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AI IMPACT 2024
40th Annual FPC Seminar + Expo
Sept 29 - Oct 1, 2024

Introduction to Firestop & Quality Control
Review of Firestop Installations

Course Number: AHCA 14

Credit Designation: 1 LU/HSW

AIA CES Provider Number: E240

October 1, 2024

The seminar has teamed with a registered provider of AIA - approved continuing education under Provider Number E240. All registered AIA CES Providers must comply with the AIA Standards for Continuing Education Programs.
Any questions or concerns about this provider or this learning program may be sent to cessupport@aia.org or 800-242-3837 Option 3.

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AIA continuing education credit has been reviewed and approved by AIA CES. Learners must complete the entire learning program to receive continuing education credit. AIA continuing education Learning Units earned upon completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

AIA Learning Objectives

1 OBJECTIVE

Understand the key test standards related to firestopping in applicable codes.

2 OBJECTIVE

Understand the many variables that affect firestop performance.

3 OBJECTIVE

Apply basic firestop knowledge to understand the requirements of a firestop system to meet code requirements.

4 OBJECTIVE

Recognize key aspects of the firestop installation process to help evaluate correct or incorrect installation.

INTRODUCTION TO FIRESTOP & QUALITY CONTROL REVIEW OF FIRESTOP INSTALLATIONS

Tips and tricks for identifying quality firestop installations

AGENDA

- Firestop Foundations
- Reviewing Through-Penetration Firestop Applications
  - Non-Combustible Penetrating Items
  - Combustible Penetrating Items
  - Mixed/Multiple Penetrations and Large Opening
  - Additional Considerations
- Reviewing Joint Firestop Applications
- Special Inspection Requirements
- Firestop Resources

LEARNING OBJECTIVES

Upon completing this course, attendees should be able to:

- Apply basic firestop knowledge to understand the requirements of a firestop system to meet code requirements
- Recognize key aspects of the firestop installation process to help evaluate correct or incorrect installation
- Understand types of firestop inspection and be able to apply best practices for firestop review

FIRESTOP FOUNDATIONS

FIRESTOPPING IS A PRECISELY TESTED MEANS AND METHODS TO RESTRICT THE SPREAD OF FIRE AND SMOKE

International Firestop Council Definition

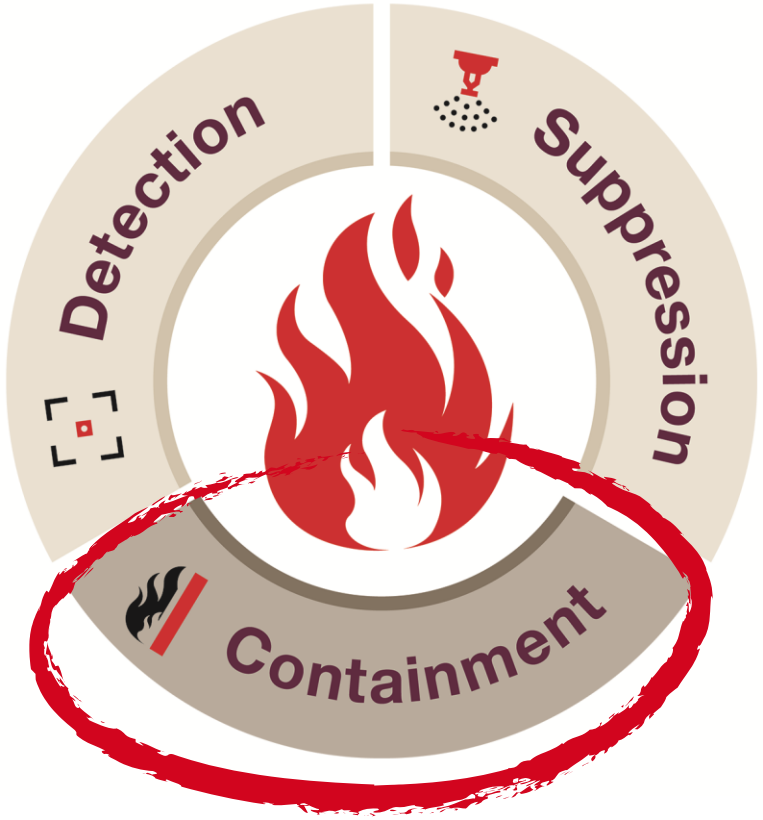
“A process whereby certain materials, some of them specially manufactured, are used to resist (or stop) the spread of fire and its byproducts through openings made to accommodate penetrations in fire-rated walls, floors and floor/ceiling assemblies.”

FIRESTOPPING IS A PRECISELY TESTED MEANS AND METHODS TO RESTRICT THE SPREAD OF FIRE AND SMOKE

Firestopping is necessary to protect lives

- Firestop systems, if installed correctly, will help restore the rating of a floor or wall as it is penetrated by an object or joint and resist the spread of smoke and fire
- It is part of the life safety plan in structures and gives people more time to safely exit a structure, even if they don’t react right away
- Mandated by the building codes (IBC, NFPA, NEC, etc.)
- NFPA and other investigations have confirmed that lack of proper firestopping has contributed to numerous large loss fires

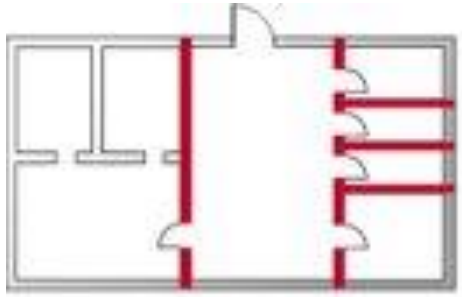
PROTECTING A BUILDING TAKES A BALANCED APPROACH; DETECTION AND SUPPRESSION ALONE ARE NOT ENOUGH

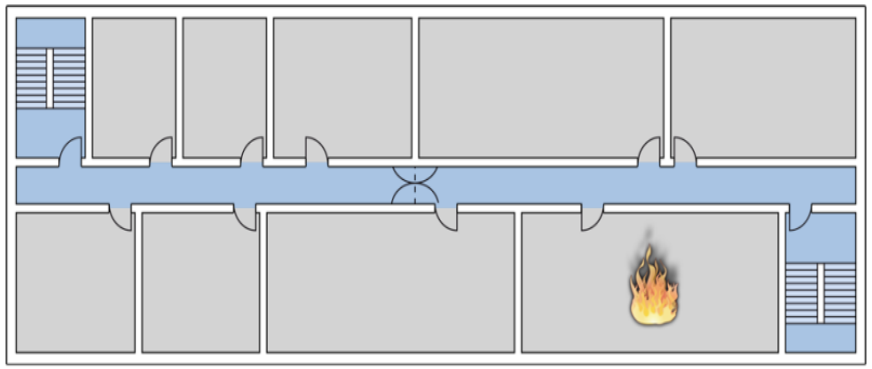


We cannot rely on any single action or safeguard to keep people safe

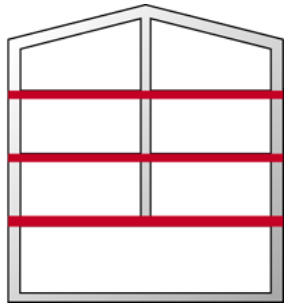
CREATING FIRE COMPARTMENTS WITH FIRE RATED WALLS AND FLOORS IS IMPORTANT TO ACHIEVE CONTAINMENT

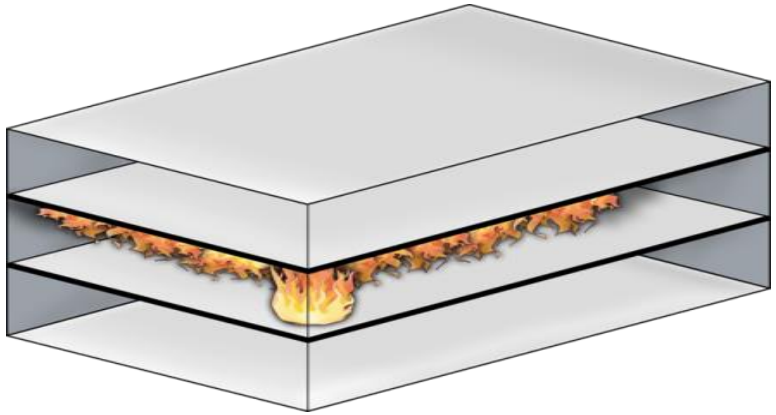
Fire Rated Walls



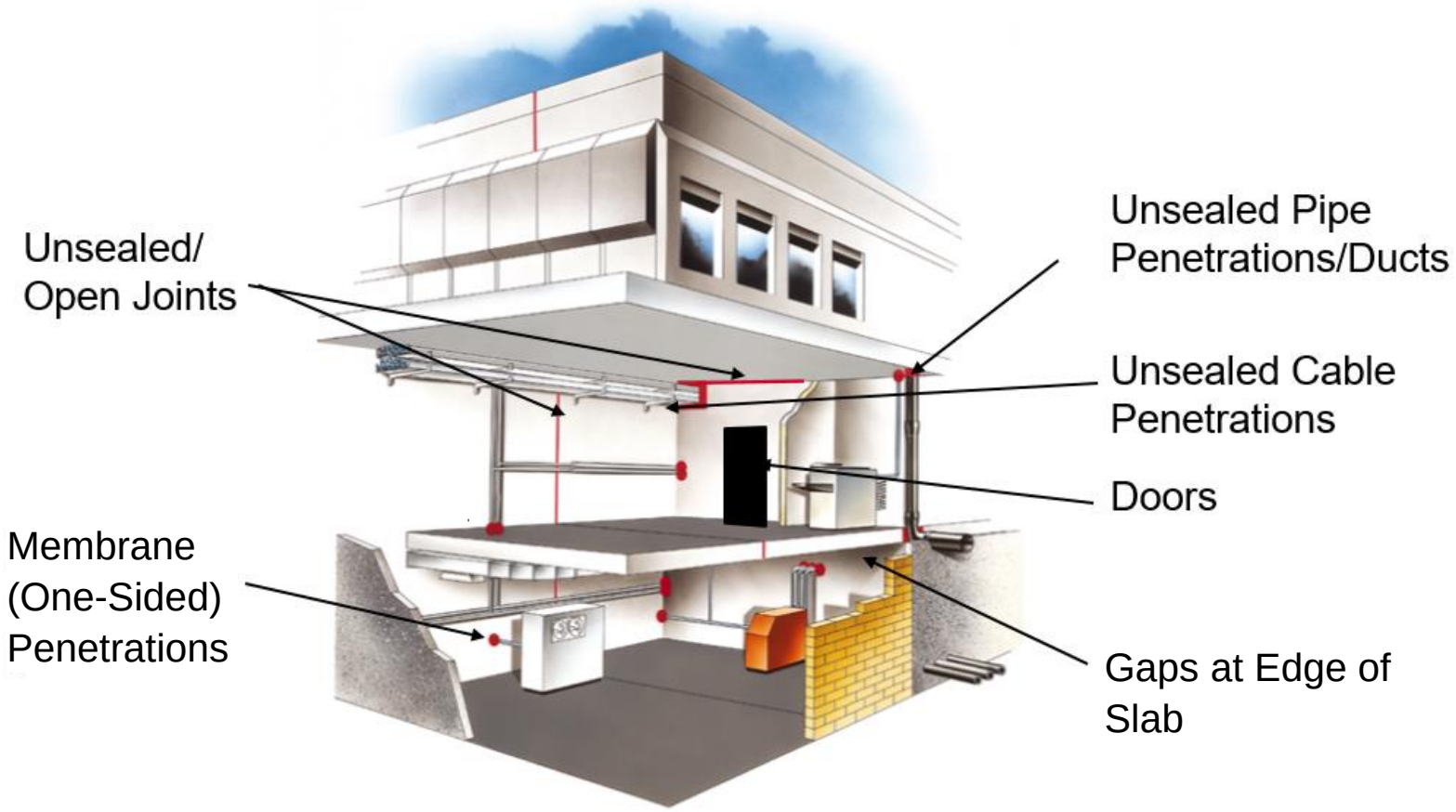


Fire Rated Floors





JOINTS AND PENETRATIONS COMPROMISE THIS COMPARTMENTALIZATION



Firestop restores the integrity of fire rated assemblies which restrict the spread of fire

INTERNATIONAL BUILDING CODE (2021) RELEVANT CODE SECTIONS AND FIRE TESTS

Code Section	Category	Referenced Test Standard
714.4.1.2	Through Penetrations (Walls)	ASTM E814 or UL 1479
714.5.1.2	Through Penetrations (Floors)	ASTM E814 or UL 1479
714.4.2	Membrane Penetrations	ASTM E814 or UL 1479
715.3.1	Fire Resistant Joints Systems	ASTM E1966 or UL 2079
715.4.1	Exterior Curtain Wall/Floor Intersection (Perimeter Joint)	ASTM E2307
1705.18	Special Inspections of Fire Resistant Penetration & Joints	Penetrations: ASTM E2174 Joints: ASTM E2393

Understanding the testing process is key to understanding how proper fire-resistant systems work

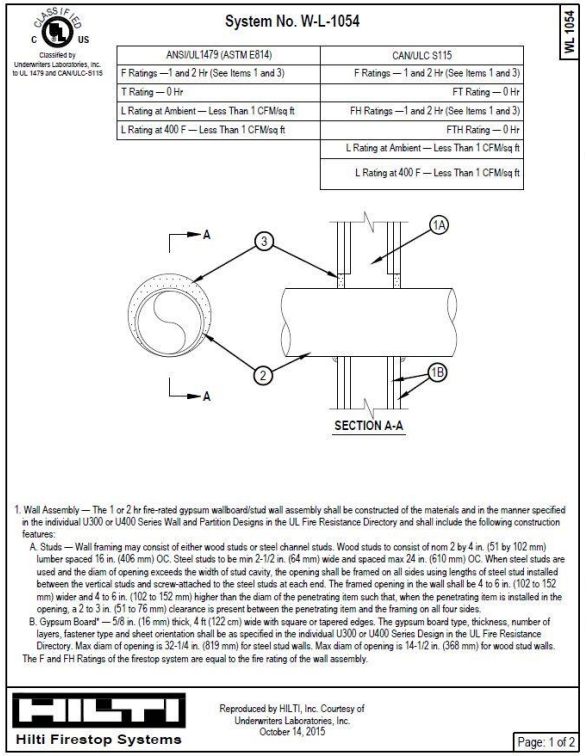
NATIONAL BUILDING CODE OF CANADA (2015) RELEVANT CODE SECTIONS AND FIRE TESTS

Code Section	Category	Referenced/Relevant Test Standard
3.1.9	Through Penetrations (Walls)	CAN/ULC-S115
3.1.9	Through Penetrations (Floors)	CAN/ULC-S115
3.1.9.4	Outlet Boxes in Rated Walls	CAN/ULC-S115
3.1.8.1	Fire Resistant Joints Systems	CAN/ULC-S115
3.1.8.1	Exterior Curtain Wall/Floor Intersection (Perimeter Joint)	CAN/ULC-S115 & ASTM E2307

Understanding the testing process is key to understanding how proper fire-resistant systems work

LISTED FIRESTOP SYSTEMS AND SUBMITTALS

- Tested firestop system are required for construction joints and through-penetration applications
- Applicable listings are used to demonstrate compliance of tested systems
- Firestop listings are the basis of installation that installers and inspectors should be referring to
- Installers should provide submittal packages which include all applicable listed systems for the project
  - Submittal packages should include product data sheets and other relevant technical information
- Inspectors or reviewers should use the submittal packages as a resource while reviewing firestop installations on a jobsite



System No. W-L-1054

WL 1054

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings —1 and 2 Hr (See Items 1 and 3)	F Ratings — 1 and 2 Hr (See Items 1 and 3)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating at Ambient — Less Than 1 CFM/sq ft	FH Ratings —1 and 2 Hr (See Items 1 and 3)
L Rating at 400 F — Less Than 1 CFM/sq ft	FTH Rating — 0 Hr
	L Rating at Ambient — Less Than 1 CFM/sq ft
	L Rating at 400 F — Less Than 1 CFM/sq ft

SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 32-1/4 in. (819 mm) for steel stud walls. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls.

The F and FH Ratings of the firestop system are equal to the fire rating of the wall assembly.

Hilti Firestop Systems

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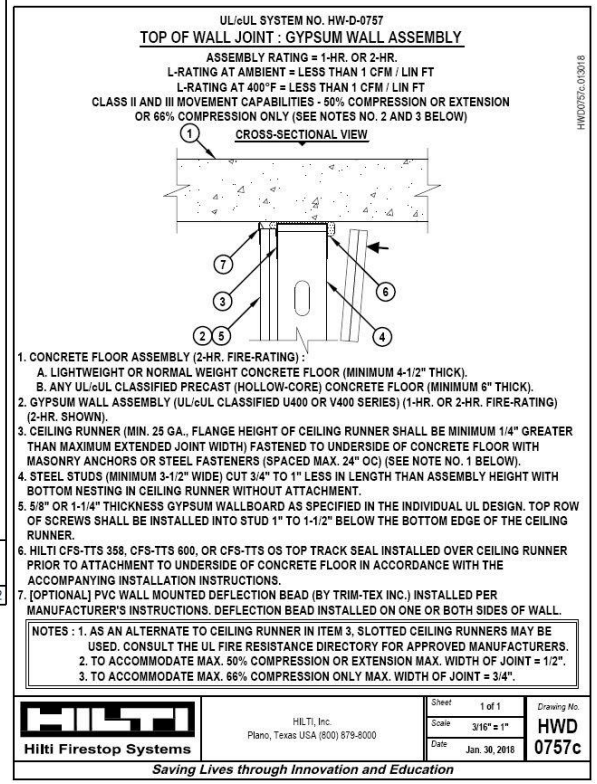


UL/cUL SYSTEM NO. HW-D-0757

TOP OF WALL JOINT : GYPSUM WALL ASSEMBLY

ASSEMBLY RATING = 1-HR. OR 2-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / LIN FT
L-RATING AT 400°F = LESS THAN 1 CFM / LIN FT
CLASS II AND III MOVEMENT CAPABILITIES - 50% COMPRESSION OR EXTENSION OR 66% COMPRESSION ONLY (SEE NOTES NO. 2 AND 3 BELOW)

HWD0757c 013016

CROSS-SECTIONAL VIEW

1. CONCRETE FLOOR ASSEMBLY (2-HR. FIRE-RATING) :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 4-1/2" THICK).
   B. ANY UL/cUL CLASSIFIED PRECAST (HOLLOW-CORE) CONCRETE FLOOR (MINIMUM 6" THICK).
2. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U400 OR V400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
3. CEILING RUNNER (MIN. 25 GA., FLANGE HEIGHT OF CEILING RUNNER SHALL BE MINIMUM 1/4" GREATER THAN MAXIMUM EXTENDED JOINT WIDTH) FASTENED TO UNDERSIDE OF CONCRETE FLOOR WITH MASONRY ANCHORS OR STEEL FASTENERS (SPACED MAX. 24" OC) (SEE NOTE NO. 1 BELOW).
4. STEEL STUDS (MINIMUM 3-1/2" WIDE) CUT 3/4" TO 1" LESS IN LENGTH THAN ASSEMBLY HEIGHT WITH BOTTOM NESTING IN CEILING RUNNER WITHOUT ATTACHMENT.
5. 5/8" OR 1-1/4" THICKNESS GYPSUM WALLBOARD AS SPECIFIED IN THE INDIVIDUAL UL DESIGN. TOP ROW OF SCREWS SHALL BE INSTALLED INTO STUD 1" TO 1-1/2" BELOW THE BOTTOM EDGE OF THE CEILING RUNNER.
6. HILTI CFS-TTS 358, CFS-TTS 600, OR CFS-TTS OS TOP TRACK SEAL INSTALLED OVER CEILING RUNNER PRIOR TO ATTACHMENT TO UNDERSIDE OF CONCRETE FLOOR IN ACCORDANCE WITH THE ACCOMPANYING INSTALLATION INSTRUCTIONS.
7. [OPTIONAL] PVC WALL MOUNTED DEFLECTION BEAD (BY TRIM-TEX INC.) INSTALLED PER MANUFACTURER'S INSTRUCTIONS. DEFLECTION BEAD INSTALLED ON ONE OR BOTH SIDES OF WALL.

NOTES : 1. AS AN ALTERNATE TO CEILING RUNNER IN ITEM 3, SLOTTED CEILING RUNNERS MAY BE USED. CONSULT THE UL FIRE RESISTANCE DIRECTORY FOR APPROVED MANUFACTURERS.
2. TO ACCOMMODATE MAX. 50% COMPRESSION OR EXTENSION MAX. WIDTH OF JOINT = 1/2".
3. TO ACCOMMODATE MAX. 66% COMPRESSION ONLY MAX. WIDTH OF JOINT = 3/4".

Hilti Firestop Systems

HILTI, Inc.
Plano, Texas USA (800) 879-8000

Sheet 1 of 1
Scale 3/16" = 1"
Date Jan. 30, 2018

Drawing No. HWD 0757c

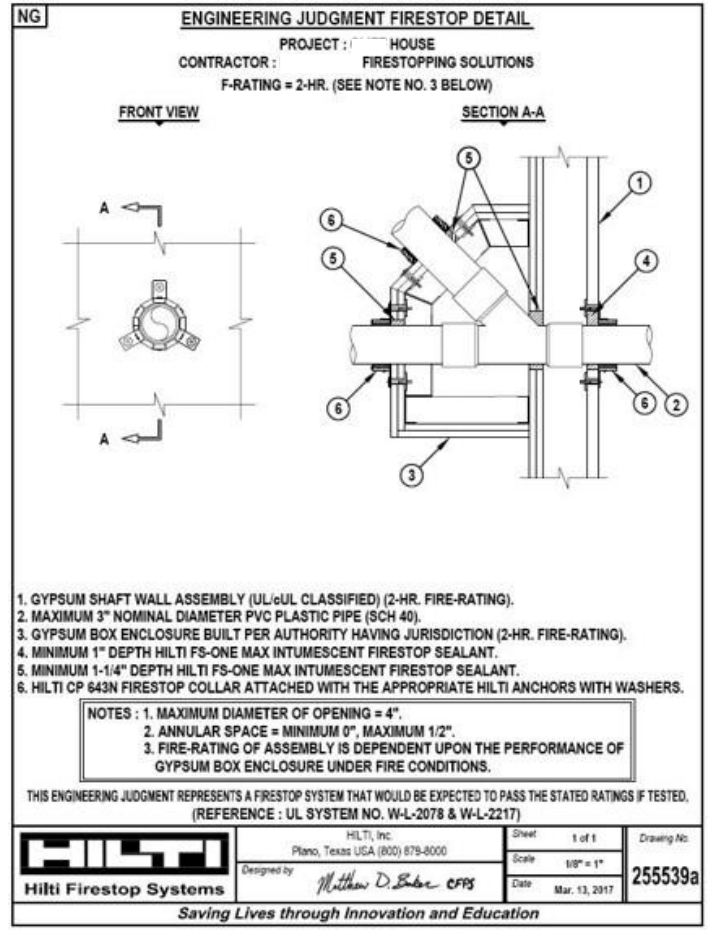
Saving Lives through Innovation and Education

WHEN A TESTED FIRESTOP SYSTEM DOES NOT MATCH A FIELD CONDITION, AN ENGINEERING JUDGMENT IS NEEDED

Engineering Judgments (EJ) are issued in accordance with the guidelines established by the International Firestop Council

- Not to be used in lieu of available tested systems
- Must be issued by qualified technical personnel
- Based upon previously tested system(s)
- Based upon assumption that the recommended system (EJ) would pass if tested for the required rated period of time
- Issued only for a specific job at a specific location and in a specific application

INTERNATIONAL FIRESTOP COUNCIL
THE Source of Firestop Expertise®

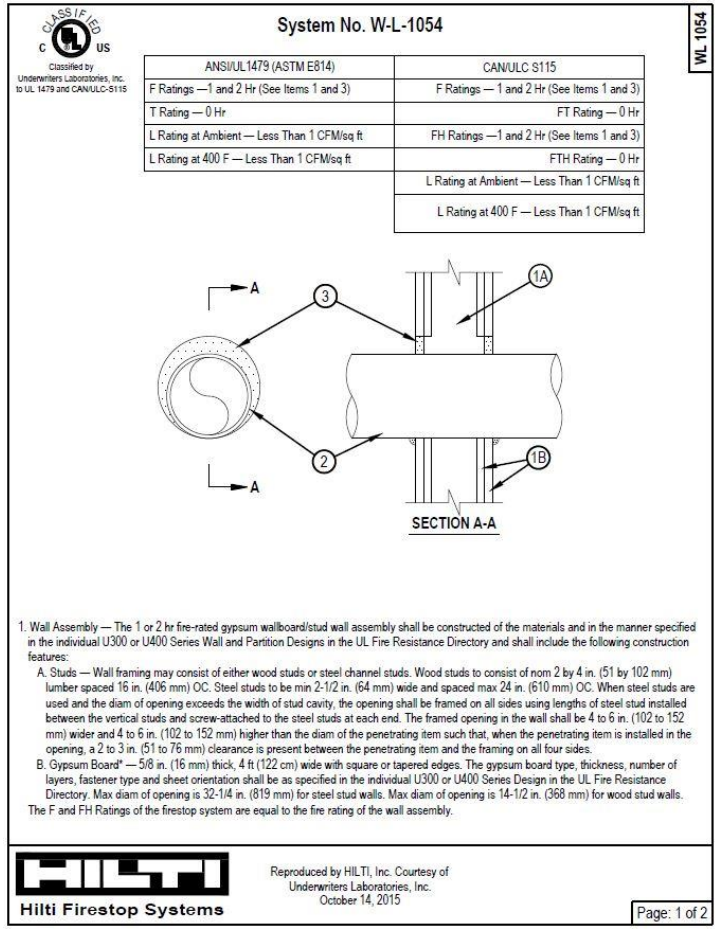


REVIEWING THROUGH-PENETRATION FIRESTOP APPLICATIONS

PENETRATION FIRESTOP SYSTEMS IDENTIFY EACH COMPONENT REQUIRED TO ACHIEVE THE DESIRED RATING

It's important to ensure that the application matches the tested system

- Fire rated assembly construction components
- Acceptable size and type of penetrating items
- Firestop materials needed to fill voids
- Specified limits for size of opening, annular space, etc.
- Each tested system is given their own Firestop System Number



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FIRESTOPPING PENETRATIONS: TYPES OF PENETRANTS

Non-Combustible Penetrants

Metallic

Combustible Penetrants

Insulated

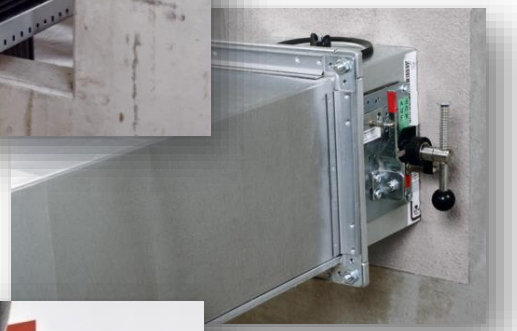
Cable Bundles

Plastic

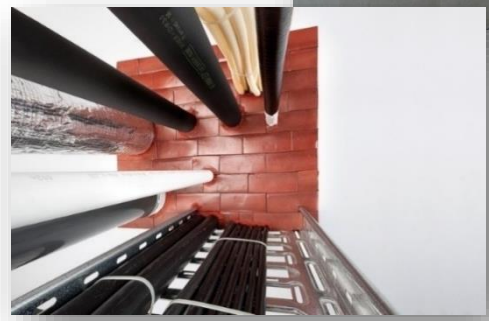
Large Openings / Multi-Pens

Cable Tray

Duct / Mechanical



Mixed / Multiple



INTUMESCENT SEALANTS & PRODUCTS

- In generally, firestop products fall into two categories:
  - Intumescent
  - Elastomeric
- Intumescent Products:
  - Swell, char or otherwise expand when subjected to a specified degree of heat (different materials have differing degrees at which they begin to intumesce)
- Elastomeric Products:
  - Elastic products resembling rubber that can retain their shape after being subjected to dynamic movement

Examples of intumescent products for combustible penetrants:

Sealant

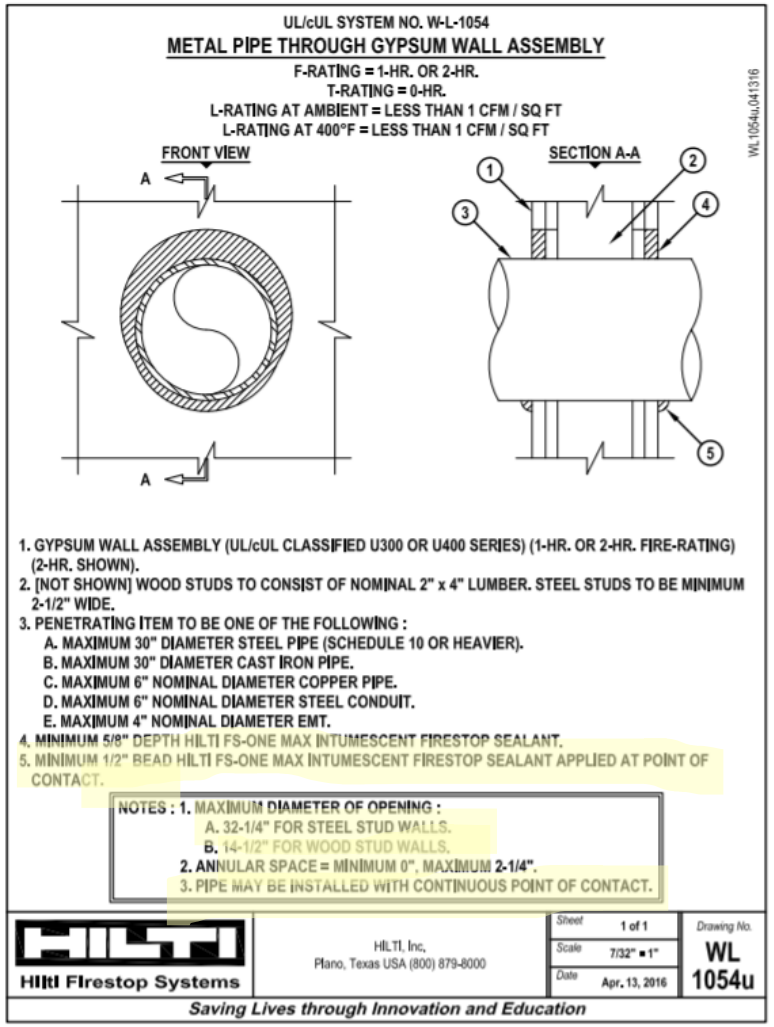
Collars

Cable Pathways

Cast In Devices

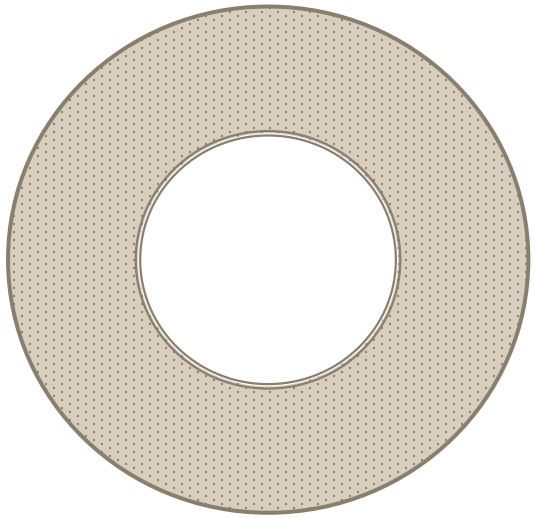
NON-COMBUSTIBLE PENETRANTS

NON-COMBUSTIBLE PENETRANT FIRESTOP SYSTEMS

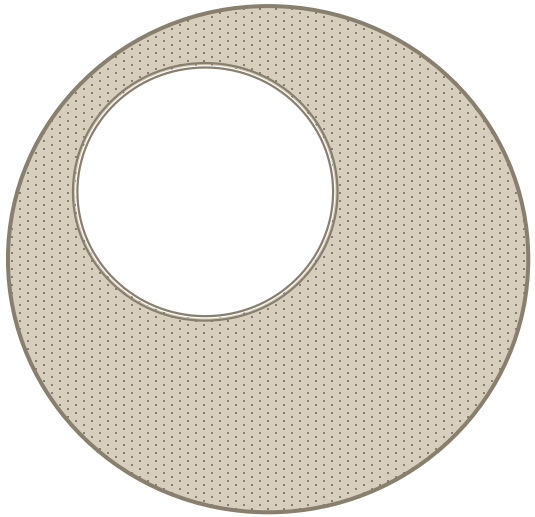


- The maximum opening size that the system can support is listed
- The maximum size of the penetrating item can vary based on material type
- The depth and type of firestop sealant required is indicated
  - A range of sealants and foams can be used as caulk to seal gaps and holes
- The minimum and maximum amount of annular space needed around the penetrant is detailed
  - Distance between the edge of the opening and the penetrant edge

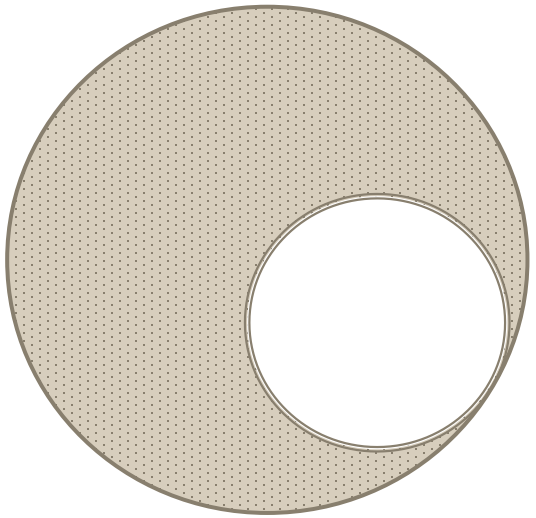
SOME SYSTEMS ALLOW A CONTINUOUS POINT OF CONTACT



Centered



Off-Center



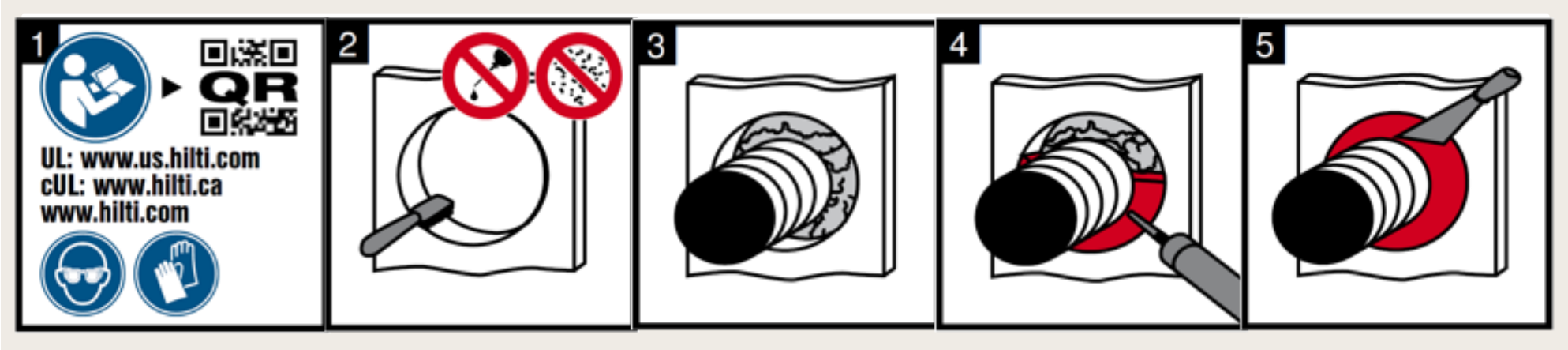
Point of Contact

Continuous Point of Contact

- A firestop system designed for continuous point of contact penetrations will specifically state this
- Minimum 0” annular space does not mean 0” all around the penetrant
- For continuous point of contact, minimum and maximum annular space will both be zero

PROCESS FOR INSTALLING FIRESTOP MATERIAL

- Read and understand the details of the firestop system or Engineering Judgement to be used
- Clean the opening of debris, dirt, oil, wax and grease; ensure the surface is free of moisture and frost
- Insert mineral wool or backer, as required
- Apply firestop sealant; ensure the correct minimum depth of sealant is installed
- Smooth the firestop sealant with a trowel



SURFACE PREPARATION AND TOOLING IS KEY TO CORRECT FIRESTOP SEALANT INSTALLATION

- Substrate surface preparation is important
  - Sealants require a dry clean surface, free of debris, to adhere to the substrate (such as concrete or gypsum board)
  - The sealant may bond to the debris, rather than the surface of the substrate
- Installation instructions typically require tooling of firestop materials
  - Tooling helps with the adhesion of the product to the base material through applying pressure to the sealant
  - Proper tooling helps to avoid voids and air pockets in the firestop sealant

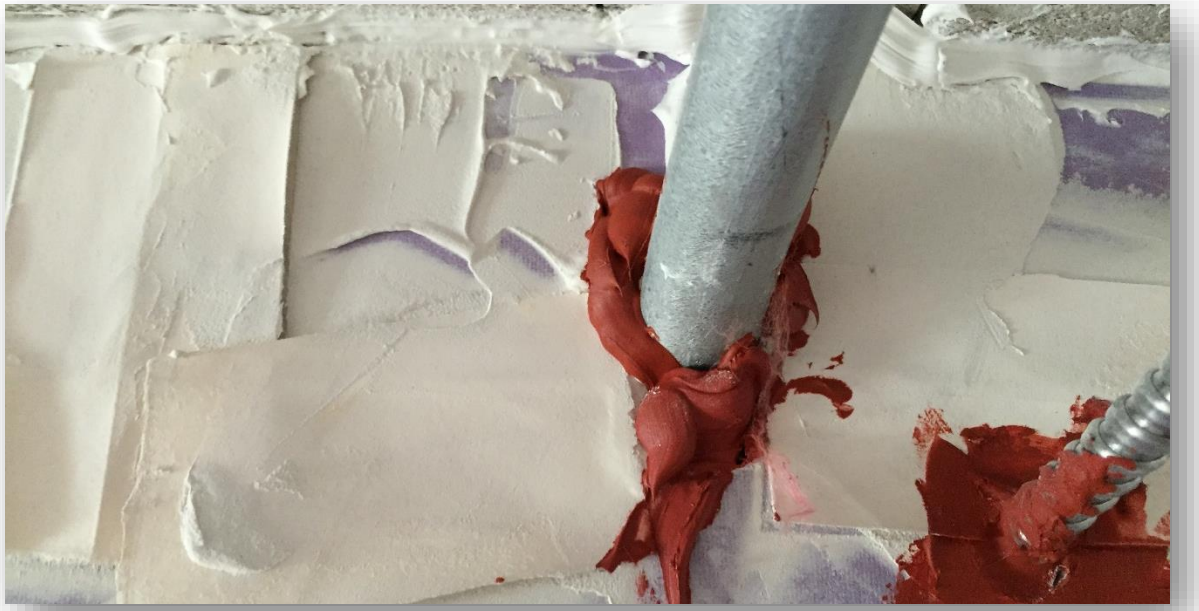
TYPES OF FIRESTOP SEALANT

- Intumescent Sealant
  - When it is exposed to heat, it works to block the passage of smoke and fire by swelling up
  - Low movement capabilities (+/- 5%)
- Acrylic based sealant
  - Can accommodate movement of +/- 12.5%
- Product Applications
  - For use on concrete, masonry, gypsum and wood frame
  - Can be used with a variety of common penetrations like metallic, combustible, insulated, cables, and ducts

THROUGH-PENETRATIONS: NON-COMBUSTIBLE

POOR FIRESTOP INSTALLATION EXAMPLES

- No firestop around penetrant

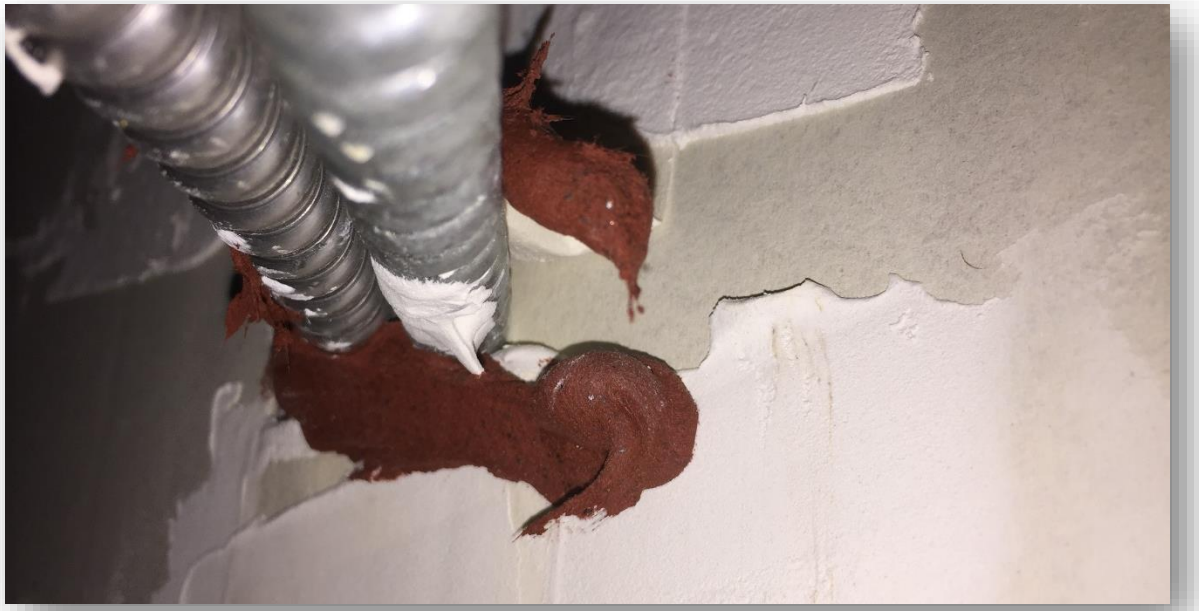


- Multiple materials/sealants are overlapping
- Firestop has not been tooled
- Visible gaps in sealant

THROUGH-PENETRATIONS: NON-COMBUSTIBLE

POOR FIRESTOP INSTALLATION EXAMPLES

- Multiple fill/backing materials are used to fill the opening around the pipe; the fill material does not appear to be compliant
- The firestop sealant does not cover the exposed backing material



- Multiple sealants have been used
- Firestop sealant has not been applied all the way around the penetrants
- Firestop sealant not properly tooled

FIRESTOPPING PENETRANTS AT AN ANGLE

- Angled penetrants do not always need Engineering Judgement
- The UL XHEZ Guide provides information for penetrants installed at angles that are not perpendicular
- Bare **metallic** penetrants can be installed at an angle if:
  - The firestop system uses a fill material (sealant, putty, or mortar)
  - The annular space requirements of the firestop system are met
- Engineering Judgments are required for combustible penetrants

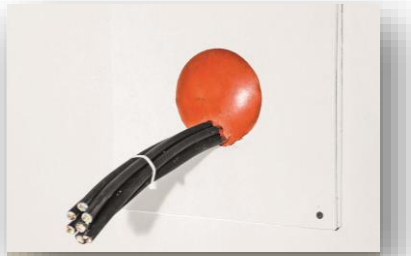
COMBUSTIBLE PENETRANTS

TYPES OF COMBUSTIBLE PENETRANTS

There are a variety of combustible penetrants:

- Insulated pipes
- Cables
- Plastic pipes (It is important to check the pipe label to determine the type)
  - PVC, CPVC, and RNC pipes can look alike
  - ABS pipes are generally black
  - PEX pipes can be red, blue, or clear
  - Polypropylene is generally green or blue-green (can also be gray)

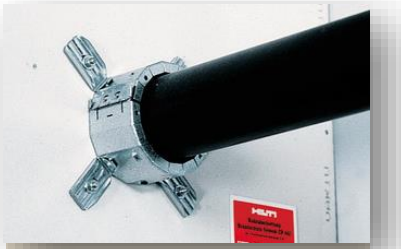

Insulated Pipes


Cables


PVC


RNC

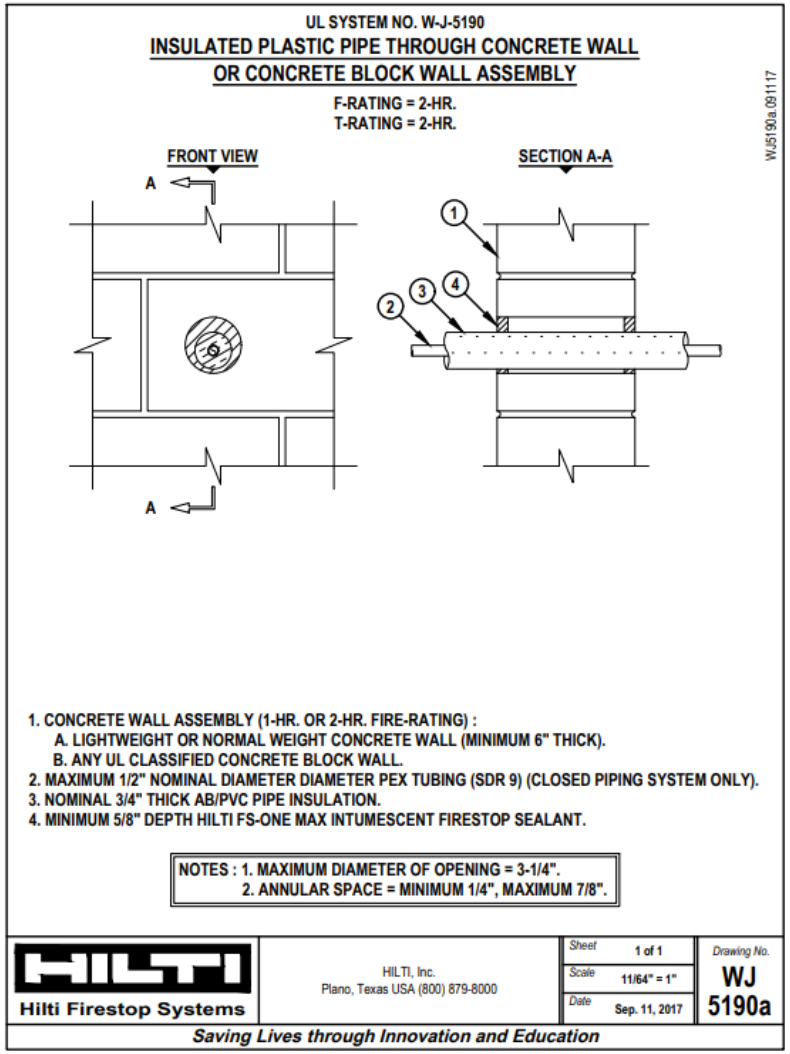

CPVC


ABS


PEX


Polypropylene

INSULATED PENETRANT FIRESTOP SYSTEMS



- Combustible penetrants will typically require an intumescent product around the penetrant
  - It is critical to ensure there is enough of the intumescent product around the penetrating item
    - Confirm that the specified depth has been installed
  - Check the product packages used on site to ensure the correct product type (intumescent material) has been used

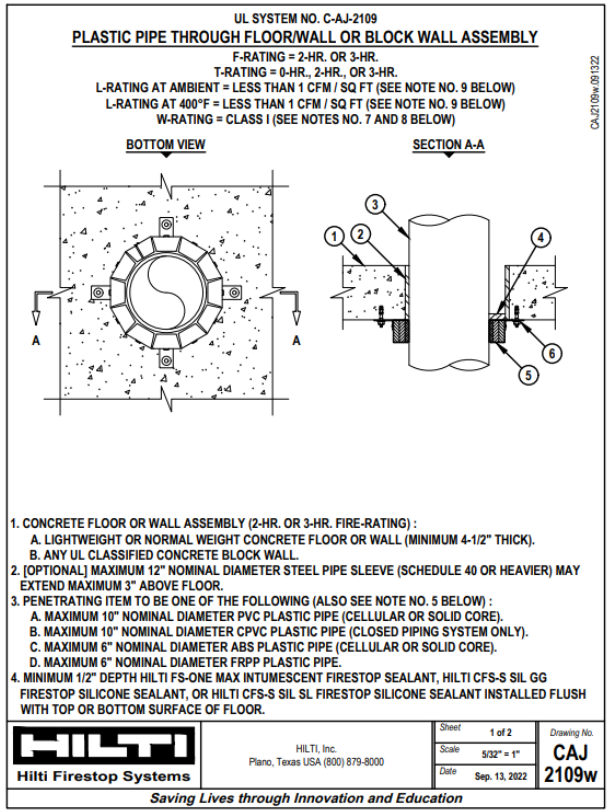
THROUGH-PENETRATIONS: INSULATED PENETRANTS

POOR FIRESTOP INSTALLATION EXAMPLES

- Penetrants with thick insulating materials may need additional firestop materials, beyond a sealant, to be properly firestopped (such as a firestop collar)

- This application involves an insulated combustible penetrant
- In this case, a backing material, mineral wool to fill the opening, and an intumescent collar device would likely be required to ensure proper firestopping (confirm with an applicable listing)

COMBUSTIBLE PENETRANT FIRESTOP SYSTEMS USING FIRESTOP COLLARS



UL SYSTEM NO. C-AJ-2109

PLASTIC PIPE THROUGH FLOOR/WALL OR BLOCK WALL ASSEMBLY

F-RATING = 2-HR. OR 3-HR.
T-RATING = 0-HR., 2-HR., OR 3-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT (SEE NOTE NO. 9 BELOW)
L-RATING AT 400°F = LESS THAN 1 CFM / SQ FT (SEE NOTE NO. 9 BELOW)
W-RATING = CLASS I (SEE NOTES NO. 7 AND 8 BELOW)

CAJ2109w 091322

BOTTOM VIEW

SECTION A-A

1. CONCRETE FLOOR OR WALL ASSEMBLY (2-HR. OR 3-HR. FIRE-RATING) :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MINIMUM 4-1/2" THICK).
   B. ANY UL CLASSIFIED CONCRETE BLOCK WALL.
2. [OPTIONAL] MAXIMUM 12" NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR HEAVIER) MAY EXTEND MAXIMUM 3" ABOVE FLOOR.
3. PENETRATING ITEM TO BE ONE OF THE FOLLOWING (ALSO SEE NOTE NO. 5 BELOW) :
   A. MAXIMUM 10" NOMINAL DIAMETER PVC PLASTIC PIPE (CELLULAR OR SOLID CORE).
   B. MAXIMUM 10" NOMINAL DIAMETER CPVC PLASTIC PIPE (CLOSED PIPING SYSTEM ONLY).
   C. MAXIMUM 6" NOMINAL DIAMETER ABS PLASTIC PIPE (CELLULAR OR SOLID CORE).
   D. MAXIMUM 6" NOMINAL DIAMETER FRPP PLASTIC PIPE.
4. MINIMUM 1/2" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT, HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT, OR HILTI CFS-S SIL SL FIRESTOP SILICONE SEALANT INSTALLED FLUSH WITH TOP OR BOTTOM SURFACE OF FLOOR.

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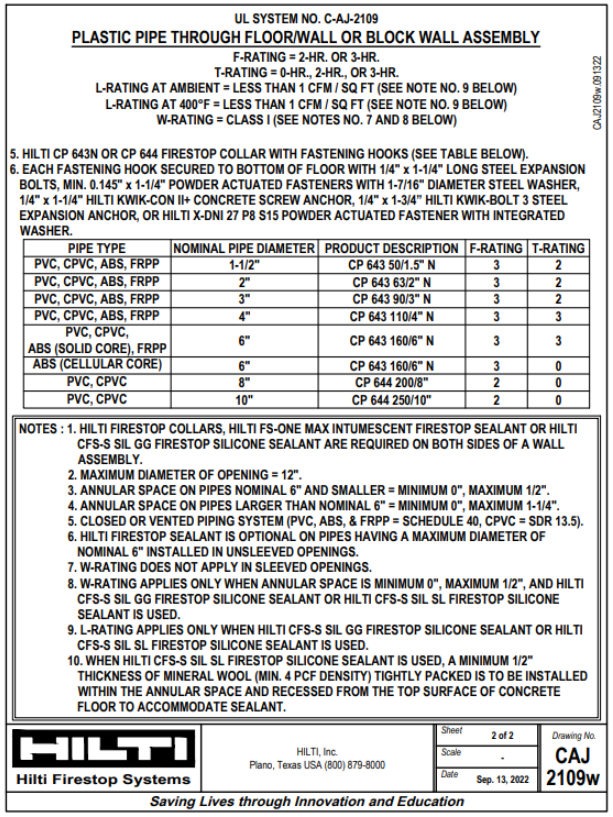

UL SYSTEM NO. C-AJ-2109

PLASTIC PIPE THROUGH FLOOR/WALL OR BLOCK WALL ASSEMBLY

F-RATING = 2-HR. OR 3-HR.
T-RATING = 0-HR., 2-HR., OR 3-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT (SEE NOTE NO. 9 BELOW)
L-RATING AT 400°F = LESS THAN 1 CFM / SQ FT (SEE NOTE NO. 9 BELOW)
W-RATING = CLASS I (SEE NOTES NO. 7 AND 8 BELOW)

CAJ2109w 091322

5. HILTI CP 643N OR CP 644 FIRESTOP COLLAR WITH FASTENING HOOKS (SEE TABLE BELOW).
6. EACH FASTENING HOOK SECURED TO BOTTOM OF FLOOR WITH 1/4" x 1-1/4" LONG STEEL EXPANSION BOLTS, MIN. 0.145" x 1-1/4" POWDER ACTUATED FASTENERS WITH 1-7/16" DIAMETER STEEL WASHER, 1/4" x 1-1/4" HILTI KWIK-CON II+ CONCRETE SCREW ANCHOR, 1/4" x 1-3/4" HILTI KWIK-BOLT 3 STEEL EXPANSION ANCHOR, OR HILTI X-DNI 27 P8 S15 POWDER ACTUATED FASTENER WITH INTEGRATED WASHER.

PIPE TYPE	NOMINAL PIPE DIAMETER	PRODUCT DESCRIPTION	F-RATING	T-RATING
PVC, CPVC, ABS, FRPP	1-1/2"	CP 643 50/1.5" N	3	2
PVC, CPVC, ABS, FRPP	2"	CP 643 63/2" N	3	2
PVC, CPVC, ABS, FRPP	3"	CP 643 90/3" N	3	2
PVC, CPVC, ABS, FRPP	4"	CP 643 110/4" N	3	3
PVC, CPVC, ABS (SOLID CORE), FRPP	6"	CP 643 160/6" N	3	3
ABS (CELLULAR CORE)	6"	CP 643 160/6" N	3	0
PVC, CPVC	8"	CP 644 200/8"	2	0
PVC, CPVC	10"	CP 644 250/10"	2	0

NOTES : 1. HILTI FIRESTOP COLLARS, HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT OR HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT ARE REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY.
2. MAXIMUM DIAMETER OF OPENING = 12".
3. ANNULAR SPACE ON PIPES NOMINAL 6" AND SMALLER = MINIMUM 0", MAXIMUM 1/2".
4. ANNULAR SPACE ON PIPES LARGER THAN NOMINAL 6" = MINIMUM 0", MAXIMUM 1-1/4".
5. CLOSED OR VENTED PIPING SYSTEM (PVC, ABS, & FRPP = SCHEDULE 40, CPVC = SDR 13.5).
6. HILTI FIRESTOP SEALANT IS OPTIONAL ON PIPES HAVING A MAXIMUM DIAMETER OF NOMINAL 6" INSTALLED IN UNSLEEVED OPENINGS.
7. W-RATING DOES NOT APPLY IN SLEEVED OPENINGS.
8. W-RATING APPLIES ONLY WHEN ANNULAR SPACE IS MINIMUM 0", MAXIMUM 1/2", AND HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT OR HILTI CFS-S SIL SL FIRESTOP SILICONE SEALANT IS USED.
9. L-RATING APPLIES ONLY WHEN HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT OR HILTI CFS-S SIL SL FIRESTOP SILICONE SEALANT IS USED.
10. WHEN HILTI CFS-S SIL SL FIRESTOP SILICONE SEALANT IS USED, A MINIMUM 1/2" THICKNESS OF MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED IS TO BE INSTALLED WITHIN THE ANNULAR SPACE AND RECESSED FROM THE TOP SURFACE OF CONCRETE FLOOR TO ACCOMMODATE SEALANT.

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- Collars are designed to simplify firestopping of combustible pipes through fire-rated walls and floors
- Note that systems require that firestop collars are installed on the bottom side only for floor/ceiling assemblies
  - Wall systems require that collars are installed on both sides of the wall
- Listings indicate attachment method for collar
- Note that systems for collars typically also require a firestop sealant be installed around the penetrant
- Some systems allow an intumescent wrap strip to be installed around the penetrant within the opening

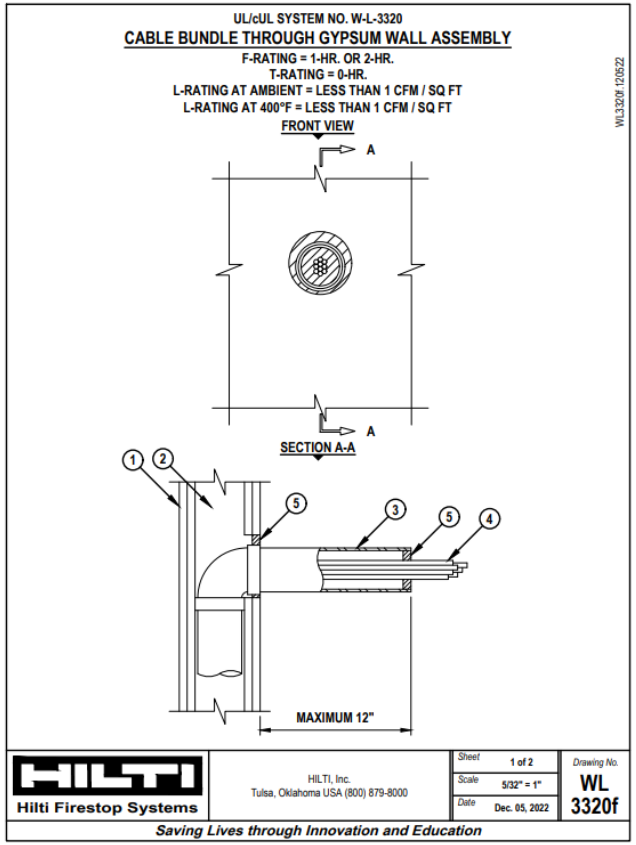
THROUGH-PENETRATIONS: COMBUSTIBLE PENETRANTS

POOR FIRESTOP INSTALLATION EXAMPLES

- Large plastic pipe penetrant likely requires additional firestop beyond sealant, such as a collar

- Firestop collars are not properly attached to the rated assembly
- Large gaps around and between penetrating items
- Sealant has not been used as would likely be called for by a listing or Engineering Judgment (which would likely be needed in this case)

CABLE BUNDLE FIRESTOP SYSTEMS



UL/cUL SYSTEM NO. W-L-3320

CABLE BUNDLE THROUGH GYPSUM WALL ASSEMBLY

F-RATING = 1-HR. OR 2-HR.
T-RATING = 0-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT
L-RATING AT 400°F = LESS THAN 1 CFM / SQ FT

WL3320f 12/05/22

FRONT VIEW

A

A

SECTION A-A

1 2 5 3 5 4

MAXIMUM 12"

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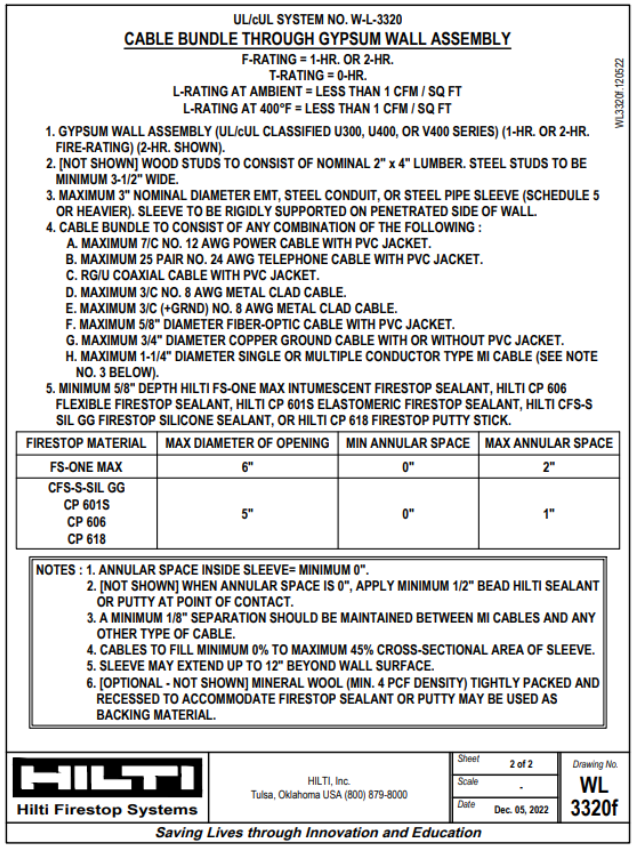

UL/cUL SYSTEM NO. W-L-3320

CABLE BUNDLE THROUGH GYPSUM WALL ASSEMBLY

F-RATING = 1-HR. OR 2-HR.
T-RATING = 0-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT
L-RATING AT 400°F = LESS THAN 1 CFM / SQ FT

WL3320f 12/05/22

1. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U300, U400, OR V400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
2. [NOT SHOWN] WOOD STUDS TO CONSIST OF NOMINAL 2" x 4" LUMBER. STEEL STUDS TO BE MINIMUM 3-1/2" WIDE.
3. MAXIMUM 3" NOMINAL DIAMETER EMT, STEEL CONDUIT, OR STEEL PIPE SLEEVE (SCHEDULE 5 OR HEAVIER). SLEEVE TO BE RIGIDLY SUPPORTED ON PENETRATED SIDE OF WALL.
4. CABLE BUNDLE TO CONSIST OF ANY COMBINATION OF THE FOLLOWING :
   - A. MAXIMUM 7/C NO. 12 AWG POWER CABLE WITH PVC JACKET.
   - B. MAXIMUM 25 PAIR NO. 24 AWG TELEPHONE CABLE WITH PVC JACKET.
   - C. RG/U COAXIAL CABLE WITH PVC JACKET.
   - D. MAXIMUM 3/C NO. 8 AWG METAL CLAD CABLE.
   - E. MAXIMUM 3/C (+GRND) NO. 8 AWG METAL CLAD CABLE.
   - F. MAXIMUM 5/8" DIAMETER FIBER-OPTIC CABLE WITH PVC JACKET.
   - G. MAXIMUM 3/4" DIAMETER COPPER GROUND CABLE WITH OR WITHOUT PVC JACKET.
   - H. MAXIMUM 1-1/4" DIAMETER SINGLE OR MULTIPLE CONDUCTOR TYPE MI CABLE (SEE NOTE NO. 3 BELOW).
5. MINIMUM 5/8" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT, HILTI CP 606 FLEXIBLE FIRESTOP SEALANT, HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT, HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT, OR HILTI CP 618 FIRESTOP PUTTY STICK.

FIRESTOP MATERIAL	MAX DIAMETER OF OPENING	MIN ANNULAR SPACE	MAX ANNULAR SPACE
FS-ONE MAX	6"	0"	2"
CFS-S-SIL GG CP 601S CP 606 CP 618	5"	0"	1"

NOTES : 1. ANNULAR SPACE INSIDE SLEEVE= MINIMUM 0".
2. [NOT SHOWN] WHEN ANNULAR SPACE IS 0", APPLY MINIMUM 1/2" BEAD HILTI SEALANT OR PUTTY AT POINT OF CONTACT.
3. A MINIMUM 1/8" SEPARATION SHOULD BE MAINTAINED BETWEEN MI CABLES AND ANY OTHER TYPE OF CABLE.
4. CABLES TO FILL MINIMUM 0% TO MAXIMUM 45% CROSS-SECTIONAL AREA OF SLEEVE.
5. SLEEVE MAY EXTEND UP TO 12" BEYOND WALL SURFACE.
6. [OPTIONAL - NOT SHOWN] MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED AND RECESSED TO ACCOMMODATE FIRESTOP SEALANT OR PUTTY MAY BE USED AS BACKING MATERIAL.

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- The firestop listing will specify:
  - Cable type, quantity, and/or bundle size
  - The maximum permitted percentage of cable fill
  - Required distance between cables (if applicable)
- Cable bundles can be installed inside a sleeve or firestop device
- In applications with cables within a sleeve:
  - Ensure that the sleeve is properly firestopped
  - AND ensure that the cables within the sleeve are properly firestopped
  - Note that there are annular space requirements for both the inside and outside of the sleeve

THROUGH-PENETRATIONS: CABLES THROUGH CONDUIT

POOR FIRESTOP INSTALLATION EXAMPLES

- Gap in firestopping around outside of conduit
- Inside of conduit has not been firestopped

- Outside of one penetrant has not been firestopped
- Inside of two conduits have not been firestopped

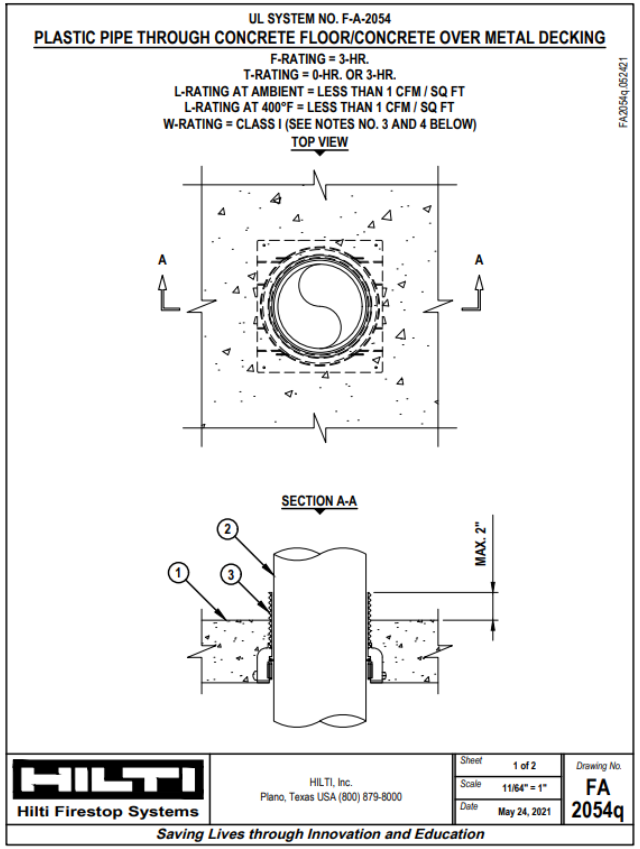
THROUGH-PENETRATIONS: CABLES THROUGH CONDUIT

POOR FIRESTOP INSTALLATION EXAMPLES

- A non-firestop foam has been used inside the conduits

- A non-firestop foam has been used inside the conduits

CAST-IN DEVICE FIRESTOP SYSTEMS



UL SYSTEM NO. F-A-2054

PLASTIC PIPE THROUGH CONCRETE FLOOR/CONCRETE OVER METAL DECKING

F-RATING = 3-HR.
T-RATING = 0-HR. OR 3-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT
L-RATING AT 400°F = LESS THAN 1 CFM / SQ FT
W-RATING = CLASS I (SEE NOTES NO. 3 AND 4 BELOW)

FA2054q 052421

TOP VIEW

A A

SECTION A-A

1 2 3

MAX. 2"

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Drawing No. FA 2054q

Hilti Firestop Systems

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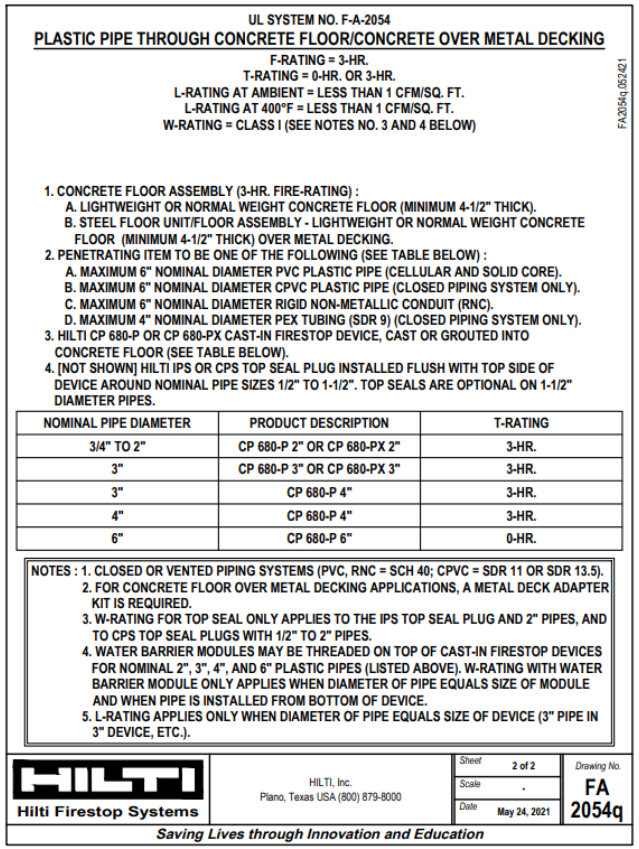

UL SYSTEM NO. F-A-2054

PLASTIC PIPE THROUGH CONCRETE FLOOR/CONCRETE OVER METAL DECKING

F-RATING = 3-HR.
T-RATING = 0-HR. OR 3-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM/SQ. FT.
L-RATING AT 400°F = LESS THAN 1 CFM/SQ. FT.
W-RATING = CLASS I (SEE NOTES NO. 3 AND 4 BELOW)

FA2054q 052421

1. CONCRETE FLOOR ASSEMBLY (3-HR. FIRE-RATING) :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 4-1/2" THICK).
   B. STEEL FLOOR UNIT/FLOOR ASSEMBLY - LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 4-1/2" THICK) OVER METAL DECKING.
2. PENETRATING ITEM TO BE ONE OF THE FOLLOWING (SEE TABLE BELOW) :
   A. MAXIMUM 6" NOMINAL DIAMETER PVC PLASTIC PIPE (CELLULAR AND SOLID CORE).
   B. MAXIMUM 6" NOMINAL DIAMETER CPVC PLASTIC PIPE (CLOSED PIPING SYSTEM ONLY).
   C. MAXIMUM 6" NOMINAL DIAMETER RIGID NON-METALLIC CONDUIT (RNC).
   D. MAXIMUM 4" NOMINAL DIAMETER PEX TUBING (SDR 9) (CLOSED PIPING SYSTEM ONLY).
3. HILTI CP 680-P OR CP 680-PX CAST-IN FIRESTOP DEVICE, CAST OR GROUTED INTO CONCRETE FLOOR (SEE TABLE BELOW).
4. [NOT SHOWN] HILTI IPS OR CPS TOP SEAL PLUG INSTALLED FLUSH WITH TOP SIDE OF DEVICE AROUND NOMINAL PIPE SIZES 1/2" TO 1-1/2". TOP SEALS ARE OPTIONAL ON 1-1/2" DIAMETER PIPES.

NOMINAL PIPE DIAMETER	PRODUCT DESCRIPTION	T-RATING
3/4" TO 2"	CP 680-P 2" OR CP 680-PX 2"	3-HR.
3"	CP 680-P 3" OR CP 680-PX 3"	3-HR.
3"	CP 680-P 4"	3-HR.
4"	CP 680-P 4"	3-HR.
6"	CP 680-P 6"	0-HR.

NOTES : 1. CLOSED OR VENTED PIPING SYSTEMS (PVC, RNC = SCH 40; CPVC = SDR 11 OR SDR 13.5).
2. FOR CONCRETE FLOOR OVER METAL DECKING APPLICATIONS, A METAL DECK ADAPTER KIT IS REQUIRED.
3. W-RATING FOR TOP SEAL ONLY APPLIES TO THE IPS TOP SEAL PLUG AND 2" PIPES, AND TO CPS TOP SEAL PLUGS WITH 1/2" TO 2" PIPES.
4. WATER BARRIER MODULES MAY BE THREADED ON TOP OF CAST-IN FIRESTOP DEVICES FOR NOMINAL 2", 3", 4", AND 6" PLASTIC PIPES (LISTED ABOVE). W-RATING WITH WATER BARRIER MODULE ONLY APPLIES WHEN DIAMETER OF PIPE EQUALS SIZE OF MODULE AND WHEN PIPE IS INSTALLED FROM BOTTOM OF DEVICE.
5. L-RATING APPLIES ONLY WHEN DIAMETER OF PIPE EQUALS SIZE OF DEVICE (3" PIPE IN 3" DEVICE, ETC.).

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Scale -
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Drawing No. FA 2054q

Hilti Firestop Systems

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- Cast-in devices can be used to seal penetrations in concrete and metal decks
- The firestop listing will specify:
  - Required thickness of concrete
  - Types and diameter of penetrating items
  - Required cast-in firestop device and product size corresponding with the nominal pipe diameter

THROUGH-PENETRATIONS: PLASTIC PIPES

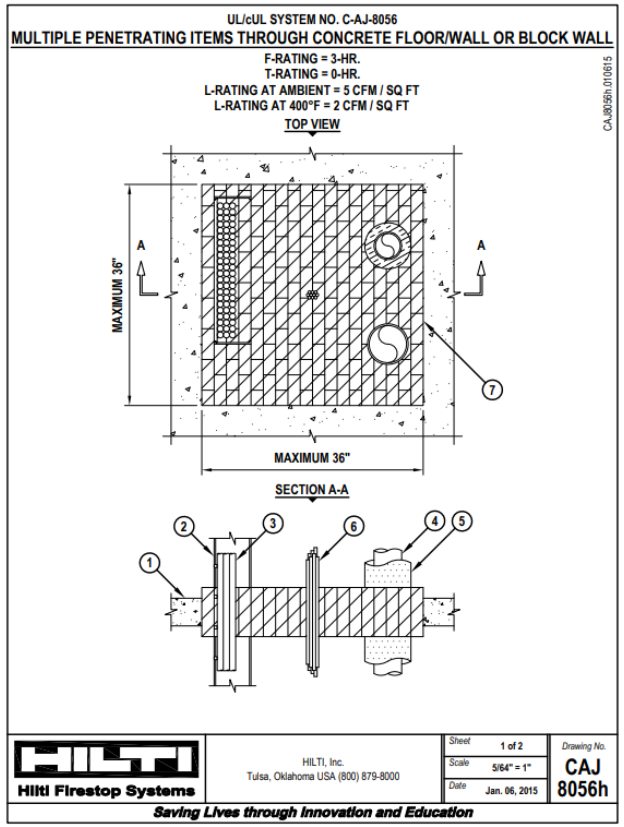
POOR FIRESTOP INSTALLATION EXAMPLES

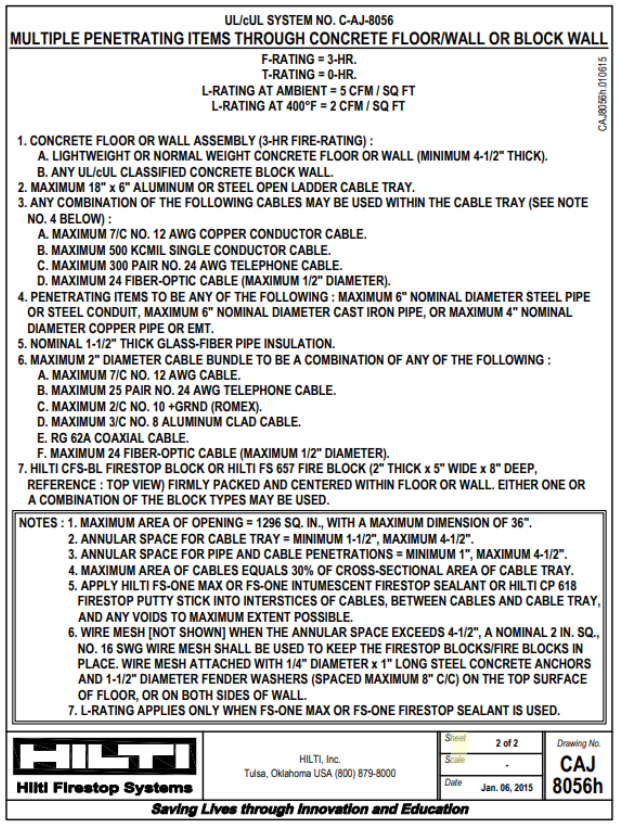
- Blue and Red plastic PEX tubing is being run through a CP-680 M (black) cast-in device, which is designed for metal pipe only
- CP-680 P (red) cast-in devices can be used for combustible penetrants
- The firestop for the iron pipe on the far left is installed correctly

- RNC or PVC combustible conduit is being run through a CP-680 M (black) which is designed for metal pipe only
- CP-680 P (red) cast-in devices can be used for combustible penetrants

MULTIPLE PENETRANTS & LARGE OPENINGS

MULTIPLE PENETRANTS / LARGE OPENINGS





- The firestop listing will indicate the types and combination of penetrants that are permitted
- When there are multiple penetrants, there are two kinds of annular space that must be measured:
  - Distance between penetrants and the opening
  - Distance between the various penetrants
- Firestop blocks often used for large openings
  - Listings to indicate any orientation and compression requirements
- For very large openings, firestop listings may require wire mesh to protect the firestop blocks and to keep them in place
- Sealant may also be required to fill any voids

THROUGH-PENETRATIONS: MIXED PENETRANTS / LARGE OPENINGS

POOR FIRESTOP INSTALLATION EXAMPLES

- Mineral wool is showing

- Insulation material is visible within large opening
- Firestop sealant has not been installed around all penetrants
- Visible gaps between penetrants and around penetrants

THROUGH-PENETRATIONS: MIXED PENETRANTS / LARGE OPENINGS

FIRESTOP INSTALLATION EXAMPLES

- Mineral wool is neatly installed and compressed as required by a listing
- Sealant is always required over mineral wool to meet firestop listing requirements

- Firestop blocks can be stacked to close larger openings
- When installing firestop blocks, it is recommended that the blocks are in a staggered orientation as shown on the Instructions for Use
  - The blocks shown in this image are not installed per the recommended orientation

THROUGH-PENETRATIONS: MIXED PENETRANTS / LARGE OPENINGS

GOOD FIRESTOP INSTALLATION EXAMPLES

- When installing firestop blocks, it is recommended that the blocks are in a staggered orientation as shown on the Instructions for Use
  - The blocks shown in this image are installed per the recommended orientation

- The blocks shown in this image are installed per the recommended orientation
- This application involves a very large openings, where wire mesh is installed to protect the firestop blocks and to keep them in place

THROUGH-PENETRATIONS – MIXED PENETRANTS / LARGE OPENINGS

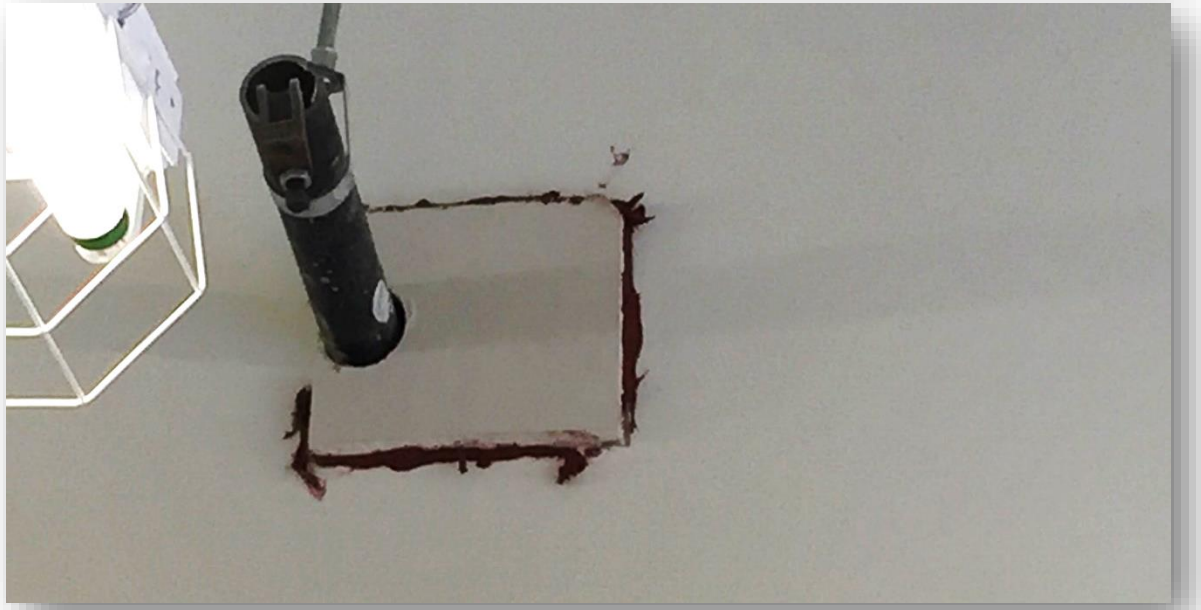
GOOD FIRESTOP INSTALLATION EXAMPLES

- Firestop foam Can be penetrated to allow for increase in cable capacity
- Designed to seal small to medium sized openings with mixed penetrants (such as cables, steel, copper, cast iron or plastic pipes)

- Preformed firestop products eliminate the need for stuffing and spraying
- Preformed firestops increase compliance and efficiency

ADDITIONAL CONSIDERATIONS

FIRESTOPPING AROUND SURFACE MOUNTED GYPSUM WALL PATCHES IS NOT CODE COMPLIANT



- No firestopping around penetrant
- Patching has been used in the wall
- Gypsum patches are not compliant per the code
- Large annular spaces must be fixed or firestopped per a listed system

- Patching has been used in the wall
- Gypsum patches are not compliant per the code
- Large annular spaces must be fixed or firestopped per a listed system

PROPER REPAIR OF DAMAGED OR OVERSIZED OPENINGS WITHIN FIRE RATED GYPSUM ASSEMBLY

- Damaged fire rated gypsum walls must be properly repaired so that they are restored to their original fire-resistive condition
- Repair guidelines have been established by the Gypsum Association's guide for **Repair of Fire-Rated Gypsum Panel Product Systems (GA-225-2019)**
- Surface mounted or "scab on" gypsum patches are not proper repair solutions
- Generally, gypsum patches should be mechanically fastened (screws) to the original wall framing or additional framing must be installed to properly secure the patch

GA-225-2019
REPAIR OF FIRE-RATED GYPSUM PANEL PRODUCT SYSTEMS


Figure 1: Damaged Gypsum Panel

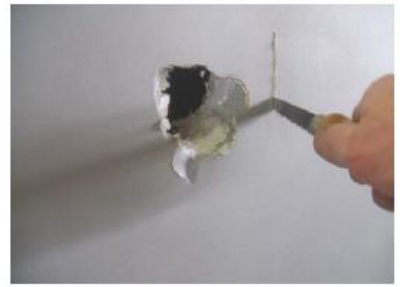


Figure 2: Square Off Damaged Area


Figure 3: Frame Opening

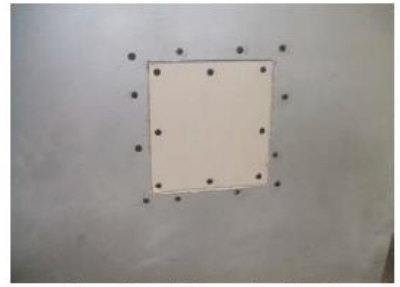


Figure 4: Apply Gypsum Panel Patch

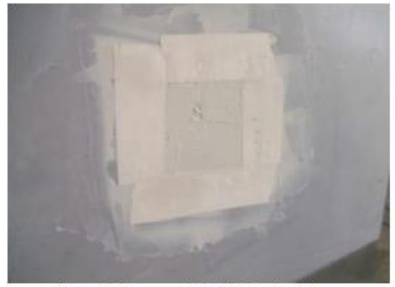


Figure 5: Tape and Finish Patched Area

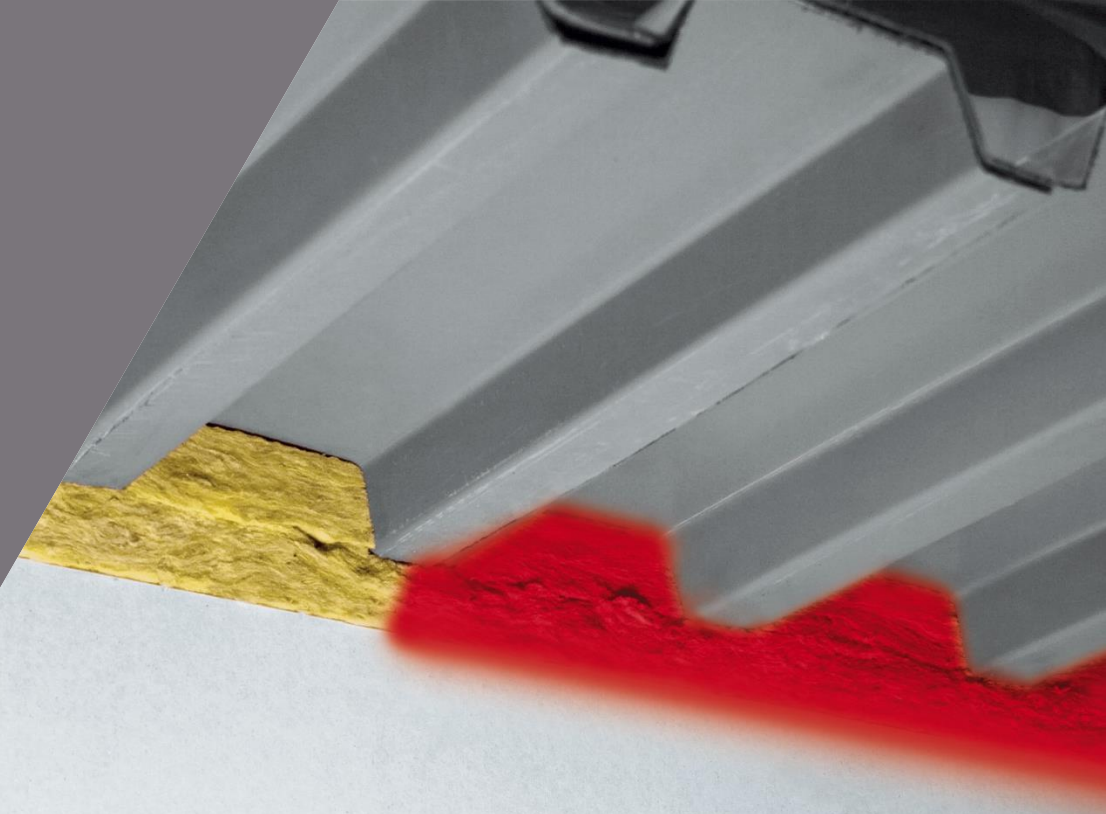

Figure 6: Redecorate Repaired Area

DISSIMILAR MATERIALS CONSIDERATIONS

IBC 714.4.3 Dissimilar materials

- Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire resistance integrity of the wall is maintained.
  - Listed solution: F-A-2154

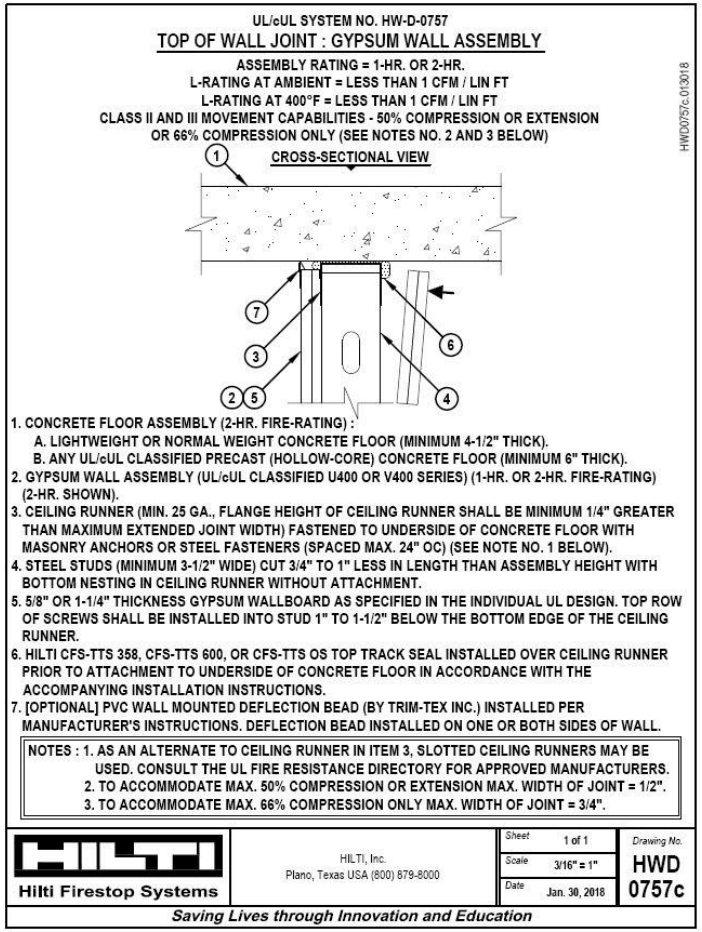
REVIEWING JOINT FIRESTOP APPLICATIONS



JOINT FIRESTOP SYSTEMS IDENTIFY EACH COMPONENT REQUIRED TO ACHIEVE THE DESIRED RATING

It's important to ensure that the application matches the tested system

- Fire-rated assembly construction components
- Joint type and width
- Movement requirements (%)
- Stud width for gypsum walls
- Firestop materials needed to fill voids



UL/cUL SYSTEM NO. HW-D-0757

TOP OF WALL JOINT : GYPSUM WALL ASSEMBLY

ASSEMBLY RATING = 1-HR. OR 2-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM / LIN FT
L-RATING AT 400°F = LESS THAN 1 CFM / LIN FT
CLASS II AND III MOVEMENT CAPABILITIES - 50% COMPRESSION OR EXTENSION OR 66% COMPRESSION ONLY (SEE NOTES NO. 2 AND 3 BELOW)

HWD0757c-013018

CROSS-SECTIONAL VIEW

1. CONCRETE FLOOR ASSEMBLY (2-HR. FIRE-RATING) :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 4-1/2" THICK).
   B. ANY UL/cUL CLASSIFIED PRECAST (HOLLOW-CORE) CONCRETE FLOOR (MINIMUM 6" THICK).
2. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U400 OR V400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
3. CEILING RUNNER (MIN. 25 GA., FLANGE HEIGHT OF CEILING RUNNER SHALL BE MINIMUM 1/4" GREATER THAN MAXIMUM EXTENDED JOINT WIDTH) FASTENED TO UNDERSIDE OF CONCRETE FLOOR WITH MASONRY ANCHORS OR STEEL FASTENERS (SPACED MAX. 24" OC) (SEE NOTE NO. 1 BELOW).
4. STEEL STUDS (MINIMUM 3-1/2" WIDE) CUT 3/4" TO 1" LESS IN LENGTH THAN ASSEMBLY HEIGHT WITH BOTTOM NESTING IN CEILING RUNNER WITHOUT ATTACHMENT.
5. 5/8" OR 1-1/4" THICKNESS GYPSUM WALLBOARD AS SPECIFIED IN THE INDIVIDUAL UL DESIGN. TOP ROW OF SCREWS SHALL BE INSTALLED INTO STUD 1" TO 1-1/2" BELOW THE BOTTOM EDGE OF THE CEILING RUNNER.
6. HILTI CFS-TTS 358, CFS-TTS 600, OR CFS-TTS OS TOP TRACK SEAL INSTALLED OVER CEILING RUNNER PRIOR TO ATTACHMENT TO UNDERSIDE OF CONCRETE FLOOR IN ACCORDANCE WITH THE ACCOMPANYING INSTALLATION INSTRUCTIONS.
7. [OPTIONAL] PVC WALL MOUNTED DEFLECTION BEAD (BY TRIM-TEX INC.) INSTALLED PER MANUFACTURER'S INSTRUCTIONS. DEFLECTION BEAD INSTALLED ON ONE OR BOTH SIDES OF WALL.

NOTES : 1. AS AN ALTERNATE TO CEILING RUNNER IN ITEM 3, SLOTTED CEILING RUNNERS MAY BE USED. CONSULT THE UL FIRE RESISTANCE DIRECTORY FOR APPROVED MANUFACTURERS.
2. TO ACCOMMODATE MAX. 50% COMPRESSION OR EXTENSION MAX. WIDTH OF JOINT = 1/2".
3. TO ACCOMMODATE MAX. 66% COMPRESSION ONLY MAX. WIDTH OF JOINT = 3/4".

Hilti Firestop Systems

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Plano, Texas USA (800) 879-8000

Sheet 1 of 1
Scale 3/16" = 1"
Date Jan. 30, 2018

Drawing No. HWD 0757c

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FIRESTOPPING JOINTS: JOINT TYPES

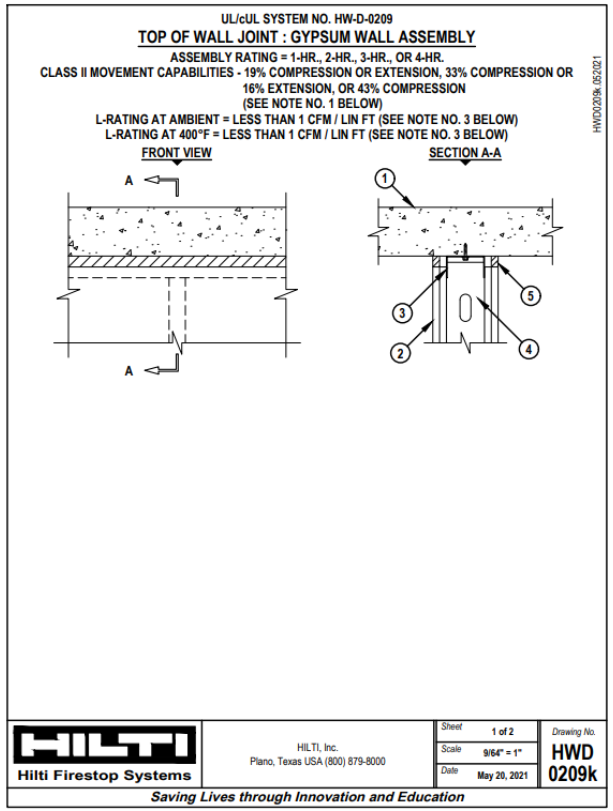
Metal Deck Joints

Top & Bottom of Wall

Wall to Wall

Edge of Slab

TOP OF WALL FIRESTOPPING – FLAT CONCRETE DECK APPLICATIONS



UL/cUL SYSTEM NO. HW-D-0209
TOP OF WALL JOINT : GYPSUM WALL ASSEMBLY
ASSEMBLY RATING = 1-HR., 2-HR., 3-HR., OR 4-HR.
CLASS II MOVEMENT CAPABILITIES - 19% COMPRESSION OR EXTENSION, 33% COMPRESSION OR 16% EXTENSION, OR 43% COMPRESSION
(SEE NOTE NO. 1 BELOW)
L-RATING AT AMBIENT = LESS THAN 1 CFM / LIN FT (SEE NOTE NO. 3 BELOW)
L-RATING AT 400°F = LESS THAN 1 CFM / LIN FT (SEE NOTE NO. 3 BELOW)

FRONT VIEW

SECTION A-A

HWD0209k 05/2021

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Plano, Texas USA (800) 879-8000

Sheet 1 of 2
Scale 9/64" = 1"
Date May 20, 2021
Drawing No. HWD 0209k

Hilti Firestop Systems
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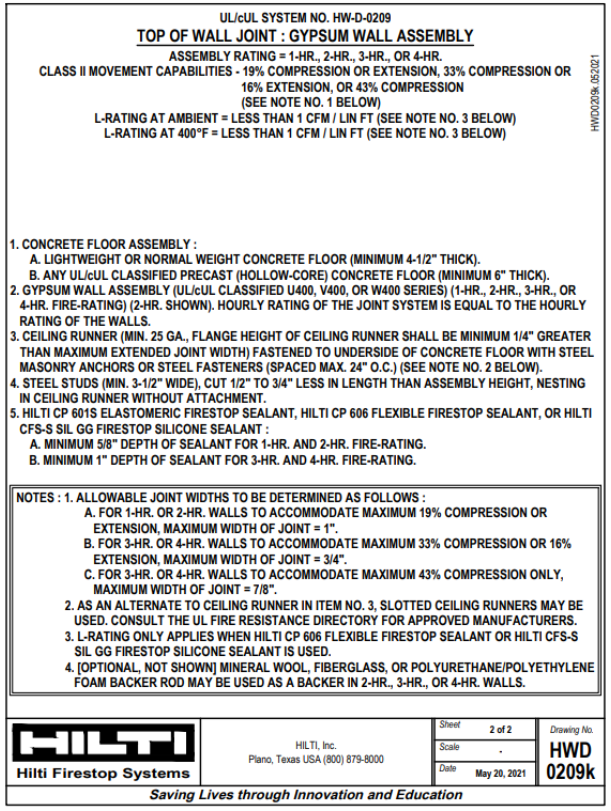

UL/cUL SYSTEM NO. HW-D-0209
TOP OF WALL JOINT : GYPSUM WALL ASSEMBLY
ASSEMBLY RATING = 1-HR., 2-HR., 3-HR., OR 4-HR.
CLASS II MOVEMENT CAPABILITIES - 19% COMPRESSION OR EXTENSION, 33% COMPRESSION OR 16% EXTENSION, OR 43% COMPRESSION
(SEE NOTE NO. 1 BELOW)
L-RATING AT AMBIENT = LESS THAN 1 CFM / LIN FT (SEE NOTE NO. 3 BELOW)
L-RATING AT 400°F = LESS THAN 1 CFM / LIN FT (SEE NOTE NO. 3 BELOW)

HWD0209k 05/2021

1. CONCRETE FLOOR ASSEMBLY :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 4-1/2" THICK).
   B. ANY UL/cUL CLASSIFIED PRECAST (HOLLOW-CORE) CONCRETE FLOOR (MINIMUM 6" THICK).
2. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U400, V400, OR W400 SERIES) (1-HR., 2-HR., 3-HR., OR 4-HR. FIRE-RATING) (2-HR. SHOWN). HOURLY RATING OF THE JOINT SYSTEM IS EQUAL TO THE HOURLY RATING OF THE WALLS.
3. CEILING RUNNER (MIN. 25 GA., FLANGE HEIGHT OF CEILING RUNNER SHALL BE MINIMUM 1/4" GREATER THAN MAXIMUM EXTENDED JOINT WIDTH) FASTENED TO UNDERSIDE OF CONCRETE FLOOR WITH STEEL MASONRY ANCHORS OR STEEL FASTENERS (SPACED MAX. 24" O.C.) (SEE NOTE NO. 2 BELOW).
4. STEEL STUDS (MIN. 3-1/2" WIDE), CUT 1/2" TO 3/4" LESS IN LENGTH THAN ASSEMBLY HEIGHT, NESTING IN CEILING RUNNER WITHOUT ATTACHMENT.
5. HILTI CP 601S ELASTOMERIC FIRESTOP SEALANT, HILTI CP 606 FLEXIBLE FIRESTOP SEALANT, OR HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT :
   A. MINIMUM 5/8" DEPTH OF SEALANT FOR 1-HR. AND 2-HR. FIRE-RATING.
   B. MINIMUM 1" DEPTH OF SEALANT FOR 3-HR. AND 4-HR. FIRE-RATING.

NOTES : 1. ALLOWABLE JOINT WIDTHS TO BE DETERMINED AS FOLLOWS :
   A. FOR 1-HR. OR 2-HR. WALLS TO ACCOMMODATE MAXIMUM 19% COMPRESSION OR EXTENSION, MAXIMUM WIDTH OF JOINT = 1".
   B. FOR 3-HR. OR 4-HR. WALLS TO ACCOMMODATE MAXIMUM 33% COMPRESSION OR 16% EXTENSION, MAXIMUM WIDTH OF JOINT = 3/4".
   C. FOR 3-HR. OR 4-HR. WALLS TO ACCOMMODATE MAXIMUM 43% COMPRESSION ONLY, MAXIMUM WIDTH OF JOINT = 7/8".
2. AS AN ALTERNATE TO CEILING RUNNER IN ITEM NO. 3, SLOTTED CEILING RUNNERS MAY BE USED. CONSULT THE UL FIRE RESISTANCE DIRECTORY FOR APPROVED MANUFACTURERS.
3. L-RATING ONLY APPLIES WHEN HILTI CP 606 FLEXIBLE FIRESTOP SEALANT OR HILTI CFS-S SIL GG FIRESTOP SILICONE SEALANT IS USED.
4. [OPTIONAL, NOT SHOWN] MINERAL WOOL, FIBERGLASS, OR POLYURETHANE/POLYETHYLENE FOAM BACKER ROD MAY BE USED AS A BACKER IN 2-HR., 3-HR., OR 4-HR. WALLS.

HILTI, Inc.
Plano, Texas USA (800) 879-8000

Sheet 2 of 2
Scale -
Date May 20, 2021
Drawing No. HWD 0209k

Hilti Firestop Systems
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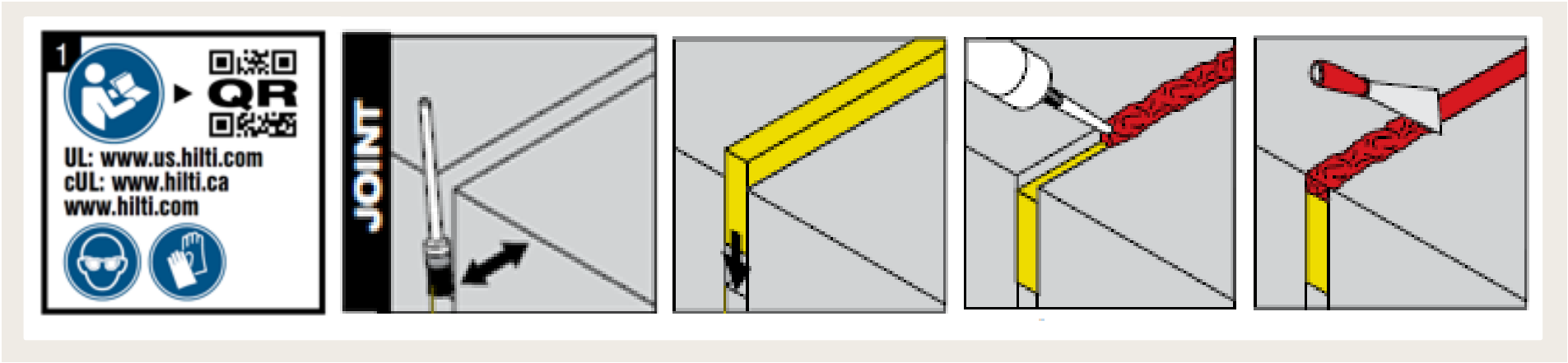
- Listing will indicate the movement capabilities of the firestop solution
  - Construction joints will often be subjected to movement
- Required depth of sealant is specified
  - Note that the requirement may change with the required fire rating
- Firestop is required on both sides of the wall
- Some systems may require mineral wool, others may include it as an option for a backer material

PROCESS FOR INSTALLING SEALANTS FOR JOINT APPLICATIONS

- Read and understand the details of the firestop system or Engineering Judgement to be used and the product manufacturer’s instructions for use.
- Clean the opening of debris, dirt, oil, wax and grease. Ensure the surface is free of moisture and frost.
- Insert mineral wool or backer, as required.
- Apply firestop sealant. Ensure the correct minimum depth of sealant is installed.
- Smooth the firestop sealant with a trowel.



CONSTRUCTION JOINTS: TOP/BOTTOM OF WALL

POOR FIRESTOP INSTALLATION EXAMPLES

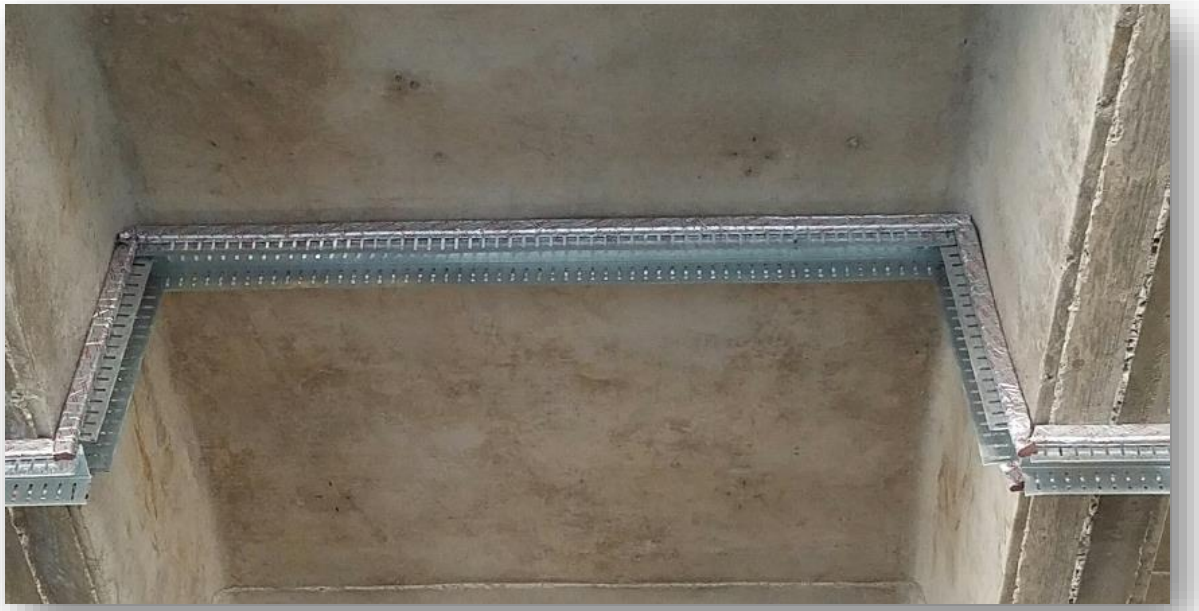
- Visible gap in firestop at joint

- Here the firestop is used as a “lip-stick”
- A very small joint at the head of wall, so CP 606 sealant was smeared on the joint
- The correct depth of sealant was not installed per a listed system
- Deflection of the joint will likely lead to cracks in the sealant

CONSTRUCTION JOINTS: TOP OF WALL

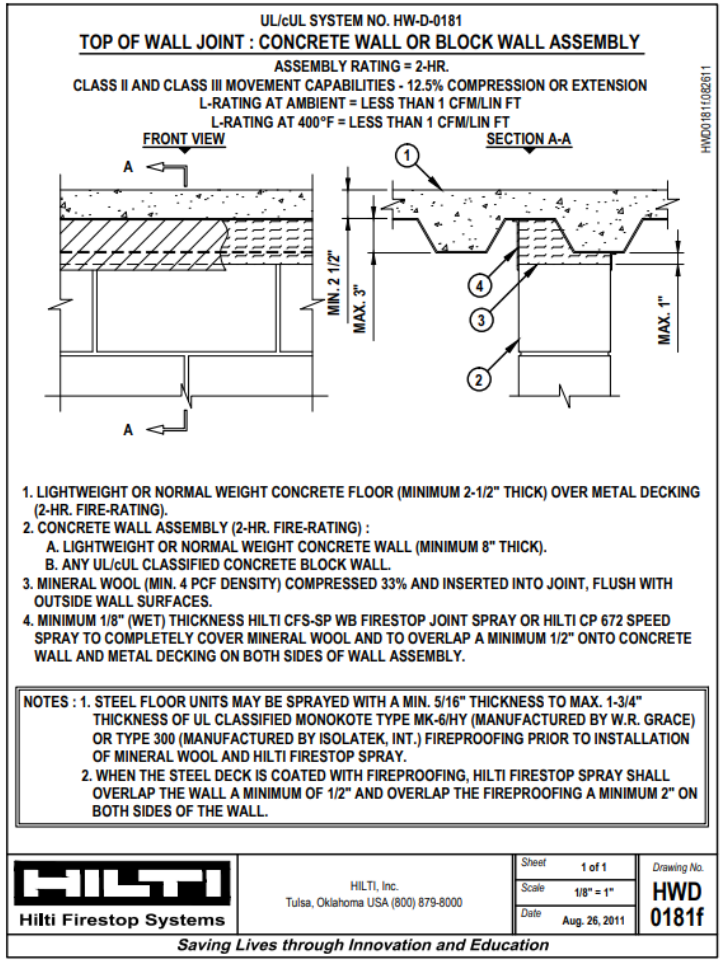
GOOD FIRESTOP INSTALLATION EXAMPLES

- Joint is filled with firestop material to the required depth
- No visible gaps
- Firestop material has been tooled per the Instructions for Use



- A firestop pre-formed device has been used to ensure correct installation and amount of material

TOP OF WALL FIRESTOPPING – METAL DECK APPLICATIONS



UL/cUL SYSTEM NO. HW-D-0181

TOP OF WALL JOINT : CONCRETE WALL OR BLOCK WALL ASSEMBLY

ASSEMBLY RATING = 2-HR.
CLASS II AND CLASS III MOVEMENT CAPABILITIES - 12.5% COMPRESSION OR EXTENSION
L-RATING AT AMBIENT = LESS THAN 1 CFM/LIN FT
L-RATING AT 400°F = LESS THAN 1 CFM/LIN FT

FRONT VIEW

SECTION A-A

HWD0181102611

1. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 2-1/2" THICK) OVER METAL DECKING (2-HR. FIRE-RATING).
2. CONCRETE WALL ASSEMBLY (2-HR. FIRE-RATING) :
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE WALL (MINIMUM 8" THICK).
   B. ANY UL/cUL CLASSIFIED CONCRETE BLOCK WALL.
3. MINERAL WOOL (MIN. 4 PCF DENSITY) COMPRESSED 33% AND INSERTED INTO JOINT, FLUSH WITH OUTSIDE WALL SURFACES.
4. MINIMUM 1/8" (WET) THICKNESS HILTI CFS-SP WB FIRESTOP JOINT SPRAY OR HILTI CP 672 SPEED SPRAY TO COMPLETELY COVER MINERAL WOOL AND TO OVERLAP A MINIMUM 1/2" ONTO CONCRETE WALL AND METAL DECKING ON BOTH SIDES OF WALL ASSEMBLY.

NOTES : 1. STEEL FLOOR UNITS MAY BE SPRAYED WITH A MIN. 5/16" THICKNESS TO MAX. 1-3/4" THICKNESS OF UL CLASSIFIED MONOKOTE TYPE MK-6/HY (MANUFACTURED BY W.R. GRACE) OR TYPE 300 (MANUFACTURED BY ISOLATEK, INT.) FIREPROOFING PRIOR TO INSTALLATION OF MINERAL WOOL AND HILTI FIRESTOP SPRAY.
2. WHEN THE STEEL DECK IS COATED WITH FIREPROOFING, HILTI FIRESTOP SPRAY SHALL OVERLAP THE WALL A MINIMUM OF 1/2" AND OVERLAP THE FIREPROOFING A MINIMUM 2" ON BOTH SIDES OF THE WALL.

Hilti Firestop Systems

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Sheet 1 of 1
Scale 1/8" = 1"
Date Aug. 26, 2011

Drawing No. HWD 0181f

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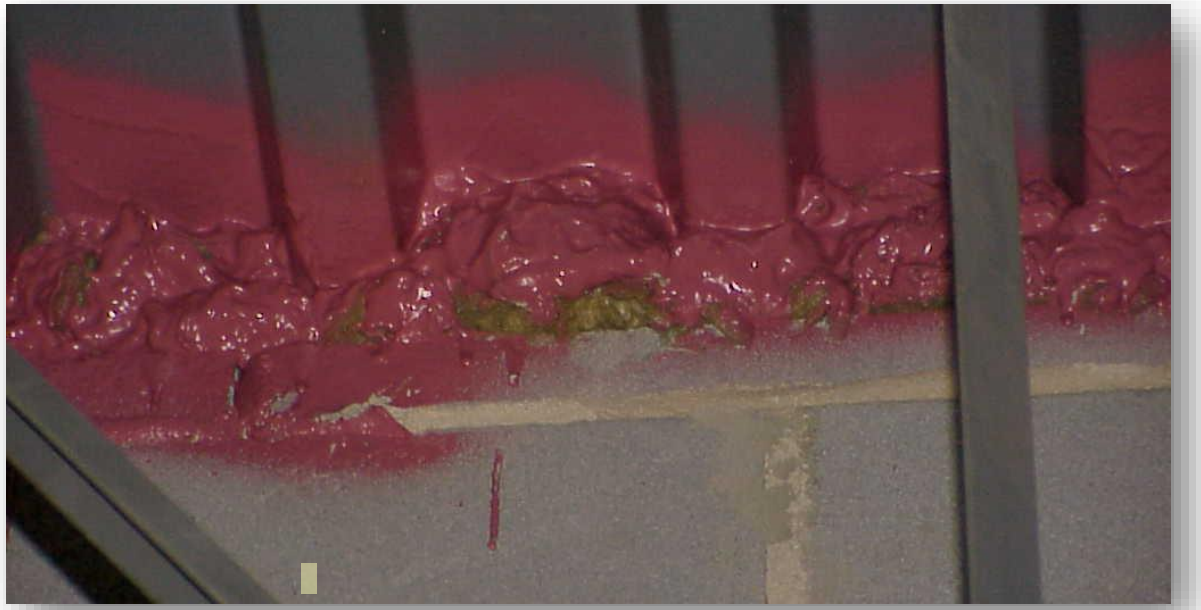
- Listing will indicate the movement capabilities of the firestop solution
  - Construction joints will often be subjected to movement
- Listing indicates the required density, compression, and orientation of the mineral wool
- Listings require that firestop spray overlap onto the construction material on either side of the joint
- Firestop is required on both sides of the wall
- If the steel deck is coated with fireproofing, additional overlap of the firestop spray is required

CONSTRUCTION JOINTS: TOP OF WALL UNDER METAL DECK

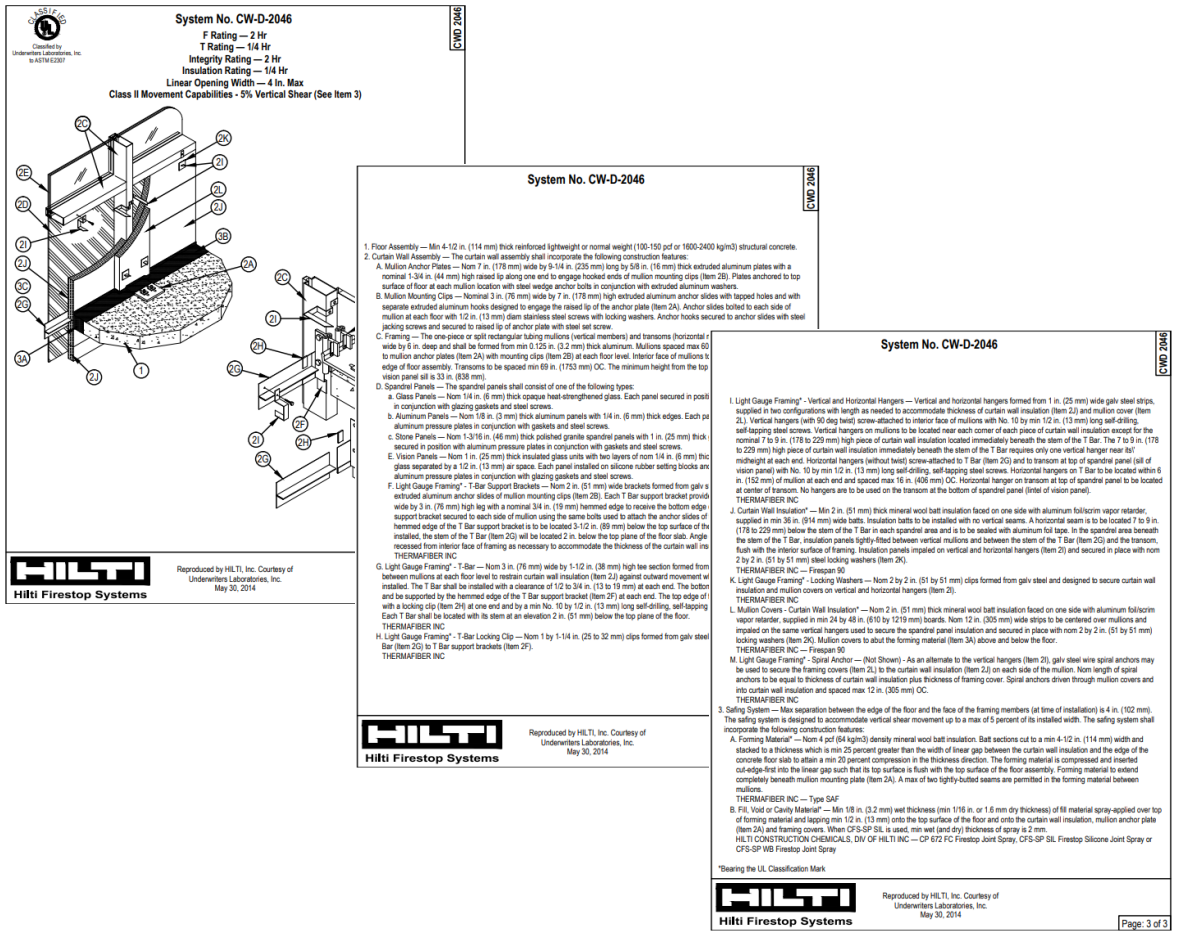
POOR VS GOOD FIRESTOP INSTALLATION EXAMPLES



- Top of wall application, concrete to metal deck
- Note the metal deck flutes run perpendicular to the wall assembly
- Mineral wool is visible through the spray
- Will not provide an adequate smoke seal and meet listing requirements

- Correct installation are not always perfect, but compliant
- Mineral wool is compressed and installed above the top of the CMU wall to the concrete over metal deck floor.
- Spray with a minimum ½” overlap onto the floor/wall

EDGE OF SLAB FIRESTOPPING



System No. CW-D-2046

F Rating — 2 Hr
T Rating — 1/4 Hr
Integrity Rating — 2 Hr
Insulation Rating — 1/4 Hr
Linear Opening Width — 4 In. Max
Class II Movement Capabilities - 5% Vertical Shear (See Item 3)

CWD 2046

Hilti Firestop Systems

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System No. CW-D-2046

1. Floor Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) structural concrete.
2. Curtain Wall Assembly — The curtain wall assembly shall incorporate the following construction features:
A. Mullion Anchor Plates — Nom 7 in. (178 mm) wide by 9-1/4 in. (235 mm) long by 5/8 in. (16 mm) thick extruded aluminum plates with a nominal 1-3/4 in. (44 mm) high raised lip along one end to engage hooked ends of mullion mounting clips (Item 2B). Plates anchored to top surface of floor at each mullion location with steel wedge anchor bolts in conjunction with extruded aluminum washers.
B. Mullion Mounting Clips — Nominal 3 in. (76 mm) wide by 7 in. (178 mm) high extruded aluminum anchor slides with tapped holes and with separate extruded aluminum hooks designed to engage the raised lip of the anchor plate (Item 2A). Anchor slides bolted to each side of mullion at each floor with 1/2 in. (13 mm) diam stainless steel screws with locking washers. Anchor hooks secured to anchor slides with steel jacking screws and secured to raised lip of anchor plate with steel set screw.
C. Framing — The one-piece or split rectangular tubing mullions (vertical members) and transoms (horizontal
wide by 6 in. deep and shall be formed from min 0.125 in. (3.2 mm) thick aluminum. Mullions spaced max 60
to mullion anchor plates (Item 2A) with mounting clips (Item 2B) at each floor level. Interior face of mullions t
edge of floor assembly. Transoms to be spaced min 69 in. (1753 mm) OC. The minimum height from the top
vision panel sill is 33 in. (838 mm).
D. Spandrel Panels — The spandrel panels shall consist of one of the following types:
a. Glass Panels — Nom 1/4 in. (6 mm) thick opaque heat-strengthened glass. Each panel secured in positi
in conjunction with glazing gaskets and steel screws.
b. Aluminum Panels — Nom 1/8 in. (3 mm) thick aluminum panels with 1/4 in. (6 mm) thick edges. Each pa
aluminum pressure plates in conjunction with gaskets and steel screws.
c. Stone Panels — Nom 1-3/16 in. (46 mm) thick polished granite spandrel panels with 1 in. (25 mm) thick
secured in position with aluminum pressure plates in conjunction with gaskets and steel screws.
E. Vision Panels — Nom 1 in. (25 mm) thick insulated glass units with two layers of nom 1/4 in. (6 mm) thic
glass separated by a 1/2 in. (13 mm) air space. Each panel installed on silicone rubber setting blocks an
aluminum pressure plates in conjunction with glazing gaskets and steel screws.
F. Light Gauge Framing* - T-Bar Support Brackets — Nom 2 in. (51 mm) wide brackets formed from galv s
extruded aluminum anchor slides of mullion mounting clips (Item 2B). Each T Bar support bracket provid
wide by 3 in. (76 mm) high leg with a nominal 3/4 in. (19 mm) hemmed edge to receive the bottom edge
support bracket secured to each side of mullion using the same bolts used to attach the anchor slides of
hemmed edge of the T Bar support bracket is to be located 3-1/2 in. (89 mm) below the top surface of the
installed, the stem of the T Bar (Item 2G) will be located 2 in. below the top plane of the floor slab. Angle
recessed from interior face of framing as necessary to accommodate the thickness of the curtain wall ins
THERMAFIBER INC
G. Light Gauge Framing* - T-Bar — Nom 3 in. (76 mm) wide by 1-1/2 in. (38 mm) high tee section formed from
between mullions at each floor level to restrain curtain wall insulation (Item 2J) against outward movement w
installed. The T Bar shall be installed with a clearance of 1/2 to 3/4 in. (13 to 19 mm) at each end. The botton
and be supported by the hemmed edge of the T Bar support bracket (Item 2F) at each end. The top edge of
with a locking clip (Item 2H) at one end and by a min No. 10 by 1/2 in. (13 mm) long self-drilling, self-tapping
Each T Bar shall be located with its stem at an elevation 2 in. (51 mm) below the top plane of the floor.
THERMAFIBER INC
H. Light Gauge Framing* - T-Bar Locking Clip — Nom 1 by 1-1/4 in. (25 to 32 mm) clips formed from galv steel
Bar (Item 2G) to T Bar support brackets (Item 2F).
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System No. CW-D-2046

I. Light Gauge Framing* - Vertical and Horizontal Hangers — Vertical and horizontal hangers formed from 1 in. (25 mm) wide galv steel strips, supplied in two configurations with length as needed to accommodate thickness of curtain wall insulation (Item 2J) and mullion cover (Item 2L). Vertical hangers (with 90 deg twist) screw-attached to interior face of mullions with No. 10 by min 1/2 in. (13 mm) long self-drilling, self-tapping steel screws. Vertical hangers on mullions to be located near each corner of each piece of curtain wall insulation except for the nominal 7 to 9 in. (178 to 229 mm) high piece of curtain wall insulation located immediately beneath the stem of the T Bar. The 7 to 9 in. (178 to 229 mm) high piece of curtain wall insulation immediately beneath the stem of the T Bar requires only one vertical hanger near its midheight at each end. Horizontal hangers (without twist) screw-attached to T Bar (Item 2G) and to transom at top of spandrel panel (sill of vision panel) with No. 10 by min 1/2 in. (13 mm) long self-drilling, self-tapping steel screws. Horizontal hangers on T Bar to be located within 6 in. (152 mm) of mullion at each end and spaced max 16 in. (406 mm) OC. Horizontal hanger on transom at top of spandrel panel to be located at center of transom. No hangers are to be used on the transom at the bottom of spandrel panel (lintel of vision panel).
THERMAFIBER INC
J. Curtain Wall Insulation* — Min 2 in. (51 mm) thick mineral wool batt insulation faced on one side with aluminum foil/scrim vapor retarder, supplied in min 36 in. (914 mm) wide batts. Insulation batts to be installed with no vertical seams. A horizontal seam is to be located 7 to 9 in. (178 to 229 mm) below the stem of the T Bar in each spandrel area and is to be sealed with aluminum foil tape. In the spandrel area beneath the stem of the T Bar, insulation panels tightly-fitted between vertical mullions and between the stem of the T Bar (Item 2G) and the transom, flush with the interior surface of framing. Insulation panels impaled on vertical and horizontal hangers (Item 2I) and secured in place with nom 2 by 2 in. (51 by 51 mm) steel locking washers (Item 2K).
THERMAFIBER INC — Firespan 90
K. Light Gauge Framing* - Locking Washers — Nom 2 by 2 in. (51 by 51 mm) clips formed from galv steel and designed to secure curtain wall insulation and mullion covers on vertical and horizontal hangers (Item 2I).
THERMAFIBER INC
L. Mullion Covers - Curtain Wall Insulation* — Nom 2 in. (51 mm) thick mineral wool batt insulation faced on one side with aluminum foil/scrim vapor retarder, supplied in min 24 by 48 in. (610 by 1219 mm) boards. Nom 12 in. (305 mm) wide strips to be centered over mullions and impaled on the same vertical hangers used to secure the spandrel panel insulation and secured in place with nom 2 by 2 in. (51 by 51 mm) locking washers (Item 2K). Mullion covers to abut the forming material (Item 3A) above and below the floor.
THERMAFIBER INC — Firespan 90
M. Light Gauge Framing* - Spiral Anchor — (Not Shown) - As an alternate to the vertical hangers (Item 2I), galv steel wire spiral anchors may be used to secure the framing covers (Item 2L) to the curtain wall insulation (Item 2J) on each side of the mullion. Nom length of spiral anchors to be equal to thickness of curtain wall insulation plus thickness of framing cover. Spiral anchors driven through mullion covers and into curtain wall insulation and spaced max 12 in. (305 mm) OC.
THERMAFIBER INC
3. Safing System — Max separation between the edge of the floor and the face of the framing members (at time of installation) is 4 in. (102 mm). The safing system is designed to accommodate vertical shear movement up to a max of 5 percent of its installed width. The safing system shall incorporate the following construction features:
A. Forming Material* — Nom 4 pcf (64 kg/m3) density mineral wool batt insulation. Batt sections cut to a min 4-1/2 in. (114 mm) width and stacked to a thickness which is min 25 percent greater than the width of linear gap between the curtain wall insulation and the edge of the concrete floor slab to attain a min 20 percent compression in the thickness direction. The forming material is compressed and inserted cut-edge-first into the linear gap such that its top surface is flush with the top surface of the floor assembly. Forming material to extend completely beneath mullion mounting plate (Item 2A). A max of two tightly-butted seams are permitted in the forming material between mullions.
THERMAFIBER INC — Type SAF
B. Fill, Void or Cavity Material* — Min 1/8 in. (3.2 mm) wet thickness (min 1/16 in. or 1.6 mm dry thickness) of fill material spray-applied over top of forming material and lapping min 1/2 in. (13 mm) onto the top surface of the floor and onto the curtain wall insulation, mullion anchor plate (Item 2A) and framing covers. When CFS-SP SIL is used, min wet (and dry) thickness of spray is 2 mm.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 672 FC Firestop Joint Spray, CFS-SP SIL Firestop Silicone Joint Spray or CFS-SP WB Firestop Joint Spray

*Bearing the UL Classification Mark

Hilti Firestop Systems

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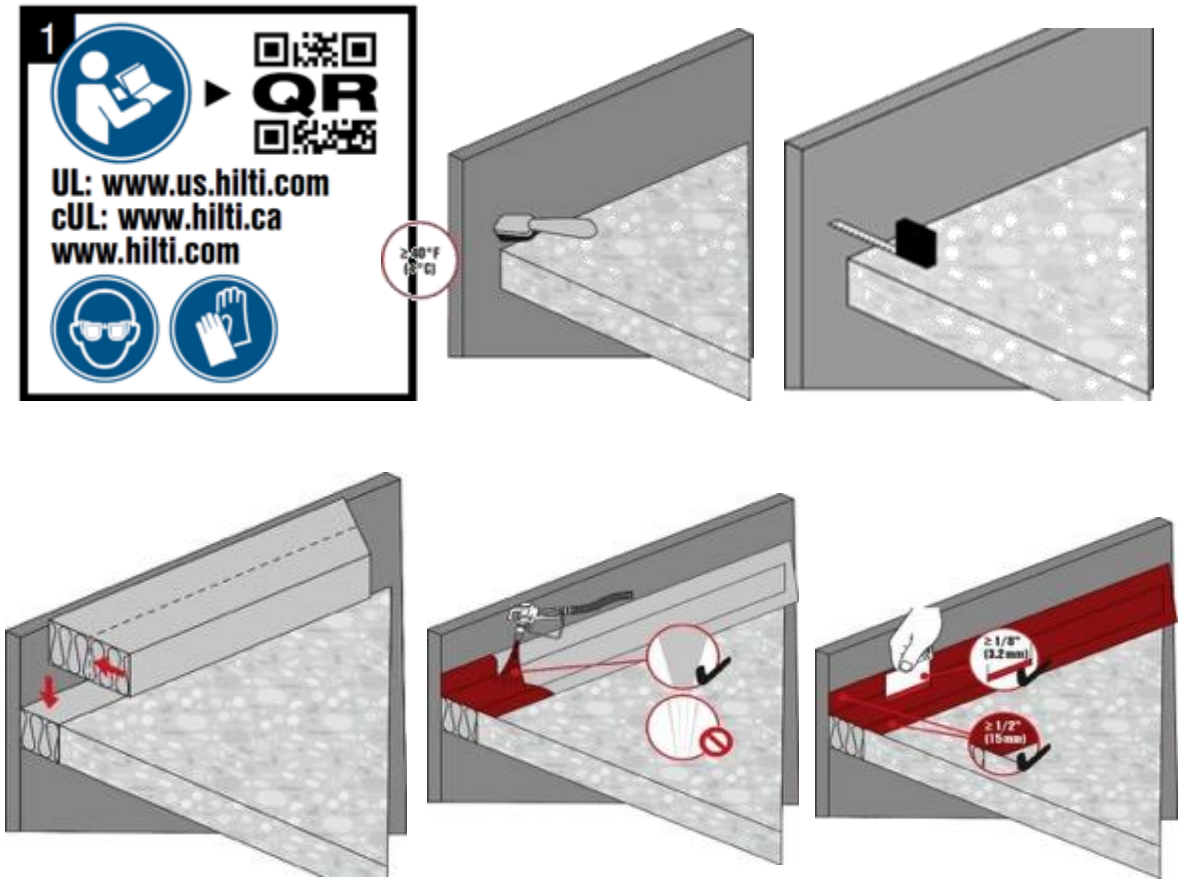
Page: 3 of 3

- Movement capabilities of the system are identified
- Permitted curtain wall assembly variables are documented in the listing, including:
  - Mullion cover (depends on system), framing (aluminum or steel), spandrel, vision panels, insulation
- Safing system forming material is indicated, including required density and compression percentage
- Required firestop materials (ex. firestop joint spray) is indicated with required wet and dry thickness and required overlap onto adjacent surfaces
- Joints or sealant can be used for firestopping edge of slab applications

PROCESS FOR INSTALLING SEALANTS FOR EDGE OF SLAB JOINT APPLICATIONS

- Read and understand the details of the firestop system or Engineering Judgement to be used
- Clean the opening of debris, dirt, oil, wax and grease; ensure the surface is free of moisture/frost
- Measure the maximum joint width; check to ensure it can be accommodated by the UL system or EJ
- Calculate the thickness of mineral wool required to meet minimum compression %; compress and insert mineral wool before installing spray
- Apply spray evenly, overlapping onto both substrates
- Measure the thickness of the joint spray when wet; it should be uniform coat of 1/8th” thickness; ensure no mineral wool is exposed



MINERAL WOOL ORIENTATION AND COMPRESSION IS KEY TO CORRECT FIRESTOP INSTALLATION

- **Edge of slab joints**: Mineral wool grain should run vertical
- The width of mineral wool to cut can be determined by the following equation:

$$\text{Thickness} = \frac{(\text{Width of joint}) \times 100}{100 - (\text{Compression \%})}$$

- **Head of wall joints**: Mineral wool grain should run horizontal

CONSTRUCTION JOINTS: EDGE OF SLAB JOINTS

POOR VS GOOD FIRESTOP INSTALLATION EXAMPLES

- Firestop at joint has detached, creating an opening

- Firestop spray has been neatly applied
- Firestop spray overlaps on adjacent materials
- Mineral wool is properly compressed and oriented

SPECIAL INSPECTION

3RD PARTY SPECIAL INSPECTIONS: WHAT IS A “SPECIAL INSPECTION”?

- Code officials (AHJ) have responsibility for overall code enforcement
- Special inspection for specific elements that are extremely critical or complex
  - Including Firestopping (as of 2012 IBC)
- Special inspection is by 3rd-party expert agency
  - Performed according to specified standards
- The process involves:
  - Statistical sampling
  - Verify materials prior to installation
  - Verify against listed systems and/or EJs
  - Verify that ALL firestop installed

SPECIAL INSPECTIONS MANDATED BY CHAPTER 17 (2012 IBC THROUGH CURRENT EDITION)

2021 IBC Language:

Chapter 17: Special Inspections and Tests

- **1705.18 Fire-resistant penetrations and joints.** In high-rise buildings, in buildings assigned to *Risk Category III or IV*, or in fire areas containing Group R occupancies with an occupant load greater than 250*, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems* that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.
- High-rise: A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.

General Special Inspection Requirements

- 1703.1.1 **Independence.** An *approved agency* shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall also disclose to the *building official* and the *registered design professional in responsible charge* possible conflicts of interest so that objectivity can be confirmed.
- 1703.1.3 **Personnel.** An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests and *special inspections*.

THE SPECIAL INSPECTION PROCESS

- **ASTM E2174: Standard Practice for On-Site Inspection of Installed Firestops**
  - For each “type” of firestop being installed:
    - Witness 10% of Installations, or Destructive Testing on 2% of Installations
- **ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers**
  - For each “type” of fire resistive joint system being installed:
    - Witness 5% of linear feet being installed, or Destructive (or disassembly) testing on 1 ft. per every 500 ft.

If non-compliance identified during Special Inspection:

- One non-compliant:
  - one full additional inspection of that type
- 10% non-compliance of one type:
  - inspection halted, installer re-inspects own work
- Non-compliant firestop must be repaired/replaced
- E2174/E2393: no guidance on what is an acceptable non-compliance percentage

ASTM E2174/E2393: SPECIAL INSPECTION INSPECTOR REQUIREMENTS

- Acceptable to AHJ
- Qualifications:
  - Meet the criteria in ASTM E699 (Construction Quality assurance agencies), OR
  - Minimum two years construction inspection experience and credentials acceptable to Authorizing Authority, OR
  - Quality assurance agency accredited by AHJ (e.g. IAS AC291 – Special Inspection Agencies)
- No conflicts of interest
  - Completely independent of installer, contractor, manufacturer, or supplier of any material
  - Not a competitor to those above
  - Inspector to submit notarized statement indicating compliance
- Must not interfere or direct

SPECIAL INSPECTION INSPECTOR QUALIFICATION STANDARD

ASTM standard E3038: Standard Practice for Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems

- Standard released August 2016
- Assist both authority having jurisdiction and authorizing authority in establishing minimum qualifications for candidates who desire to conduct firestop inspection.

Qualification Prerequisites

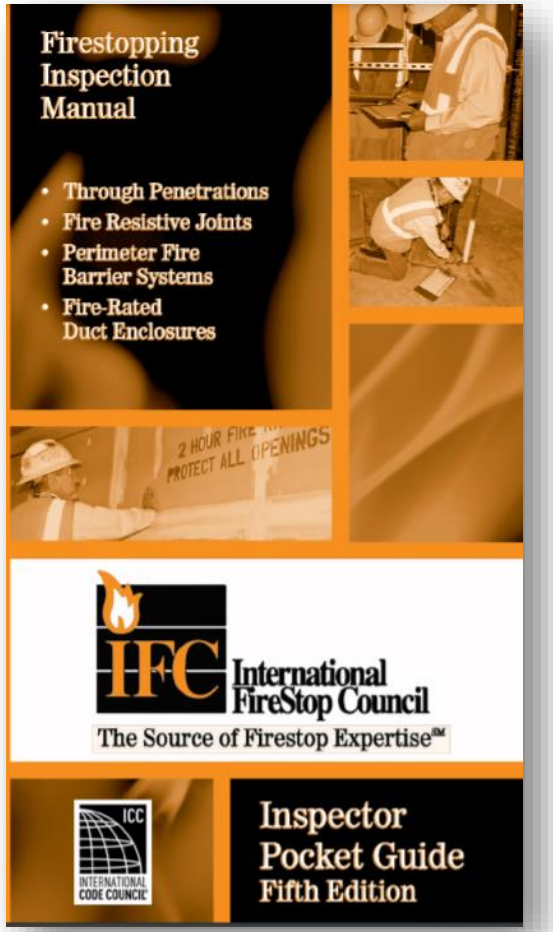
- Have a minimum of two-years' experience in building construction within the firestop industry conducting inspections under the direction of an inspector; or
- Have a minimum of two years of experience in the firestop industry conducting quality control; or
- Have a minimum four years of full-time (or at least (6160 h) experience in the selection or installation, or both, of firestop systems or fire-resistive joint systems, or both; or
- Hold license as a registered design professional with experience in the firestop industry

FIRESTOP RESOURCES

INTERNATIONAL FIRESTOP COUNCIL INSPECTOR POCKET GUIDE

Firestop Inspection Manual

- Through Penetrations
- Fire Resistive Joints
- Perimeter Fire Barrier Systems
- Fire-Rated Duct Enclosures
- Plan Review and Inspection Process



Download or purchase hardcopy here:
https://www.firestop.org/technical-library

International Firestop Council homepage:

https://www.firestop.org/

FIRESTOP INSPECTION AND REVIEW REMINDERS

- Review technical data
  - Firestop listings
  - Product Data Sheets, MSDS, drawing details
- Observe:
  - Firestop color
  - Material texture
  - Installation consistency
  - Required product cure times
  - Required product depth/thickness per listing (wet applied and cured)
- Understand products IFU (Instructions for Use)

Thank you for your attention!

THANK YOU!

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