Garfield County
BUILDING DEPARTMENT
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Fire Separation Requirements at Two-Family Dwellings

Including ADUs located within the same structure as Primary Dwelling

August 2019

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 2015 International Residential Code. For more detailed information, refer to the attached requirements as excerpted from I.R.C. Code & Commentary – Volume 1.

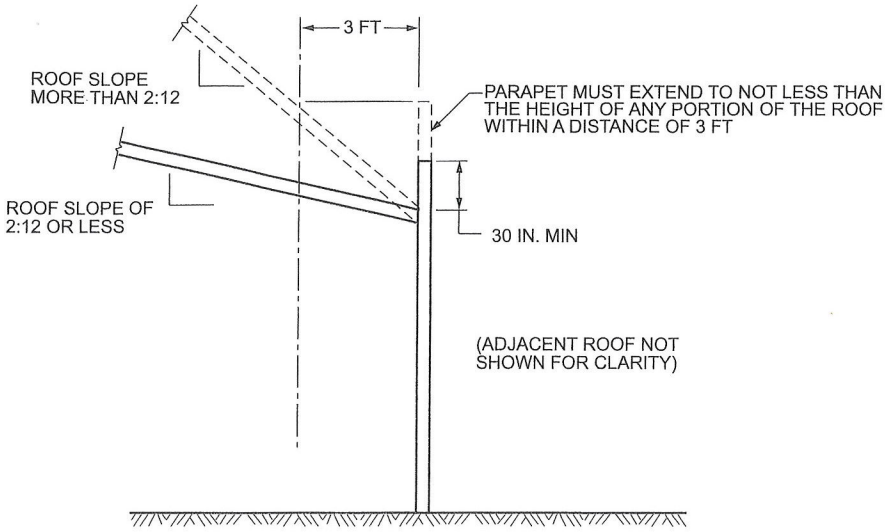
Garfield County residential projects with two or more dwelling units in the same structure require a Colorado licensed Architect to wet-seal drawings submitted for building permit. The Architect shall specifically address key fire resistance provisions of the Building Code (as referenced above), and the Architect must wet seal/stamp the drawings submitted along with the building permit application.

Drawings prepared by the Architect and 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 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 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.
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 2015 I.B.C.

Attachments:

- *"Two-Family Dwellings – Fire Separation Requirements" as excerpted from 2015 I.R.C. Code/Commentary*



For SI: 1 inch = 25.4 mm, 304.8 mm.

Figure R302.2.3
PARPET REQUIREMENTS

R302.2.4 Structural independence. Each individual *townhouse* shall be structurally independent.

Exceptions:

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common wall as provided in Section R302.2, Item 1 or 2.

❖ Each townhouse must be structurally independent and capable of being removed without affecting the adjacent dwelling unit. 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 or UL 263. 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 $^1/_2$ 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 $^5/_8$-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 $^1/_2$-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. Despite this poor fire record, there is widespread resistance to mandating much in the way of fire protection systems or methods because of our society's belief that people's homes are their castles. This viewpoint has limited the types of protection that are imposed on these private homes to the installation of smoke alarms and the more recent requirement of dwelling unit separation. 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 or UL 263, which is the normal test used for determining fire resistance. Many tested assemblies are available for use in these locations.

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

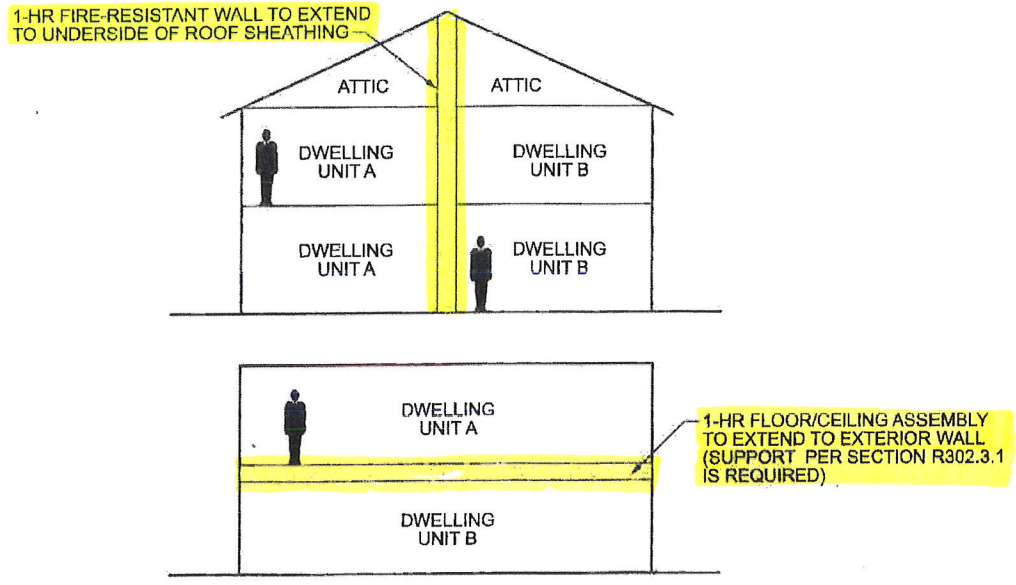


Figure R302.3
DWELLING UNIT SEPARATIONS IN TWO-FAMILY DWELLINGS

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. When 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).

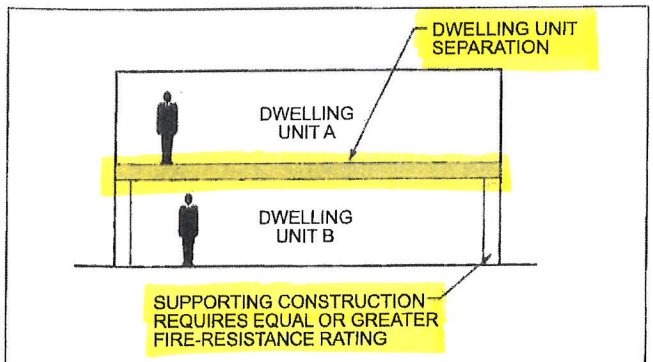


Figure R302.3.1
SUPPORT OF DWELLING UNIT SEPARATION

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 mm^2).
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

assure 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.

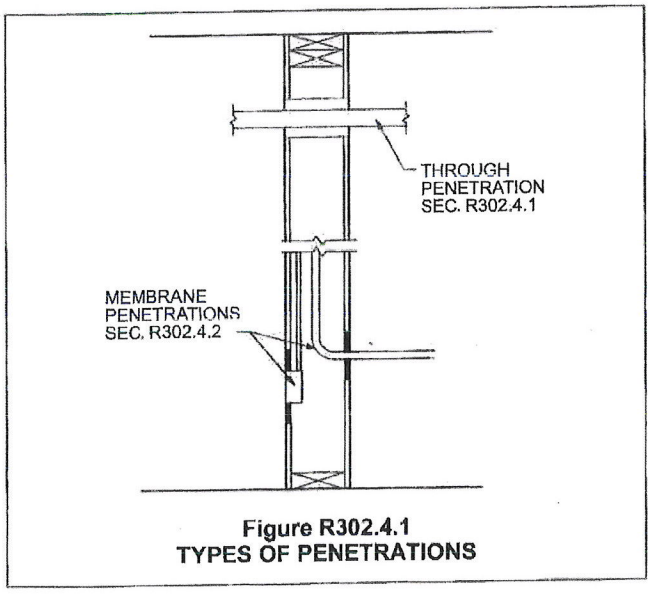


Figure R302.4.1
TYPES OF PENETRATIONS

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 on 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 m^2) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet (9.29 m^2) 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 noncommunicating 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.

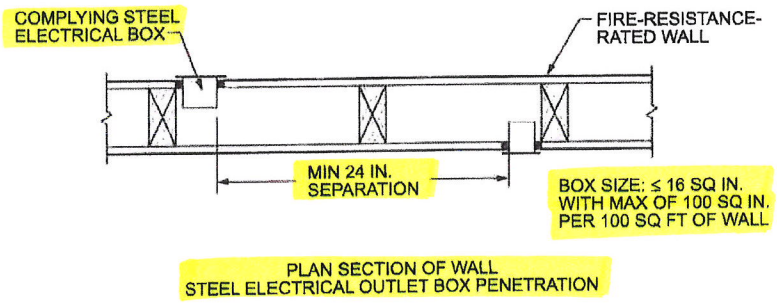
❖ This section deals with instances where only a single side of the fire-resistance-rated assembly is penetrated. This would be the situation for items such as electrical outlet boxes or plumbing fixtures located on one side of the wall only. Commentary Figure R302.4.1 shows this type of penetration. 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 m^2) or less in area and to an aggregate area not to exceed 100 square inches (64 500 mm^2) in each 100 square foot (9.3 m^2) 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 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 Underwriters Laboratory's (UL) *Fire-Resistance Directory* and the Gypsum Association's *Fire-resistance Design Manual* specify a maximum over-cut of $^1/_8$ 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)].



For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2, 1 square foot = 0.0929 m^2.

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

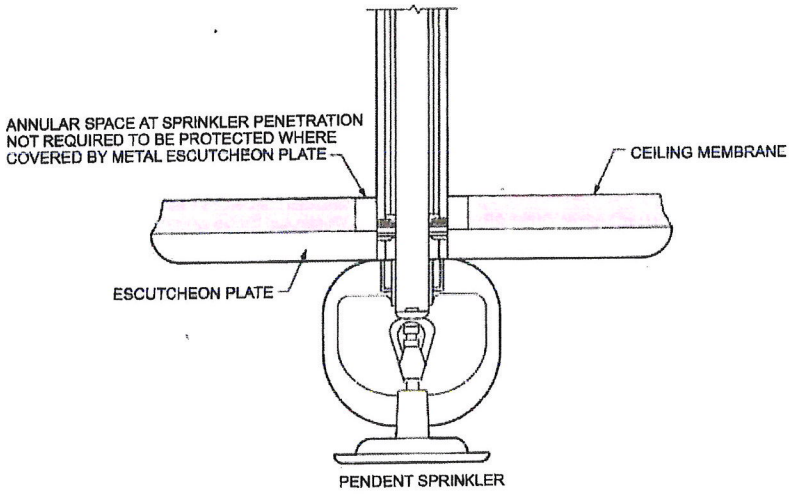


Figure R302.4.2(2)
EXCEPTION TO ANNULAR SPACE PROTECTION