INSPECTION GUIDEBOOK

For Fire protection Installation

May, 2024

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Intended for use

This guidebook is intended to provide construction professionals and code enforcement officials with general guidance on the inspection of various firestopping applications within fire rated construction. This guidebook is not intended to be all encompassing or to be used as a design guide. It is solely for information purposes only.

1. FIRE PROTECTION BASICS

Fire protection refers to the measures taken to prevent fires from igniting, reducing the impact of an uncontrolled fire, or extinguishing fires. There are three primary strategies for fire protection in construction:

Fig. 1

- **Detection:** Fire alarm systems are considered active fire protection, as their smoke and heat-detecting sensors respond to the presence of fire. These systems are designed to detect and alert building occupants and emergency response teams to the presence of smoke, fire, carbon monoxide or other fire-related emergencies within the building.
- **Suppression:** Fire suppression systems are also a part of active fire protection and are used to extinguish, control or, in some cases, entirely prevent fires from spreading or occurring. Sprinkler systems are the most commonly used form of suppression.
- **Containment:** Fire containment is achieved by creating robust fire compartments within a building that prevent the spread of fire and smoke and allow occupants to evacuate a building.

Fire detection and suppression systems are categorized as active fire protection systems that utilize smoke detectors, sprinklers etc. to detect and stop the fire, whereas fire containment is a passive fire protection system designed to help prevent the spread of fire or smoke.

1.1 Active and passive fire protection

- **Active fire protection** refers to anything that needs a follow-up action to help stop or combat a fire. This comes into action immediately after the fire starts. Examples include activation of fire sprinklers or the use of hoses, water spray or deluge until the fire is completely extinguished.
- **Passive fire protection** refers to components or systems of a building or a structure that slow or impede the spread of fire or smoke without system activation, and usually without movement. Examples include fire resistance rated walls, floors, glass, intumescent paint and coatings.

1.2 Compartmentation

Compartmentation is the key principle to ensure that there are physical (or “passive”) barriers in place to restrict the movement of fire and smoke within a building. The main objective of compartmentation is to contain a fire within a specific section of a building, limiting the passage of flames and smoke. This then allows more time for occupants to safely evacuate a building and to protect valuable assets. Architects, planners, engineers, and building owners all play a role in ensuring effective and well-designed compartmentation. As a criterion, the fire rating of the fire protection system in the fire rated assembly should be greater than or equal to the fire rating of the compartment itself.

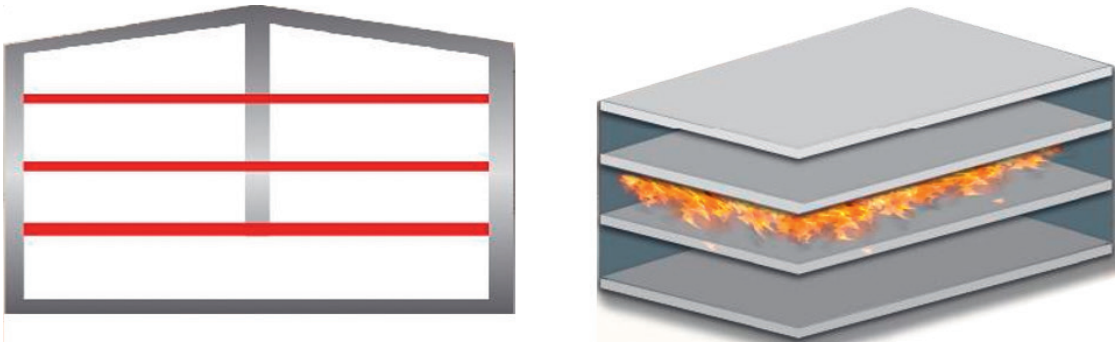


Fig. 2: Horizontal compartments along the height of the building

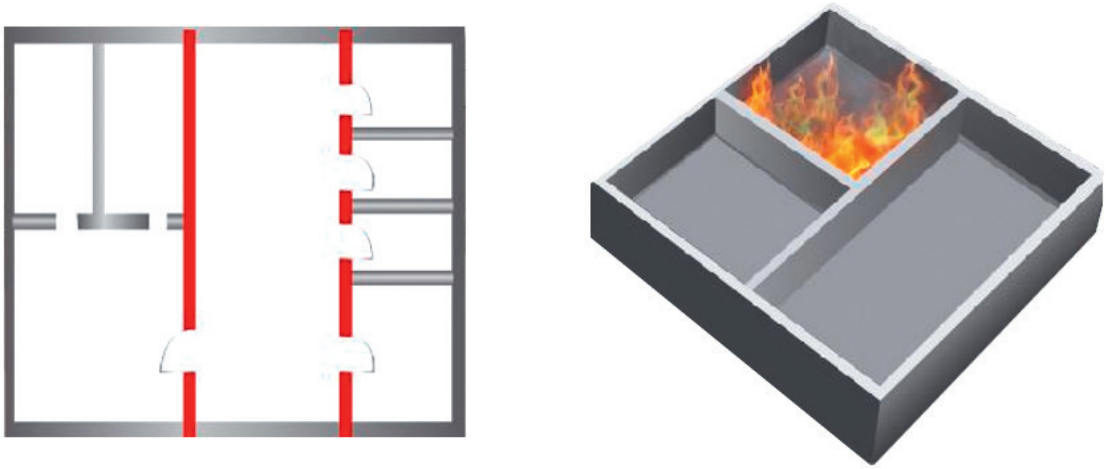


Fig. 3: Vertical compartments dividing the floor plan into sections

Compartments help stop the spread of fire, limit the fuel supply and cut off the supply of oxygen. Therefore, they attack the three main components of a fire: heat, fuel, and oxygen. Compartments also protect escape routes, such as corridors and stairs, allowing more time for occupants to safely evacuate the building and for firefighters to extinguish the flames.

The degree of sub-division that should be provided by fire compartments depends on various factors. Therefore, additional guidance is given by different local regulations based on:

1. The type and occupancy of the building (e.g., hospital, mall, hotel, residential or industrial building etc.)
2. The fire load in the building (e.g., storage room with hazardous liquids)
3. The height of the building (e.g., single story house or high-rise building)
4. The availability of a sprinkler system

1.3 Fire protection systems

Fire protection systems are designed and installed to impede the passage of fire and toxic smoke, with some systems designed to also restrict water and sound, through construction openings in fire-rated assemblies (walls and floors).

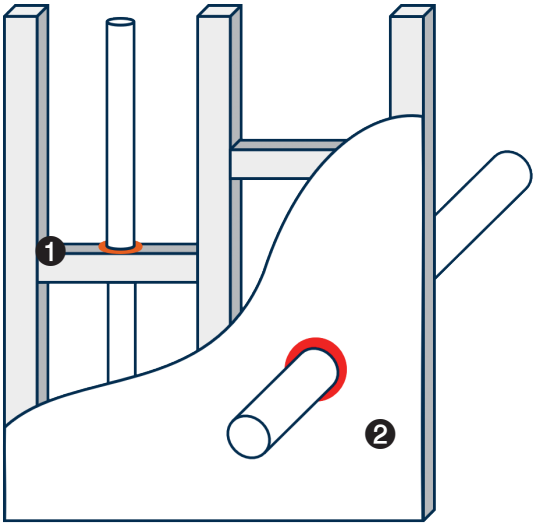
Throughout a building, the fire-rated assemblies are breached to allow the passage of piping, conduits, cable trays and other building system components to extend from room to room. In addition, openings or gaps between the wall and floor surfaces of the fire rated assemblies might exist to allow for movement or deflection of the assembly. To restore the integrity of the fire rated assembly, all the openings or penetrations need to be sealed to maintain the original fire rating of the assembly.

- **Through penetration fire protection systems** are used to restore the integrity of a fire-rated floor or wall assembly when a penetrating item passes through the assembly.
- **Fire resistive joint systems** are used to protect the joints or spaces installed within or between fire-rated assemblies.
- **Membrane penetration fire protection systems** are used to restore the integrity of a fire-rated wall assembly when only one side of the wall is penetrated.
- **Perimeter fire containment systems,** which are specific constructions consisting of a floor with an hourly fire rating, an exterior curtain wall with no hourly fire rating, and material installed to fill gaps between the floor and the curtain wall to prevent the vertical spread of fire in a building.

2. DIFFERENCE BETWEEN FIRESTOPPING AND FIREBLOCKING

Often times firestopping products and fireblocking materials are mistakenly interchanged. However, the purpose and application for using a firestopping product versus a fireblocking material differ as described below.

- **Firestopping** is a process whereby certain materials, some of them specially manufactured, are used to resist (or stop) the spread of fire and its byproducts through openings made to accommodate penetrations in fire-rated walls, floors and floor/ceiling assemblies.
- **Fireblocking** is defined as generic materials such as lumber, structural wood panels, gypsum board, cement fiberboard or particleboard, batts or blankets of glass, or mineral wool, installed within concealed spaces to resist or block the migration of fire and hot gases for an undetermined period. Fire blocking is used to subdivide or block off the stud cavity inside a wall, in a soffit over cabinets, between stair stringers at the top and bottom of a run, in an exterior cornice or in the space between the combustible finish materials and the wall itself.



❶ Fireblocking – the use of approved building material to resist or block the migration of fire and hot gases within concealed spaces.
❷ Firestopping – a form of fire protection that is used to seal around penetrations (openings) through a fire-rated wall or floor assembly.

Fig. 4: Difference between firestopping and fire blocking

3. FIRE PROTECTION CODES AND STANDARDS

3.1 Building codes requirements

Firestopping is well defined in the model building codes and safety codes. The various fire protection codes and standards help to define where firestopping is required within a building, the appropriate testing standards, and other requirements to ensure life safety. The following list references some of the relevant code sections related to firestopping.

- International Building Code (IBC) (2018 Edition)
  - Section 714.4.1.2 Through Penetration Fire protection (walls)
  - Section 714.4.2 Membrane Penetrations
  - Section 714.5.1.2 Through Penetration Fire protection (floors)
  - Section 714.5.4 Smoke Barriers
  - Section 715.1 Joints
  - Section 715.4 Curtain Wall
  - Section 715.6 Joints (Smoke Barriers)
- International Fire Code (IFC) (2018 Edition)
  - Section 701.2 Fire Resistance Rated Construction
  - Section 701.3 Smoke Barriers
  - Section 701.4 Smoke Partitions
- NFPA 101: Life Safety Code (2018 Edition)
  - Section 8.3.4.1.1 Penetrations
  - Section 8.3.4.7.1 Membrane Penetrations
  - Section 8.3.5 Joints
  - Section 8.3.5.4.1 Curtain Walls and Perimeter Joints

Apart from these international standards, we also have a few local standards cross-referring to international standards.

- **India:**
  - National Building Code 2016
  - IS 12458: 2019 – Fire Resistance of Through Penetration Fire protections
  - IS 18190: 2023 – Fire Resistance of Perimeter Fire Barrier Joint System
- **Philippines:**
  - RA9514 The Fire Code of The Philippines (revised 2019)
  - National Building Code of The Philippines (P.D. no. 1096)
  - 2012 Philippine Mechanical Engineering Code
  - Chapter 9 on A. Smoke-control systems and B. Fire protection Protection – cross-refers to ASTM E814, ASTM E119
  - Philippine Electrical Code (2017)
  - Section 3.0.1.21
- **Indonesia:**
  - SNI 03-1736-2000: Procedure for Planning Building Structures to Prevent Fire Hazards in Buildings
  - Cross-refers to Building Code of Australian 1966
  - Ministry Public Works Regulation No 26/2008
- **Thailand:**
  - Fire regulation no. 47 on “existing buildings” and no. 33 on “New buildings”
  - EIT 3002-51 (based on NFPA 101)
  - DPT 8301-52, 8302-52, 8303-52

3.2 Applicable standards

Test standards relevant to fire protection systems:

1. ASTM E 1399 “Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems”
2. ASTM E 1966 (ANSI/UL 2079) “Standards Test Method for Fire-Resistive Joint Systems”
3. ASTM E 2174 “Standard Practice for On-Site Inspection of Installed Fire protections”
4. ASTM E 2307 “Standard Test Method for Determining the Fire Resistance of Perimeter Fire Barrier Systems Using the Intermediate Scale, Multi-Story Test Apparatus”
5. ASTM E 2336 “Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems”
6. ASTM E 2393 “Standard Practice for On-Site Inspection of Installed Fire Resistive Joint System and Perimeter Fire Barriers”
7. ASTM E 2750 “Standard Guide for Extension of Data from Fire protection Penetration System Tests Conducted in Accordance with ASTM E814”
8. ASTM E 814 (ANSI/UL 1479) “Standard Test Method for Fire Tests of Through-Penetration Fire protections”
9. ICC ES AC179 “Acceptance Criteria for Metallic HVAC Duct Enclosure Assemblies”
10. ISO 6944 “Fire Resistance Tests – Ventilation Ducts”

4. THIRD PARTY TESTING AGENCIES

There are several independent testing laboratories, also referred to as third party testing agencies, which perform fire testing of fire protection manufacturer products in accordance with a specific fire test standard. After successful completion of the fire tests, the agencies generate details of the tested fire protection systems. These details are usually included as design listings in the fire resistance directories published by the testing laboratory. These directories are an important source of information during the plan review process and inspection process.

The following are some of the recognized independent laboratories conducting tests of fire protection systems:

1. Underwriters Laboratories Inc. (UL), Northbrook, IL
   (847) 272-8800, www.ul.com
2. Southwest Research Institute San Antonio, TX
   (210) 522-2311, www.fire.swri.org
3. Factory Mutual Norwood, MA
   (781) 762-4300, www.fmglobal.com
4. Intertek Testing Services, San Antonio, TX
   (210) 625-8100, www.intertek.com

4.1 Identification guide (UL)

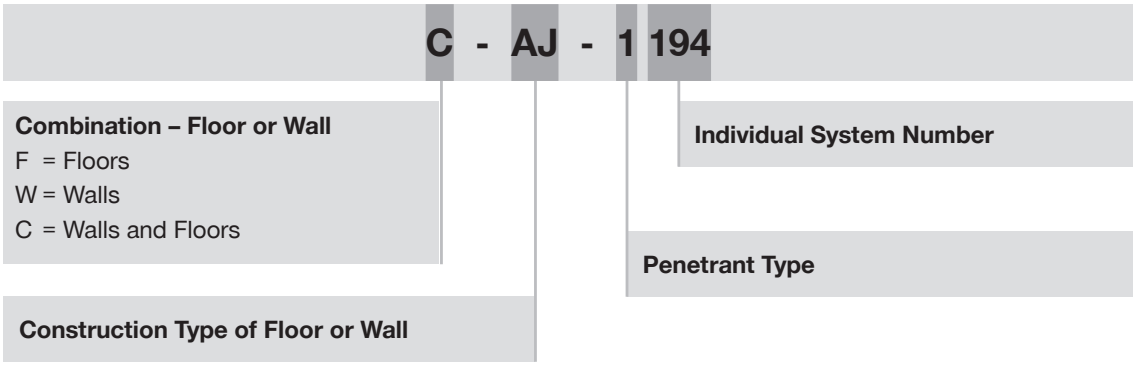
To identify the most relevant or closest UL fire protection system that meets a contractor's unique site requirement, one should be aware of the different nomenclatures UL follows to categorize its various documents.

For each category/type of fire protection system, UL has a separate UL Category Control Number
- XHEZ (Through-penetration fire protection systems)
- XHBN (Joint systems)
- XHHW (Fill, void, or cavity materials)
- XHDG (Perimeter fire containment systems)
- CLIV (Wall opening protective materials)

To further narrow down the search within the category control number, UL uses the following nomenclature rules.

4.2 Nomenclature for penetrations

Fire protection systems are identified in this category by an alphanumeric identification system. The first alpha component identifies the type of assembly being penetrated i.e. walls, floors or both. The second alpha component identifies the material of assembly being penetrated and the numeric component identifies the type of penetrating item in a sequential format.



Second letter(s) provide more info on wall/floor:

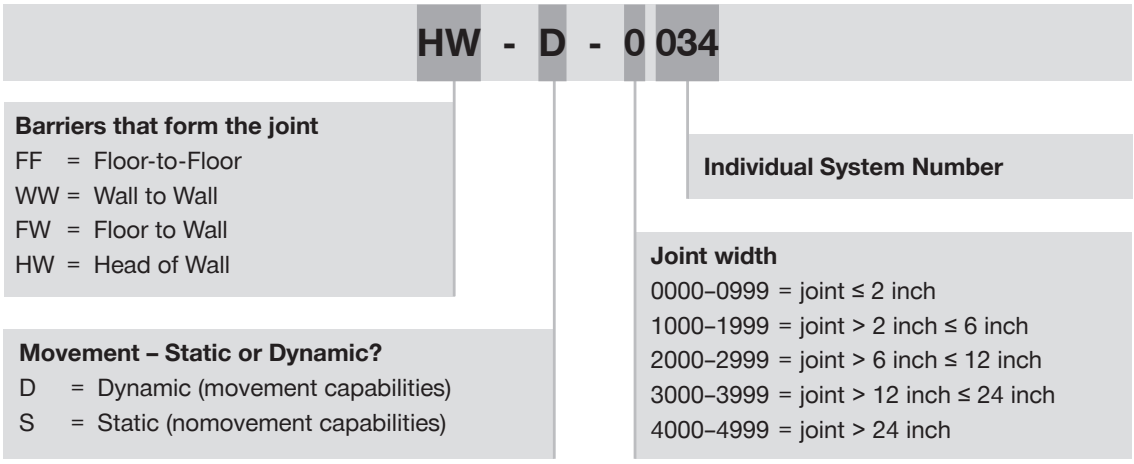
- **A:** Concrete floors ≤ 5 inches thick
- **B:** Concrete floors > 5 inches
- **C:** Framed floors – floor/ceiling assemblies
- **D:** Steel deck construction
- **J:** Concrete or masonry walls ≤ 8 inches thick
- **K:** Concrete or masonry walls > 8 inches thick
- **L:** Framed walls – gypsum wallboard assemblies

1st digit describes the penetrating item(s):

- **0:** Blank openings
- **1:** Metal Pipe, conduit, or tubing
- **2:** Non-metallic pipe, conduit or tubing
- **3:** Cables
- **4:** Cable trays
- **5:** Insulated pipes
- **6:** Miscellaneous electrical (busways)
- **7:** Miscellaneous mechanical (ductwork)
- **8:** Groupings of penetrations, including any combination of items listed above

4.3 Nomenclature for joints

The joint systems are identified by an alphanumeric identification system. The first two alpha characters identify the type of joint system. The third alpha character is either S or D. The S (static) signifies joint systems that do not have movement capabilities. This D (dynamic) signifies joint systems that do have movement capabilities. The numeric component uses sequential numbers to identify the nominal width of the joint systems.



5. LISTED FIRE PROTECTION SYSTEMS

A UL/CUL listed fire protection system contains complete information about a tested system as per ASTM and/or Canadian standards. It shows a typical assembly of all involved components/parameters with their detailed description. It mentions overall fire rating of the testing system along with a few possible variations of different parameters, the size range of different penetrating components, plus different possible materials. It also provides a list of all applicable product ranges for the given assembly.

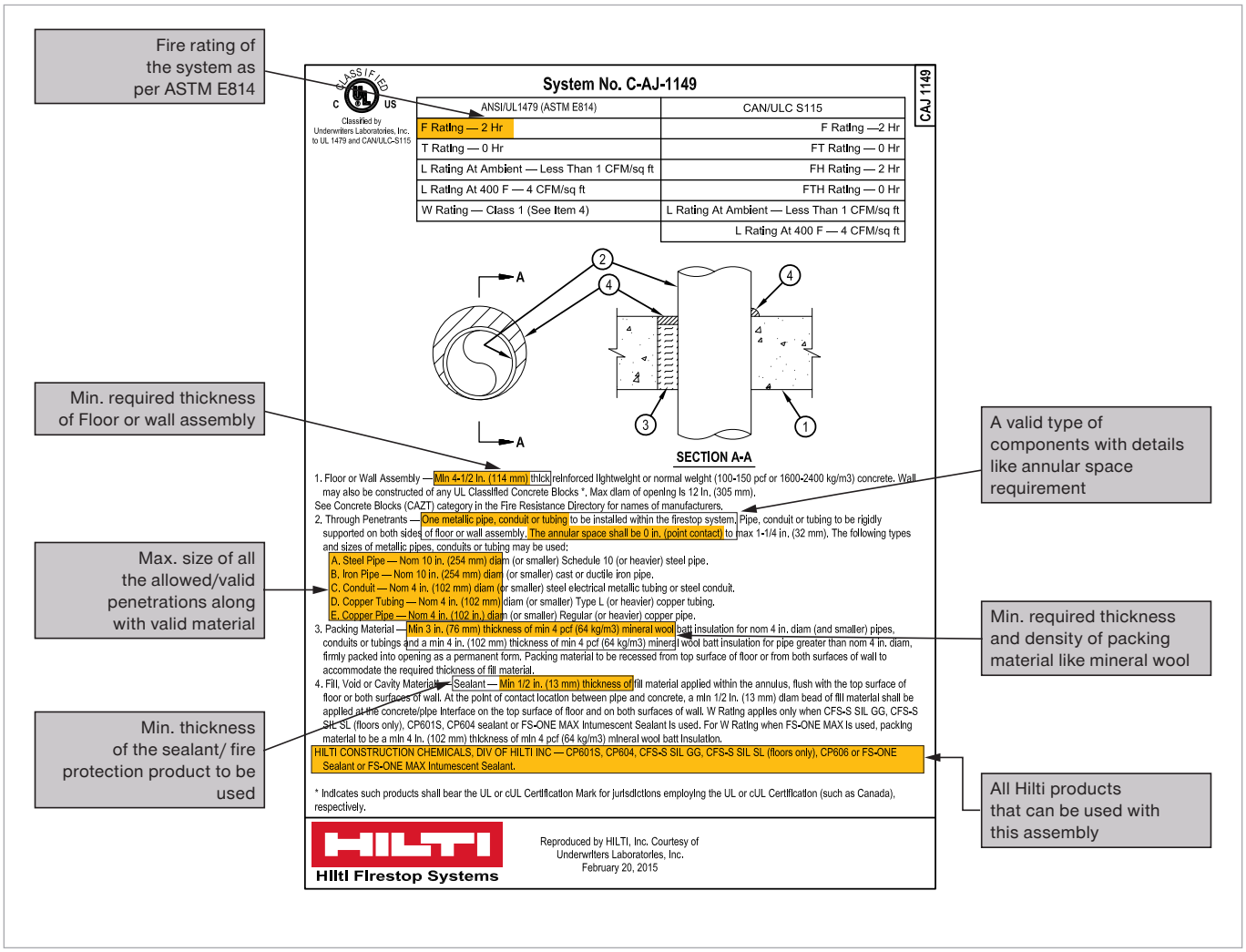


Fig. 5: Sample UL listing of through-penetration system

A UL system gives you information on different variations for a particular assembly/system. It is a complete document and considered credible among all the countries following UL/ASTM standards. One should first check the availability of a tested system for a particular arrangement onsite. If it is not available, only then the contractor should use the manufacturer's engineering judgment (EJ) services.

The performance of various materials is heavily dependent on sealing of the site system according to the tested one.

It is important to check the annular gap between penetrants in case of multiple penetration. The gaps should be according to the tested system, otherwise it could result in deviation from the required fire rating

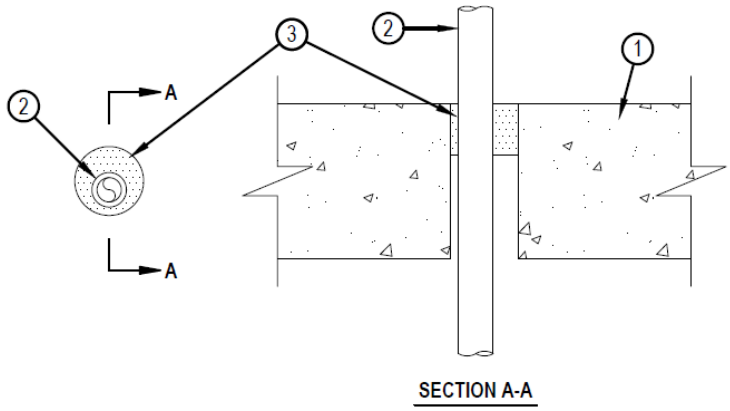


Figure 6 Annular gap in a pipe penetration

System tested for closed pipe cannot be used to create EJs for open pipe and vice-versa. For closed systems, the unexposed side (non-fireside) of the through penetrating item is capped or sealed during the test. The exposed side is always capped or connected whereas open pipe is not pressurized and is not connected to anything or open to atmosphere at atleast one end.
Application of firestopping material on dampers should be avoided as it can hamper the proper functioning of dampers. If it is not avoidable, approval from damper manufacturer should be attained beforehand.

Similarly, tested system should indicate the requirement of retaining angles. (Retaining angles are used to stiffen large ducts preventing it from bending in case of fire).

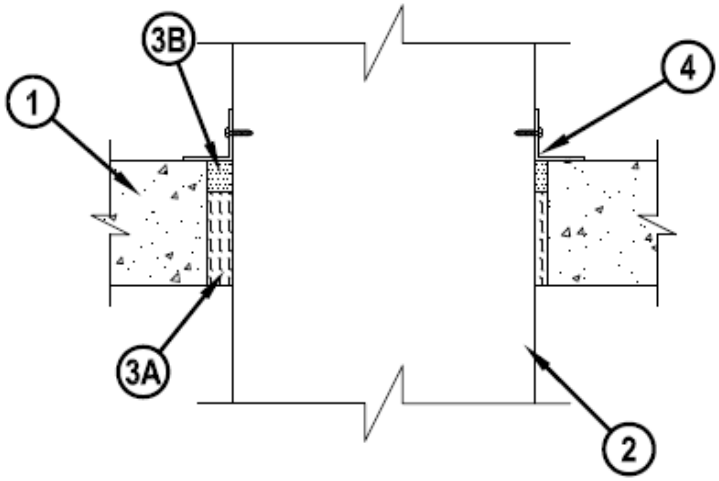


Figure 7 Retaining angle requirement is mentioned in a tested system

6. ENGINEERING JUDGMENTS (EJ)

At times, a contractor may encounter a unique jobsite condition for a firestopping application which has not been tested and listed. In such cases, customized engineering judgment (EJ) fire protection details are provided by the fire protection manufacturer for a single application or for an entire project to account for these unique applications.

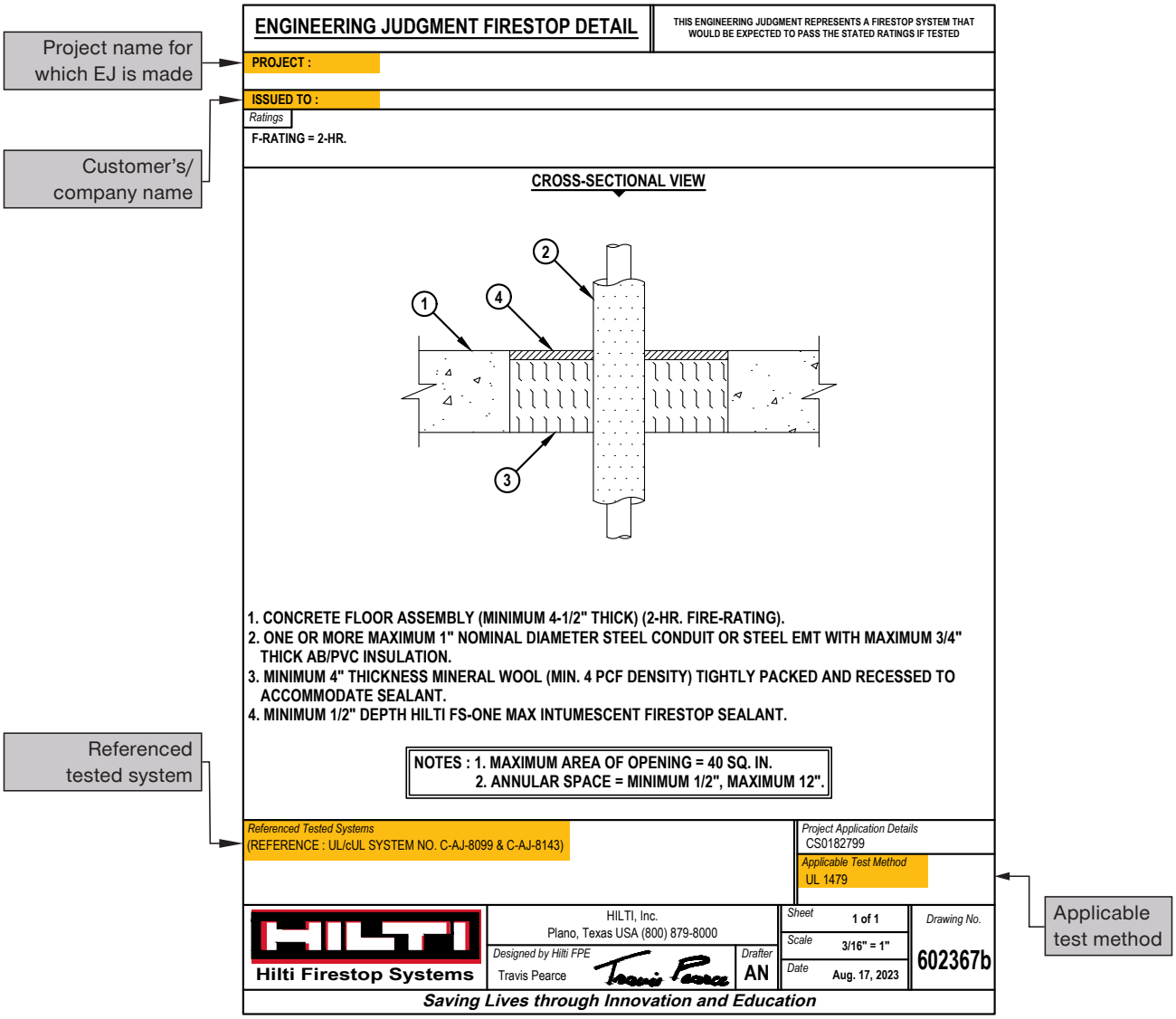


Fig. 8: Sample EJ provided by Hilti

Per International Fire protection Counsel (IFC) guidelines, engineering judgments are fire protection designs created by qualified personnel based off of third-party tested and approved systems. These designs are in accordance with the recommended IFC guidelines for evaluating fire protection system engineering judgments.

The International Building Code (IBC) justifies the use of engineering judgments as referenced under sections 703.2 Fire Resistance Ratings and 703.3 Alternative Methods for Determining Fire Resistance, IBC 2012. The testing and rating process ensures that each specifically designed system will maintain or exceed the hourly fire rating, as tested, for which it was approved.

Below are some of the fundamental guidelines recommended by the IFC for evaluating engineering judgments:

- Use tested systems in lieu of EJs when available.
- Issued only by qualified technical personnel.
- Issued for a single construction project and are not transferable to another job without review by the issuing entity.
- Issued only in those locales where local code enforcement jurisdictions permit their use as suitable for meeting building code requirements.
- Indicate clearly that the recommended fire protection system is an Engineering Judgment and NOT a listed system.
- Must identify the project name, contractor, non-standard conditions and required hourly rating.
- Shows the date of issue and authorization signatures as well as the issuer's name, address and telephone number.
- Must reference the number of the tested system(s) the design is based on.

The project plan submittals should clearly identify which details are based on engineering judgments and these details should be provided to the field inspector.

7. INSPECTION PROCESS

The performance of any passive fire protection system to impede the spread of smoke and fire is directly proportional to the quality of the installation. Fire protection inspections provide quality control and quality assurance that the fire protection systems installed on a project meet the required fire resistance requirements defined by the building code and local jurisdiction.

Inspection is performed by the fire department, however in most cases detail checklists and guidelines are not available nationally. The inspecting authorities may must follow ASTM E2174 “Standard Practice for On-Site Inspection of Penetration Fire protections” and ASTM E2393 “Standard Practice for On-Site Inspection of Fire-Resistant Joint Systems and Perimeter Fire Barriers”.

For an instance, Philippines Code --The National Building Code of The Philippines cross-refers to ASTM E2393, India Code --The Indian Facade standard IS 18903 cross-refers to ASTM E2307. These ASTM standards provide guidelines for conducting visual inspection and destructive testing of fire protection installations. Since it is not feasible to inspect every fire protection penetration or the entire length of a fire-resistive joint, the referenced ASTM standards for on-site inspection can provide general guidelines for the percentage of work to inspect.

The fire protection inspection process typically begins by obtaining the approved fire protection system documentation. During the construction phase, the Contractor should maintain documentation of all the listed fire protection systems and engineering judgments that were utilized on the project. These fire protection system details should serve as a blueprint for the fire protection installer to properly select and install the appropriate firestopping materials. These documents will also serve as a blueprint for inspectors when verifying the proper installation of the firestopping materials.

Some of the recommended guidelines and best practices for performing a quality on-site inspection of firestopping installations include:

- Coordinate/schedule the on-site inspection during the installation phase and again at a final walk-through.
- Contractor should not conceal any fire protection systems until after the work has been inspected and approved.
- Review the construction documents to identify the location of the fire rated wall/floor assemblies within the building.
- Obtain a copy of the approved fire protection system submittal package for the project.
- Compare the installed fire protection system with the corresponding fire protection detail within the approved submittal package.
- Observe empty containers, boxes, or other packaging to identify the specific firestopping products installed are as specified in the submittal package.

The following sections of this guidebook provide more detailed guidelines for inspecting specific types of fire protection systems on a project.

Fig.9: Sealant thickness measurement when wet

8. INSPECTION GUIDELINES FOR THROUGH PENETRATIONS FIRE PROTECTION SYSTEMS

When a building system component, such as plumbing piping, electrical conduit, cabling, etc, penetrates through a fire rated floor or wall assembly, the fire resistance integrity of that assembly is breached. An appropriate firestopping material must be installed per a tested fire protection system that matches the specific penetration application in order to restore the integrity of the fire rated assembly.

For firestopping of through penetrations, some of the commonly used firestopping materials include:

- Preformed fire protection products such as fire installation plugs (Hilti CFS-PL), fire protection collars (Hilti CP644) or wrap strips Hilti CP648-E for single pipe penetrations.
- Fire protection blocks (Hilti CFS-BL) for multiple pipe penetrations in large openings.
- Fire protection devices such as a fire protection speed sleeve (Hilti CP653) for cable bundles.
- Cast-in-place fire protection floor devices (Hilti CP680-P).
- Acrylic based fire protection sealants (Hilti CP606).
- Silicone based fire protection sealants (Hilti CFS-SP SIL).
- Intumescent fire protection seleants (Hilti FS-ONE MAX).

8.1 Steps for inspection

CHECK POINTS FOR THROUGH PENETRATIONS	OBSERVATION	COMMENTS
1) Is the hourly fire rating of the referenced fire protection system or EJ greater than or equal to the fire rating of the floor/wall assembly being penetrated?	Yes No N/A	
2) Does the floor or wall construction match the floor/wall assembly listed in the fire protection system or EJ?	Yes No N/A	
3) Does the penetrating Item(s) match the acceptable list of penetrants (material, size, diameter, insulation type and thickness, etc.) shown in the fire protection system or EJ?	Yes No N/A	
4) Does the field installation comply with the following requirements of the referenced fire protection system or EJ?	Yes No N/A	
a) Size of opening	Yes No N/A	
b) Minimum and maximum annular space requirements	Yes No N/A	
c) Proper backing material (when required)	Yes No N/A	
d) Proper firestopping product, including type, amount, thickness, orientation, etc.	Yes No N/A	
e) Proper accessories installed, including anchor/fasteners, mounting or cover plates, frames, etc.	Yes No N/A	
f) For multiple penetrants: proper distance between penetrating items	Yes No N/A	
g) For cables: allowable cable size, spacing, bundle size, and percent fill of opening	Yes No N/A	
5) For wall assemblies, verify that the field installation was installed properly on both sides of the wall	Yes No N/A	

8.2 Example comparison

8.2.1 Correct installation

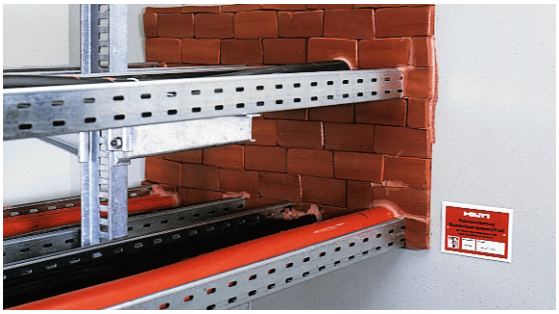


Fig. 10: Preformed fire protection block, Hilti CFS-BL Fire protection Block used for sealing large openings with multiple through penetrations. The fire protection block should be stacked with staggered seams within the opening

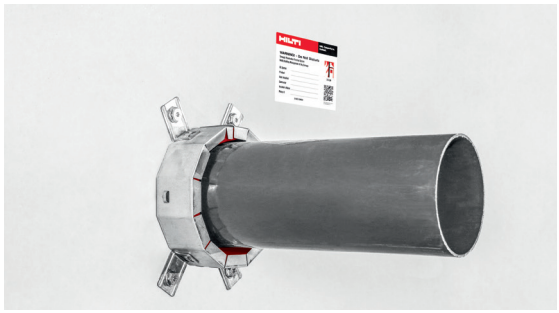


Fig. 11: Fire protection collar, Hilti CP-643 N, used for sealing large metallic pipes

Fig. 12: Speed sleeve with gang plate, Hilti CFS-SL GA used for small cable bundles

Fig. 13: Group of modular sleeves with gang plate for sealing multiple cable bundles of different sizes Hilti CFS-MSL GPA. Watch the video

Fig. 14: Fire protection cable disc, Hilti CFS-D used for sealing a cable bundle of size < 1 in. Watch the video

Fig. 15: Device flange should be secured to the top surface as per listed system Hilti CFS-DID

8.2.2 Incorrect installation

Fig. 16: Sealant not properly tooled leaving gaps in the installation

Fig. 17: Multiple cable collars Hilti CP-643 N used for sealing a large opening, leaving gaps in the installation

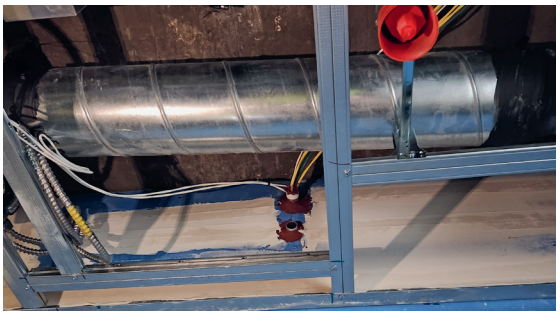


Fig. 18: Blank opening (bottom one out of two sealed small openings)

Fig. 19: Hilti CP 680 sleeve not cast into concrete

Fig. 20: Gaps in opening exist

Fig. 21: Incorrect installation of collar installed on top side of floor

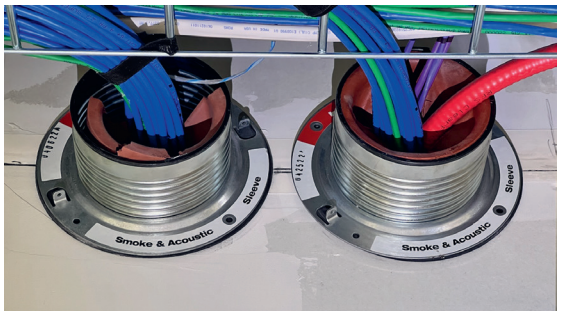


Fig. 22: Incorrect on the left as the red intumescent strip is not evenly distributed, leaving gaps. Correct on the right

9. INSPECTION GUIDELINES FOR FIRE RESISTIVE JOINTS

When a fire rated wall/floor assembly intersects another wall/floor assembly an opening or joint exists that needs to be properly sealed in accordance with a fire resistive joint system. The fire resistive joints occur at the top-of-wall (head-of-wall), bottom-of-wall, floor-to-wall, wall-to-wall, and floor-to-floor conditions.

Fire resistive joint systems are design to prevent the spread of fire through a linear opening between the two fire rated wall/floor assemblies. In addition, most joint systems also accommodate movement, compression and/or extension, of the joint.

For fire resistive joint systems, some of the commonly used firestopping materials include:
- Preformed fire protection products such as a fire protection top track seal (Hilti CFS-TTS)
- Flexible, silicone based fire protection sealants (Hilti CP606)
- Elastomeric fire protection sealants (Hilti CP601S)
- Water-based fire protection sprays (Hilti CFS-SP WB)

9.1 Steps for inspection

CHECK POINTS FOR JOINTS	OBSERVATION	COMMENTS
1) Is the hourly fire rating of the referenced fire resistive joint system or EJ greater than or equal to the fire rating of the floor/wall assembly?	Yes No N/A	
2) Does the floor and/or wall construction match the floor/wall assembly listed in the fire protection system or EJ?	Yes No N/A	
3) Is the fire resistive joint system tested for the amount of movement required for the assembly? Does it match the required class and type of movement?	Yes No N/A	
4) Does the field installation comply with the following requirements of the referenced fire resistive joint system or EJ?	Yes No N/A	
a) Minimum and/or maximum width of the joint	Yes No N/A	
b) Proper backing material (when required), including proper orientation and compression of backing material	Yes No N/A	
c) Proper firestopping product, including type, amount, thickness, orientation, etc.	Yes No N/A	
d) Proper accessories installed, including anchor/fasteners, mounting or cover plates, frames, etc.	Yes No N/A	
e) For fire protection spray products: does the applied fire protection spray overlap the adjacent surfaces properly?	Yes No N/A	

9.2 Example comparison

9.2.1 Correct installation

Fig. 23: Flexible fire protection sealant (Hilti CP606 - white) applied to both sides of the wall with mineral wool backing material

Fig. 24: fire protection sealant applied to the top-of-wall joint

Fig. 25: Hilti CFS-TTS used on top of wall joint
Watch the video

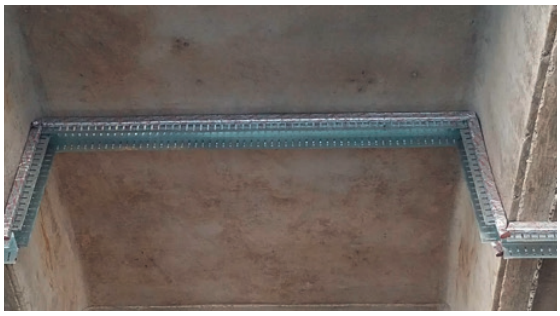


Fig. 26: Hilti CFS-TTS used on top of wall joint

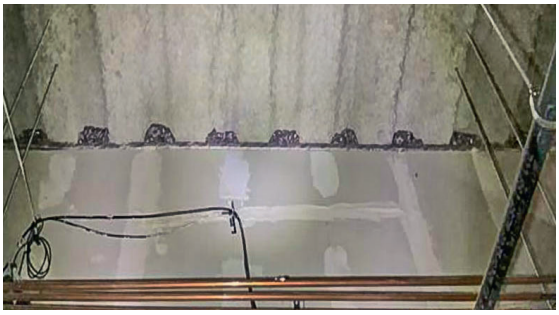


Fig. 27: Hilti CFS-TTS MD installed correctly per EJ

Fig. 28: Bottom track seal installed on floor runner

Fig. 29: Hilti CFS-TTS MD installed correctly per EJ

9.2.2 Incorrect installation

Fig. 30: Gap in application

Fig. 31: Inadequate width of the sealant/gap

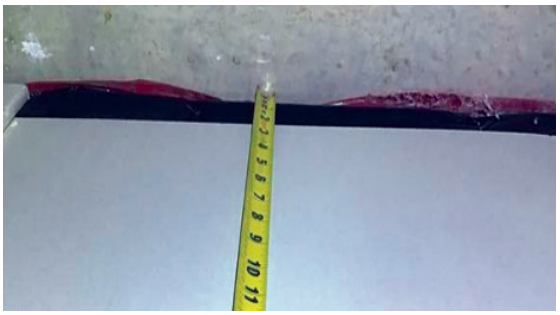


Fig. 32: Head of wall joint – width exceeded listed system

10. INSPECTION GUIDELINES FOR PERIMETER FIRE BARRIER SYSTEMS

A perimeter fire barrier system is designed to prevent the spread of fire through a linear opening between a fire rated floor assembly and a non-fire rated exterior wall assembly. The continuity requirements of the building codes state that the rating of a floor assembly must extend to and be tight against the exterior wall assembly.

For a perimeter fire barrier system, some of the common firestopping materials used include:
- Water based fire protection spray (Hilti CFS SP WB)
- Silicone based fire protection spray (Hilti CFS SP SIL)

10.1 Steps for inspection

CHECK POINTS FOR PERIMETER FIRE BARRIER SYSTEMS	OBSERVATION	COMMENTS
1) Is the hourly fire rating of the referenced perimeter fire barrier system or EJ greater than or equal to the fire rating of the floor assembly?	Yes No N/A	
2) Does the floor construction and the exterior wall construction match the floor/wall construction listed in the perimeter fire barrier system or EJ?	Yes No N/A	
3) Does the curtain wall construction comply with the following requirements of the referenced perimeter fire barrier system or EJ?	Yes No N/A	
a) Does the system include vision glass (if applicable)?	Yes No N/A	
b) Proper spacing of mullions and transoms?	Yes No N/A	
c) Proper mullion coverings (type, thickness, density, etc.)	Yes No N/A	
d) Proper curtain wall spandrel insulation (type, thickness, density, etc.)	Yes No N/A	
e) Proper spandrel panel perimeter angles or stiffeners (dimensions, gauge, fastener spacing, etc.)	Yes No N/A	
4) Does the field installation of the firestopping materials comply with the following requirements of the referenced fire resistive joint system or EJ?	Yes No N/A	
a) Minimum and/or maximum width of the joint	Yes No N/A	
b) Proper backing material installed including proper orientation, depth and compression of backing material	Yes No N/A	
c) Proper firestopping product, including type, amount, thickness, orientation, etc.	Yes No N/A	
d) Proper accessories installed, including support clips for backing material.	Yes No N/A	
e) For fire protection spray products: does the applied fire protection spray overlap the adjacent surfaces properly?	Yes No N/A	

10.2 Example comparison

10.2.1 Correct installation

Fig. 33: Sealant Hilti CP-672, application in edge of slab assembly

Fig. 34: Correct depth of sealant, Hilti CFS-SP SIL

Fig. 35: Comparison between CFS-EOS QuickSeal vs traditional method

10.2.2 Incorrect installation

Fig. 36: Cracked sealant coating

11. PERFORMANCE OF CONSTRUCTION MATERIALS UNDER FIRE

11.1 Mineral wool vs. insulation

Mineral wool is a key component used in many fire protection systems as a backing material for the fire protection sealant to be installed against when you have larger annular space.

The reason for its popularity as an ideal fire protection backing material is that it does not conduct heat and can resist temperatures over 1,000 °C. Since its density is over three times more than fiberglass insulation, mineral wool also offers better accoustic insulation properties. Other materials used on site for insulation purposes like foam, fiberglass insulation, backer rods, etc., usually burn easily and quickly in the event of a fire, thus are not suitable alternatives to mineral wool. When inspecting firestopping applications, it is imperative that the proper backing material is installed, including the proper orientation and compression, per the listed fire protection system. For the correct installation of Mineral Wool (MW), it needs to be cut perpendicular to the fibers and to assembled along the fibers to allow for the required compression.

11.2 Combustible and non-combustible pipes

Combustible and non-combustible pipes act in different ways in case of a fire due to the difference in their flammable properties.

Combustible pipes like plastic pipes (PVC) burn away creating a hole/opening in place of the pipe. Combustible pipe penetrations generally require intumescent materials to properly fire protection around the penetration. These could be an intumescent sealant or intumescent device such as a fire protection collar or fire protection cast-in device. Intumescent products consist of materials which rapidly expands when exposed to fire and seals or closes the annular space around the combustible pipe as it burns away.

Non-combustible pipes like metallic pipes does not burn. They melt leaving a char or residue behind. For non-combustible pipes, non-intumescent products such as flexible or elastomeric fire protection sealants are generally sufficient to properly fire protection a non-combustible pipe penetration. Different plastic pipes like polypropylene (PP), polypropylene random copolymer (PPR) have different composition, pipe thickness/schedule (SDR) and will act differently in case of fire. Thus, always refer to a tested UL fire protection system or engineering judgment which will identify the appropriate firestopping products to be installed for the specific application.

11.3 Compatibility with CPVC pipes

Chlorinated polyvinyl chloride (CPVC) is a thermoplastic produced by chlorination of polyvinyl chloride (PVC) resin. CPVC is significantly more flexible than PVC, has greater insulating properties than copper and can also withstand higher temperatures.

CPVC is easy to work with, including machining, welding and forming processes. It offers high corrosion resistance at elevated temperatures and it can be bent, shaped and welded, making it a better choice for wide variety of processes and applications. It also has fire-retardant properties.

When firestopping CPVC pipes, care must be taken not to allow the pipe to meet any material that may result in a failure. Incorrect sealant may contain phthalates and phosphate esters which can migrate from the sealant and into the CPVC pipe, which can then cause it to weaken, split or crack. Therefore, it is important that the products that are used in conjunction with these CPVC piping systems do not contain any of these components and are chemically compatible.

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