

UL Solutions - Firestop and Joint Application Guide

1. Preface

Model building, fire and life safety codes require fire and smoke protection features to safeguard building occupants and structural elements from fire hazards and hazards associated with smoke and hot toxic gases generated during a fire situation. These model codes provide fire and life-safety for both building occupants and emergency first responders during fire emergency operations. This application guide provides technical information for design professionals and code authorities selecting UL Solutions certified products and systems for compliance with model code requirements for limiting the spread of fire, smoke and toxic gases through the protection of joints and penetrations in fire and smoke rated assemblies.

UL Solutions has developed this guide for use by code officials, inspection authorities, architects, contractors, installers, and other interested parties. It is intended to provide an overview of code compliance methods and best practices for protecting various types penetrations in fire resistance-rated assemblies, in association with the applicable model building, fire and life-safety code requirements.

Application guides are updated as necessary due to new product development, changes in the codes, or the need for clarification. To confirm the current status of any Guides, please consult the [Code Authorities web page](#) located on the [UL Solutions web site](#).

Limiting the movement of fire, along with the associated smoke and toxic gases, from traveling throughout a building, or to adjacent buildings, using a compartmentation approach is one of the most important aspects of fire-resistance rated construction. Compartmentation to limit the spread of fire is created by requiring fire-resistance rated assemblies, such as fire walls, fire barriers, fire partitions, shaft enclosures and horizontal assemblies and properly firestopping those assemblies. Building, fire and life-safety codes also include specific requirements designed to limit the movement of smoke and toxic gases through the building by requiring smoke barriers and partitions, creating smoke compartments. These systems of passive protection is an integral part of the overall balanced fire safety approach put forth by the model codes.

There are different types of applications that are utilized within the built environment to protect breaches in fire-resistance rated assemblies. Each of these are recognized by the model codes for this purpose. These applications are joint systems, firestop systems and perimeter fire containment systems. UL Solutions tests these systems and their materials in accordance with the requirements in model building, fire, and mechanical codes to specific performance standards. More information on these products is located in UL Solutions online certifications directory, [Product iQ®](#), available at www.ul.com/PiQ.

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2. Use of this guide

This application guide is intended to assist users to locate, specify or verify the correct type and code compliant UL Listed firestop assembly based on the installation.

Model codes require firestop assemblies used in these applications to be “listed”. “Certified” is another term used by UL Solutions to identify that the product has been evaluated by a third party certification organization in accordance with the appropriate required standard. The terms “listed”, “certified” and “classified” as used by UL Solutions all meet the definition of “listed” and “labeled” as described in the model codes.

3. Introduction to firestopping

Firestopping is a means of passive fire protection provided to contain a fire to the room or floor of origin by sealing-off any breaches that are made through fire-resistance rated assemblies using tested and listed firestop systems. Breaches can be any type of penetrations in a fire resistance rated wall or floor/ceiling assembly or a joint between two assemblies (i.e. wall and floor-ceiling assembly). The requirements to install and properly maintain firestop systems are found in the locally adopted building and fire codes. Since firestopping is such a vital part of the required level of safety within the built environment, it is paramount that firestopping is properly installed and maintained throughout the life of a building.

4. Definitions

- i. **Bricks / Blocks** - Firestop bricks or blocks are prefabricated and cured material ready for installation in openings. Generally used in large openings that have multiple penetrations. Some bricks or blocks have intumescent properties. Installation may or may not require the use of additional sealant or caulk.
- ii. **Code Authority** – The building or fire code official; authority having jurisdiction (AHJ) as designated by the model codes to administer the adopted codes.
- iii. **Continuous Point of Contact** – Firestop systems with continuous point of contact indicate no annular space is present and a penetrating item is “friction fit” into an assembly. Firestop systems indicating an annular space of “0” do not allow for continual point of contact unless specifically noted in the individual system.
- iv. **Curtain Wall** - Fenestration products used to create an external non-load bearing wall that is designed to separate the exterior and interior environments.
- v. **Fire Barrier** - A vertical fire resistance rated wall assembly designed to restrict fire spread while maintaining the continuity of the wall.
- vi. **Fire Partition** - A vertical wall assembly in which openings are protected constructed of materials designed to restrict the spread of fire.
- vii. **Firewall** - A vertical fire-resistance rated wall assembly having openings that are protected and extending continuously from the foundation to the roof or through it, with sufficient structural stability to allow collapse of construction under fire conditions on either side without collapse of the wall while restricting the spread of fire.
- viii. **Perimeter Fire Containment System** - An assembly consisting of specific products or materials designed to resist the passage of fire through voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies for a prescribed period of time.
- ix. **Pillows, Plugs** - Prefabricated packages ready for installation in through openings or joint systems. Pillows or plugs consist of a block or plug of insulation with an outer packaging. Some pillows contain intumescent materials. Pillows are used to quickly fill large openings with multiple penetrants. Plugs are similar to pillows and are generally used for filling the void below a fluted deck and top of wall.
- x. **Point of Contact** - Firestop systems that indicate “Point of Contact” allow for a single point where the penetrating item touches the assembly or possibly another penetrating item.
- xi. **Rigidly Supported** – This relates to the firestop system and it indicates that the penetrating item must be fully supported and the firestop system provides no support.
- xii. **Sleeves** - Either metallic or non-metallic and are used to create or form an opening for a penetrating item. These are supplemental to the construction of substrate and assist in the installation and containment of firestop system components.
- xiii. **Tightly Packed / Firmly Packed** – Some firestop systems require mineral wool to be installed either “tightly packed” or “firmly packed”. When packing materials such as mineral wool a minimum compression of 25% would be an example of tightly/firmly packed.

5. Types of Firestop Applications

The primary types of firestopping applications include joints and penetrations associated with fire-rated wall and floor assemblies. The systems are identified by an alphanumeric identification system. The alpha components identify the type of joint system and whether the joint system has movement capabilities. The numeric components identify the nominal joint width. In the case of head-of-wall joint systems, the width of the joint does not include the voids created under the crests of metal deck floor or roof systems.

a. Joints

This category ([XHBN](#)) covers joint systems, which are specific constructions consisting of adjacent wall and/or floor assemblies and the materials designed to prevent the spread of fire through a linear opening between the wall and/or floor assemblies.

The specifications for materials in a joint system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings. The individual components are not assigned ratings and are not intended to be interchanged between systems. Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

The certification of joint systems contemplate installation in heated and air-conditioned environments unless stated otherwise in the description of the system. Materials used in the joint systems are intended to be installed in accordance with the manufacturer's instructions provided with the material. The structural integrity of the floor or wall assembly has not been investigated as a result of the openings.

There are several items that are considered joints that can be found within the built environment.

- i. HW - Head of Wall, top of wall to rated floor/ceiling assembly
- ii. BW – Bottom of Wall, bottom of wall to floor assembly
- iii. WW – Wall to Wall, rated wall to rated wall
- iv. FF - Floor to Floor, rated floor to rated floor/ceiling assembly
- v. FW – Floor to Wall, rated floor to rated wall.
- vi. Perimeter Fire Containment - An assemblage of specific materials or products that is designed to resist the passage of fire through voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies for a prescribed period of time.
- vii. Control Joint – a joint in an assembly that is non-continuous through the barrier. Generally, part of installation and finishing of gypsum protected assemblies. Construction is described in the BXUV Guide Information or as specified in individual designs. A control joint is not evaluated in accordance with UL 2079.

Each joint system assembly when tested and listed within the online product database is given a certain number to identify the tested system. The number is based upon the width of the joint that system can be utilized with. Below you will find the [Numbering Guide for Joints](#)

Number Range	Nominal Joint Width
0000 – 0999	Less than or equal to 2 in.
1000 – 1999	Greater than 2 in. and less than or equal to 6 in.
2000 – 2999	Greater than 6 in. and less than or equal to 12 in.
3000 – 3999	Greater than 12 in. and less than or equal to 24 in.
4000 – 4999	Greater than 24 in.

b. Penetration Firestop Systems (Through and Membrane)

This category ([XHEZ](#)) covers both through and membrane firestop systems, which are found in specific construction applications consisting of a wall or floor assembly, a penetrating item passing through or into the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings.

The specifications for materials in a firestop system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings. The individual components are not assigned ratings and are not intended to be interchanged between systems.

Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines. Each penetration firestop system is assigned a number corresponding to the type of penetrant within the tested system. Below you will find the [Numbering Guide for Penetrations](#).

No. Range	Description
0000-0999	No penetrating items
1000-1999	Metallic pipe, conduit or tubing
2000-2999, 21000-29999	Nonmetallic pipe, conduit or tubing
3000-3999	Electrical cable
4000-4999	Cable trays with electrical cable
5000-5999	Insulated pipe
6000-6999	Miscellaneous electrical penetrants, such as busducts
7000-7999	Miscellaneous mechanical penetrants, such as air ducts
8000-8999	Groupings of penetrations, including any combination of items listed above
9000-9999	Not used at present time

6. Firestop Systems and Types of Ratings

The model codes contain requirements for firestop systems that are for membrane and through penetrations. The code states that penetrations such as these shall be protected by an approved penetration firestop system. It also requires that these systems be installed as tested in accordance with ASTM E814 or UL 1479 as they are the recognized standards. Furthermore, the codes require that the system have an F rating of not less than the required fire-resistance rating of the wall penetrated and be able to maintain a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water.

When it comes to cutting a hole for a penetrating item care should be taken to read and understand the allowance provided in the individual listings. During testing of firestop systems in lab settings careful attention is provided to cut an opening as perfect as possible. In this condition, the point of contact is extremely small. Where an imperfect opening is cut in the field it has become a question as to how much contact can be made. Codes typically require systems to be installed as tested. Multiple points of contact are not allowed unless otherwise indicated in the tested and listed system.

Sleeves pass through an assembly but are open at each end and allow for the penetrating item to be installed inside the sleeve. Sleeves may be a mandatory element of a firestop system or optional if the listing allows. Sleeves could influence the performance of a firestop system. It is important not to confuse sleeves with firestop devices.

The [UL ProductIQ](#) guide card states "Where the individual system specifies the penetrating item is to be rigidly supported on both sides of wall or floor, the support system should be designed based upon the premise the firestop system provides no support." To determine where the supports for the penetrating items should be placed, the applicable codes and/or standards should be referenced (Example: electrical conduit ref NEC). Should a code or standard reference the supports at three feet spacing then they would need to be installed so that the assembly being penetrated is not considered as one of the supports.

Firestop Types

There are ratings assigned to each of the firestop system assemblies which in many cases are required to properly construct in accordance with the building codes. These ratings consist of the standard F and T ratings as well as the supplemental ratings which are the L, W, and M ratings. All assemblies require an F rating but the building codes have requirements and exceptions that illustrate when a T rating, or an L rating is required. Currently the building codes do not have requirements for W ratings or M ratings.

Standard ratings for firestops include:

F Rating:

The time period that a through-penetration firestop system or perimeter fire containment system limits the spread of fire through the penetration or void.

T Rating:

The time period that a penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E814 or UL 1479.

Supplemental Ratings include:

L Rating:

The L rating criteria determines the amount of air passing through the system. The air leakage is measured in cubic feet per minute per square foot of opening (CFM/sq ft) or in cubic feet per minute per unit (CFM/unit) for fixed-size opening units, through the firestop system at ambient and/or 400°F air temperatures at an air-pressure differential of 0.30 in. W.C. The L ratings are intended to assist the code authority and others in determining the suitability of firestop systems for the protection of penetrations and miscellaneous openings in floors and smoke barriers for the purpose of restricting the movement of smoke in accordance with NFPA 101, "Life Safety Code."

W Rating:

The W rating indicates the ability of system to prevent passage of water to opposing side. This rating is intended to assist code authorities and others in determining the suitability of firestop systems in applications where submersion in water may be a factor.

The Class 1 W rating determines the capability of the firestop system to maintain watertightness of the penetration through a floor or wall construction at ambient air conditions under 3 ft of water pressure head (1.3 psi) for a period of 72 hours. The W rating may be applicable for building structures whose floors are subjected to incidental standing water or for buildings that house critical equipment as described in NFPA 75, *Fire Protection of Information Technology Equipment*, and NFPA 76, *Fire Protection of Telecommunications Facilities*.

Acceptance is based upon the ability of the firestop system to withstand the applied pressure without the passage of any water through the firestop system. After the Class 1 watertightness test, the firestop system is conditioned in accordance with the requirements of [UL 1479](#) and the fire and hose stream tests described in the standard are conducted.

M Rating:

The M rating measures ability of penetration firestop system maintain function after specified displacement in one or more axis and is tested using ASTM E3037.

Standard Ratings for Joint Systems

When it comes to the Fire-resistant joint systems referenced in the model codes these shall be tested in accordance with the requirements of either ASTM E1966 or [UL 2079](#) as the approved standards. Nonsymmetrical wall *joint* systems shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests.

Some codes allow for an exception for exterior walls with a horizontal fire separation distance greater than 10 feet. If this is the intended installation then the for joint system would be tested for interior fire exposure only.

Standard Ratings for Joint Systems is the Assembly Rating. This consists of a time, size and where applicable the Movement Class. The time period that a joint restricts the spread of fire as well as restricting the temperature rise through the joint, similar to combine F and T rating of a firestop rating section. For Dynamic Joint Systems the Movement Class is commonly expressed as a percentage of the nominal joint width that the joint can compress or extend. Class I, II and III describe the frequency and number of cycles in that movement range the joint was subject to prior to the Fire Endurance test.

Supplemental ratings include L and W Ratings as described in firestop ratings section.

7. Types of Firestop Solutions

- a. **Fill, Void, Cavity Materials** - ([XHHW](#)) Caulk, Bricks, Mortar, Pillows, Plugs, Putty, Sealant, Spray, Wrap- These materials are for use in joint systems, perimeter fire-containment systems, firestop systems, and firestop systems in marine applications. These materials have been investigated for the capacity to provide a degree of fire resistance to openings provided in fire-resistive walls, decks, bulkheads or floors.
- b. **Intumescent materials** – Materials in this category have properties to close off penetrants and seal openings. Strength and amounts of expansion vary from product to product. Intumescent materials work on openings with combustible penetrations to fill the void as the penetrant is consumed. Sealants or caulks are often paired with a device or wrap to protect larger openings. Materials that are indicated to be intumescent undergo environmental exposures to assess performance through the intended service lifespan.
- c. **Elastomeric** – These materials are intended to seal opening and permit various ranges of flexibility while maintaining fire resistance and possibly air, water or movement capabilities. Various formulations and applications for general firestopping and a wide range of penetrations or joint systems. Often paired with devices or intumescent to protect openings.

- d. **Firestop Devices Collars, Devices and Sleeves** - This category ([XHJJ](#)) covers firestop devices, which are factory-built products intended to provide a degree of fire resistance to openings in fire-resistive walls, bulkheads, decks or floors to accommodate penetrating items, such as electrical cable, cable trays, conduit and pipe for use in firestop systems.
- i. Collars are devices designed to be installed on the surface of the wall or floor and protect a penetration. Collars contain intumescent materials to close off penetrants and maintain the opening. Securement of collars to substrate is important due to the nature of the intumescent.
 - ii. Cast in place, Drop In - Devices that are generally self-contained with various capabilities of fire and option air water capabilities. Cast in devices are either cast into the assembly during the pour or are back filled in openings sitting on the bottom of the assembly form. Drop in devices are generally inserted into cored openings from the top side.
 - iii. Modular devices- Consisting of framing and modular inserts. The inserts are sized to accommodate various penetrants and configurations. Modules may be installed in single or ganged configurations with supporting framing construction as specified in the individual firestop system listing. Easily modified to add or remove penetrants. Modular devices are mainly found in marine applications.
 - iv. Sleeves- firestop device that can be pre-installed or installed after penetrants. Generally consisting of a single or two-part metal shell and integrated intumescent material.
- e. **Wall Opening Protective Materials** - This category ([QCSN](#)) and ([CLIV](#)) cover those products that are used to maintain the hourly ratings of fire-resistive walls and partitions containing flush-mounted devices (membrane penetrations), such as metallic and nonmetallic outlet boxes. These devices are often referred to in the industry as “putty pads”.

8. Establishing Fire Resistance Ratings

There are analytical methods for determining the fire resistance of the elements of a building, the components or the assemblies found within a building. These can be established by any of the methods listed within chapter 7 of the international building code or chapter 8 of NFPA 101. Each of these utilize ASTM E119 or UL 263 to establish the fire-resistance based on the exposure to the fire test and the acceptance criteria specified in the test standards.

One of the methods acceptable to be used is fire-resistance designs documented in approved sources. This includes published industry agency documents like fire test reports from approved agencies or fire resistance designs published by an industry organization such as the gypsum association.

Another option is designs certified by an approved agency. These are tested options found in a published database and are based on scientific data gathered during the test. Fire-resistance designs for firestop are certified by an approved agency and must be tested to the applicable test standard to understand the fire behavior to achieve the proper fire rating.

Because of the unique features of structures, structures with new technologies, use of prescriptive methods not referenced in listed designs and other reasons there will always be a need for engineering analysis, which is commonly referred to as an engineering judgement (EJ). This is another acceptable method based on comparison of building elements, components or assemblies that have a fire resistance rating based on UL 263 or ASTM E119.

Penetrations:

Testing and Certification Standards that apply to penetrations are ASTM E814 (Test Method for Fire Tests of Penetration Firestop Systems) or UL 1479 (Fire Tests of Penetration Firestops) requirements in Section 714 (2021) cover the firestop system materials and methods of construction used to protect through penetrations and membrane penetrations in fire-resistance-rated partitions and walls (vertical assemblies) and horizontal assemblies.

Fire-Resistant Joint Systems:

Testing and certification standards that apply to fire-resistant joint systems are ASTM E1966 (Standard Test Method for Fire-resistive Joint Systems) or UL 2079 (Tests for Fire Resistance of Building Joint Systems). The requirements in section 715 cover joint systems installed in or between fire resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies. These joints must be protected by an approved fire-resistant joint system designed and certified to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed.

Tested and listed systems shall be utilized when determining how to firestop a penetration or joint. These need to be followed as prescribed in the parameters set forth within the tested assembly.

9. Engineering Judgements (EJ)

In cases where a tested system is not available for a specific application found within the built environment, an engineering judgment may be provided. EJ's have played an important role within the firestopping community for many years and are critical part of proper fire protection engineering. In some cases, they may contain what appears to be a simplistic measure to solving an issue, while other cases may be much more complex and detailed. Since no two firestop products perform the exact same during testing any

variations of installed conditions could have a potentially catastrophic impact on a tested and listed system.

Firestop engineering judgements are only utilized when there is not a tested system available, but the conditions of the construction and penetration are similar to tested systems. When these minor deviations occur, and the field conditions cannot be easily or cost effectively redesigned, then an EJ may be requested by design professionals to address the condition to demonstrate code compliance to the code authority. EJ's are not intended to address materials that have not been evaluated but should be based on interpolation or extension of previously tested firestop systems and materials that are similar. ASTM E-2750 – Standard Guide for Extension of Data from Penetration Firestop System Tests Conducted in Accordance with ASTM E-814 and ASTM E-2032 – Standard Guide for Extension of Data from Fire Resistance Tests Conducted in Accordance with ASTM E-119. EJ's issued are expected to pass a fire test if it was subjected to applicable test standard for the condition it was issued. They are not intended to be used in lieu of a tested system or as a means to correct a system was incorrectly installed.

Supporting code sections

Engineering Judgements fall into the International Building Code (IBC) in the section related to *Analytical Methods* and the section on *Approved Alternate Methods*. The model codes permit for solutions to be submitted provided they comply with the concepts and requirements for code equivalency as permitted by the alternative means and methods provisions. Various analytical methods for determining an hourly rating of a system or assembly are also discussed within the IBC. Please consult with the appropriate code authority regarding these approaches prior to submittal. These methods are intended for use when listed and labeled materials are not available or field situations do not match published systems or designs.

Issuing engineering judgements

Engineering judgements may be issued by the firestop manufacturer's technical staff where their product(s) are being utilized or in concert with them by a third party. The professional issuing the EJ should have a full understanding of site-specific conditions and base the judgment on the principles of fire protection engineering and knowledge/experience with testing of fire resistance-rated systems in accordance with ASTM E119 or UL 263 and the appropriate firestop or joint system standard. Firestop manufacturers will typically address the firestop portion and not the assembly rating. When conditions such as this occur, the manufacturer is still best suited to understand the performance of the firestop materials due to the access to the various test data of pass and failed conditions they have from research and/or certification fire tests that have passed or failed. Third party engineering staff may not have access to the intellectual property of the manufacturer and may not be able to fully understand or assess the firestopping.

UL Solutions provides a management system-based program to firestop manufacturers to issue technical evaluations (EJ's) under the Technical Evaluation Developer program as referenced in [Appendix C](#).

10. Category Control Number (CCN)

The four-letter code associated with products covered in this marking and application guide is the UL Solutions category code designation for that product. Each category code provides a link to the published product GuideInfo for that product and links to the products certified within that category. The product GuideInfo is a technical document which details the scope of the products covered, information relating to limitations or special conditions applying to the product, the requirements used for the investigation of the products and general installation and use information. Product GuideInfo is available in UL [Product iQ](#). The information provided in the product GuideInfo is different from the overview and expanded explanatory information contained in this application guide.

(BXUV) Fire-resistance Ratings – This category covers fire-rating certifications based upon the test method and acceptance criteria in UL 263 (ASTM E119), "Fire Tests of Building Construction and Materials." The ratings are expressed in hours and are applicable to floor-ceilings, roof-ceilings, beams, columns, walls and partitions.

(QCIT) Metallic Outlet Boxes – This category covers certified single- and double-gang metallic outlet and switch boxes with metallic or nonmetallic cover plates used in bearing and nonbearing wood stud and steel stud walls with ratings not exceeding 2 hours. The metallic outlet or switch boxes should be securely fastened to the studs and the opening in the gypsum board facing should be cut so that the clearance between the box and the wallboard does not exceed 1/8 in. The surface area of individual metallic outlet or switch boxes should not exceed 16 sq in. The aggregate surface area of the boxes should not exceed 100 sq in. per 100 sq ft of wall surface. The aggregate surface area of the boxes may be exceeded when Wall-opening Protective Materials ([CLIV](#)) are installed according to the requirements of their certification.

Metallic boxes located on opposite sides of walls or partitions should be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when Wall-opening Protective Materials ([CLIV](#)) are installed according to the requirements of their certification.

Metallic boxes should not be installed on opposite side of walls or partitions of staggered stud construction unless wall-opening protective materials are installed with the metallic boxes in accordance with certification requirements for the protective materials.

(QCMZ) Non-Metallic Outlet Boxes – This category covers outlet boxes and fittings certified for fire resistance ([CEYY](#)) and includes certifications for nonmetallic outlet and switch boxes for use in wall or partition assemblies. The information provided for each certification includes the model numbers for the certified products, a description of the rated assemblies, the spacing limitations for the boxes and the installation details. Nonmetallic boxes should not be installed on opposite sides of walls or partitions of staggered stud construction unless certified for use in such constructions.

(XHKU) Forming and Backing Materials – This category covers forming materials investigated for use in firestop systems, joint systems and perimeter-fire-containment systems. The forming materials are manufactured from proprietary materials, processed into the form of boards or sheets and formed into various sizes and shapes.

These materials are used as a form and seal to prevent leakage during the installation and curing of some fill, void or cavity materials and should be installed in accordance with the instructions specified in the individual joint system, perimeter-fire-containment system or through-penetration firestop system. After installation, forming materials are left in place and, together with the fill material, provide a degree of fire resistance for the opening.

(XHEZ) Membrane Penetrations – This category covers penetrations that are firestop systems specifically designed to address a breach in one side of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly to accommodate an item installed into or passing through the breach.

(CLIV) Wall-opening Protective Materials – This category covers wall-opening protective materials investigated for use in fire-resistance designs and consists of metallic and non-metallic boxes for electrical and communication connections openings in walls that are in excess of what is allowed in the BXUV guide information.

(CEYY) Outlet Boxes and Fittings Certified for Fire Resistance – This category covers outlet boxes and fittings investigated for use in fire-resistance designs that include special-purpose boxes intended for installation in floors, and nonmetallic outlet boxes intended for installation in floors, walls and partitions, and/or ceilings. They are intended for installation in accordance with ANSI/NFPA 70, "National Electrical Code" (NEC). They have shown a degree of fire resistance when installed in the particular floor(s), wall(s) and/or ceiling(s) described for each certified company. These are often times referred to as poke through inserts and are pre-set and post-set inserts for use in concrete floors for electrical and communication connections.

(XHJI) Firestop Devices – This category covers firestop devices, which are factory-built products intended to provide a degree of fire resistance to openings in fire-resistive walls, bulkheads, decks or floors to accommodate penetrating items, such as electrical cable, cable trays, conduit and pipe for use in firestop systems.

(XHHW) Fill, Void or Cavity material – This category covers fill, void or cavity materials, which are proprietary materials investigated for use in joint systems, perimeter fire-containment systems, firestop systems, and firestop systems in marine applications. Except as specified below, properties of the fill, void or cavity materials other than the capacity to provide a degree of fire resistance to openings provided in fire-resistive walls, decks, bulkheads or floors have not been investigated.

(XHGK) Cabinets – This category covers factory-built cabinets that penetrate one surface of a fire-resistive wall or floor assembly. These cabinets are intended to be installed in accordance with the instructions provided with the product and the instructions specified in the individual through-penetration firestop system. Certification of these products contemplates installation within a controlled environment, unless stated otherwise in the individual certifications. Examples of products certified in this category include fire extinguisher/fire equipment cabinets, eyewash stations and dryer boxes.

(CAZT) Concrete Blocks – This category covers concrete blocks investigated for use in fire-resistance designs as detailed in Fire-resistance Ratings - ANSI/UL 263 ([BXUV](#)). The solid and hollow blocks are composed of portland cement and fine and coarse aggregates. The aggregates include sand and gravel, cinders, blast furnace slag, burned shale, pumice, etc., using definite cement aggregate proportions, and of specific compressive strength. These are the types of CMU blocks referenced in firestop systems. The only way to identify them is the UL certificate supplied with the CMU blocks from the manufacturer.

11. Related Guide Information

There is a variety of supplemental information that can be found for the categories that cover passive firestopping in guides that are related to specific topics. These guides pertain to tested assemblies and are a helpful resource which are available for reference through the links below.

[XHBN GuideInfo - Joint Systems](#)

This guide provides information related to joint systems, which are specific constructions consisting of adjacent wall and/or floor assemblies and the materials designed to prevent the spread of fire through a linear opening between the wall and/or floor assemblies. The specifications for materials in a joint system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings. The individual components are not assigned ratings and are not intended to be interchanged between systems. Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

The certification of joint systems contemplate installation in heated and air-conditioned environments unless stated otherwise in the description of the system.

Materials used in the joint systems are intended to be installed in accordance with the manufacturer's instructions provided with the material. The structural integrity of the floor or wall assembly has not been investigated as a result of the openings.

[XHBO GuideInfo - Continuity Head-of-wall Joint Systems](#)

This guide provides information related to continuity head-of-wall joint systems, which are specific constructions consisting of the materials designed to prevent the spread of fire through a linear opening between a fire-resistance-rated wall and a non-fire-resistance-rated horizontal assembly. The specifications for materials in a continuity head-of-wall joint system and the assembly of the materials are details that directly relate to the established rating. Information concerning these details is described in the individual systems. The hourly Joint Ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve the specified rating. The individual components are not assigned ratings and are not intended to be interchanged between systems. Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

Each continuity head-of-wall joint system includes a published hourly Joint Rating. The hourly Joint Rating is the period of time the system will meet the criteria of both an F Rating and a T Rating as defined in ASTM E2837, "Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies."

The certification of continuity head-of-wall joint systems contemplate installation in climate-controlled environments unless stated otherwise in the description of the system.

Materials used in the continuity head-of-wall joint systems are intended to be installed in accordance with the manufacturer's instructions provided with the material. The structural integrity of the nonrated horizontal assembly or wall assembly has not been investigated as a result of the openings.

[XHEZ GuideInfo - Through-penetration Firestop Systems](#)

This guide provides information related to firestop systems, which are specific constructions consisting of a wall or floor assembly, a penetrating item passing through an opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings. The specifications for materials in a firestop system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings. The individual

components are not assigned ratings and are not intended to be interchanged between systems. Additionally, the substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

[CFTV.GuidelInfo - Precast Concrete Units](#)

This application guide provides information related to precast concrete units investigated for use in fire-resistance designs as detailed in Fire-resistance Ratings - ANSI/UL 263 ([BXUV](#)). The concrete units are precast hollow or solid slabs and planks, stemmed units, beams and joists intended for use in floor, roof or wall assemblies. The units are cast at the plant and consist of portland cement and fine and coarse natural or processed aggregates. The reinforcement may be welded-wire fabric, deformed bars, and/or high-tensile-strength-wire strand.

[QCSN.GuidelInfo - Wall Opening Protective Materials](#)

This category covers proprietary compositions that are used to maintain the hourly ratings of fire-resistive walls and partitions containing flush-mounted devices, such as outlet boxes, electrical cabinets, and mechanical cabinets. The individual certifications indicate the specific applications and the method of installation for which the materials have been investigated. Additionally electrical devices are intended to be installed in accordance with ANSI/NFPA 70, "National Electrical Code."

[CDHW Guideinfo - Luminaires, Luminaire Assemblies and Luminaire Enclosures Certified for Fire Resistance](#)

This category covers luminaires specifically investigated for installation in floor-ceiling and roof-ceiling designs are covered under Luminaires, Luminaire Assemblies and Luminaire Enclosures Certified for Fire Resistance. Refer to the individual certifications for details on the designs in which the luminaires have been investigated and found acceptable.

12. Plan Review

When it comes to the reproduction of the material contained in the Online Certification Directory, UL Product iQ, there are some rules that apply for reproducing and utilizing the designs on such things as construction documents or project plans.

UL permits the reproduction of the designs subject to the following conditions:

- a. The Guide Information, Assemblies, Constructions, Designs, Systems, and/or Certifications (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings).
- b. The statement "*Reprinted from Product iQ with permission from UL Solutions*" must appear adjacent to the extracted material.
- c. The reprinted material must include a copyright notice in the following format:
"© 202X UL Solutions" **Construction site inspections**

a. Verifying compliance

Firestop inspection is the verification of listed systems or engineering judgements being verified to be correctly installed in the field based on an ASTM inspection standard adopted by code. The inspection of firestop systems as referenced in the model codes may be performed by a professional engineer if they qualify as an inspector. ASTM has published Special Inspection Standards E-2174 "On-Site Inspection of Installed Firestop Systems" and E-2393 "On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers". These standards are referenced in model building, fire and life safety codes. The standards provide requirements for inspector qualifications, documentation from contractors, inspection form and reporting, scheduling, material verification and inspection frequencies. These documents provide the foundation of inspections for code authorities to verify code compliance.

b. Inspector training and qualifications

Firestop system inspector training and competency are critical skills for individual inspectors to competently perform firestop system inspections. Competencies and Job Performance Requirements (JPRs) are identified in ASTM inspection standards. These standards mandate that each inspector be acceptable to the code authority.

There are multiple industry testing programs that issue certificates for a passing test score, however, this in and of itself does not certify an inspector. Determination of competency is the duty of the code authority. Successfully passing an industry exam such as the UL Firestop exam may be used to demonstrate requisite knowledge of the inspector to the code authority.

ASTM E-3038 Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems is not specifically referenced in the inspection standards or required by model building, fire or life safety codes. However, this standard can serve as a guide to assist code authorities with assessing new inspector competency. This standard includes two years of training under a qualified inspector to gain practical experience in a wide variety of jobsite conditions, provide exposure to different manufacturers providing firestop systems and products that are available for the numerous potential types of penetrations requiring code compliant protection.

c. Inspection tools and equipment

Tools and equipment are not standardized as they will greatly vary based on the condition being inspected. Inspectors will likely need a measuring device (tape measure, steel ruler, calipers, feeler gauges) to determine annular space, joint size, spacing of items, size of penetrants, mineral wool compression or other items. A variety of cutting tools will be needed for destructive inspections of sealants. Other tools such as screw drivers and prying tools may also be needed. Caution should be used when removing portions of the firestop system being inspected to prevent false results such as when a malleable sealant thickness is reduced during extraction.

NOTE: Many sealants have shrinkage during cure cycles that must be taken into consideration as a system will reference wet thickness unless otherwise noted. Consult

manufacturer's product listing under CCN [XHHW](#) for shrinkage volume to determine inspection results accurately.

d. The firestop inspection process

Performing a firestop inspection can be conducted in one of two processes in accordance with the ASTM standards. Option one is to witness the installation and option two is to conduct destructive testing. The volume or frequency of the inspection varies based upon what option is selected and differs based on firestop penetration versus joint system as indicated in the standards. Penetrations require randomly witnessing of 10% of each type of firestop system installed OR destructive verification of a minimum of 2%, but not less than one, of each firestop system shall be inspected per floor or each area of a floor when a floor is larger than 10,000 sq ft. An area consists of 10,000 sq ft or less. Joint systems require randomly witnessing 5% of total linear feet of each type of fire resistive joint system being installed or destructive verification sampling once every 500 linear feet per installed system. Regardless of the inspection method chosen, the inspector is still required to visually verify that all firestopping was installed. This is considered a representative sample of the installed systems, or a periodic inspection as required by the chapter for *Special Inspections and Tests* in the IBC, not a continuous inspection.

Inspection failures can occur on every project due to a variety of issues that range from unqualified installers to continued construction activities that impact previously installed systems such as a trades person who connects another section to pipe or conduit on the adjacent side of the wall or floor and disturbs the firestop. This requires the repair and reinspection of that system and the additional inspection of a similar system in that area. The reinspection is intended to determine if the failure is localized or widespread so repairs can be properly accomplished.

The firestop inspection process is not detailed in standards as it's impossible to cover all the conditions that could be encountered. Various associations have guidelines or recommended practices. Firestop inspectors should consult with the local code authorities for approval as an inspector and to determine the requirements.

e. Post-Inspection Repair

Upon completion of the inspection activities, it is imperative that any joints or penetrations which have been subjected to the destructive inspection methods be repaired. Proper repair may require reapplication of the specified materials and or systems as indicated by the product manufacturer and listing instruction. As a best practice, the firestop installer should be on-site and follow the inspector to make needed repairs Immediately.

14. Maintenance

Determining when maintenance is required depends on which of the model fire codes are adopted by the jurisdiction (IFC, NFPA 1 or others). The maximum timeframe between conducting a maintenance inspection may vary but the intent of the model codes is consistent with the intent to maintain the level of protection (fire containment) from the date of initial construction through the life of the building. Continuously maintaining passive fire protection systems is imperative as they can be damaged during the life of the building. In some cases there could be movement of penetrants such as seen from water hammer that damages systems not designed for the movement. It is not uncommon for new penetrants to be added to assemblies or remodels of buildings to have unforeseen impacts on systems.

15. Field programs

a. Qualified Firestop Contractor Program ([QFCP](#))

There are management system-based contractor qualification programs offered by Nationally Recognized Testing Laboratories (NRTL) such as UL Solutions and others. The UL Solutions program lists the qualified contractors within the Product iQ database under the product categories [RFTI](#) and for Canada [RFTI7](#). The specialty firestop contractors qualified by UL Solutions or other Nationally Recognized Testing Laboratories (NRTL) undergo a vigorous audit annually for compliance with a quality management system at the company office and a jobsite visit is conducted to verify the processes and procedures in place are being utilized. The specialty contractors are required to maintain extensive documentation for management, staff training, quality control and other items as part of the ten quality elements subject to the audit. Use of a specialty contractor can provide projects with someone who understands firestopping systems, nomenclature, products and can provide the required documentation to facilitate expedited inspections and approvals.

b. A Master Audit Certificate of Compliance (MACC)

A voluntary certificate offered as part of the [UL Solutions Qualified Firestop Contractor Program](#). The MACC is a renewable, structure specific certificate issued by UL Solutions to a qualified contractor to verify the contractor was fully audited on the project and complied with the stringent 10 element program requirements. This certificate can be used as evidence of compliance for annual maintenance required in the code.

c. Firestop Inspections

UL Solutions offers Firestop Special Inspections as a qualified third party as referenced in the model building, fire and life safety codes. Firestop Systems is the only industry where UL Solutions tests the products, lists the systems, qualifies manufacturers to write engineering judgements, qualifies installers and provides inspection services. This full spectrum offering is in response to both the number and severity of historic fire events

linked to failure of fire containment and the need to better educate all the stakeholders in this industry with the requisite knowledge and experience to help ensure compliance with model code requirements for fire containment. UL Solutions has a Firestop Special Inspection label that is serialized and can be applied to inspected systems or judgements at the option of the building owner or code authority to verify code compliance. The serial number on the label can tie back to inspection reports for further inspection evidence of compliance.

Appendices

Appendix A - Codes and Standards

Firestop systems and joint systems have been investigated for installation in accordance with the following model codes:

- [International Building Code \(IBC\)](#)
- [International Fire Code \(IFC\)](#)
- [NFPA 1 – Fire Code](#)
- [NFPA 101 – Life Safety Code](#)
- [NFPA 5000 – Building Construction and Safety Code](#)
- [NBCC – National Building Code of Canada](#)

These model codes specify where firestop systems and joint systems are required to be installed in fire resistance-rated construction, the standards to which these systems are tested and certified and the related installation and maintenance requirements.

Appendix B - Resources

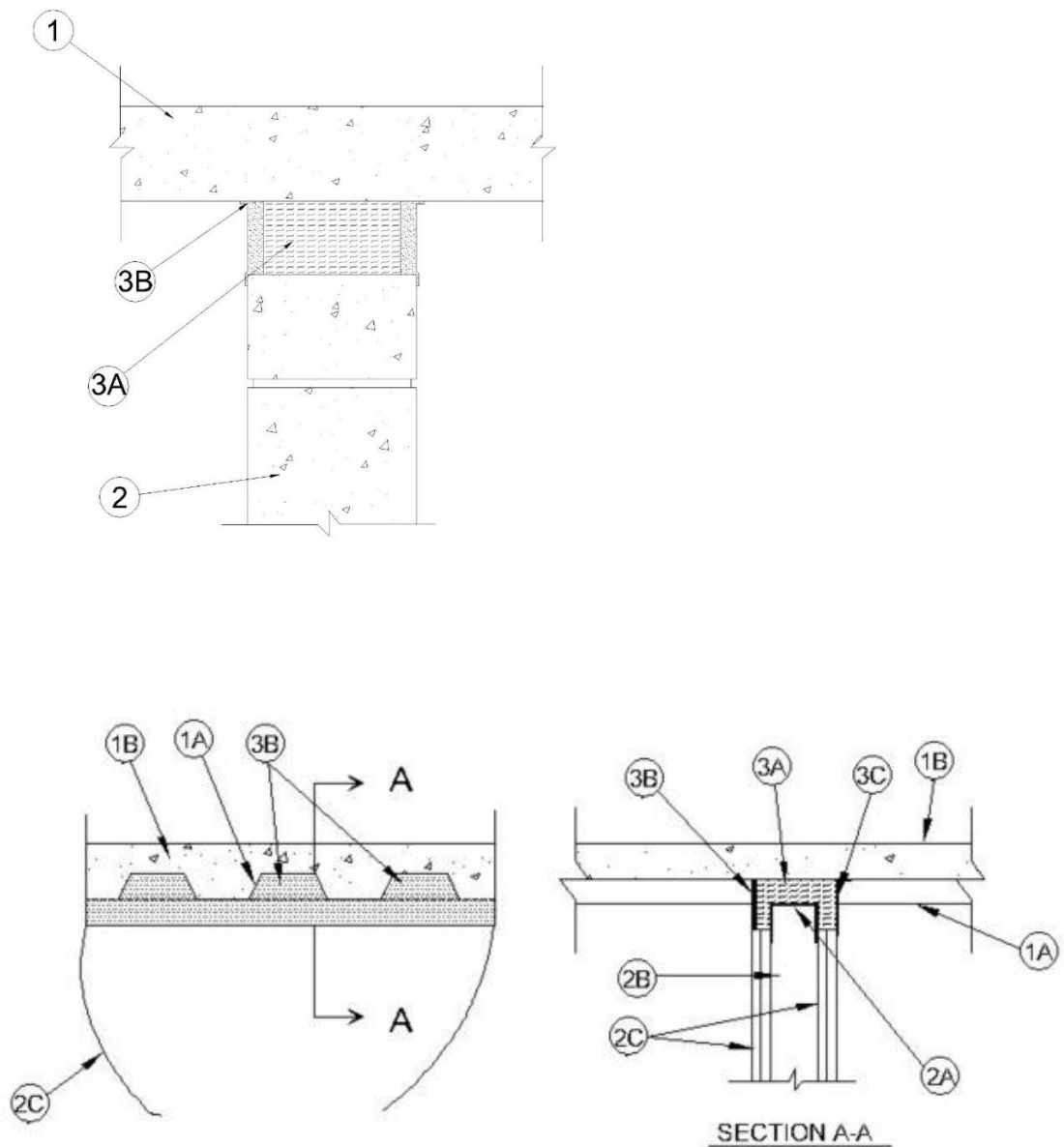
- [Fire Barrier Management](#)
- [Qualified Firestop Contractor Program](#)
- [UL and ICC Announce New Firestop Credentialing Program](#)
- [UL Solutions Updates Firestop System Numbering Scheme](#)
- [Firestop Systems in CLT Construction | UL Solutions](#)
- [Firestop Contractors International Association \(FCIA\)](#)
- [International Firestop Council \(IFC\)](#)
- [Demonstration Of Proper Vs Improper Firestopping](#)
- [Inspecting Firestop for Compliance](#)
- [Gypsum Association](#)

DIAGRAMS OF COMPLETE ASSEMBLIES

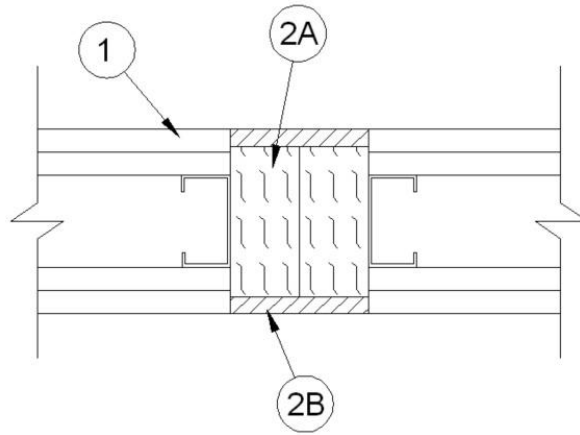
Below are some typical diagrams used in listed systems. The systems call out the individual elements that are performance factors in testing. Firestopping is not a product solution but a system that only achieves a rating if all elements are constructed correctly and in accordance with the listing.

A. Fire Resistive Joint Systems

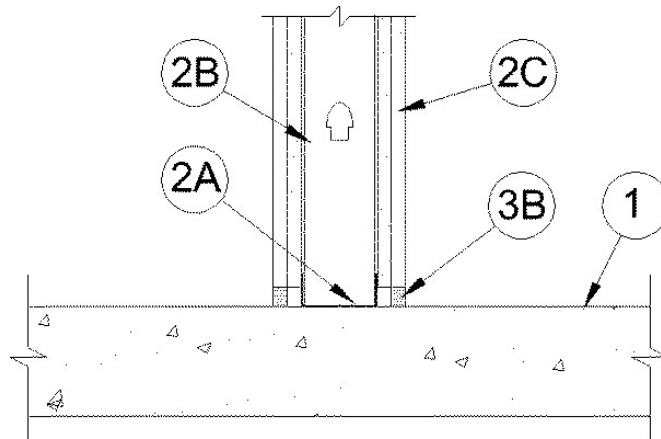
Head Of Wall Joint Systems



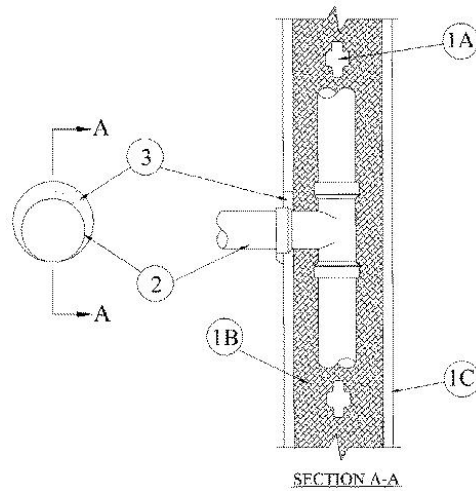
Wall to Wall Joint System

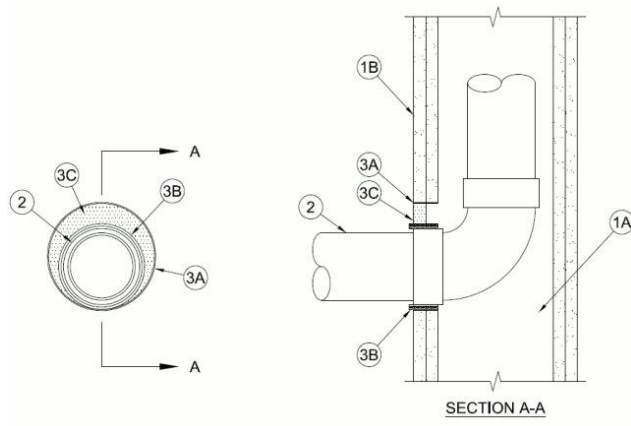


Bottom of Wall Joint System

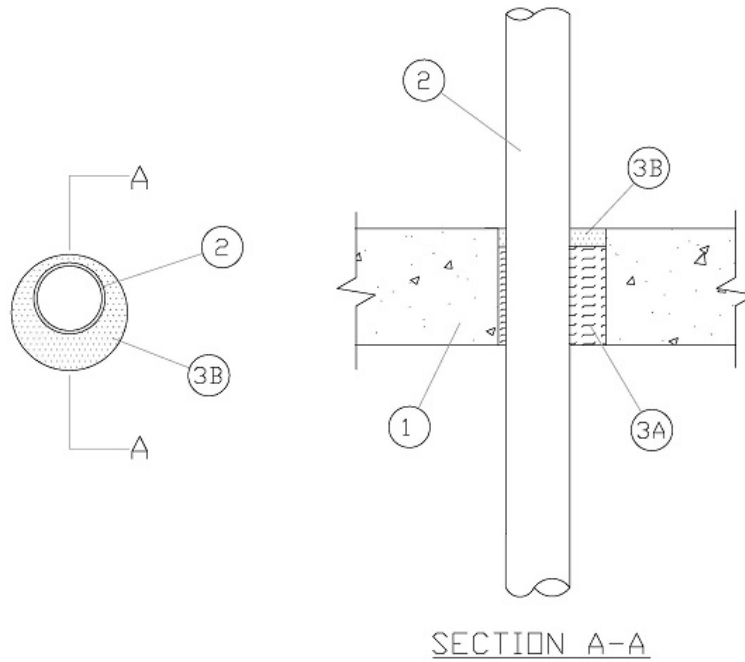
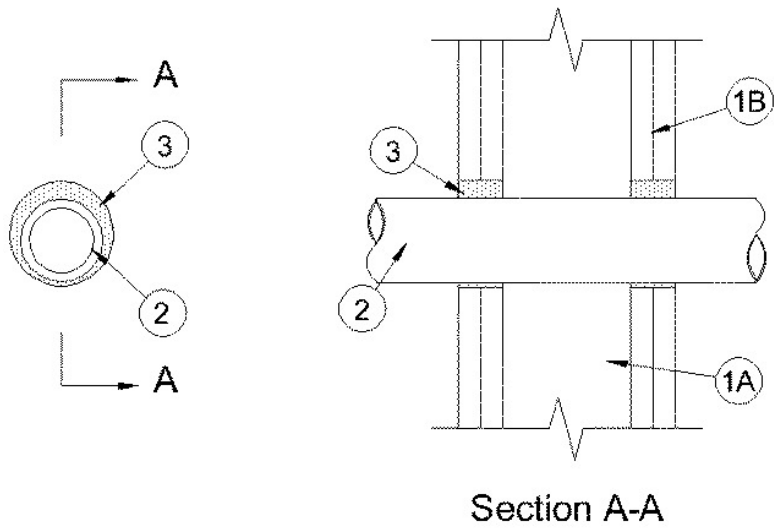


B. Membrane Penetration Systems





Through Penetration Firestop Systems



Appendix C - Technical Evaluation Developer Program

The Technical Evaluation Developer program provides a quality management scheme for firestop manufacturers who issue technical evaluations. The scheme is limited to manufacturers who utilize UL Solutions for services involving firestopping, joint systems, perimeter fire containment and duct products. Manufacturers who have successfully completed the enrollment for the Technical Evaluation Developer Program are included on [UL Product iQ](#) in the category [WYGB](#). Each company's listing will include the scope of program participation and the applicable standards.

Clients participating in the program must meet the Program Requirements as defined by UL Solutions. The Program Requirements includes such steps as quality management scheme audits, random selection of technical evaluations for laboratory testing and knowledge checks of the manufacturer's technical staff. Program participants must renew their listing every year to maintain participation in the scheme.