

Fire-Resistive Construction, 2021 IRC Two-Family Dwellings & Townhouses



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“Disclaimer”

→ The text in this presentation does not necessarily represent actual code language. The presented text may summarize, highlight or generalize the code section. Additional provisions or exceptions may be included in the actual code section. References to the code sections are given for the purpose of verifying the complete provisions of the code section. ←

→ Participants of the code are responsible for reading, studying, (reading & studying) interpreting (attending code panels & discussions), and enforcing the code as directed by the administrators of their code. ←

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In Reference to all: Materials / Products / Illustrations / Pictures
of this presentation

“Do not Assume:”

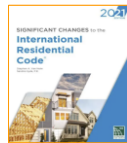
- ...that any picture in this presentation is in compliance of code, manufacturer’s listing etc...
- ...that any product has been fully researched to the intent of the code
- ...that any product that can be sold / purchased meets any code requirements
- ...that any one product has been tested and meets the intent of any past/current adopted codes
- ...that any product has been properly installed unless you have done a complete research of that product through the manufacturer’s installation instruction, approved acceptable tested listing, and have reviewed its current evaluation report requirements.

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Chapter 1: JHA Construction Code

Reference and Resources Material

- 2021 *International Residential Code*® (IRC ®)
- Significant Changes to the IRC 2021 Edition



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1. IRC Provisions

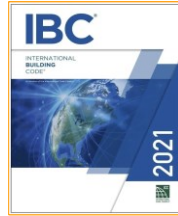
- Prescriptive Code.
- “Cookbook” with ingredients.
- Limits.
- It is the worst house you can build by law!



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2. Engineered Design

- When structural element exceeds limits of IRC.
- “Accepted engineering practice.”
- May be portion or entire structure.
- Reference IBC.



R301.1.3

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3. Introduction

- In order for the designer of a multiple dwelling-unit project to get started with the code requirements, he or she will need to determine if his or her project fits into the **scope** of the IRC.
- If it does not meet the scope then it will need to be designed and constructed using the **IBC**. The differences between the two codes will be discussed more in detail later in the program.



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3. Comparative IRC/IBC

Issue	IBC	IRC
Number of stories above grade	3 maximum	Undeclared
Number of dwelling units	Unlimited	Unlimited
Type of construction	No requirement	Unlimited
1 hour roof/ceiling construction	No requirement	V-B within limited areas
1 hour floor assemblies with listed penetrations	Only with upper/lower two-family dwellings, otherwise no requirement.	Based on type of construction and occupancy classification.
4-unit back-to-back dwelling units	Permitted	Permitted as Group R-2 with no exterior lot lines (see next item)
4-unit back-to-back dwelling units	Permitted	Permitted as Group R-3 separated by lot lines and protected based on location on lot.
Fire separation required for 4-unit back-to-back	1 hour	1 hour between dwelling units of a Group R-2
6-unit back-to-back dwelling units	Not permitted because a 1-hour fire needs two sides open to a yard or a public way	Permitted as Group R-2, or with lot lines between each dwelling unit.

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4. Reference Standards



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The objective of this portion is to address fire-resistive assemblies with background information on the fire-resistive requirements addressed by 2021 IRC.

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Background

The emphasis of this program are the requirements for **fire-separation of attached dwellings (townhouses & two family dwelling units)**.

Does the history of fires influence code requirements?

Yes, most codes are written based upon fires, major catastrophes or history of accidents. This code is no exception... (continued)



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Scope

For Townhouses constructed under the provisions of the International Residential Code (IRC):

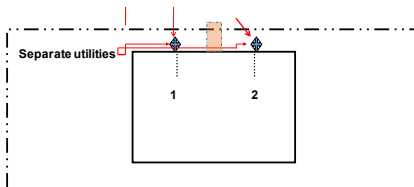
Each townhouse **shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies...**(IRC section R302.2)

Electrical requirement: A building **or structure served shall be supplied by only one service ...**(National Electrical Code, article 230.)

A service lateral (underground) **or drop (overhead)** would be required to be provided to each townhouse unit.

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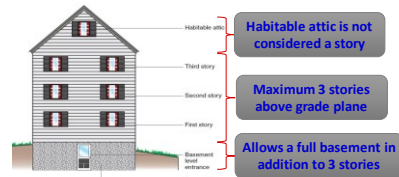
"Utilities Separation"



This example would be considered a townhouse based on the definition. All townhouse provisions would be required. Property line may or may not be present.

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1 & 2 Family Dwellings and Townhouses



R101.2 Scope

International Residential Code, section R202

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"Townhouse" Definition



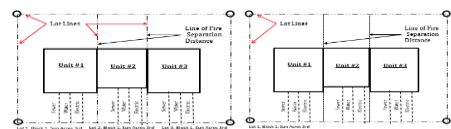
TOWNHOUSE. A *building* that contains three or more attached *townhouse units*.

TOWNHOUSE UNIT. A single-family *dwelling unit* in a *townhouse* that **extends from foundation to roof and** that has a *yard or public way* on not less than **two sides**.

International Residential Code, section R202

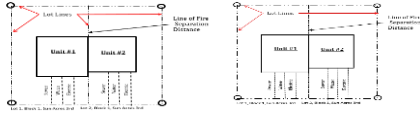
17

Scope and Definitions



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Scope and Definitions



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Dwellings and Townhouses

- Separate means of egress to the outdoors for each dwelling unit.
 - One exterior exit door
 - Egress travel distance is not limited
 - Egress to grade outdoors
- No limit on area size of dwelling units.



The required egress door shall open directly into a public way or to a yard or court that opens to a public way. R311.1

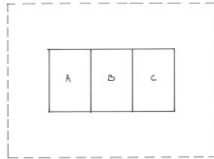
R101.2 Scope

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“Townhouse” definition

In this example, all three dwelling units are open on at least two sides.

Lot lines are not required between the units.



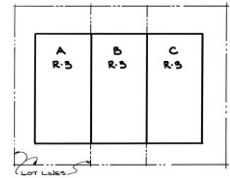
International Residential Code, section R202

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“Townhouse” definition

In this example, all three dwelling units are open on at least two sides.

Lot lines are not required between the dwelling units, but the inclusion of lot lines does not change the code provision for fire separation.



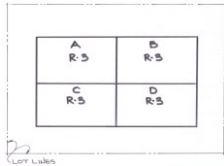
International Residential Code, section R202

22

“Townhouse” definition

In this example, all four dwelling units are open on at least two sides.

Lot lines are not required between the dwelling units.



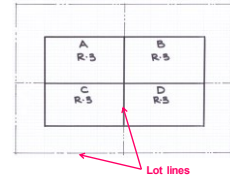
International Residential Code, section R202

23

“Townhouse” definition

In this example, all four dwelling units are open on at least two sides.

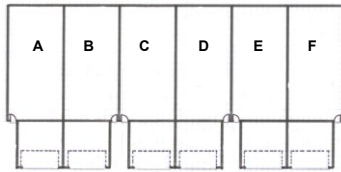
Lot lines are not required between the dwelling units, but the inclusion of lot lines does not change the code provision for fire separation.



International Residential Code, section R202

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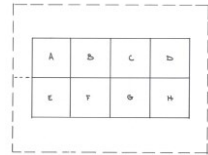
"Townhouse" definition



These units with the garage in front are considered "open" because they are **not obstructed by another dwelling unit**.

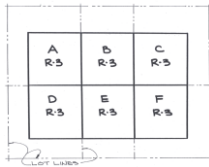
"Townhouse" definition

These eight attached dwelling units would not comply with the definition of IRC "townhouse" because the middle units lack two sides open. They would most likely be **constructed as an R-2 occupancy under the IBC** because they **lack lot lines** that could create R-3 dwelling units (also under the IBC).



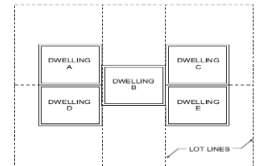
"Townhouse" definition

These six attached dwelling units would not comply with the definition of IRC "townhouse" because the **middle two units lack two sides open**. They would most likely be constructed as **R-3 occupancies under the IBC** because they are **separated by lot lines**.



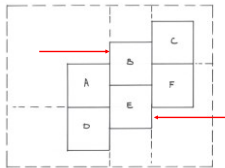
R202 – Townhouses

- A five-unit back-to-back style dwelling project is proposed containing a single middle dwelling unit and two dwelling units at each end corner. Does it meet the definition of "Townhouse"?

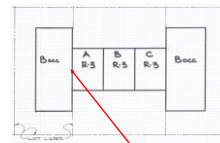


"Townhouse" definition

These six attached dwelling units **would not comply** with the definition of "townhouse" because units "B" and "E" are **not open on two sides**.



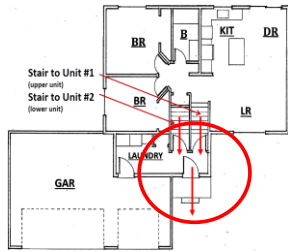
"Townhouse" definition



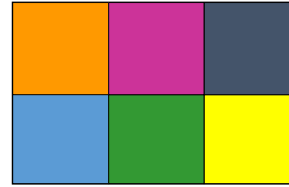
Units "A", "B", and "C" **do not comply** with the definition of "townhouse" because they cannot be attached to the "B" occupancy. They will need to be constructed per the International Building Code.

Exercise/Discussion

IRC or IBC?
Why?



Public Way



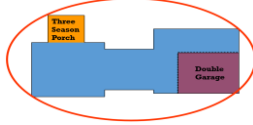
Public Way

Does this meet the new
Townhouse definition?

“Exterior wall” definition

The definition of exterior – Walls including both above-grade walls . . . roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and basement walls with an average below-grade wall area that is less than 50 percent of the total opaque and nonopaque area of that enclosing side.

Definition applicable in [Chapter 11](#), see [Section N1101.6](#).



Tool
Shed

International Residential Code, section R 202

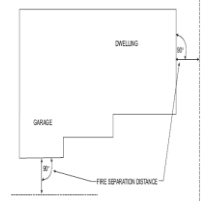
“Fire Separation Distance”

???

The distance measured from the building face

- to the closest interior lot line,
- to the centerline of a street, alley or public way,
- or to an imaginary line between two buildings on the property.

The distance shall be measured at right angles from the **face** of the wall.



International Residential Code, section R202

R302.1 Exterior Walls

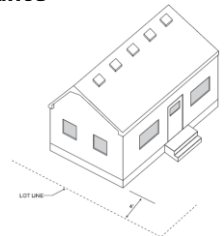


- Separation distance **or** fire resistance required to protect against spread of fire.



R202 – Fire Separation Distance

- Projections are cornices and eave overhangs, such as the gable and roof overhang, that project beyond the exterior wall.
- When structures are in close proximity to a lot line these projections create problems that are a result of trapping the convective heat from a fire in an adjacent building (or dwelling).



Same Lot

- **ACCESSORY STRUCTURE.** A structure that is accessory to and incidental to that of the dwelling(s) and that is located on the same lot.
- **R302.1 Exterior walls.** Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1); or . . .
Exceptions:
 1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
 2. Walls of individual dwelling units and their accessory structures located on the same lot.
- **Table R302.6 Garages** located less than 3 feet from a dwelling unit on the same lot.
- **R303.9 Required glazed openings** shall open directly onto a street or public alley, or a yard or court located on the same lot as the building. Exceptions: 1- 3

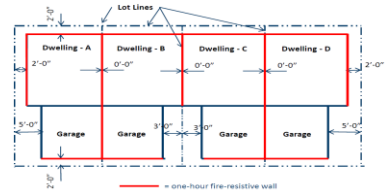
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Townhouse

Fire Separation Distance

Exercise/Discussion

Which walls require a fire-resistive rating?
Why?



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Townhouse



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Townhouse

Fire Separation Distance

Exercise/Discussion

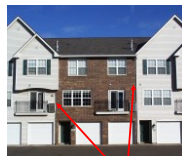


What if? Solution?

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“Location on Lot”

In order to better understand how this applies to a **multiple attached dwelling**, such as the example pictured on this slide, let's start with the example of a single family dwelling on a lot, and how the code applies.



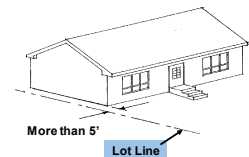
Fire-separation location

International Residential Code, section R302.1

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“Location on Lot”

Just as noted earlier, the code looks at **location on lot** as a **critical element** in establishing **fire-separation between dwellings**. If a dwelling is constructed at least **5 feet** from the lot line, there are **no requirements** for fire resistance of the exterior walls of the structure.



EXTERIOR WALL ELEMENT	MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	1 hour—provided in accordance with A01301 (1) 119, sub. 203 in Section 103.2 of the International Building Code with exception from both tables	0 feet
	0 hours	≥ 5 feet

International Residential Code, section R302.1

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"Location on Lot"

Exterior walls with a fire separation distance less than 5 feet shall have not less than a one-hour fire-resistive rating with exposure from both sides.

Does not apply to walls which are perpendicular to the property line.

International Residential Code, section R302.1 43

"Location on Lot"

Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than 3 feet.

Exception: 5
Foundation vents that are installed in compliance with this code are permitted.

International Residential Code, section R302.2 44

EXTERIOR WALL CATEGORY	MINIMUM FIRE RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Openings in walls	1-hour	3 feet
25% maximum of wall area	1-hour	3 feet
Unrated	1-hour	3 feet
Penetrations	1-hour	3 feet
	1-hour	3 feet

"Townhouses"

- Separate buildings
- 1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{b, c}
- 4' of FRT roof sheathing at fire separation
- Structural independence

Table R302.1(1) & Table R302.1(2) 45

R302.2 - Townhouse Common Wall

R302.2.2 Common walls separating *townhouse units* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides.

Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing.

The common wall shared by two *townhouse units* shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall.

Electrical installations shall be in accordance with Chapters 34 through 43.

Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

2021IRC 46

R302.2 - Townhouse Common Wall

R302.2.2 Common walls separating *townhouse units* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. . .

- Where an automatic sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the IBC.
- Where an automatic sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the IBC.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two 2-inch nominal thickness wood studs.

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R302.2 - Townhouse Common Wall

Exception:

- Common walls separating townhouses can terminate at the inside of exterior walls:
 - Two 2 in. studs as fireblocking

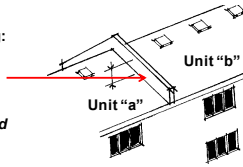
2021IRC 48

"Dwellings with lot line"

If a two-unit dwelling is constructed with a lot line separating the two dwelling:

...No parapet is required.

Parapets are only addressed under the provisions for townhouses R302.2.4.



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"Two-Family Dwelling"



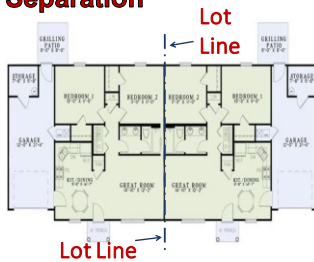
Dwelling units in two-family dwellings

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2021IRC

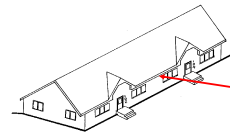
R302.3 Two-Family Dwelling Separation

- One-hour separation whether or not a lot line exists between units



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"Two-Family Dwellings"



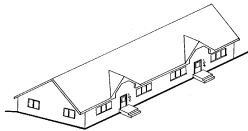
This provision is based on a dwelling with two dwelling units on one lot (no lot line separation).

Dwelling units in two-family dwellings shall be separated from each other by wall and floor assemblies of not less than one-hour fire-resistive rating when tested in accordance with ASTM E119 or UL 263 or Section 703.2.2 of the IBC.

International Residential Code, section R302.3

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"Two-Family Dwellings"



This provision is based on a dwelling with two dwelling units on one lot (no lot line separation).

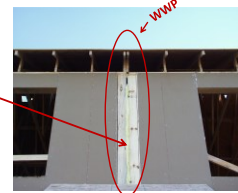
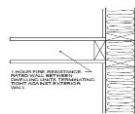
Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be **tight against** the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

International Residential Code, section R302.3

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"Two-Family Dwellings"

Fire-resistance-rated wall assemblies shall extend to and be tight against the exterior wall.

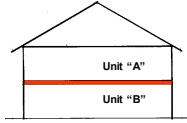


International Residential Code, Section R302.3

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“Two-family dwellings”

Dwelling units in two-family dwellings shall be separated from each other by wall and floor assemblies of not less than one-hour fire-resistance-rating when tested in accordance with ASTM E119 or UL 263 or Section 703.2.2 of the IBC.

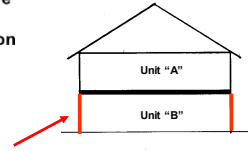


International Residential Code, section R302.3

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“Two-family dwellings”

When floor assemblies are required to be fire-resistance-rated by section R302.3.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.



International Residential Code, section R302.3.1

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“Two-family dwellings”

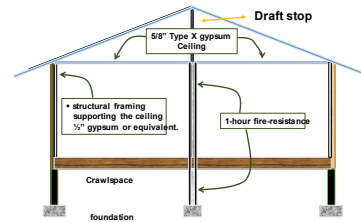
A fire-resistance rating of 1/2 hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.



International Residential Code, section R302.3 Except.1

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“Two-family dwellings”

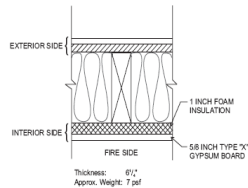


R302.3 Except. 2

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“Fire Resistance”

- Some walls are tested from both sides (symmetrical wall systems) and some walls are tested from one side only (nonsymmetrical wall systems).



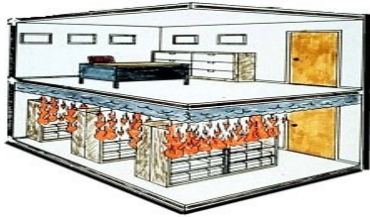
59

“Fire Resistance”

- Floor/ceiling and wall assemblies are considered to be generic materials, unless specified as a proprietary material (specific manufacturer noted in listing of the assembly).
- Each proprietary system shall be built utilizing the components specified by the company or companies listed under a detailed description for that system, in other words, substitution of materials is not permitted.

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“Fire Resistance”



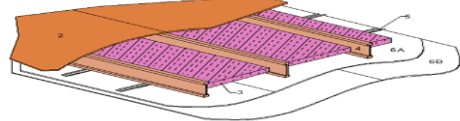
Testing an assembly

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Published on the Web site to be researched for approval

Fire Rated Wood Floor and Wall Assemblies Update

A new I-joist assembly (WD-1.7) has been added that includes a double-gypsum-layer floor/ceiling assembly insulated with fiberglass. All assemblies include sound ratings (STC and IIC). The updated files are available at www.awc.org/Codes/dcindex.html.



WD-1.7 One-Hour Fire-Resistive Ceiling Assembly
Floor/Ceiling - 100% Design Load - 1 Hr Rating -
ASTM E 119 / NFPA 251

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“Dwellings with lot line”



If a two-unit dwelling is constructed with a lot line separating the two dwellings:

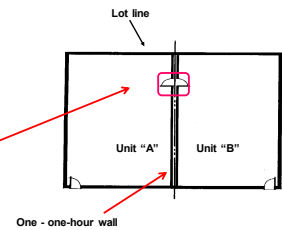
The common walls between the dwellings need to be constructed as one wall - one-hour fire-resistive walls according to R302.3 ASTM E119, UL 263, or section 703.3 of IBC.

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“Dwellings with lot line”

If a two-unit dwelling is constructed with a lot line separating the two dwellings:

Openings for doors and windows are permitted in this two one-hour fire-resistive walls construction



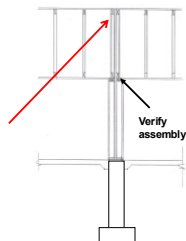
International Residential Code, section R302.3

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“Two – Family Dwellings”

Two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating:

Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.



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Fire Wall

– 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. IBC

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Def - Fire-resistance rating

- The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703. (IBC)
 - Passage of Flames
 - Heat Transmission
 - Structural Integrity

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- The fire-resistance rating of building elements shall be determined in accordance with the test procedures set forth in ASTM E 119

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Fire Testing Standards

ANSI / UL 263
ASTM E 119
~~**NFPA 251**~~

69

Fire-Resistance Ratings

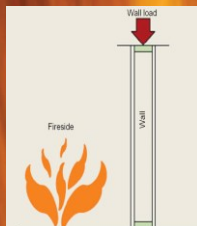
The fire-resistance ratings of building elements shall be determined in accordance with:

- The procedures set forth in ASTM E 119 (*Test Methods of Fire Tests for Building Construction and Materials*), or UL 263 (*Standard for Fire Test of Building Construction and Materials*) or
- The alternative methods for determining fire resistance established in IBC 703.3.

70

Wall Assembly Fire Test

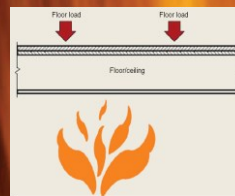
ASTM E 119 Fire Test for Wall Assemblies



- Assembly must:**
- Sustain applied load.
 - Have no passage of flame or gas hot enough to ignite cotton waste.
 - Have average temperature rise on unexposed surface not more than 250°F (121°C) above initial temperature or more than 325°F (163°C) at any point.
 - Have no water pass through during hose stream test.

71

Floor Assembly Fire Test

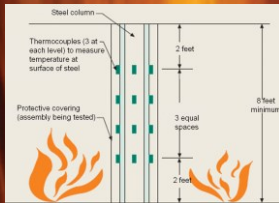


- Assembly must:**
- Sustain applied load.
 - Have no passage of flame or gas hot enough to ignite cotton waste.
 - Have average temperature rise on unexposed surface not more than 250°F (121°C) above initial temperature or more than 325°F (163°C) at any point.

72

Steel Column Fire Test

ASTM E 119 Alternate Fire Test for Steel Column Protection



Production must limit:

- Average temperature to 1,000°F (538°C) at any level.
- No temperature above 1,200°F (649°C) at any single point.

73

Fire-resistance ratings

- Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the assembly, sufficient data must show that the required fire-resistance rating is not reduced.
- Materials and methods of construction used to protect joints and penetrations shall not reduce the required fire-resistance rating.

74

ASTM E119



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

75

ASTM E 119 Time-Temperature Curve

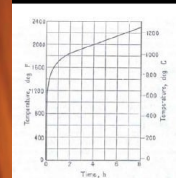


FIG. 1 Time-Temperature Curve

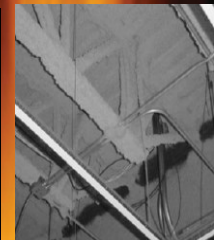


76

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

77

- Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements shall not reduce the required fire-resistance rating.
 - Except Exterior Walls




78





Gypsum Association



- **Gypsum Association**
 - 810 First St., NE #510
Washington DC, 20002
 - Phone: 202-289-5440
Fax: 202-289-3707
 - www.gypsum.org
- **Online Library**
 - www.gypsum.org/download.html



- **Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein listed.**

WALLS AND INTERIOR PARTITIONS, WOOD FRAMED		1 HOUR FIRE	35 to 39 STC SOUND
GA FILE NO. WP 3510	GENERIC		
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 24" o.c. with flat coated nails, 1 1/4" long, 0.0915" shank, 1/4" heads, 7" o.c.			
Joints staggered 24" on opposite sides. (LOAD-BEARING)			
			
		Thickness: 4 1/4"	Thickness: 5 1/4"
		Approx. Weight: 7 pcf	Approx. Weight: 8 pcf
		Fire Test: U.L. R3501-47, -48, 9-17-05, U.L. Design U509	Fire Test: U.L. R2717-52, 9-9-68, U.L. Design U312
		UL E1313a, 129, 7-22-70, U.L. Design U314	UL E Design W300
		Sound Test: NSC 2404, 10-14-70	Sound Test: G&H BW-2FF, 7-13-67


- Where the word "proprietary" appears in system descriptions either the system or one or more of its components is considered proprietary.
- Each proprietary system shall be built utilizing the components specified by the company or companies listed under the detailed description for that system.
- All other systems are generic.
- Generic systems are applicable to the products of any manufacturer, whether a member of the gypsum association or not, provided the products meet the appropriate standards.

WALLS AND INTERIOR PARTITIONS, WOOD FRAMED		1 HOUR FIRE	45 to 49 STC SOUND
GA FILE NO. WP 3342	PROPRIETARY*		
GYPSUM WALLBOARD, WOOD STUDS			
Base layer 1/2" proprietary gypsum wallboard applied parallel to each side of 2 x 4 wood studs 16" o.c. with flat coated nails, 1 1/2" long, 0.095" shank, 1/4" heads, 12" o.c. Joints staggered 16" on opposite sides. Face layer 1/2" proprietary type X plain or predecorated gypsum wallboard or gypsum veneer base applied parallel to each side with 1/2" beads of adhesive 16" o.c. and flat coated nails, 1 1/4" long, 0.0915" shank, 1/4" heads, 6" o.c. at top and bottom plates only. Joints offset 24" from base layer joints. (LOAD-BEARING)			
PROPRIETARY GYPSUM PANEL PRODUCTS			
G-P Gypsum		1/2" Toughlock® Sound Deadening Board 1/2" Densorep® Plus Fireguard® C Interior Guard	
			
		Thickness: 5 1/4"	Thickness: 5 1/4"
		Approx. Weight: 8 pcf	Approx. Weight: 8 pcf
		Fire Test: U.L. R2717-52, 9-9-68, U.L. Design U312	Fire Test: U.L. R2717-52, 9-9-68, U.L. Design U312
		UL E Design U314	UL E Design W300
		Sound Test: NSC 2404, 10-14-70	Sound Test: G&H BW-2FF, 7-13-67

GA Explanatory Notes


23 Notes!

- 2. Nails shall comply with ASTM F 547 or ASTM C 514. Other nails, suitable for the intended use, and having dimensions not less than those specified in this Manual shall be permitted as substitutions.



GA Explanatory Notes

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



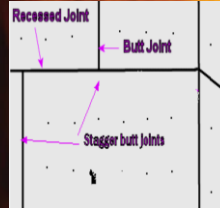
GA Explanatory Notes



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

34

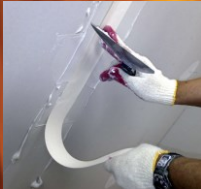
GA Explanatory Notes



- 7. Unless otherwise stated in the detailed description of the individual system, joints shall be staggered as follows.
 - Horizontal butt joints on opposite sides of a partition in single-layer applications shall be staggered not less than 12"
 - Horizontal butt joints in adjacent layers on the same side of a partition in multi-layers applications shall be staggered not less than 12"
 - Vertical joints on opposite sides of a partition in single layer applications shall not occur on the same stud

35

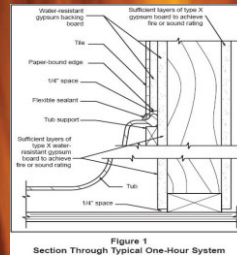
GA Explanatory Notes



- 8. When a fire-resistive rated partitions extends above the ceiling, the gypsum board joints occurring above the ceiling need not be taped and fasteners need not be covered when all of the following conditions are met.
 - The ceiling is part of the fire-resistance rated floor-ceiling or roof-ceiling system;
 - All vertical joints occur over framing systems;
 - Horizontal joints are either staggered 24" o.c. on opposite sides of the partition, or are covered with strips of gypsum board not less than 6" wide, or the partition is a two-layer system with joints staggered 16" or 24" o.c.; and
 - The partition is not part of a smoke or sound control system.

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GA Explanatory Notes



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

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GA Explanatory Notes

11. When not specified as a component of a fire tested wall or partition system, either faced or unfaced mineral fiber, glass fiber, or cellulose fiber insulation of a thickness not exceeding that of the cavity depth shall be permitted to be added within the stud cavity. Adding insulation may improve the STC.

GA FILE NO. WP 1072	GENERIC	1 HOUR FIRE	45 to 49 STC SOUND
GYPSUM WALLBOARD, STEEL STUDS			
One layer 5/8" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 3/4" steel studs 24" o.c. with 1" Type S drywall screws 6" o.c. at vertical joints and 12" o.c. at floor and ceiling runners and intermediate studs.			
Joints staggered 24" on each side and on opposite sides. Sound tested with 3 1/4" glass fiber friction fit in stud space. (NLB)			

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GA Explanatory Notes

- 12. In floor-ceiling or roof-ceiling systems, the addition or deletion of mineral or glass fiber insulation in ceiling joist spaces could possibly reduce the fire-resistance rating. The addition of up to 16 3/4 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 1/2 inch type X or 5/8 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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GA Explanatory Notes

- 15. Although the systems are arranged in general groupings (i.e. walls and interior partitions, floor-ceilings, roof-ceilings, etc.), this is not intended to limit their use only to the specific category in which they are listed. For example, systems listed as shaft walls shall be permitted to be used as interior partitions. However, systems tested vertically (walls and partitions) shall not be permitted to be arbitrarily used in a horizontal orientation.

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GA Explanatory Notes



- 18. Greater stud sizes (depths) shall be permitted to be used in metal- or wood-stud systems. Metal studs of heavier gage than those tested shall be permitted. The assigned rating of any load-bearing system shall also apply to the same system when used as a nonload-bearing system. Indicated stud spacings are maximums.

92

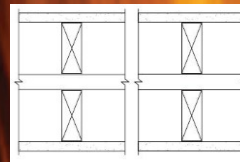
GA Explanatory Notes

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



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GA Explanatory Notes



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

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GA Explanatory Notes

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

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GA Explanatory Notes

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

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WALLS AND INTERIOR PARTITIONS, NON-COMBUSTIBLE

GA FILE NO. WP 1071	PROPRIETARY*	1 HOUR FIRE	45 to 49 STC SOUND
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GYPSON WALLBOARD, STEEL STUDS, INTERMEDIATE SPACING, Gypsum Veneer

One layer 1/2" proprietary Type X gypsum wallboard or gypsum veneer base applied at right angles to each side of 2x4 steel studs 24" o.c. with 1" Type G gypsolux corner 12" o.c. at vertical joints and 12" o.c. at intermediate studs and wall perimeter. 2" mineral fiber insulation, 3/8" and 1/8" in stud space.

Vertical joints staggered 24" on each side and on opposite sides. Horizontal joints need not be staggered (R16.0).

Thickness: 3/4"
 Approx. Weight: 2 psf
 Fire Test: UL 10C, E832, E832G2748
 U.L. Design 1401, FM 55753, 51-234
 See WP 1072
 EMI, Table 42, 10-17-03

Sound Test

GA FILE NO. WP 1072	GENERIC	1 HOUR FIRE	45 to 49 STC SOUND
----------------------------	----------------	--------------------	---------------------------

GYPSON WALLBOARD, STEEL STUDS

One layer 1/2" Type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 2x4 steel studs 24" o.c. with 1" Type G gypsolux corner 12" o.c. at vertical joints and 12" o.c. at floor and ceiling runners and intermediate studs.

Insulation staggered 24" on each side and on opposite sides. Sound tested with 2x4 gypsolux studs in stud space (R16.0).

Thickness: 3/4"
 Approx. Weight: 2 psf
 Fire Test: U.L. Design 1401, FM 55753, 51-234
 U.L.C. 7974M, 797500, 797497, 6-1-04
 U.L.C. Design 1401
 MNC 18E-01, 13-01

Sound Test

Woods Exterior Wall

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

GYPSON WALLBOARD, GYPSON SHEATHING, WOOD STUDS

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

INTERIOR SIDE: One layer 1/2" Type X gypsum wallboard, water-resistant gypsum backing board, or gypsum veneer base applied parallel or at right angles to studs with 6d coated nails, 19" long, 0.91915" shank, 1/4" heads, 7" o.c. (LOAD-BEARING)

Thickness: Varies
 Approx. Weight: 7 psf
 Fire Test: See WP 3510 (UL R501-47, -48, 9-17-05, UL Design 1002, UL R5110, 120, 7-22-70, UL Design 1314)

UL Underwriters Laboratories Inc. www.ul.com



2016

Directory

<http://www.ul.com/fire/resistance.html>

UL Underwriters Laboratories Inc.

UL Design Information


- Fire-resistance ratings apply only to assemblies in their entirety.
- Except for those separately rated structural members supporting tested assemblies, individual components are not assigned a fire-resistance rating and are not intended to be interchanged between assemblies but rather are designated for use in a specific design in order that the ratings of the design may be achieved.

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UL Underwriters Laboratories Inc.

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- Except for those separately rated structural members supporting tested assemblies, individual components are not assigned a fire resistance rating and are not intended to be interchanged between assemblies but rather are designated for use in a specific design in order that the ratings of the design may be achieved.

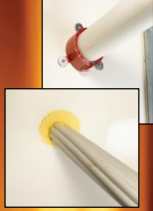


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UL Underwriters Laboratories Inc.

UL Penetrations

- Penetrations through all or a portion of an assembly can significantly affect the rating.
- Firestop systems developed to protect openings created by penetration items are covered in Volume 2 of the Fire Resistance Directory

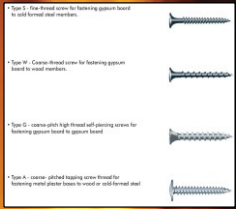


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UL Underwriters Laboratories Inc.

UL Nails and Screws

- Nails are specified according to ASTM F547 or ASTM C514. Nails used to attach gypsum board to wood framing should be cement-coated box nails or cement-coated cooler nails unless specified otherwise in the specific designs.
- Screws meeting ASTM C1002 or ASTM C954 may be substituted for nails, one for one, when the head diameter, length, and spacing equal or exceed the requirements for the specified nails.



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Gypsum Board Orientation

- Vertically applied gypsum board is gypsum board that is applied with the long edges parallel to the framing members to which it is attached.
- Horizontally applied gypsum board applied is gypsum board applied with the long edges perpendicular to the framing members to which it is attached.

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Gypsum Board Joint Treatment (Fire Taping)



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

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Sound Transmission Class (STC)

- In addition to the fire-resistance ratings, where indicated in the individual designs, the Sound Transmission Class (STC) rating is published for those designs where the sound transmission loss (STL) test was also investigated. ASTM E90-99, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions," is the test method used to evaluate the sound transmission loss for the various designs. The STC rating applies to the assembly of materials as indicated in the individual designs.

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Gypsum Board

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

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UL Underwriters Laboratories Inc.

Gypsum Board

- For designs containing the statement "See Gypsum Board (CKNX) Category for names of Classified Companies," any product in the category (CKNX) that meets the specifications (i.e., thickness, size) described in the design may be used. This statement is applicable to any gypsum board manufacturer who produces Classified gypsum board meeting the thickness and size of the board specified in the design. It is not required that these Design Numbers appear in the individual Classifications.

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Wood Frame Construction

Spaces between joists or trusses and spaces between the ceiling and the floor above should be provided with firestopping or draft stopping as specified in the provisions of applicable building codes.

When a non fire rated wood stud wall assembly abuts the bottom of a wood joist floor-ceiling assembly employing a membrane ceiling, the membrane should be continuous above the top plate of the wall assembly.



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UL Fire Resistance Directory

Product Name	UL Classification	Fire Resistance Rating	Fire Test Standard	Fire Test Method	Fire Test Conditions	Fire Test Results	Fire Test Details	Fire Test Notes	Fire Test Comments
1. Gypsum Wallboard on Wood Studs	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
2. Gypsum Wallboard on Steel Studs	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
3. Gypsum Wallboard on Concrete Block	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
4. Gypsum Wallboard on Concrete	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
5. Gypsum Wallboard on Brick	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
6. Gypsum Wallboard on Masonry	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
7. Gypsum Wallboard on Concrete Block	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
8. Gypsum Wallboard on Concrete	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
9. Gypsum Wallboard on Brick	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119
10. Gypsum Wallboard on Masonry	UL-100	1-Hour	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119	ASTM E119

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"Townhouse overview"

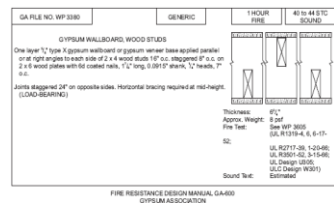


111

"Townhouses"

What is a 1-hour fire-resistance-rated wall?

1-hour fire-resistance rating refers to a wall assembly tested in accordance with [ASTM E119](#), [UL 263](#) or [Section 703.3 IBC](#) with exposure from both sides [Section R 302.2](#).

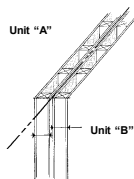


IRC R302.2

112

"Townhouses"

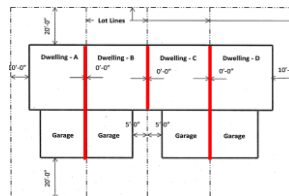
Each townhouse shall be considered a separate by two 1-hour fire-resistance-rated wall assemblies tested in accordance with [ASTM E119](#), [UL 263](#) or [Section 703.3](#) of the International Building Code. The code does not require property lines between units.



IRC R302.2.1

113

"Townhouse fire-separation"



Townhouses. Walls separating townhouses shall be constructed in accordance with [Section R302.2.1](#) or [R302.2.2](#).

R302.2.1 – Double walls

R302.2.2 – Common walls

114

"Townhouse fire-separation"

Exercise/Discussion

Townhouse? Why?

Dwelling A Dwelling B Dwelling C

Lot Lines Sewer/Water/Electric services to each building

IRC R202, R302 115

"Townhouse fire-separation"

DECK DECK DECK

A B C

IRC R202, R302 116

"Townhouse fire-separation"

A B C

IRC R202, R302 117

"Townhouses"

R302.2.3 Continuity

The fire-resistance-rated wall or assembly separating townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab.

IRC R302 118

Townhouses

Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of section R302.2 and if double section R302.2.1.

One-hour assembly

Dwelling 1 Dwelling 2

Vertical separation

ONE HOUR ASSEMBLY

GENERAL: One-hour fire-resistance-rated wall assembly consisting of a single layer of 5/8 inch (15.9 mm) gypsum board on each side of a 1/2 inch (12.7 mm) metal lath and 1/2 inch (12.7 mm) concrete or grout filled CMU.

CONSTRUCTION: See Section 0505.1.1 for details.

FINISHES: See Section 0905.1.1 for details.

TESTING: See Section 0505.1.1 for details.

NOTES: See Section 0505.1.1 for details.

DATE: 11/11/11

SCALE: 1/8" = 1'-0"

PROJECT: 11-11-11

DESIGNER: [Name]

CHECKER: [Name]

DATE: 11/11/11

119

Foundation Anchorage

Definitions: *sill plate, sole plate*

Sole Plate

Sill Plate

A.B. to be embedded 7" into concrete or grout filled CMU

R403.1.6

120

Foundation Anchorage

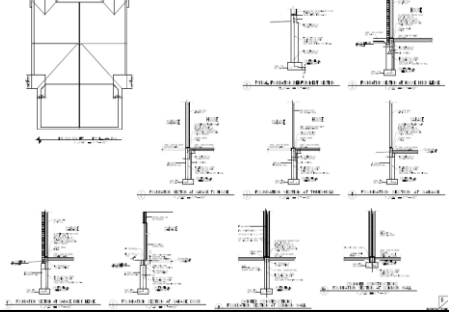
Exterior wall?
Interior wall?
Why?



Interior bearing wall sole plates on monolithic slab foundations shall be positively anchored with approved fasteners. *???? (if approved by the Building Official)*

International Residential Code, section R403.1.6

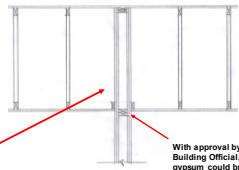
Top to Bottom



Townhouses

A common 2-hour fire-resistance-rated wall is shared by two townhouses such walls can not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. Penetrations for electrical outlet boxes shall be in accordance with section R302.4

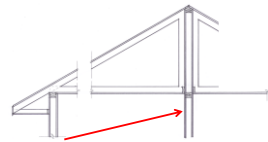
Except



With approval by the Building Official, this gypsum could break at the framing locations to allow for proper structural attachment.

IRC R302.2.2

"Townhouse"



The common wall shared by two townhouses shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall.

The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing.

Penetrations for electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.2



GA FILE NO. WP-3380	GENERIC	1 HOUR FIRE	40 to 44 STC SOUND
GYPSUM WALLBOARD, WOOD STUDS One layer 1/2" type X gypsum wallboard on gypsum reinforced lesser angled parallel or at right angles to studs with 2x4 wood studs. EP c/c. Integridense EP c/c. on 2x4 wood studs with full coated nails, 5/16" long, @ 16" o/c. Studs, 1/2" x 4". Studs, 1" x 4". Joints staggered 24" on opposite faces. Vertical bracing required at stud height. (LOAD-BEARING)			
Thickness	5/8"	5/8"	5/8"
Allowable Weight	8 psf	8 psf	8 psf
Free End	Free	Free	Free
	See WP-3025	See WP-3025	See WP-3025
	See WP-3025, 4, 16, 17, 32;	See WP-3025, 4, 16, 17, 32;	See WP-3025, 4, 16, 17, 32;
	18, 20, 22, 24, 26, 28;	18, 20, 22, 24, 26, 28;	18, 20, 22, 24, 26, 28;
	30, 32, 34, 36, 38, 40;	30, 32, 34, 36, 38, 40;	30, 32, 34, 36, 38, 40;
	42, Design 17005;	42, Design 17005;	42, Design 17005;
	(See Design WP31)	(See Design WP31)	(See Design WP31)

FIREBLOCKING Definitions

- Draft stop**: to divide a large concealed spaces into smaller compartment (Intent: limit the movement of air w/in the cavity, reducing the potential rapid fire spread)
- Fire block**: resist free passage of fire to other conceal spaces (Intent: to isolate movement from vertical to horizontal concealed areas)
- Fire stop**: is an opening protection in rated assemblies
- Fire barrier**: fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

R302.11 & R302.12

Where required - Fireblocking

In combustible construction, fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and the roof space.

• Fireblocking shall be provided in wood-frame construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs, as follows:
 - 1.1 Vertically at the ceiling and floor levels.
 - 1.2 Horizontally at intervals not exceeding 10'.

R302.11.1

127

"Fireblocking" Where required - Fireblocking

2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with approved material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the [ASTM E 136](#) requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

R302.11

128

Fireblocking – Materials

Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. 2 x nominal lumber.
2. 2 -1" nominal lumber with broken lap joints.
3. 1-23/32" WSP w/ joints backed by 23/32" WSPs. (.71875)
4. 1 - 3/4" particleboard w/ joints backed by 3/4" particleboard.
5. 1/2" gypsum board.
6. 1/4" cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested for the specific application.

R302.11.1

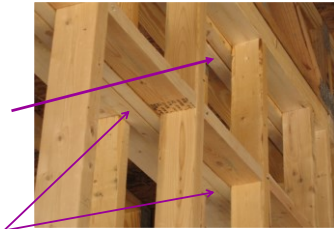
129

"Fireblocking"



130

"Fireblocking" (OFFSET)



131

"Part II"

Exterior Walls

Staggered Stud Design

Termination from One Design to Another Design

132

“Exterior Walls”

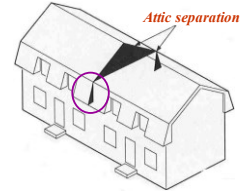


133

“Townhouses”

R302.2 Townhouses. Each townhouse shall be considered a separated building by fire-resistance-rated wall assemblies meeting the requirements of Section R302 for exterior walls.

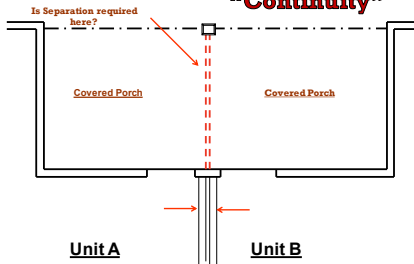
Continuity: The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed accessory structures.



IRC R302.2.1

134

“Continuity”



IRC R302.2.3

The fire-resistance-rated wall or assembly separating townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed accessory structures.

135

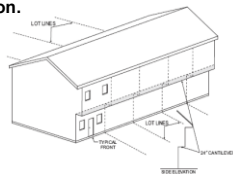
R302.1 – R302.13 – Fire-resistant construction

1. Exterior walls
2. Townhouses
3. Two-family dwellings
4. Rated Assemblies
5. Penetrations
6. Dwelling / Garage
 - Under stair protection
 - Fireblocking/Draftstopping
 - Under floor protection (Ch 5)
7. Fire Resistance



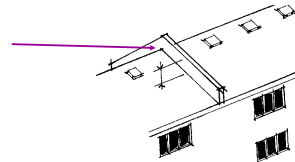
R202 – Fire Separation Distance

- Cantilevered floors and balconies that project parallel of the lot line, such as the upper floor cantilever are not considered projections for the purpose of determining exterior wall and opening protection.



“Townhouses (parapets)”

Parapets constructed in accordance with Section R302.2.4 shall be constructed for townhouses as an extension of exterior walls or common walls in accordance with the following:



IRC R302.2

138

“Parapets”

Exception: A parapet is not required in the two cases (items 1 and 2) when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet on each side of the wall or walls, or 1 layer of 5/8” Type X gypsum board installed directly beneath the roof decking or...

No Openings

IRC R302.2.4 139

“Parapets Exception”

However???

CertainTeed XT25 shingles conform to:
 ASTM D3018 Type I
 ASTM D3462
 ASTM E108 Class A Fire Resistance
 ASTM D3161 Wind Resistance
 ASTM D1922 Tear Strength (D3462)
 CSA Standard A123.5-M90
 NYC-MEA-120-79-M

...roof covering complies with a minimum Class C rating....

ASTM E108 or UL 790

The fire-resistance rating of the shingles is noted on the shingle package.

IRC R302.2.4 (2) except, R905.2.4.1 140

“Parapets”

Exceptions: ...or one layer of 5/8 inch Type X gypsum board is installed directly beneath the roof decking or sheathing for a distance of 4 feet on each side of the wall or walls.

In this example, the gypsum board is 6 feet in distance. Is this ok?

IRC R302.2.4 (2) except 141

“Parapets”

3) A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall not have less than a 1-hour fire-resistive rating.

IRC R302.2.4 142

143

“Fire-resistive wall”

There are **no requirements** to provide a fire-resistive assembly to the adjoining decks or the privacy wall that separates the decks in this example.

144

"Fire-resistive walls"

There are **requirements** in the International Residential Code that address one-hour fire-resistive construction on these **perpendicular** walls according to location of the lot line R302.



R302.1 except 1

145

Table R302.1(1) - Exterior Walls

EXTERIOR WALL ELEMENT	MINIMUM FIRE RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE	
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposures from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	≥ 2 feet
	Fire-resistance rated	1 hour on the underside, on heavy timber, or fire-retarded treated wood ^{a, b}	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
	All	Comply with Section R302.4	< 3 feet
Penetrations	All	None required	3 feet

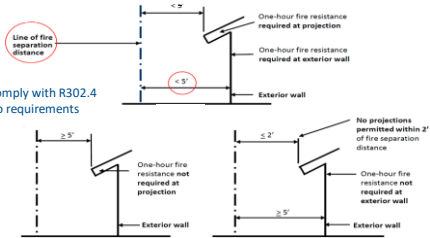
- a. The fire-resistance rating shall be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.

146

Fire-Separation Distance

TABLE R302.1(1)
EXTERIOR WALLS

Penetrations < 3', comply with R302.4
Penetrations > 3', no requirements



147

Townhouse

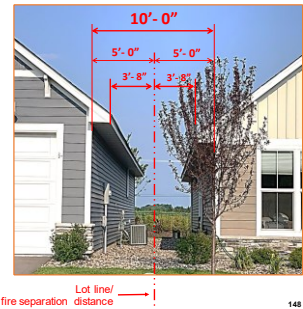
Example:
See Table R302.1(1)
[dwellings without fire sprinkler system]

Exterior Walls: 5'- 0"
• One-hour fire resistive exterior walls
NOT REQUIRED

Projections: 3'- 8"
• < 5'- 0" and one-hour fire resistive protection **REQUIRED**

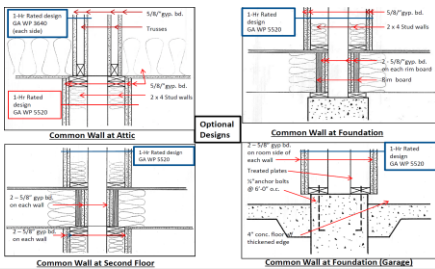
Openings in exterior walls: 5'- 0"
• **No limitations** to area of openings

Penetrations in exterior walls: 5'- 0"
• **No limitations** to area of openings



148

Fire-Separation Walls - Examples



149

"Fire-resistive walls"

When the two one-hour fire-resistance-rated walls are constructed, the gypsum board is required to be installed per the listed fire-resistive assembly.



USGA Explanatory Notes, UL Guidelines, GA Introductions

150

“Fire-resistive walls”

The fastener spacing will be specified by the listing of the assembly.

Some listings, such as those in the “Fire Resistance Design Manual” published by the Gypsum Association, allow some substitution of fasteners when specific requirements are followed.



151

“Townhouses”

Fire separation distance.
Continuity.

The separation shall extend through enclosed soffits, overhangs, and similar projections.



IRC R302.2

152

“Townhouses”

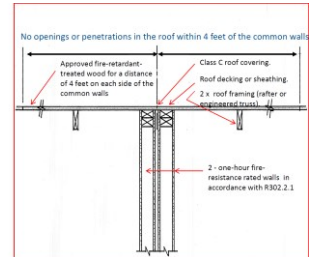
The air space is only required if noted by the listed assembly.



153

“Townhouses”

Parapets.



154

“Townhouses”

Verify design of roof / floor truss system to accommodate the additional dead load of the fire-restive material, ex. Gypsum psf.



155

“Townhouses”

Verify extension of fire-resistive separation at the rim area.



156

“Townhouses”

Verify the listing of the assembly during the installation.

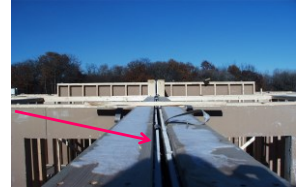
The designer/builder chose to use tip-up panel construction for this project.



157

“Townhouses”

The code requires that **gypsum board** be inspected if part of a fire-resistive assembly or if part of a shear assembly.



Where fire-resistance-rated construction is required between dwelling units or due to location on property, the building official shall require an inspection...

IRC R109.1.5.1

158

“Townhouses”

Verify the fire-resistive assembly.



Fire-resistance-rated wall

159

“Townhouses”

Verify installation of the fire-resistive assembly between these **back-to-back** dwelling units.



160

“Townhouses”

Verify structural integrity, including proper truss bracing.



161

“Townhouses”

Fire-resistance-rated wall required here.

No requirement here for a fire-resistance-rated wall.



The common wall between dwellings is here.

162

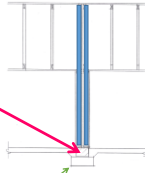
“Townhouses (Structural Independence)”

Each individual townhouse shall be structurally independent.

Exceptions:

- 1) Foundations supporting exterior walls or common walls.

(continued)



Frost Footing Required

IRC R302.2.6

163

“Townhouses (Structural Independence)”

Each individual townhouse shall be structurally independent.

Exceptions:

- 2) Structural roof and wall sheathing from each unit may fasten to the common wall framing.

(continued)



IRC R302.2.6

164

“Townhouses (Structural Independence)”

Each individual townhouse shall be structurally independent.

Exceptions:

- 3) Non-structural wall covering.

(continued)



R302.2.6

165

“Townhouses (Structural Independence)”

Each individual townhouse shall be structurally independent.

Exceptions:

- 4) Flashing at termination of roof covering over common wall.

(continued)



IRC R302.2.4

166

Townhouse

Structural independence.

- Each individual townhouse shall be structurally independent.

- **Exceptions:**(see all exceptions)

-Townhouses separated by a common wall as provided in Section R302.2.

Structural independence.



167

Townhouse

Structural independence.



168

Townhouse

Structural independence.



169

Townhouse

Structural independence.



170

Townhouse

Structural independence.

BEFORE



Section R302.2.6

171

Townhouse

Structural independence.

AFTER



Code compliance performs when everyone does their job.

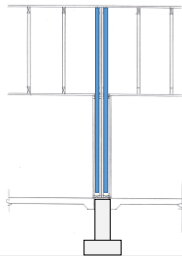
172

"Sound Transmission"

If adopted IRC Appendix K section AK101

Airborne sound insulation for wall and floor-ceiling assemblies shall meet a Sound Transmission Class (STC) rating of 45 when tested in accordance with ASTM E 90.

Floor/ceiling assemblies between dwelling units...shall have an Impact Insulation Class (IIC) rating of not less than 45 when tested in accordance with ASTM E 492.



"Sound Transmission"

If adopted IRC Appendix K section AK101



Verify STC rating of not less than 45

- Sound Transmission, is adopted by the municipality, the airborne sound insulation for wall and floor/ceiling assemblies
- Penetrations need to maintain this rating as it needs to be airtight.
- Substituting mechanical fasteners for designed adhesives, or the use of more fasteners, may affect the rating.

APPENDIX K

174

Sound Transmission

General information.

- **Air-Borne Sound:**
 - Sound traveling through air in a structure.
- **Impact Sound:**
 - **Structural-borne Sound (Impact Sound):**
 - The sound created when a building surface is struck by an object.
 - Sound that has traveled through a structure as vibration in solid material

175

Sound Transmission

General information.

STC = Sound Transmission Class rating
Minimum Air-borne sound and Structural-borne sound = 45

STC	People Reaction Measurement
If the STC = 35	Clearly hear conversation
If the STC = 45	Conversation is muddled
If the STC = 55	Won't hear conversation; but will still hear loud sounds such as raised voices, bass music, or television.

176

Sound Transmission

General information.

- Air is the basic medium for sound transmission
- Close off air leak paths allowing noise to go through or around the system using an acoustic sealant

A 1/4" perimeter crack surrounding a 96 sq. ft. wall represents an approximate 1 sq. ft. hole.

177

Sound Transmission

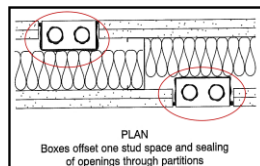
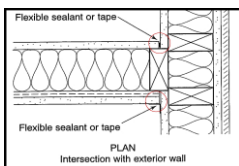
General information.

- All I need is to select a high STC wall and the job is done, right?
- The devil is in the details. Sealing all gaps, cracks and penetrations with acoustical caulk is critical in achieving the design STC rating. Just remember the saying,
"If it's airtight, it's sound tight."
- Acoustical caulk is a permanently flexible sealant that is designed and tested for this application.

178

Sound Transmission

General information.



179

GA - 600

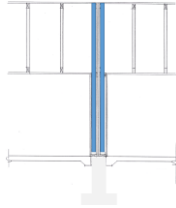
GA FILE NO. / WP SIZE	GENERIC	2 HOUR FIRE	95 TO 80 STC SOUND
Base layer 1/2" type X gypsum wallboard or gypsum veneer base applied at right angles to each layer of structure over 2 1/2" x 4" studs @ 16" o.c. in regular pattern. 1/2" layer with 20 lb. sound mat, 1/2" air gap, 1/2" mineral wool, 1/2" studs @ 16" o.c. Base layer 1/2" type X gypsum wallboard or gypsum veneer base applied at right angles to each side with 20 lb. sound mat, 1/2" air gap, 1/2" mineral wool, 1/2" studs @ 16" o.c.	GYPSUM WALLBOARD, WOOD STUDS		
Joints staggered 1/2" each layer and side. Sound tested with 210" glass fiber insulation installed to finish in stud bays on one side, acoustically sealed to base layer, minimum 1/2" o.c. Horizontal bracing required at 100" height. (SOUND WALLBOARD)	STC >45 - OK	Thickness: 105/4" Approx. Weight: 13 pcf Prod. Ref: 500, 5-21-11 Sound Test: HSC 2006, 4-7-70	

180

"Sound Transmission"

As adopted IRC Appendix K section AK101

Wall and floor-ceiling assemblies separating dwelling units shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.



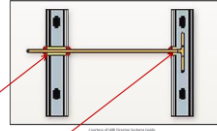
181

Dwelling Unit Rated Penetrations

Dwelling unit rated penetrations.

There are **two types** of penetrations to be considered:

- A **through penetration** passes entirely through a fire-resistance rated assembly.
- A **membrane penetration** passes through one side of fire-resistance rated assembly.



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"Dwelling Unit Rated Penetrations"

Protection of **through penetrations** of fire-resistance-rated **wall** or **floor/ceiling** assemblies may be accomplished by various methods

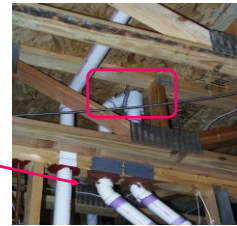
- Where tested as part of the approved fire-resistance-rated assembly
- Use of a proprietary penetration fire stop system tested per [ASTM E 814](#)
- Compliance with prescriptive method set forth in code:
 - Applicable only to steel, ferrous or copper pipes and steel conduits
 - In concrete or masonry construction, use of grout, mortar or concrete to fill area around penetrating item (limits to opening size)
 - Use of approved material to fill annular space around penetrating item

IRC R302.4.1

183

"Penetrations"

The installer of **Mastic and Intumescent Coatings** (Underwriters Laboratories, Inc. classification "**CDWZ**"), should **consult the manufacturer** regarding the proper application of the product.



Assemblies Yes? - No?

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Listed Assemblies for Penetrations

ASSEMBLY	TYPE	HEIGHT	WIDTH
PLASTIC PIPE THROUGH WOOD FLOOR/CEILING ASSEMBLY	1	2 1/2"	2"
PLASTIC PIPE THROUGH WOOD FLOOR/CEILING ASSEMBLY	2	2 1/2"	2"
CONCRETE/MASONRY THROUGH WOOD FLOOR/CEILING ASSEMBLY	1	2 1/2"	2"
CONCRETE/MASONRY THROUGH WOOD FLOOR/CEILING ASSEMBLY	2	2 1/2"	2"

"Penetrations"

The installer of this **intumescent caulk (firecaulk)** may **not have checked** for proper installation method with the manufacturer or the product listing.



R302.11 Fireblocking.

In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between a top story and the roof space.

186

“Rated Penetrations”

Membrane penetrations protected in manner similar to through penetrations with additional prescriptive methods of R302.4.1 set forth:

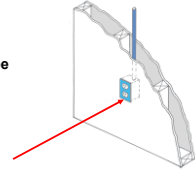
- ❑ Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.
 - ❑ Steel electrical boxes of limited size and minimum separation
 - ❑ Listed two-hour fire-resistance-rated nonmetallic electrical outlet boxes
 - ❑ Use of metal escutcheon plate over penetration of fire sprinkler

IRC R302.4.2

187

“Membrane Penetrations”

Penetrations of wall or floor/ceiling assemblies required to be fire-resistance-rated ... shall be protected in accordance with ... section R302.4, “Through Penetrations” and “Membrane Penetrations” section R302.4.2.



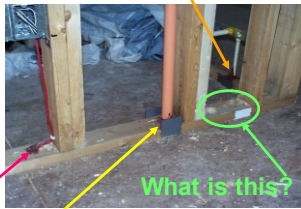
IRC R302.4.2

188

“Penetrations”

Some UL listings contain the use of **Mastic and Intumescent Coatings** (Underwriters Laboratories, Inc. classification “CDWZ”), for plastic pipe, wire, and other penetrations.

These products need to be installed according to the product listing.



R302.11 item (4)

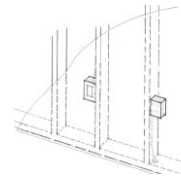
189

“Electrical Penetrations”

Penetrations for **electrical outlet boxes** shall be in accordance with section R302.4.

Exceptions:

1. Steel electrical boxes that do not exceed 16 square inches in area provided the total area of such openings does not exceed 100 square inches for any 100 square feet of wall area.



IRC R302.4.2 expt 1

190

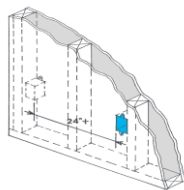
“Electrical Penetrations”

Exceptions (continued):

Outlet boxes on **opposite sides of the wall** shall be separated as follows:

- 1.1 By a horizontal distance of not less than 24 inches, or...

(continued)



IRC R302.4.2

191

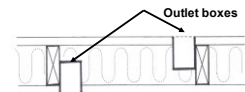
“Electrical Penetrations”

Exceptions (continued):

Outlet boxes on **opposite sides of the wall** shall be separated as follows:

- 1.2 By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill or mineral fiber insulation, or...

(continued)



IRC R302.4.2

192

“Electrical Penetrations”

Exceptions (continued):

Outlet boxes on **opposite sides of the wall** shall be separated as follows:

1.3 By solid fireblocking in accordance with IRC section R302.11 (fireblocking materials) or...

(continued)

IRC section R302.11, “Fireblocking,” contains all of the materials (such as lumber, wood panels, cement-based board, gypsum board, etc.) noted for use as fireblocking.

IRC R302.4.2

193

“Electrical Penetrations”

Exceptions (continued):

Outlet boxes on opposite sides of the wall shall be separated as follows:

1.4. By protecting both boxes with listed putty pads; or



194

“Electrical Penetrations”

Exceptions (continued):

Outlet boxes on **opposite sides of the wall** shall be separated as follows:

1.5 By other listed materials and methods.

(continued)



IRC R302.4.2

195

“Electrical Penetrations”

Membrane penetrations (continued).

Exceptions:

2. Membrane penetrations by **listed** electrical boxes of any materials provided that the boxes have **been tested** for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.



(continued)

International Residential Code, section R302.4.2

196

“Electrical Penetrations”

• Membrane penetrations (continued)

• Exceptions:

[Ceiling membrane penetrations by listed luminaires or by luminaires protected with listed materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.](#)



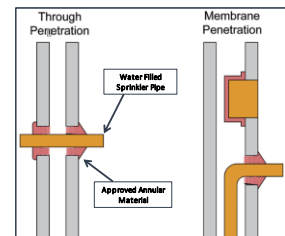
R302.4.2 Exception 4

197

2021IRC

R302.4 Dwelling Unit Rated Penetrations

- Water-filled fire sprinkler piping of any approved material
 - does not require a firestop system
 - provided annular space is filled with the prescribed materials



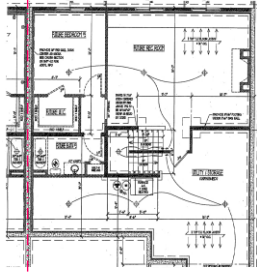
198

Dwelling Unit Rated Penetrations

Exercise/Discussion

Does this plan require rated penetration protection?

Why or Why Not?



Lower Level / Fdn Plan - "B"

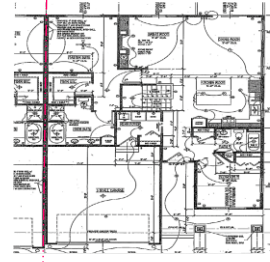
199

Dwelling Unit Rated Penetrations

Exercise/Discussion

Does this plan require rated penetration protection?

Why or Why Not?



Main Level Plan - "B"

200

"Joints and Penetrations"

Two-family Dwellings and Townhouses ...
Fire Separation.



IRC R302

201

"Joints and Penetrations"

Fire Separation.
Penetrations of the rated (listed) assembly.



IRC R302.2

202

"Joints and Penetrations"

Fire separation.
Penetrations in the rated wall assembly.

Fire rated Elec. Box?



IRC R302.4.2

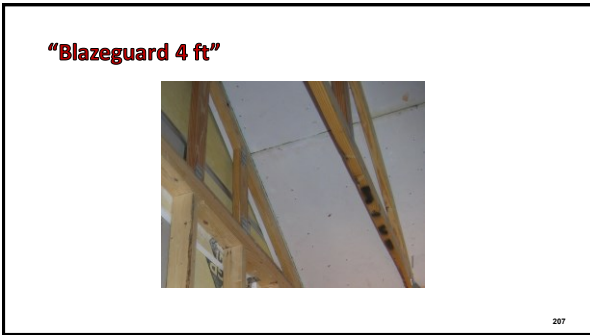
203

"Which window was added?"



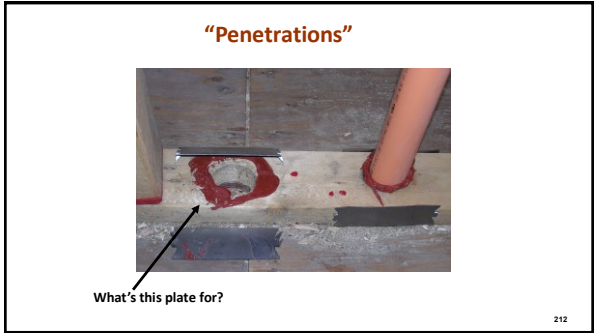
"WWP"

204





211



212



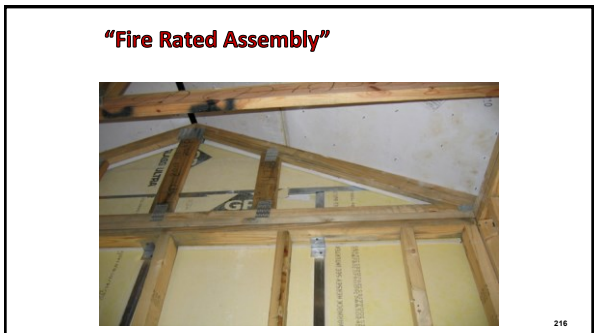
213



214

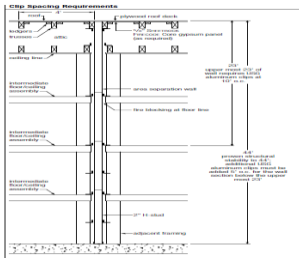


215



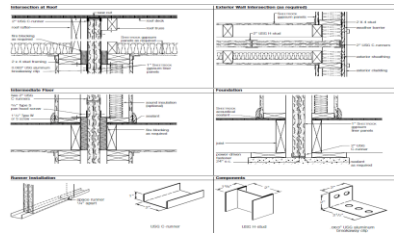
216

“USG Area Separation”



217

“USG Area Separation”



218

“Firewalls/Veneer”

- Check edits!
- Ensure the lot(s) is/are identified.
- Ensure approved plans are on site.
- Perform inspection
 - As well as what is usually inspected, some townhouse units require that we look at portions of the firewall that extends into areas that will be concealed by the time of framing/firewall inspection.

219

“Fire Separation Walls”

Points to remember:

- EACH TOWNHOUSE SHALL BE CONSIDERED A SEPARATE BUILDING
 - WITH SEPARATE ONE-HOUR RATED WALL ASSEMBLIES
- OR HAVE A COMMON TWO-HOUR RATED ASSEMBLY
- THEY MAY SHARE COMMON FOUNDATIONS.
- THE STRUCTURAL ROOF AND WALL SHEATHING MAY FASTEN TO COMMON WALL FRAMING

220

“Fire Separation Walls”



Note:
Fire-Separation Walls(s) Shall Be Tight Against Exterior Wall Sheathing, and Extend to the Underside of the Roof Sheathing.

221

“Fire Separation Walls”



Note that the fire separation wall material is missing.

222

"Fire Separation Walls"



Note that the fire separation wall must extend into this soffit area.

223

"Fire Separation Walls"



Fire separation wall correctly extends to ends of building including the soffits.

224

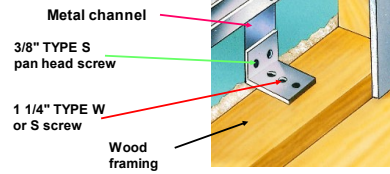
"Fire separation walls"



Note how the fire separation wall extends into the soffit area.

225

"Fire Resistive walls"



226

"Fire Resistive walls"



Wood Screw

Sheetmetal screw

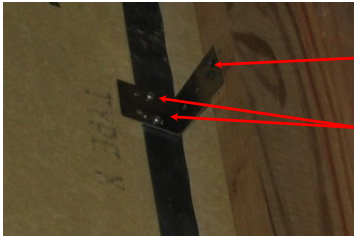
227

"Fire Resistive walls"



228

"Fire Resistive construction walls"

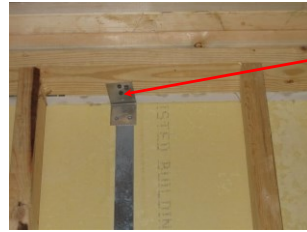


Wood screw

Sheet Metal Screw

229

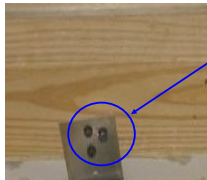
"Fire Resistive construction walls"



Wood screws are permitted to be used to secure clips to framing. Minimum of 1 screw per clip.

230

"Fire Resistive construction walls"



Wood screw

231

"Fire Resistive construction walls"



Missing clips

232

"Fire Resistive Construction walls"



Clips missing at plates

233

"Fire Resistive Construction Walls"



Clips missing at midpoint of fire-separation wall

234

“Fire Resistive Construction Walls”



H – channel used to support the area-separation wall material

235

“Fire Resistive Construction Walls”

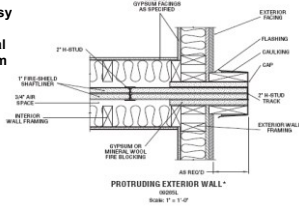


Missing Clips

236

“Fire Resistive Construction Walls”

Courtesy of National Gypsum



Please take notice that the fire separation assembly must extend into any protruding soffits and eaves. This must be checked at veneer inspection, otherwise it will be concealed.

237

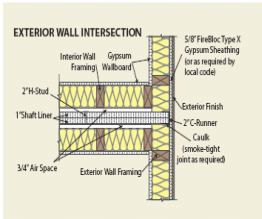
“Fire Resistive Construction Walls”



Soffit fire stopping

238

“Fire Resistive Construction Walls”



Courtesy of American Gypsum

239

“Fire Resistive Construction Walls”



1" air gap between framing and area-separation wall

240

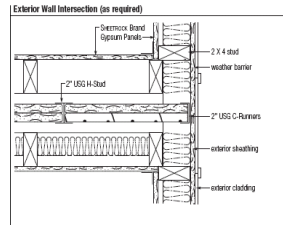
“Fire Resistive Construction Walls”



1" air gap maintained through to roof line

241

“Fire Resistive Construction Walls”



Note: same requirement for USG, NG, AG.

242

“Fire Resistive Construction Walls”



Missing Fire stopping

243

“Fire Resistive Construction Walls”



Fire-resistive walls that work.

244

“Fire Resistive Construction Walls”



Fire-resistive walls that work.

245

“Summary”

- Verify all code requirements.
- Call your local building department with questions.
- ...And remember: “Life is good.”
(Brent Snyder 2006)



246