

2021 Virginia Construction Code

CHAPTER 7 FIRE AND SMOKE PROTECTION FEATURES

SECTION 714 PENETRATIONS

714.1 Scope.

The provisions of this section shall govern the materials and methods of construction used to protect *through penetrations* and *membrane penetrations* of *horizontal assemblies* and fire-resistance-rated wall assemblies.

714.1.1 Ducts and air transfer openings.

Penetrations of fire-resistance-rated walls by ducts that are not protected with *dampers* shall comply with [Sections 714.3 through 714.4.3](#). Penetrations of *horizontal assemblies* not protected with a *shaft* as permitted by [Section 717.6](#), and not required to be protected with *fire dampers* by other sections of this code, shall comply with [Sections 714.5 through 714.6.2](#). Ducts and air transfer openings that are protected with *dampers* shall comply with [Section 717](#).

714.2 Installation.

A listed *penetration firestop* system shall be installed in accordance with the manufacturer's installation instructions and the listing criteria.

714.3 Installation details.

Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

714.4 Fire-resistance-rated walls.

Penetrations into or through *fire walls*, *fire barriers*, *smoke barrier walls* and *fire partitions* shall comply with [Sections 714.4.1 through 714.4.3](#). Penetrations in *smoke barrier walls* shall also comply with [Section 714.5.4](#).

714.4.1 Through penetrations.

Through penetrations of fire-resistance-rated walls shall comply with [Section 714.4.1.1](#) or [714.4.1.2](#).

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the *annular space* between the penetrating item and the fire-resistance-rated wall is permitted to be protected by either of the following measures:

1. In concrete or masonry walls where the penetrating item is a maximum 6-inch (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (0.0929 m²), concrete, grout or *mortar* is permitted where installed the full thickness of the wall or the thickness required to maintain the *fire-resistance rating*.
2. The material used to fill the *annular space* shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to [ASTM E119](#) or [UL 263](#) time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the *fire-resistance rating* of the construction penetrated.

714.4.1.1 Fire-resistance-rated assemblies.

Through penetrations shall be protected using systems installed as tested in the *approved* fire-resistance-rated assembly.

714.4.1.2 Through-penetration firestop system.

Through penetrations shall be protected by an *approved penetration firestop* system installed as tested in accordance with [ASTM E814](#) or [UL 1479](#), with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an *F rating* of not less than the required *fire-resistance rating* of the wall penetrated.

714.4.2 Membrane penetrations.

Membrane penetrations shall comply with [Section 714.4.1](#). Where walls or partitions are required to have a *fire-resistance rating*, recessed fixtures shall be installed such that the required *fire resistance* will not be reduced.

Exceptions:

1. *Membrane penetrations* of maximum 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 (3.2 mm). Such boxes on opposite sides of the wall or partition 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

Copyright © 2024 International Code Council, Inc., or its licensors (ALL RIGHTS RESERVED).

Accessed by Venkatesh Shanmugam on 11/13/2024 pursuant to License Agreement with ICC. No further reproduction or distribution authorized. Any Unauthorized reproduction or distribution is a violation of the federal copyright, and subject to civil and criminal penalties thereunder.

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 718.2.1](#).
- 1.4. By protecting both outlet boxes with *listed* putty pads.
- 1.5. By other *listed* materials and methods.
2. *Membrane penetrations* by *listed* electrical boxes of any material, provided that such 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 $\frac{1}{8}$ inch (3.2 mm) unless *listed* otherwise. Such boxes on opposite sides of the wall or partition 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 718.2.1](#).
 - 2.3. By protecting both boxes with *listed* putty pads.
 - 2.4. By other *listed* materials and methods.
3. *Membrane penetrations* by electrical boxes of any size or type, that have been *listed* as part of a wall opening protective material system for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
4. *Membrane penetrations* by boxes other than electrical boxes, provided that such penetrating items and the *annular space* between the wall membrane and the box, are protected by an *approved membrane penetration firestop system* installed as tested in accordance with [ASTM E814](#) or [UL 1479](#), with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water, and shall have an F and T rating of not less than the required *fire-resistance rating* of the wall penetrated and be installed in accordance with their listing.
5. The *annular space* created by the penetration of an automatic sprinkler, provided that it is covered by a metal escutcheon plate.
6. *Membrane penetrations* of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that exceed 16 square inches (0.0103 m²) in area, or steel electrical boxes of any size having an aggregate area through the membrane exceeding 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area, provided that such penetrating items are protected by *listed* putty pads or other *listed* materials and methods, and installed in accordance with the listing.

714.4.3 Dissimilar materials.

Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the *fire-resistance* integrity of the wall is maintained.

714.5 Horizontal assemblies.

Penetrations of a *fire-resistance-rated* floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a *shaft* by [Section 712.1](#) shall be protected in accordance with [Sections 714.5.1](#) through [714.5.4](#).

714.5.1 Through penetrations.

Through penetrations of horizontal assemblies shall comply with [Section 714.5.1.1](#) or [714.5.1.2](#).

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or masonry items through a single fire-resistance-rated floor assembly where the *annular space* is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to [ASTM E119](#) or [UL 263](#) time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the *fire-resistance rating* of the construction penetrated. Penetrating items with a maximum 6-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly, provided that the aggregate area of the openings through the assembly does not exceed 144 square inches (92 900 mm²) in any 100 square feet (9.3 m²) of floor area.
2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch (152 mm) nominal diameter, provided that the concrete, grout or *mortar* is installed the full thickness of the floor or the thickness required to maintain the *fire-resistance rating*. The penetrating items shall not be limited to the penetration of a single concrete floor, provided that the area of the opening through each floor does not exceed 144 square inches (92 900 mm²).
3. Penetrations by *listed* electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and installed in accordance with the instructions included in the listing.

714.5.1.1 Fire-resistance-rated assemblies.

Copyright © 2024 International Code Council, Inc., or its licensors (ALL RIGHTS RESERVED).

Accessed by Venkatesh Shanmugam on 11/13/2024 pursuant to License Agreement with ICC. No further reproduction or distribution authorized. Any Unauthorized reproduction or distribution is a violation of the federal copyright, and subject to civil and criminal penalties thereunder.

Through penetrations shall be protected using systems installed as tested in the *approved* fire-resistance-rated assembly.

714.5.1.2 Through-penetration firestop system.

Through penetrations shall be protected by an *approved through-penetration firestop system* installed and tested in accordance with [ASTM E814](#) or [UL 1479](#), with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an *F rating/ T rating* of not less than 1 hour but not less than the required rating of the floor penetrated.

Exceptions:

1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a *T rating*.
2. Floor penetrations by floor drains, tub drains or shower drains contained and located within the concealed space of a *horizontal assembly* do not require a *T rating*.
3. Floor penetrations of maximum 4-inch (102 mm) nominal diameter metal conduit or tubing penetrating directly into metal-enclosed electrical power switchgear do not require a *T rating*.

714.5.2 Membrane penetrations.

Penetrations of membranes that are part of a *horizontal assembly* shall comply with [Section 714.5.1.1](#) or [714.5.1.2](#). Where floor/ceiling assemblies are required to have a *fire-resistance rating*, recessed fixtures shall be installed such that the required *fire resistance* will not be reduced.

Exceptions:

1. *Membrane penetrations* by steel, ferrous or copper conduits, pipes, tubes or vents, or concrete or masonry items where the *annular space* is protected either in accordance with [Section 714.5.1](#) or to prevent the free passage of flame and the products of combustion. The aggregate area of the openings through the membrane shall not exceed 100 square inches (64 500 mm²) in any 100 square feet (9.3 m²) of ceiling area in assemblies tested without penetrations.
2. Ceiling *membrane penetrations* of maximum 2-hour *horizontal assemblies* by steel electrical boxes that do not exceed 16 square inches (10 323 mm²) in area, provided that the aggregate area of such penetrations does not exceed 100 square inches (44 500 mm²) in any 100 square feet (9.29 m²) of ceiling area, and the *annular space* between the ceiling membrane and the box does not exceed ¹/₈ inch (3.2 mm).
3. *Membrane penetrations* by electrical boxes of any size or type, that have been *listed* as part of an opening protective material system for use in *horizontal assemblies* and are installed in accordance with the instructions included in the listing.
4. *Membrane penetrations* by *listed* electrical boxes of any material, provided that such 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 ceiling membrane and the box shall not exceed ¹/₈ inch (3.2 mm) unless *listed* otherwise.
5. The *annular space* created by the penetration of a fire sprinkler, provided that it is covered by a metal escutcheon plate.
6. Noncombustible items that are cast into concrete *building elements* and that do not penetrate both top and bottom surfaces of the element.
7. The ceiling membrane of a **maximum** 2-hour fire-resistance-rated *horizontal assembly* is permitted to be interrupted with the double wood top plate of a wall assembly that is sheathed with Type X *gypsum wallboard*, provided that all penetrating items through the double top plates are protected in accordance with [Section 714.5.1.1](#) or [714.5.1.2](#) and the ceiling membrane is tight to the top plates.
8. Ceiling *membrane penetrations* by listed luminaires (light fixtures) or by luminaires protected with *listed* materials, which have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.

714.5.3 Dissimilar materials.

Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the *fire-resistance* integrity of the *horizontal assembly* is maintained.

714.5.4 Penetrations in smoke barriers.

Penetrations in *smoke barriers* shall be protected by an *approved through-penetration firestop system* installed and tested in accordance with the requirements of [UL 1479](#) for air leakage. The *L rating* of the system measured at 0.30 inch (7.47 Pa) of water in both the ambient temperature and elevated temperature tests shall not exceed either of the following:

1. 5.0 cfm per square foot (0.025 m³/s × m²) of penetration opening for each *through-penetration firestop system*.
2. A total cumulative leakage of 50 cfm (0.024 m³/s) for any 100 square feet (9.3 m²) of wall area, or floor area.

Copyright © 2024 International Code Council, Inc., or its licensors (ALL RIGHTS RESERVED).

Accessed by Venkatesh Shanmugam on 11/13/2024 pursuant to License Agreement with ICC. No further reproduction or distribution authorized. Any Unauthorized reproduction or distribution is a violation of the federal copyright, and subject to civil and criminal penalties thereunder.

714.6 Nonfire-resistance-rated assemblies.

Penetrations of nonfire-resistance-rated floor or floor/ceiling assemblies or the ceiling membrane of a nonfire-resistance-rated roof/ceiling assembly shall meet the requirements of [Section 713](#) or shall comply with [Section 714.6.1](#) or [714.6.2](#).

714.6.1 Noncombustible penetrating items.

Noncombustible penetrating items that connect not more than five *stories* are permitted, provided that the *annular space* is filled to resist the free passage of flame and the products of combustion with an *approved* noncombustible material or with a fill, void or cavity material that is tested and classified for use in *through-penetration firestop systems*.

714.6.2 Penetrating items.

Penetrating items that connect not more than two *stories* are permitted, provided that the *annular space* is filled with an *approved* material to resist the free passage of flame and the products of combustion.