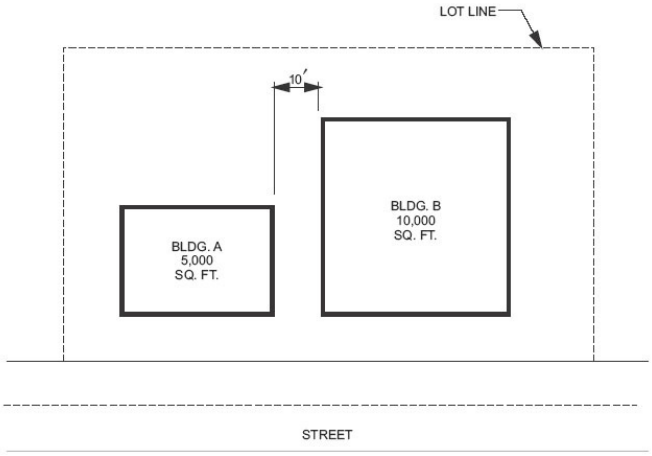
705 Exterior Walls

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	Ad	B	Ad	B	HT	Ad	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior[f, g] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1½[b]	1[b, c]	1[b, c]	0[c]	1[b, c]	0	HT	1[b, c]	0

For SI: 1 foot = 304.8 mm.
a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected 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 903.3.1.1 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 506.3 or an allowable height increase in accordance with Section 504.2. 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 fire separation distance (see Table 602).
g. 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[a, e]

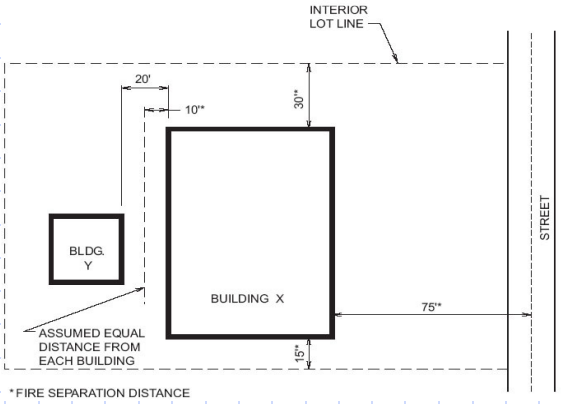
FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[f]	OCCUPANCY GROUP F-1, M, S-1[g]	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2[g], U[b]
X < 5[c]	All	3	2	1
5 ≤ X < 10	IA Others	3 2	2 1	1 1
10 ≤ X < 30	IA, IB IIB, VB Others	2 1 1	1 0 1	1[d] 0 1[d]
X ≥ 30	All	0	0	0

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 an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
f. For special requirements for Group H occupancies, see Section 415.3.
g. For special requirements for Group S aircraft hangars, see Section 412.4.1.

705 Exterior Walls

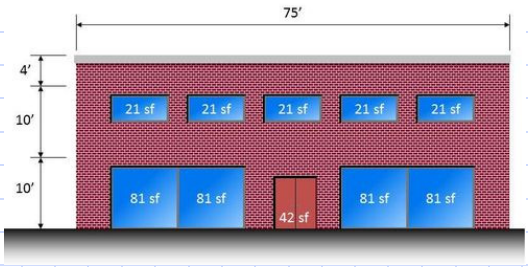
705.5 Fire resistance

- Fire separation distance



705 Exterior Walls

705.8 Openings



705 Exterior Walls

705.8 Openings

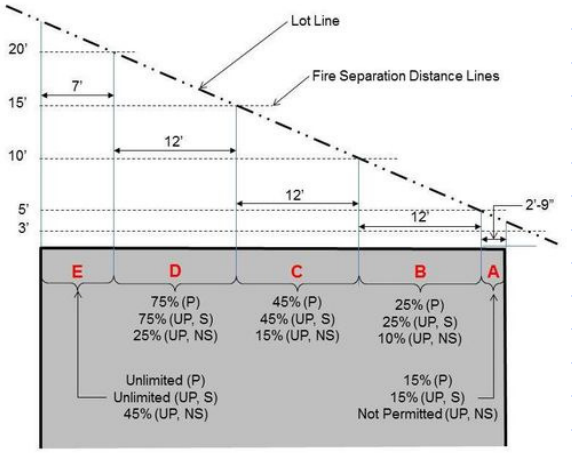
TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA[a]
0 to less than 3[b, c]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S)[i]	Not Permitted
	Protected (P)	Not Permitted
3 to less than 5[d, e]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S)[i]	15%
	Protected (P)	15%
5 to less than 10[d, f]	Unprotected, Nonsprinklered (UP, NS)	10%[h]
	Unprotected, Sprinklered (UP, S)[i]	25%
	Protected (P)	25%
10 to less than 15[d, f, g]	Unprotected, Nonsprinklered (UP, NS)	15%[h]
	Unprotected, Sprinklered (UP, S)[i]	45%
	Protected (P)	45%
15 to less than 20[f, g]	Unprotected, Nonsprinklered (UP, NS)	25%
	Unprotected, Sprinklered (UP, S)[i]	75%
	Protected (P)	75%
20 to less than 25[f, g]	Unprotected, Nonsprinklered (UP, NS)	45%
	Unprotected, Sprinklered (UP, S)[i]	No Limit
	Protected (P)	No Limit
25 to less than 30[f, g]	Unprotected, Nonsprinklered (UP, NS)	70%
	Unprotected, Sprinklered (UP, S)[i]	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (UP, NS)	No Limit
	Unprotected, Sprinklered (UP, S)[i]	Not Required
	Protected (P)	Not Required

For SI: 1 foot = 304.8 mm.
UP, NS = Unprotected openings in buildings not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
UP, S = Unprotected openings in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
P = Openings protected with an opening protective assembly in accordance with Section 705.8.2.
a. Values indicated are the percentage of the area of the exterior wall, per story.
b. For the requirements for fire walls of buildings with differing heights, see Section 706.6.1.
c. For openings in a fire wall for buildings on the same lot, see Section 706.8.
d. The maximum percentage of unprotected and protected openings shall be 25 percent for Group R-3 occupancies.
e. Unprotected openings shall not be permitted for openings with a fire separation distance of less than 15 feet for Group H-2 and H-3 occupancies.
f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies, with a fire separation distance of 5 feet or greater.
g. The area of openings in an open parking structure with a fire separation distance of 10 feet or greater shall not be limited.
h. Includes buildings accessory to Group R-3.
i. Not applicable to Group H-1, H-2 and H-3 occupancies.

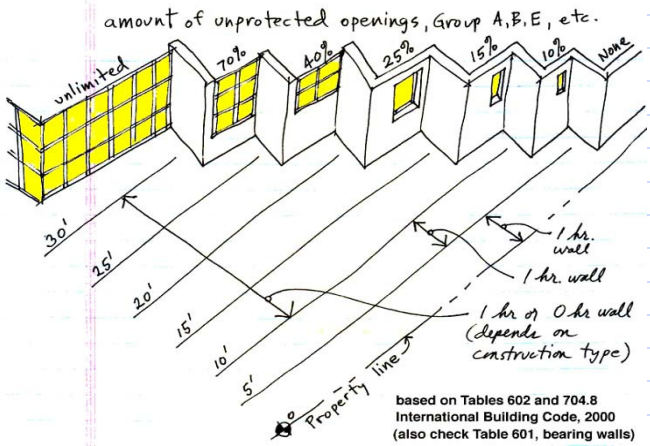
705 Exterior Walls

705.8 Openings



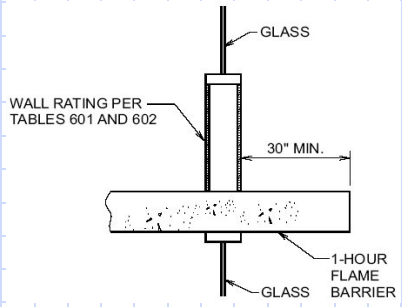
705 Exterior Walls

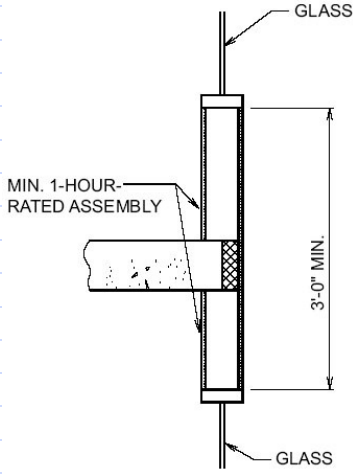
705.8 Openings



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 2-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

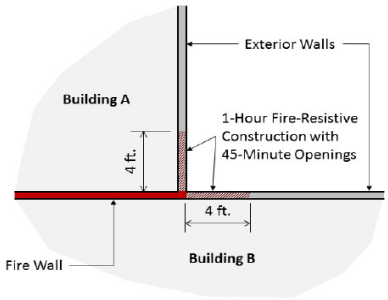


Figure 1 – Termination of fire wall at exterior walls less than 180° apart using Option 1 simple prescriptive method

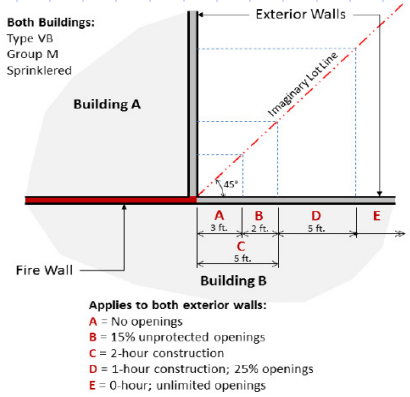


Figure 2 – Example of terminating fire wall at exterior walls less than 180° apart using Option 2 fire separation distance method.

706 Fire Walls

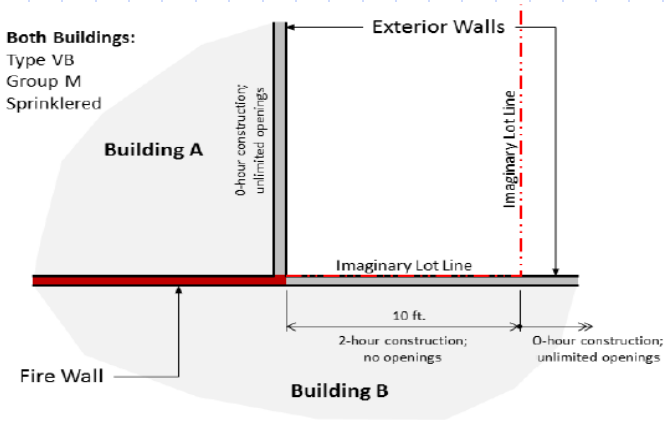


Figure 3 – Another Option 2 example using a different imaginary lot line location.

706 Fire Walls

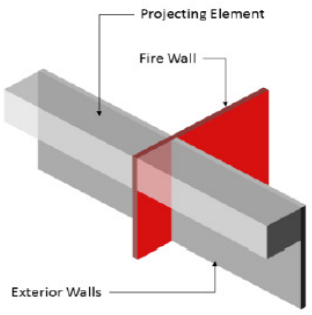


Figure 4 – Requirement for fire wall through projecting element.

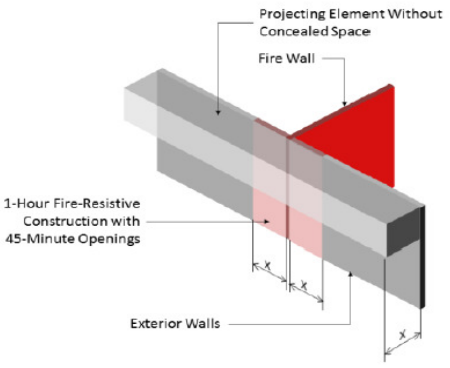


Figure 5 – Requirement for fire wall through projecting elements without concealed space.

706 Fire Walls

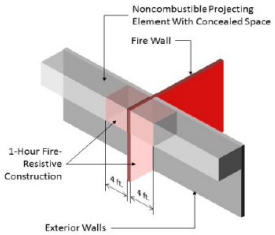


Figure 6 – Requirement for fire wall through noncombustible projecting element with concealed space.

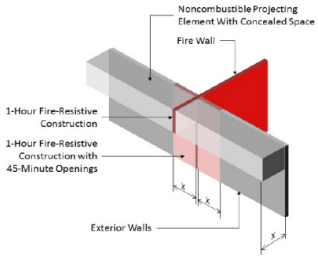


Figure 7 – Alternate requirement for fire wall through noncombustible projecting element with concealed space.

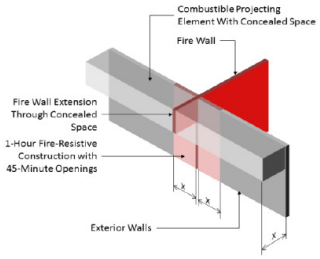


Figure 8 – Requirement for fire wall through combustible projecting element with concealed space.

706 Fire Walls

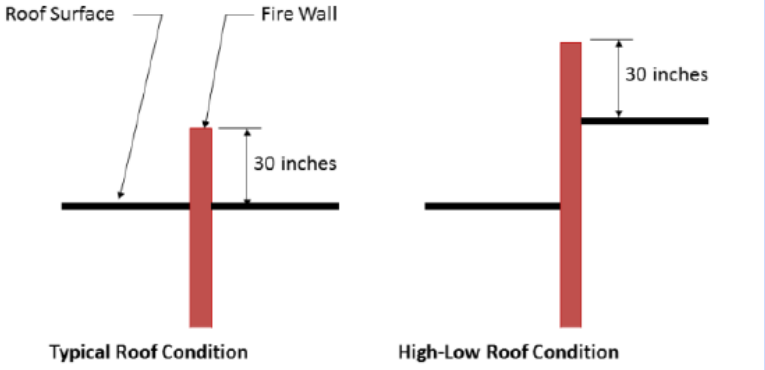


Figure 9 – Vertical extension of fire wall through roof.

706 Fire Walls

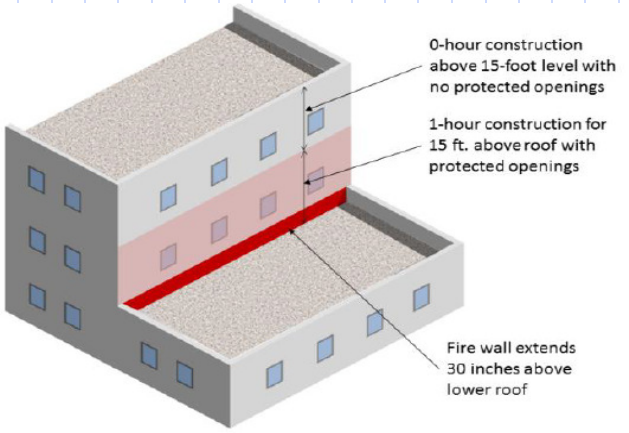


Figure 10 – Fire wall extension through roof for stepped buildings.

706 Fire Walls

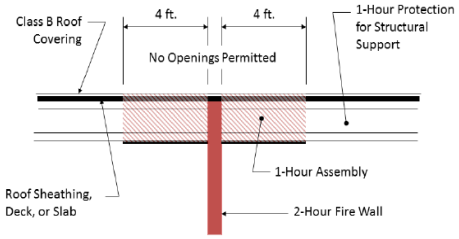


Figure 11 – 2-hour fire wall termination at underside of roof.

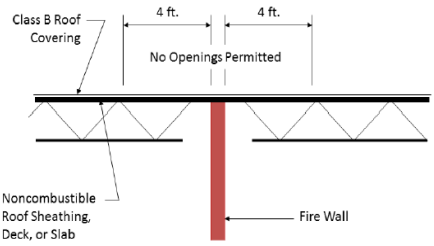


Figure 12 – Fire wall termination at noncombustible roofs.

706 Fire Walls

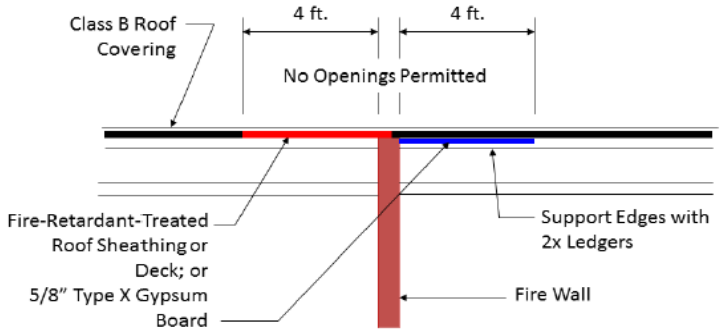


Figure 13 – Fire wall termination at combustible roofs for Type III, IV, and V construction. Left side shows fire-retardant-treated wood option and right side shows gypsum board application method.

Description	Fire Walls (FW) : 705 Building Separation	Fire Barriers (FB) : 706 Hazardous Area Separation	Shaft Enclosures (SE) : 707 Shaft Separation	Fire Partitions (FP) : 708 Corridor Separation	Smoke Barriers (SB) : 709 Smoke Separation	Smoke Partitions (SP) : 710 Smoke Separation
Definition	A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.	A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained. Lacks the inherent structural integrity of FW's. Cannot terminate at a ceiling. Can separate building into different "fire areas."	The walls or construction forming the boundaries of a shaft (shaft: an enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.	A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.	A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.	A continuous membrane designed and constructed to restrict the movement of smoke.
General	Serve to create separate buildings. Serve to create separate occupancies. Provide the same protection as exterior walls. Party walls: FW on the property line To be constructed without openings and shall create separate bldgs.	Separate the following spaces: shaft enclosures (707.4), exit enclosures (1020.1), exit passageways (1020.1), horizontal exits (1025.1), atriums (404.3), incidental use areas (508.2), control areas, hazardous material (414.2.3) mixed occupancies (508.3.2), single occupancy fire-areas (Table 706.3.9), areas of refuge	All vertical shafts: interior stairways (1006.3.2), refuse/linen chutes (707.13), dev/dumbwaiter hoistways (707.14)	Required to separate the following: dwelling units (310.3), guestrooms in R-1 (310.3), tenant spaces in covered malls (402.7.2), corridor walls (1004.3.2.1.)	Divide buildings into separate smoke compartments. (Where SB are required: 407.4.6 407.5, Smoke control system: 909.5, Accessible M of E: 1008.2.13.5.2	SP are used to prevent smoke passage into corridors in Group I-2. (407.3) Sprinklers obviates the need for a fire-rating.
Materials	Any approved noncombustible materials	Permitted by the bldg type of construction. (602)	Permitted by the bldg type of construction. (602)			
(Exceptions)	Bldgs of Type V construction	Fire-resistance-rated glazing				
	No	No	No			
Fire-resistance ratings	*Table 706.4 4-hr, 3-hr, 2-hr (minimum) Type II or Type V Const: 2-hr (minimum)	4 hr, 3 hr, 2 hr, 1 hr	Shafts connecting 4 stories or more: 2 hrs, Shafts connecting less than (4) stories: 1 hr, Not less than the floor assembly penetrated but not more than 2	1 hr, 0.5 hrs, 0 hrs * *Corridor walls: 1 hr or 0 hrs (1004.3.2.1)	1 hr (fire-resistance rating)	0 hrs (not required to have a fire-resistance rating)
Exterior Walls	FW's provide the same level of structural integrity and independence as an exterior wall. FW's intersecting exterior walls (less than 180 degrees): extend rating 4'-0" on either side.	Where exterior walls are part of a required rated shaft or exit enclosure, such walls shall comply with 704 for exterior walls.				
(Exceptions)		Yes				
Continuity Horizontal	Extend 18" beyond exterior walls.				From outside wall to outside wall	Top of foundation or floor below to underside of the floor, roof deck or ceiling membrane(constructed to limit smoke passage).
(Exceptions)	Yes				Yes	No
Horiz Projections	Extend to outer edge w/in 6' of FW.					
(Exceptions)	Yes					
Vertical	Extend 30" above both adjacent roofs.	Extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above.	Extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above.	Extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above.	Extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above.	
(Exceptions)	Yes	Yes	No	Yes	Yes	
Openings	Any single opng: not exceed 120 sf Aggregate width not exceed 25% of wall length at any (1) floor area	Any single opng: not exceed 120 sf Aggregate width not exceed 25% of wall length.	Section 714 Prohibited openings: only those openings required for the purpose of the shaft.	Section 714	Section 714 Openings protective shall have a minimum fire-protection of 20 minutes (0.3 hrs)	
(Exceptions)	Yes: 120 sf max in full-sprinkled	Yes	No	No	Yes	
Penetrations	Section 712.2 and 712.3	Section 711 Prohibited penetrations: exit enclosures as per 1005.3.4.1	Section 711 and 715 Only necessary penetrations in the SE are permitted. Ducts shall not penetrate exit shaft enclosures except ones that either ventilates or pressurizes the SE.	Section 711	Section 711	
(Exceptions)	No	No	Yes	No	No	
Joints	Section 713	Section 712				
Ducts/Air Transfer Openg	Not allowed	Section 711 and 715				
(Exceptions)	Yes: Section 712 and 716.6 FW is not on a lot line	No				

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

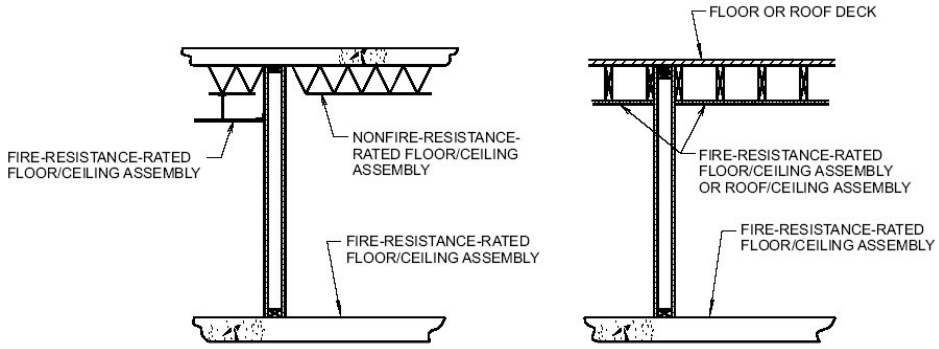
- Shaft enclosures
- Exit enclosures
- Exit passageway
- Horizontal exit
- Atriums
- Incidental accessory occupancies
- Control areas
- Separated occupancies
- Fire areas (along w/ horizontal assemblies)

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, 5-1	3
A, B, E, F-2, H-4, H-5, I, M, R, 5-2	2
U	1

707 Fire Barriers



709 Fire Partitions

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

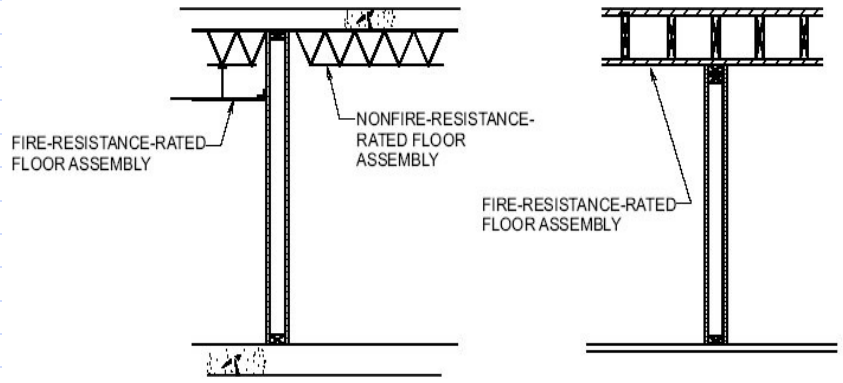
709 Fire Partitions

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

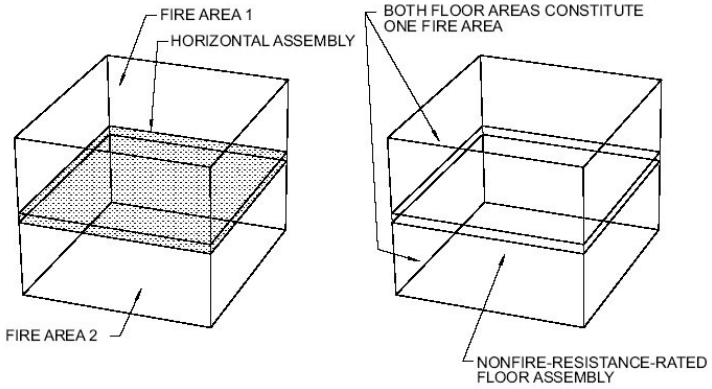
Smoke Barrier	Smoke Partition
Fire Resistance Rated (1-hour)	No Fire Rating
Rated, Protected Openings (smoke dampers)	Openings must resist passage of smoke (smoke dampers)
Extends from top of floor to underside of floor above or rated, smoke-resistant ceiling	Extends from top of floor to underside of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

712 Horizontal Assemblies

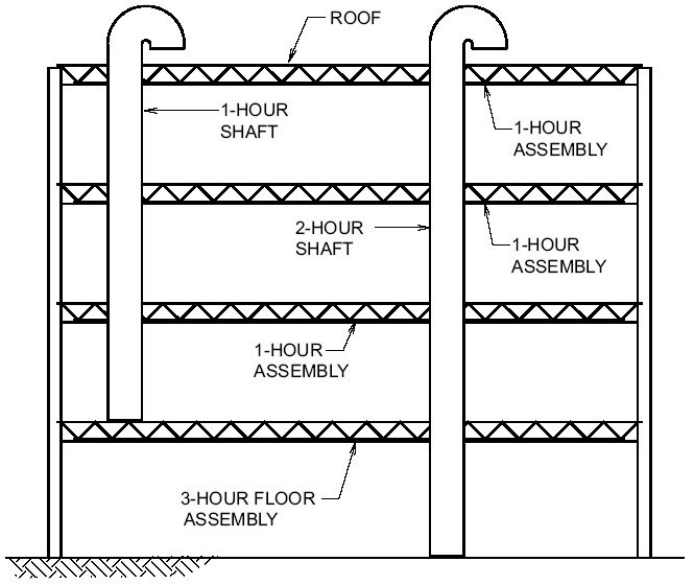
712.3 Fire-resistance rating. The *fire-resistance rating* of floor and roof assemblies shall not be less than that required by the building type of construction. Where the floor assembly separates mixed occupancies, the assembly shall have a *fire-resistance rating* of not less than that required by 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 I-hour fire-resistance-rated construction.

Exception: *Dwelling unit* and *sleeping unit* separations in buildings of Type lIB, 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.

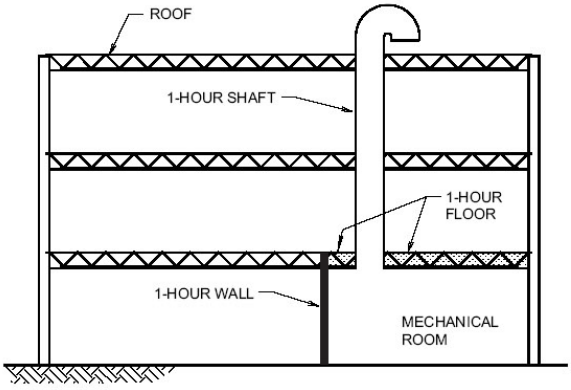
712 Horizontal Assemblies



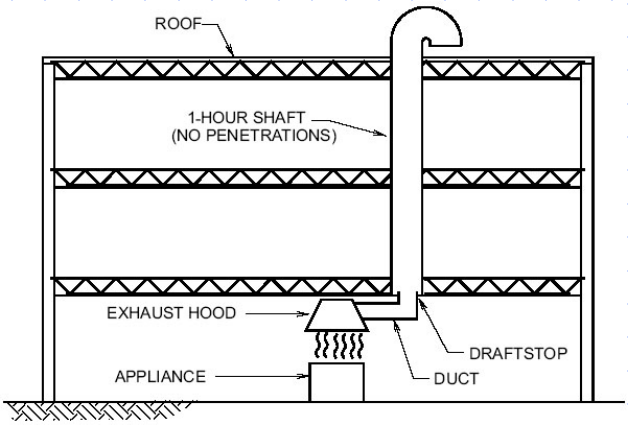
708 Shaft enclosures



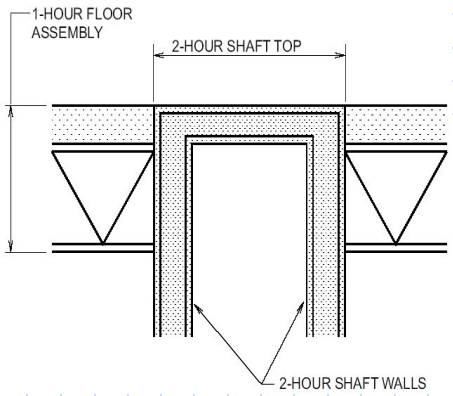
708 Shaft enclosures

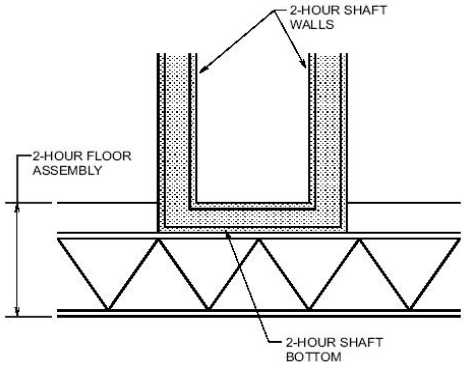


708 Shaft enclosures



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)