

# Membrane Penetration Firestop Systems

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*What are membrane penetration firestop systems and how has the penetration firestop standard evolved to evaluate them?*

Recently, the ANSI/UL 1479 Standards Technical Panel (STP) drafted and adopted changes to the fire test standard ANSI/UL 1479, Fire Tests of Penetration Firestops, which add test criteria to evaluate various types of membrane-penetration firestop systems within vertical assemblies to the existing test criteria for through-penetration firestop systems. The changes include a new section for definitions relating to the various types of membrane-penetrations, a description of the test setup for membrane-penetrations, and the conditions of acceptance for membrane-penetrations.

The scope of ANSI/UL 1479 is to evaluate firestop systems that are installed to maintain the fire performance of a fire-resistance-rated assembly when the assembly is breached by a penetrating item. For example, when a firestop system

protecting a plumbing pipe penetrates the gypsum membrane on one side of a fire-resistance-rated gypsum wall, this revised standard would be used to evaluate that firestop system. These changes to ANSI/UL 1479 are significant, since, until this point, the standard only provided test criteria for evaluating through-penetration firestop systems.

You may be wondering, “What is a membrane-penetration firestop system?” or even, “What is a penetration or through-penetration firestop system?” Here are the terms, as defined in the 2015 International Building Code (IBC):

**1. PENETRATION FIRESTOP SYSTEM**

A through-penetration firestop or a membrane-penetration firestop.

**2. MEMBRANE-PENETRATION FIRESTOP SYSTEM**

An assemblage consisting of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly, one or more penetrating items installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time.

**3. THROUGH-PENETRATION FIRESTOP SYSTEM**

An assemblage consisting of a fire-resistance-rated floor, floor-ceiling or wall

assembly, one or more penetrating items passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time.

The building code goes on to require penetration firestop systems, both through and membrane type, to be tested in accordance with ANSI/UL 1479 (ASTM E814) to ensure the opening created by the penetration will not reduce the fire rating of the assembly breached. The various types of membrane-penetrations identified in the building code are box type penetrations (outlet boxes, gang boxes, hose cabinets, etc.) and utility penetrations (pipes, ducts, cables, etc.).

Let’s remember that fire-rated vertical and horizontal assemblies (walls and floors/ floor-ceilings, respectively) must also meet building code criteria, which include testing in accordance with ANSI/UL 263 (ASTM E119). These assemblies must demonstrate ability to withstand the propagation of fire and hot gases (limit the average temperature rise measured at multiple points on the unexposed side of the assembly to 250° Fahrenheit and limit a single point on the unexposed side of the firestop assembly to 325° Fahrenheit), maintain load bearing capabilities (nonbearing assemblies are exempt from the load criteria), and withstand a hose stream impact (for vertical

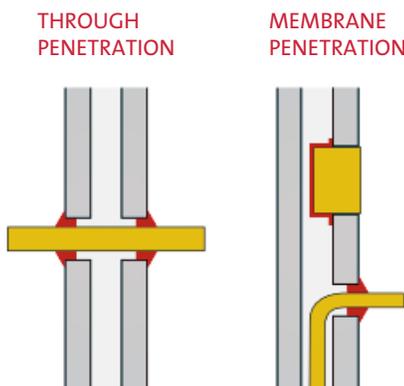


Figure 1 - Courtesy of archtoolbox.com/images/materials/thermal/through-membrane-penetrations.png



### Through penetration firestops in rated wall

assemblies only). Therefore, the firestop systems protecting penetrations within these assemblies need to maintain a similar level of performance. Failure of the firestop system to maintain a similar level of performance may compromise the fire rating of the assembly.

Unlike a through-penetration firestop system that penetrates entirely through the fire-resistance rated assembly, and as such can be seen from either side of the assembly, a membrane penetration firestop system may not be seen from the non-breached side

of the assembly. For this condition, ANSI/UL 1479 requires membrane-penetration firestop systems to have a T rating equal to the F rating of the assembly. The International Building Code, Section 714.3.2, Exception 4 requires membrane-penetrations of wall assemblies by boxes other than electrical boxes (such as dryer boxes) to have an F and T rating not less than the required fire-resistance rating of the wall penetrated. The collective intent here is to maintain a similar level of performance between the wall

with a penetration and the wall without a penetration. For reference, the definition of F and T ratings are as follows:

**F Rating:** A penetration firestop shall remain in the opening during the fire test and hose stream test and shall comply with the following:

a) The sample shall withstand the fire test for the rating period without permitting the passage of flame through openings, or the occurrence of flaming on any element of the unexposed side of the sample.

b) During the hose stream test, the sample shall not develop any openings that would permit a projection of water from the hose stream beyond the unexposed side.

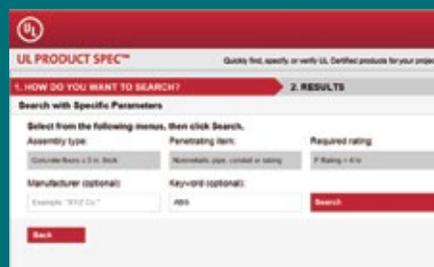
**T Rating:** A penetration firestop shall remain in the opening during the fire test and hose stream test and shall comply with the following:

a) The transmission of heat through the sample during the rating period shall not raise the temperature measured by any thermocouple on the unexposed surface of the firestop or on any penetrating item by more than 325°F (180°C) above its initial temperature. Also, the sample

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To learn more about searching for firestop systems using UL Product Spec, go to our online Technical Library page ([ul.com/code-authorities/resources/technical-library/](http://ul.com/code-authorities/resources/technical-library/)), and click on the article relating to locating firestop systems. The screenshot above shows an example of how UL Product Spec can be used to search for firestop systems based on required parameters.



## Membrane Penetration (continued from page 5)

shall withstand the fire test during the rating period without permitting the passage of flame through openings, or the occurrence of flaming on any element of the unexposed side of the sample. For wall opening protective materials used with electrical and non-electrical box membrane penetrations, the T rating shall be equal to the F rating.

b) During the hose stream test, the sample shall not develop any opening that would permit a projection of water from the stream beyond the unexposed side.

But there is more work ahead for this STP and industry. While the test criteria for

membrane-penetration firestop systems has recently been added to ANSI/UL 1479, the test method only provides guidance for such penetrations in a vertical fire resistance rated assembly. The STP that maintains and advances this standard must now work on providing guidance for horizontal rated assemblies. This group must consider what type of penetration firestop system challenges are presented, and how the test standard can help to rectify these challenges with focused test criteria such that field conditions can be considered safe as they have been evaluated by way of fire testing. This effort is already

ongoing and will be the primary focus for this standard.

These membrane-penetration firestop systems can be found in the UL Fire Resistance Directory or online using UL Product Spec™ ([ul.com/productspec](http://ul.com/productspec)) under the UL category XHEZ. If you have a desire to offer input or technical expertise, please consider participating as a formal member of the UL 1479 STP.

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