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CodeNotes™

Firestopping for Plumbing and Piping Systems

Based on the 2018 International Building Code® (IBC®) and 2018 International Plumbing Code® (IPC®)

Firestopping is a Life Safety topic addressed in the *International Plumbing Code*, but only briefly. The bulk of this topic is addressed within the *International Building Code*.

The IBC is a logical place for this topic to be addressed in detail. The fact of the matter is that within a building there are wide varieties of fire-rated assemblies and elements, the most common being walls and floors. When a floor or wall carries a fire rating, such as 1-Hour, 2-Hour or 3-Hour, and it gets penetrated by the passage of a pipe, cable, conduit, drain, etc. the fire rating becomes compromised and results in a pathway for fire, smoke and poisonous gases to pass from one compartment of a building to another. It is vital for plumbing and mechanical system installers and inspectors to have a clear understanding of what the codes require on this topic, as well as their obligations to perform their work in a way that results in a building that is safe for its occupants.

What do Plumbing and Building Codes Require, Regarding Firestopping?

Examples:

International Plumbing Code 2018, Section 315.1, Sealing of annular spaces

"Annular spaces created by pipes penetrating fire-resistance-rated assemblies or membranes of such assemblies shall be sealed or closed in accordance with Section 714 of the *International Building Code.*"

International Building Code 2018, Section 714.5.1.2, Through-penetration firestop systems

"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/T-rating of not less than 1 hour, but not less than that required of the floor penetrated."

The Three Elements of Fire Protection

1. *Detection,* such as smoke detectors and similar devices
2. *Suppression* (Active fire protection), such as fire sprinkler systems
3. *Compartmentation* (Passive fire protection), such as firestopping
   - Contains fire within the boundaries of rated assemblies, to allow adequate time for building occupants to escape

What is Firestopping?

A firestop is a fire protection system comprising various components used to seal openings and joints in fire-rated walls and floors. Firestops are designed, tested and listed to restore or maintain the continuous fire-resistance of the wall or floor assembly, thus impeding the spread of fire and smoke, by filling gaps, openings and annular spaces with fire-resistant materials. Firestopping is not "Fire blocking", "Draft stopping", or similar activities.

Why is Firestopping Required in a Building with Smoke Detectors and Fire Sprinklers?

No single method of fire protection is adequate. Sprinklers operate effectively in 88% of the fires large enough to activate them. (Source: NFPA US Experience with Sprinklers, July 2017). Why might these critical systems perform only 88% of the time? Here are some possibilities:

- Sprinkler system valves were deliberately or inadvertently shut off
- City water mains were shut off and/or were in the process of repair when a fire occurred
- City water mains fail to provide water, due to natural disaster conditions, like earthquakes

Bottom line: There must be a balance between Active and Passive methods of Fire Protection!

Firestop Systems are Designed to Protect Building Occupants

When installed properly, firestopping helps complete compartmentation in the event of a fire.

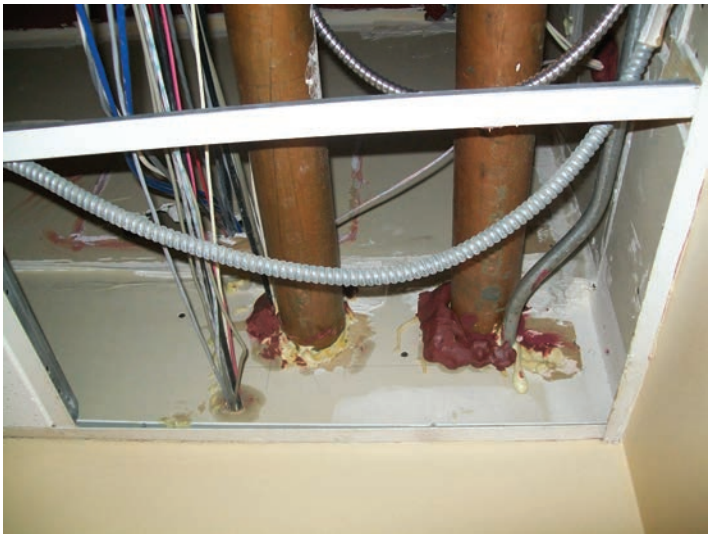
- The escape time provided is at least equal to the "F-rating"
- Example: An F-rating of 1 hour provides a 1-hour escape time
  - » If an 8,000-cubic foot room were divided in half by a fire-rated wall with an F-rating of 1 hour and a fire started in one half of the room, a person could theoretically stand in the other half of the room for 1 hour
- ¾ of all fire-related deaths occur due to smoke inhalation
  - » Source: Hall, Jr John R. NFPA Fire Analysis & Research, Quincy, MA. "Burns, Toxic Gases, and other Hazards"

Listed Firestop Systems are tested per ASTM E814 "Fire Tests of Penetration Firestop Systems" and/or UL 1479, as required by Section 714.4.1.2 of the *International Building Code*.

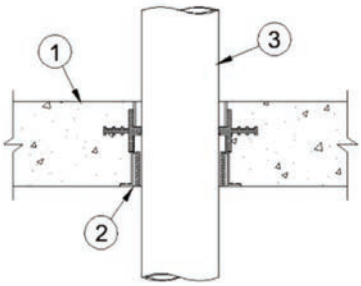
- These tests determine the performance of a firestop system:
  - » Exposure to standard time-temperature fire test
  - » Resistance to dis-lodgment, by means of a hose-stream test
- Performance is dependent upon specific assemblies
  - » Type of materials tested, such as a plastic pipe or a metal pipe
  - » Number, type and size of penetrations
  - » Materials used to construct the floors or walls in which the penetrant is installed

Firestop systems must be installed exactly as shown in the details of the listing. Failure to install exactly according to the listing's details will result in a system that will not, or at least may not, perform in the event of a fire. Below are a few examples of poor installations that may not perform properly in a fire.

Examples of Unapproved Installations



Proper Firestop Systems are Comprised of Three Key Elements



1. A fire-rated assembly—such as a wall or a floor
2. Firestop materials—typically includes backing material such as mineral wool and a fire caulking compound or a pliable intumescent wrap strip
3. Penetrating item(s), "Penetrant"—such as a plumbing pipe, drain, cable, electrical conduit, etc.

Firestopping Materials

The active ingredients/materials used in firestop systems are typically broken into two main categories, Intumescent and Non-Intumescent.

Intumescent materials are those that expand when subjected to extreme heat. Some intumescent firestop products expand up to 35 times their original physical size when subjected to heat! This is particularly important when a plastic pipe or insulated pipe is penetrating through a fire-rated building element because in the case of a fire, the plastic material or insulation will melt/burn away and leave a dangerous void. Intumescent materials expand to fill the resulting opening, void, or annular space.

Non-intumescent materials are those that do not expand, or expand very little, when subjected to heat. This type of material is most appropriate for use with metallic penetrants, such as metal pipes that are penetrating a fire-rated assembly. Why? Because during a fire the metal penetrant will not burn/melt away and the annular space (the gap between the penetrant and opening in the building element or hole in the floor or wall) will remain consistent, and thus not require the expansive activity of intumescent firestop materials to close the void.

Purpose of UL (or similar) Systems

These listed systems serve two main purposes:

- Installation instructions and evidence of compliance to appropriate standards
- Document with which to inspect the installation

What do the Various Firestop "Ratings" Granted by UL (or similar) Mean?

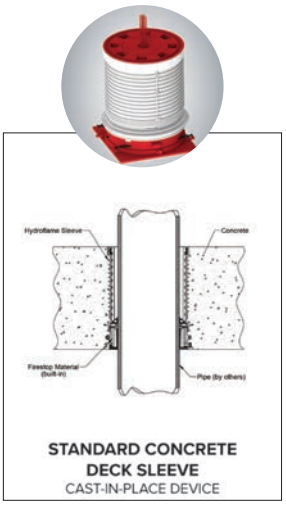
Ratings are assigned for firestop systems, based on specific characteristics of each system assembly

- **F** rating for passage of **F**lame
- **T** rating for fire and **T**emperature
- **L** rating based on amount of air, smoke and gas **L**eakage
- **W** rating based on **W**ater resistance

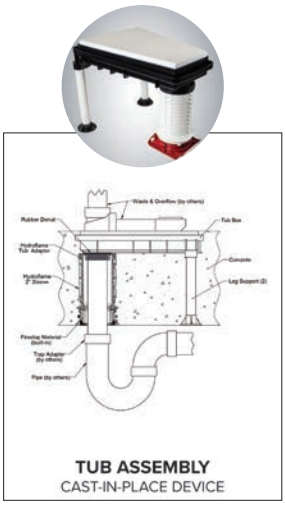
Built-in-place Firestop Systems vs. Pre-manufactured Firestop Devices

There are a wide variety of firestop materials available in the U.S. for use in installing Listed Firestop Systems. Historically, firestop systems have been manually installed on the jobsite with the use of caulking, intumescent wrap strip, mineral wool, etc. In addition to "built-in-place" methods, in recent years a variety of manufactured Firestop Devices have become available in the market from numerous manufacturers and are becoming the methods of choice by a growing number of contractors. These sleeve devices provide a wide range of listed firestop solutions for everything from pipe, conduit and cable penetrations, to toilet, bathtub, shower and floor drain penetration.

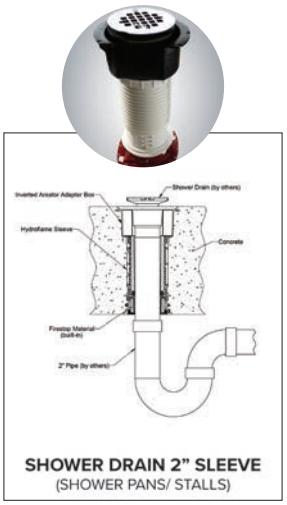
These devices are gaining adoption by specifying engineers, architects and contractors because they help to speed up the firestopping process as well as help to minimize the human error involved with many manually installed firestop systems. These devices can provide an uncomplicated way to provide F, T, L and W-ratings, while eliminating a variety of tasks that might otherwise have to be performed at multiple stages on a jobsite. Example photos and application drawings of these types of devices are shown below:



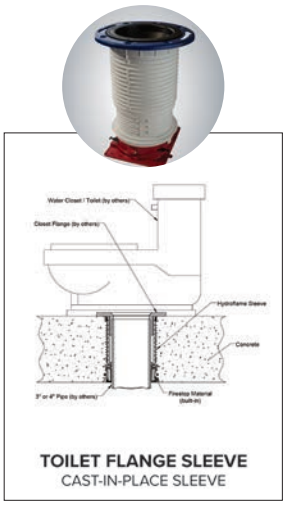
STANDARD CONCRETE DECK SLEEVE
CAST-IN-PLACE DEVICE



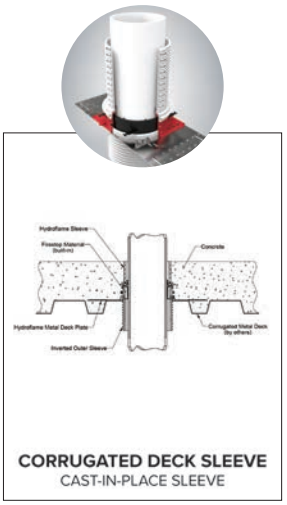
TUB ASSEMBLY
CAST-IN-PLACE DEVICE



SHOWER DRAIN 2" SLEEVE
(SHOWER PANS/ STALLS)



TOILET FLANGE SLEEVE
CAST-IN-PLACE SLEEVE



CORRUGATED DECK SLEEVE
CAST-IN-PLACE SLEEVE

What if Jobsite Conditions Do Not Match the Details Shown in a Listed System?

The applicable codes and standards allow some degree of latitude, when a firestop installation matching a listed system is not possible.

- For instance, let's say the way an architect designed the construction of a certain fire-rated wall does not allow you to install the listed firestop system per the drawings provided, and you can't find any listed system that matches this condition.
- When field conditions differ from the original design or unanticipated construction hindrances are encountered, design recommendations are typically made to propose alternative means and methods that ensure performance of the firestop system is not compromised. These are referred to as "Engineering Judgements", or "EJs", although other terms may apply in specific jurisdictions.
- Appropriate guidelines are needed when considering the use of Engineering Judgements, since they are in fact alternatives to actual tested and proven scenarios. This process is also sometimes referred to as an "interpolation of data" from previously tested firestop systems that are significantly similar, or that clearly bracket the conditions upon which the judgement is to be given. Put differently, competent individuals within the firestop industry (usually technical personnel from a firestop manufacturer) or a registered fire protection engineer, or an independent testing agency, or similar qualified person with experience with the tested and proven functionality of specific firestop products renders a judgment on the appropriate use of firestop materials that will maintain/restore the required rating in the specific situation.
- For further direction on the proper handling of this EJ process, it is recommended the following information be reviewed and complied with: http://www.firestop.org/uploads/2/4/5/4/24544763/ifc_guidelines_for_evaluating_firestop_systems_in_engineering_judgments.pdf
  - » This document is entitled, "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)"

Ensuring Proper Firestop Installations

From the installer's point of view, several steps are recommended, to ensure that firestop systems are properly installed within a building.

1. Review and become familiar with the project's Plans and Specifications
   a. Identify all types of firestop applications that will need to be addressed
   b. Collect all pertinent UL (or similar) firestop system documentation that applies
   c. Obtain all submittal documentation for the firestop manufacturer of choice
      i. Product spec sheets
      ii. Installation drawings
      iii. Copies of their UL System Listings for the project
2. Arrange for a pre-construction meeting with the contractor and the AHJ (Authority Having Jurisdiction)
   i. Reach a consensus regarding decisions made for firestopping on the project
3. Train all firestop installers, per the UL System documents and the specified materials to be used
   a. Oversee installations on site, to be sure they match the UL System documents
4. Invite AHJ to inspect when needed and supply the AHJ with applicable UL System information.

Please view the video entitled, "Close Enough is Not Good Enough: A Demonstration of Proper vs. Improper Firestopping." This video demonstrates the results of both proper and improper firestop installations: https://youtu.be/J4bw-2ME4uc (Produced by UL and the International Firestop Council)

Inspection of Firestop Systems is Becoming More Formalized and Regulated

Firestopping is typically inspected by an AHJ such as a building inspector. Since the release of the 2012 IBC, high-rise buildings (over 75' in height) and other critical structures must all have firestopping inspected by a special inspector. These inspectors are trained in the art and science of firestop inspection, per the local codes and industry best practices.

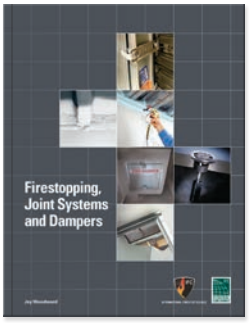
Helpful Links

- For information on how firestop systems should be inspected, view "IFC: Inspecting Firestop for Compliance" https://youtu.be/p6ZQy4CuGbk
- Code inspection seminars for AHJs and Firestop Special Inspectors are available at http://www.firestop.org/firestop-inspectors--code-officials1.html

- A free pocket-sized "Firestopping Inspection Manual" is available: http://a.firestop.org/~firestp5/files/IFC_Pocket_Guide-Rev_2016.pdf

Additional valuable information on the topic of firestopping can be located at these websites:

- https://www.ul.com/
- http://www.nfpa.org/
- http://www.sfpe.org/
- http://firesafenorthamerica.org/
- https://holdrite.com/firestop-systems/



For more information regarding code-required firestopping of plumbing systems, it is recommended that you refer to the ICC publication *Firestopping, Joint Systems and Dampers*. Online classes and webinars based on this publication are available at https://learn.iccsafe.org/ihtml/application/student/interface.icc/index.htm

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