

# Introduction to Firestopping

3M™ Fire Protection Solutions

August 2022



# Training Objectives

- ❑ Understand the basics of firestopping and the importance of the UL System
- ❑ Become comfortable with identifying UL systems for through-penetration applications
- ❑ Become familiar with common UL systems used by various trades

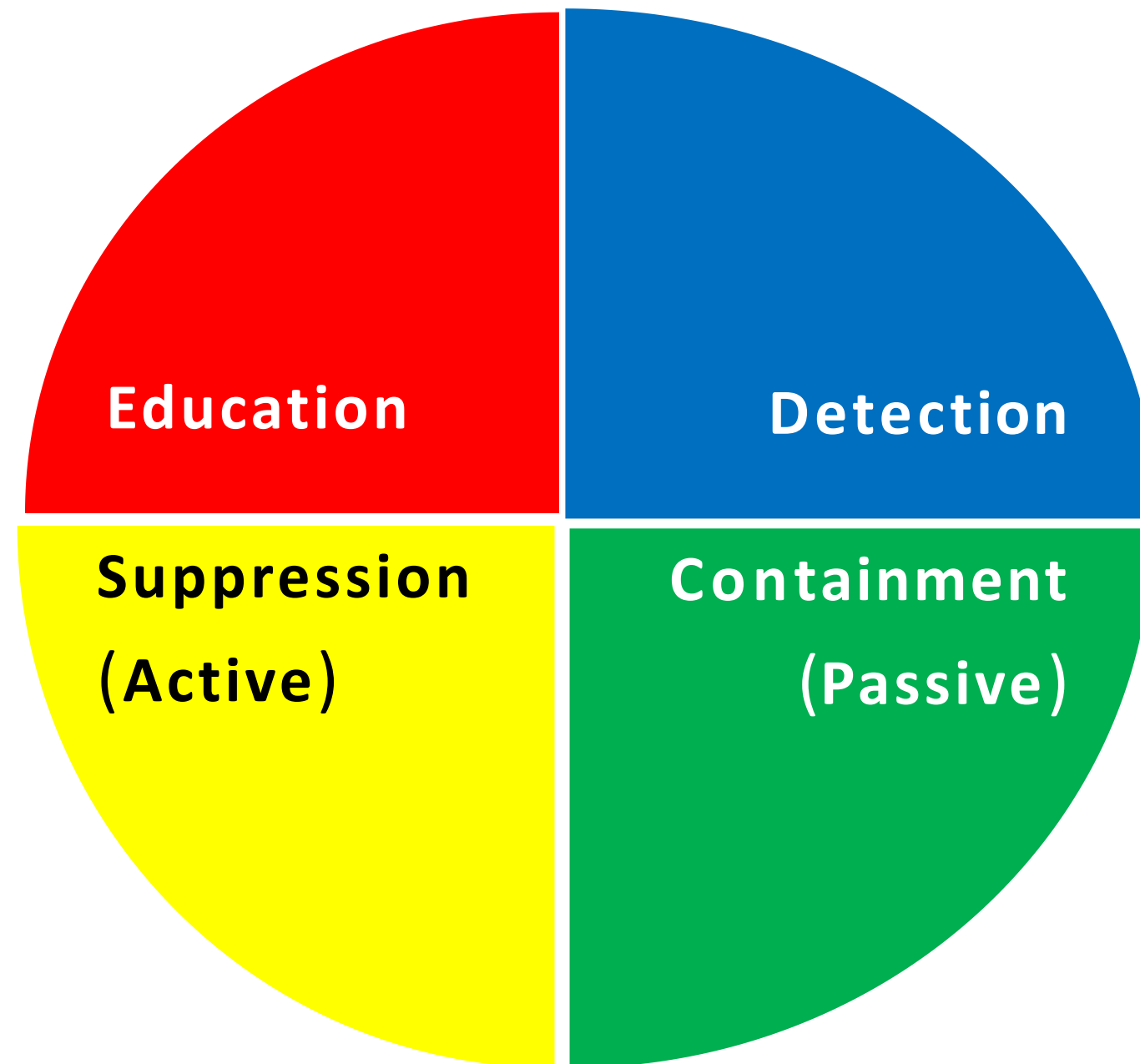
# Defining Fire Protection



Exit Signs,  
“Stop, Drop, and Roll”



Sprinklers  
Fire Departments



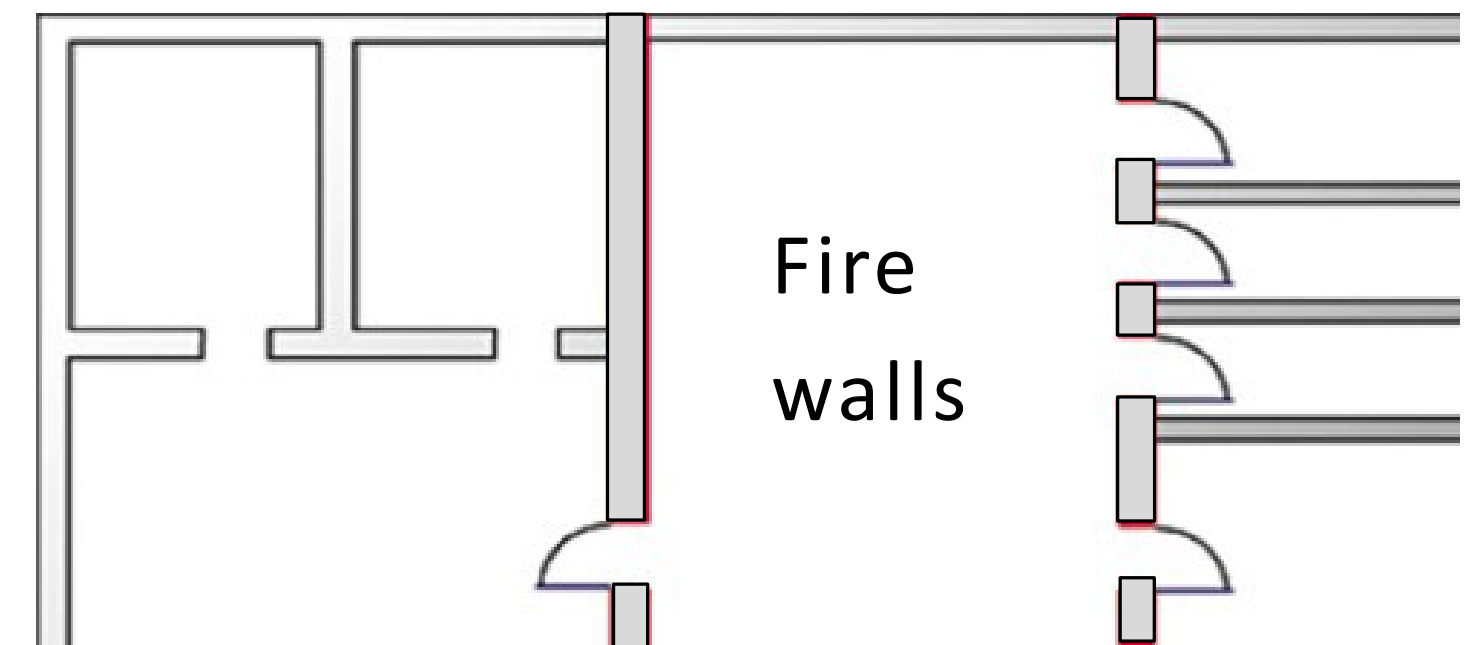
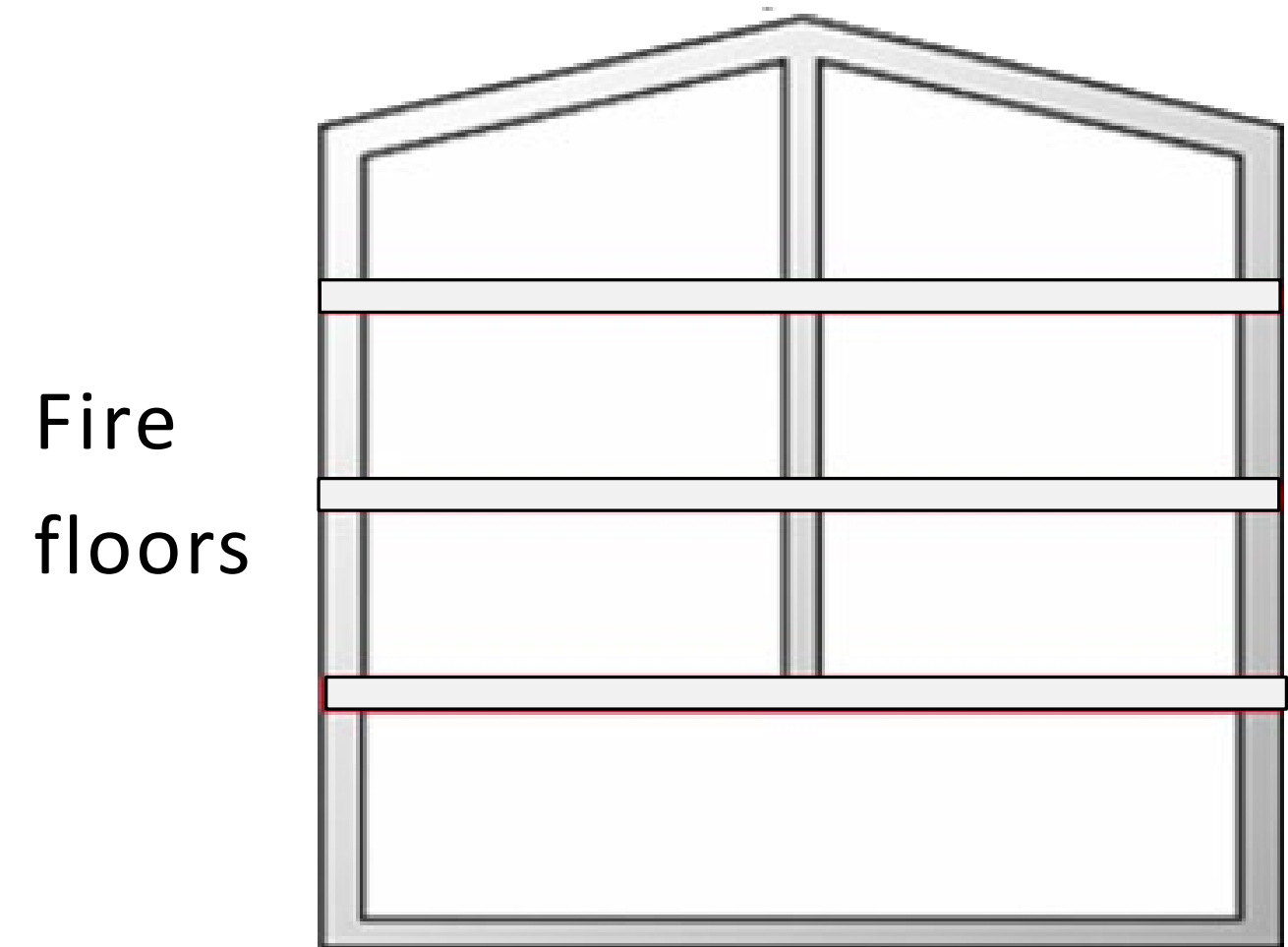
Smoke Detectors



Fire Protection Products

# What is firestop?

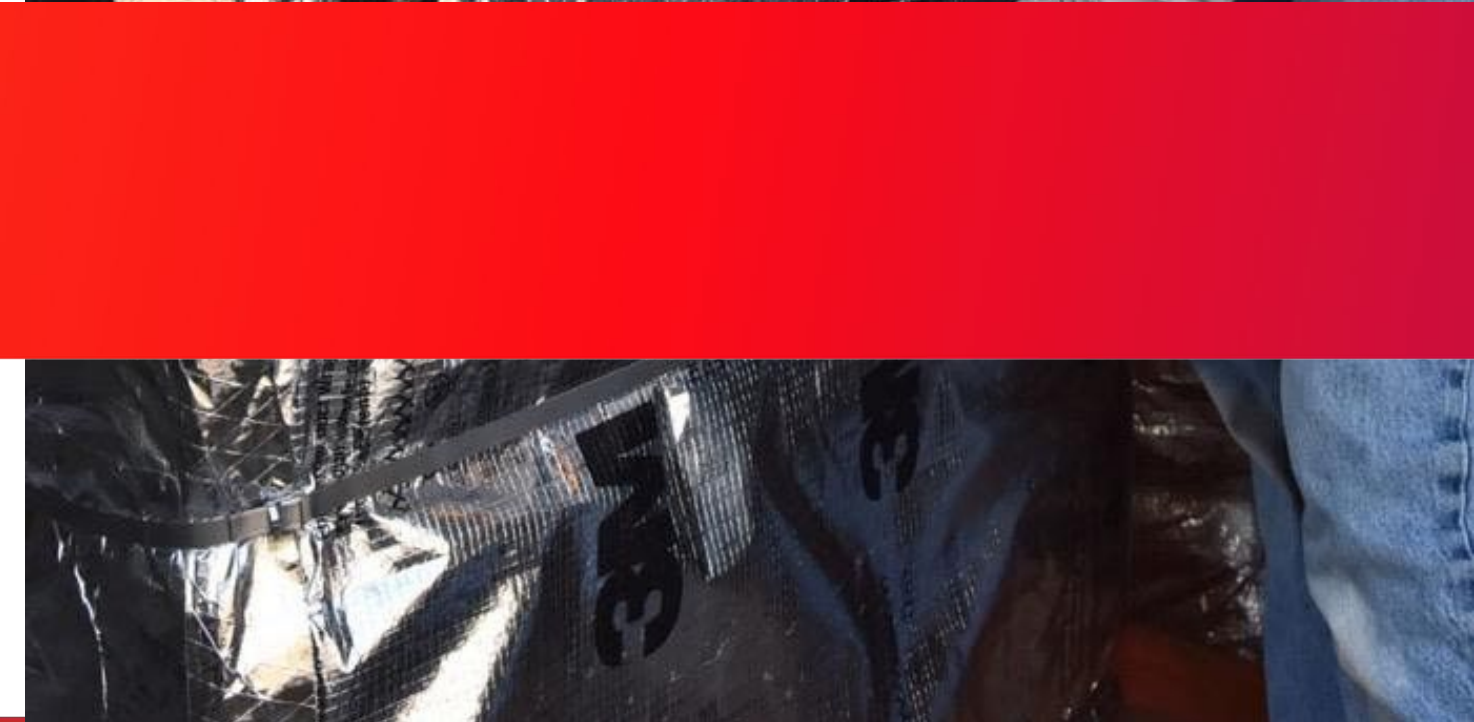
- Divide building into separate compartments via: Fire rated Floors, Fire rated Walls & Fire and Smoke Barriers
- Confine fire to the zone of origin for a specified time (fire-resistance rating, F-rating)
- Prevents spread of fire, smoke and toxic gases
- Increases evacuation time for occupants
- Minimize damage



# Firestop systems

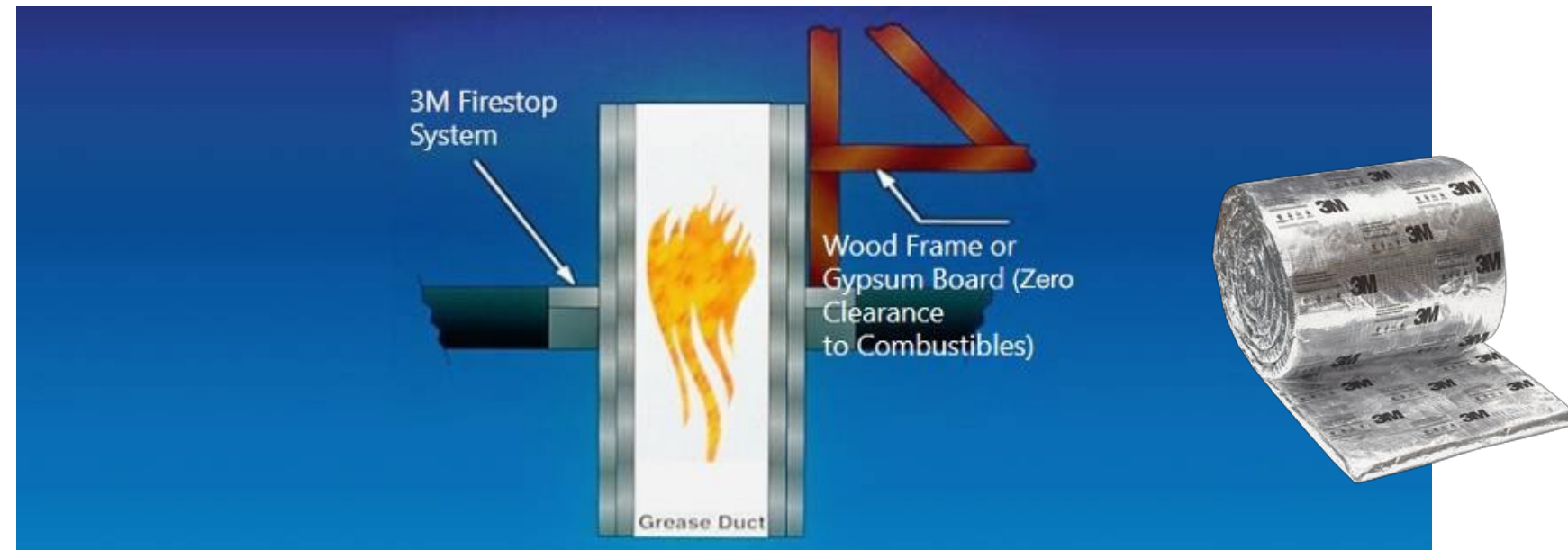
A firestop system is a complete, tested assembly that prevents the passage of flames, smoke and toxic gases through penetrations, joints or other weaknesses in fire-rated walls and floors for specified period of time.

**Products alone do not carry a rating.  
Tested, and listed systems do.**



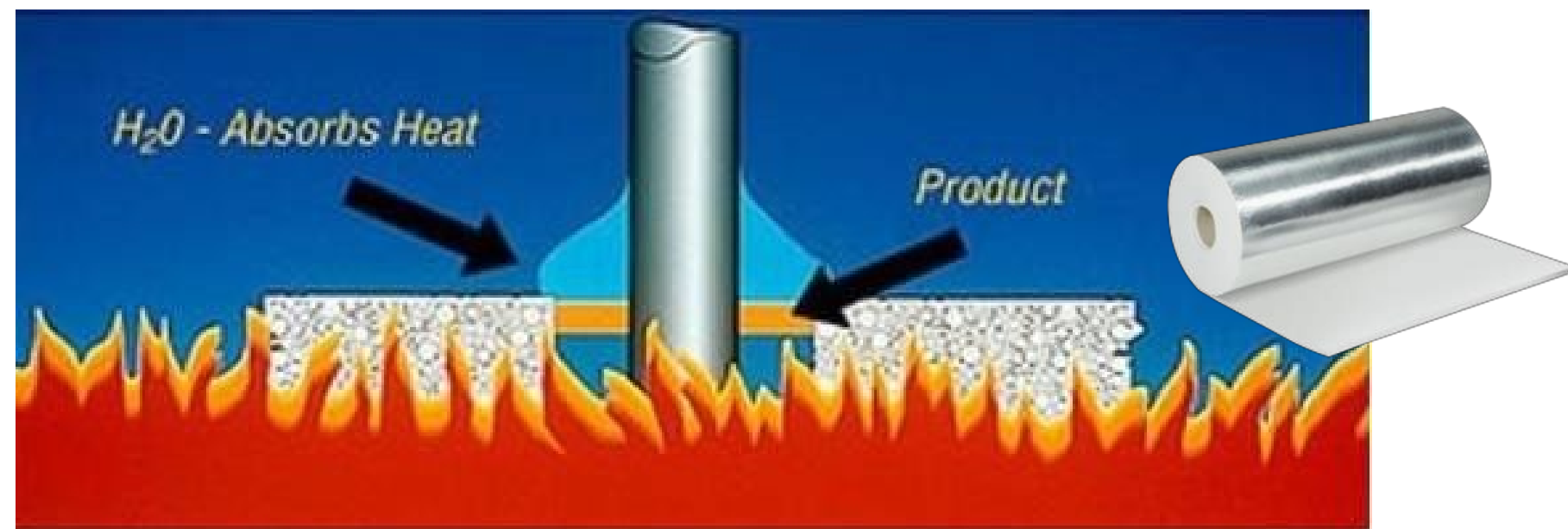
# Firestop technologies

## Insulative



As fire intensifies, product helps prevent fire from spreading to combustibles.

## Endothermic



As fire intensifies, chemically bound water molecules are released.

## Intumescent



As fire intensifies, product expands and chars.

## Ablative



As fire intensifies, a hard char with thermal insulation is formed.

# Key Terms

**Engineering Judgement** – When a tested & listed system is not available, work with 3M Application Engineer to establish a *job specific system* based on conditions at the jobsite.

**F Rating** – Measures fire resistance in which flame cannot pass through the assembly for the duration of the fire test.

**T Rating** – Length of time that the unexposed surface of the assembly will not exceed 325°F above initial temperature during ASTM E 814 fire test.

**L Rating** – Shows the effectiveness of the firestop as a smoke and toxic gas barrier.

**W Rating** – Refers to the water-resistant and/or watertight seal and indicates the effectiveness of the firestop material in restricting the flow of water through penetrations in the assembly.

# Primary areas of containment



Through Penetrations

Openings in walls, floors, ceilings through which a penetrating item (e.g. pipe, cable) is passed



Linear openings in or between adjacent fire-rated assemblies typically designed to allow independent movement of the building, includes perimeter joints



Used to protect grease, chemical, and ventilation air ducts (shaft alternatives), plenums, structural steel, and electrical circuitry



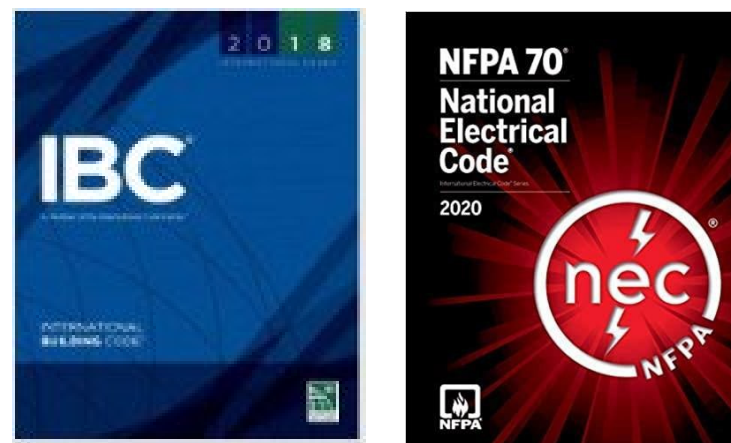
# Code requirements for firestopping

## Minimum requirements for new construction & maintenance

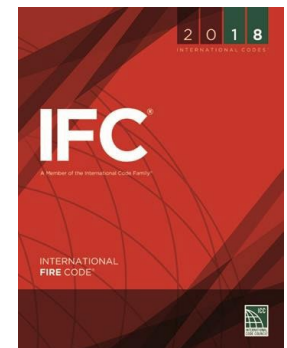
Code bodies place an emphasis on “Approved Methods”, defined as a material, device or system tested in accordance to a nationally recognized test standard at a recognized testing facility.

International Building Code, Chapter 7

National Electrical Code, NFPA 70



International Fire Code,  
Chapter 7



NFPA 101 (Life Safety Code),  
Chapter 8



# Roles & Responsibilities of Testing Agencies

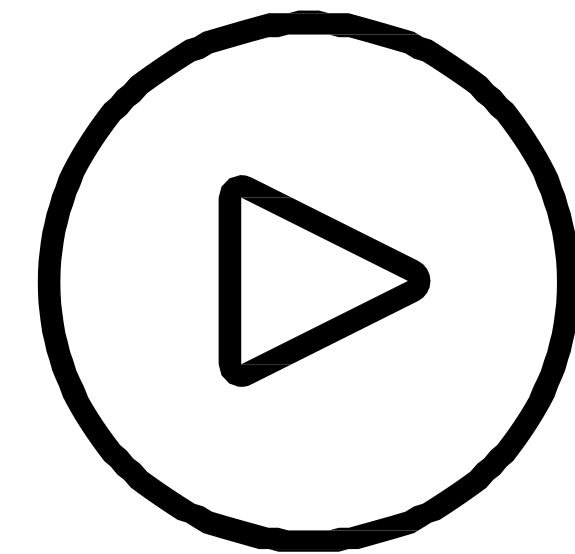
- Develop the criteria for what a firestop system needs to pass the applicable test standards (e.g. ASTM E 814)
- Provide listed systems or design listings for each approved manufacturer's tested configuration
- Develop and establish a nomenclature for each category of listed systems



# Test standards for firestop systems

Category	ASTM Standard	UL
Through penetrations	E814	1479
Cable Tray	E1725	1724
Joints	E1966	2079
Perimeter joints	E2307	
Continuity of wall joints	E2837	
Grease ducts	E2336	
Air ventilation ducts	E2816	
Assemblies	E119	263
High intensity – hydrocarbon pool fires	E1529	1709

# Example: Key test for through penetrations



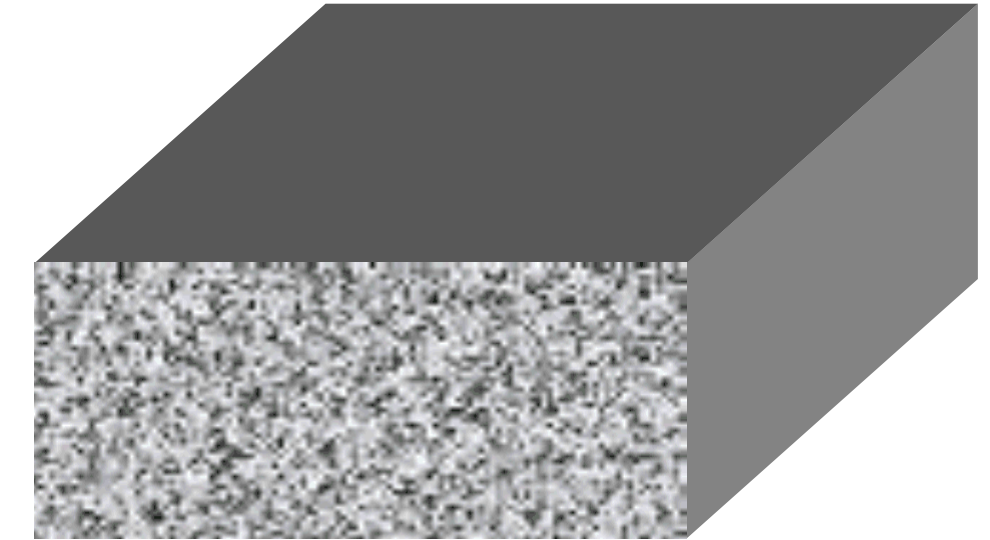
video

# UL System Nomenclature Overview

*Consider reading a UL System to be  
a recipe for firestopping.*

# Understanding system nomenclature

**C**



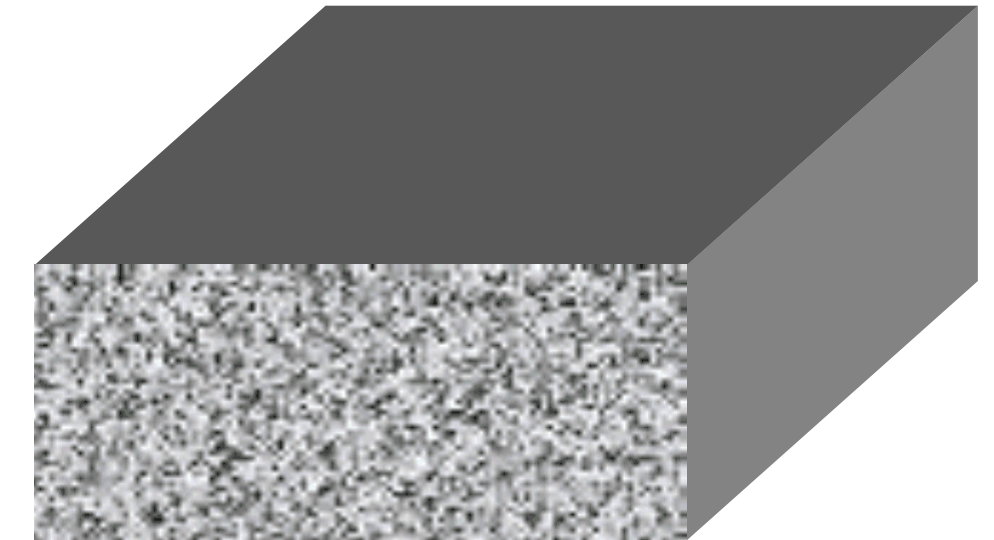
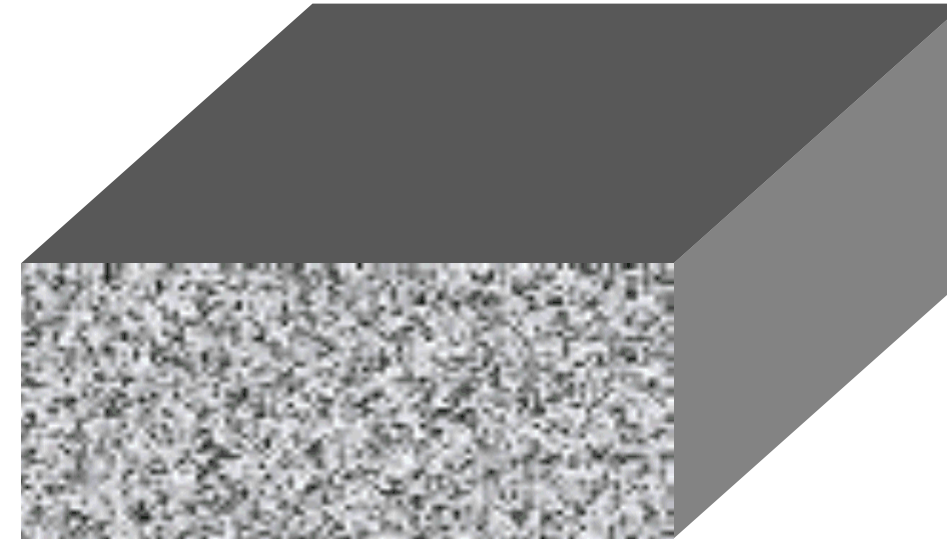
**The first alpha component identifies the type of assembly being penetrated.**

**C** combination floor or wall

**F** floor

**W** wall

# Understanding system nomenclature



**The second alpha component further identifies the construction type.**

**A** signifies a concrete with a minimum thickness less than or equal to 5"

B. signifies a concrete with a minimum greater than to 5"

C. signifies a framed floor

D. signifies a steel deck in a marine vessel

E. signifies a floor-ceiling assembly consisting of concrete with membrane protection

**F-I** currently not used

**J** signifies a concrete or masonry wall with a minimum thickness less than or equal to 8"

K. signifies a concrete or masonry wall with a minimum thickness greater 8"

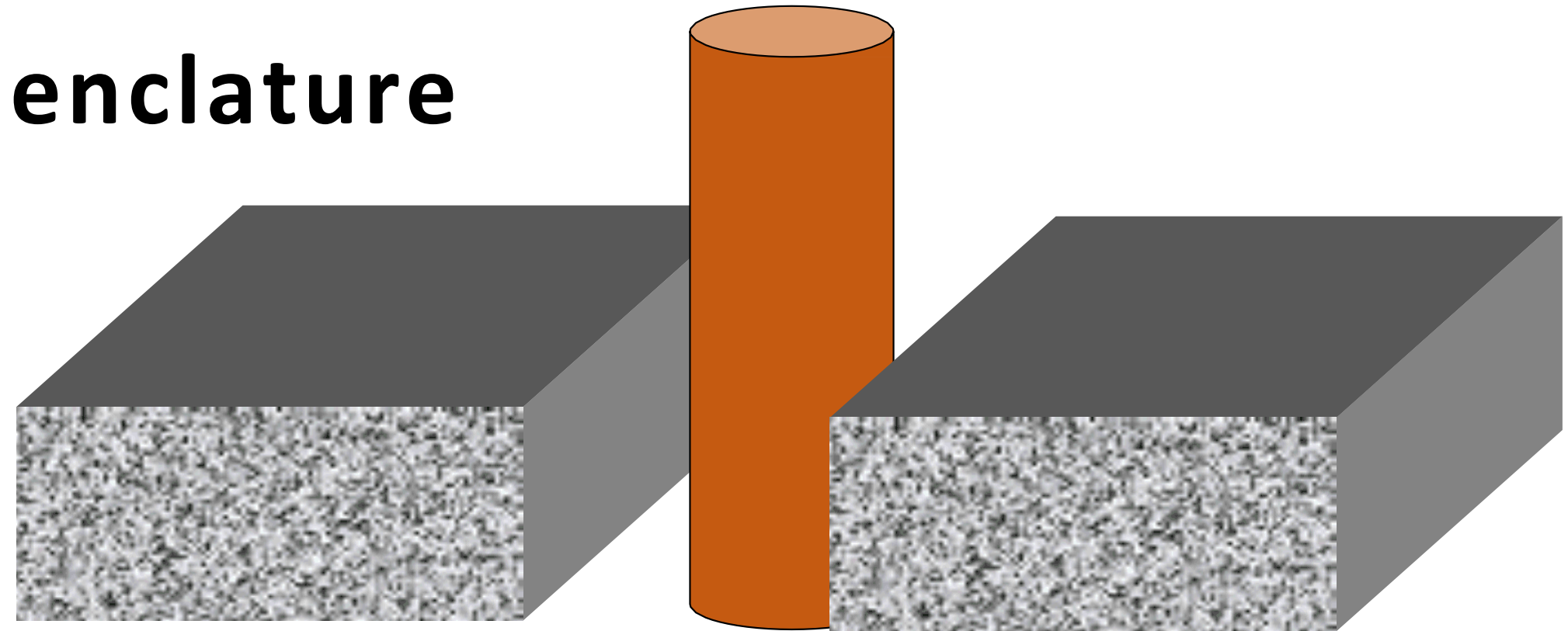
L. signifies a framed wall

M. signifies bulkheads in marine vessels

**O-Z** currently not used

# Understanding system nomenclature

**1552**



**The numeric component uses sequential numbers to identify the penetrating item.**

**0000–0999** No penetrating items

**1000–1999** Metallic pipe, conduit, or tubing

**2000–2999** Nonmetallic pipe, conduit, or tubing

**3000–3999** Electrical cables

**4000–4999** Cable trays with electrical cables

**5000–5999** Insulated pipes

**6000–6999** Miscellaneous electrical penetrants such as buss ducts

**7000–7999** Miscellaneous mechanical penetrants such as air ducts

**8000–8999** Groupings of penetrations including any combination of items listed above

**9000–9999** Currently not used



# Example: Reading a UL system

## System No. C-AJ-1044

March 15, 2007

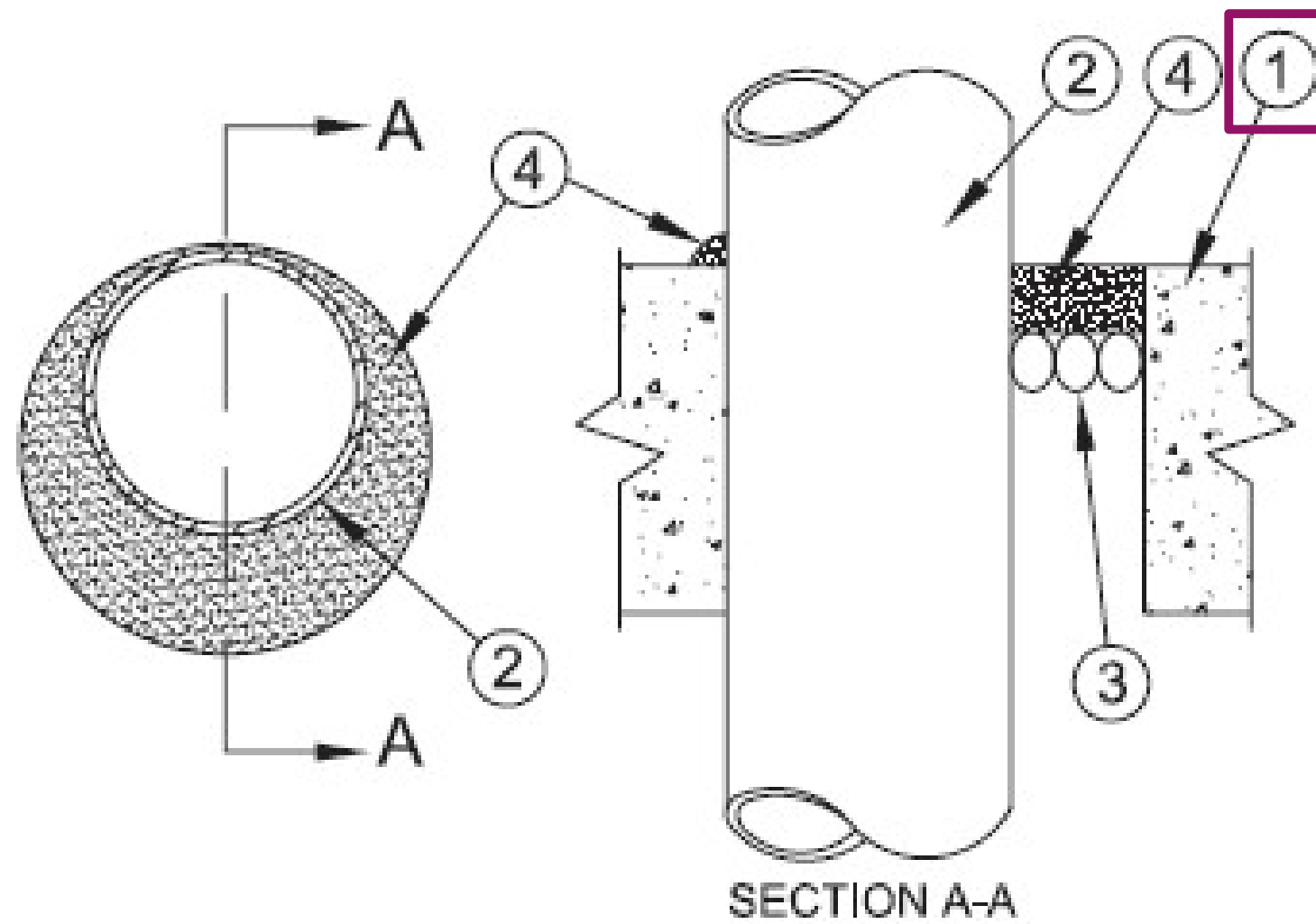
F Ratings – 2, 3, and 4 Hr (See Items 2A and 4)

T Rating – 0 Hr

L Rating At Ambient – 2 CFM/sq ft

L Rating At 400 F – less than 1 CFM/sq ft

W Rating – Class 1 (See Item 4)



1. **Floor or Wall Assembly** – Lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Except as noted in table under Item 4, min thickness of solid concrete floor or wall assembly is 4-1/2 in. (114 mm). Floor may also be constructed of any min 6 in. (152 mm) thick UL Classified hollow core **Precast Concrete Units\***. When floor is constructed of hollow core precast concrete units, packing material (Item 3) and caulk fill material (Item 4) to be installed symmetrically on both sides of floor, flush with floor surface. Wall assembly may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening in solid lightweight or normal weight concrete floor is 32 in. (813 mm). Max diam of opening in floor constructed of hollow-core precast concrete units is 7 in. (178 mm)  
  
See **Concrete Blocks (CAZT)** and **Precast Concrete Units (CFTV)** categories in the Fire Resistance Directory for names of manufacturers.
- 1A. **Steel Sleeve** – (Optional, Not Shown) - Nom 16 in. (406 mm) diam (or smaller) Schedule 10 (or heavier) steel sleeve cast or grouted into floor or wall assembly. Sleeve may extend a max of 2 in. (51 mm) above top of floor or beyond either surface of wall. As an alternate, nom 16 in. (406 mm) diam (or smaller) min 0.028 (0.71 mm) thick galvanized sheet steel sleeve cast or grouted into floor or wall assembly flush with floor or wall surfaces.
2. **Through Penetrants** – One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Max annular space between pipe, conduit or tubing and edge of through opening or sleeve is dependent on the parameters shown in Item 4. Min annular space between pipe or conduit and edge of through opening is 0 in. (point contact). Max annular space to be as shown in the table in Item 4. Pipe, conduit or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
  - A. **Steel Pipe** – Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
  - B. **Iron Pipe** – Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.
  - C. **Conduit** – Nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
  - D. **Conduit** – Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing.
  - E. **Copper Tubing** – Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tube.
  - F. **Copper Pipe** – Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
3. **Packing Material** – Polyethylene backer rod or nom 1 in. (25 mm) thickness of tightly-packed mineral wool batt or glass fiber insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of caulk fill material (Item 4).
- 3A. **Forming Material\*** – As an alternate to the packing material in Item 3, nom 4 in. (102 mm) wide strips of min 1/2 in. (13 mm) thick compressible mat to be stacked to a thickness greater than the width of the annular space and compression-fitted, edge-first, to fill the annular space to a min 4 in. (102 mm) depth. As an option, the strips of min 1/2 in. (13mm) thick compressible mat may be folded in half, lengthwise, and stacked to a thickness greater than the width of the annular space and compression-fitted, edge-first, to fill the annular space to a min 2 in. (51 mm) depth. Top of forming material to be recessed from top surface of floor or from both surfaces of wall as necessary to accommodate the required thickness of caulk fill material.

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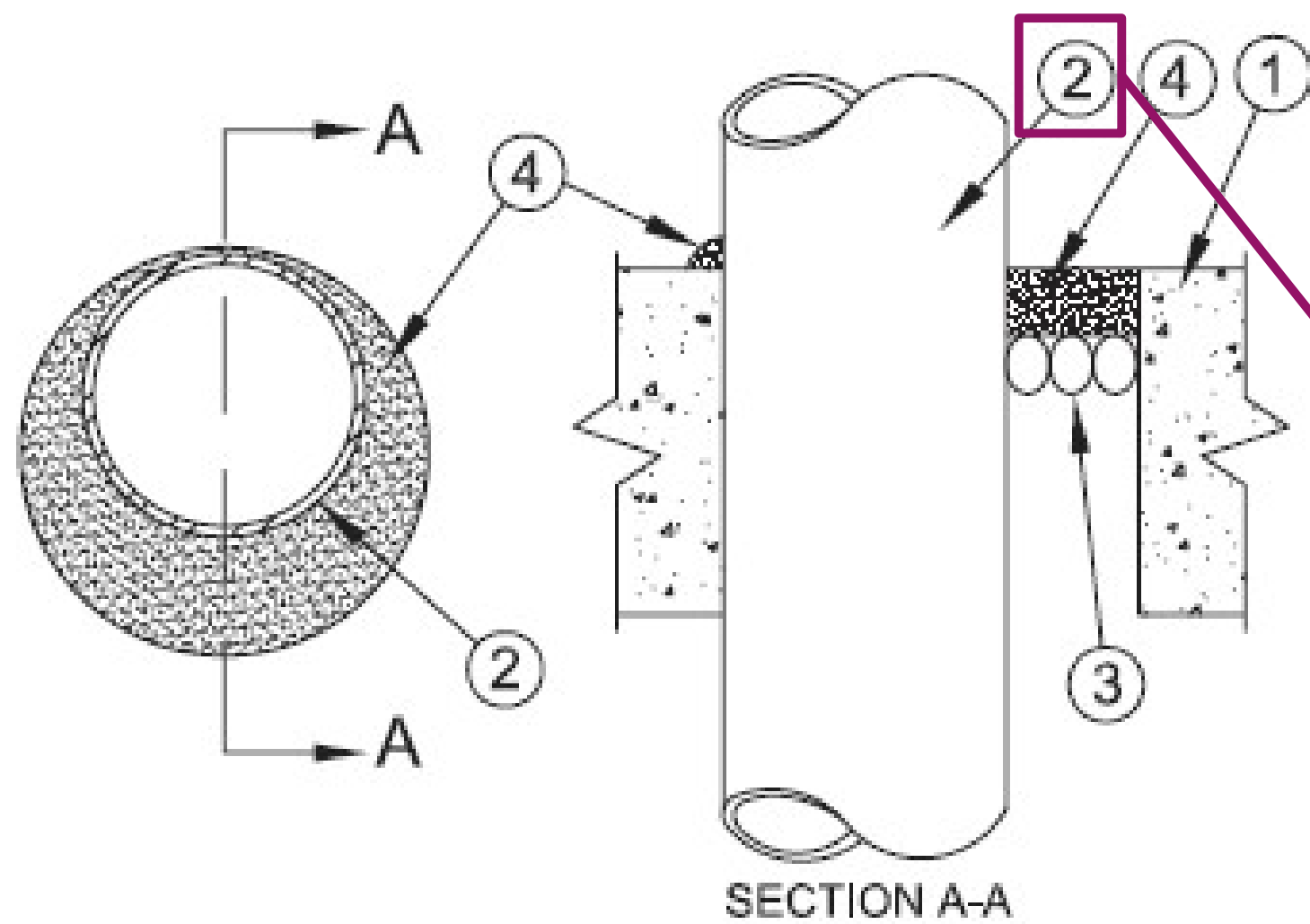
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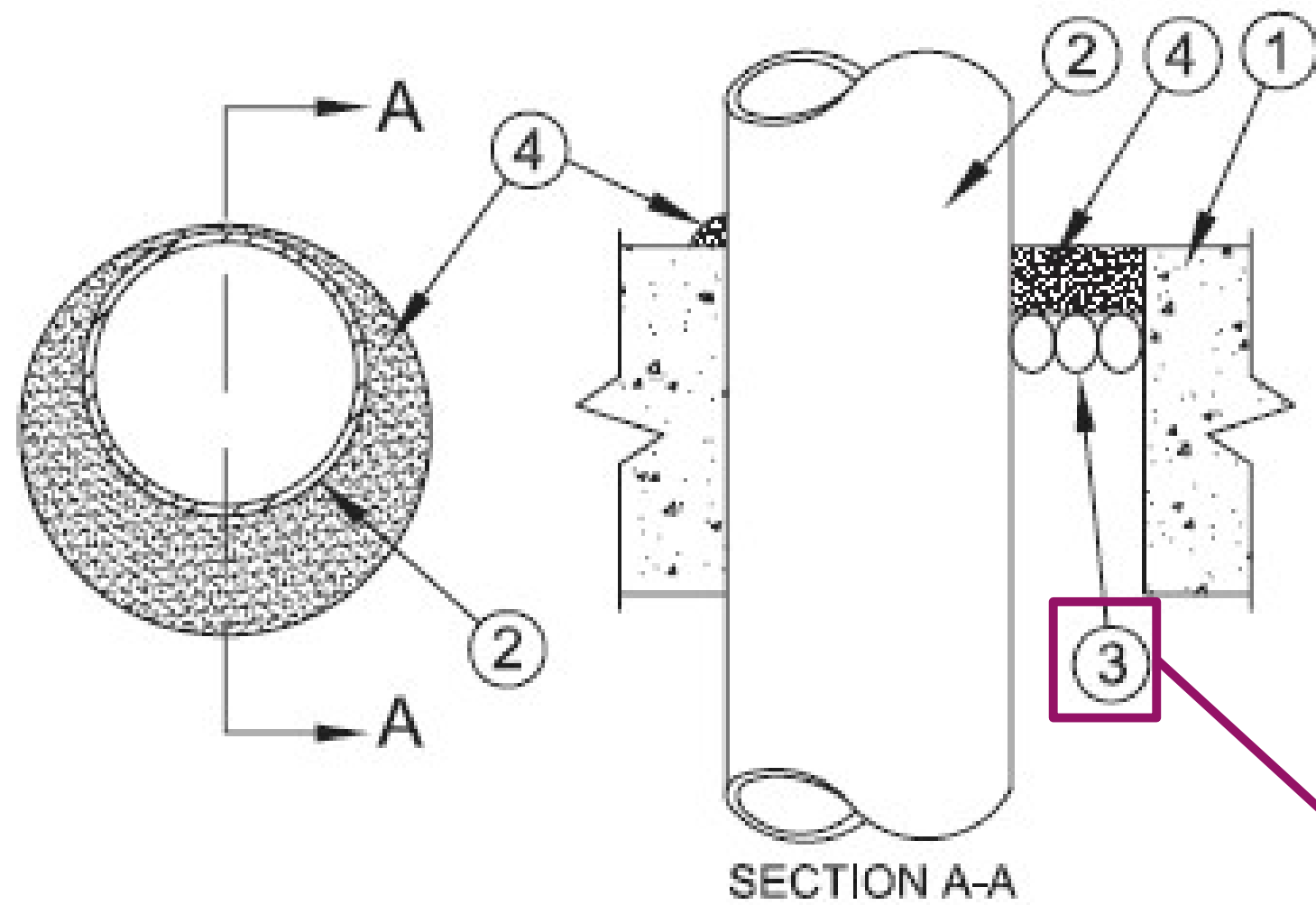
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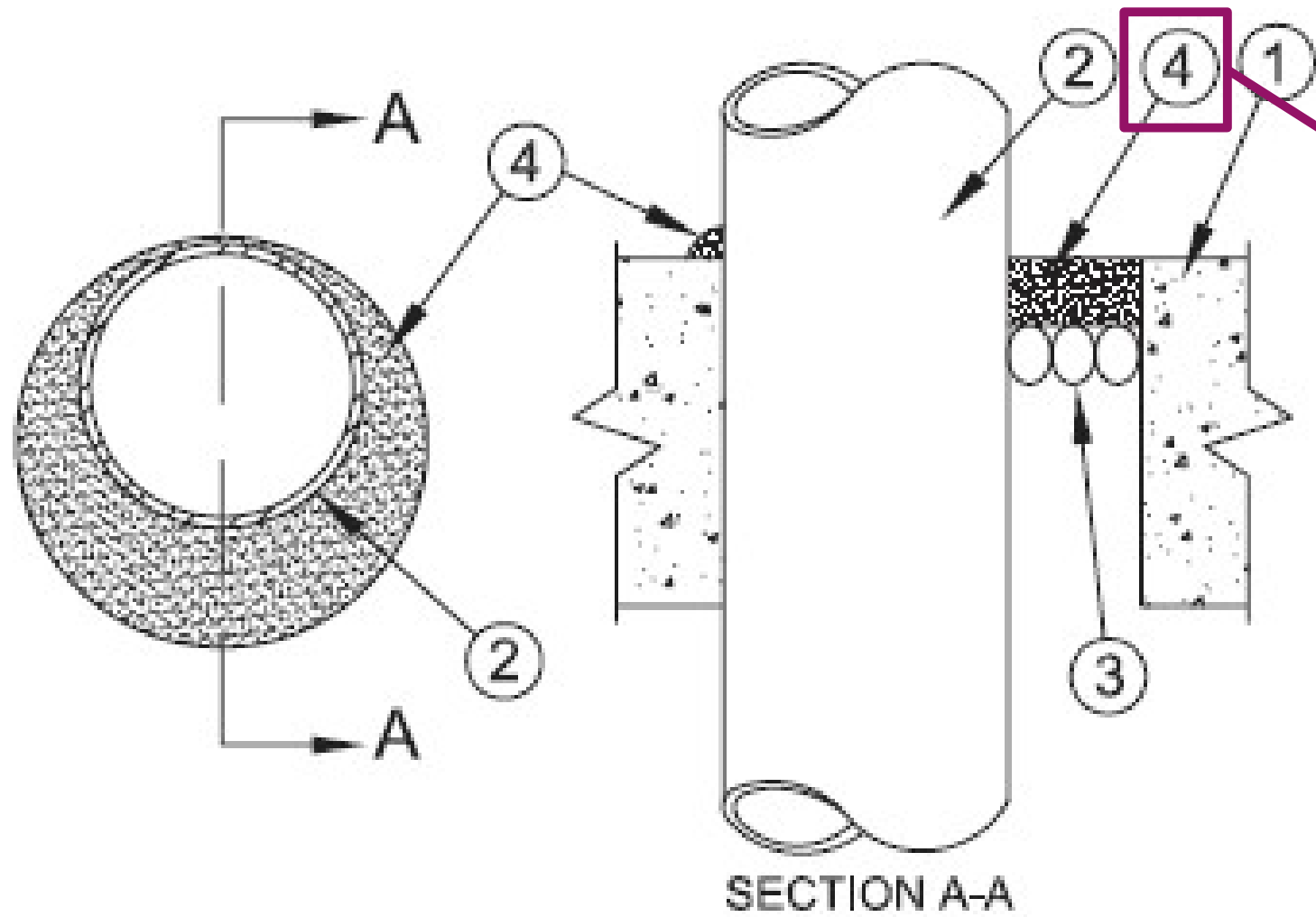
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T Rating – 0 Hr

L Rating At Ambient – 2 CFM/sq ft

L Rating At 400 F – less than 1 CFM/sq ft

W Rating – Class 1 (See Item 4)



4. **Fill, Void or Cavity Material\* – Caulk, Sealant** – Applied to fill the annular space flush with top surface of floor. In wall assemblies, required caulk thickness to be installed symmetrically on both sides of wall, flush with wall surface. At point contact location between penetrant and sleeve or between penetrant and concrete, a min 1/4 in. (6 mm) diam bead of caulk shall be applied at top surface of floor and at both surfaces of wall. The hourly F Ratings and the min required caulk thicknesses are dependent upon a number of parameters, as shown in the following table::

Min Floor or Wall Thkns In. (mm)	Nom Pipe Tube or Conduit Diam In. (mm)	Max Annular Space In. (mm)	Min Caulk Thkns In. (mm)	F Rating Hr
2-1/2 (64)	1/2-12 (13-305)	1-3/8 (35)	1/2 (13)	2
2-1/2 (64)	1/2-12 (13-305)	3-1/4 (83)	1 (25)	2
4-1/2 (114)	1/2-6 (13-152)	1-3/8 (35)	1/4(6)(a)	2
4-1/2 (114)	1/2-12 (13-305)	1-1/4 (32)	1/2 (13)	3
4-1/2 (114)	1/2-20 (13-508)	2 (51)	1 (25)	3
4-1/2 (114)	1/2-20 (13-508)	2 (51)	1 (25)	3
4-1/2 (114)	1/2-12 (13-305)	3-1/4 (83)	1 (25)	3
4-1/2 (114)	22-30 (558-762)	2 (51)	2 (51)	3
5-1/2 (140)	1/2-6 (13-152)	1-3/8 (35)	1 (25)(b)	4

(a) Min 2 in. (51 mm) thickness of mineral wool batt insulation or forming material (Item 3A) required in annular space.

(b) Min 1 in. (25 mm) thickness of mineral wool batt insulation required in annular space on both sides of floor or wall assembly.

Min 1 in. (25 mm) thickness of caulk to be installed flush with each surface of floor or wall assembly.

**3M COMPANY** – CP 25WB+ or FB-3000 WT.

(Note: W Rating applies only when FB-3000 WT is used.)

\*Bearing the UL Classification Marking



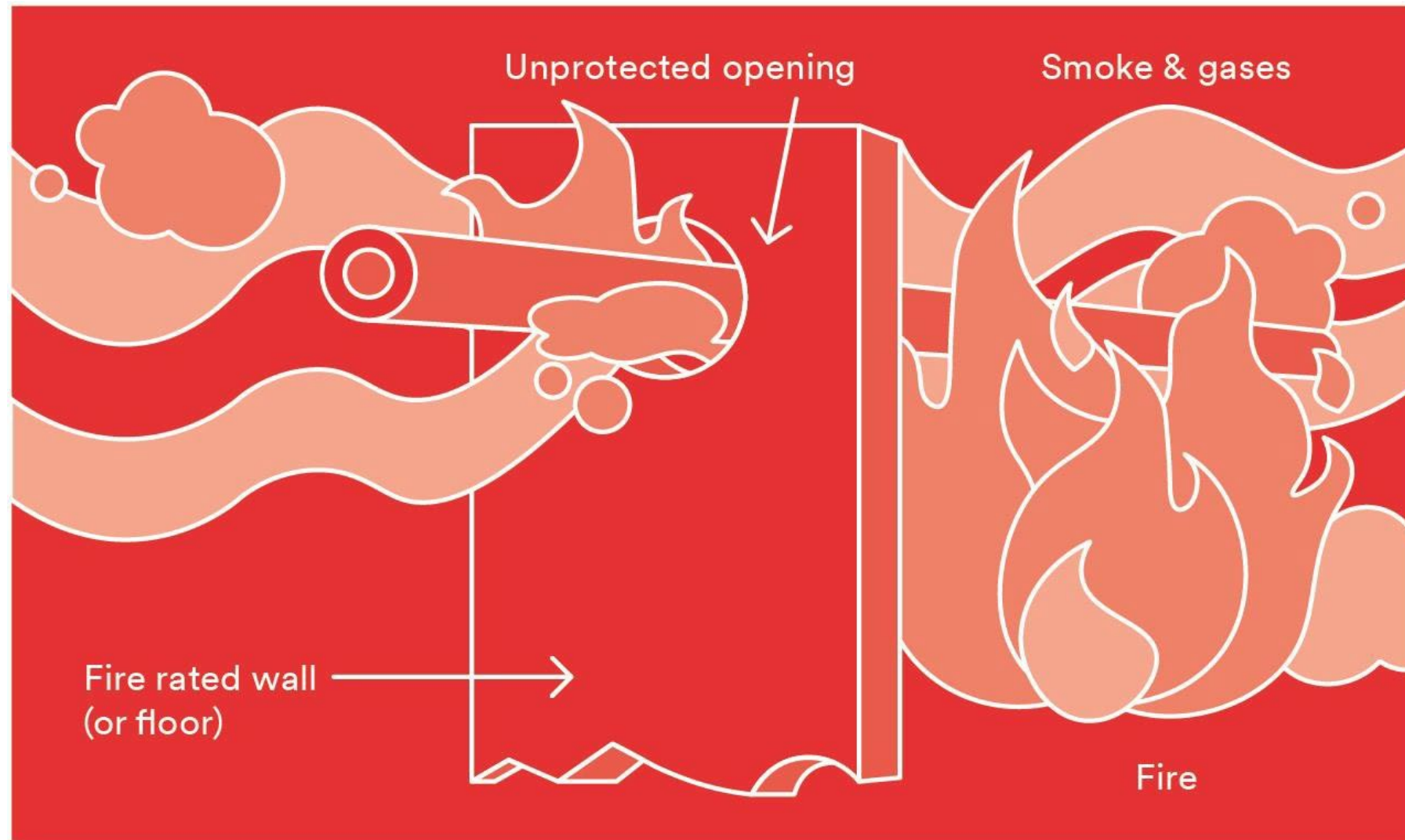
# Firestopping Through & Membrane Penetrations

3M™ Fire Protection Solutions

August 2022

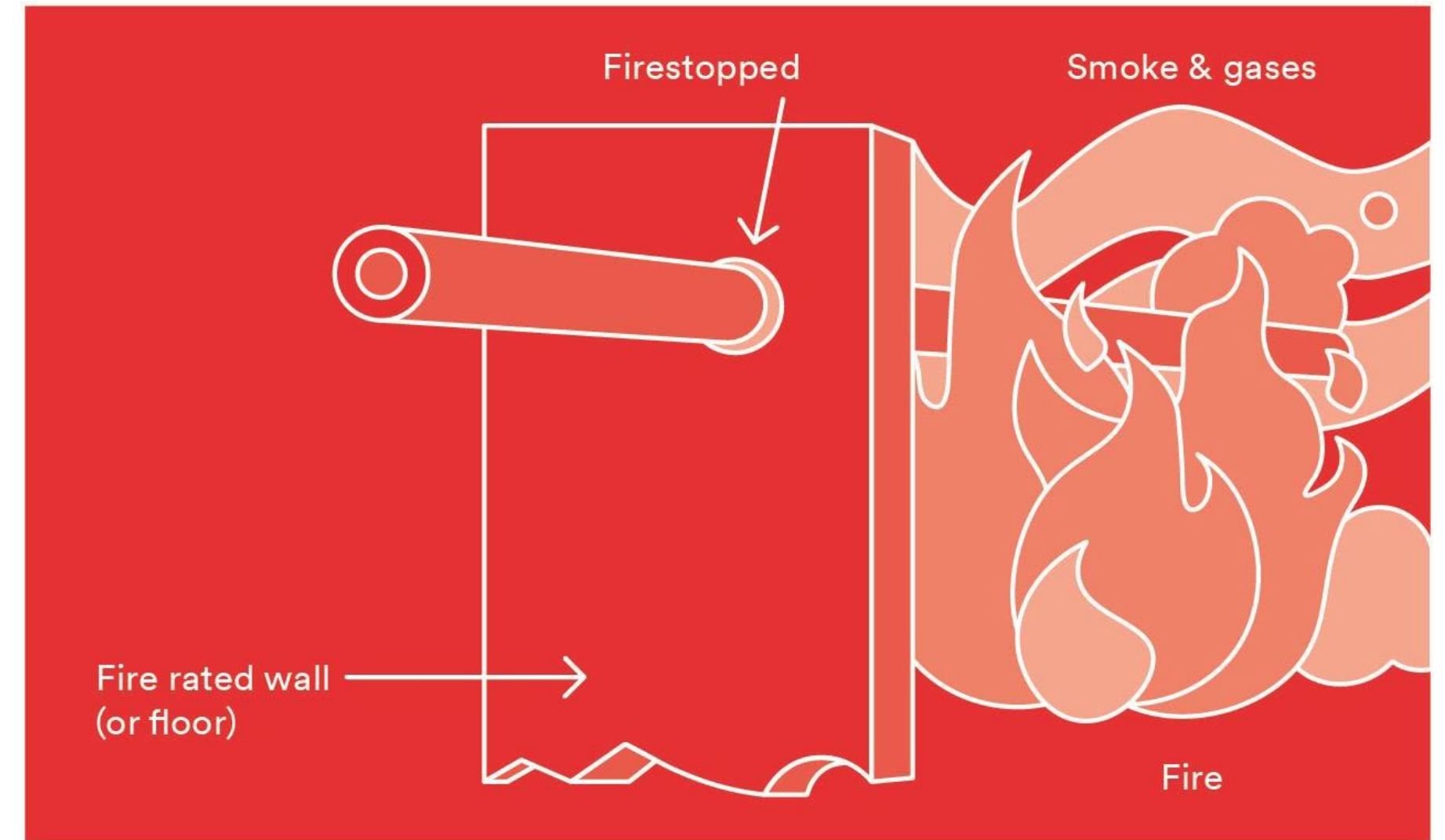


# Why the need for fire-resistive through and membrane penetrations?



## Unprotected Assembly

Fire travels through the path of least resistance, such as an unprotected opening in a floor or wall.



## Firestopped Assembly

Proper installation of a firestop restricts the movement of a fire into adjacent areas by restoring the integrity of a **fire-rated** assembly.

# Criteria for Proper UL System Selection

- What is the hourly rating of the assembly?
- Floor or wall construction type and thickness?
- What is the penetrating item(s)?
- What is the size of the penetrating item?
- What is the annular space?
- Is a sleeve optional or required?
- What is the percent cable fill?
- What packing materials are required?
- What is the insulation type & thickness?
- Are there any special conditions or considerations?
- Installation quality (ease of installation)
- STC-rating, W-rating, L-rating, M-rating

## Hourly rating

*Each construction type is designed for a specific hourly rating (F-Rating). In general, when choosing a firestop system, its hourly rating must be equal to the hourly rating of the construction type.*

### HOURLY RATING

System No. C-AJ-1044

March 15, 2007

F Ratings — 2,3, and 4 hr. (See Items 2A and 4)

T Rating — 0 hr.

L Rating at Ambient — 2 CFM/sq. ft.

L Rating at 400°F — less than 1 CFM/sq. ft.

W Rating — Class I (See Item 4)



# Common Types of Substrates

- Gypsum wall board assemblies
- Poured in-place concrete
- Pre-cast concrete
- Hollow-core concrete
- Post-tension concrete
- CMU concrete block wall
- Fluted metal deck
- Wood frame assemblies

*The characteristics and thickness of the construction material used will affect the type of firestop product(s) and system(s) needed to firestop your application.*

# Common Types of Penetrating Items

- Metallic pipe—copper, cast Iron, EMT, conduit, metal clad, steel, aluminum
- Plastic pipe—ccPVC, PVC, CPVC, FRPP, PVDF, ENT, ccABS, ABS
- Glass pipe
- Fiberglass pipe
- Cables—thermostat, communication, power and control, coaxial, romex, fiber optic, metal clad, SER
- Insulated pipe (type of insulation) —fiberglass, foamglass, AB/PVC, mineral wool
- Cable trays—aluminum, steel
- Blank openings
- Air, chemical and grease ducts—aluminum, steel
- Any combination of these items

*There are many different types of penetrating items which need firestopping. Each item may react differently during a fire—some are combustible, some are not. Knowing this will help you select the correct firestop product(s) and system detail.*

## Penetrating item size

*The size of a pipe, cable, or even the insulation thickness all can affect how each penetrating item reacts in a fire. Knowing this will help you select the correct firestop product(s) and system detail.*

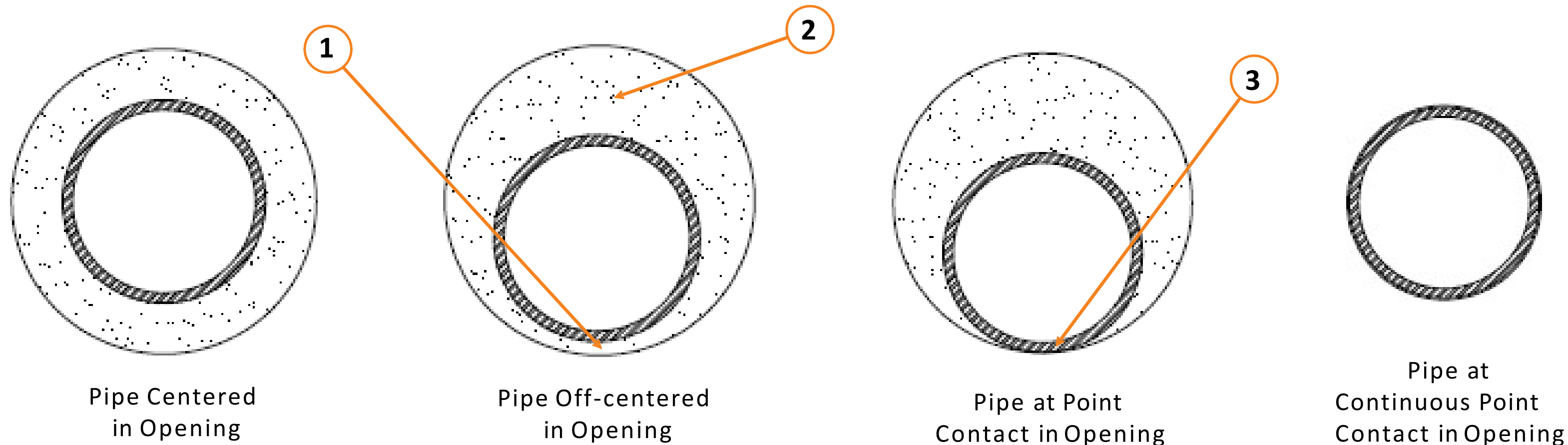


# Annular space

*Annular space is the distance between the penetrating item and the periphery of the opening or the distance between multiple penetrations.*

## Be aware of minimums and maximums

1. Minimum distance between penetrant and side of hole
2. Maximum distance between penetrant and side of hole
3. Make sure the system indicates point of contact is allowable (if applicable)



# Sleeve Effect

*In some assemblies, a steel sleeve is required as part of the assembly. The system detail tells you whether or not the system has a sleeve option.*



Without Sleeve

With Sleeve.

## Percent Cable Fill

*The system detail states what calculated percentage cable fill is allowed, and what size and types of cables may be used through the penetration.*

**Actual/Calculated %fill = half of visual**



**Example showing visual fill of 70%, with an actual/calculated fill of 35%**

# Common Types of Packing Materials

- Ceramic blanket/wool
- Fiberglass
- Backer rod
- Mineral Wool
- Nothing

*Packing materials are required in many system details. The system detail tells you what type of packing materials are acceptable.*

# Common Types of Insulation

- Foamglass®
- Fiberglass
- Mineral Wool
- AB/PVC Insulation - Armaflex
- Polyethylene - Tubolit
- Calcium Silicate
- Polyisocyanate
- EPDM – Solaflex™
- Perlite
- Polystyrene

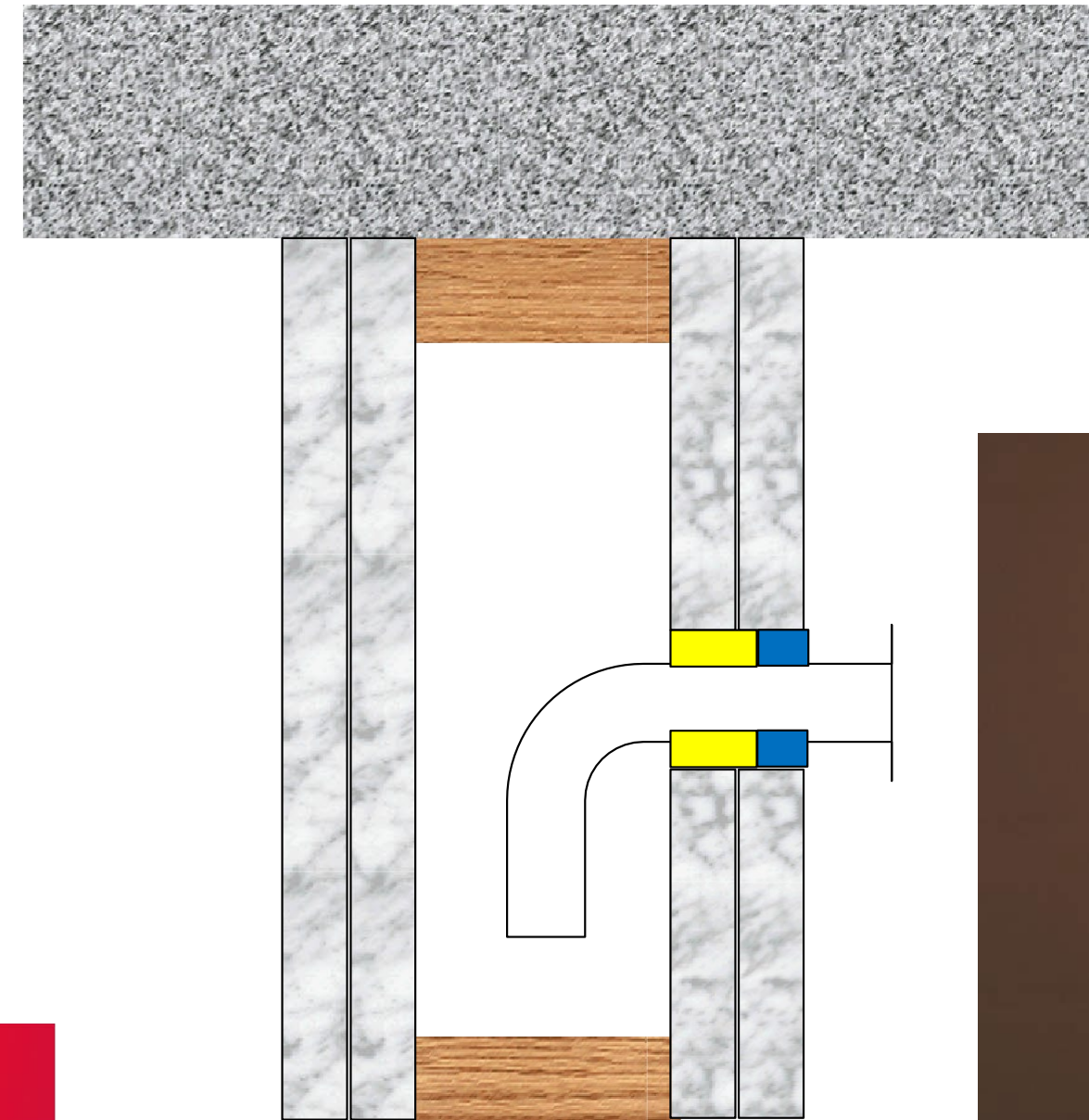
*There are different types of insulation used in the construction industry, each type reacts differently during a fire.*



# Definition: Membrane Penetration

- Cables, pipes, electrical boxes, tubes, combustion vents, wires
- Penetration: one side of the wall, floor, or floor/ceiling assembly
- Membrane: ceiling tile, concrete masonry unit (block), concrete wall, gypsum wallboard
- Installation: Penetrated side only

**Code states: Membrane penetrations are firestopped the same as through penetrations.**

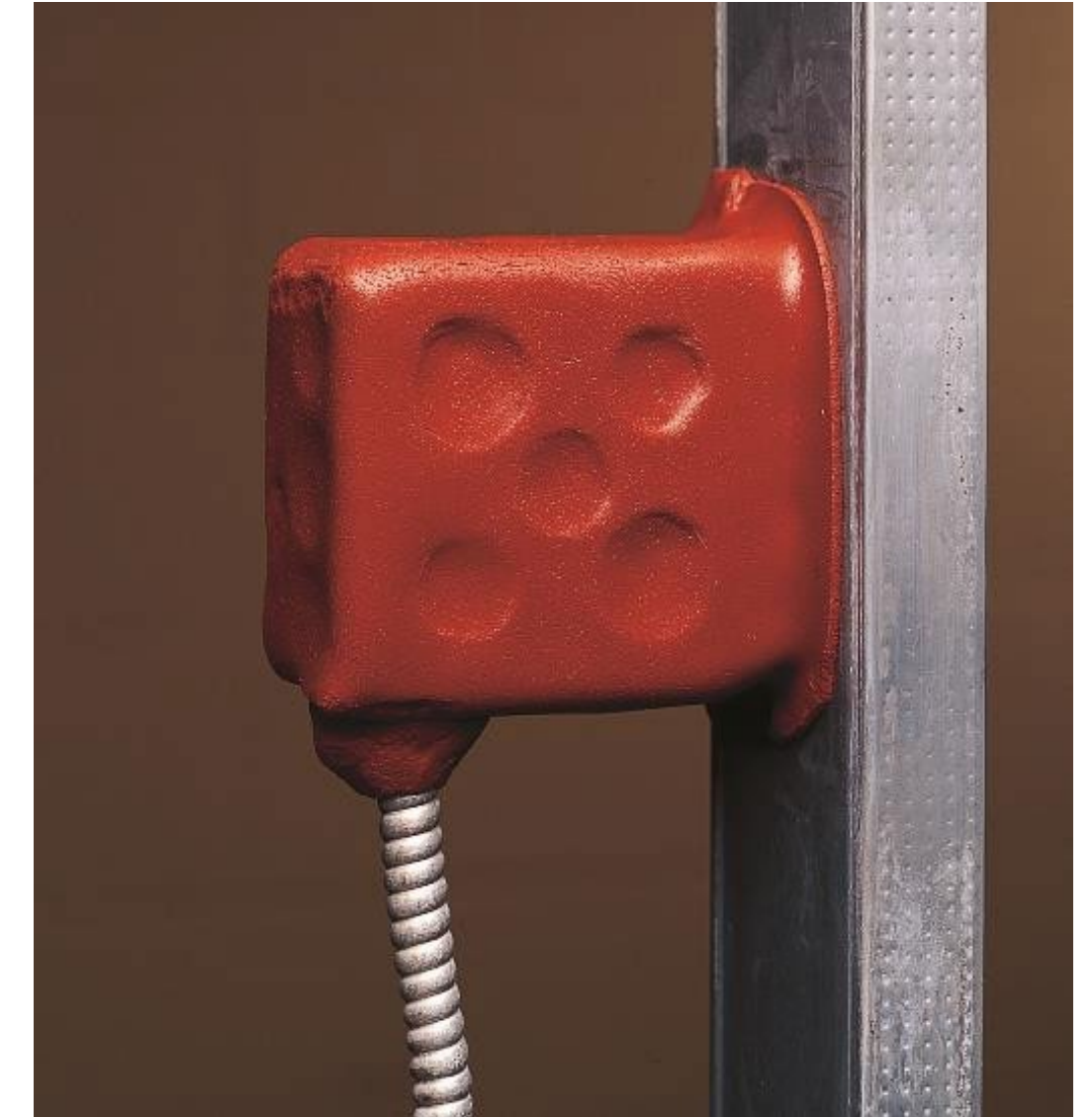


# Metallic Electrical Outlet Boxes

Outlet boxes must be installed per code requirements.

## Exceptions:

- If the steel outlet box is less than 16 sq. in. (103 sq. cm), provided that the openings do not exceed 100 sq. in. (645 sq. cm) for any 100 sq. ft. (9.3 sq. m)
- Outlet boxes on opposite sides of the wall are separated by a horizontal distance of more than 24 in. (60.96 cm)



International Building Code, Sections 712.3.2 and 712.4.1.2



# Firestopping with Endothermic Mats

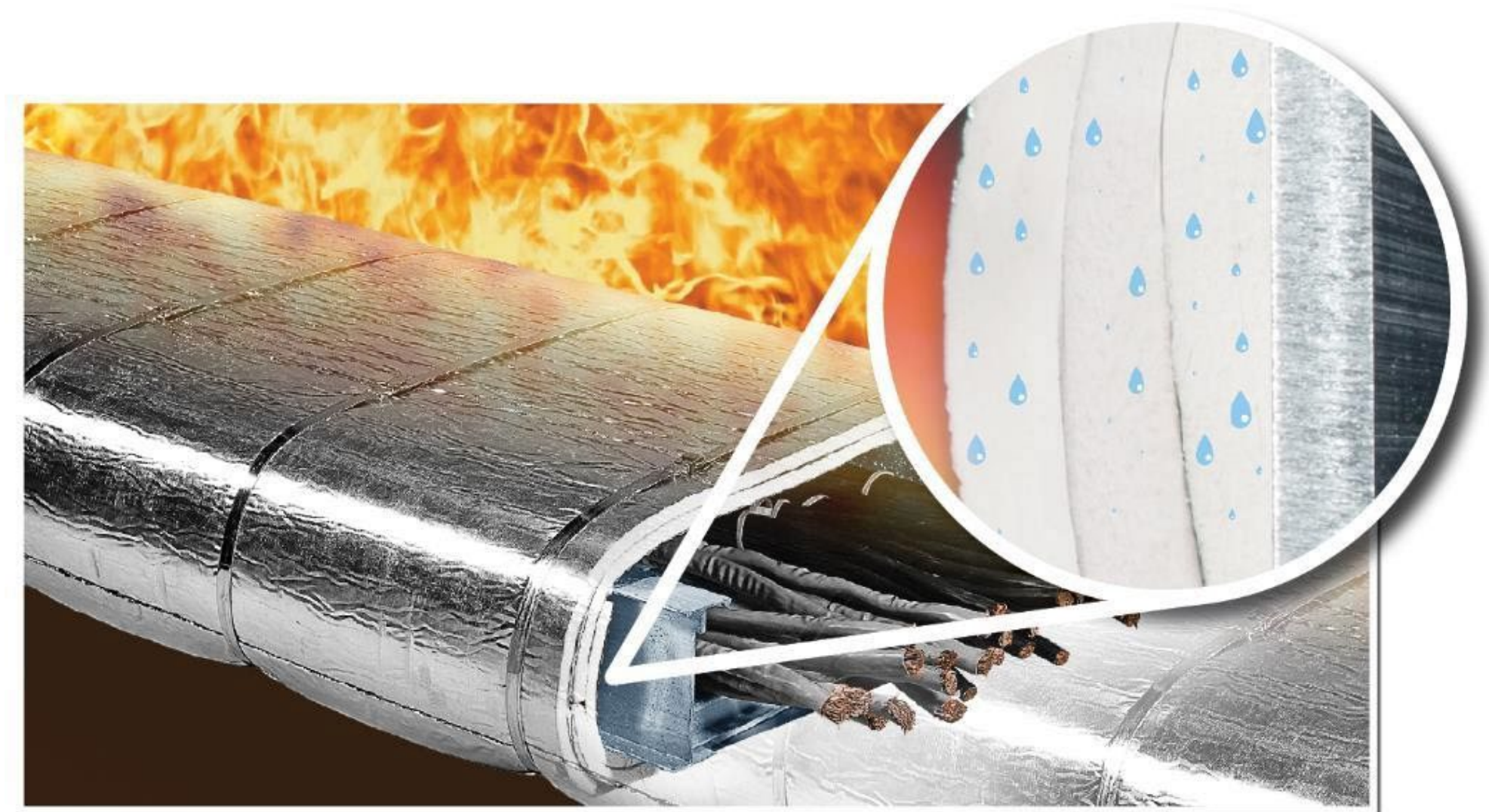
3M™ Fire Protection Solutions

August 2022



# Endothermic technology

- Endothermic process absorbs heat energy through the release of chemically bound water.
- Releases chemically bound water at 600°F (316°C)
- Creates cooling effect



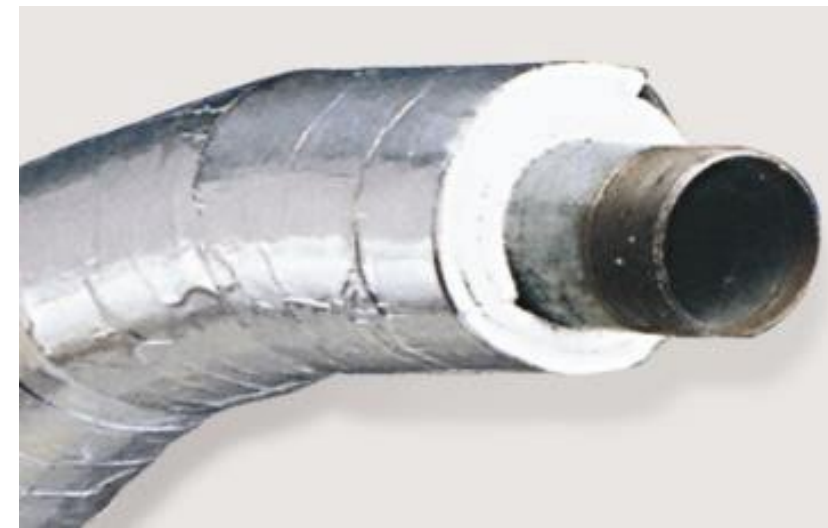
3M™ Fire Protection Solutions

# 3M™ Interam™ Endothermic Mat



Provides endothermic fire protection in a wide variety of structural steel, conduit, cable tray and membrane penetrations.

- Endothermic mat releases chemically bound water
- Up to 4-hour structural steel systems
- Suitable for cellulosic, hydrocarbon and jet fire exposures
- Listed with UL, Intertek and FM
- Available in 24.5 in. x 20 ft. rolls
- Meets the intent of LEED® VOC Environmental Regulations



Conduit



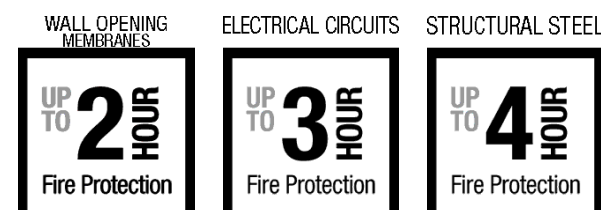
Cable Trays



Electrical Panel Box



Structural Steel



# 3M™ Interam™ Endothermic Mat



## Features and Benefits:

- No surface preparation required
  - Can easily be cut to size (with scissors, shears or utility knife)
  - Re-enterable for quality inspections or future rework and retrofitting
  - Flexible, applies to various shapes and sizes
  - Seismically tested
  - UL 2431 listed to endure outdoor industrial environment without the need for additional cladding or coverings.
- 
- Used in both interior and exterior applications
  - Increase protection rating just by adding layers
  - Ideal for electrical system with low ampacity derating
  - Allows for labor and time savings

# Common Applications: Commercial Buildings

Need to find image source or replace image

## Electrical Protection

- Cable trays
- Conduit
- Fire pump feeders
- Emergency power
- Critical communication circuits
- Emergency ventilation



## Steel Box Membrane Protection

- Elevator call boxes
- Security deposit boxes
- Valve gas boxes



## Fuel Oil Line Protection

## Structural Steel Protection

# Electrical Protection

When a fire occurs, the electrical systems that control critical areas (e.g. control rooms, ventilation, lighting, alarms and elevators) and components (e.g. switches, conduit, controls) in a fire zone must remain operational to facilitate a safe and orderly evacuation.



Electrical raceways (cable tray, conduits, etc.) which contain critical signal, control or power cables, require protection from a fire-rated enclosure in order to maintain functionality during a fire event. The cable jacketing must remain intact to allow cable operation.



# Steel Box Membrane Protection



Elevator Call Box



Valve Box (Medical Gas)



Safe Deposit Box



Electrical Panel

## Requirements

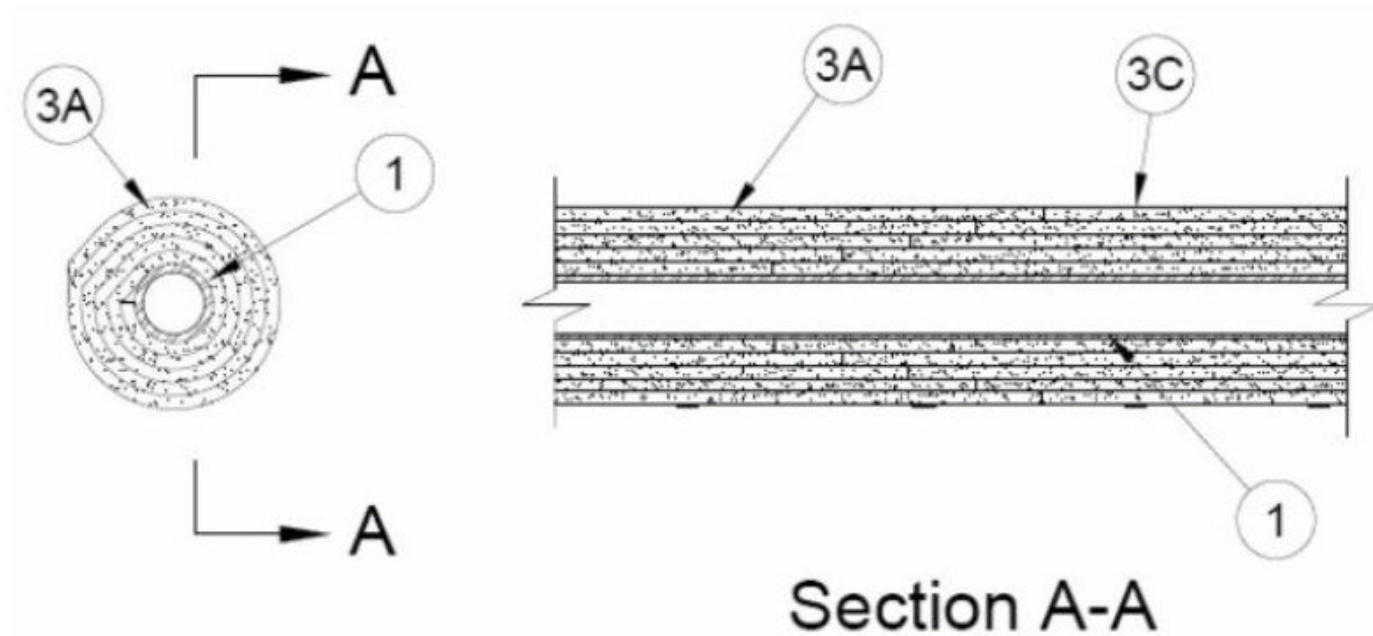
Steel Boxes Max 20 in. (508mm) wide by max 48 in. (1219mm) high by max 6 in. (152mm) deep recessed steel utility box with hinged steel door and mounting flange.

# Fuel Oil Line Protection

## System No. FP-1

January 19, 2017

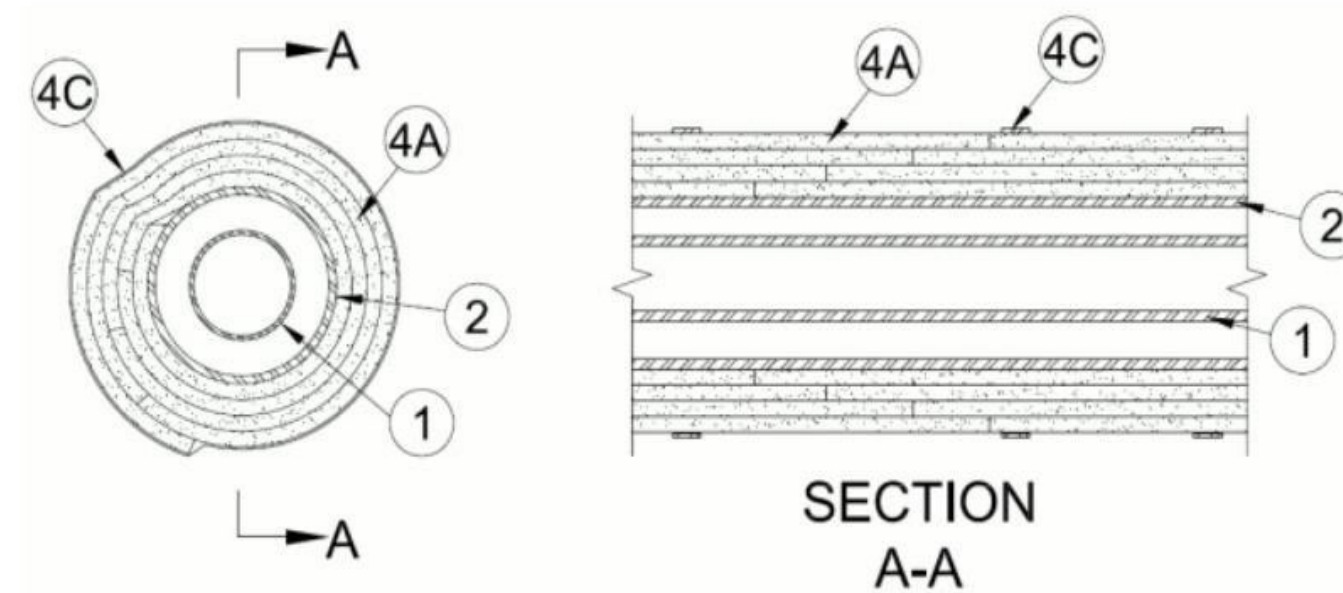
Fire-resistance Rating – 2 H



## System No. FP-2

February 28, 2017

Fire-resistance Rating – 2 and 3 H (See Item 2)



## Requirements

The 2015 Ed. of the IBC and IFC were modified to add ‘piping protective systems’ for the fuel oil lines servicing emergency generators that are routed through the building.

3M worked with UL to create a new test method, UL 1489.

# Structural Steel Protection

## Applications include:

- Beams
- Columns
- Tubular Steel (Pipes)
- Block-outs



## Requirements

Structural steel beams and columns require protection from a fire-rated enclosure in order to maintain supporting strength during a fire event.

*Note: layering requirements depend on mass of steel and fire exposure.*

# Structural Steel Protection

In ASTM E119 the goal is to keep the average steel temperature below 1000F (538C) and any individual point below 1200F (649C).

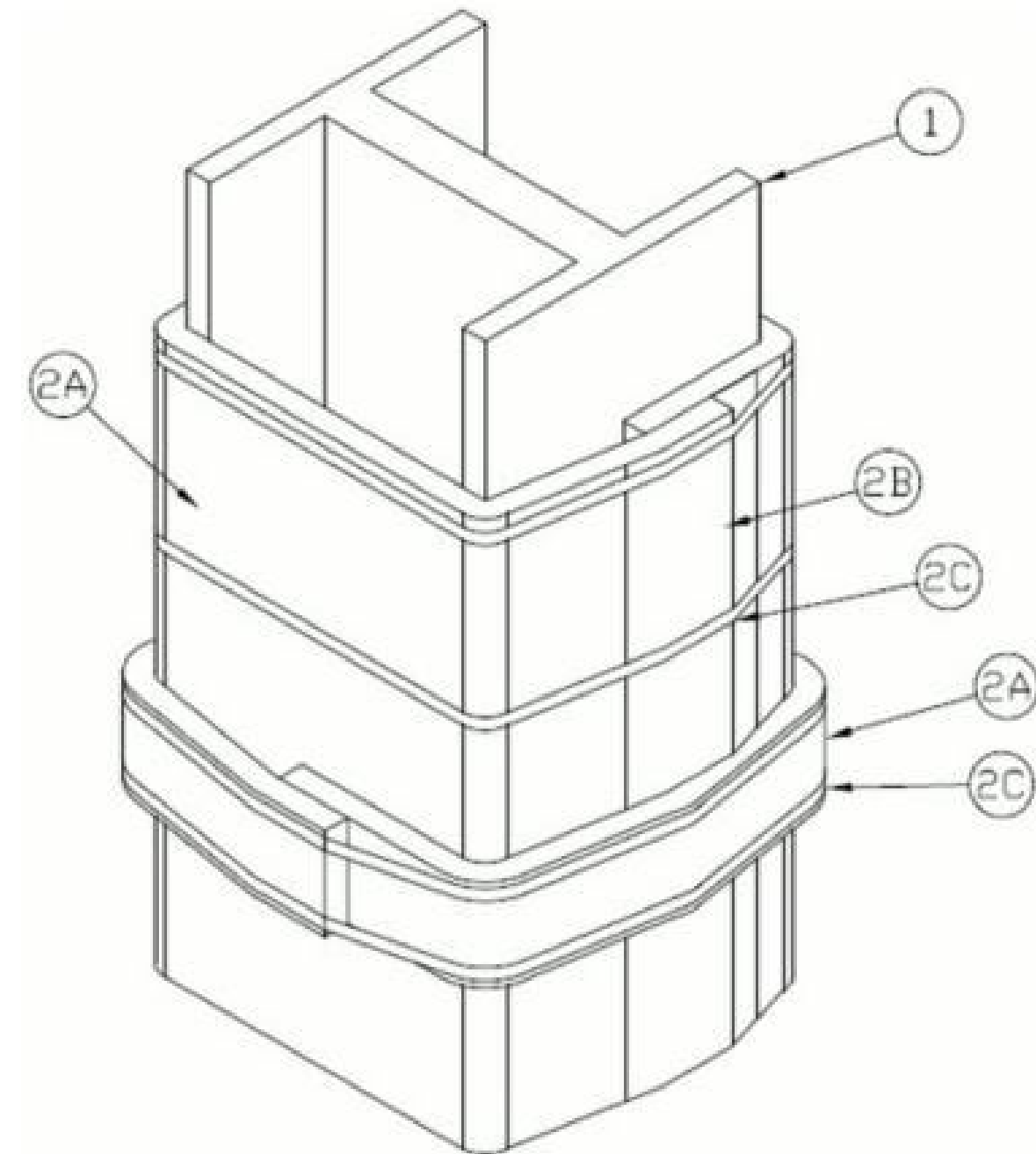
The number of E-Mat layers required can be increased or decreased depending on the hourly rating required for the application and to accommodate the size of the structural steel element.

## Design No. X206

July 01, 2013

Ratings — 1/2, 3/4, 1, 1-1/2, 2, 3 and 4 Hr.

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



# Building code references for E-mat construction applications

Category	Code	Section	Heading	Systems
Electrical Systems	IBC	412.3.7	Airport Traffic Control Towers	
		909.20.6.1	Smoke Control Systems	
		913.2.2	Fire Pumps	
		2702.3	Emergency and Standby Power Systems	
		3007.8.1	Fire Service Access Elevators	FHIT.7 (UL)
		3008.8.1	Occupant Evacuation Elevators	FHIT.8 (UL)
		250.12	Grounding and Bonding   Equipment Grounding Conductor Installation	FHIT.9 (UL) FHIT.34 (UL)
	NEC	695.6 / .14	Special Equipment   Fire Pumps   Power Wiring / Generator Control Wiring Methods	3MU/AF 60-01
		700.10	Special Conditions   Emergency Systems   Feeder Circuit Wiring	3MU/AF 60-02 3MU/AF 60-03
		708.10	Special Conditions   Critical Operations Power Systems (COPS)   Feeder and Branch Circuit Wiring	3MU/AF 60-04 3MU/AF 60-05
		760.179	Special Conditions   Fire Alarm Systems   Listing and Marking of PLFA Cable and Insulated Continuous Line-Type Fire Detectors	3MU/AF 120-01
		770.179	Optical Fiber Cables and Raceways   Optical Fiber Cables	
		800.179	Communication Systems   Communication Circuits   Communication Wires and Cables	

# Building code references for E-mat construction applications

Category	Code	Section	Heading	Systems
Structural Steel	IBC	704	Fire-Resistance of Structural Members	3MU/AF 240-02 (Intertek)
		601	Fire-Resistance Rating Requirements for Building Elements (Hours)	BXUV.X206 (UL)
Membrane	IBC	714.3.2 Exception 4	Penetrations   Fire-Resistance-Rated Walls   Membrane Penetrations by boxes other than electrical boxes	XHEZ.W-L-7168 XHEZ.W-L-7190 XHEZ.W-L-7126
Fuel Oil	IBC	IBC	Fuel Oil Piping and Storage   Fuel Oil System Installation   Protection of Pipe, Equipment and Appliances	
	IBC (IFC)	403.4.8.2 (604.2.14.1)	Special Detailed Requirements Based on Use and Occupancy   High-Rise Building   Emergency System   Standby and Emergency Power   Fuel Line Piping Protection	HNKJ.FP-1 HNKJ.FP-2 (UL)
	(IFC)	415.11.64 (415.11.6.4)	Special Detailed Requirements Based on Use and Occupancy   Groups H-1, H-2, H-3, H-4 and H-5   Piping and Tubing   Installations in Corridors and Above Other Occupancies	

# How is E-mat applied?

E-mat is wrapped around conduit, cable trays, structural steel, vessel skirts, and placed inside of junction boxes



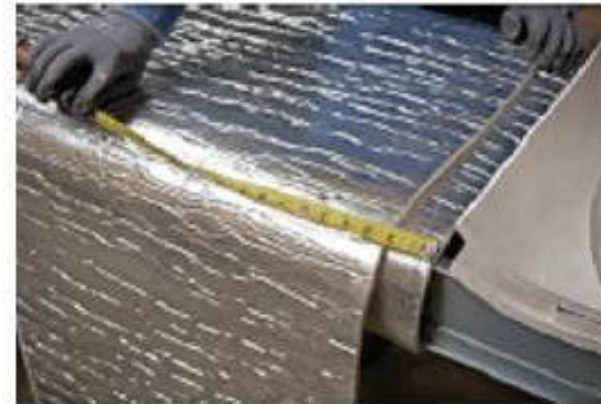
# Installation rules of thumb

Apply the required number of E-Mat layers (refer to system details) and follow these guidelines:



2" Overlaps  
wrapping around  
the protected item

Seams between  
sections of E-Mat  
tightly butted



2" Seam offset  
between layers



Areas requiring  
special cutting and  
gaps greater than  
1/8" wide are  
sealed with 3M™  
Fire Barrier Sealant  
CP 25WB+ or 3M™  
Fire Barrier Water  
Tight Sealant 3000  
WT



Seams, joints,  
sealed gaps and  
overlaps covered  
with 3M™  
Aluminum Foil  
Tape 425



System is  
mechanically  
restrained to stay in  
place during a fire



Heat transfer items  
(supports) exiting  
the system are  
properly covered  
for 12"



# Electrical panel



Applying spray adhesive



Applying adhesive to the box



Applying mat to box sides



Securing mat to sides of box with roller



Sides, top and bottom

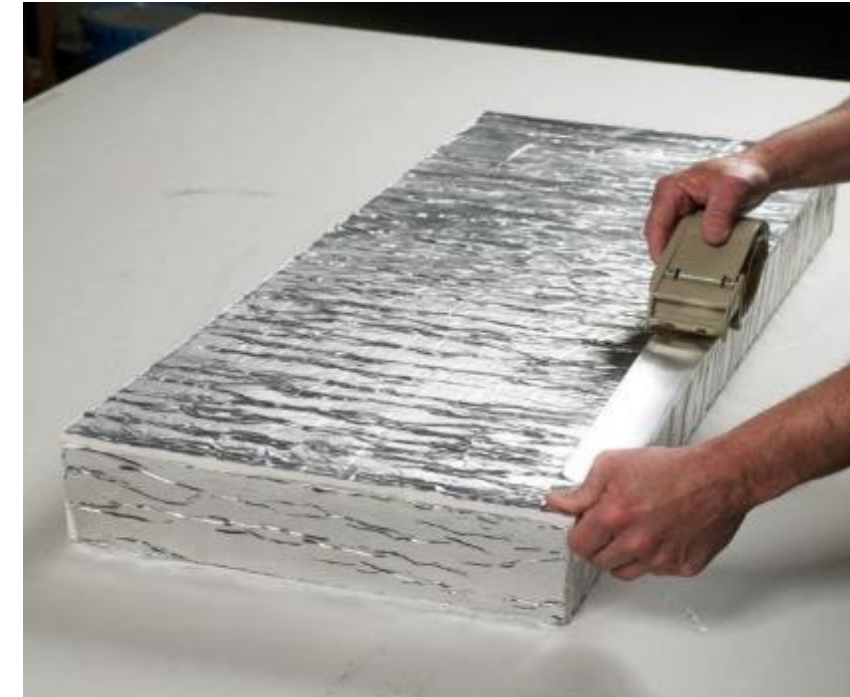
Account for mat thickness when sizing the opening.

Follow instructions for use on can when applying 3M™ Spray Adhesive.

# Electrical panel



Adhesive, installing and adhering to back of box



Sealing all mat interfaces with aluminum foil tape



Box installed into wall cavity showing conduit



Securing box to the studs



Applying sealant to mat and gypsum interface



Box installed to studs



Completed electrical panel

# Three-sided application

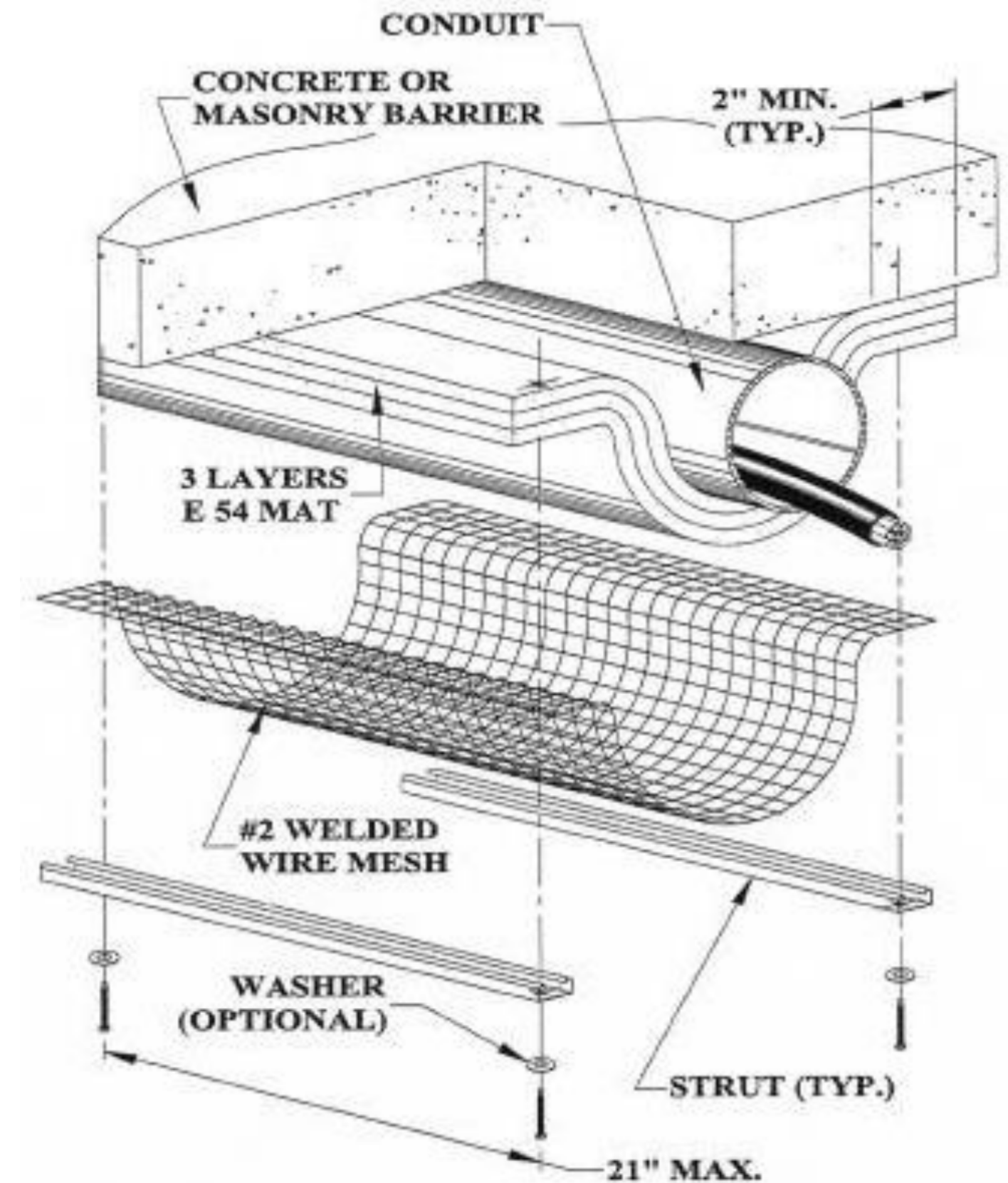
**E-mat can be ‘flared out’ to the barrier and still provide protection.**

**Note:** If space exists between the conduit and the barrier, wrap as many layers as possible around the conduit first before following flaring application procedure.

**The method utilizes a combination of strut and welded wire mesh to secure the E-Mat against the barrier.**

Strut: 13/16" wide x 13/32" deep x 18 ga. galvanized steel

Anchors: Site approved 1/4" diameter x 1" embedment 2 in. minimum overlap



# Firestopping with Insulative Wraps

3M™ Fire Protection Solutions

August 2022



# When are insulative wraps used?

- As a means to prevent fire from entering a duct and passing through a fire rated wall or floor
- As a means to prevent fire within a duct from escaping into a fire compartment or travelling between fire compartments (grease and chemical fume ducts)
- As an integral part of through penetrations that contain a duct
- As a protective wrap in plenum spaces to protect combustible materials
- As a protective wrap on various penetrants to fulfill the temperature (T-rating) requirements in floor through penetrations



# Types of wraps



**Duct wraps**



**Dryer ventilation wraps**



**Plenum wraps**



3M™ Fire Protection Solutions

## 3M™ Fire Barrier Duct Wrap 615+

*Provides excellent insulating capabilities and offers a space-saving alternative to traditional bulky fire protection methods such as installing a gypsum wall shaft or enclosure*

- Lightweight (6 lbs per cu ft) and thin (1.5 in\*) for easier application
- Up to 2-hour fire protection
- Third party certified to ASTM E2336 (grease duct test standard) and ISO 6944 (air duct test standard)
- Supports maximum temperatures of up to 2192°F (1200°C)
- Apply 2 layers for grease ducts
- Apply 1 layer for air ducts (external fire threat)
- Blanket is adhesively bound to the foil scrim



- Commercial kitchen grease ducts
- Ventilation air ducts



\*In accordance with the tolerances in ASTM C892 Standard Specification for High-Temperature Fiber Blanket Thermal Insulation.



3M™ Fire Protection Solutions

# 3M™ Fire Barrier Dryer Ventilation Wrap

*Designed as a strong, lightweight and flexible material for easy installation.*

- Provides single layer 1-hour rating for dryer, bathroom and domestic kitchen ventilation ductwork
- Strong, lightweight and flexible
- Features foil encapsulated scrim
- Non-asbestos wrap
- Provides equal Fire and
- Temperature rating (F&T)
- Tested to ASTM E2816, Condition B



- Dryer ventilation ducts
- Kitchen ventilation ducts in woodframe fire rated construction





3M™ Fire Protection Solutions

## 3M™ Fire Barrier Plenum Wrap 5A+

*Keep your plenum areas safe by wrapping plastic pipes and cables. Creates a fire-resistive enclosure that reduces flame and smoke spread ratings to code compliant levels in return air plenums.*

- ASTM E84, NFPA 262 (UL 910), and UL 1887
- Strong, lightweight and flexible material for easy installation
- Foil scrim encapsulated blanket

- Plenum areas, pipes, and cables



# Insulative wrap applications

- *Grease ducts*
- *Ventilation air ducts*
- *Chemical fume ducts*
- *Plenum spaces*
- *Through penetration temperature requirements (t-ratings)*

# Grease Ducts

## Flexible wrap systems for grease ducts are designed to:

- ✓ Contain internal grease duct fires
- ✓ Help prevent external fires from entering the duct
- ✓ Help to maintain the structural integrity of the duct
- ✓ Be lightweight and flexible

Cost-effective, two-hour fire protection in two-layer systems tested to ASTM E2336 (Grease duct standard)

Per code, grease ducts must be protected when within 18 inches of a combustible material, or when it penetrates one or more fire rated assemblies.

When a duct system penetrates a fire-rated assembly, it must be continuously enclosed from where it first penetrates a rated assembly to where it terminates at the exterior of the building.

Correct installation can achieve zero clearance to combustibles

Prevents any fiber from contaminating the kitchen space because it is foil encapsulated

Core blanket material is adhesively bonded to the foil which helps prevent the blanket from slumping

3M™ Fire Barrier Duct Wrap 615+

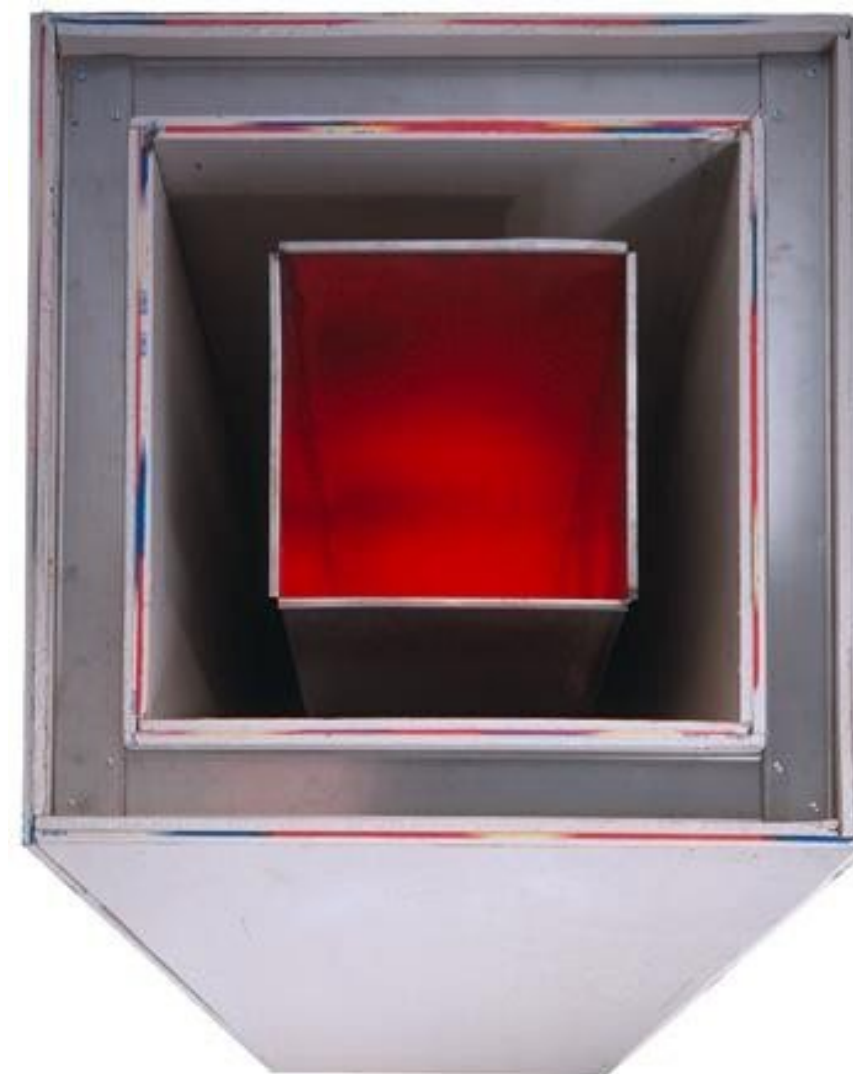
# Wrap is a space saver.

compared to the gypsum shaft alternative

## Gypsum Shaft

The gypsum shaft is spaced 6 inches from the duct per NFPA 96.

18-inch duct consumes about 22.5 square feet of space.



## 3M™ Fire Barrier Duct Wrap 615+

Zero clearance to combustibles



18-inch duct consumes about 4 square feet of space. **Almost 80% less!**

## Butt joint inner layer with telescoping outer layer

With the butt-joint inner layer and telescoping outer layer technique, the inner layer of blankets abut the adjacent pieces of blanket. The outer layer blankets each overlap one adjacent blanket, and then the exposed edge is covered by the next blanket as shown in Figure 1A.

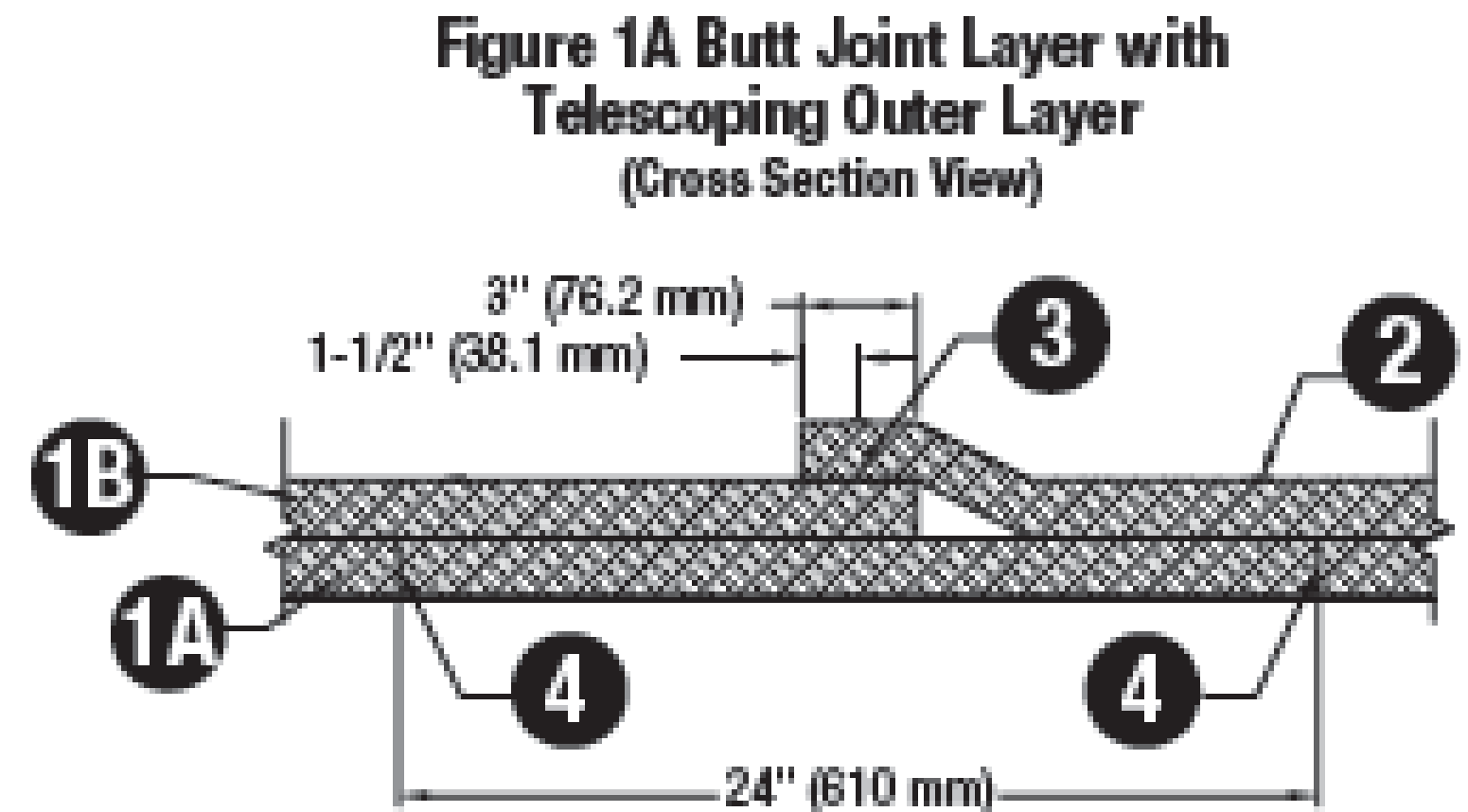
1A. First layer of 3M™ Fire Barrier Duct Wrap 615+

1B. Second layer of 3M™ Fire Barrier Duct Wrap 615+

2. Steel Banding 1/2 in. (12.7mm) Wide Minimum Typical

3. 3 in. (76.2mm) Min. Longitudinal Overlap

4. Firmly Butted Joint



## Telescoping 3 inch (76.2 mm) overlap wrap

With the telescoping overlap wrap method, each blanket overlaps one adjacent blanket, and each blanket has one edge exposed and one edge covered by the next blanket as shown in Figure 1B.

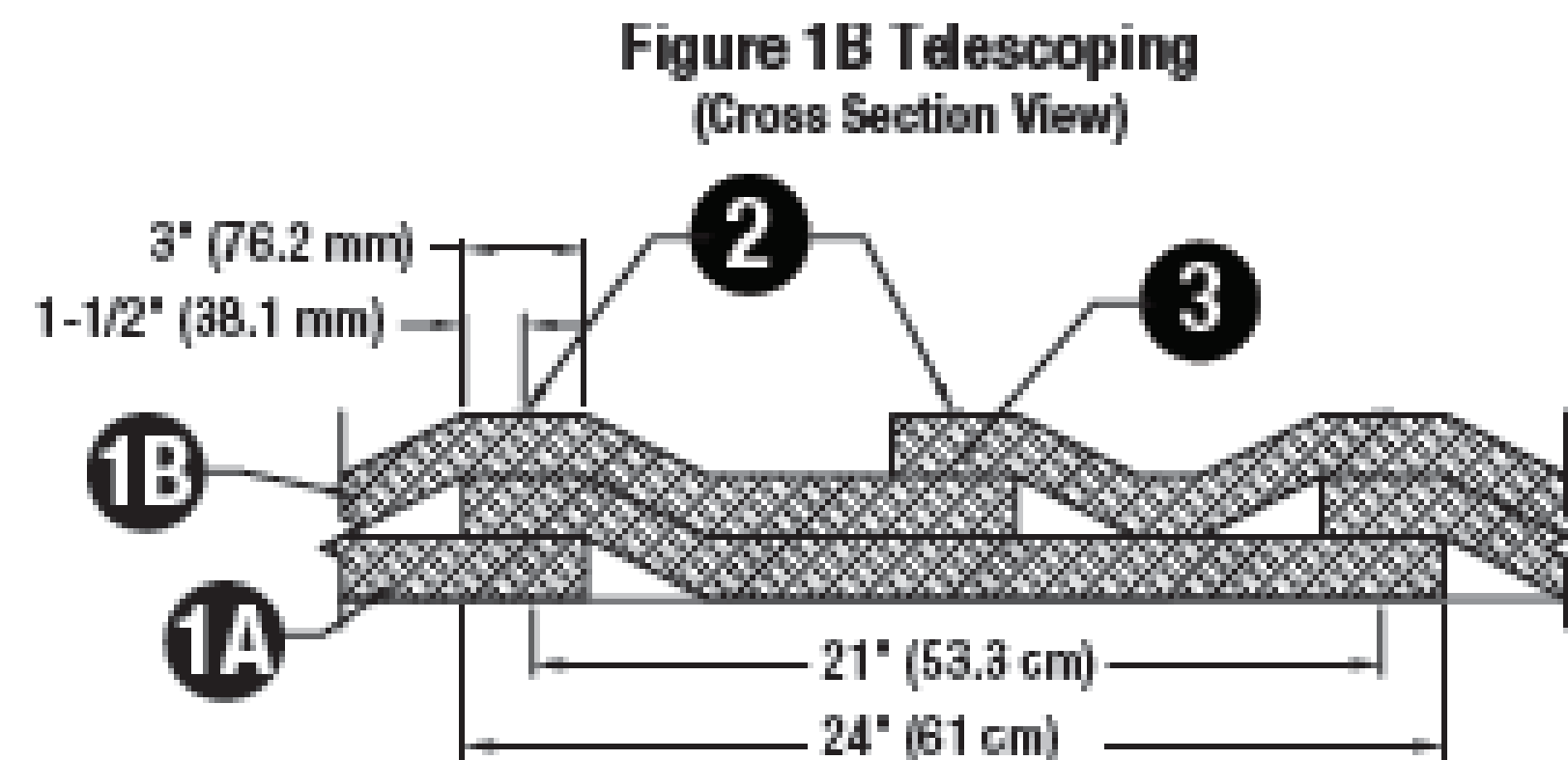
1A. First layer of 3M™ Fire Barrier Duct Wrap 615+

1B. Second layer of 3M™ Fire Barrier Duct Wrap 615+

2. Steel Banding 1/2 in. (12.7mm) Wide Minimum Typical

3. 3 in. (76.2mm) Minimum Longitudinal Overlap

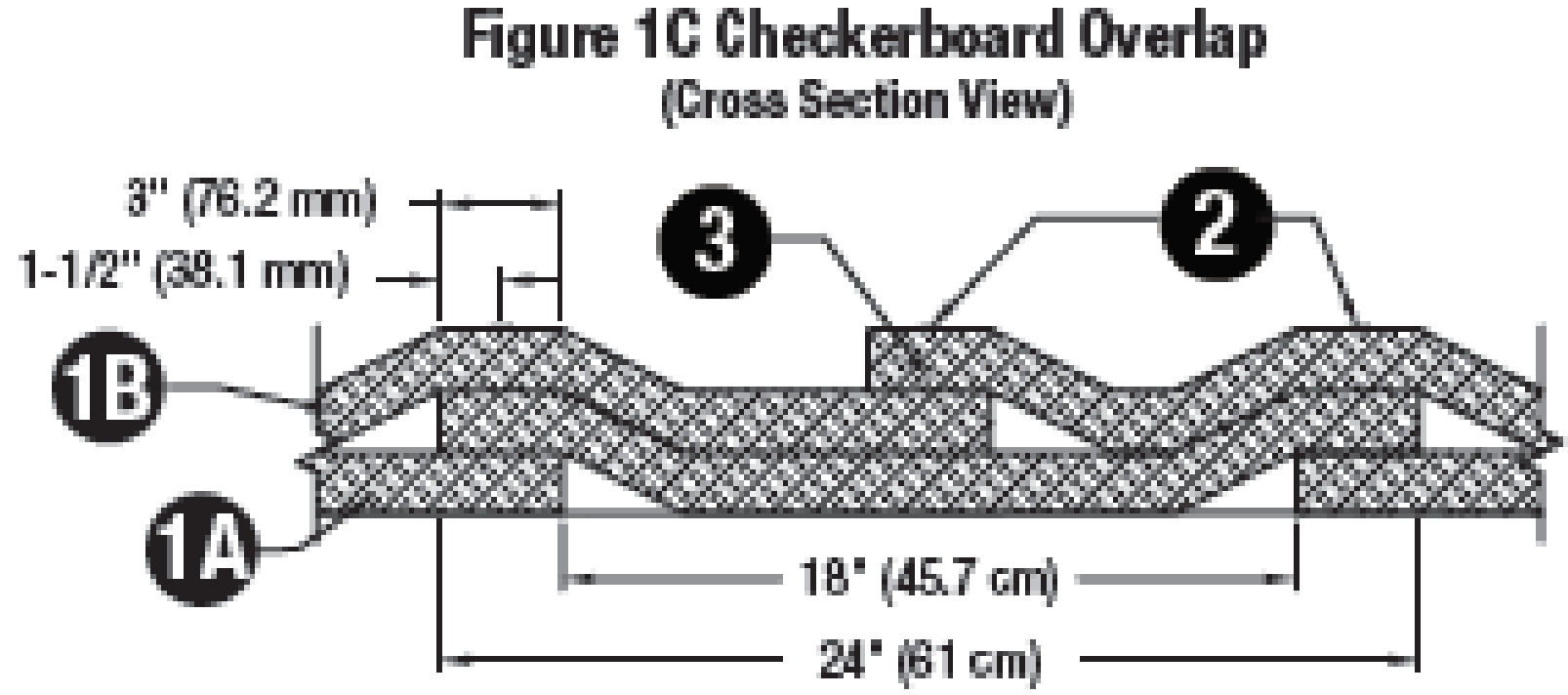
\*Often preferred by contractors for enhanced productivity.



# Checkerboard 3 inch (76.2 mm) overlap wrap

With the 3 in. (76.2mm) checkerboard overlap wrap method, blankets with both edges exposed alternate with blankets with covered edges, as shown in Figure 1C.

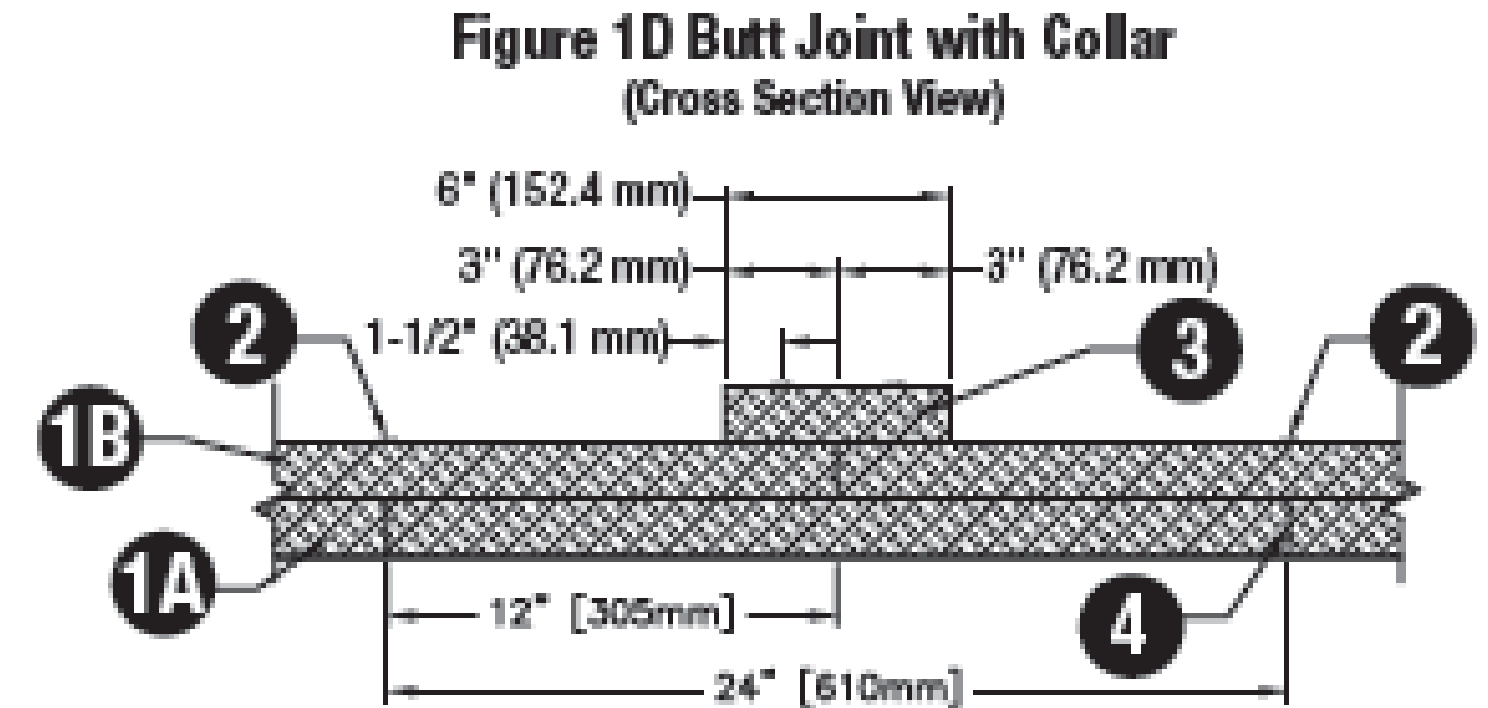
- 1A. First layer of 3M™ Fire Barrier Duct Wrap 615+
- 1B. Second layer of 3M™ Fire Barrier Duct Wrap 615+
- 2. Steel Banding 1/2 in. (12.7mm) Wide Min. Typical
- 3. 3 in. (76.2 mm) Min. Longitudinal Overlap



## Butt joint with collar

With the butt joint and collar method, adjacent blankets are butted tightly together, and 6 in. (152.4 mm) wide collar of duct wrap is centered over the joint, overlapping each blanket by 3 in. (76.2mm) minimum as shown in Figure 1D.

- 1A. First layer of 3M™ Fire Barrier Duct Wrap 615+
- 1B. Second layer of 3M™ Fire Barrier Duct Wrap 615+
- 2. Steel Banding 1/2 in. (12.7mm) Wide Min. Typical
- 3. 6 in. (152.4mm) Min. Wide Fire Barrier Duct Wrap 615+ Collar
- 4. Firmly Butted Joint





# Installation techniques for duct wrap

- For duct sizes larger than 24 inches (60.9 cm), install weld pins to the bottom side of a horizontal duct or at least one face of a vertical duct. This helps prevent sagging in the wrap and should be done in air, chemical and grease duct sizes over 24 inches.
- Impaling pins are installed on the bare duct, then the flexible wrap is installed, and finally self-locking insulation washers are slid over the pins
- Insulated cup-head pins are installed after the wrap installation

- Banding is applied around the duct 1½ inches from each edge of the blanket and a maximum 10 ½ inches on centers. This holds the material to the duct and is an important step in all air, chemical and grease duct installations



Insulation Washer



Cup Head Weld Pin



Capacitor Discharge Weld Pin

# Ventilation Ducts

**Flexible wrap systems for ventilation and air ducts are designed to:**

- ✓ Help insulate the duct
- ✓ Help to maintain the integrity of the duct
- ✓ Help to maintain the stability of the duct

Currently ISO 6944 and ASTM E2816 are the standards by which flexible wraps for ventilation ducts are tested

Code has yet to adopt a standard test method.

Per IBC Section 104 “DUTIES AND POWERS OF BUILDING OFFICIAL” the AHJ has the authority to accept this testing

Flexible wraps are gaining market acceptance as an alternative to gypsum wallboard shafts.

Requires one layer of material

Significant labor savings  
(when compared to gypsum shaft alternative)

R-value, single layer 6.38 (°F - ft -hr/Btu), 0.89 (m - °K/ W)

Meets IECC Requirements For Interior Ducts  
(International Energy Conservation Code)

3M™ Fire Barrier Duct Wrap 615+

# Ventilation duct testing standards, third-party listings, and installation methods

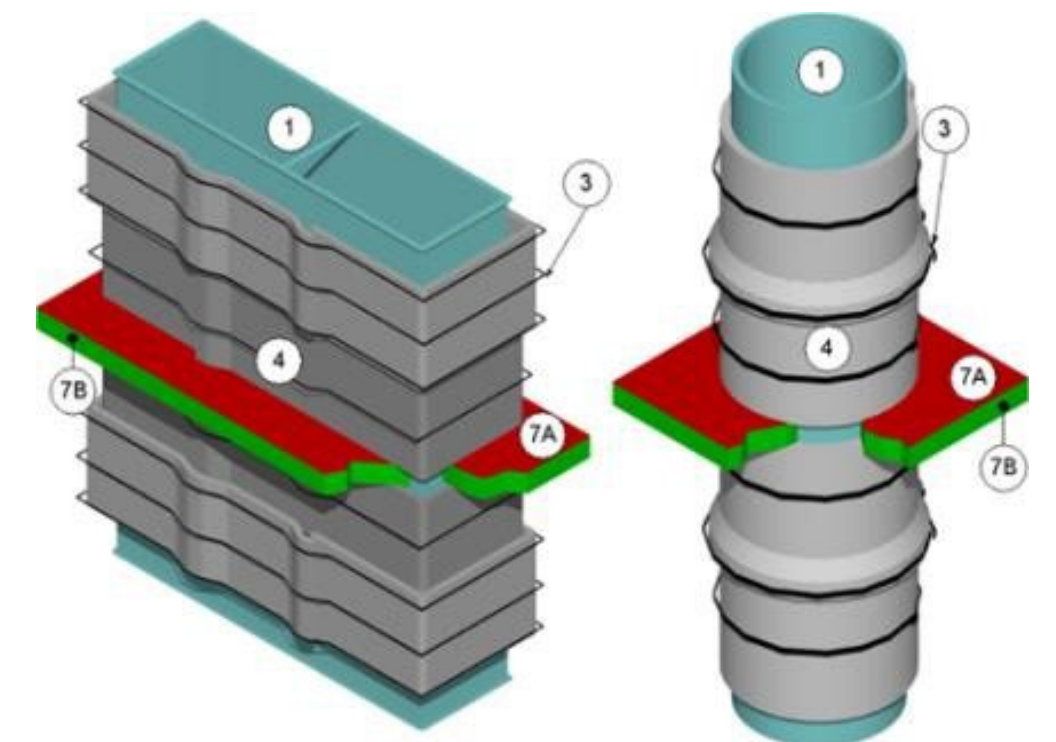
- *ISO 6944 and ASTM E2816*
- *Stair pressurization, Life safety, Exit corridors*

# Ventilation duct design listings

## Intertek listing features

Intertek grease duct and ventilation air duct systems incorporate through penetrations into their systems.

Fire Resistive Rating	Enclosure System	Third-Party Testing Services Design Listing	Description
<b>Grease duct listings – ASTM E 2336 / ICC-ES AC101</b>			
1- and 2-hour	2 layers of 3M™ Fire Barrier Duct Wrap 615+	ICC-ES ESR-1255 Intertek 3MU/FRD 120-18 Intertek 3MU/FRD 120-19	Rectangular Rectangular Round
<b>Ventilation Duct Listings – ISO 6944</b>			
1- and 2-hour	1 layer of 3M™ Fire Barrier Duct Wrap 615+	Intertek 3MU/DI 60-01 UL HNLJ.V-27 Intertek 3MU/DI 120-01	Rectangular/Round (1 hour) Rectangular (2 hour) Rectangular/Round (2 hour)



Asymmetrical Firestops for Vertical Ventilation Ducts without Insulation Through Floor Assemblies

Flexible wrap systems for ducts tested at Intertek are identified by an alpha-numeric identification system. The first alpha components identify the manufacturer (e.g. 3MU = 3M United States). The second alpha components identify the application (e.g. FRD = fire-resistive duct, DI = duct insulation). The first numeric component identifies the rating of the system (e.g. 120 = 120 minutes). The numeric information after the dash is a unique sequential identifier.

# Ventilation duct design listings

## UL systems for ventilation air ducts (HNLJ)

UL uses alpha numeric nomenclature for listing ventilation air ducts where the V = ventilation and the numeric portion is simply a one or 2 digit that is sequential.

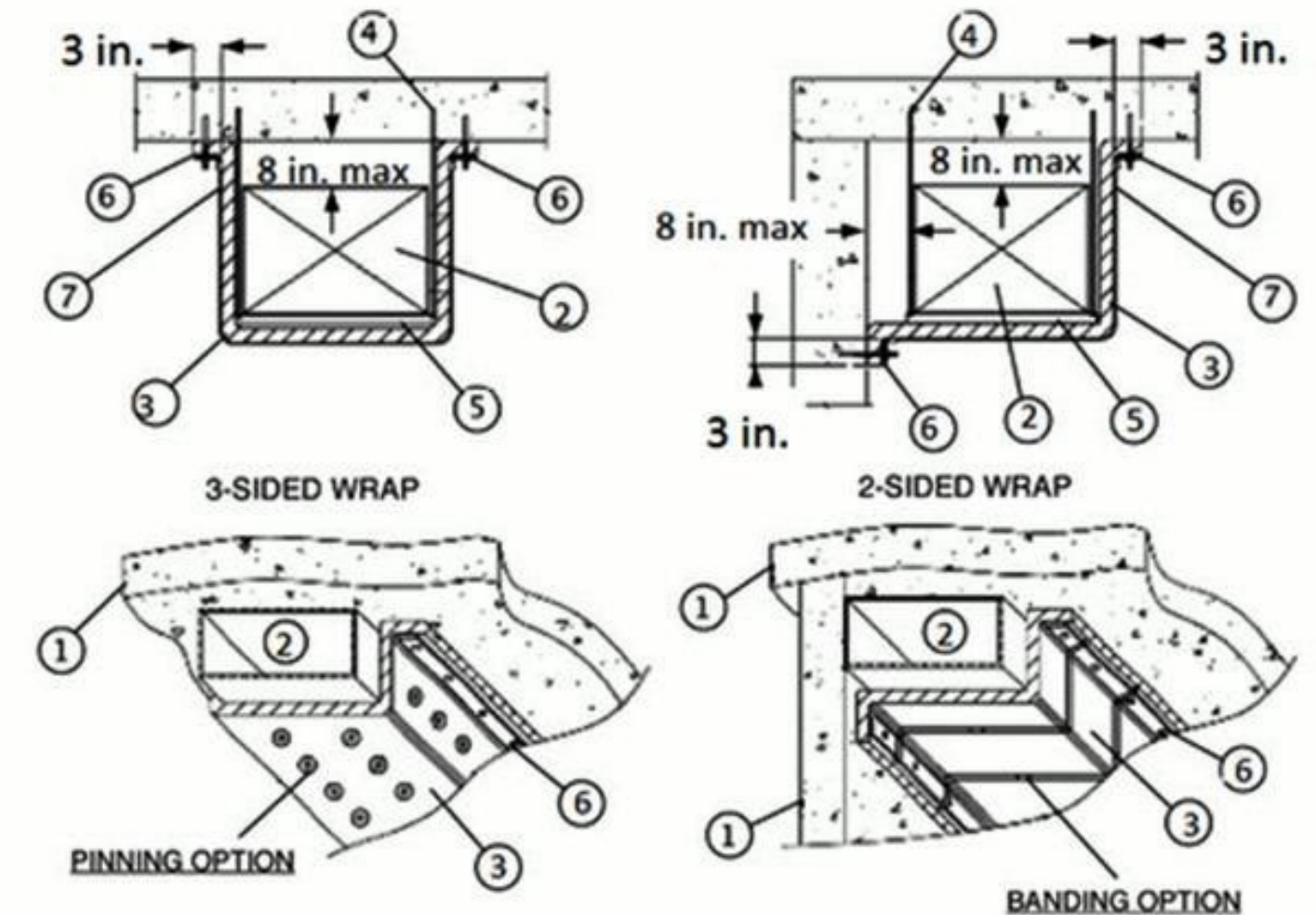
UL Duct systems with an assembly that penetrate a fire-rated floor or wall assembly include reference to one or more through-penetration firestop systems. In UL thorough penetration nomenclature, ducts are found in the 7000—7999 category (MISCELLANEOUS MECHANICAL)

### 3M Systems for Ventilation Air Ducts:

System V-20 (Max 24" x 60" steel air duct)

System V-27 (Max 85" x 24", min 22 ga. steel air duct)

System V-31 (Same as V-27, but with 2- and 3-sided options)

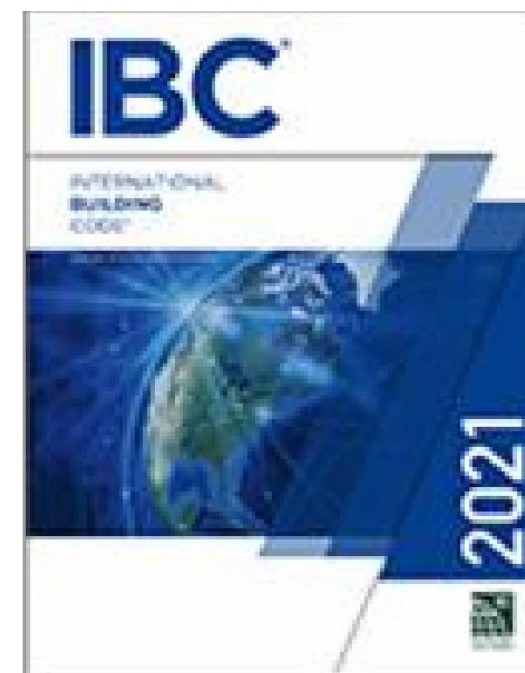
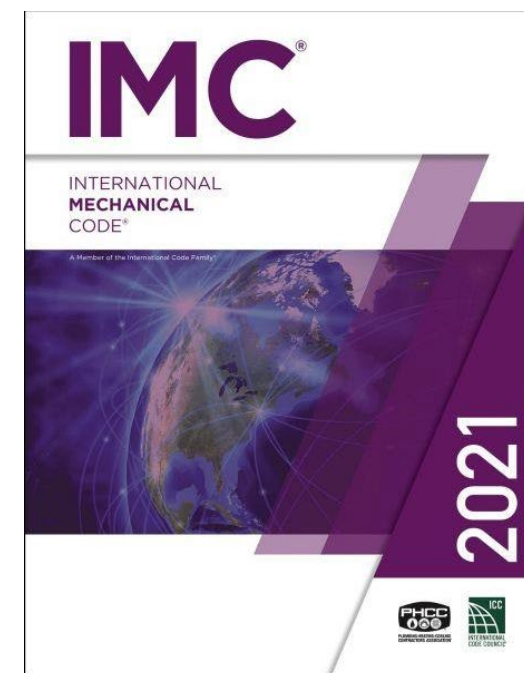
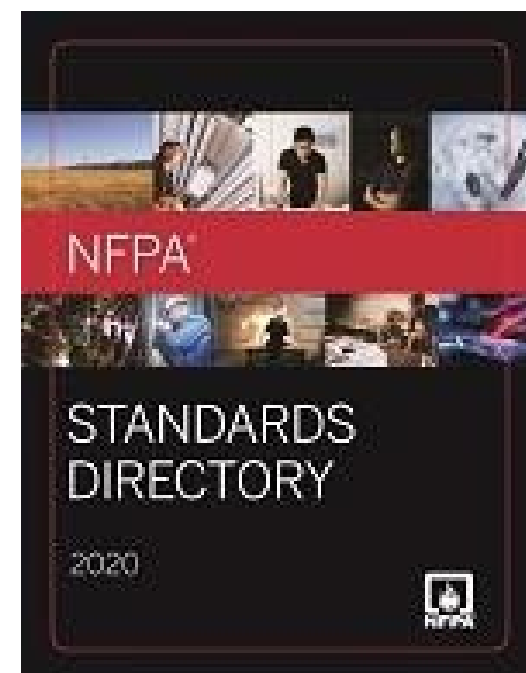


Images from UL System V-31

**Note:** UL also has an “Uninsulated Duct Systems” category (HNLN) with a similar V-## listing name which is also tested to ISO 6944 but excludes the insulation rating. HNLN systems provide a fire protective rating, not a fire resistive rating. These systems do not limit the heat transmission from the fire exposure of the duct and REQUIRE 18 INCHES CLEARANCE to combustibles for the full run of the duct.

# Code requirements for chemical flume ducts

- **NFPA 101 Life Safety Code** points to NFPA 91 for the protection of laboratory exhaust ducts in which 4.2.12 specifies how to protect ducts penetrating fire barriers
- **IMC Section 510.7.1** prohibits the use of fire dampers on hazardous exhaust ducts and further sub sections describe how to properly protect the system
- **IBC Section 717.5.2** similarly describes that dampers are not appropriate for these types of systems and lists alternative methods for protection.



# Chemical flume design listings

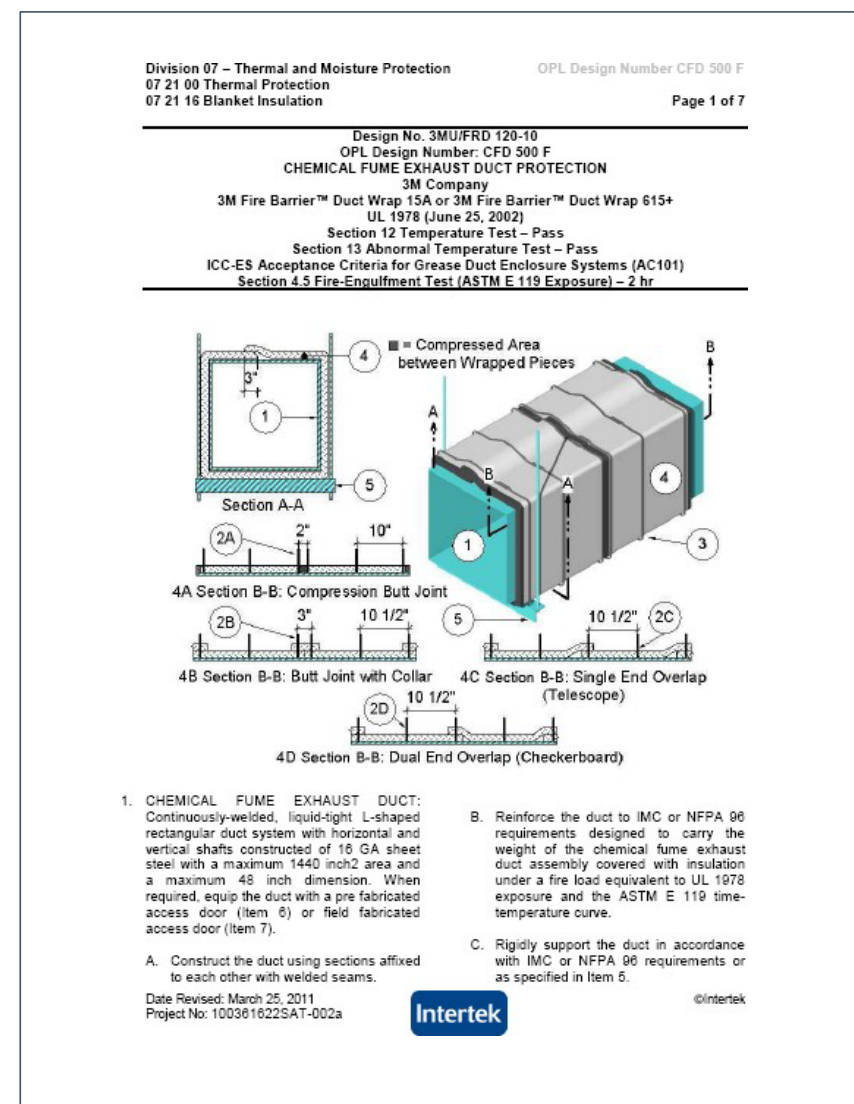
## 3M™ Fire Barrier Duct Wrap 615+

These systems are based on a combination of two tests:

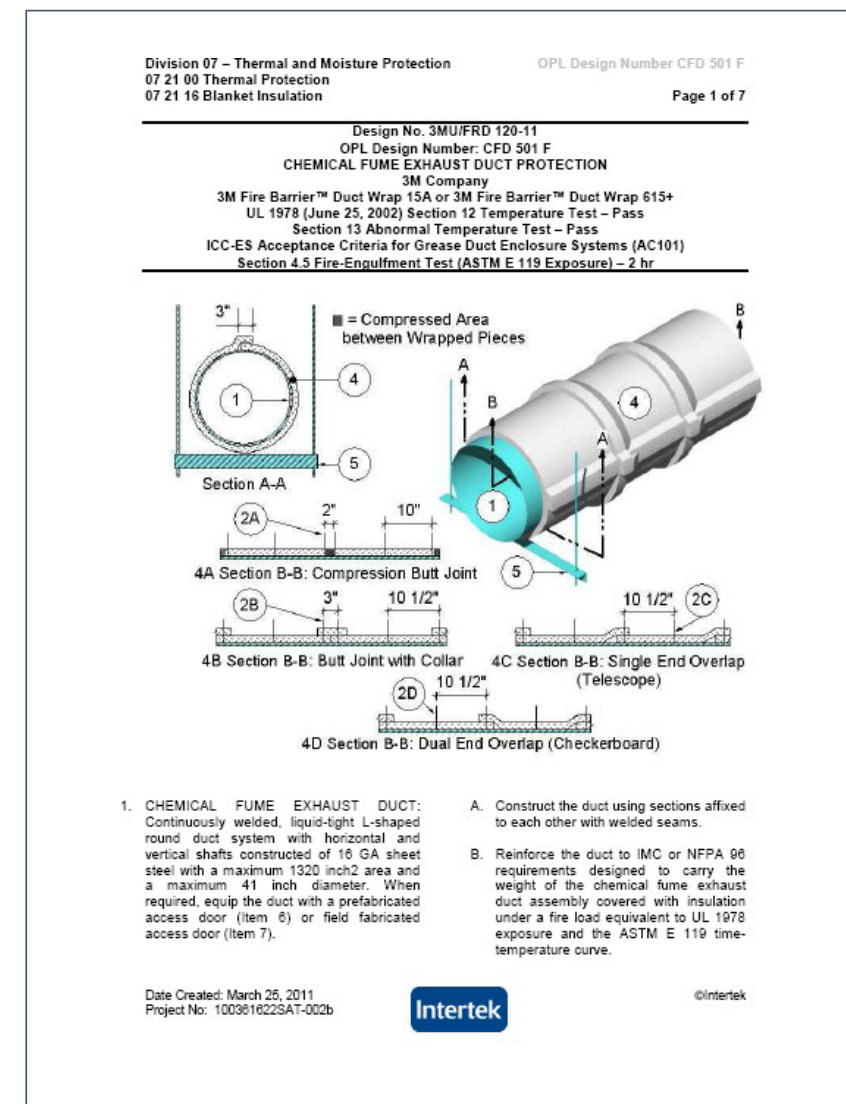
An engulfment fire using the 2-hour **ASTM E119** fire exposure time-temperature curve. This simultaneously demonstrates the wrapped duct's ability to prevent fire from entering the duct and that the firestopped penetration prevent fire from passing through the annular space to an adjacent compartment.

A **UL 1978** internal fire exposure, which soaks the duct at 500°F for 4 hours and then ramps up to 2000°F for 30 minutes.

Note: Intertek Testing Services issued a bulletin 10/10/2010 indicating that the CFD category would be withdrawn 6/30/2011. As of 3/14/2012 they have not withdrawn the listings, and accordingly 3M has not yet retracted them from our online system selector.



1- and 2-hour fire resistive rating with 1 layer of wrap for rectangular ducts



1- and 2-hour fire resistive rating with 1 layer of wrap for round ducts

# Plenum applications



Plenum is an enclosed portion of the building structure, other than an

The 2021 International Mechanical Code section 602.2.1 states that materials exposed within plenums (an enclosed portion of buildings designed to allow air movement) shall be non-combustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84.

- ✓ 3M™ Plenum Wrap 5A+ can be installed around combustible items that do not meet these criteria, such as plastic pipe and jacketed electrical cables in a plenum area to meet these requirements as a part of exemption 5.3.



# Intertek nomenclature

- Flexible wrap systems for plenums tested at Intertek/OPL follow a similar alpha numeric nomenclature. Note that two listings fall under the FRD application and one listing falls under BI (Blanket Insulation).
- The test standards for plenum areas are ASTM E84, NFPA 262 (UL 910) and UL 1887. These standards measure surface burning characteristics for flame propagation and smoke-density.

## Plenum Wrap Listings

Enclosure System	Design Listing Number, Intertek (OPL)	Protected Item	Testing
1 layer of 3M™ Fire Barrier Plenum Wrap 5A+, 1" (25mm) perimeter and longitudinal overlaps	3MM/FRD 120-16 (PP 100 P)	Plastic Pipe: PVC, CPVC, ABS, PB, PE, PP and PVDF	UL 1887
	3MM/FRD 120-17 (PP 101 P)	Cabling with PVC, CPVC, ABS, PB, PE, PP and PVDF jacketing	NFPA 262 (UL 910)
	3MU/BI 120-01	Plastic Pipe: PVC, CPVC, ABS, PB, PE, PP and PVDF	ASTM E84

## Surface Burning Characteristics

Test Method	Flame Spread (ft.)	Smoke Developed (Optical Density)		Flame Spread Index	Smoke Developed Index
		Maximum	Average		
NFPA 262 (formerly UL 910)	1.4	0.056	0.010	N/A	N/A
UL 1887	0	0.000	0.002	N/A	N/A
ASTM E 84 (Modified)	N/A	N/A	N/A	0	5

# Intertek nomenclature

1 layer of 3M™ Plenum Wrap 5A+ is installed around the combustible item(s) in a plenum area to limit the spread of flame and smoke developed.

Design Number 3MU/FRD 120-16  
(Formerly OPL PP 100 P)  
PLENUM PROTECTION SYSTEM  
3M Company  
3M Fire Barrier™ Plenum Wrap 5A+  
UL 1887  
(Former Test UL 910)  
Maximum Flame Spread = 0.0 ft  
Maximum Smoke (optical density) = 0.0  
Average Smoke (optical density) = 0.002

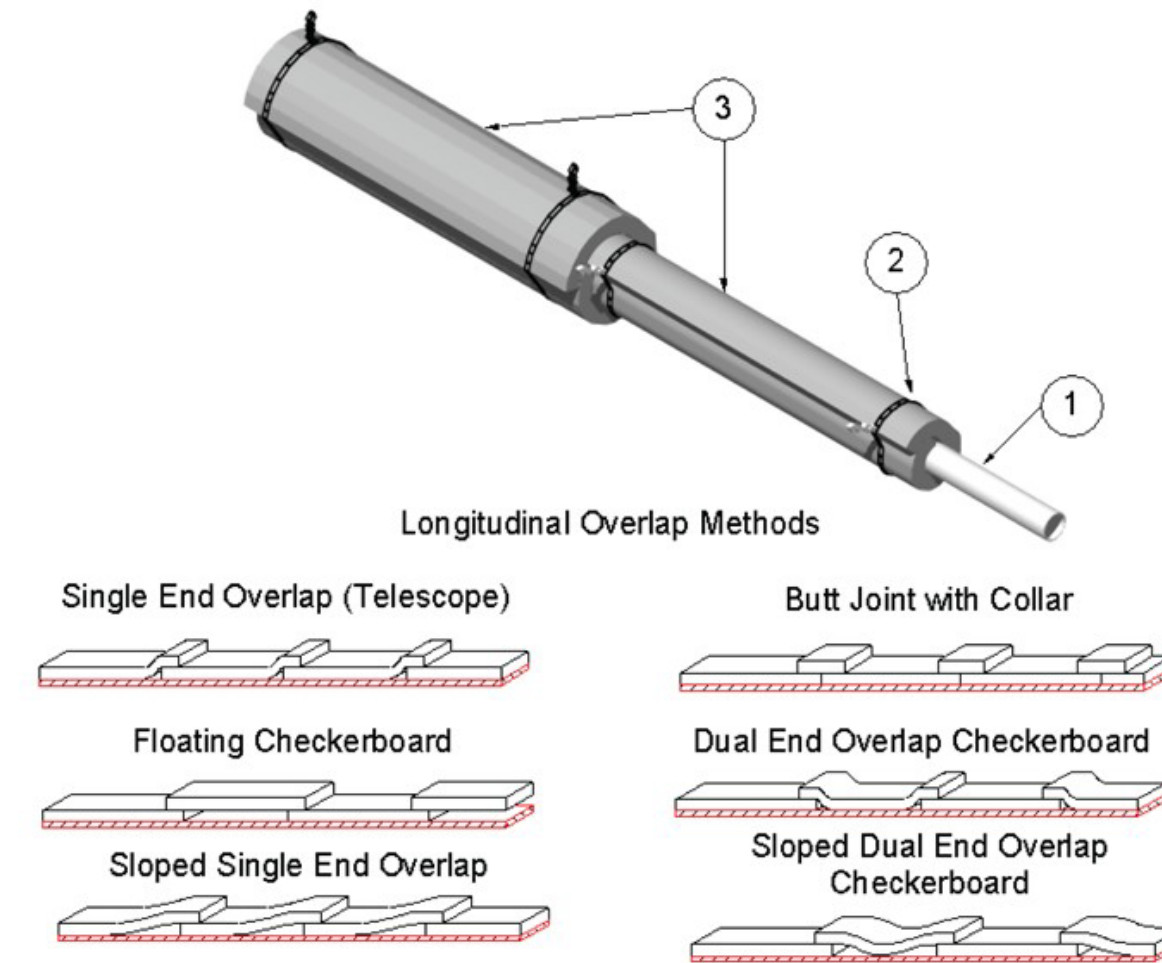


Figure 1

1. PIPE ASSEMBLY: One or more min. 1-inch diameter pipe or conduits composed of various compositions including polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC),

acrylonitrile butadiene styrene (ABS), polybutylene (PB), polyethylene (PE), polypropylene (PP) and polyvinylidene fluoride (PVDF).

Date Created: June 28, 2010  
Project No: 100069071SAT003



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## T-ratings for metallic penetrants

**714.5.1.2** Through-penetration firestop system. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an F rating/T rating of not less than 1 hour but not less than the required rating of the floor penetrated.

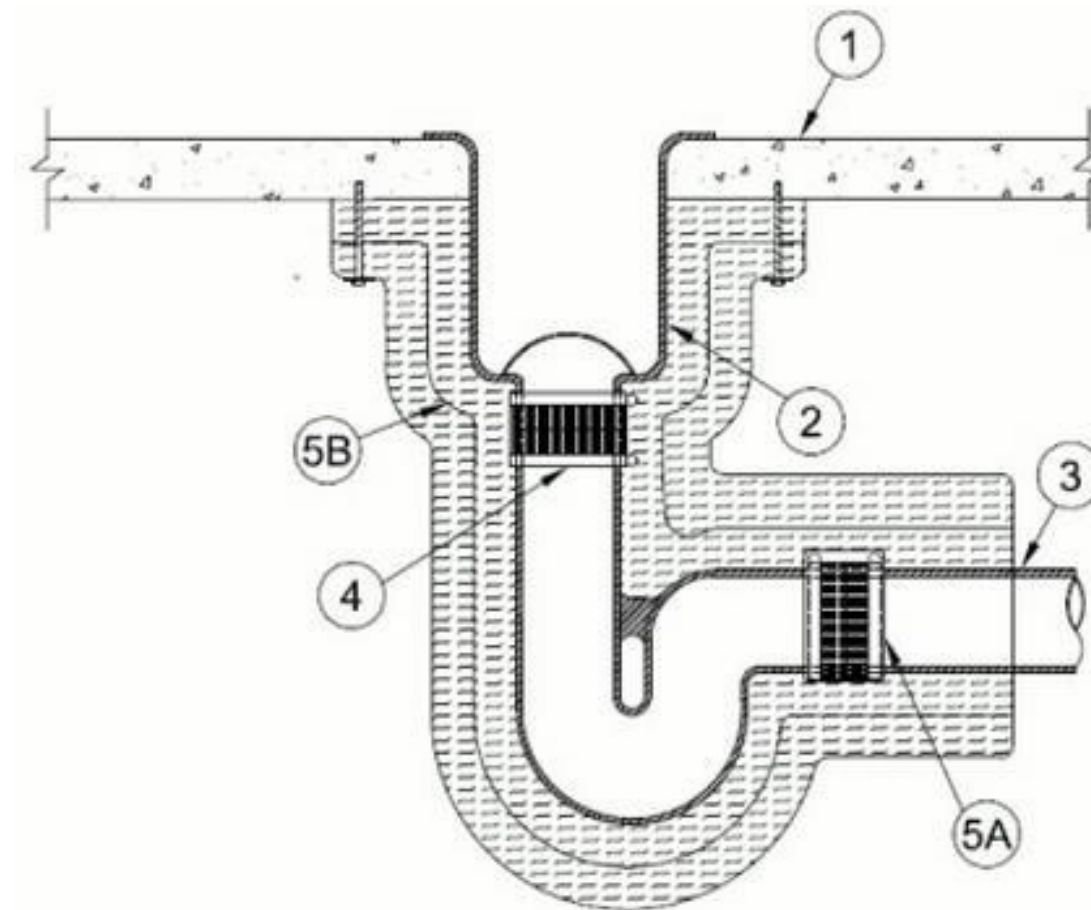
### **Exceptions:**

1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a T rating .
2. Floor penetrations by floor drains, tub drains or shower drains contained and located within the concealed space of a horizontal assembly do not require a T rating .
3. Floor penetrations of maximum 4-inch (102 mm) nominal diameter metal conduit or tubing penetrating directly into metal-enclosed electrical power switchgear do not require a T rating .

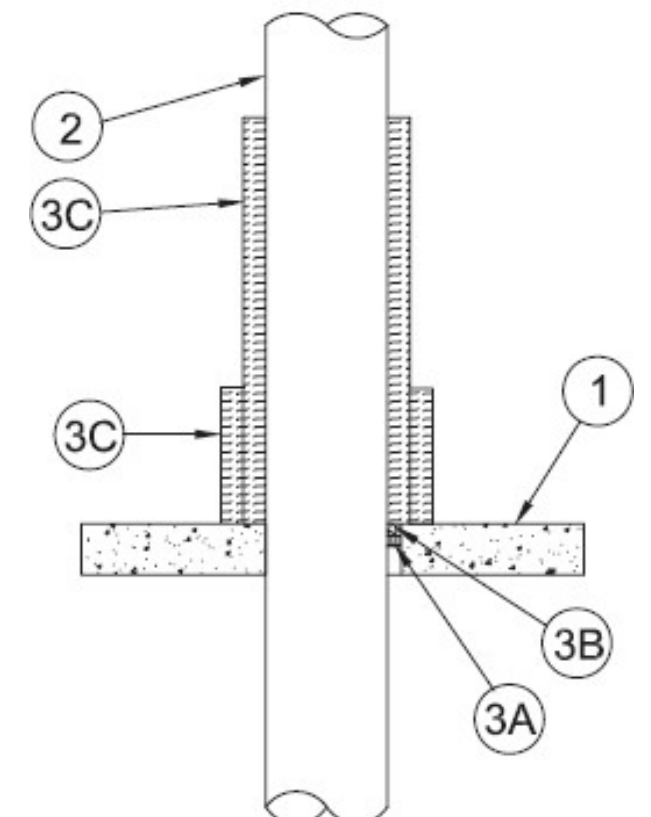
# T-ratings for metallic penetrants

## UL systems for 3M™ Fire Barrier Duct Wrap 615+:

- C-AJ-1473
- W-L-1323
- F-A-1057
- F-A-1131



**System No. F-A-1057**  
August 18, 2009  
F Rating – 2 Hr  
T Rating – 2 Hr  
L Rating at Ambient – 2 CFM/sq ft  
L Rating at 400°F – Less than 1 CFM/sq ft  
W Rating – Class 1 (See Item 3)



# Key Takeaways

- ✓ Understanding of how fire-resistive enclosures can help meet current building codes
- ✓ Ability to identify third party listings and testing requirements for insulative wrapped system assemblies
- ✓ Familiarity with identifying insulative wrapped system solutions
- ✓ Understanding of the 3M products and the technologies incorporated in insulative wrapped systems

# Thank You!