

# ENHANCING PASSIVE FIRE PROTECTION IN BUILDINGS

MASTERING RATED BARRIER ELEMENTS  
FOR OPTIMAL SAFETY



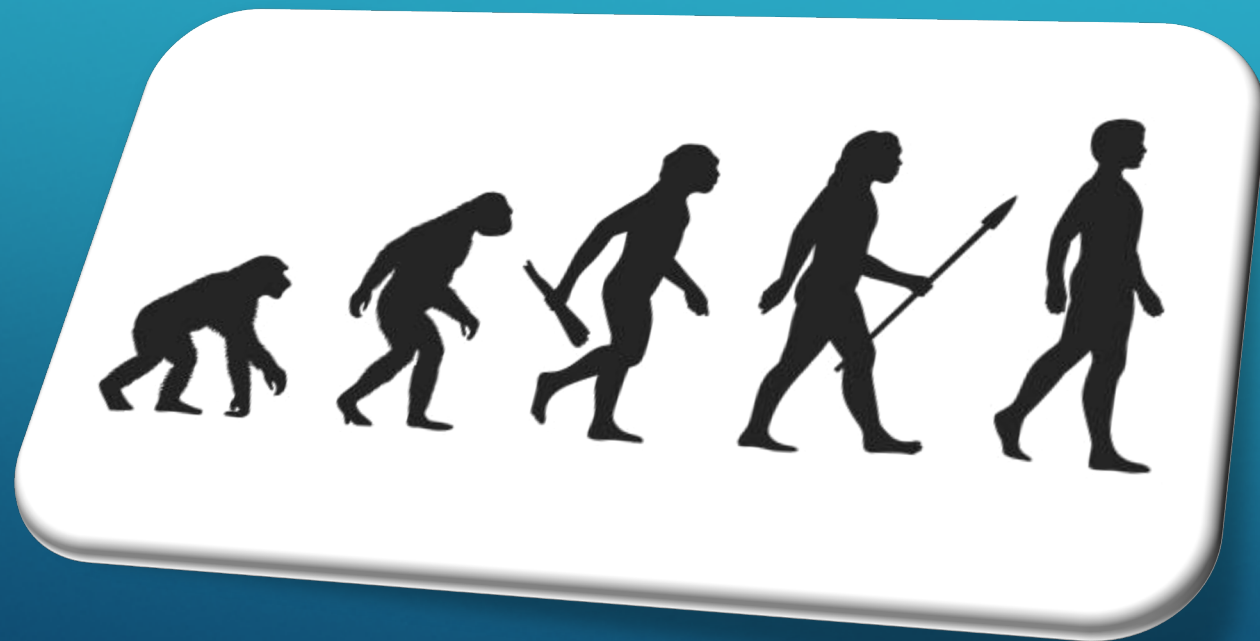
# AGENDA

Evolution of Firestopping

Three pillars of Fire protection  
(Understanding their role in Compartmentation)

Compromised Barriers  
(Common causes and consequences)

# THE EVOLUTION OF FIRESTOPPING



# THE BURNING FACTS



# WHY WE MUST CONTAIN FIRE, SMOKE & TOXIC GASES??



75% of all fire deaths are caused by smoke inhalation



Approximately 57% of people killed in fires are not in the room of the fire's origin



Visibility - 47% of survivors caught in a fire could not see more than 12 feet in any direction



Smoke travels 120-420 feet per minute under fire conditions



# CONSEQUENCES OF FIRES...

## MGM Grand Hotel & Casino

On Nov. 21<sup>st</sup>, 1980, a fire broke out at 7am in the hotel restaurant:

- 87 people were killed and more than 600 injured
- Fire spread from the hotel restaurant to the hotel lobby
- Took less than 6 minutes for the entire lobby floor to be engulfed in dangerous smoke and gases
- *While the fire primarily damaged the lobby floor, 64 deaths occurred on the upper levels (20<sup>th</sup> to 25<sup>th</sup> floors), from smoke inhalation.*



# CONSEQUENCES OF FIRES...

## Grenfell Tower, London, England

June 14, 2017: fire destroyed 151 homes, both in the tower and surrounding areas:

- At least **80 fatalities** have been reported to date.
- It was reported the fire started from a fridge freezer on the 4th floor and spread very rapidly throughout the building due to the highly combustible exterior cladding.
- Advisors say a combination of sprinklers and proper compartmentation would have prevented the fire from spreading beyond the kitchen.
- Both the aluminum-polyethylene cladding and the PIR insulation plates failed fire safety tests conducted after the fire.

# WHAT IS FIRESTOPPING?

Refers to methods used to restore the hourly fire-resistance rating of walls, floors, or other fire-resistant assemblies that have been breached by penetrations or meet at construction joints.



INTERNATIONAL FIRESTOP COUNCIL



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Three pillars of Fire protection  
(Understanding their role in Compartmentation)

Compromised Barriers  
(Common causes and consequences)

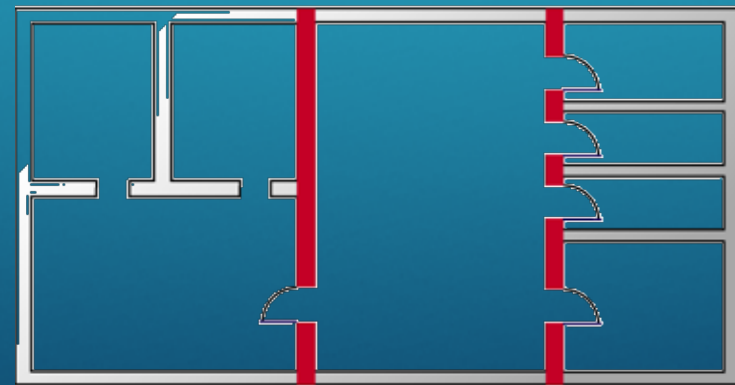
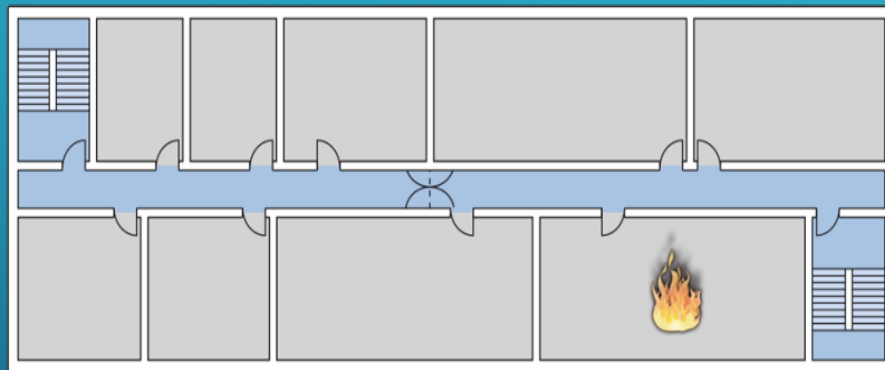


# THE BALANCED APPROACH TO FIRE PROTECTION

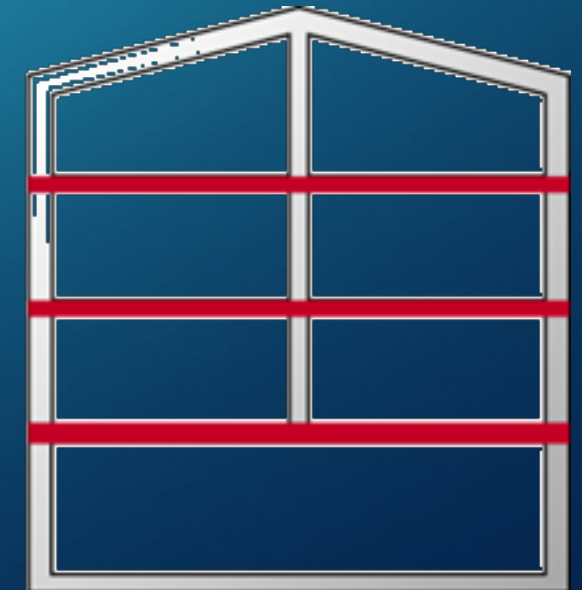
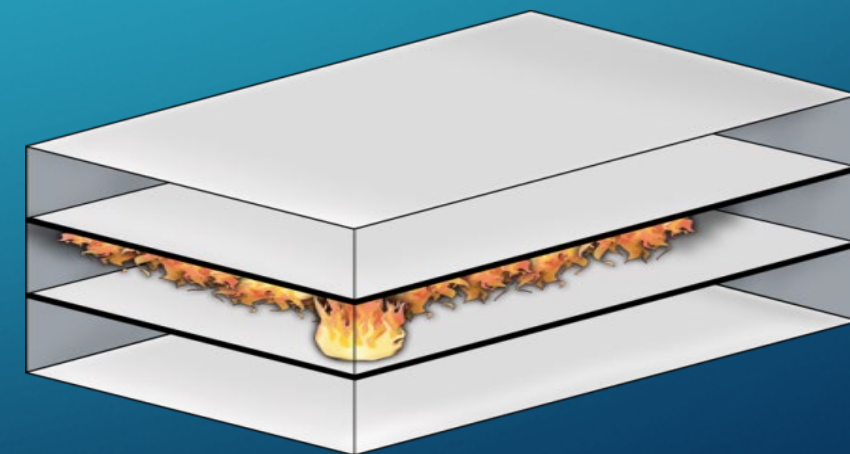
# ONE GLOBALLY APPLIED PRINCIPLE FOR FIRE SAFETY: COMPARTMENTATION (FIRE COMPARTMENTS)

The spread of fire can be restricted by dividing a building into separate compartments with fire-resistive walls and floors—increasing the availability of escape routes for occupants.

Fire rated walls



Fire rated floors

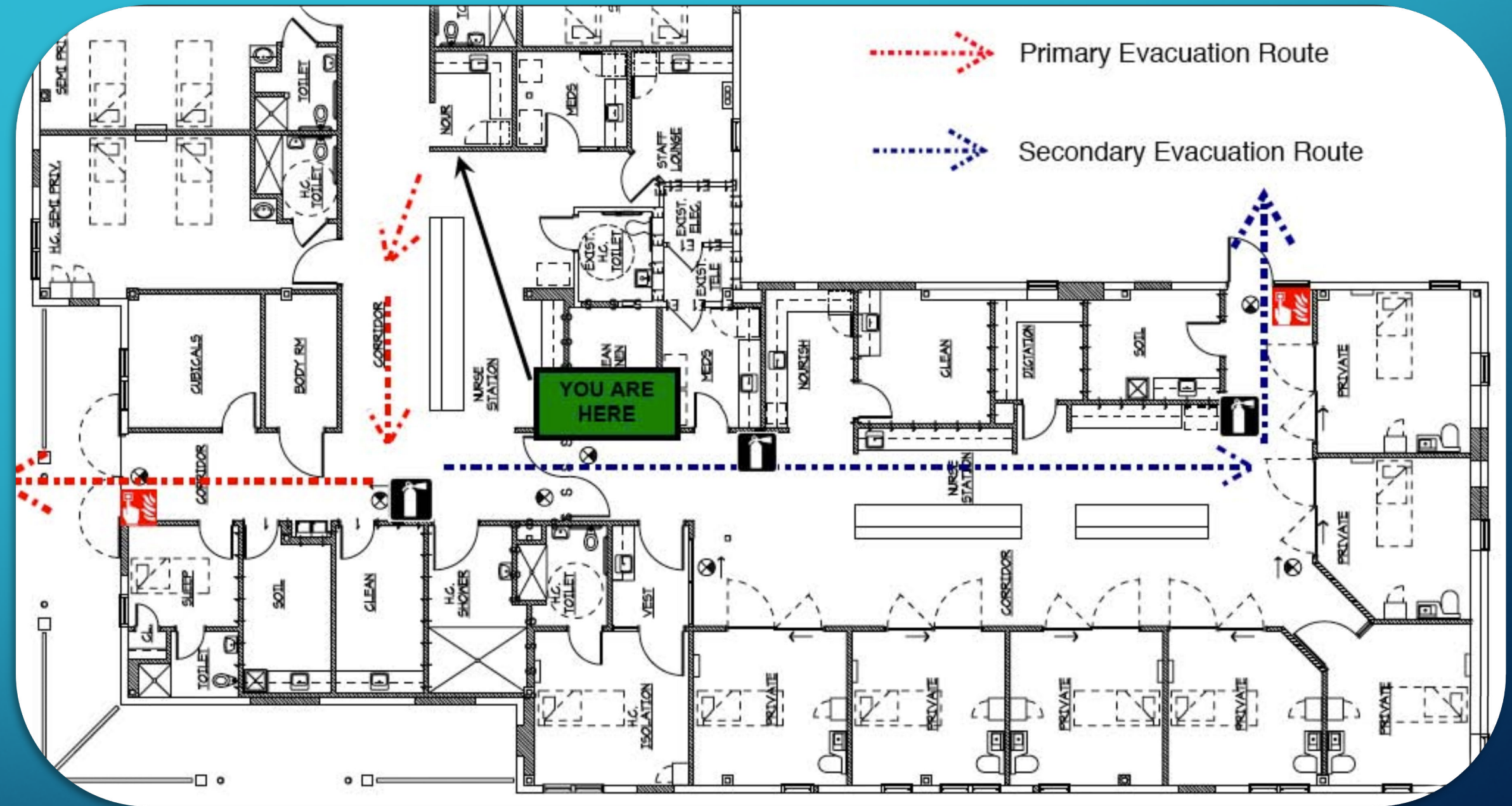


# AREAS THAT CAN ALLOW FOR FIRE/SMOKE SPREAD



# TYPES OF FIRE/SMOKE WALL ASSEMBLIES

- Fire walls
- Fire Barriers Walls
- Shaft Walls
- Fire Partitions
- Smoke Barriers
- Smoke Partitions



# FIRE WALL

- Can carry a **1, 2, or 3 hour** rating
- Designed to stop the spread of fire from one building to another
- Firewalls are constructed separately from other buildings running from the basement to above the roofline
- Extends continuously from foundation to roof assembly.
- Openings are protected

# FIRE BARRIER

- Can carry a 1, 2, or 3 hour rating
- Designed to stop the spread of fire from one area to another
- Barrier starts at the floor and ends at the ceiling assembly/top of the deck (doesn't have to be continuous from story to story)
- Openings are protected



# SMOKE BARRIER

- Can carry a 1, 2, or 3 hour rating
- Designed to stop the spread of fire & smoke from one area to another
- It is a special wall type needed to divide a facility into sections
- Can be vertical or horizontal
- Is required to have a “L” rating on all installed systems
- An extra air leakage test that is performed on some fire details
- Openings are protected

## *Most common use:*

*Divides hospitals into smoke compartments not exceeding 22,500 sq ft and prisons into blocks not exceeding 200 occupants*



# SMOKE PARTITIONS

- Designed to stop the passage of cold smoke
- It does not carry a fire rating
- Ceiling tile or hard ceiling can be considered an ending point (wall does not have to go to deck)
- Most common use:
  - ❖ Corridor walls in sprinklered hospitals



# WHEN COMPARTMENTATION WORKS

Lehigh Valley Hospital Fire, Dickinson City  
February 4<sup>th</sup>, 2026: destroying Orthopedic wing.

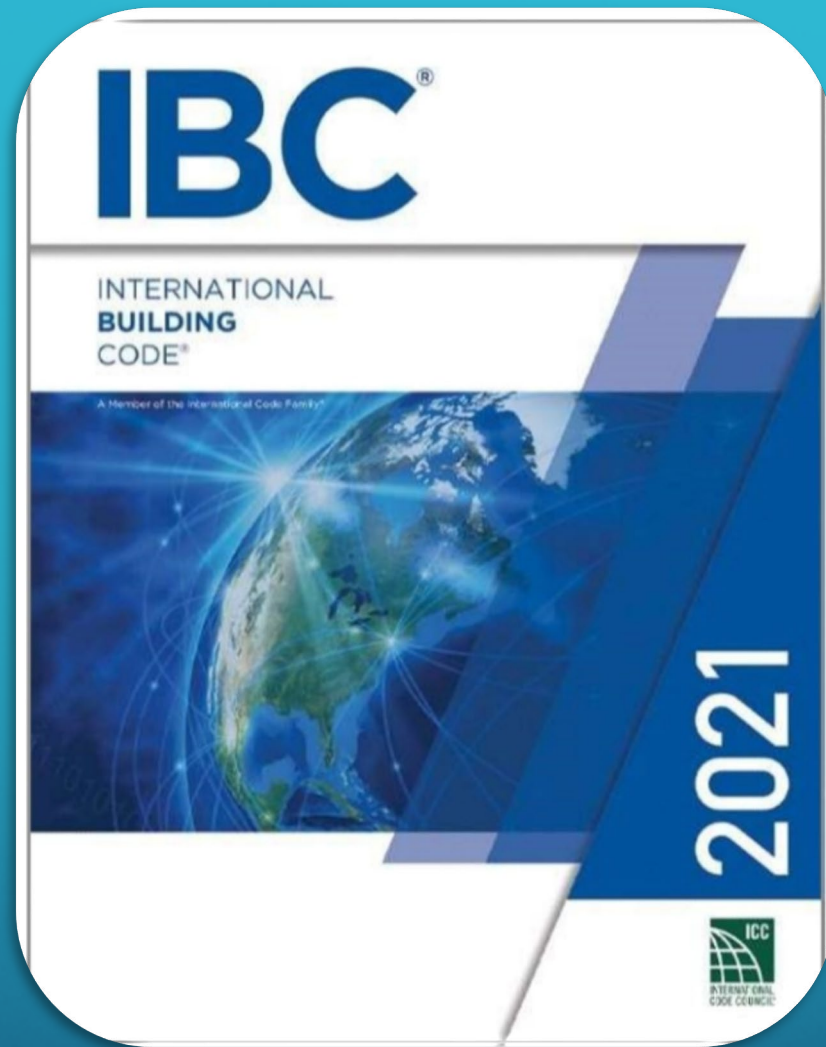
- Fire broke out at 9:40pm
- 77 patients evacuated.
- Fire originated in Orthopedic Institute
- Destroyed Ortho wing, but main hospital sustained only smoke damage on floors 3 & 4 with water damage on floor 1.
- *Fire chief stated the 3hr firewall prevented fire spread to primary hospital.*

# WHEN COMPARTMENTATION WORKS

- Hell's Kitchen New York 2014
- Compartmentation worked to keep the blaze contained to its origin
- Started due to an overloaded power strip in an apartment on the 20<sup>th</sup> floor.
- Only one casualty due to smoke inhalation



# FIRESTOPPING IS NOT NEW: REQUIRED BY ALL CURRENT AND LEGACY CODES



# 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 designing fire resistant systems

# FIRESTOPPING IS A SYSTEM APPROACH



# INTERNATIONAL BUILDING CODE (2021) FIRESTOP REQUIREMENTS



## Section 714.4.1.2 - Through-penetration firestop **systems**

- “*Through penetrations* shall be protected by an *approved penetration firestop **system*** installed as tested in accordance with ASTM E 814 or UL 1479...”

## Section 715.3.1 - Fire resistant joint **systems**

- “*Fire-resistant joint **systems*** shall be tested in accordance with the requirements of either ASTM E1966 or UL 2079...”

*What is the key term in the code language above?*

# MANY FACTORS AFFECT FIRE PERFORMANCE, AND EACH ARE PARAMETERS IN THE TESTING OF A SYSTEM

## Through Penetrations

- Size and type of penetrating item(s)
- Size and shape of opening
- Desired fire rating (hrs.)
- Floor or wall construction type and thickness
- Annular space
- Firestop products used

## Joints

- Joint width
- Desired assembly rating (hrs.)
- Floor or wall construction type and thickness
- Movement requirements (%)
- Stud width for gypsum walls
- Firestop products used

Once a tested firestop system has achieved the desired fire ratings, then a “Firestop System” is issued (published) by the testing agency

# FIRESTOP SYSTEMS IDENTIFY EACH COMPONENT REQUIRED TO ACHIEVE THE DESIRED FIRE RATING

- 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



intertek



**System No. W-L-1054**  
F Ratings — 1 and 2 Hr (See Items 1 and 3)  
T Rating — 0 Hr  
L Rating At Ambient — Less Than 1 CFM/Sq Ft  
L Rating At 400 F — 4 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. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. 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. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing on all four sides.
- B. Gypsum Board\* — 5/8 in. thick, 4 ft 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. for steel stud walls. Max diam of opening is 14-1/2 in. for wood stud walls. The F Rating of the firestop system is equal to the fire rating of the wall assembly.

2. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. Pipe may be installed with continuous point contact. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

- A. Steel Pipe — Nom 30 in diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. Iron Pipe — Nom 30 in. diam (or smaller) cast or ductile iron pipe.
- C. Conduit — Nom 4 in diam (or smaller) steel electrical metallic tubing or 6 in. diam steel conduit.
- D. Copper Tubing — Nom 6 in. diam (or smaller) Type L (or heavier) copper tubing.
- E. Copper Pipe — Nom 6 in. diam (or smaller) regular (or heavier) copper pipe.

3. Fill, Void or Cavity Material\* — Sealant — Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and wall, a min 1/2 in. diam bead of fill material shall be applied at the pipe wall interface on both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant  
\*Bearing the UL Classification Mark

WL 1054

# UL NOMENCLATURE FOR PENETRATIONS

First Alpha Character	
Letter	Description
C	Systems intended to protect penetrations through either floors or walls
F	Systems intended to protect penetrations through floors
W	Systems intended to protect penetrations through walls

Second and Third Alpha Characters	
Letter	Description
A	Concrete floors with a minimum thickness less than or equal to 5 in
B	Concrete floors with a minimum thickness greater than 5 in
C	Framed floors
D	Steel decks in marine vessels
E	Floor-ceiling assemblies consisting of concrete with membrane protection
G	Cross laminated timber (CLT) floor assembly
F, H - I	Not used at present time
J	Concrete or masonry walls with minimum thickness less than or equal to 8 in
K	Concrete or masonry walls with a minimum thickness greater than 8 in
L	Framed walls
M	Bulkheads in marine vessels
N	Composite panel walls
O-Z	Not used at present time

Numeric Characters	
Numeric Range	Description
0000 – 0999, 01000, 01001, 01002 etc.	No penetrating item
1000 – 1999, 11000, 11001, 11002 etc.	Metallic pipe, conduit or tubing
2000 – 2999, 21000, 21001, 21002 etc.	Nonmetallic pipe, conduit or tubing
3000 – 3999, 31000, 31001, 31002 etc.	Electrical cables
4000 – 4999, 41000, 41001, 41002 etc.	Cable trays with electrical cables
5000 – 5999, 51000, 51001, 51002 etc.	Insulated pipes
6000 – 6999, 61000, 61001, 61002 etc.	Misc. electrical penetrants such as busducts
7000 – 7999, 71000, 71001, 71002 etc.	Misc. mechanical penetrants such as air ducts
8000 – 8999, 81000, 81001, 81002 etc.	Groupings of penetrants including any combination of items listed above
9000 – 9999, 91000, 91001, 91002 etc.	Not used at present time

Example: WL - 1054

W: Wall system

L: Framed Wall

1054: Metallic pipe, conduit or tubing

# FIRESTOPPING PENETRATIONS: TYPES OF PENETRANTS

## Non-Combustible Penetrants

Metallic



## Combustible Penetrants

Insulated



Cable Bundles



Plastic



## Large Openings / Multi-Pens

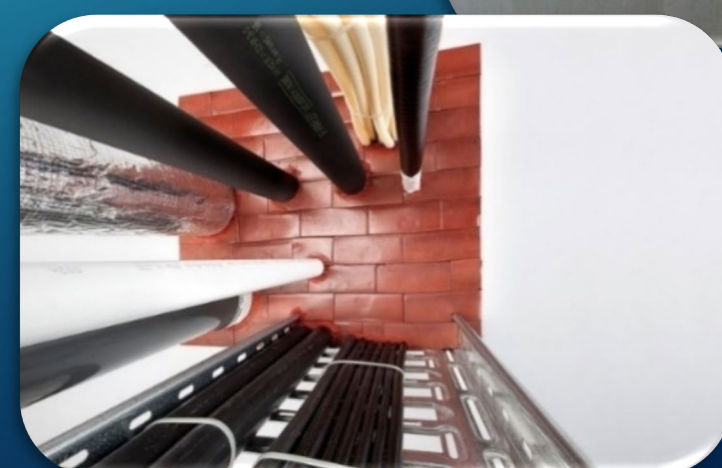
Cable Tray



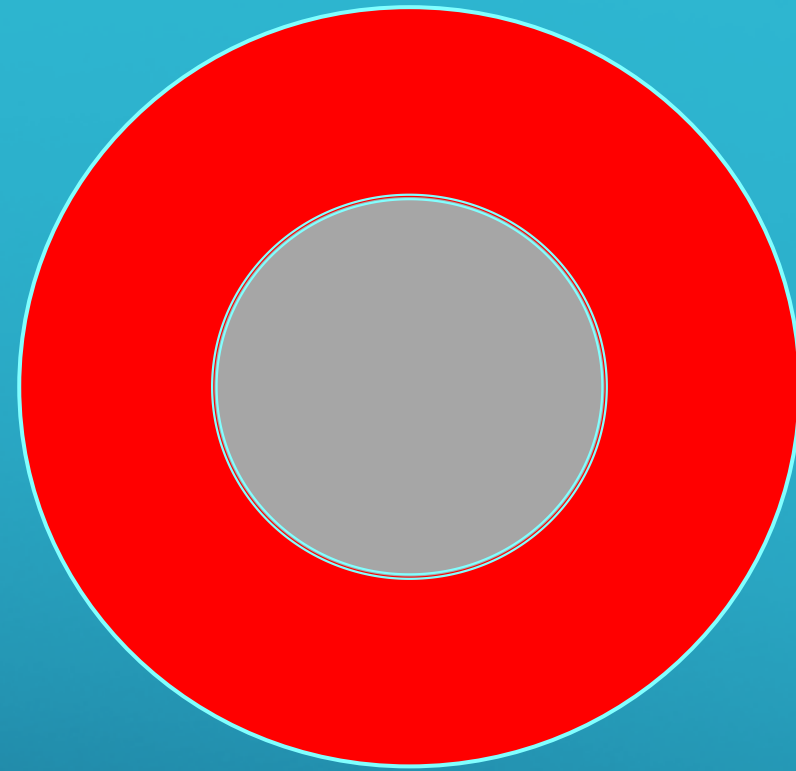
Duct / Mechanical



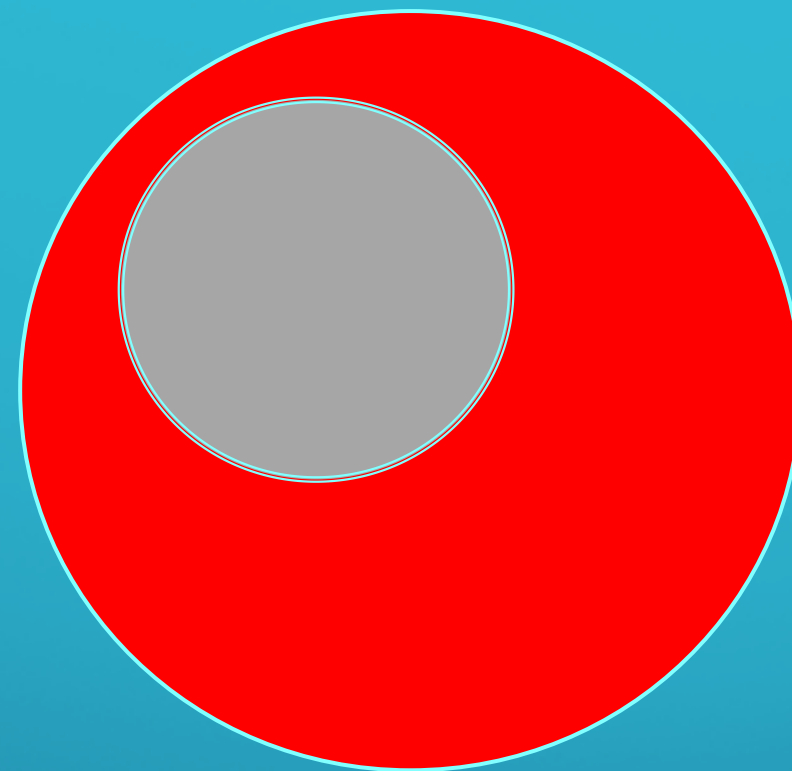
Mixed / Multiple



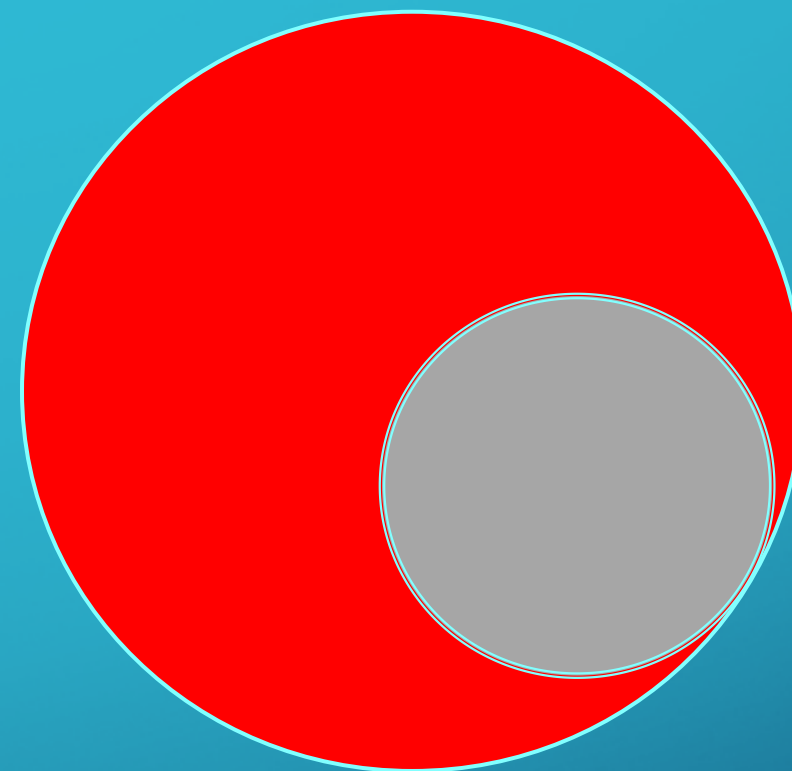
# ANNULAR SPACE - SINGLE PENETRATION



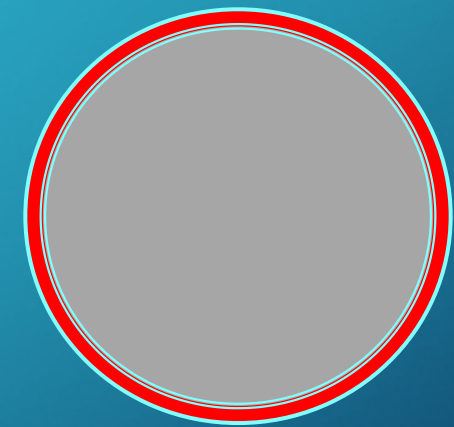
Centered



Off-Center



Point of Contact

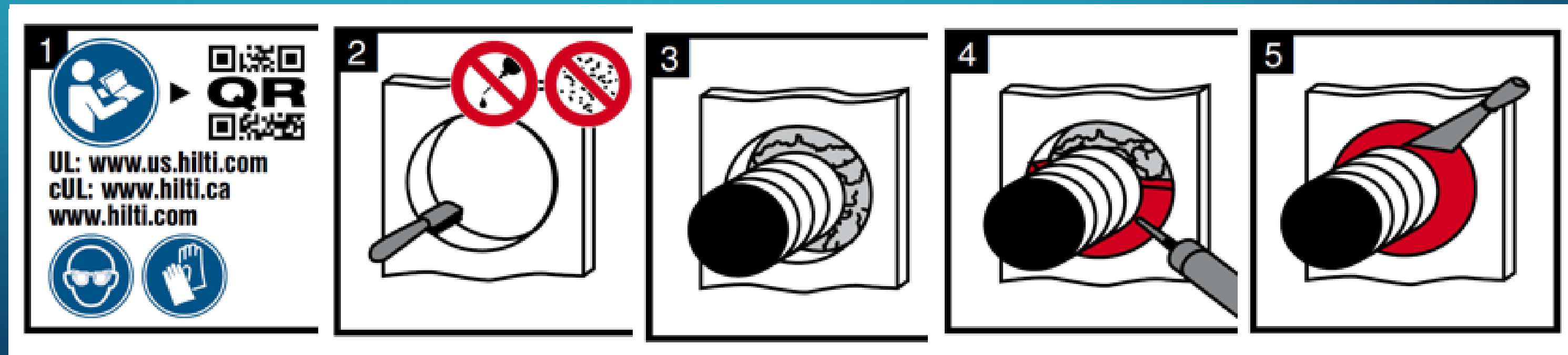


Continuous Point of Contact

- 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 SEALANT

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



# THROUGH PENETRATION FIRESTOP SYSTEMS (ASTM E814/UL 1479)

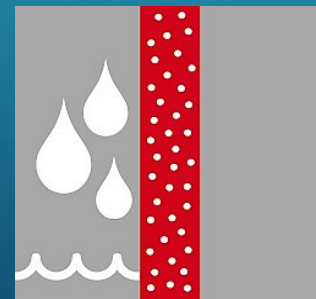
- F-Rating      The duration of time in which flames do not pass through the system.
- T-Rating      The time-period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325° above its initial temperature through the penetration on the non-fire side when tested  
In accordance with ASTM E 814.



To receive either rating the firestop system must pass hose stream test

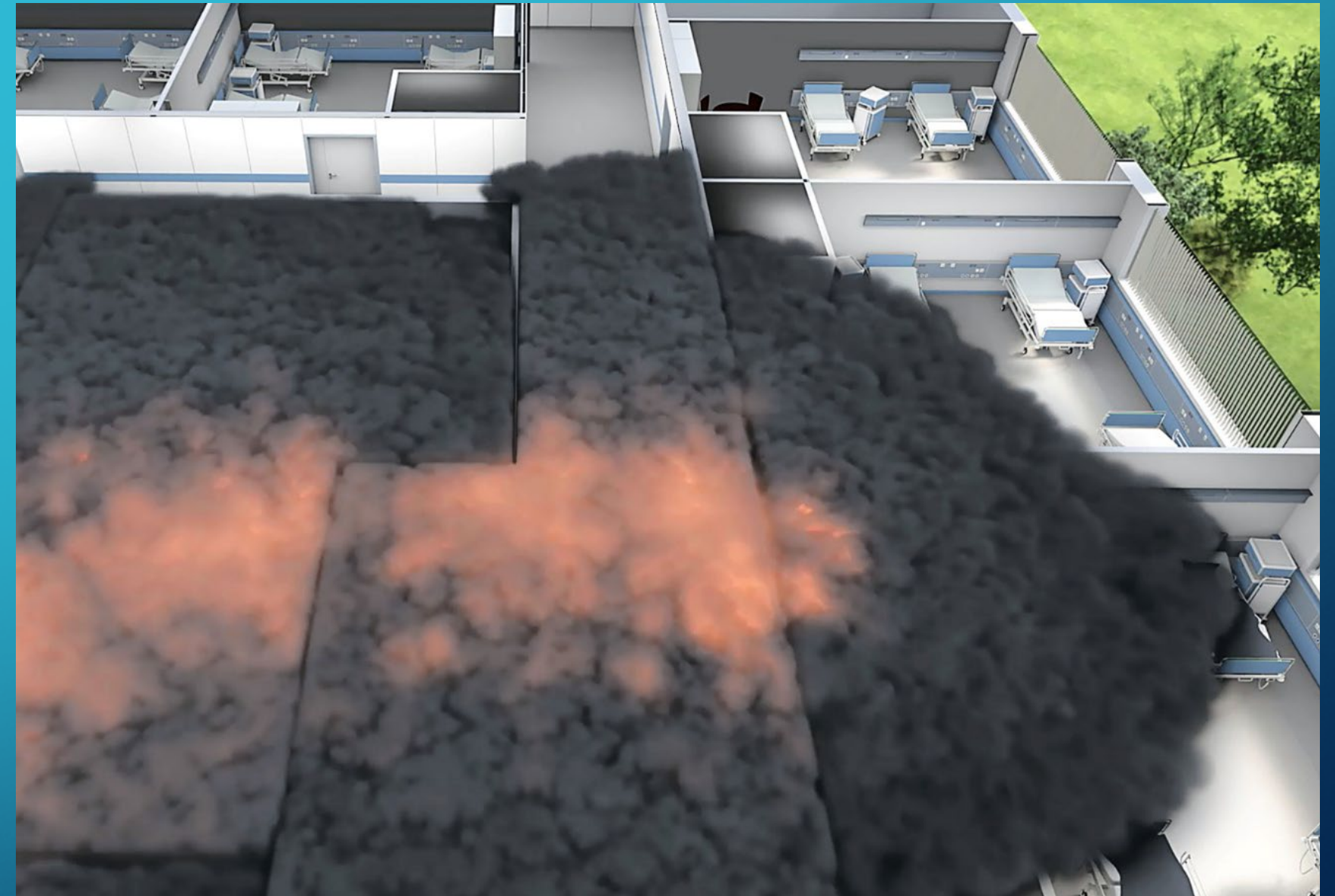
# FIRESTOP SYSTEM ARE SPECIFICALLY DESIGNED AND TESTED FOR WATER RESISTANCE

- **W-Rating** (optional test) - determines effectiveness of a firestop system to restrict flow of water.
- Tested to resist up to 3 feet of water column for 72 hours
- Specify for floor penetration
- **ASTM D6904** “Standard Practice for Resistance to Wind Driven Rain...”
- Specify for perimeter fire barrier system



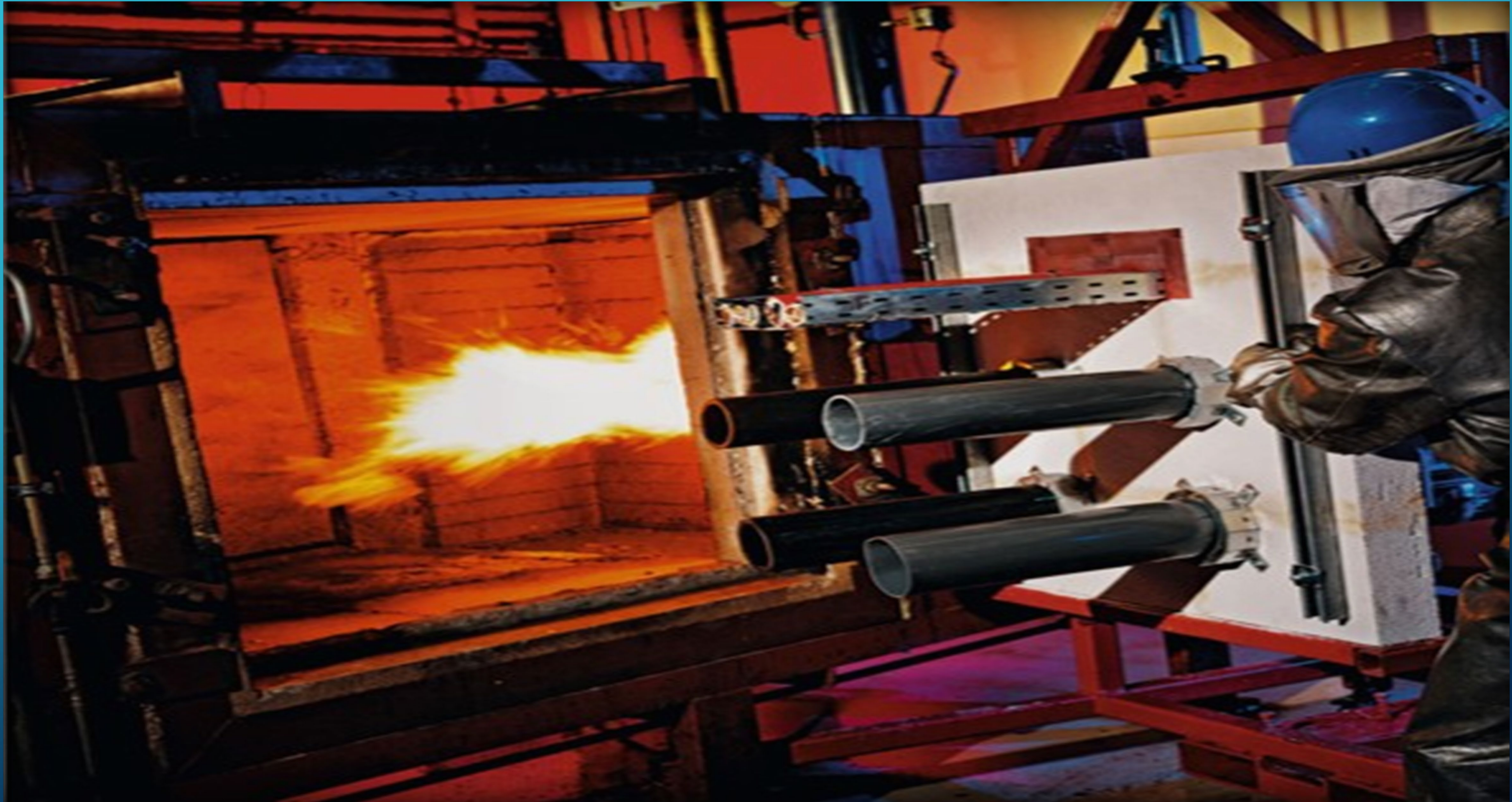
# LEAKAGE RATING (L-RATING) DETERMINES SUITABILITY TO RESTRICT PASSAGE OF SMOKE

- Optional test per UL 1479. Required on smoke barriers (healthcare, prisons, etc.)
- Smoke Barrier is a continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly that is designed & constructed to restrict the movement of smoke
- Measures amount of air leakage through the firestop system
- Test conducted at two temperature ranges:
  - Ambient temperature (simulates cold smoke away from fire origin)
  - 400° F (simulates warm smoke near fire origin)
- Measured in CFM: the lower the number, the better the L-Rating



Even with smoke as the leading killer in fires, this rating varies greatly from one system to another

# FIRESTOP SYSTEM TESTING



# HOSE STREAM TEST (ASTM E814/UL1479)

Hose Stream verifies mechanical integrity after fire

Stream delivered through 2-1/2 inch hose with a straight-bore nozzle at:

- 30 psi - 1, 2 & 3-hour tests
- 45 psi - 4-hour test

The time duration is calculated based on the area of the test assembly and the fire resistance period.

Example:

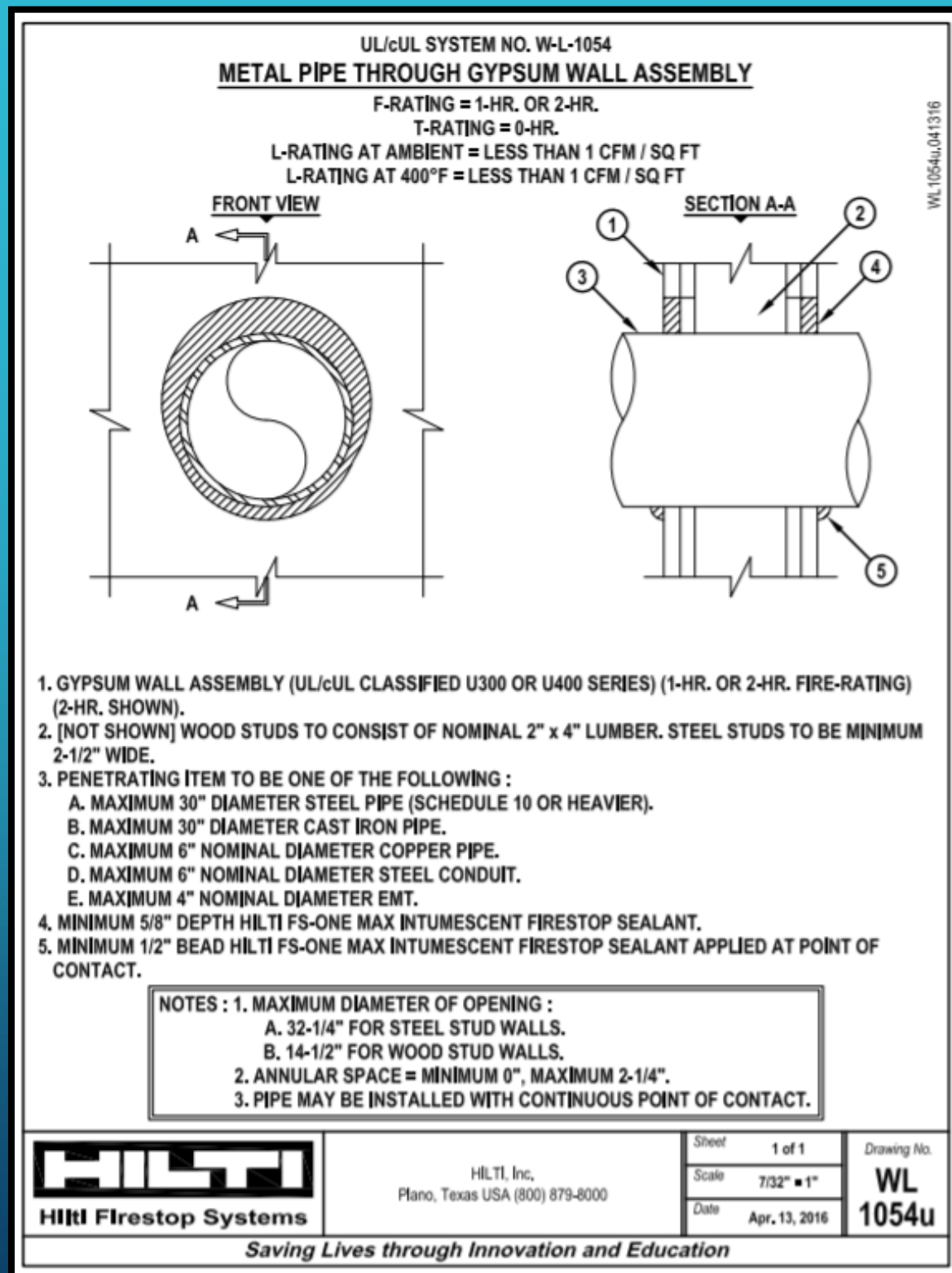
2-hour concrete floor (48" x 48") = 24 seconds based upon 1.5 sec/sq. ft.

*“Firestop system must not develop any openings that would permit a projection of water from the hose stream”*



# PENETRATION SYSTEMS

# 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

# NON-COMBUSTIBLE PENETRANT FIRESTOP SYSTEMS



Typical Application

- Block Wall
- F-Rating = 3 hours
- Steel Pipe - 2"
- Annular Space:
  - Min: Point of contact (top)
  - Max: 2.0" (below the pipe)



Typical Application

- Concrete Floor
- F-Rating = 2 hours
- Steel Pipe - 2"
- Annular Space:
  - Min: 1.5" (back right)
  - Max: 3" (left side)

UL/cUL SYSTEM NO. C-AJ-1155  
**METAL PIPE THROUGH CONCRETE FLOOR/WALL OR BLOCK WALL**  
 F-RATING = 2-HR, OR 3-HR,  
 T-RATING = 0-HR,  
 L-RATING AT AMBIENT = LESS THAN 1 CFM / SQ FT  
 L-RATING AT 400°F = 4 CFM / SQ FT  
 W-RATING = CLASS 1 (SEE NOTE NO. 5 BELOW)

**TOP 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/cUL CLASSIFIED CONCRETE BLOCK WALL.

**2. [OPTIONAL] MAXIMUM 32" NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR HEAVIER).**

**3. PENETRATING ITEM TO BE ONE OF THE FOLLOWING :**  
 A. MAXIMUM 20" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).  
 B. MAXIMUM 20" NOMINAL DIAMETER CAST IRON PIPE.  
 C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE.  
 D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT.  
 E. MAXIMUM 4" NOMINAL DIAMETER EMT.

**4. MINIMUM 4" THICKNESS MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED.**

**5. MINIMUM 1/2" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT.**

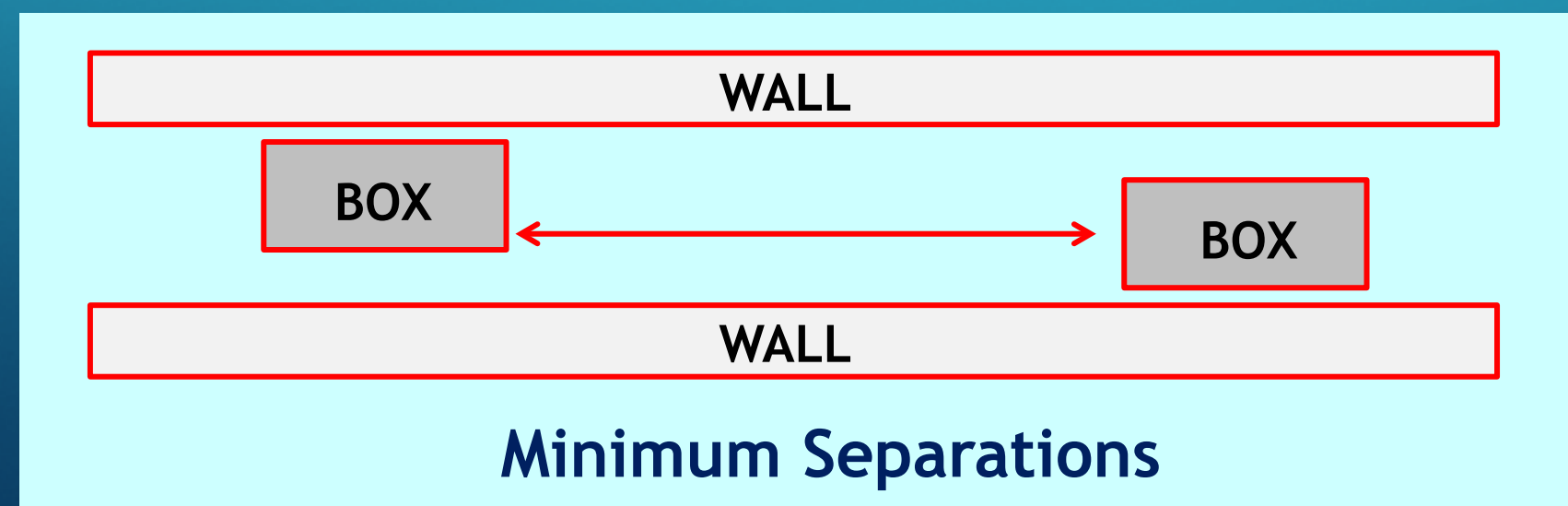
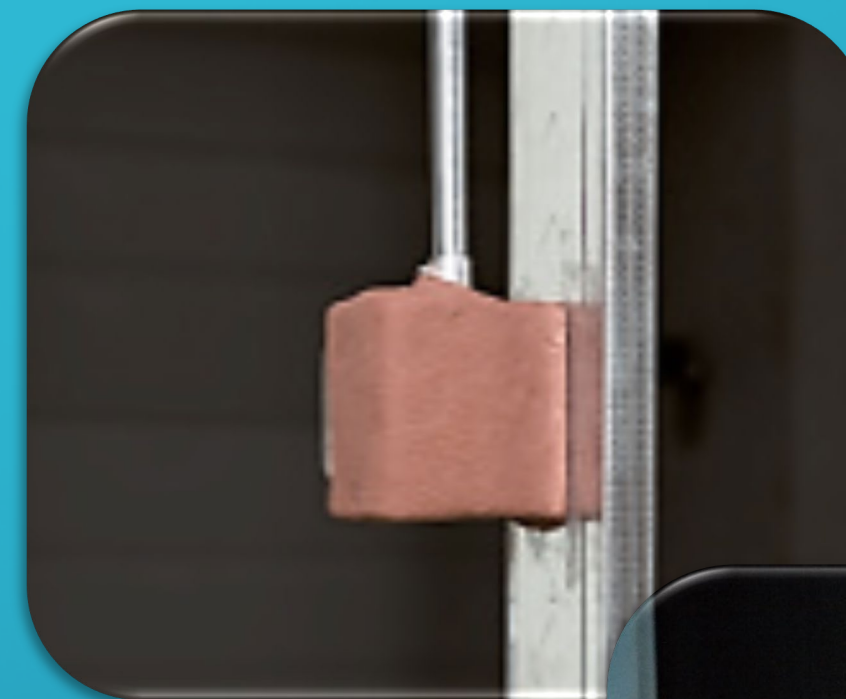
**6. MINIMUM 1/2" CROWN HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT APPLIED AT POINT OF CONTACT.**

**NOTES :** 1. MAXIMUM DIAMETER OF OPENING = 32",  
 2. ANNULAR SPACE [FOR 3-HR, F-RATING] = MINIMUM 0", MAXIMUM 2-1/4",  
 3. ANNULAR SPACE [FOR 2-HR, F-RATING] = MINIMUM 0", MAXIMUM 12",  
 4. MINIMUM 1/2" DEPTH HILTI FS-ONE MAX INTUMESCENT FIRESTOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY.  
 5. FOR W-RATING, MAXIMUM ANNULAR SPACE IS 1-7/8" AND AN ADDITIONAL FILM SHALL BE APPLIED OVER SLEEVE (WHEN USED) LAPPING MINIMUM 1/2" ONTO FLOOR.

# IBC 714.4.2: MEMBRANE PENETRATIONS FIRESTOP SYSTEMS TESTED TO ASTM E814 / UL 1479

Recessed fixtures shall be installed such that the required fire resistance will not be reduced.

- Total area of openings does not exceed 100 square inches for any 100 sq. ft. of wall
- Steel electrical boxes on opposite sides of wall must be separated by a horizontal distance > 24 inches




Steel boxes outside these parameters must be protected

# MEMBRANE PENETRANT FIRESTOP SYSTEMS



## Typical Application

- Gypsum Board
- F-Rating = 1 or 2 Hr
- Steel Pipe - 2"
- Annular Space:
  - Min: Point of contact (top)
  - Max: 2.0" - FS ONE MAX
  - Max: 1.0" - CP 606, CFS-SIL GG

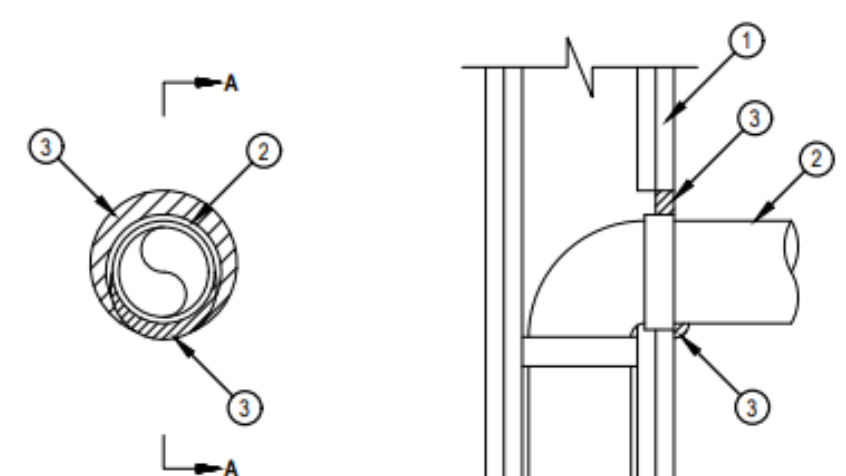


Classified by  
Underwriters Laboratories, Inc.  
to UL 1479 and CANULC-S115


**System No. W-L-1410**

ANSI/UL1479 (ASTM E814)	CANULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
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 Item 1)
L Rating at 400°F — Less Than 1 CFM/sq ft	FTH Rating — 0 Hr
	L Rating at Ambient — Less Than 5.1 L/s/m <sup>2</sup>
	L Rating at 204°C — Less Than 5.1 L/s/m <sup>2</sup>

WL 1410



**SECTION A-A**



**Hilti Firestop Systems**

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June 7, 2023

Page: 1 of 2

**System No. W-L-1410**

WL 1410

1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

- 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 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
- Gypsum Board\* — One or two layers of nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. The max diam of opening is dependent upon the type of fill material as shown in Item 3.

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

2. Through Penetrants — One metallic pipe or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space is dependent upon the type of fill material as shown in Item 3. Pipe or conduit to be rigidly supported on the penetrated side of the wall assembly. The following types and sizes of metallic pipes or conduits may be used:


- Steel pipe — Nom 3 in. (76 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
- Conduit — Nom 3 in. (76 mm) diam (or smaller) steel electrical metallic tubing (EMT), nom 3 in. (76 mm) diam steel conduit or nom 1 in. (25 mm) diam (or smaller) flexible steel conduit.
- Copper Tubing — Nom 1 in. (25 mm) diam (or smaller) Type L (or heavier) copper tubing.
- Copper Pipe — Nom 1 in. (25 mm) diam (or smaller) Regular (or heavier) copper pipe.
- Iron Pipe — Nom 3 in. (76 mm) diam (or smaller) cast or ductile iron pipe.

3. Fill, Void or Cavity Material\* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with surface of wall. Min 1/2 in. (13 mm) diam bead of sealant applied at point contact location.

Type of Fill Material	Max Diameter of Opening, in. (mm)	Min Annular Space, in. (mm)	Max Annular Space, in. (mm)
FS-ONE MAX Intumescent Sealant	6 (152)	0 (0), point contact	2 (51)
CFS-S-SIL GG Sealant	5 (127)	0 (0), point contact	1 (25)
CP601S Elastomeric Sealant	5 (127)	0 (0), point contact	1 (25)
CP 606 Sealant	5 (127)	0 (0), point contact	1 (25)
CP618 Putty	5 (127)	0 (0), point contact	1 (25)

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE MAX Intumescent Sealant, CFS-S-SIL GG Sealant, CP601S Elastomeric Sealant, CP 606 Sealant, or CP618 Putty.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

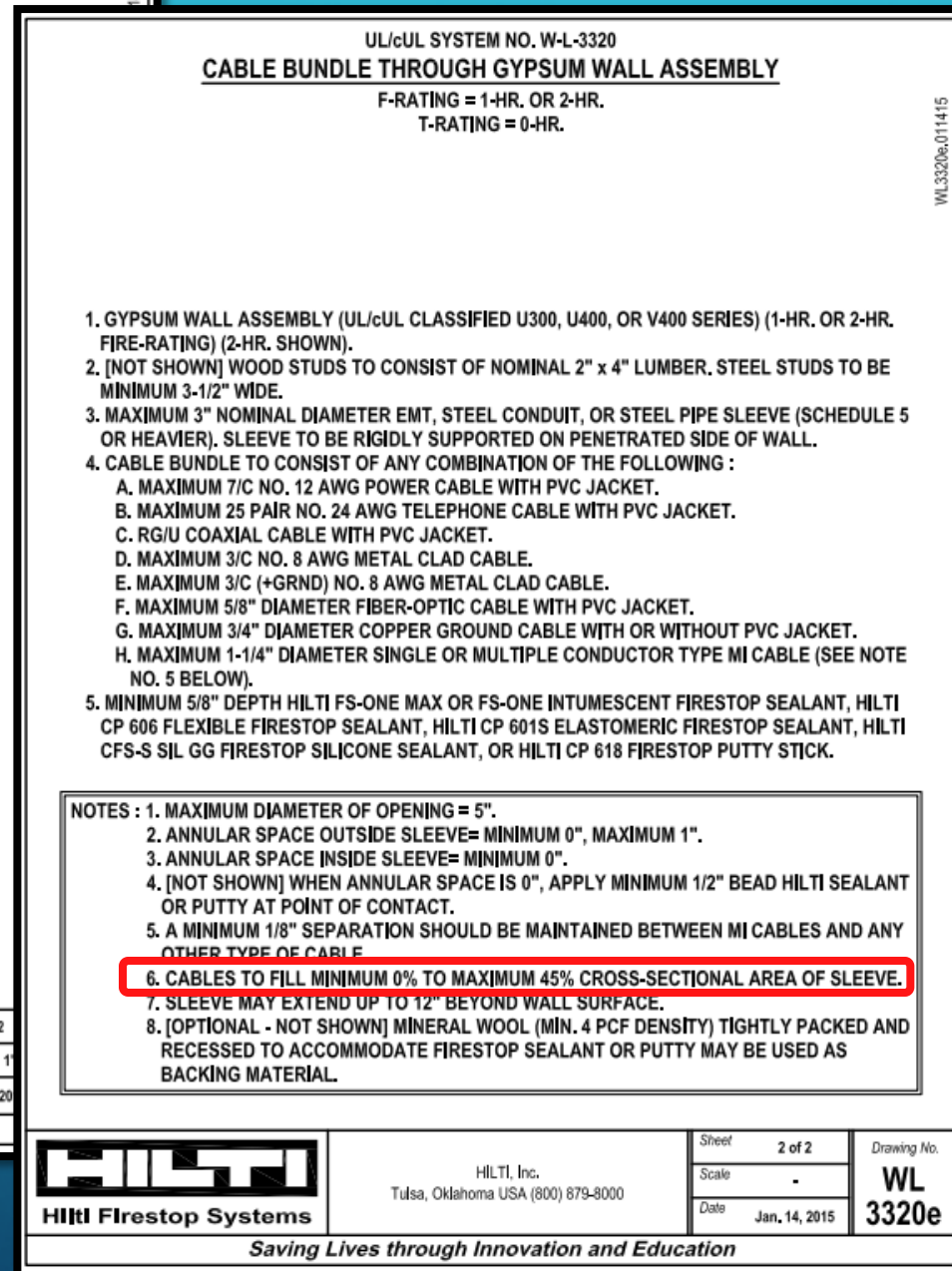
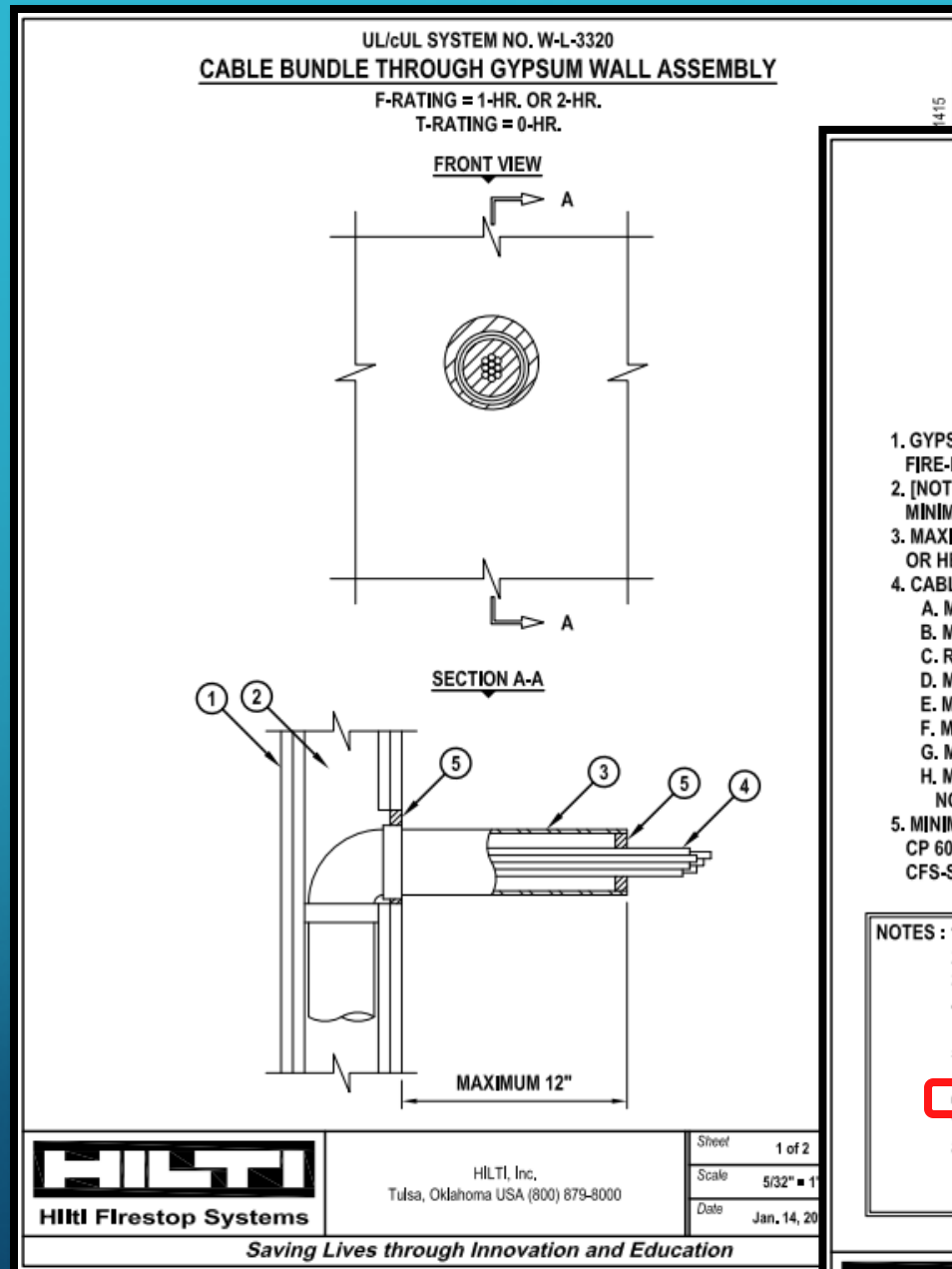


**Hilti Firestop Systems**

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Underwriters Laboratories, Inc.  
June 7, 2023

Page: 2 of 2

# CONDUIT WITH CABLE BUNDLE - MEMBRANE

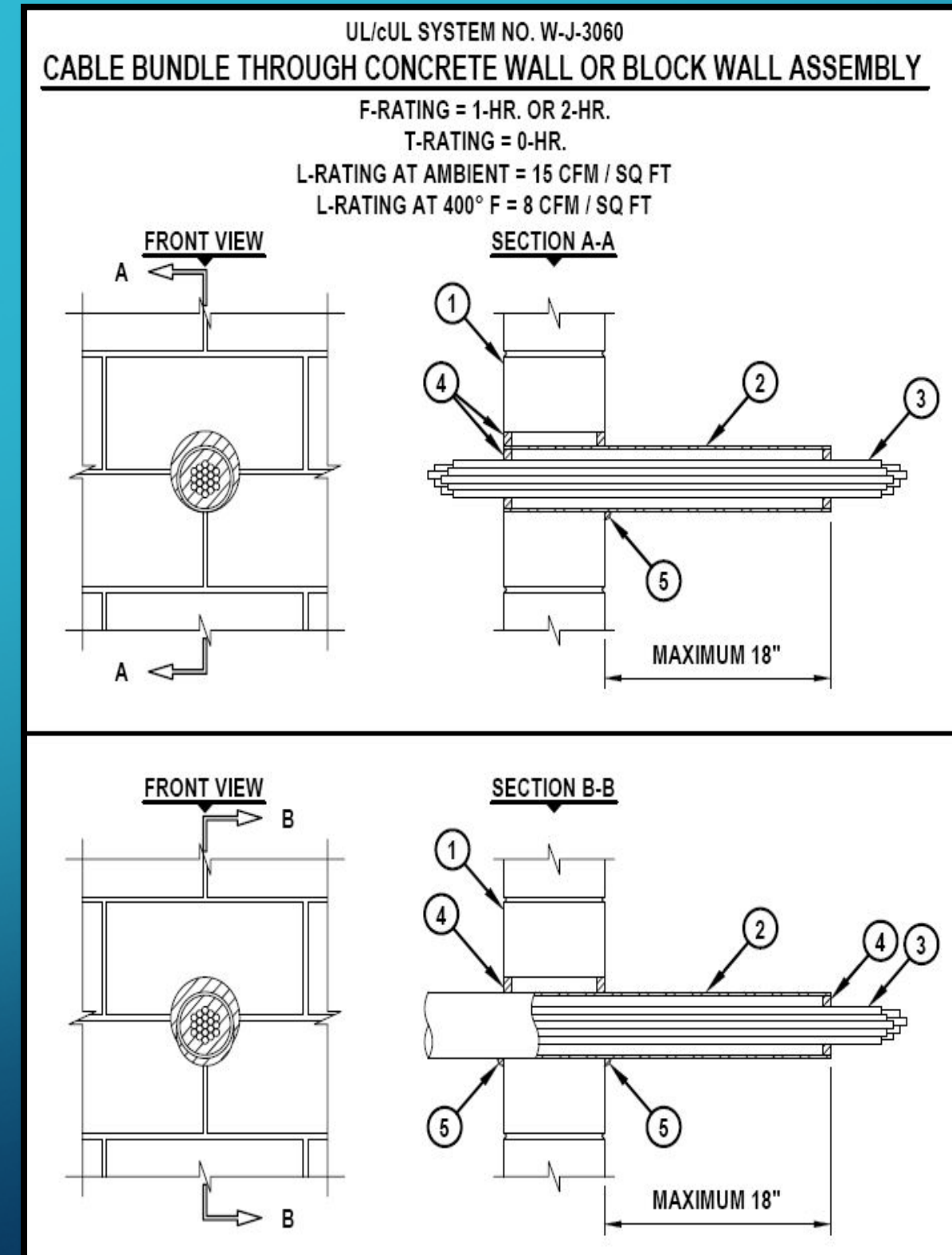


- The firestop listing will specify:
  - Cable type, quantity, and/or bundle size
  - The maximum permitted percentage of cable fill
  - Required distance between cables (if applicable)
- Cable bundles can be installed inside a sleeve or firestop device
- In applications with cables within a sleeve:
  - 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

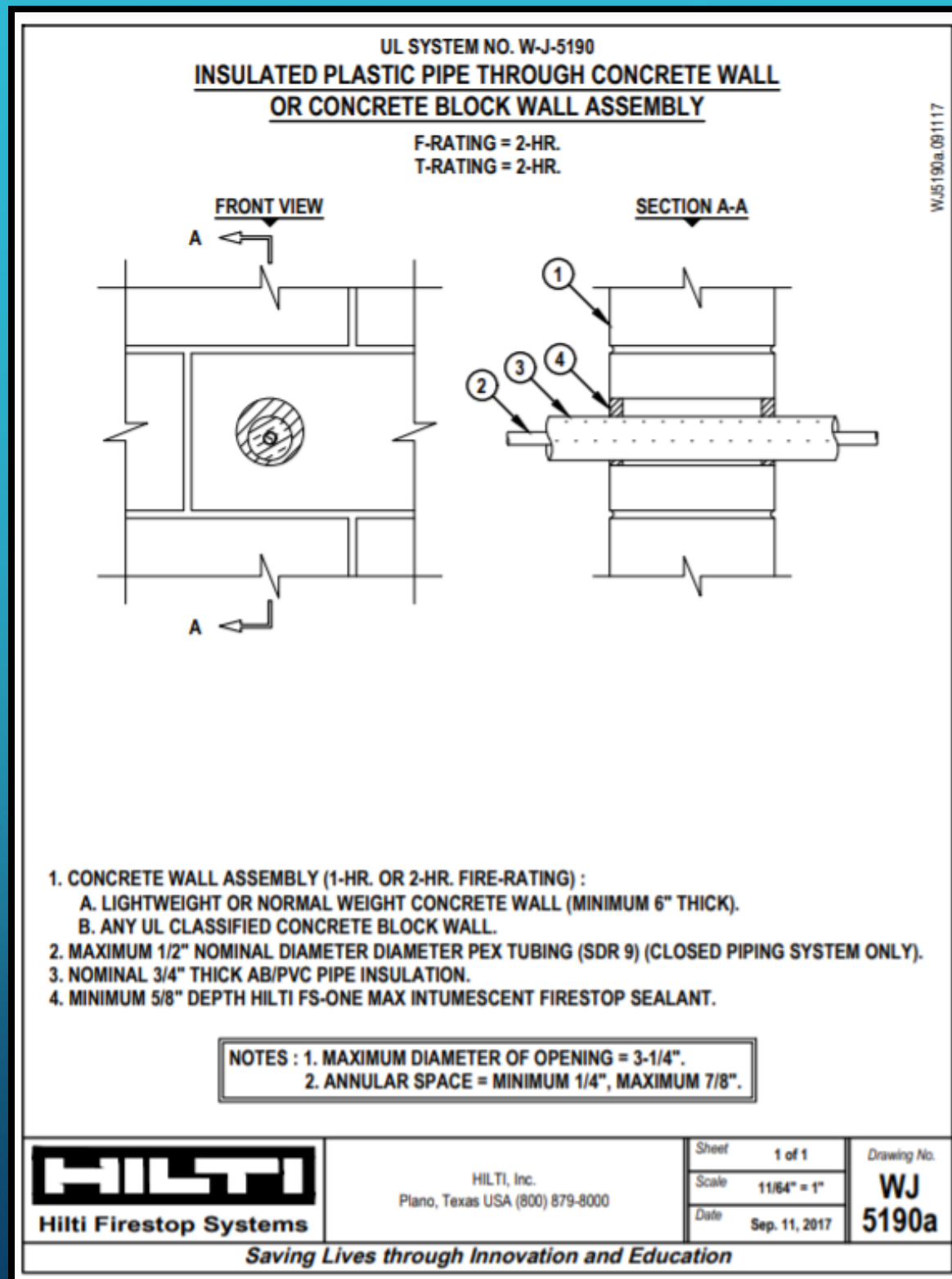
# CONDUIT WITH CABLE BUNDLE - THROUGH



**Percent Fill** The cross-sectional area of an opening that is occupied by a penetrating item(s). Typically found in UL Systems containing cables. Percent fill may be calculated with the following formulas:

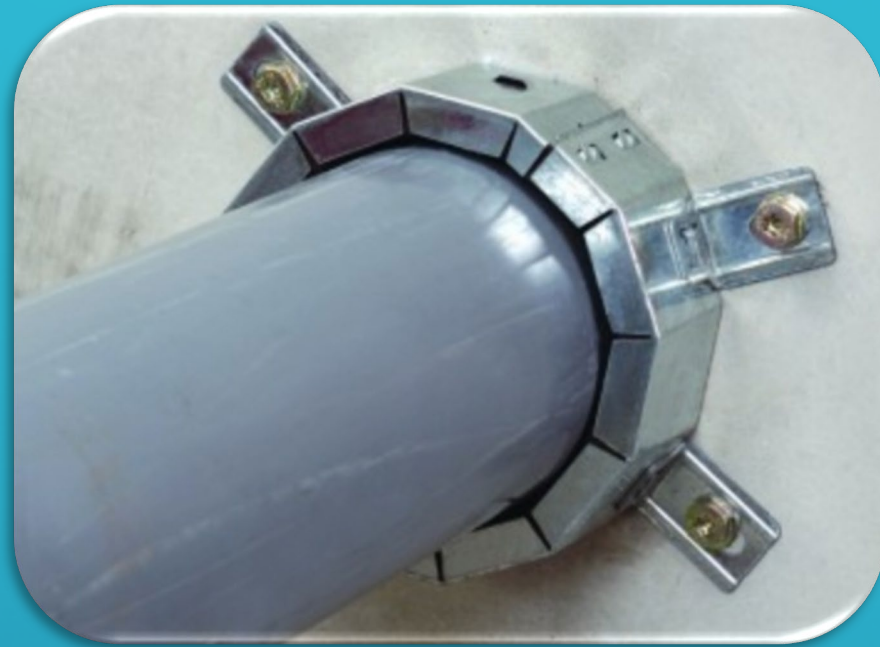


# INSULATED PIPE



- Combustible penetrants will typically require an intumescent product around the penetrant
  - Check the product packages used on site to ensure the correct product type
  - It is critical to ensure there is enough of the intumescent product around the penetrating item
    - Confirm that the specified depth has been installed
- Types of Insulation: AB/PVC, Poly FOAMGLASS/Cellular Glass, Mineral Fiber, Calcium Silicate, Polyethylene, Polyisocyanurate

# PVC PIPE



## Typical Application

Gypsum Wall

F-Rating = 2 Hrs

PVC Pipe 4"

Annular Space

Min: Point of contact (top)


Max: 2.0" (below the pipe)

UL SYSTEM NO. W-L-2078  
**PLASTIC PIPE THROUGH GYPSUM WALL ASSEMBLY**

F-RATING = 1-HR. OR 2-HR.  
T-RATING = 0-HR., 1-HR., OR 2-HR.  
L-RATING AT AMBIENT = 3 CFM / SQ FT  
L-RATING AT 400° F = LESS THAN 1 CFM / SQ FT

FRONT VIEW

SECTION A-A



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

Sheet	1 of 2	Drawing No.	WL
Scale	5/32" = 1"		2078q
Date	Apr. 17, 2018		

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UL SYSTEM NO. W-L-2078  
**PLASTIC PIPE THROUGH GYPSUM WALL ASSEMBLY**

F-RATING = 1-HR. OR 2-HR.  
T-RATING = 0-HR., 1-HR., OR 2-HR.  
L-RATING AT AMBIENT = 3 CFM / SQ FT  
L-RATING AT 400° F = LESS THAN 1 CFM / SQ FT

- GYPSUM WALL ASSEMBLY (UL CLASSIFIED U300, U400, OR V400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
- [NOT SHOWN] WOOD STUDS TO CONSIST OF NOMINAL 2" x 4" LUMBER. STEEL STUDS TO BE MINIMUM 2-1/2" WIDE.
- PENETRATING ITEM TO BE ONE OF THE FOLLOWING (ALSO SEE NOTE NO. 3 BELOW) :
  - MAXIMUM 10" NOMINAL DIAMETER PVC PLASTIC PIPE (CELLULAR OR SOLID CORE).
  - MAXIMUM 10" NOMINAL DIAMETER CPVC PLASTIC PIPE (CLOSED PIPING SYSTEM ONLY).
  - MAXIMUM 6" NOMINAL DIAMETER ABS PLASTIC PIPE (CELLULAR OR SOLID CORE).
  - MAXIMUM 6" NOMINAL DIAMETER FRPP PLASTIC PIPE.
  - MAXIMUM 4" NOMINAL DIAMETER PVDF PLASTIC PIPE.
  - MAXIMUM 4" NOMINAL DIAMETER CROSS-LINKED POLYETHYLENE (PEX) TUBING (SDR 9) (AQUAPEX OR WIRSBO HEPEX BY UPONOR) (CLOSED PIPING SYSTEM ONLY).
- HILTI FS-ONE MAX OR FS-ONE INTUMESCENT FIRESTOP SEALANT :
  - [OPTIONAL] MINIMUM 1/4" DEPTH OF SEALANT INSTALLED ON PIPES NOMINAL 6" AND SMALLER. EXCEPTION : WHEN ITEM 3F IS INSTALLED, SEALANT IS REQUIRED.
  - MINIMUM 1/2" DEPTH OF SEALANT INSTALLED ON PIPES LARGER THAN NOMINAL 6".
- HILTI CP 643N OR CP 644 FIRESTOP COLLAR WITH FASTENING HOOKS (SEE TABLE BELOW).
- ATTACH EACH FASTENING HOOK TO WALL ASSEMBLY WITH HILTI 3/16" TOGGLER BOLTS AND WASHERS. FOR PIPES 4" OR SMALLER, COLLARS MAY BE FASTENED WITH NO. 10 x 1-1/2" LONG DRYWALL OR LAMINATE SCREWS WITH 3/4" STEEL WASHERS.

NOMINAL PIPE DIAMETER	PRODUCT DESCRIPTION	NO. OF FASTENING HOOKS	MAXIMUM HOLE SIZE
1-1/2"	CP 643 50/1.5" N	2	2-1/8"
2"	CP 643 63/2" N	2	2-5/8"
3"	CP 643 90/3" N	3	4"
4"	CP 643 110/4" N	3	5"
6"	CP 643 160/6" N	4	7"
8"	CP 644 200/8"	10	9-1/2"
10"	CP 644 250/10"	12	11-1/2"

NOTES : 1. ANNULAR SPACE = MINIMUM 0", MAXIMUM 1/2".  
2. CLOSED OR VENTED PIPING SYSTEM (PVC, ABS, FRPP = SCHEDULE 40; CPVC = SDR 13.5; PVDF = SDR 32.5).  
3. L-RATINGS ONLY APPLY ON PIPES NOMINAL 6" AND SMALLER, WHEN HILTI FS-ONE MAX OR FS-ONE INTUMESCENT FIRESTOP SEALANT IS USED.



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

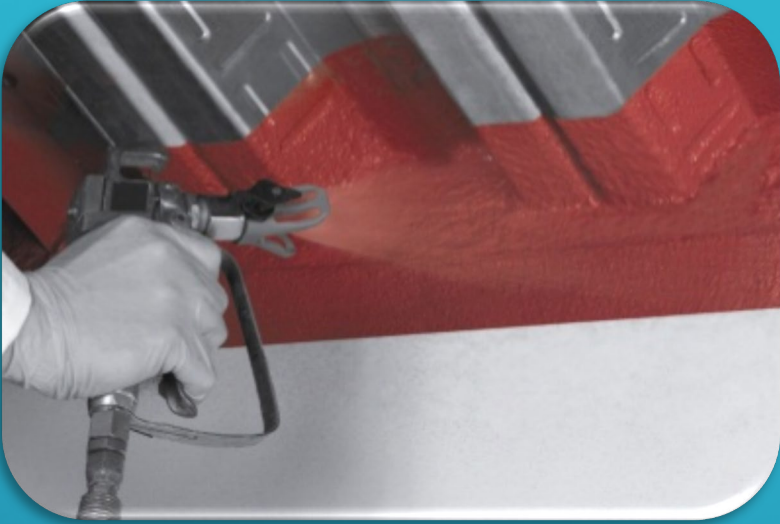
Sheet	2 of 2	Drawing No.	WL
Scale	-		2078q
Date	Apr. 17, 2018		

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# JOINT SYSTEMS

# TYPES OF FIRE RESISTANCE JOINT SYSTEMS

Metal Deck Joints



Top & Bottom of Wall



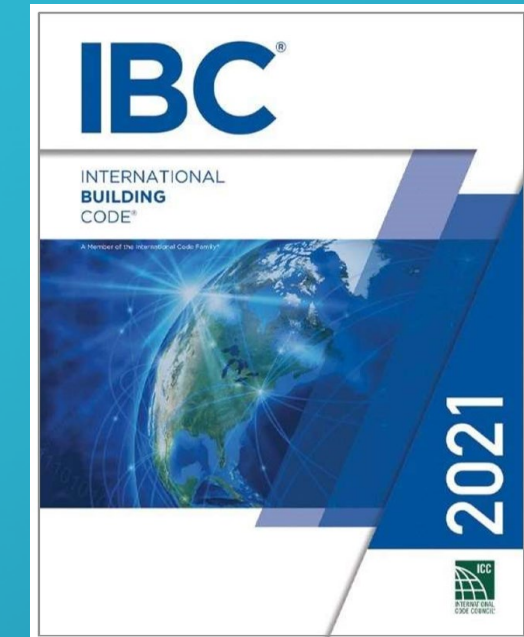
Wall to Wall



Edge of Slab



# INTERNATIONAL BUILDING CODE (2021) FIRESTOP REQUIREMENTS



## Section 714.4.1.2 - Through-penetration firestop **systems**

- “*Through penetrations* shall be protected by an *approved penetration firestop **system*** installed as tested in accordance with ASTM E 814 or UL 1479...”

## Section 715.3.1 - Fire resistant joint **systems**

- “*Fire-resistant joint **systems*** shall be tested in accordance with the requirements of either ASTM E1966 or UL 2079...”

*What is the key term in the code language above?*

# MANY FACTORS AFFECT FIRE PERFORMANCE, AND EACH ARE PARAMETERS IN THE TESTING OF A SYSTEM

## Through Penetrations

- Size and type of penetrating item(s)
- Size and shape of opening
- Desired fire rating (hrs.)
- Floor or wall construction type and thickness
- Annular space
- Firestop products used

## Joints

- Joint width
- Desired assembly rating (hrs.)
- Floor or wall construction type and thickness
- Movement requirements (%)
- Stud width for gypsum walls
- Firestop products used

Once a tested firestop system has achieved the desired fire ratings, then a “Firestop System” is issued (published) by the testing agency

# IBC SECTION 715.3.1: JOINT FIRESTOP SYSTEMS TESTED TO ASTM E 1966 / UL 2079

## Assembly Rating

- *Fire* and *temperature* on the non-fire side of the joint are measured using thermocouples
- Hose stream required for top-of-wall and wall-to-wall joints
- Joint undergoes cyclic testing prior to fire testing



Thermocouples - measure heat transfer

# 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)

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**  
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

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# BOTTOM OF WALL FIRESTOP - WHEN DOES IT HAPPEN IN THE WALL BUILD PROCESS & WHEN IS IT REQUIRED

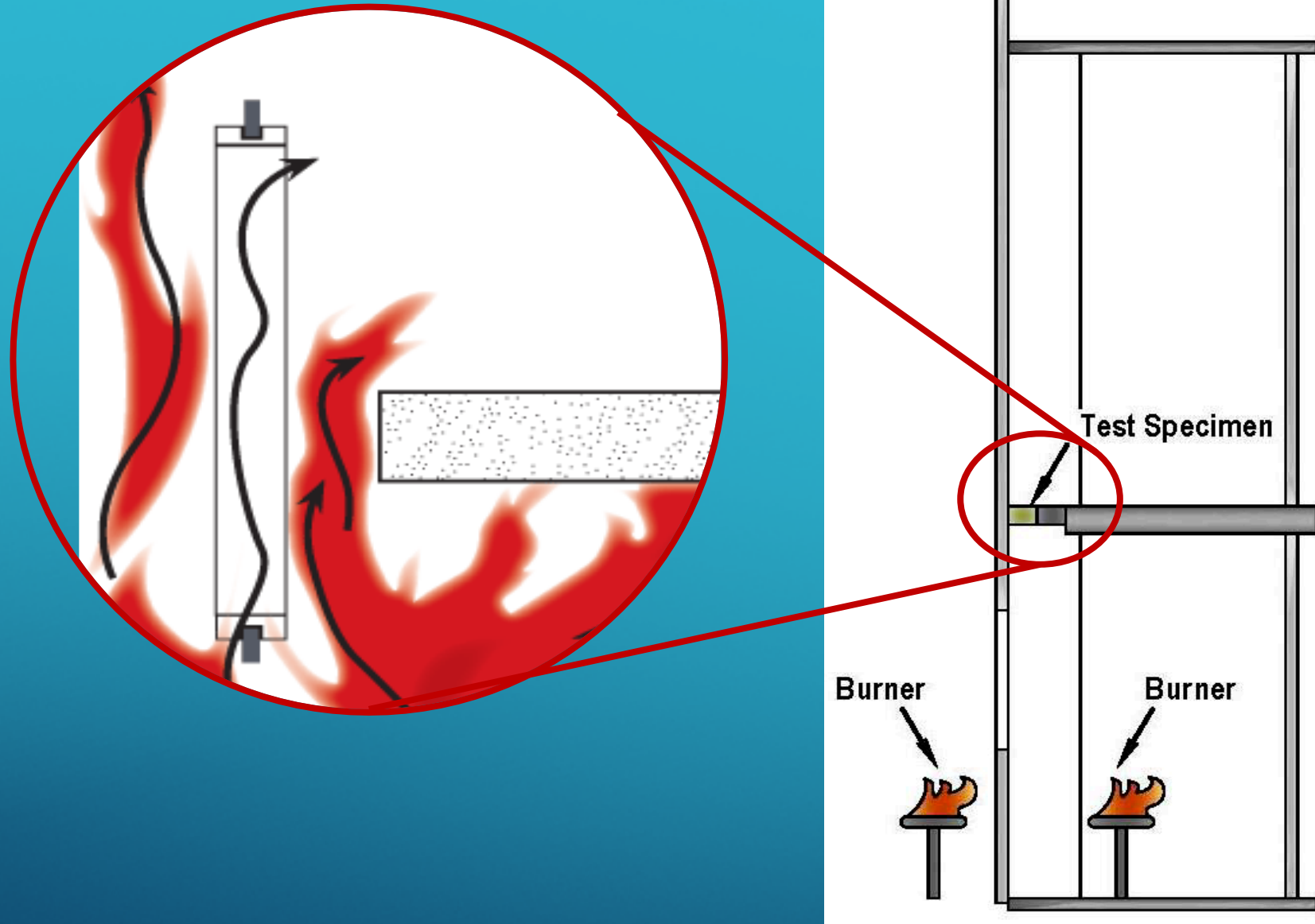
**707.5 Continuity.** *Fire barriers shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such fire barriers shall be continuous through concealed space, such as the space above a suspended ceiling. Joints and voids at intersections shall comply with Sections 707.8 and 707.9*

- *The fire resistance must begin right from the floor below (not 1/64th of an inch above the floor, or 1/4 inch above the floor, etc.)*
- *The continuity statement indicates that any bottom-of-wall gap would need to be suitably sealed to maintain the fire rating of the wall from slab below to the slab above, or from slab below to deck above.*

**707.8 Joints.** *Joints made in or between fire barriers, and joints made at the intersection of fire barriers with underside of a fire-resistance-rated floor or roof sheathing, slab or deck above, and the exterior of the vertical wall intersection shall comply with Section 715.*

**715.1 General.** *Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor, or roof in or between which the system is installed. Fire-resistant joint systems shall be tested in accordance with Section 715.3*

# IBC 715.4.1: PERIMETER FIRE BARRIER (JOINT) EXTENDS THE FIRE RATING OF THE FLOOR TO THE EXTERIOR WALL



Perimeter fire barrier testing to E2307 - fire exposure from both below and from outside

# AGENDA

Evolution of Firestopping

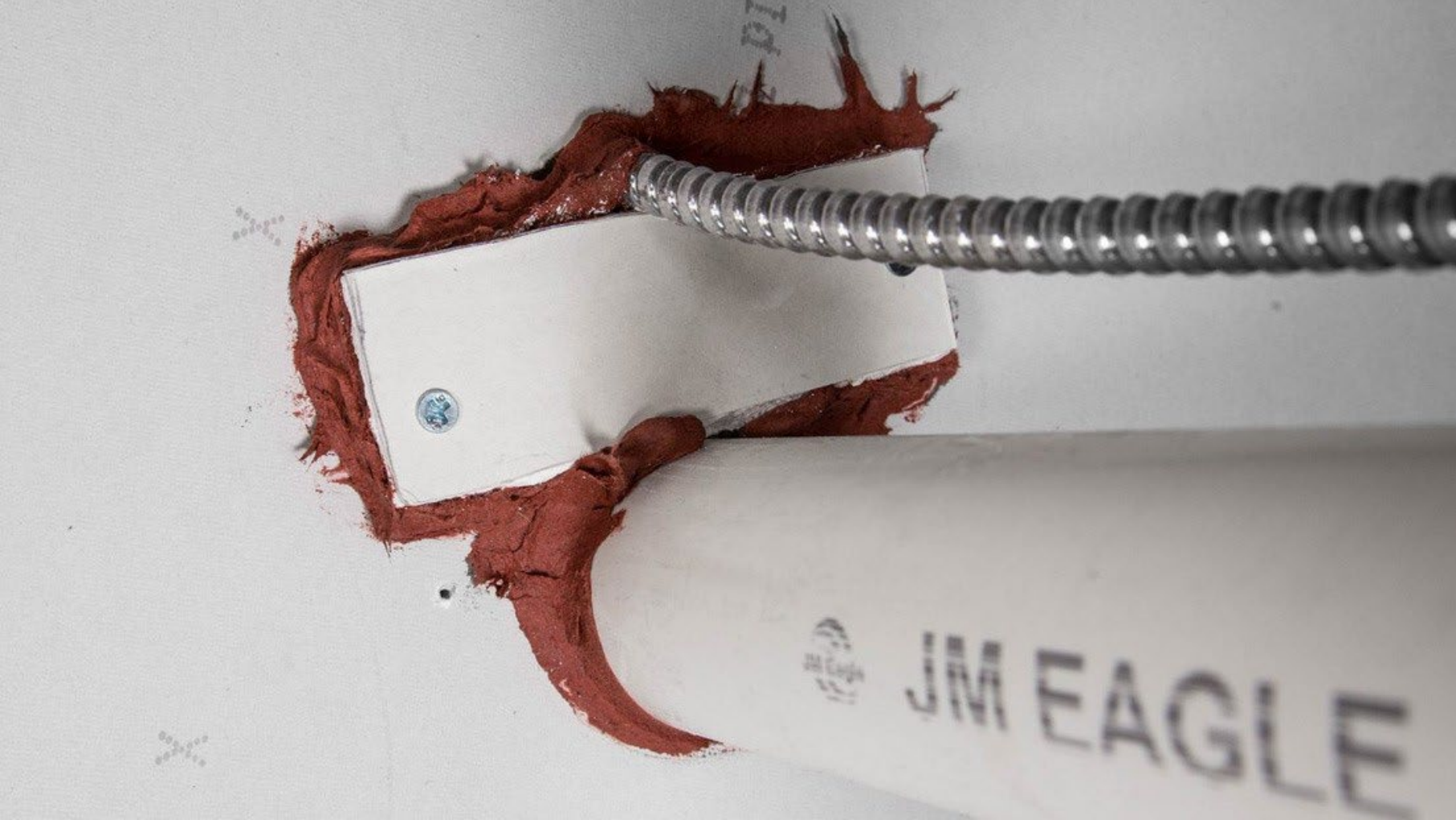
Three pillars of Fire protection  
(Understanding their role in Compartmentation)

Compromised Barriers  
(Common causes and consequences)



# The Sad Reality

- Design changes
- Improper budgeting/Estimating
- IT Infrastructure Upgrades
- Unsealed Openings & Top of Wall
- Above Ceiling Permit Process
- Overlooked Maintenance
- Unskilled & Uneducated Labor
- Visual Inspections & No Destruction testing



# WHEN BARRIERS FAIL, SMOKE & TOXIC GASES SPREAD

- **Real case:** fire in a hospital and smoke progression (Finland, 09/2011). In less than 4 minutes the hallways in this hospital were full of toxic smoke...



# THROUGH-PENETRATIONS: CABLES THROUGH CONDUIT



- 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
- NOT Rigidly supported (Plastic zip ties)

# THROUGH-PENETRATIONS: CABLES THROUGH CONDUIT

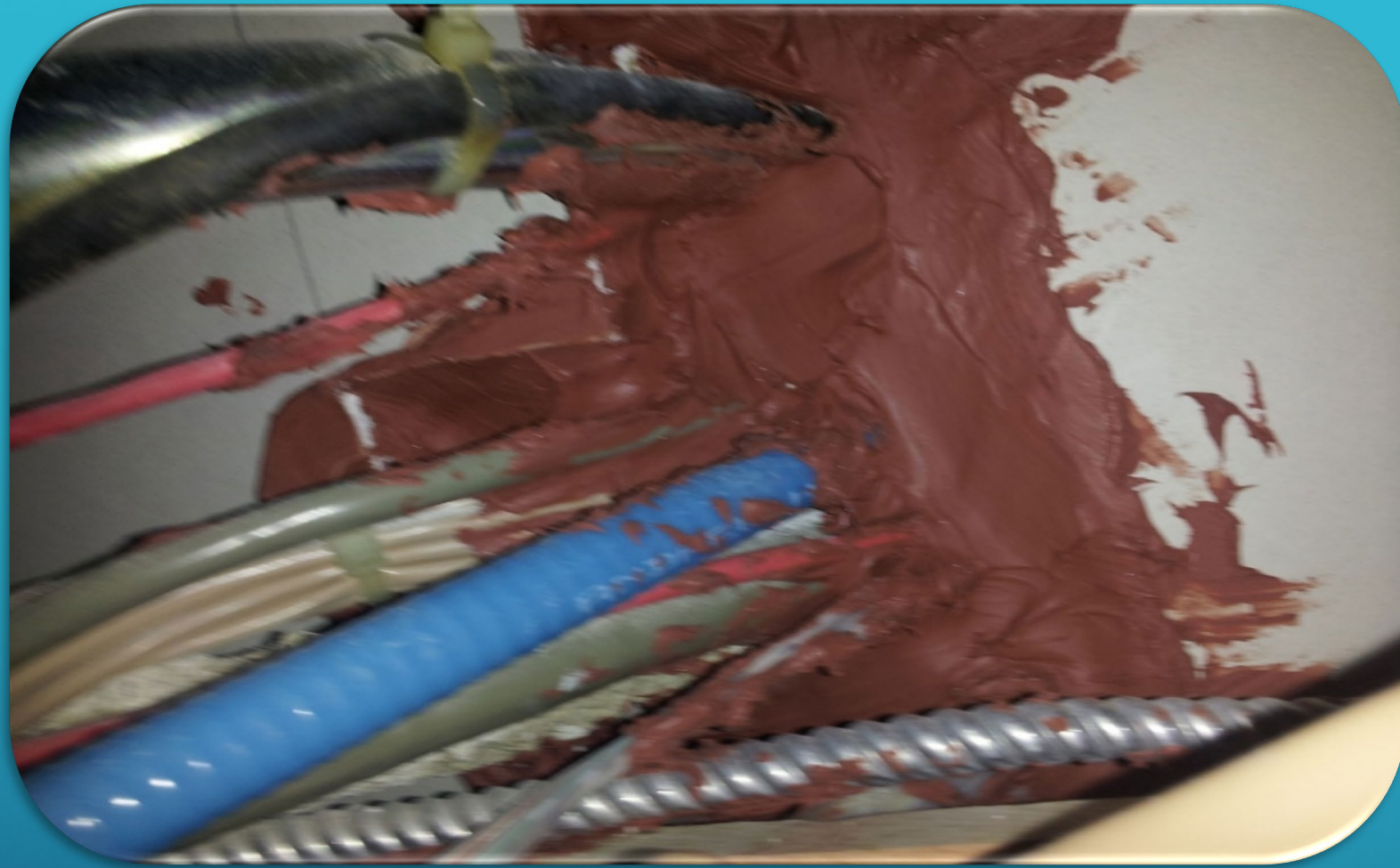


- A non-firestop foam has been used inside the conduits
- No sealant
- What system is this installed to?

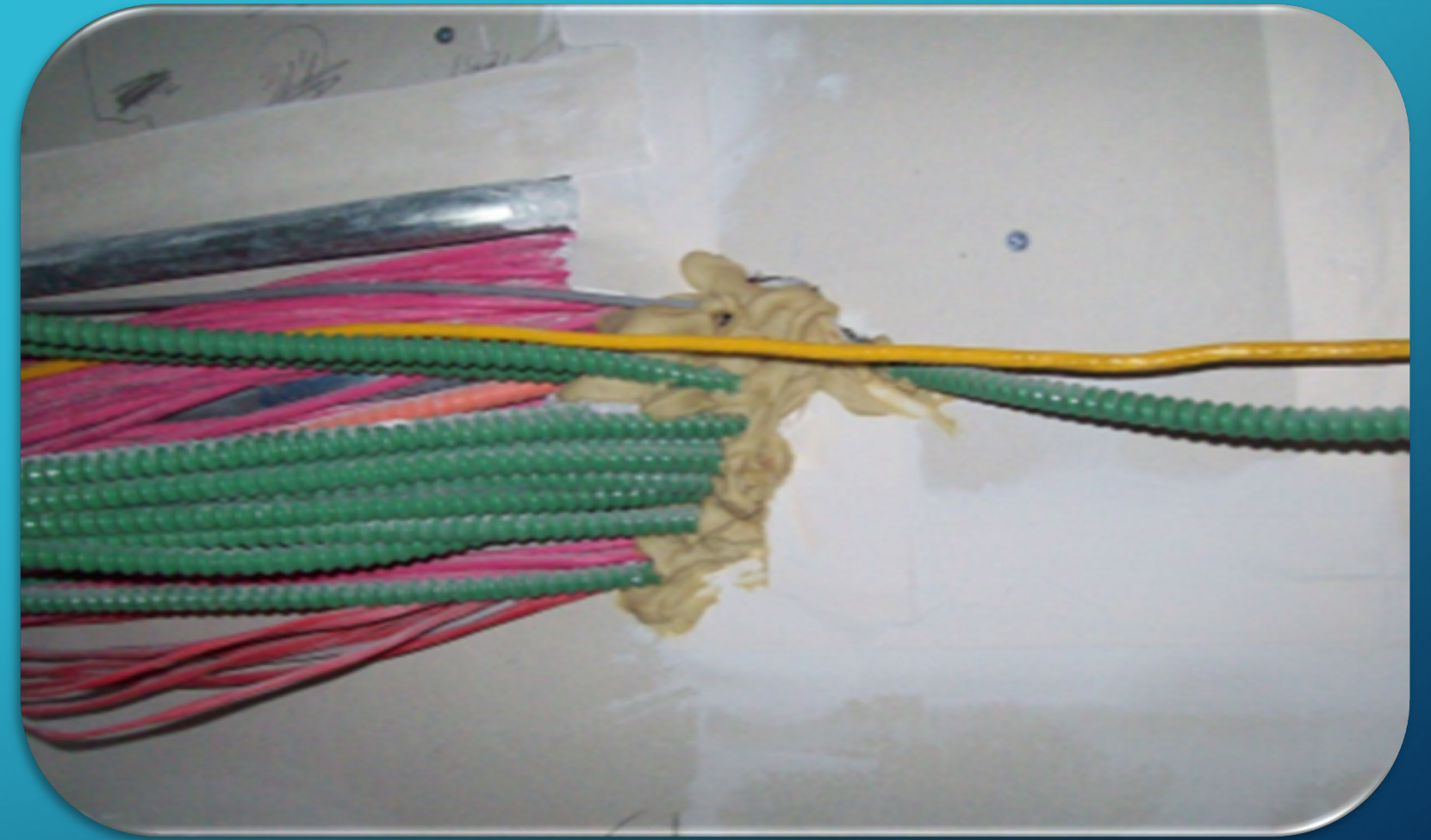


- A non-firestop foam has been used inside the conduits
- Over fill of cables in conduit

# MULTIPLE PENETRANTS / LARGE OPENINGS



- Annular space between penetrants
- What product vs System used?
- Opening size



- No firestopping used
- Only Mineral wool

# IDF/MDF ROOM - TELECOM/ELECTRICAL CLOSET



- Mineral wool exposed
- Firestop sealant not covering entire opening
- What system?

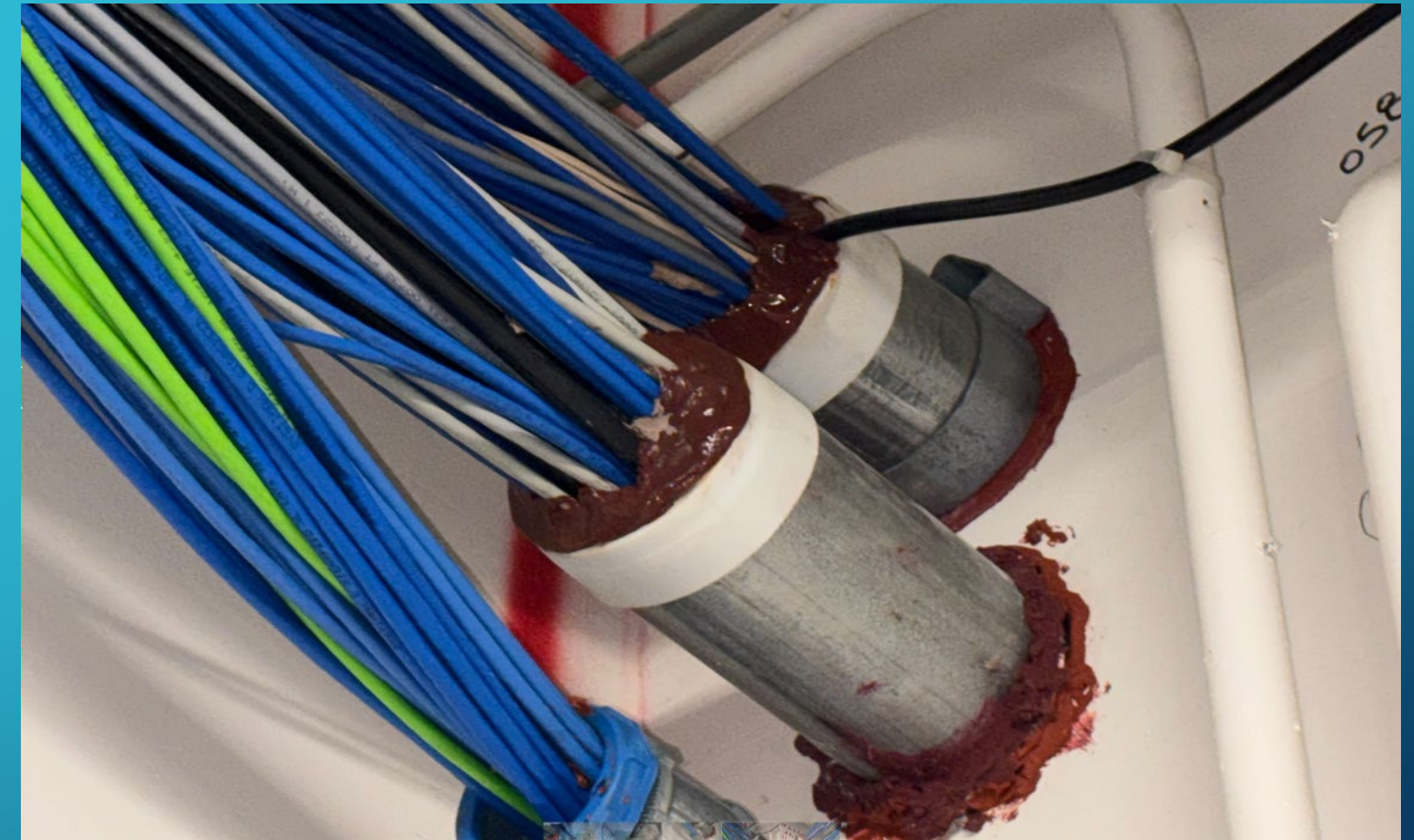


- Blank opening
- Non-firestop sealant used
- What system?

# IDF/MDF ROOM - TELECOM/ELECTRICAL CLOSET



- Mineral wool exposed
- Over-fill?
- Inconsistency can trigger destruction testing



- Blank opening
- Over-fill?
- Cracks in sealant around the conduit

# DOUBLE LEAF DOOR/CORRIDOR DOORS

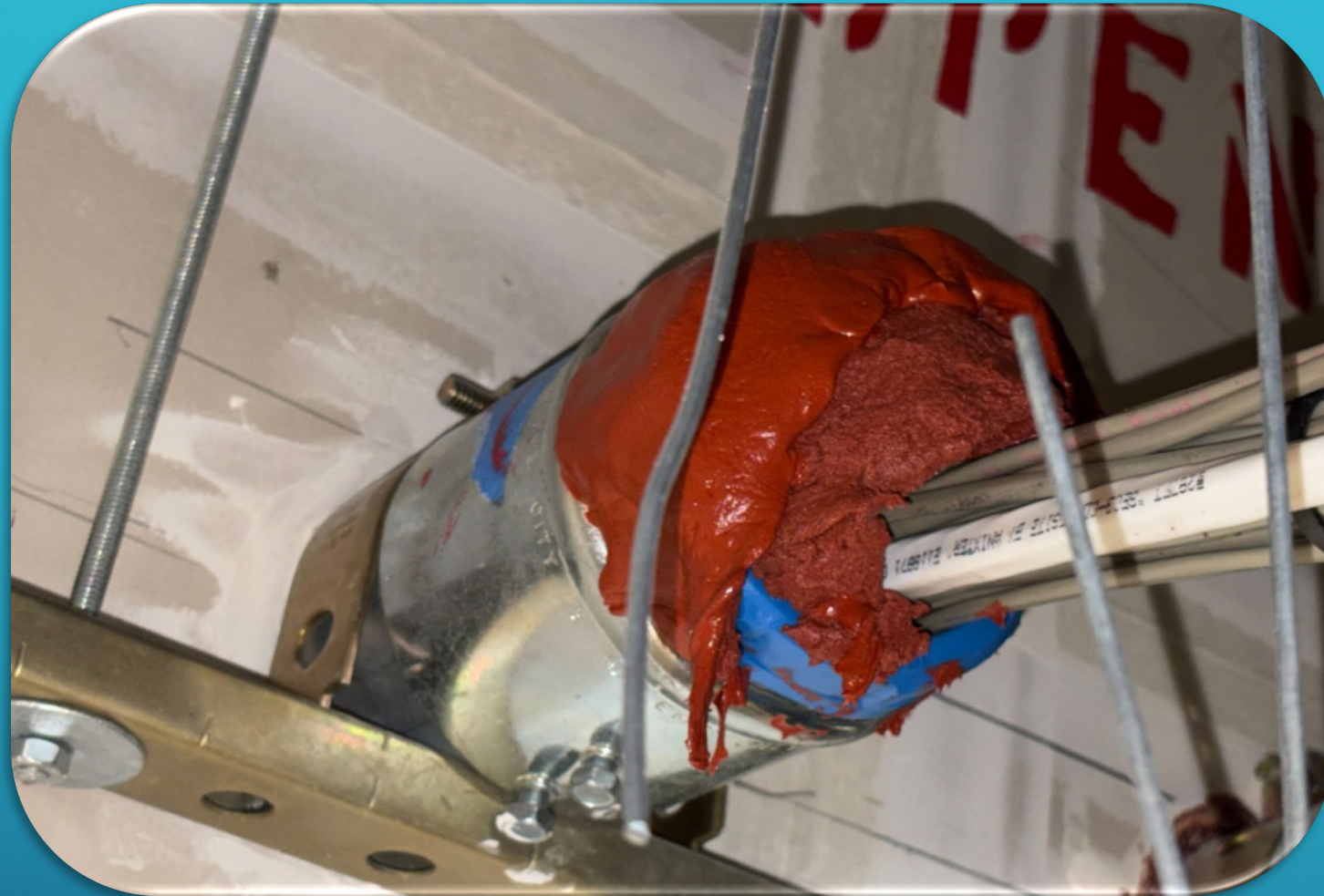


- Unsealed conduits
- What system?



- Mud vs Firestop Sealant
- Not maintained to code
- What system?

# DOUBLE LEAF DOOR/CORRIDOR DOORS



- Two products used to seal one conduit
- What system?



- No sealant
- Mineral wool exposed
- What system?

# GYPSUM PATCHES



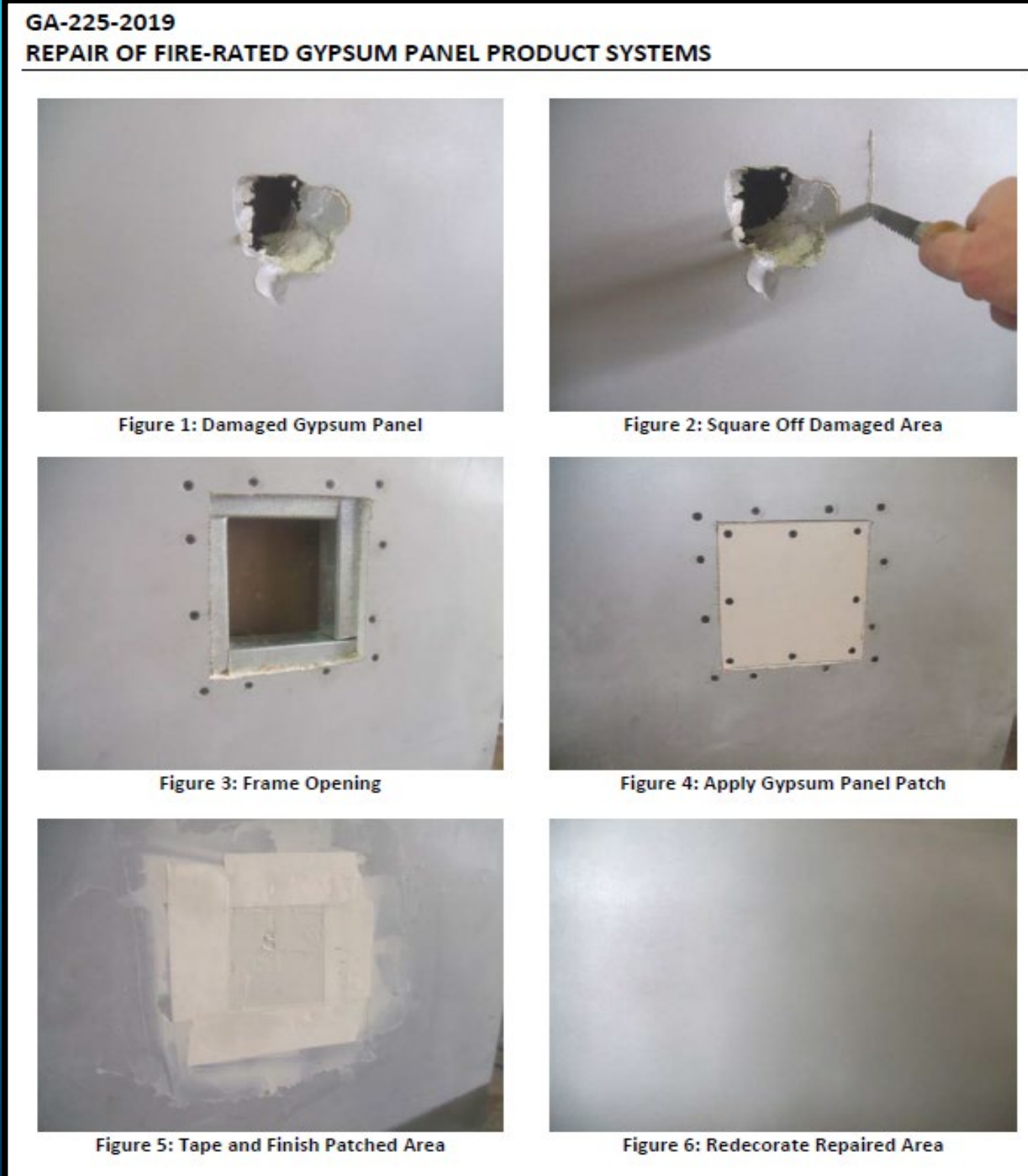
- Is gypsum patch mechanically fastened
- Tooling of Firestop material
- What System used?



- Non-compliant foam used
- Gypsum patch not following GA-225-2019
- What system used?

# 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



# CONSTRUCTION JOINTS: TOP OF WALL

## POOR FIRESTOP INSTALLATION EXAMPLES



- Visible gap in firestop at joint
- Not enough material
- Joint not cleaned
- Not in Compliance



- Here the firestop is used as a “lip-stick”
- A very small joint at the head of wall, 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

## POOR FIRESTOP INSTALLATION EXAMPLES



- No caulk around all pipes
- Sealant not tooled
- What system

- No sealant in the joint

# CONSTRUCTION JOINTS: TOP OF WALL

## POOR 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.
- Sprayed with CFS-S SP WB spray with a minimum ½” overlap onto the floor/wall

# ADDITIONAL CONSIDERATIONS

Engineering Judgments

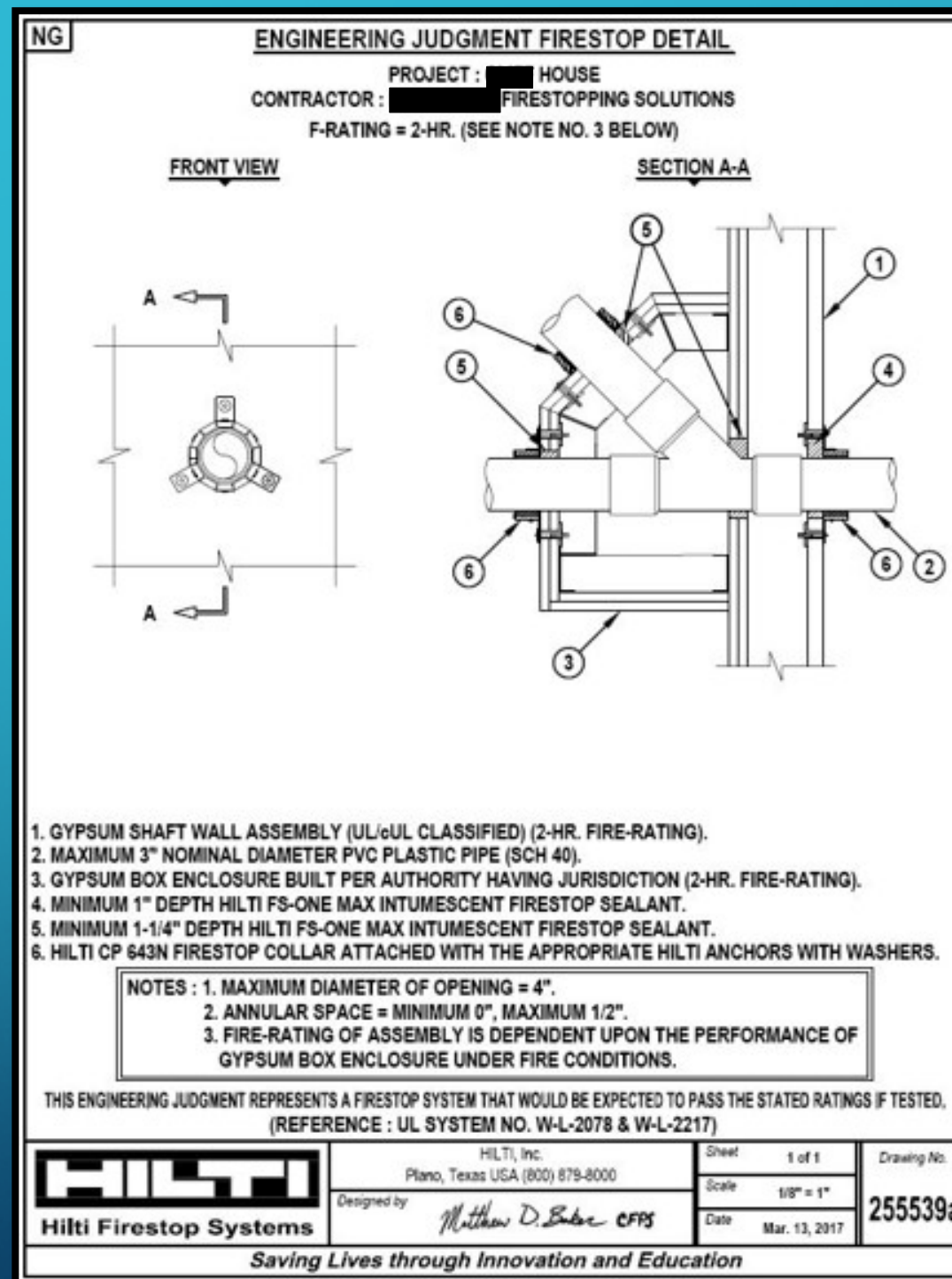
Maintenance: Inspection & Labeling

Best Practices: Who to partner with?

# 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



# FIRESTOP SYSTEM SUBMITTALS AND PROPER DOCUMENTATION FOR INSTALLATION & INSPECTION

- 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



intertek



WL 1054

**System No. W-L-1054**  
**F Ratings — 1 and 2 Hr (See Items 1 and 3)**  
**T Rating — 0 Hr**  
**L Rating At Ambient — Less Than 1 CFM/Sq Ft**  
**L Rating At 400 F — 4 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. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. 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. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing on all four sides.

B. Gypsum Board\* — 5/8 in. thick, 4 ft 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. for steel stud walls. Max diam of opening is 14-1/2 in. for wood stud walls.

The F Rating of the firestop system is equal to the fire rating of the wall assembly.

2. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. Pipe may be installed with continuous point contact. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. Steel Pipe — Nom 30 in diam (or smaller) Schedule 10 (or heavier) steel pipe.  
 B. Iron Pipe — Nom 30 in. diam (or smaller) cast or ductile iron pipe.  
 C. Conduit — Nom 4 in diam (or smaller) steel electrical metallic tubing or 6 in. diam steel conduit.  
 D. Copper Tubing — Nom 6 in. diam (or smaller) Type L (or heavier) copper tubing.  
 E. Copper Pipe — Nom 6 in. diam (or smaller) regular (or heavier) copper pipe.

3. Fill, Void or Cavity Material\* — Sealant — Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and wall, a min 1/2 in. diam bead of fill material shall be applied at the pipe wall interface on both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant  
 \*Bearing the UL Classification Mark

# NFPA 1 / NFPA 101

## 4.6.12 Maintenance, Inspection, and Testing.

### 4.6.12.1

Whenever or wherever any device, equipment, system, condition, arrangement, level of protection, fire-resistive construction, or any other feature is required for compliance with the provisions of this code, such device, equipment, system, condition, arrangement, level of protection, fire-resistive construction, or other feature SHALL THEREAFTER BE CONTINUOUSLY MAINTAINED in accordance with applicable NFPA requirements.

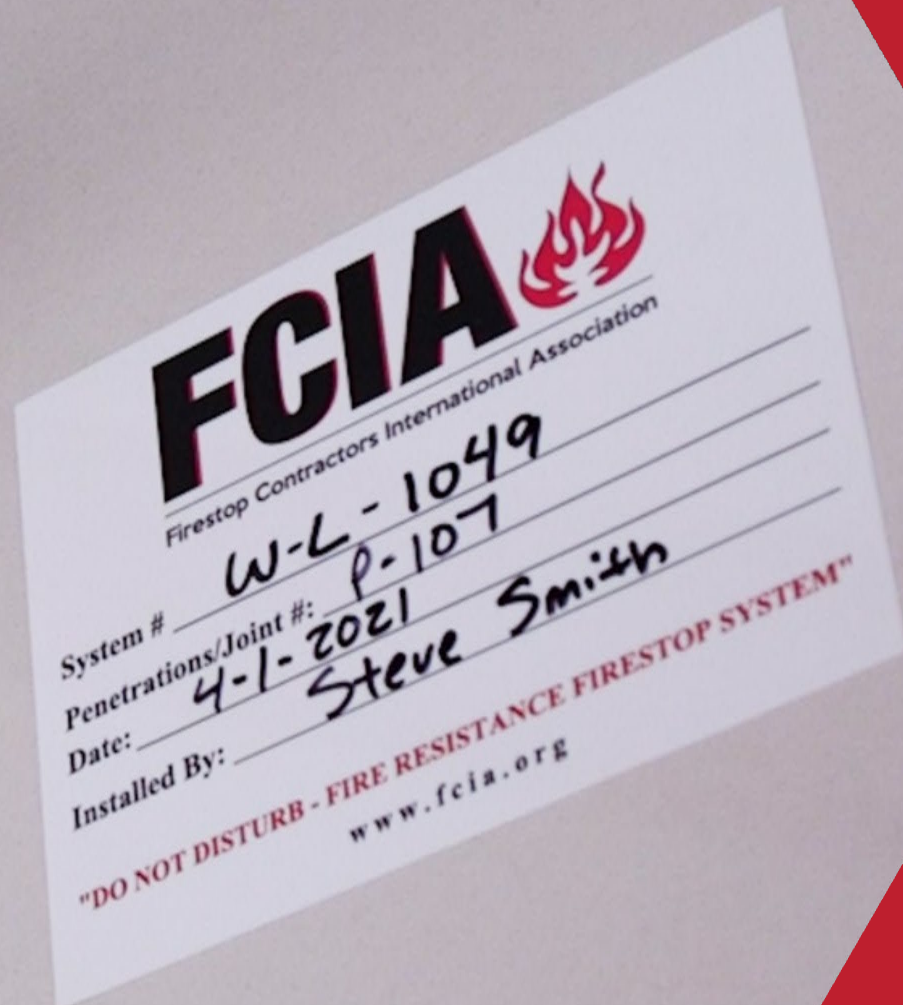
# LABELING PENETRATIONS & JOINTS IN RATED WALL ASSEMBLIES - IBC 2018

## 701.1 Scope

The provisions of this chapter shall govern the inspection and maintenance of the materials, systems and assemblies used for structural fire resistance, fire resistance, rated construction separation of adjacent spaces and construction installed to resist the passage of smoke to safeguard against the spread of fire and smoke within a building and the spread of the fire or from buildings. New buildings shall comply with the IBC.

## 701.6 Owners responsibility

THE OWNER SHALL MAINTAIN AN INVENTORY OF ALL REQUIRED FIRE-RESISTIVE AND SMOKE RESISTANT CONSTRUCTION, and the construction included in sections 703 through 707 and such construction shall be visually inspected by the owner annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated.



# IBC 2006

## Chapter 1 - Administration (Inspection)

### Complete inspection + 100% Compliance

- **Section 109.3.6** - Fire-resistant penetrations  
“Protection of joints and penetrations in fire-resistance- rated assemblies shall not be concealed from view until inspected and approved.”
- **Section 109.6** - Approval required  
“...Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.”

# IBC 2021

## Chapter 17 Special Inspection & Tests

- **Section 1705.17**

(Fire-resistant penetrations and joints) require inspection of firestop systems. Must verify materials, installation, and compliance before concealment.

- **Section 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.

# ENGAGE AN EXPERIENCED INSTALLER WHO IS QUALIFIED TO PERFORM THE FIRESTOP WORK

## Professional Installer Qualifications

- FM 4991 Approved Firestop Contractor
- UL Qualified Firestop Contractor Program
- Manufacturer Accredited Firestop Specialty Contractor
- Firestop Manufacturer Training





Thank you

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