



COMMUNITY DEVELOPMENT AGENCY

BUILDING DEPARTMENT

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FIRE SEPARATION REQUIREMENTS AT TWO-FAMILY DWELLINGS

A Secondary or Accessory Dwelling Unit (ADU) located within the same structure as a primary dwelling unit invokes certain Building Code provisions that require proper detailing of construction assemblies on the part of the designer, as well as proper execution at the job site by the builder.

Building Code requirements for “two-family dwellings” include ***fire-rated construction assemblies*** at walls, floors and/or roofs, as well as ***penetrations*** occurring in these fire-resistant building elements. Fire separation requirements of two-family dwellings are described in detail in Sections R302.3–R302.4 of the 2022 California Residential Code. For more detailed information, refer to the attached requirements as excerpted from 2022 I.R.C. Code & Commentary – Volume 1.

Drawings submitted to the Building Department for permit shall include the following:

1. **For All Projects** – Clearly identify location and extent of all fire-rated assemblies between adjacent dwelling units – as shown on floor plans, building sections, details – and including the following requirements:
 - a. Construction assemblies of both vertical and/or horizontal separations are required to meet a one-hour fire-resistance rating (*Note: Fire sprinklers designed based on NFPA 13 reduce fire-rating to 30 minutes).
 - b. Floor/ceiling and wall assemblies shall extend to and be tight against exterior walls. Wall assemblies shall extend from foundation up to underside of roof sheathing.
 - c. Where floor assemblies are required to be fire-resistance rated, supporting construction (walls, beams, posts) shall have an equal or greater fire-resistance rating.
 - d. Penetrations (including electrical, recessed lights & mechanical ductwork) located within fire-rated assemblies shall comply with specific requirements.
 2. **For New Construction Projects** – Show detailed drawings or otherwise describe wall, floor, ceiling, and roof fire-rated assemblies. Reference numbers of approved construction assemblies from Chapter 7 of the 2022 CBC or nationally recognized agencies (for example, Underwriters’ Laboratories, U.S. Gypsum Association, etc.) may be submitted, but descriptive specifications and/or illustrations must also be included.
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3. **For Retrofit/Remodel Projects** – In lieu of specific documentation for the original structure, the Building Department may accept installation of (2) layers of 5/8” Type X drywall at one side of wall, floor/ceiling, or roof assemblies to provide the required one-hour fire rating between adjacent dwelling units. The Architect may otherwise provide alternative fire resistance rating for assembly components as per Chapter 7 of the 2022 CBC.

Attachments:

- “Two-Family Dwellings – Fire Separation Requirements” as excerpted from 2022 I.R.C. Code/Commentary
- 1-hour Fire-rated separation details: Interior wall, exterior walls, floor ceiling assemblies
- 1-hour Fire-rated penetration Details: Various material types
- 1-hour fire-rated membrane penetration details: Various material types

4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common wall as provided in Section R302.2.2, Item 1 or 2.

❖ Each townhouse must be structurally independent and capable of being removed without affecting the adjacent dwelling unit, unless one of the exceptions is satisfied. This provision is applicable only to townhouses, not two-family dwellings. This independence is useful not only in the event of a fire in one unit, but also during any remodeling or alteration. The objective of this structural independence is that a complete burnout could occur on one side of the wall without causing the collapse of the adjacent townhouse. This condition occurs rarely. The provision also helps, if there is ever a fire or other problem, by creating a clear separation between the units. With separate ownership and each owner having a different insurance company, the ability to gain access or get repairs made can be difficult and time consuming. By having clearly separated units, it is much easier to determine who is responsible and to make any needed repairs.

The code lists five exceptions that waive the structural independence requirement. A quick review of the exceptions shows that they generally deal with items that will not structurally affect townhouses should a problem develop in the adjacent dwelling unit. Exception 1 is based on the norm within the industry for foundation construction. In the code, Section R402 lists only wood and concrete within the foundation materials section, although Section R404 accepts masonry foundation walls. In general, concrete and masonry are the most common types of foundations; wood foundations are viewed as unique. Given the performance of both masonry and concrete, and the fact that these foundation systems must sustain loads from both the structure and the adjacent soils, it is reasonable to assume that the foundation will not be the item that fails in most situations. Permitting a common foundation also helps solve other problems that would arise if the structural independence issue were taken as an absolute. An example where requiring separate foundations would probably create more problems or difficulty is in the dampproofing or waterproofing of below-grade foundation walls.

If a wood foundation is used between adjacent units, what is the level of fire protection that may be needed? Because concrete and masonry foundations are the norm, it would be easy to forget or overlook protecting the foundation when it is constructed of wood. In these cases, it would seem appropriate to deal with the foundation as any other wall, and protect it on any exposed side. The level of fire resistance should be equal to that of the wall or walls that the foundation supports.

R302.3 Two-family dwellings. *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.3 of the *International Building Code*. 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.

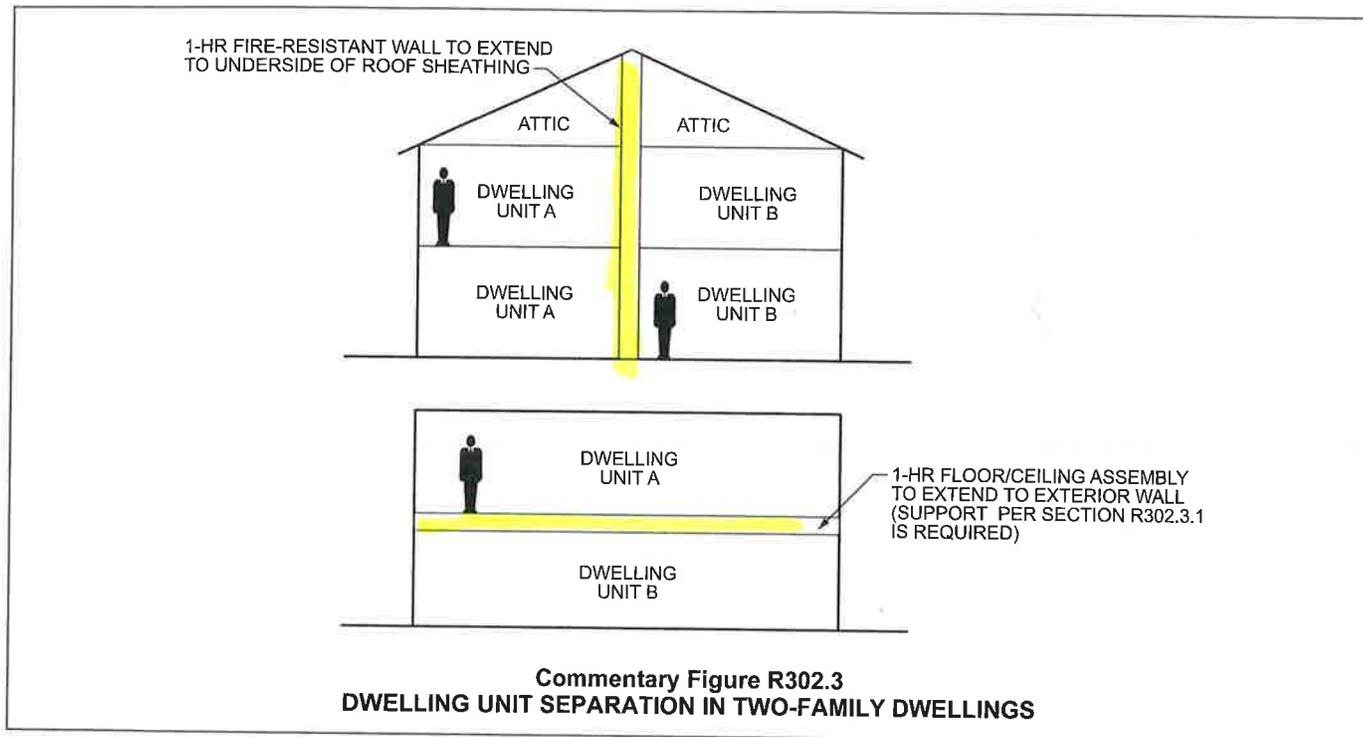
Exceptions:

1. A fire-resistance rating of $\frac{1}{2}$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through *attic* spaces where the ceiling is protected by not less than $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board, an *attic* draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings* and the structural framing supporting the ceiling is protected by not less than $\frac{1}{2}$ -inch (12.7 mm) gypsum board or equivalent.

❖ Most of the nation's fires occur in residential buildings, particularly one- and two-family dwellings. These fires account for more than 80 percent of all deaths from fire in residential uses (including hotels, apartments, dormitories, etc.) and about two-thirds of all fire fatalities in any type of building. One- and two-family dwellings also account for more than 80 percent of residential property losses and more than one-half of all property losses from fire. Section R302.3 provides a separation for protection of the occupants of one dwelling unit in a two-family dwelling from the actions of their neighbor in the adjacent dwelling unit. To accomplish this protection, the code addresses separation between the units, structural support and any openings or penetrations of the separation.

Depending on the layout of the various dwelling units, Section R302.3 requires that the walls and/or floor assemblies that divide one dwelling unit from the adjacent unit be at least 1-hour fire-resistance rated. See Commentary Figure R302.3 for examples of the separation. The separation rating is to be determined by either ASTM E119, UL 263 or the provisions of Section 703.3 of the IBC. E119 and UL 263 are the normal tests used for determining fire resistance. Many tested assemblies are available for use in these locations. Section 703.3 offers numerous methods for determining fire resistance, including the prescriptive provisions of Section 721 of the IBC and the calculation-based provisions of Section 722 of the IBC.

The provisions of the section also address the continuity of the separation, so that one dwelling unit is completely divided from the other. The horizontal aspect of the separation, which requires that the assemblies extend to and be tight against the exterior



wall, is not difficult to comply with. It is most likely the vertical aspect (continuing a wall assembly to the underside of the roof sheathing) that will require some detailed planning, careful construction and careful inspection for the units to be separated.

Exception 1 grants a reduction in the required separation for those cases in which the building is equipped with an automatic sprinkler system. In these cases, a rating of 1/2 hour is permitted versus a 1-hour fire-resistance rating. The sprinkler system must be "installed in accordance with NFPA 13," and is to be installed "throughout" the building. The type of sprinkler system used must meet NFPA 13 and may not be installed to either NFPA 13D or 13R, even though those two standards do address certain types of residential uses. The word "throughout" requires that the sprinkler system be installed in all portions of both dwelling units and any common spaces. The provisions of NFPA 13 that permit omitting sprinklers in certain areas, such as small concealed spaces, are applicable. Therefore, the provision requires a complying sprinkler system "throughout" the building (that is, in all areas of the building that must be protected according to the standard), and it does not accept any partial system, such as one installed in only one dwelling unit or only in the basement level of both units.

Exception 2 addresses separation in the area of the attic of two-family dwellings or duplexes. As long as an attic draft stop is present that meets the requirements in Section R302.12.1, the 1-hour fire separation is permitted to stop at a ceiling constructed of 5/8-inch (15.9 mm) Type X gypsum board. This may be beneficial as, in many cases, the type of

truss or attic rafter and rafter tie/collar tie configuration will prohibit continuing construction of the 1-hour separation wall all the way up to the roof sheathing.

R302.3.1 Supporting construction. Where floor assemblies are required to be fire-resistance rated by Section R302.3, the supporting construction of such assemblies shall have an equal or greater fire-resistance rating.

- ❖ This provision applies only to walls that support the fire-resistance-rated floor assemblies that form the separation between dwelling units in a two-family dwelling where the dwelling units are stacked vertically. Where either all or portions of a dwelling unit separation are provided by a floor assembly, the code requires that the structural supports for the separation have a rating equal to or higher than the floor. This is conceptually similar to the garage separation of Section R302.6. Without the supporting construction being protected, a fire on the lower level could lead to an early failure of the dwelling unit separation (see Commentary Figure R302.3.1).

R302.4 Dwelling unit rated penetrations. Penetrations of wall or floor-ceiling assemblies required to be fire-resistance rated in accordance with Section R302.2 or R302.3 shall be protected in accordance with this section.

- ❖ This section addresses the specific requirements for maintaining the integrity of fire-resistance-rated assemblies at penetrations. If the penetration of a rated assembly is not properly constructed, the assembly itself is jeopardized and may not perform as intended. The provisions of this section apply to penetrations of fire-resistance-rated walls and floor/ceiling assemblies that are a part of the dwelling unit

separation in either two-family dwellings or townhouses. Penetrations of the rated assemblies range from combustible pipe and tubing to noncombustible wiring with combustible covering to noncombustible items, such as pipe, tube, conduit and ductwork.

Each type of penetration requires a specific method of protection, which is based on the type of fire-resistance-rated assembly penetrated and the size and type of the penetrating item. The first step in determining the type of penetration protection required is to identify whether a wall or floor/ceiling assembly is being penetrated. The next step is to determine the type of penetrating item and whether it is a membrane or through penetration. Once these factors are known, then the applicable section must be applied and the applicable method of protection must be decided upon.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:

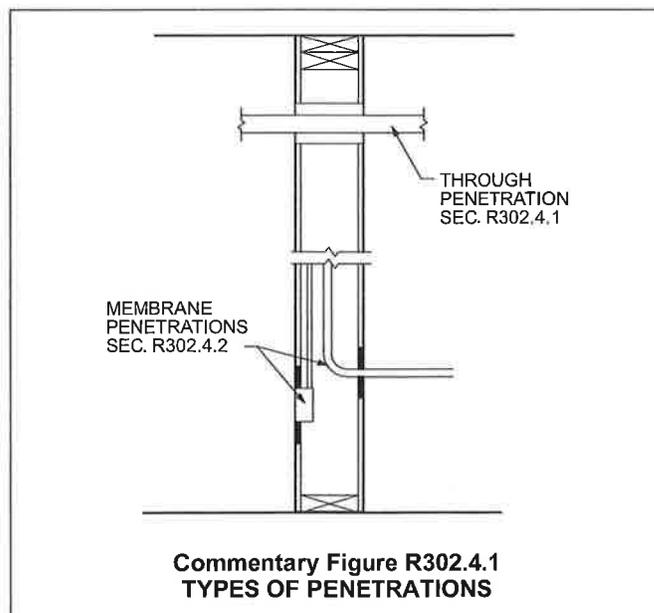
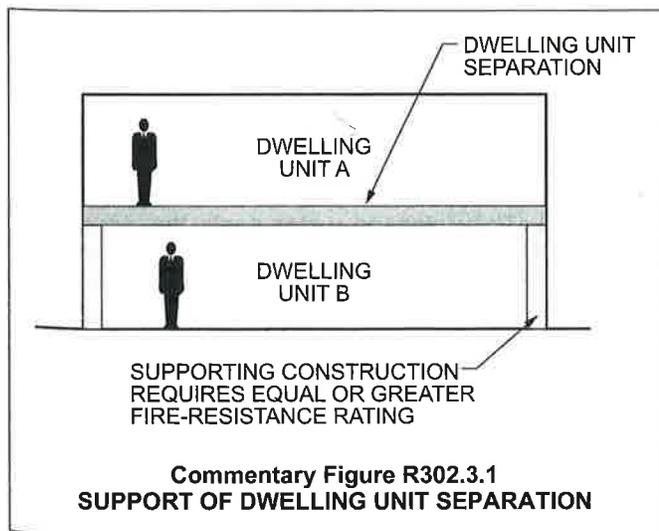
1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:
 - 1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
 - 1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm²).
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration

for the time period equivalent to the fire-resistance rating of the construction penetrated.

- ❖ This section contains the general requirements for through penetrations, which are penetrations that pass through an entire assembly. A through penetration is in contrast to a membrane penetration, which creates a penetration through only one side of an assembly. Membrane penetrations are addressed later in Section R302.4.2. See Commentary Figure R302.4.1 for an illustration of these two types of penetrations.

Through penetrations must be protected to maintain the fire resistance of the penetrated assembly. The code states two methods, found in Sections R302.4.1.1 and R302.4.1.2, which can be used to ensure the adequacy of the penetration protection. The difference between these two is the test methodology used, but they both provide essentially the same results. The commentary for those sections is additional discussion of the differences.

Based on the history of these provisions and on the wealth of fire test data that exists concerning items such as conduit, water piping and other similar penetrations, the code provides two exceptions that permit protection by methods other than those generally required. The first permits the use of concrete, grout or mortar to protect certain penetrations of concrete and masonry wall or floor assemblies. The concrete, grout or mortar must be applied for the full thickness of the assembly unless evidence can be produced demonstrating that the required fire-resistance rating can be achieved with a lesser depth. Concrete, grout and mortar have traditionally been used as protection for the annular space in penetrations of concrete and masonry assemblies. Experience has shown this form of protection to be viable. However, caution must be used any time something, such as a water pipe or conduit, is placed in concrete or masonry.



Sections P2603.3 and P2603.5 contain examples of protection of plumbing systems.

Exception 2 addresses the space between the penetrating item and the original assembly construction. This gap is called the annular space, and this exception provides a method to simply evaluate the performance of the material used to fill that space. It is often mistakenly believed that this exception permits a variety of untested items, but as can be seen from the provision itself, the materials need to meet a specific performance level. This exception requires that the ability of the material to prevent the passage of flame and hot gases sufficient to ignite cotton when subjected to the time-temperature criteria of the ASTM E119 test standard be prequalified. This requirement is similar to provisions found in both ASTM E119 and ASTM E814, the standards used to evaluate fire-resistant assemblies and penetration protection. Because it is very likely that the penetration in the actual fire will be exposed to a positive pressure, this section specifies that the test-fire exposure include a positive pressure of 0.01 inch (0.25 mm) of water column as a further means to verify the performance of this protection method. Thus the protection will not be blown out or moved from its place during a fire.

R302.4.1.1 Fire-resistance-rated assembly. Penetrations shall be installed as tested in the *approved* fire-resistance-rated assembly.

❖ This section addresses situations in which the penetration is tested as a part of the regular full-scale test for the wall or floor/ceiling assembly. The penetration and proposed type of protection are evaluated as a part of the regular ASTM E119 test, which evaluates the wall or floor/ceiling rating. This section and the option it provides are not used frequently because of the cost of conducting such full-scale tests and the limitations placed on the application of the tested assembly. Because of these issues, penetrations are most often protected in accordance with one of the exceptions in Section R302.4.1 or the provisions of Section R302.4.1.2.

R302.4.1.2 Penetration firestop system. Penetrations shall be protected by an *approved* penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479, with a positive pressure differential of not less than 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor-ceiling assembly penetrated.

❖ Through-penetration firestop systems consist of specific materials or an assembly of materials that are designed to restrict the passage of fire and hot gases for a prescribed period of time through openings made in fire-resistance-rated assemblies. To determine the effectiveness of a through-penetration firestop system in restricting the passage of fire, and to determine that the penetration has not jeopardized the original fire-resistant assembly, firestop systems must be subjected to fire testing using the ASTM

E814 or UL 1479 test standard. This is a small-scale test method developed specifically for the evaluation of a firestop system's ability to resist the passage of flame and hot gases, withstand thermal stresses and restrict the transfer of heat through the penetrated assembly. There are hundreds if not thousands of tested through-penetration firestop systems available today. The actual type of system used will depend on the type and construction of the assembly being penetrated, the material makeup and size of the penetrating item, and the size of the annular space that exists between the penetrating item and the assembly being penetrated. Because there are a multitude of products available, and there is no "one size fits all" system available, it is helpful if the methods of protection are included in the construction documents as covered by Section R106.1.1.

The actual rating of the through-penetration firestop system is generated from the results of the testing and is reported as an "F" (flame) rating and a "T" (temperature) rating. The code requires only an F rating. The F rating indicates the period of time, in hours, that the through-penetration firestop system remained in place without allowing the passage of fire during the fire exposure test, or the passage of water during the hose stream portion of the test. The required F rating must be equal to the fire-resistance rating of the wall or floor/ceiling assembly that is being penetrated. This means either a 1- or 2-hour rating, depending on the dwelling unit separation.

Two of the most common materials used in through-penetration firestop systems are intumescent and endothermic materials. Intumescent materials expand approximately 8 to 10 times their original volume when exposed to temperatures exceeding 250°F (121°C). The expansion of the material fills the voids or openings within the penetration to resist the passage of flame, while the outer layer of the expanded intumescent material forms an insulating charred layer that assists in limiting the transfer of heat. The expansion properties of intumescent materials allow them to seal openings left by combustible penetrating items that burn away during a fire, but they do not retard heat as well as endothermic materials. Intumescent materials are typically used with combustible penetrating items or where a higher T rating is not required.

Endothermic materials provide protection through chemically bound water released in the form of steam when exposed to temperatures exceeding 600°F (316°C). This released water cools the penetration and retards heat transfer through the penetration. Endothermic materials tend to be superior in heat-transfer resistance and have higher T ratings, but they do not expand to fill voids left by combustible penetrating items that burn away during a fire. Therefore, endothermic materials are typically used with noncombustible penetrating items and where a higher T rating is required.

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. 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.

Exceptions:

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m²) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual non-communicating stud cavities.
 - 1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
 - 1.3. By solid fireblocking in accordance with Section R302.11.
 - 1.4. By protecting both boxes with *listed* putty pads.
 - 1.5. By other *listed* materials and methods.
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*. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm) unless *listed* otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 2.1. By the horizontal distance specified in the *listing* of the electrical boxes.

2.2. By solid fireblocking in accordance with Section R302.11.

2.3. By protecting both boxes with *listed* putty pads.

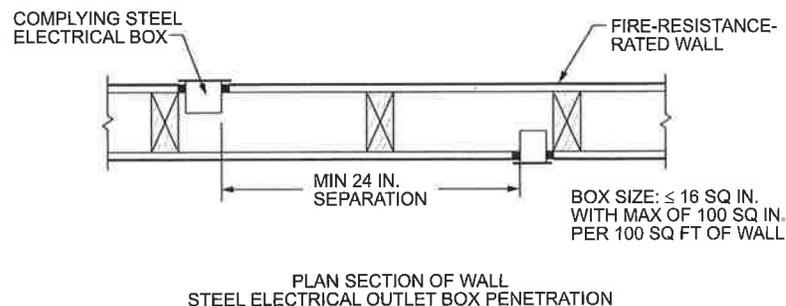
2.4. By other *listed* materials and methods.

3. The annular space created by the penetration of a fire sprinkler provided that it is covered by a metal escutcheon plate.

4. 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*.

❖ This section deals with instances where only a single side of the fire-resistance-rated assembly is penetrated. This would be the situation for items such as electrical outlet boxes or plumbing fixtures located on one side of the wall only. Commentary Figure R302.4.1 shows this type of penetration. For the most part, a membrane penetration is to be protected by one of the previously described methods established for through penetrations. However, there are some penetrations that are allowed without a specific firestopping material in the annular space around them. These are addressed by the exceptions. This section also deals with the installation of recessed luminaires in fire-resistance-rated assemblies and states that their installation may not reduce the assembly's protection. Although these fixtures are common, they do represent a penetration of the assembly's protection and must be installed so that the assembly is not compromised.

Exception 1 allows penetrations of steel electrical outlet boxes under certain conditions. The criteria of this section limit the size of the box to 16 square inches (0.0103 m²) or less in area and to an aggregate area not to exceed 100 square inches (64 500 mm²) in each 100-square-foot (9.3 m²) area. Commentary Figure R302.4.2(1) shows some of the requirements of this section. The area limitations are consistent with the criteria from fire tests, which have



For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm², 1 square foot = 0.0929 m².

Commentary Figure R302.4.2(1)
MEMBRANE PENETRATION BY OUTLET BOX

shown that within these limitations, these penetrations will not adversely affect the fire-resistance rating of the assembly. However, the boxes are assumed to be installed as they were during the fire tests. In general, the test requirements match the limitations shown by the code regarding their size and the need to be offset. An additional requirement, one that does not appear in the code, regulates the size of the annular space created around the outlet boxes. Both the *UL Fire Resistance Directory* and the Gypsum Association's *Fire Resistance Design Manual* specify a maximum over-cut of $\frac{1}{8}$ inch (3 mm) for the annular space around the outlet boxes. Additionally, Article 314 of the National Electrical Code (NEC) (also known as NFPA 70) includes the size limitation of the over-cut. Therefore, the exception applies only when the boxes are installed as they were during the original fire tests, including the limited annular space. Because outlet boxes on both sides of a wall create penetrations of both layers of a wall assembly's protection, the code provides five methods to address this problem. This gives code users several options and does not limit them to the usual 24-inch (610 mm) offset.

Exception 2 permits using outlet boxes of nonmetallic materials if they have been specifically tested. Because many different types of nonmetallic boxes are available, it is important to determine that the boxes being used in the rated dwelling unit separation have been tested. Although the exception applies to nonmetallic electrical outlet boxes, the same concept would apply to steel boxes that exceed the sizes specified in Exception 1.

Exception 3 provides an alternative to the annular space protection provisions for a fire sprinkler that penetrates a single membrane. This exception is available if the annular space around the sprinkler is

completely covered by an escutcheon plate of noncombustible material. The nature of the hazard posed by single-membrane penetrations of the sprinkler is limited by the size of the opening, the potential number of openings present and the presence of a sprinkler system. The installation of a noncombustible escutcheon provides protection against the free passage of fire through the annular space and allows for the movement of the sprinkler piping without breaking during a seismic event [see Commentary Figure R302.4.2(2)].

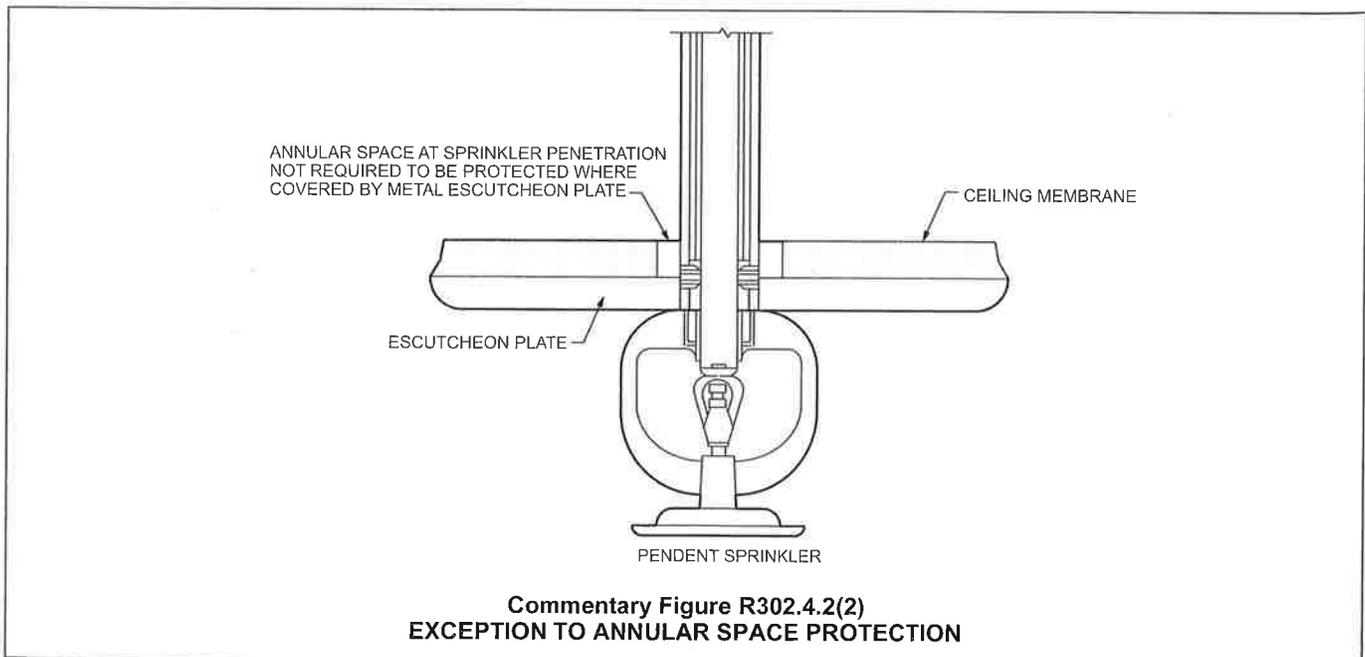
Exception 4 permits the use of luminaires where they have been specifically tested, or where luminaires are protected with materials that have been tested, for the conditions indicated in their listing and where the installation is in accordance with the listing.

R302.5 Dwelling-garage opening and penetration protection. Openings and penetrations through the walls or ceilings separating the *dwelling* from the garage shall be in accordance with Sections R302.5.1 through R302.5.3.

- ❖ Openings to sleeping rooms from garages are not allowed because a person might not wake up in time if there was a hazard from CO fumes or smoke from the garage. The three subsections address doors, ducts and pipes. For wall and ceiling separation requirements, see Section R302.6 and Table R302.6.

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than $1\frac{3}{8}$ inches (35 mm) in thickness, solid or honeycomb-core steel doors not less than $1\frac{3}{8}$ inches (35 mm) thick, or 20-minute fire-rated doors, equipped with a self-closing or automatic-closing device.

- ❖ Openings from the garage are permitted only into rooms that are not used for sleeping. These openings



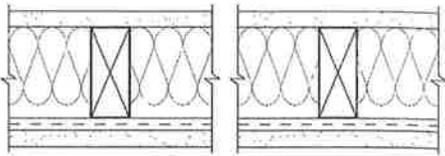
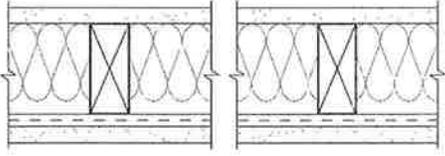
FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(2)—continued
 RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, c, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (Inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.13 ^q	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard, 4' wide, applied vertically with all joints over framing or blocking and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. R-19 mineral fiber insulation installed in stud cavity.	—	—	—	6 3/4
	15-1.14 ^q	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S drywall screws, spaced 7" on center.	—	—	—	6 3/4
	15-1.15 ^q	2" x 4" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard and sheathing, respectively, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. Cavity to be filled with 3 1/2" mineral wool insulation.	—	—	—	4 3/4
	15-1.16 ^q	2" x 6" wood studs at 24" centers with double top plates, single bottom plate; interior and exterior side covered with two layers of 5/8" Type X gypsum wallboard, 4' wide, applied horizontally with vertical joints over studs. Base layer fastened with 2 1/4" Type S drywall screws, spaced 24" on center and face layer fastened with Type S drywall screws, spaced 8" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Cavity to be filled with 5 1/2" mineral wool insulation.	—	—	8	—
	15-2.1 ^d	3 5/8" No. 16 gage steel studs at 24" on center or 2" x 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum 3/4" thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C1088, Grade TBS or better, installed in running bond in accordance with Section 1405.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 1 3/4". Interior side covered with one layer of 5/8" thick Type X gypsum wallboard attached to studs with 1" long No. 6 drywall screws at 12" on center.	—	—	—	6
	15-2.2 ^d	3 5/8" No. 16 gage steel studs at 24" on center or 2" x 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum 3/4" thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C1088, Grade TBS or better, installed in running bond in accordance with Section 1405.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 2". Interior side covered with two layers of 5/8" thick Type X gypsum wallboard. Bottom layer attached to studs with 1" long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 5/8" long No. 6 drywall screws at 12" on center.	—	—	6 7/8	—
	15-2.3 ^d	3 5/8" No. 16 gage steel studs at 16" on center or 2" x 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 5/8" thick complying with ASTM C216 installed in accordance with Section 1405.6 with a minimum 1" airspace. Interior side covered with one layer of 5/8" thick Type X gypsum wallboard attached to studs with 1" long No. 6 drywall screws at 12" on center.	—	—	—	7 1/8

(continued)

15-1.15: 1-hr interior separation wall.

WALLS AND INTERIOR PARTITIONS, WOOD FRAMED			
GA FILE NO. WP 3242	GENERIC	1 HOUR FIRE	50 to 54 STC SOUND
<p>GYPSUM WALLBOARD, RESILIENT CHANNELS, MINERAL OR GLASS FIBER INSULATION, WOOD STUDS</p> <p>Fire Design: Resilient channels 16" o.c. attached at right angles to ONE SIDE of 2 x 4 wood studs 24" o.c. with 1-1/4" Type S screws. One layer 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to channels with 1" Type S screws 8" o.c. with vertical joints located midway between studs. 3" mineral or glass fiber insulation in stud space.</p> <p>OPPOSITE SIDE: One layer 5/8" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to studs with 6d cement coated nails, 1-7/8" long, 0.0915" shank, 15/64" heads, 7" o.c.</p> <p>Vertical joints staggered 24" on OPPOSITE SIDES. (LOAD-BEARING)</p> <p>Sound Design: Sound tested as constructed for fire.</p>		 <p>Thickness: 5-3/8" (Fire and Sound) Approx. Weight: 7 psf (Fire and Sound) Fire Test: Based on UL R14196, 05NK05371, 2-15-05, UL Design U309 Sound Test: NRCC TL-93-098, IRC-IR-761, 3-98</p>	
GA FILE NO. WP 3243	GENERIC	1 HOUR FIRE	50 to 54 STC SOUND
<p>GYPSUM WALLBOARD, RESILIENT CHANNELS, MINERAL OR GLASS FIBER INSULATION, WOOD STUDS</p> <p>Fire Design: Resilient channels 24" o.c. attached at right angles to ONE SIDE of 2 x 4 wood studs 24" o.c. with 1-1/4" Type S screws. One layer 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to channels with 1" Type S screws 8" o.c. with vertical joints located midway between studs. 3" mineral or glass fiber insulation in stud space.</p> <p>OPPOSITE SIDE: One layer 5/8" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to studs with 6d cement coated nails, 1-7/8" long, 0.0915" shank, 15/64" heads, 7" o.c.</p> <p>Vertical joints staggered 24" on OPPOSITE SIDES. (LOAD-BEARING)</p> <p>Sound Design: Sound tested as constructed for fire.</p>		 <p>Thickness: 5-3/8" (Fire and Sound) Approx. Weight: 7 psf (Fire and Sound) Fire Test: Based on UL R14196, 05NK05371, 2-15-05, UL Design U309 Sound Test: NRCC TL-93-103, IRC-IR-761, 3-98</p>	

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

TABLE 721.1(2)—continued
 RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

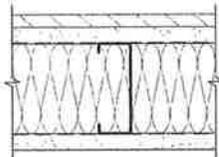
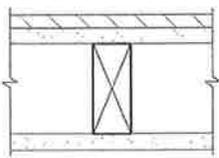
MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^o (Inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls	15-2.4 ^d	3 ⁵ / ₈ " No. 16 gage steel studs at 16" on center or 2" x 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 ⁵ / ₈ " thick complying with ASTM C216 installed in accordance with Section 1405.6 with a minimum 1" airspace. Interior side covered with two layers of ⁵ / ₈ " thick Type X gypsum wallboard. Bottom layer attached to studs with 1" long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 ⁵ / ₈ " long No. 6 drywall screws at 12" on center.	—	—	8 ¹ / ₂	—
16. Exterior walls rated for fire resistance from the inside only in accordance with Section 705.5.	16-1.1 ^a	2" x 4" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with ⁵ / ₈ " Type X gypsum wallboard, 4" wide, applied horizontally unblocked, and fastened with 2 ¹ / ₄ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with ³ / ₈ " wood structural panels, applied vertically, horizontal joints blocked and fastened with 6d common nails (bright) — 12" on center in the field, and 6" on center panel edges. Cavity to be filled with 3 ¹ / ₂ " mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4 ¹ / ₂
	16-1.2 ^a	2" x 6" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with ⁵ / ₈ " Type X gypsum wallboard, 4" wide, applied horizontally or vertically with vertical joints over studs and fastened with 2 ¹ / ₄ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound, exterior side covered with ⁷ / ₁₆ " wood structural panels fastened with 6d common nails (bright) spaced 12" on center in the field and 6" on center along the panel edges. Cavity to be filled with 5 ¹ / ₂ " mineral wool insulation. Rating established from the gypsum-covered side only.	—	—	—	6 ⁹ / ₁₆
	16-1.3 ^a	2" x 6" wood studs at 16" centers with double top plates, single bottom plates; interior side covered with ⁵ / ₈ " Type X gypsum wallboard, 4" wide, applied vertically with all joints over framing or blocking and fastened with 2 ¹ / ₄ " Type S drywall screws spaced 7" on center. Joints to be covered with tape and joint compound. Exterior covered with ³ / ₈ " wood structural panels, applied vertically with edges over framing or blocking and fastened with 6d common nails (bright) at 12" on center in the field and 6" on center on panel edges. R-19 mineral fiber insulation installed in stud cavity. Rating established from the gypsum-covered side only.	—	—	—	6 ¹ / ₂

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm², 1 cubic foot = 0.0283 m³.

- a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.
- b. Thickness shown for brick and clay tile is nominal thicknesses unless plastered, in which case thicknesses are net. Thickness shown for concrete masonry and clay masonry is equivalent thickness defined in Section 722.3.1 for concrete masonry and Section 722.4.1.1 for clay masonry. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block or brick using specified dimensions as defined in Chapter 21. Equivalent thickness shall include the thickness of applied plaster and lath or gypsum wallboard, where specified.
- c. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is not less than 75 percent of the gross cross-sectional area measured in the same plane.
- d. Shall be used for nonbearing purposes only.
- e. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided that attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with not less than ¹/₁₆-inch gypsum veneer plaster.
- f. The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a 2-hour fire-resistance rating in Item 3, and having a thickness of not less than 7⁵/₈ inches is 4 hours where cores that are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of ³/₈ inch.
- g. The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 0216. Lightweight aggregates shall have a maximum combined density of 65 pounds per cubic foot.

(continued)

1-hr Exterior Wall Assembly: 16-1.2 or 16-1.3

EXTERIOR WALLS			
GA FILE NO. WP 8008	PROPRIETARY*	1 HOUR FIRE	
<p>GLASS MAT GYPSUM SUBSTRATE, STEEL STUDS, MINERAL OR GLASS FIBER INSULATION</p> <p>Fire Design: EXTERIOR SIDE: One layer 5/8" proprietary type X glass mat gypsum substrate (sheathing) applied parallel to 3-1/2", 33 mil steel studs 24" o.c. with 1" Type S-12, self-drilling, corrosion resistant, bugle head, screws 12" o.c. Studs attached to both vertical legs of floor and ceiling runners either by welding or with 1/2" Type S-12 pan head screws. Mineral or glass fiber insulation friction fit into the stud space. Exterior cladding to be attached through glass mat gypsum panel to studs.</p> <p>INTERIOR SIDE: One layer 5/8" proprietary type X glass mat gypsum substrate applied parallel to studs with 1" Type S-12 screws 12" o.c.</p> <p>Bracing: All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies. Where required for lateral support of studs, support may be provided by means of steel straps, channels or other similar means as specified in the structural design. Tested at 100 percent of design load. (LOAD-BEARING)</p>			<p>Thickness: 4-3/4" (Fire) Approx. Weight: 6 psf (Fire) Fire Test: UL R3501, 07NK179922, 12-12-07, UL Design U425</p>
<p>PROPRIETARY GYPSUM PANEL PRODUCTS</p> <p>National Gypsum Company 5/8" Gold Bond® Brand eXP® FIRE-SHIELD® Gypsum Sheathing 5/8" Gold Bond® Brand eXP® Interior Extreme® Gypsum Panels</p>			
GA FILE NO. WP 8105	GENERIC	1 HOUR FIRE	
<p>GYPSUM WALLBOARD, GYPSUM SHEATHING, WOOD STUDS</p> <p>Fire Design: EXTERIOR SIDE: One layer 48" wide 5/8" type X gypsum sheathing applied parallel to 2 x 4 wood studs 24" o.c. with 1-3/4" galvanized roofing nails 4" o.c. at vertical joints and 7" o.c. at intermediate studs and top and bottom plates. Joints of gypsum sheathing may be left untreated. Exterior cladding to be attached through sheathing to studs.</p> <p>INTERIOR SIDE: One layer 5/8" type X gypsum wallboard, water-resistant gypsum backing board, or gypsum veneer base applied parallel or at right angles to studs with 6d coated nails, 1-7/8" long, 0.0915" shank, 1/4" heads, 7" o.c. (LOAD-BEARING)</p>			<p>Thickness: Varies (Fire) Approx. Weight: 7 psf (Fire) Fire Test: See WP 3510 (UL R3501-47, -48, 9-17-65, UL Design U309; UL R1319-129, 7-22-70, UL Design U314)</p>

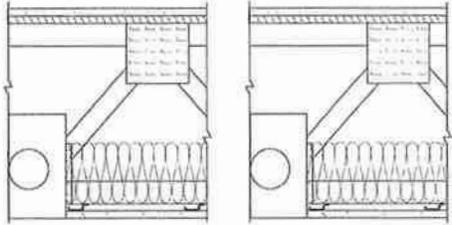
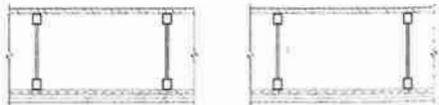
* Contact the manufacturer for more detailed information on proprietary products.

TABLE 721.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, c}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (Inches)				MINIMUM THICKNESS OF CEILING (Inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
20. Perlite concrete proportioned 1:6 (Portland cement to perlite aggregate) poured to 1/8" thickness above top of corrugations of 1 5/16" -deep galvanized steel deck maximum span 8'-0" for 0.024" (No. 24 galvanized sheet gage) or 6'-0" for 0.019" (No. 26 galvanized sheet gage) with deck supported by individually protected steel framing. Approved polystyrene foam plastic insulation board having a flame spread not exceeding 75 (1" to 4" thickness) with vent holes that approximate 3 percent of the board surface area placed on top of perlite slurry. A 2' by 4' insulation board contains six 2 3/4" diameter holes. Board covered with 2 1/4" minimum perlite concrete slab. Slab reinforced with mesh consisting of 0.042" (No. 19 B.W. gage) galvanized steel wire twisted together to form 2" hexagons with straight 0.065" (No. 16 B.W. gage) galvanized steel wire woven into mesh and spaced 3". Alternate slab reinforcement shall be permitted to consist of 4" x 8", 0.109/0.238" (No. 12/4 B.W. gage), or 2" x 2", 0.083/0.083" (No. 14/14 B.W. gage) welded wire fabric. Class A or B roof covering on top.	20-1.1	None	—	—	Varies	—	—	—	—	—
21. Wood joists, wood I-joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with 1/2" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with 8d nails. The wood structural panel thickness shall be not less than nominal 1/2" nor less than required by Chapter 23.	21-1.1	Base layer 5/8" Type X gypsum wallboard applied at right angles to joist or truss 24" o.c. with 1 1/4" Type S or Type W drywall screws 24" o.c. Face layer 5/8" Type X gypsum wallboard or veneer base applied at right angles to joist or truss through base layer with 1 7/8" Type S or Type W drywall screws 12" o.c. at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2" back on either side of face layer end joints, 12" o.c.	—	—	—	Varies	—	—	—	1 1/4

(continued)

21-1.1: Floor ceiling assembly

FLOOR-CEILING SYSTEMS, WOOD FRAMED			
GA FILE NO. FC 5121	PROPRIETARY*	1 HOUR FIRE	50 to 54 STC SOUND
<p>WOOD TRUSSES, WOOD STRUCTURAL PANELS, RESILIENT CHANNELS, GLASS BATT OR LOOSE FILL INSULATION, CEILING DAMPER, GYPSUM WALLBOARD</p> <p>Fire Design: One layer of 5/8" proprietary type X gypsum wallboard applied at right angles to resilient furring channels 12" o.c. with 1" Type S screws 8" o.c. No limit on overall thickness of glass fiber batt or loose fill insulation when applied directly over gypsum board. Minimum 12" deep parallel chord wood trusses spaced 24" o.c. supporting a 23/32" wood structural panel subfloor, long edges T&G, applied at right angles to trusses with construction adhesive and 6d ring shank nails 12" o.c. A 15/32" wood structural panel underlayment applied over subfloor.</p> <p>Optional ceiling damper (refer to manufacturer for information on the type of damper).</p> <p>Sound Design: Sound tested with 3-1/2" glass batt insulation, carpet, padding as well as vinyl flooring.</p> <p style="text-align: center;">PROPRIETARY GYPSUM BOARD</p> <p>American Gypsum Company LLC 5/8" FireBloc® Type C Gypsum Board</p>		 <p>Approx. Ceiling Weight: 3 psf (Fire and Sound)</p> <p>Fire Test: UL R14196 04NK25585 01-15-05 4786440611 06-06-14 UL R13446 10CA05196 10-21-10 UL R8477 98NK22455 05NK24841 4786440611 UL Design I574 UL Design M508 UL Design L528 UL Design L546 UL Design L579 UL Design L589</p> <p>Sound Test: RAL TL08-310, 10-31-08; RAL TL08-311, 10-31-08 IIC & Test: (40 sheet vinyl), RAL IN08-039, 10-31-08; (64 C&P), RAL IN08-040, 10-31-08</p>	
GA FILE NO. FC 5241	GENERIC	1 HOUR FIRE	45 to 49 STC SOUND
<p>WOOD I-JOISTS, GYPSUM WALLBOARD, RESILIENT CHANNELS</p> <p>Fire Design: Base layer 1/2" type X gypsum wallboard applied at right angles to resilient channels 16" o.c. with 1-1/4" Type S screws 12" o.c. Resilient channels applied at right angles to minimum 9-1/2" deep wood I-joists, with minimum 1-1/4" deep x 1-1/2" wide flanges and minimum 3/8" webs, 24" o.c. with 1-1/4" Type W screws. Face layer 1/2" type X gypsum wallboard applied at right angles to channels with 1-5/8" Type S screws 12" o.c. Face layer end joints located midway between channels and attached to base layer with 1-1/2" Type G screws 12" o.c. Wood I-joists supporting 5/8" oriented strand board applied at right angles to I-joists with 8d common nails 12" o.c.</p> <p>Edge joints offset 24" from base layer edge joints.</p> <p>Sound Design: Sound tested as constructed for fire.</p>		 <p>Approx. Ceiling Weight: 5 psf (Fire and Sound)</p> <p>Fire Test: NRCC A-4440.1 (Revised), 6-24-97</p> <p>Sound Test: NRCC B-3150.1, 6-30-00 IIC & Test: 40 (68 C&P) NRCC B-3150.1, 6-30-00; NRCC B-3150.2, 6-30-00</p>	

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

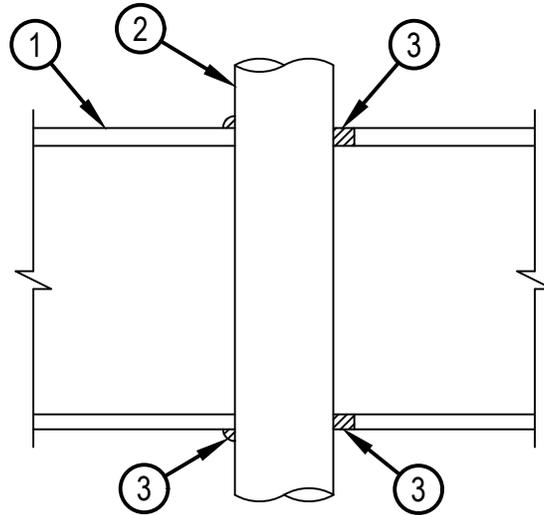


Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

System No. F-C-1106

FC 1106

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 Hr	F Rating — 1 Hr
T Rating — 1/4 Hr	FT Rating — 1/4 Hr
	FH Rating — 1 Hr
	FTH Rating — 1/4 Hr



1. Floor-Ceiling Assembly — The 1 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. The general construction features of the floor-ceiling assembly are summarized below:
 - A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or Floor Topping Mixture* as specified in the individual Floor-Ceiling Design. Max diam of opening shall be 5 in. (127 mm).
 - B. Wood Joists* — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or Structural Wood Members* with bridging as required and with ends firestopped.
 - C. Gypsum Board* — Min 5/8 in. (16 mm) thick as specified in the individual Floor-Ceiling Design. Gypsum board secured to wood joists or furring channels as specified in the individual Floor-Ceiling Design. Max diam of opening shall be 5 in. (127 mm).
- 1A. Chase Wall — (Optional, Not Shown) — The through penetrants (Item 2) may be routed through a fire rated or non-rated single, double or staggered wood stud/gypsum board chase wall. Depth of chase wall stud cavity to be min 1/2 in. greater than diameter of opening cut in sole and top plates to accommodate the through penetrant (Item 2). The chase wall shall be constructed to include the following construction features:
 - A. Studs — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm), 2 by 8 in. (51 by 203 mm) or double nom 2 by 4 in. (51 by 102 mm) lumber studs.
 - B. Sole Plate — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or 2 by 8 in. (51 by 203 mm) lumber plates or double nom 2 by 4 in. (51 by 102 mm) lumber plates tightly butted together. Circular opening to be centered in sole plate. Sole plate to be min 1 in. (25mm) wider than diam of opening. Max diam of opening in sole plate is 5 in. (140 mm).
 - C. Top Plate — The double top plate shall consist of two nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or 2 by 8 in. (51 by 203 mm) lumber plates or double nom 2 by 4 in. (51 by 102 mm) lumber plates tightly butted together. Circular opening to be centered in top plate. Top plate to be min 1 in. (25mm) wider than diam of opening. Max diam of opening in top plate is 5-1/2 in. (140 mm).
 - D. Gypsum Board* — One layer of min 1/2 in. (13 mm) gypsum board.



Hilti Firestop Systems

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March 08, 2018

2. Through Penetrants — One metallic pipe, conduit or tubing, to be installed concentrically or eccentrically within the opening. The diam of the opening shall be 1 in. larger than the nom diam of the penetrant. The annular space between the pipe, conduit or tubing and the periphery of opening shall be min 0 in. (point contact) to max 7/8 in. . (22 mm). Pipe, conduit or to be rigidly supported on both sides of floor-ceiling assembly.

The following types and sizes of metallic pipes, conduits or tubing may be used:

- A. Copper Tube — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tube.
- B. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
- C. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- D. Iron Pipe — Nom 4 in. (102 mm) diam (or smaller) cast or ductile iron pipe.
- E. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or steel conduit.

3. Fill, Void or Cavity Materials*-Sealant — Min 3/4 in. (19 mm) thickness of sealant applied within the annulus flush with the top surface of the floor or sole plate and min 5/8 in. (16 mm) thickness of sealant applied within the annulus flush with the bottom surface of gypsum board or lower top plate. A min 1/2 in. (13 mm) diameter bead of sealant applied at the penetrant/subflooring or sole plate interface and the penetrant/gypsum board or top plate interface at point contact locations.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 606 Flexible Firestop Sealant, FS-One Sealant or FS-ONE MAX Intumescent Sealant

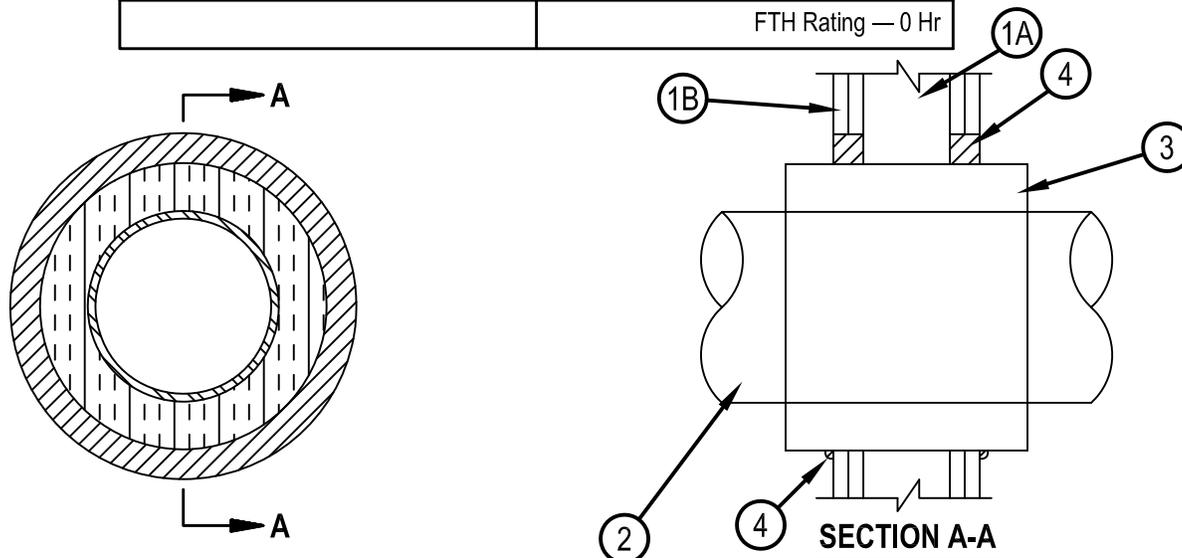
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



System No. W-L-1148



ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Item 1)	F Rating — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 1 and 2 Hr (See Item 1)
	FTH Rating — 0 Hr



- 1. Wall Assembly** — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the Fire Resistance Directory and shall include the following construction features:

 - A. Studs** — Wall framing shall consist of either wood studs or channel shaped steel studs. Wood studs to consist of 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide, fabricated from min 25 MSG galvanized steel, spaced max 24 in. (610 mm) OC.
 - B. Gypsum Board*** — 5/8 in. (16 mm) thick, 4 ft (1219 mm) wide with square or tapered edges. The gypsum wallboard type, number of layers and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 13 in. (330 mm).
The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
 - 2. Through Penetrants** — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of the assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

 - A. Steel Pipe** — Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. Iron Pipe** — Nom 8 in. (203 mm) diam (or smaller) cast or ductile iron pipe.
 - C. Conduit** — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or steel conduit.
 - 3. Pipe Covering** — Nom 2 in. (51 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) fiberglass pipe covering with an all-service jacket. Pipe covering material to be min 9 in. long and installed on penetrant to extend 2 in. (51 mm) beyond both sides of wall surface. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap (SSL) tape. The annular space between the pipe covering and periphery of opening shall be min 0 in. (point contact) to max 3/8 in. (10 mm).
See Pipe and Equipment Covering-Materials (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
 - 4. Fill, Void or Cavity Material* — Sealant** — In 1 hr assemblies, min 5/8 in. (16 mm) thickness of fill material applied within annulus flush with both surfaces of wall. In 2 hr assemblies, min 1-1/4 in. (32 mm) thickness of fill material applied within annulus flush with both surfaces of wall. For both 1 and 2 hr assemblies, at point contact location between insulation and gypsum, a min 1/2 in. (13 mm) bead of fill material shall be applied on both sides of wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant
- * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



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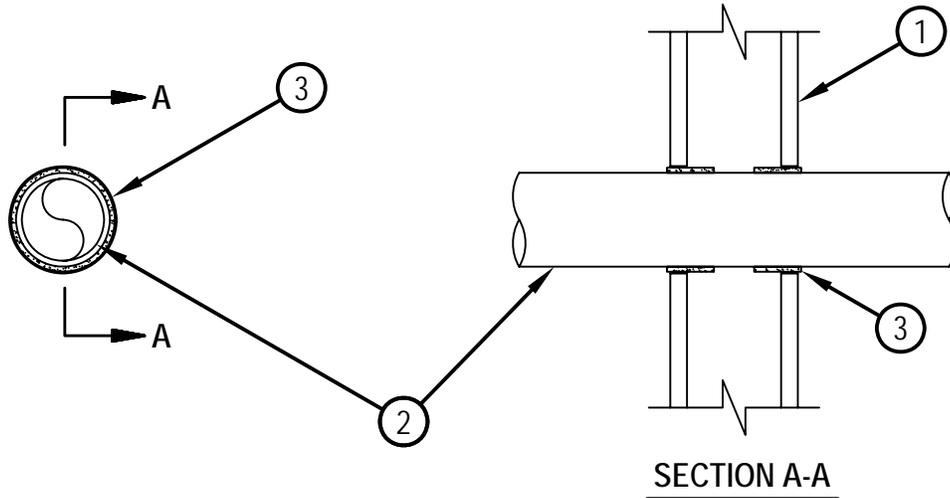


Classified by
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to UL 1479

System No. W-L-2284

F Rating - 1 Hr
T Rating - 1 Hr

WL 2284



1. Wall Assembly -- The 1 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - A. Studs -- Wall framing shall consist of wood studs or steel channel studs. Wood studs to consist of 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-1/2 in. wide and spaced max 24 in. OC.
 - B. Gypsum Board* -- Min 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers and orientation shall be as specified in the individual U300 or U400 Wall and Partition Design. Max diam of opening is 4 in.
2. Through Penetrants -- One nonmetallic pipe to be centered within the firestop system. An annular space of 3/16 to 1/4 in. is required within the firestop system. Pipe to be rigidly supported on both sides of wall assembly. The following types and sizes of nonmetallic pipes may be used:
 - A. Polyvinyl Chloride (PVC) Pipe -- Nom 3 in. diam (or smaller) Schedule 40 solid or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - B. Chlorinated Polyvinyl Chloride (CPVC) Pipe -- Nom 3 in. diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
3. Fill, Void or Cavity Material* -- Wrap Strip - Layers of intumescent wrap strip are continuously wrapped around the pipe with ends held in place with tape. Wrap strip installed such that ends protrude nom. 1/8 in. beyond both surfaces of wall. Size of wrap strip and number of layers are shown in table below.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- CP648-E W25/1" or CP648-E W45/1-3/4" Firestop Wrap Strip

Product Designation	Pipe Diameter (in.)	Number of Layers	Nom. Wrap Strip Width (in.)
CP648-E-W25/1"	1-1/2 and 2	1	1
CP648-E-W45/1-3/4"	1-1/2, 2 and 3	1	1-3/4

A. Fill, Void or Cavity Material* - Wrap Strip -- (As an alternate to the wrap strip in Item 3) - One layer of intumescent wrap strip is tightly wrapped around the pipe with ends butted and held in place with integrated tape. Wrap strip installed such that ends protrude nom. 1/8 in. beyond both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF
HILTI INC -- CP648-S-1.5" US, CP648-S-2" US, CP648-S-3" US

*Bearing the UL Classification Mark



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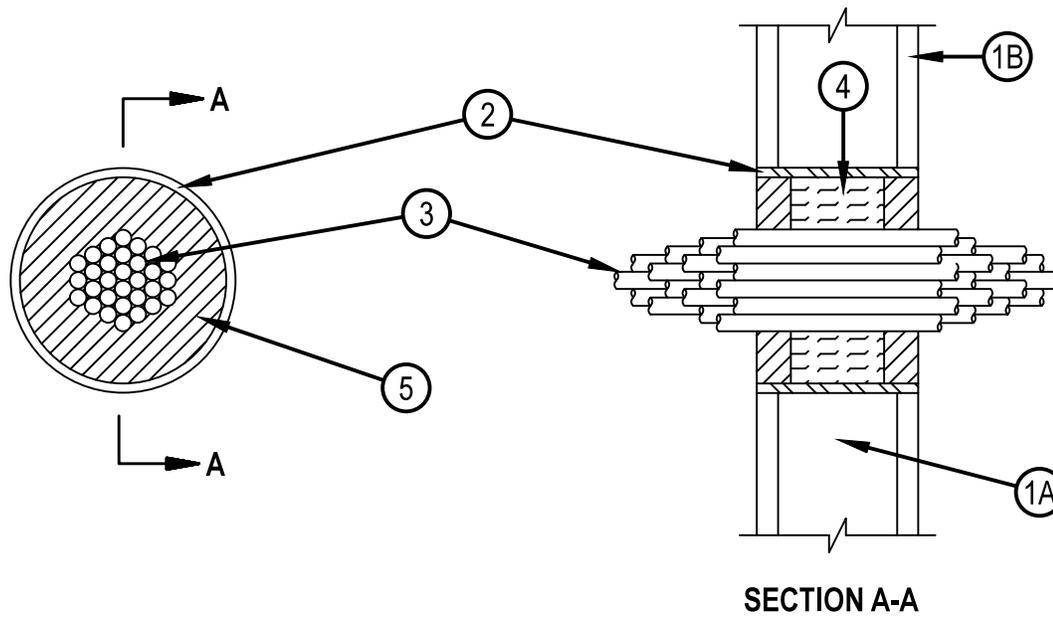


Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

System No. W-L-3046

WL 3046

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 Hr	F Rating — 1 Hr
T Rating — 1/2 Hr	FT Rating — 1/2 Hr
	FH Rating — 1 Hr
	FTH Rating — 1/2 Hr



- Wall Assembly** — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - Studs** — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
 - Gypsum Board*** — One layer of 5/8 in. (16 mm) thick gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 6 in. (152 mm).
 - Metallic Sleeve** — Nom 6 in. (152 mm) diam (or smaller) Schedule 40 (or thinner) steel pipe cast into wall assembly with joint compound and installed flush with wall surface.
 - Cables** — Max 7/C No. 12 AWG cables with polyvinyl chloride jacket and insulation. Aggregate cross-sectional area of tightly bundled cable group to be 33 percent of the aggregate cross-sectional area of the opening. Cables to be rigidly supported on both sides of wall assembly.
 - Packing Material** — Min 2-3/4 in. (70 mm) thickness of min 4.0 (64 kg/m³) pcf mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from both surfaces of wall as required to accommodate the required thickness of fill material.
 - Fill, Void or Cavity Material* — Sealant** — Min 1 in. (25 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant
- * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



Hilti Firestop Systems

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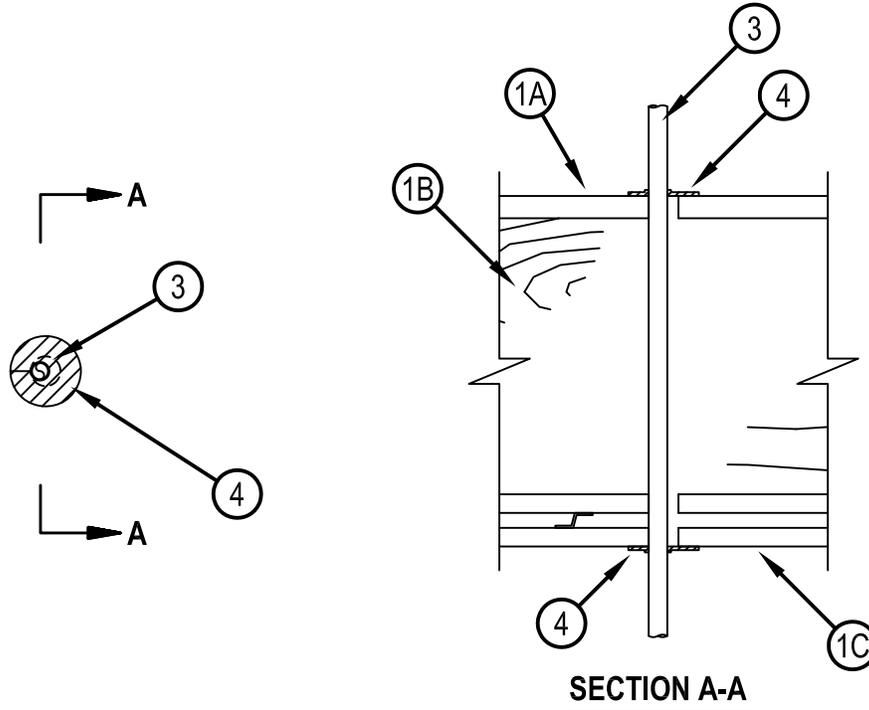


Classified by
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to UL 1479 and CAN/ULC-S115

System No. F-C-1168

FC 1168

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 1 and 2 Hr (See Item 1)	FT Ratings — 1 and 2 Hr (See Item 1)
L Rating at Ambient — Less than 1 CFM/Opening	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating at 400 F — Less than 1 CFM/Opening	FTH Ratings — 1 and 2 Hr (See Item 1)
	L Rating at Ambient — Less than 1 CFM/Opening
	L Rating at 400 F — Less than 1 CFM/Opening



1. Floor-Ceiling Assembly — The 1 or 2 hr fire-rated solid or trussed lumber joist Floor-Ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory, as summarized below:

- A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or Floor Topping Mixture* as specified in the individual Floor-Ceiling Design. Opening may be round, rectangular or irregular with a max diam or dimension of 1 in. (25 mm).
- B. Joists — Nom 10 in. (254 mm) deep (or deeper) lumber and steel joist, trusses or Structural Wood Members* with bridging as required and with ends firestopped.
- C. Gypsum Board* — Nom 4 ft (122 cm) wide by 5/8 in. (16 mm) thick. Gypsum board direct-attached to joists or screw-attached to furring channels as specified in the individual Floor-Ceiling Design. Opening may be round, rectangular or irregular with a max diam or dimension of 1 in. (25 mm).

The F, FT, FH and FTH Rating of the firestop system is equal to the rating of the floor-ceiling assembly.



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System No. F-C-1168

FC 1168

2. Chase Wall — (Optional. Not Shown) — The through penetrants (Item 3) may be routed through a fire-rated or non-rated single, double or staggered wood stud/gypsum board chase wall constructed of the materials and Partition design in the UL Fire Resistance Directory and shall include the following construction features:
- A. Studs — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or 2 by 8 in. (51 by 203 mm) lumber studs.
 - B. Sole Plate — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or 2 by 8 in. (51 by 203 mm) lumber plates. Opening to be centered in sole plate. Opening may be round, rectangular or irregular with a max diam or dimension of 1 in. (25 mm).
 - C. Top Plate — The double top plate shall consist of two nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or 2 by 8 in. (51 by 203 mm) lumber. Opening to be centered in top plate. Opening may be round, rectangular or irregular with a max diam or dimension of 1 in. (25 mm).
 - D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.
3. Through Penetrant — Max one metallic pipe, tubing or conduit installed either concentrically or eccentrically within the firestop system. The annular space between penetrant and periphery of the opening shall be min 0 in. (point contact). Pipe or tubing to be rigidly supported on both sides of floor-ceiling assembly. The following types and sizes of pipes, tubing or conduit may be used:
- A. Steel Pipe — Nom 3/4 in. (19 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
 - B. Iron Pipe — Nom 3/4 in. (19 mm) diam (or smaller) cast or ductile iron pipe.
 - C. Copper Tubing — Nom 1/2 in. (13 mm) diam (or smaller) Type L and Type K (or heavier) copper tubing.
 - D. Copper Pipe — Nom 1/2 in. (13 mm) diam (or smaller) Regular (or heavier) copper pipe.
 - E. Conduit — Nom 3/4 in. (19 mm) diam (or smaller) rigid or flexible steel conduit.
 - F. Conduit — Nom 3/4 in. (19 mm) diam (or smaller) electrical metallic tubing (EMT).
4. Fill, Void or Cavity Material* — Nom 60 mm diam by 3 mm thick putty disc with one seam at radius. Paper-backer of disc to be removed and disc firmly pressed around the penetrant lapping nom 5 mm onto penetrant to completely cover opening and firmly pressed to lap onto the floor and ceiling (or plates) around periphery of opening. Disc seam to be firmly pressed and sealed tight, Disc to be installed at both sides of opening in floor-ceiling assembly.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-D 1" Firestop Cable Disc

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



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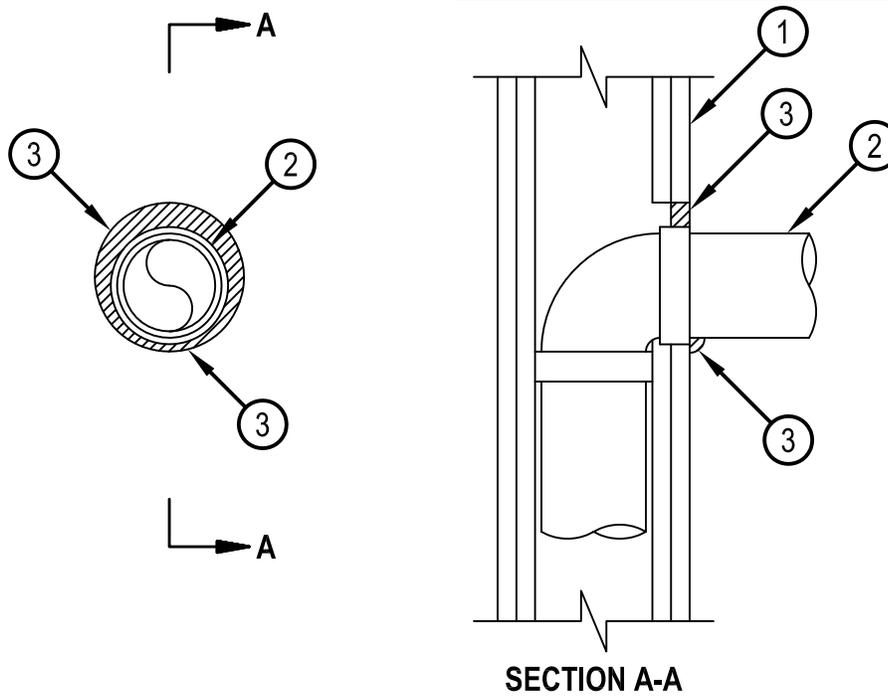
Page: 2 of 2

System No. W-L-1410

CLASSIFIED

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 to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Rating — 0 Hr



1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.

B. Gypsum Board* — One or two layers of nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Max diam of opening is 5 in. (127 mm).

The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly.

2. Through penetrants — One metallic pipe or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space shall be 0 in. (point contact) to 1 in. (25 mm). Pipe or conduit to be rigidly supported on the penetrated side of the wall assembly. The following types and sizes of metallic pipes or conduits may be used:

A. Steel pipe — Nom 3 in. (76 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.

B. Conduit — Nom 3 in. (76 mm) diam (or smaller) steel electrical metallic tubing (EMT), nom 3 in. (76 mm) diam steel conduit or nom 1 in. (25 mm) diam (or smaller) flexible steel conduit.

C. Copper Tubing — Nom 1 in. (25 mm) diam (or smaller) Type L (or heavier) copper tubing.

D. Copper Pipe — Nom 1 in. (25 mm) diam (or smaller) Regular (or heavier) copper pipe.

3. Fill, Void or Cavity Material++— Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with surface of wall. Min 1/2 in. (13 mm) diam bead of sealant applied at point contact location.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, FS-ONE MAX Intumescent Sealant, CFS-S-SIL GG Sealant, CP601S Elastomeric Sealant, CP 606 Sealant, or CP618 Putty.

++ Bearing the UL Classification Mark



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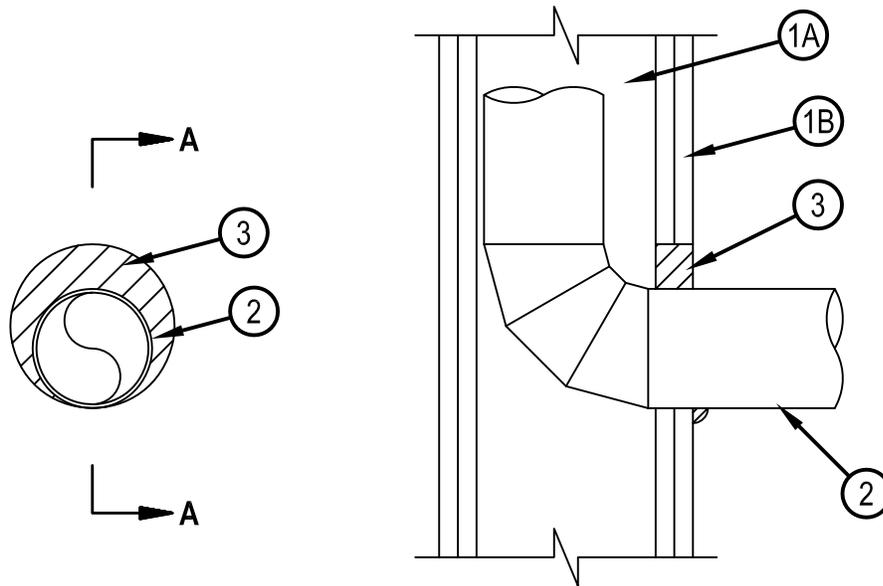


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to UL 1479 and CAN/ULC-S115

System No. W-L-7198

WL 7198

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Rating — 2 Hr	FT Rating — 2 Hr
L Rating at Ambient — Less Than 1 CFM/sq ft	FH Rating — 2 Hr
L Rating at 400 F — Less Than 1 CFM/sq ft	FTH Rating — 2 Hr
	L Rating at Ambient — Less Than 1 CFM/sq ft
	L Rating at 400 F — Less Than 1 CFM/sq ft



SECTION A-A

1. Wall Assembly — The 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

- A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs shall consist of nom 2 by 6 in. (51 by 152 mm) wide wood studs spaced max 24 in. (610 mm) OC. Steel studs to be min 6 in. (152 mm) wide and spaced max 24 in. (610 mm) OC.
- B. Gypsum Board* — Min two layers of 5/8 in. (16 mm) thick gypsum board. Thickness, type and orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 5-1/2 in. (140 mm).

2. Steel Duct — Max 4 in. (102 mm) diam No. 30 gauge (or heavier) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The space between the steel duct and periphery of opening shall be min 0 in. (point contact) to max 1-1/2 in. (38 mm). Steel duct to be rigidly supported within the wall assembly.

3. Fill, Void or Cavity Material* — Sealant — Min 1-1/4 in. (32 mm) thickness of fill material applied within the annulus, flush with surface of wall. Min 1/2 in. (13 mm) diam bead of fill material shall be applied at the point contact location between the steel duct and the gypsum board.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



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