Fire and Life Safety Through Effective Compartmentation and Firestopping
CSC 2009

Firestop Contractors International Association

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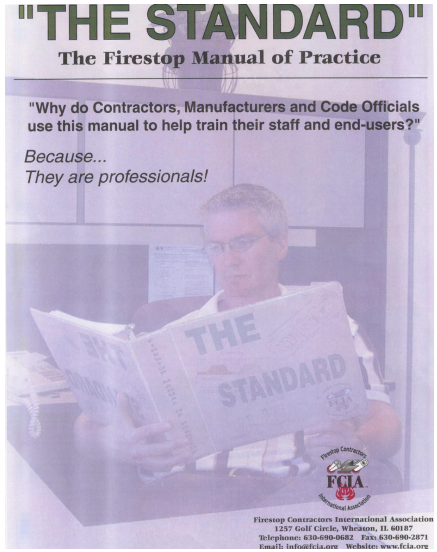
The Firestopping & Compartmentation Process

- Outline
  - FCIA
  - Total Fire Protection & Effective Compartmentation
  - Codes, Testing, Products - Materials
  - The Firestopping Process – A Quality Protocol
    - Properly Designed and Specified Firestopping - 07841/07842
    - Tested Systems - ASTM E 814 / UL 1479 – S115 - UL 2079
    - Professional Installation – FCIA Member, FM 4991 Approved, UL Qualified Contractors
    - Properly Inspected - ASTM E 2174 / 2393 Protocol
    - Maintained by FCIA Member Contractors

The Firestopping Process

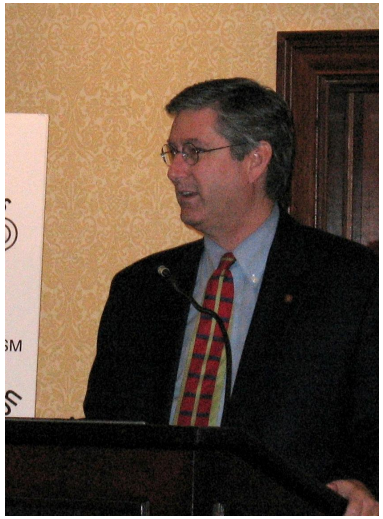
- FCIA – Worldwide Association
- Firestop Contractors, Manufacturers, Consultants, Reps, Distributors,
- Website Resources for FREE
  - **www . fcia . org**



The Firestopping Process

FCIA Membership Means ……

- Industry Interest
  - FCIA Seminars
  - FCIA Publications
- Industry Investment
  - FCIA Manual of Practice
  - FCIA Conference Education
  - Committee Membership
    - Return to the industry
- **"Specialty Firestop Contractors"**
  - **Knowledge, Value, Expertise**

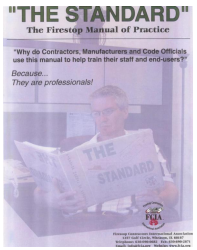


FCIA at CSC 2009

- **Membership Reflects FCIA's Activity…**

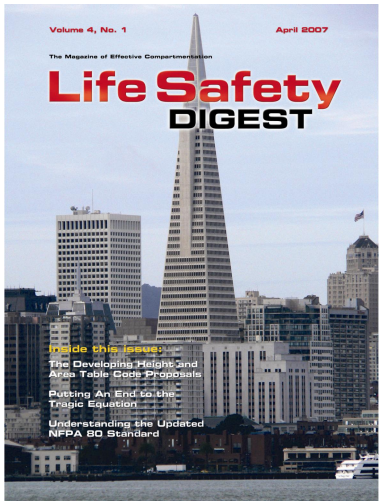
  225 Members…US, Canada, Middle East

  – Accreditation – FM, UL & IAS - Growth
  – Apprenticeship – US Dept. of Labor; Ministry
  – Technical & Education – MOP, UL TFPSS
  – Codes & Standards – ICC, NFPA, ASTM, IAPMO
    UL STP's
  – Marketing – Relationships, Shows
  – Program – Committee work, Education
  – Legislative – Track, Advocate



FCIA at CSC 2009

- **FCIA Membership Benefits**
  - **FCIA Committee Participation**
  - **FCIA.org Website – 7000+/Mo.Visits**
    - **Member Lists**
    - **FCIA FM, UL, IAS Contractor Lists**
    - **Members Only Access**
  - **Discounts**
    - **FCIA Manual of Practice & electronic updates**
    - **FCIA Conferences**
  - **Relationships …**
  - **FCIA Life Safety Digest, Enews**
  - **FREEBIES TO CSC 2009….**



The Firestopping Process

- "TOTAL FIRE PROTECTION"
- Effective Compartmentation
  - Fire Walls/Floors & Firestopping
  - Fire Dampers, Fire Doors, Fire Glass
- Detection & Alarm Systems
- Sprinkler Suppression Systems
- Education – Building Managers, Occupants and Firefighters

The Firestopping Process

Proper ***'DIIM'*** Effective Compartmentation
Means Reliable Systems…

- ***Designed -*** A/E, Firestop Consultant
  - Tested and Listed Systems, FCIA Member Mfr's.
- Properly ***Installed***
  - FCIA Member, "FM 4991, or UL QFC Contractors"
- Properly ***Inspected***
  - ASTM E 2174 & ASTM E 2393 Inspection
- Properly ***Maintained*** –
  - FCIA Member, FM 4991, or UL QFC Contractor

The Firestopping Process

- **Code Requirements**
  - International Building Code – Chapter 7
    - New Construction
  - International Fire Code – Chapter 7
    - Existing Buildings
    - Enforced by Fire Marshal
  - NFPA 5000 – 101- Chapter 8
  - National Building Code – Canada
    - New and Existing Buildings
  - ***Minimum requirements*** for ***Construction*** & ***Maintenance***

The Firestopping Process

- Code - Regulatory Basis for Firestopping
  - NFPA 5000 - 101
  - ICC – International Family of Codes
    - *Firestopping Fire Resistance Rated Floor and Wall*
  - NBC - Canada
    - ***Effective Compartmentation Continuity Maintained***

FCIA Firestopping Quality Process

- **NFPA**
  - **NFPA 5000 – "Consensus Codes"**
  - **NFPA 101 – Life Safety Code**
    - **Healthcare Industry**

FCIA Firestopping Quality Process

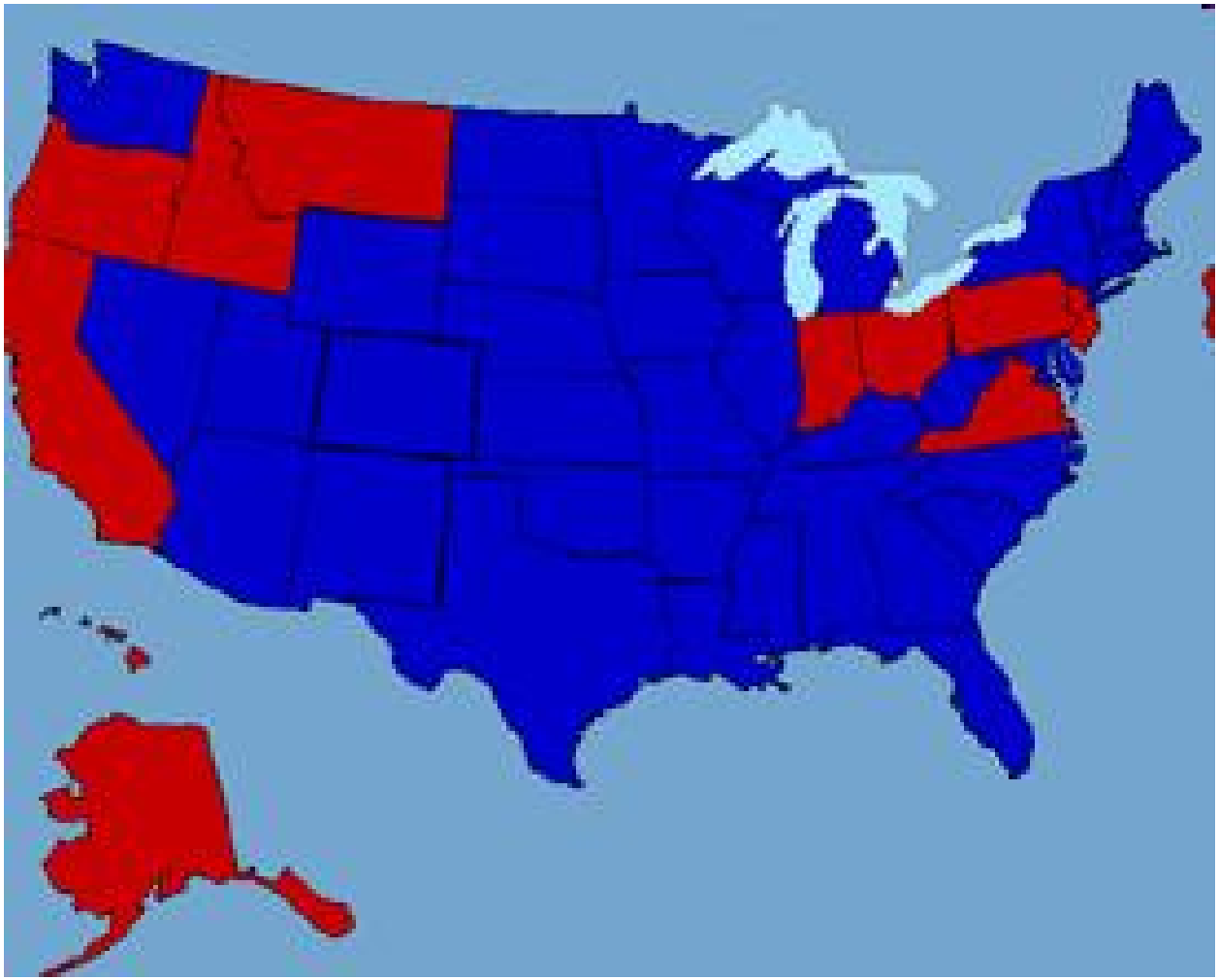
- **ICC=International Code Council**
  - **IBC – Building Code - New**
  - **IFC – Fire Code - Maintenance**

FCIA Firestopping Quality Process

- **US Codes were 3….**
  - **BOCA**
  - **SBCCI**
  - **UBC - ICBO**
- **Now One…or two**
  - **ICC Family**
  - **NFPA 5000**

US ICC Adoptions – ICCsafe.org

US NFPA 101Adoptions– NFPA.org



FCIA Firestopping Process

- Compartmentation Codes - US
  - **Fire Resistance** – Time, in minutes or hours that materials or assemblies have withstood a fire exposure as determined by tests, methods based on tests, or this code …. NFPA. ICC adds… "*Systems*"

    Ch. 7 – IBC - Fire Barrier – Hourly Rated – IBC
    - **Ch. 8 - NFPA - Fire Barrier Walls** – wall other than fire rated, that have a fire resistance rating; 2 hour Rated – NFPA
    - **Ch. 7 IBC - Fire Wall** – Fire rating, structural independence
    - Ch. 7 IBC – **Fire Partition** – Not Rated, not continuous.
    - Ch. 7 IBC - **Smoke Barrier** – Hourly Rated, continuous…
    - Ch. 7 IBC - **Smoke Partition – Not Rated…not continuous**

FCIA Firestopping Process

- Compartmentation Codes – US
  - **Smoke Barrier** – Firestopping
    - IBC – Hourly Rated, sealed, “L” Rating
      - <5cfm/sf
      - <100CFM/SF – 100 SF / Wall
    - NFPA - Similar
  - **Smoke Partition**
    - IBC – Continuous barrier, not rated.
    - NFPA – Continuous membrane that is designed to form a barrier to limit the transfer of smoke.

FCIA Firestopping Process

- Compartmentation Codes – US & Canada
  - Firestopping Systems
    - Standards Exist
      - F - Hours
      - T - Temperature
      - L – Air Leakage / Smoke
      - W – Water
    - Standards means suitability for use
    - ***"Anything less …. Up to Judge"***

      –Karen Layng, Esq.

The Firestopping Process

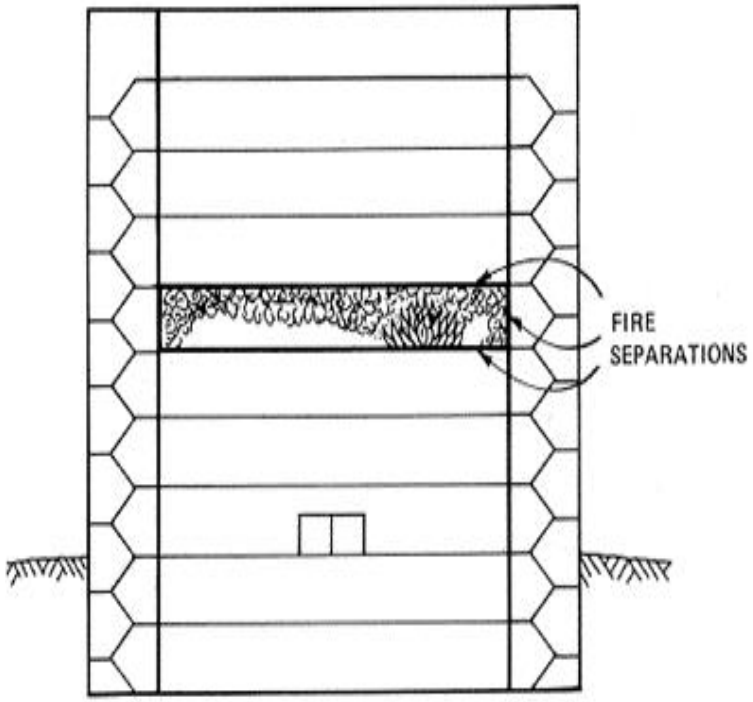
- Compartmentation - IBC?
  - Eliminated Rated Corridors in Schools
  - Eliminated Rated Mechanical Rooms
  - Occupancy Separations Reduced
  - Increased Height and Area
  - “Sprinkler Trade Offs”

The Firestopping Process

- Optimization Debate
  - IBC Height and Area Tables
    - Increased allowable SF w/o compartments
      - Fire Resistance Rated Walls become ‘0’ rated
        - » Add Non Resistance Rated Smoke Partitions
    - 12,000 SF to 250,000 SF depending on occupancy

The Firestopping Process

- Compartmentation Reductions
  - Education
  - Office
  - Mercantile
  - Multi Family Residential
  - Industrial – Insurance influences
  - Institutional - Healthcare – No change



The Firestopping Process

- FCIA, UL & Total Fire Protection
  - Detection & Alarms
  - Sprinkler Systems
  - Occupant Education
  - Compartmentation
- ***Buildings are Safe because…***

The Firestopping Process

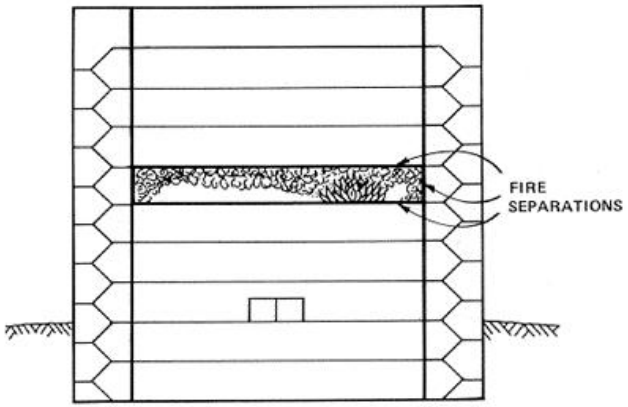
- Total Fire Protection Stats…
  - Detection & Alarms
  - Sprinkler Systems
  - Occupant Education
  - Compartmentation
- ***11,000 High Rises, 70% in NY, SF, LA, CHI, HI…Compartmentation,etc…***
- ***85% of Schools built before 1985…***

The Firestopping Process

- Total Fire Protection Stats…***North America***
- ***11,025 20 story + Tall Buildings, 70% in NY, SF, LA, CHI, HI, Toronto…***
  - ***2/3 Canada's high rise built before 1985***
  - ***85% of Schools built before 1985***
- ***Compartmentation Primary…***
  - ***Chicago, NY – Older stock of buildings***
  - ***SF, LA, HON - Earthquakes***

» ***Source, Emporis.com***

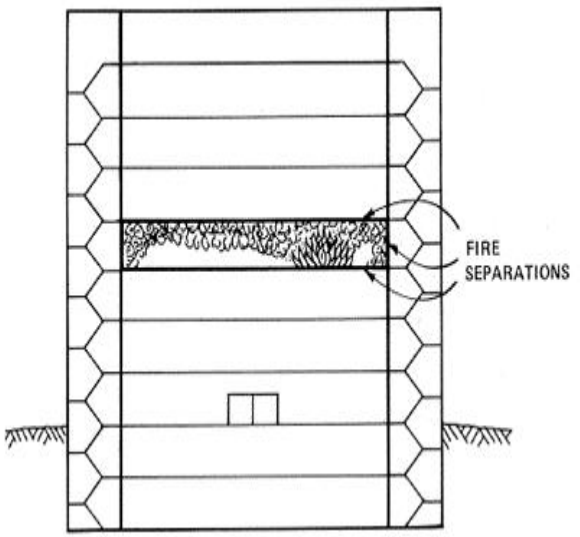
The Firestopping Process



LIFE SAFETY
&
HIGH-RISE
ORDINANCE

The Firestopping Process

- Chicago High Rise Life Safety Code
  - Sprinklers in Pre 1975 Buildings
    - Now MANDATED as Required
  - ***COMPARTMENTATION EXCEPTION***
    - Life Safety Evaluation
      - Residential High Rise
      - Historic Structures



The Firestopping Process

- World Trade Center 7 - Recommendation C, (NIST NCSTAR 1A, report for towers I & II
- **'the need for redundancy in fire protection systems that are critical to life structural integrity;** (passive fire protection system, (including SFRM, Compartmentation and Firestopping) and the active sprinkler system each provide redundancy for maintaining structural integrity in a building fire, should one of the systems fail to perform it's intended function.'
- **"the ability of the structure and local floor systems to withstand a maximum credible fire scenario, without collapse, recognizing that sprinklers could be compromised, not operational, or non existent.".**

The Firestopping Process

- NIST Report - World Trade Center 7
- Chapter 4, 4.6, 'Factors that could have mitigated structural collapse' - "improved compartmentation in tenant areas to limit the spread of fires'

The Firestopping Process

- NIST Report - World Trade Center 7
- 'buildings should not collapse in infrequent fires that may occur when active fire protection systems are rendered ineffective, e.g., when sprinklers do not exist, are not functional, or are overwhelmed by the fire‘.
- Message - Quantifiable compartmentation

The Firestopping Process

- **NIST Report - World Trade Center 7 - Recommendation B (NEW),**
- NIST recommends that buildings be explicitly evaluated to ensure adequate performance of the structural system under maximum credible (infrequent) design fires with any active fire protection system rendered ineffective. **Of particular concern are the effects of thermal expansion in buildings with one or more of the following features:**
  - **(1) Long span floor systems** which experience thermal expansion and sagging effects;
  - **(2) connection designs** (especially shear connections) that cannot accommodate thermal effects,
  - **(3) floor framing** that induces asymmetric thermally induced (ie net lateral) forces on girders,
  - **(4) shear studs** that could fail due to differential thermal expansion in composite floor systems, and
  - **(5) lack of shear studs on girders.** Careful consideration should also be given to the possibility of other design features that may adversely affect the performance of the structural system under fire conditions. 3

The Firestopping Process

- **NIST Report - World Trade Center 7 – B (NEW)**
- **B**uildings explicitly evaluated … with any active fire protection system rendered ineffective.
  - **Solutions?**
    - **Redesign Connections to accommodate thermal expansion**
      - New construction, ok….old buildings?
    - **Compartmentation – reduce fire zone sizes – 3000sf? 10000?**
      - Fuel Loads
      - Fire Spread Speed
      - Horizontal same floor safe havens
      - Minor event damage control

FCIA Firestopping Quality Process

- Effective Compartmentation for Safety
  - High Rise Safety … 75’
  - ***Stairwells – Photoluminescent Markings…***
  - ***Havens of Safety –***
  - ***Occupancy Separations – 12000 SF Max?***
  - ***Smoke Control Systems – Activation devices…Chemical, Biological, Radiation?***
  - ***Firefighter floor area sizes?***

FCIA Firestopping Quality Process

- Effective Compartmentation for Safety
  - ***Chemical, Biological, Radiation, Explosion***
    - **Standards?**
      - **R - Nuclear Power Plants**
      - **E – 2psf blast?**
      - **C – Check with manufacturer**
      - **B – Check with manufacturer**

FCIA Firestopping Quality Process

The Canadian Commission on Building and Fire Codes (CCBFC):

- appointed by NRC
- members are volunteers
- represents regulators, construction industry and public interest

Oversees the code development system

National Building Code of Canada (NBC)

FCIA Firestopping Quality Process

- Compartmentation Codes – Canada - NBC
  - – *Fire separation* means a construction assembly that acts as a barrier against the spread of fire.
    - (See Appendix A.)
  - – Appendix A:
    - A *fire separation* may or may not have a fire-resistance rating.

FCIA Firestopping Quality Process

- Compartmentation Codes
- NBC – 3.1.8.1
  - Any wall, partition or floor assembly required to be a fire separation shall
  - a) except as permitted by Sentence (2), be constructed as a continuous element, and
  - b) as required in this Part, have a fire-resistance rating as specified (see Appendix A).

  - 2)Openings in a fire separation shall be protected with closures, shafts or other means in conformance with Articles 3.1.8.4. to 3.1.8.17. and Subsections 3.1.9. and 3.2.8. (See Appendix A.)

FCIA Firestopping Quality Process

- Compartmentation Codes
  NBC - 3.1.8.1.(1)(b)

  Although a fire separation is not always required to have a fire-resistance rating, the **fire separation** should act as a **barrier to the spread of smoke and fire** until some response is initiated. **If the fire-resistance rating of a fire separation is waived** on the basis of the presence of an automatic **sprinkler system**, it is intended that the ***fire separation will be constructed so that it will remain in place and act as a barrier against the spread of smoke for a period of time*** until the sprinklers have actuated and controlled the fire.

FCIA Firestopping Quality Process

- Compartmentation Codes
- 3.1.8.3 - Continuity

  1) Except as permitted by Sentence 3.6.4.2.(2), a horizontal service space or other concealed space located above a required vertical fire separation, including the walls of a vertical shaft, shall be divided at the fire separation by an equivalent fire separation within the service space.

FCIA Firestopping Quality Process

- Compartmentation Codes
- **3.1.9.1.Fire Stopping of Service Penetrations**
- Except as required by Sentence (2), piping, tubing, ducts, chimneys, optical fibre cables, electrical wires and cables, totally enclosed noncombustible raceways, electrical outlet boxes and other similar building services that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating shall be
- a) ***sealed by a fire stop system*** that, when subjected to the fire test method in **ULC-S115, "Fire Tests of Firestop Systems,"** has an F rating not less than the fire-protection rating required for closures in the fire separation in conformance with Table 3.1.8.4., or (50pa, plastics)
- b) ***cast in place*** (see Appendix A).

FCIA Firestopping Quality Process

- Compartmentation Codes
- A-3.1.9.1.(1)(b)Service Penetration

The intention behind the use of the term "cast in place" is to reinforce that there are to be no gaps between the building service and the membrane it penetrates. The term "cast in place" describes a typical means of fire stopping for a service penetration through a concrete slab or wall.

FCIA Firestopping Quality Process

- Fire Resistance Rated
  Effective Compartmentation
  - – ***Continuous*** Walls / Floors
    - Interior and Exterior Walls
      - – Firestop Systems
        - » Penetrations
        - » Joints – Walltops – Perimeter Joints
    - Fire Damper Duct Systems
    - Fire Doors and Hardware Systems
    - Fire Glass

FCIA Firestopping Quality Process

- ***NBC Canada*** 2010 – Coming….

FCIA Firestopping Quality Process

- Effective Compartmentation for Safety
  - ***Continuous*** Walls / Floors – Standards
    - Interior and Exterior Walls – **Some standards…**
    - Firestop Systems - **Developing**
    - Fire Damper Duct Systems - **Developing**
    - Fire Doors and Hardware Systems - **Developing**
    - Fire Rated Glazing - **Developing**

The Firestopping Process
Effective Compartmentation

- Fire Walls and Floors –
  - ***Continuous Fire Resistance Rated Assemblies***

–Concrete

–Concrete Block

–Plaster

–Gypsum Block

–Drywall

–Floor/Ceiling Assemblies

–Firestop Systems

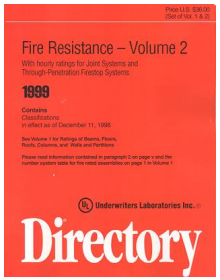
"Tested & Listed Wall/Floor Systems"

The Firestopping Process

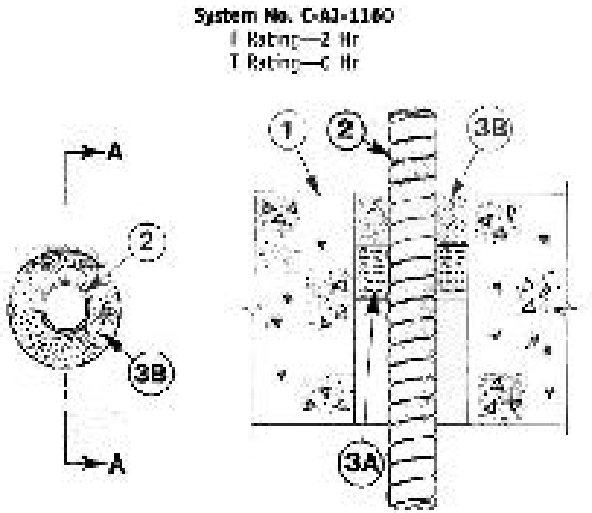
Effective Compartmentation Features

The Firestopping Process

- FCIA Members Understand Effective Compartmentation & Firestop Quality Process…
  - Firestop ***Systems*** **Tested to ASTM E 814, UL 1479/2079, CAN S-115, ASTM E 2307**
  - Specified by Professionals
  - **Installed by FCIA Member**
  - **Inspected to ASTM E2174 & ASTM E2393**
    Inspection Process by Qualified Firms/Individuals
  - **Maintained** by FCIA Member Firestopping Contractors

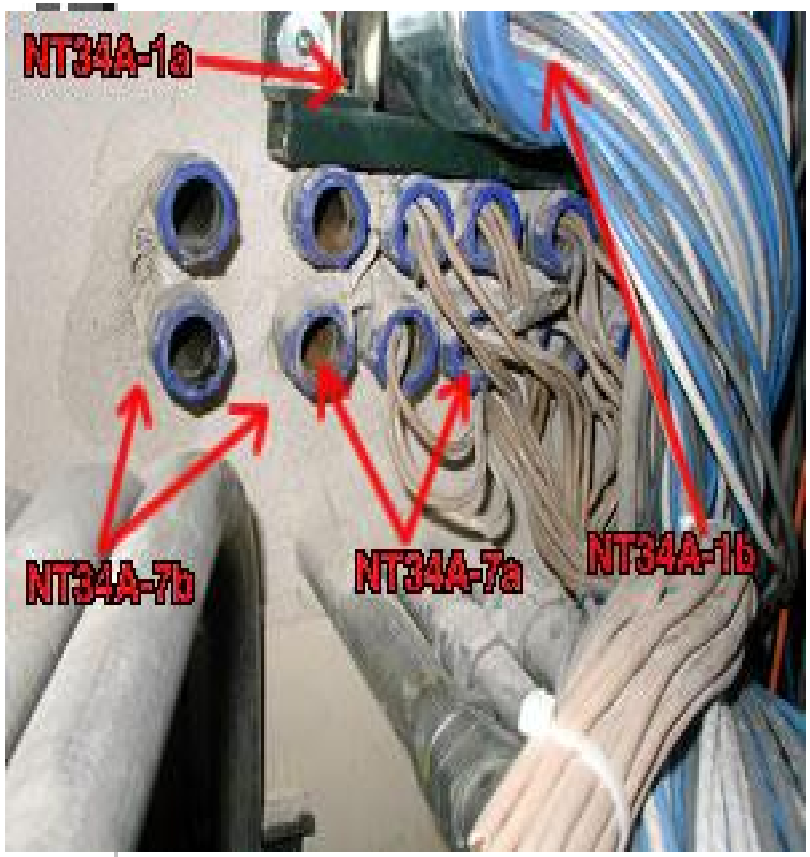


The Firestopping Process
I – Classified Systems



1. Floor or Wall Assembly—Min 4-1/2 in. thick lightweight or normal weight (100 to 150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Diam of circular through opening in floor or wall assembly to be 1/4 in. to 1-1/2 in. larger than diam of flexible metal conduit (Item 2) installed in through opening. Max diam of opening is 6 in.
   See Concrete Block (CAJU) category in the Fire Resistance Directory for names of manufacturers.
2. Through Penetrating Product*—Nom 4 in. diam (or smaller) steel, or nom 3/4 in. diam (or smaller) aluminum Flexible Metal Conduits. Max one flexible metal conduit to be installed near center of circular through opening in floor or wall assembly. Flexible metal conduit to be rigidly supported on both sides of floor or wall assembly.
   Alliance Cable Corp.
3. Packing Material—Nom 1 in. thickness of ceramic (alumina silica) fiber blanket or mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed min 1 in. from top surface of floor or from both surfaces of wall.
4. Fill, Void or Cavity Material*—Caulk—Applied to fill the annular space around the flexible metal conduit. In floors, a min 1 in. depth of fill material to be installed flush with top surface of floor. In walls, a min 1 in. depth of fill material to be installed flush with wall surface on both sides of wall assembly.
   Minnesota Mining & Mfg. Co.—[illegible]

*Bearing the UL Classification Marking
†Bearing the UL Listing Mark



The Firestopping Process

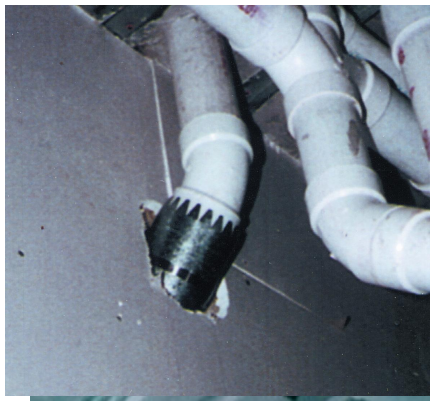
- **Sealants**
  - Silicone, Latex, Intumescent
- **Wrap Strips**
  - “Thick, Thin, Wide, Less Wide”
- **Putties**
- **Pillows**
- **Composite Sheets**
- **Bricks / Plugs**
- **Pre Fabricated Kits**
- **Mortar**
- **Spray Products**
  - » Graphics
  - » STI, 3M, A/D, HILTI, Nelson






The Firestopping Process

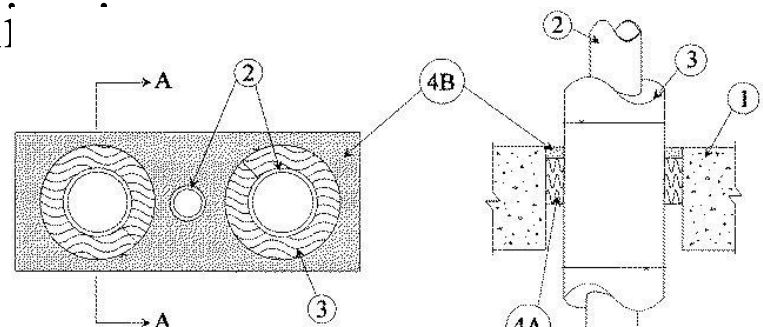
- **Firestop Systems Materials**
- Pipes – Cables
  - Sealants, Wrap strips, Putties, Prefabricated Kits
- Gaps/Joints/Walltops/Perimeter Joints
  - Sealants – Sprays – Track Systems
- “Backing Material”
  - Mineral Wool, Ceramic Fiber,
  - Backer Rod, Others



» Graphics-W.R.Grace, Nelson Firestop, Tremco

The Firestopping Process

- Firestop Products Become Firestop Systems --
  - "A Specific field erected construction, consisting of an assemblage of materials to prevent the spread of fire through openings in fire rated walls and floors using ASTM E 814 / UL 1479, S-115, UL 2079, E 1966, E 2307 as the test method…"
  - ***S-115 – Incorporated all of UL 2079 in 2004***
  - **Testing** = Suitability statement for use of a firestop product in a specific system appli



The Firestopping Process

- What are Firestop ***Systems***?
  - ASTM E814/UL 1479–UL S115 Tested Systems
    - **F Rating - Flame**
    - T Rating – Temperature
    - H Rating – Hose (CAN-Optional)
    - **L Rating – Smoke (UL)**
    - W Rating – Water (ULus)

The Firestopping Process
Hose Stream
& “W” Rating

The Firestopping Process

- **Firestop Systems Directories – ULc, ULus®,**

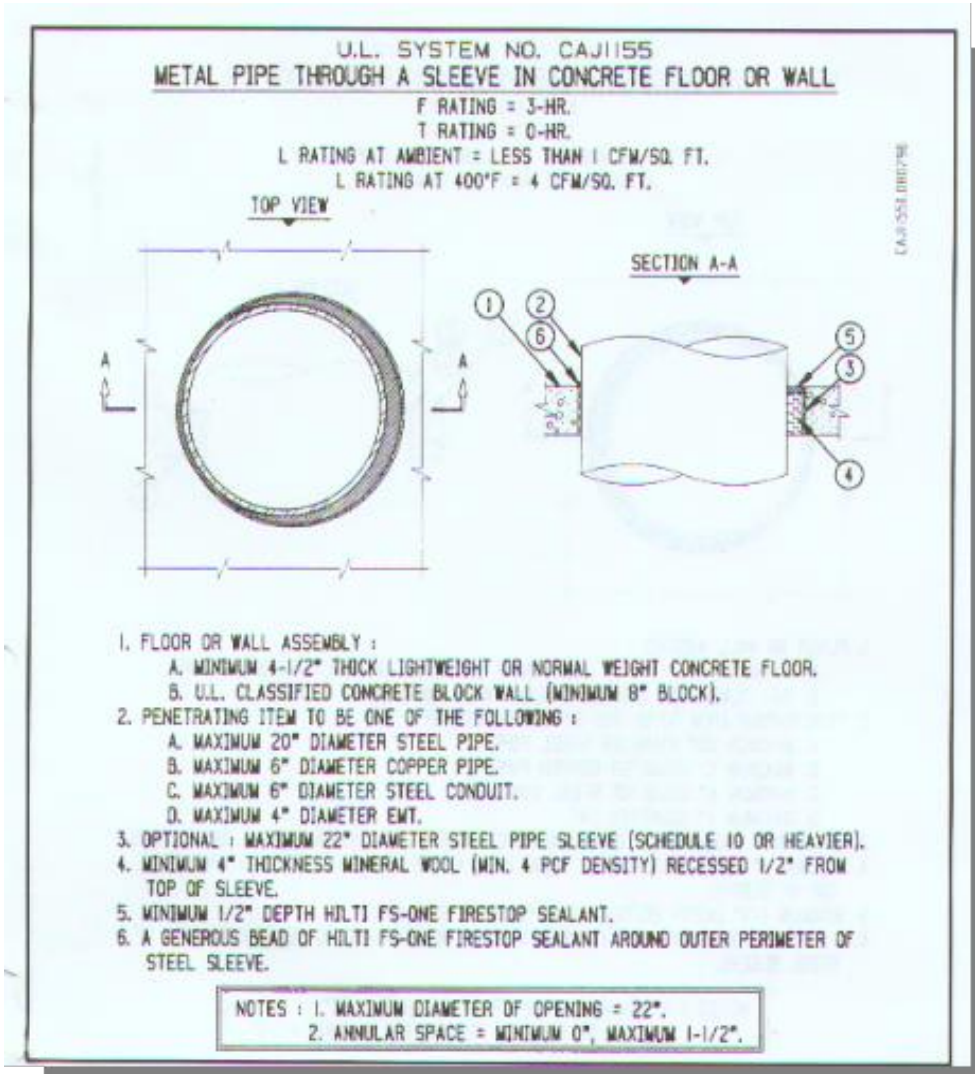
  Systems Selection…Not as easy as it looks…

The Firestopping Process
UL Systems

System Example:

CAJ 1155

Metal Pipe in Concrete Floor or Wall



The Firestopping Process

- **Firestop Systems Directories - UL®**

  Alpha: The first letter is either “F” for floors, “W” for walls or “C” for a combination of walls and floors.

  Alpha: The second letter or combination of letters, signify the following.

A	Concrete floors < 5”
B	Concrete floors > 5”
C	Frame floors
D	Deck construction
E – I	Reserved for future use
J	Concrete or Masonry walls < 8”
K	Concrete or Masonry walls > 8”
L	Framed Walls
M	Bulkheads
N – Z	Reserved for future use

The Firestopping Process

- **Firestop Systems Directories - UL®**
  - F - Floors
  - W - Walls
  - C - Combination

  } First letter of the system
  - A - Concrete floors < 5 inches
  - B - Concrete floors > 5 inches
  - C - Frame floors
  - D - Deck construction
  - E - I - Reserved for future use
  - J - Concrete or Masonry walls < 8 inches
  - K - Concrete or Masonry walls > 8 inches
  - L - Framed Walls
  - M - Bulkheads
  - N - Z - Reserved for future use

The Firestopping Process

- **Numeric:** The first digit of the four digit number, identifies the type of penetrant in accordance with the following list. The next three digits will be assigned sequentially to successfully tested systems.
  - 0000 – 0999 No Penetrant
  - 1000 – 1999 Metallic Pipe, Conduit or Tube
  - 2000 – 2999 Non Metallic Pipe, Conduit or Tube
  - 3000 – 3999 Cables
  - 4000 – 4999 Cables in a Tray
  - 5000 – 5999 Insulated Pipes
  - 6000 – 6999 Misc. Electrical Penetrates
  - 7000 – 7999 Misc. Mechanical Penetrates
  - 8000 – 8999 Mixed multiple penetrates
  - 9000 – 9999 Reserved for future use

The Firestopping Process

- **ULc = AlphaNumeric:**
  - HW – Head of Wall Firestop Systems
  - JF – Joint Firestop Systems
  - SP – Service Penetration Systems
  - SPC – Service Penetration for Combustible Systems
- ***Renumbering is coming…similar to ULus***

The Firestopping Process

- **Firestop Systems Directories – UL - Joints**

  First letter of the system

  – 0 – 999 = Less than 2” wide
  – 1000-1999 = 2”-6”
  – 2000-2999 = 6”-12”
  – 3000-3999 = 12”-24”
  – 4000-4999 = 24++”

The Firestopping Process

- **ULc = Ratings**
  - F – Fire – no poke through
  - FT – Fire, Temperature resistance
  - FTH – Fire, Temperature, Hose Stream
  - L – Air Leakage – Cold, Hot

The Firestopping Process

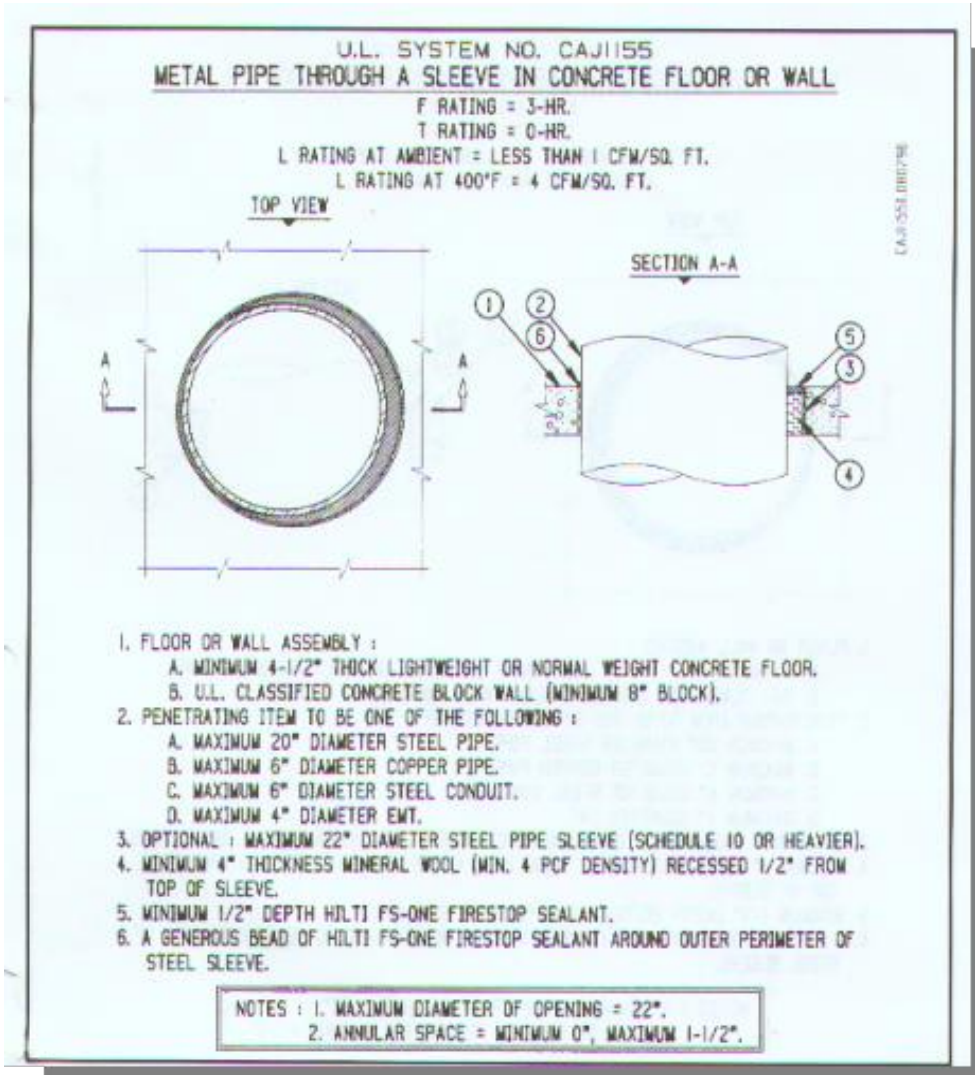
- **ULc = AlphaNumeric:**
  - HW – Head of Wall Firestop Systems
  - JF – Joint Firestop Systems
  - SP – Service Penetration Systems
  - SPC – Service Penetration for Combustible Systems
- ***Renumbering is coming…similar to ULus***

The Firestopping Process
UL Systems

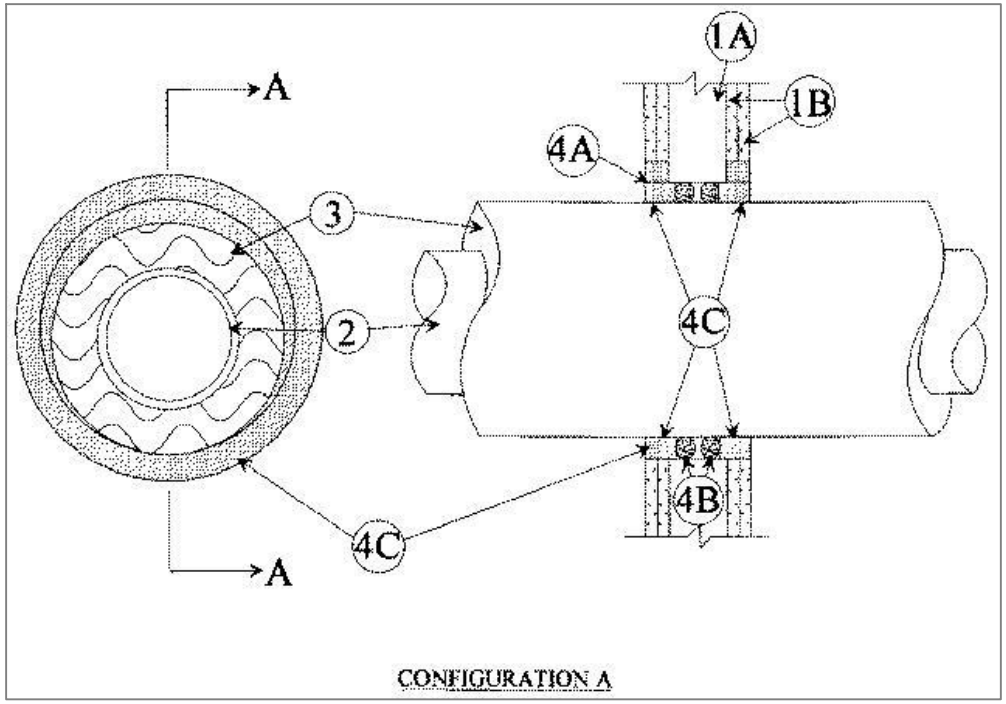
System Example:

CAJ 1155

Metal Pipe in Concrete Floor or Wall

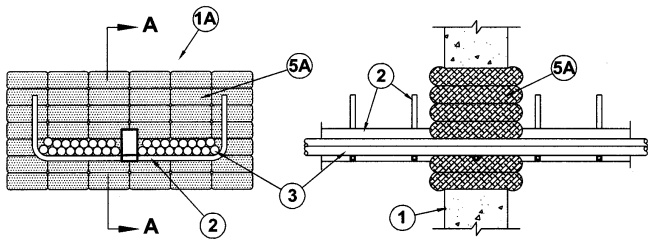


UL Classified Firestop Systems



Manufacturer: Specified Technologies Inc.
System No.: UL C-AJ-5021
Rating: F = 2 and 3
Rating: T = 1/2and1
Rating: L = <1CFM/SF

UL Classified Firestop Systems



Section A-A

System No. W-J-4021
F Rating — 2 Hr
T Rating — 0 Hr

1. **Wall Assembly** — Min 6 in. thick reinforced lightweight or normal-weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks* . Max area of opening is 288 sq in. with max dimension of 24 in.
   See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. **Cable Tray*** — Max 18 in. wide by 6 in. deep center-hung cable tray formed from min 0.060 thick aluminum with nom 1/2 in. square tubular rungs spaced 6 in. OC. The annular space between the cable tray and the top and bottom of the opening shall be 1/2 in. min to 5-1/2 in. max. Cable tray to be rigidly supported on both sides of the wall assembly.
3. **Cables** — Max 3 in. deep cable loading within cable tray. Any combination of the following types and sizes of cables may be used:
   - **A.** Max 200 pair No. 24 AWG (or smaller) copper conductor cable with polyvinyl chloride (PVC) jacketing and insulation.
   - **B.** Max 7/C No. 2/0 AWG (or smaller) multiconductor power and control cables with XLPE or PVC insulation and XLPE or PVC jacket.
   - **C.** Max RG59/U (or smaller) coaxial cable with fluorinated ethylene insulation and jacketing.
   - **D.** Max 62.5/125 micron fiber optic cable with PVC insulation and jacketing.
   - **E.** Max 4 pair No. 24 AWG (or smaller) copper conductor Category 5 cable with Hylar insulation and jacketing.
   - **F.** Max 4/C No. 10 AWG (or smaller) copper or aluminum conductor aluminum or steel Metal-Clad# or Armored-Clad# cable.
4. **Nonmetallic Penetrants** — One or more nom 1-1/2 in. diam (or smaller) Optical Fiber Raceways+ formed from either polyvinyl chloride (PVC) or polyvinylidene fluoride (PVDF). Min separation between optical fiber raceways is 2 in. When optical fiber raceway is included in the cable tray, no other cables may be installed in cable tray within 2 in. of optical fiber raceway. Raceway to be installed in accordance with Article No. 770 of the National Electrical Code (NFPA No. 70).
   See **Optical Fiber Raceway** (QAZM) category in the Electrical Construction Materials Directory for names of manufacturers.
5. **Firestop System** — The firestop system shall consist of the following:
   - **A. Fill, Void or Cavity Material*** — **Pillows** — Max 9 in.. long by 6 in. wide by 3 in. thick plastic covered intumescent pillows. Pillows to be installed lengthwise through the opening and positioned to extend equally in both directions from the approximate center line of the wall. Pillows tightly packed to fill the annular space between cables and periphery of opening and between cable tray and periphery of opening.
     Specified Technologies Inc. — SpecSeal Firestop Pillows.
   - **B. Fill, Void or Cavity Material*** — **Putty** — (Not Shown) — After installation of pillows (Item 4A), putty applied to seal any voids between cables, between cables and the pillows on both sides of the wall assembly.
     Specified Technologies Inc. — SpecSeal Putty

*Bearing the UL Classification Marking
#Bearing the UL Listing Marking

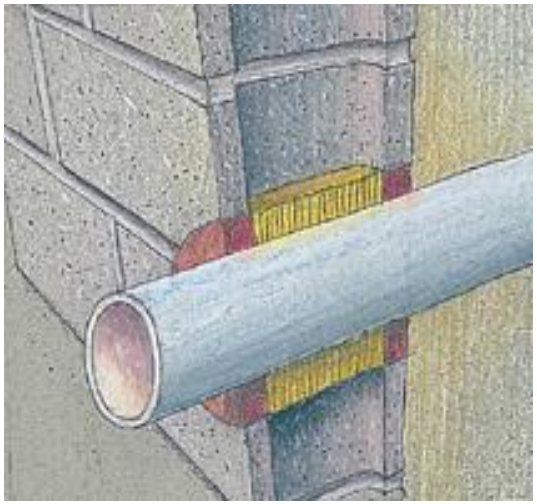
Every application has its own unique UL tested assembly which specifies:

- **Hourly Fire Rating**
- **Type of Barrier**
- **Type of Penetrant**
- **Min/Max Hole/Gap Size**
- **Firestop Products**

STI Graphic

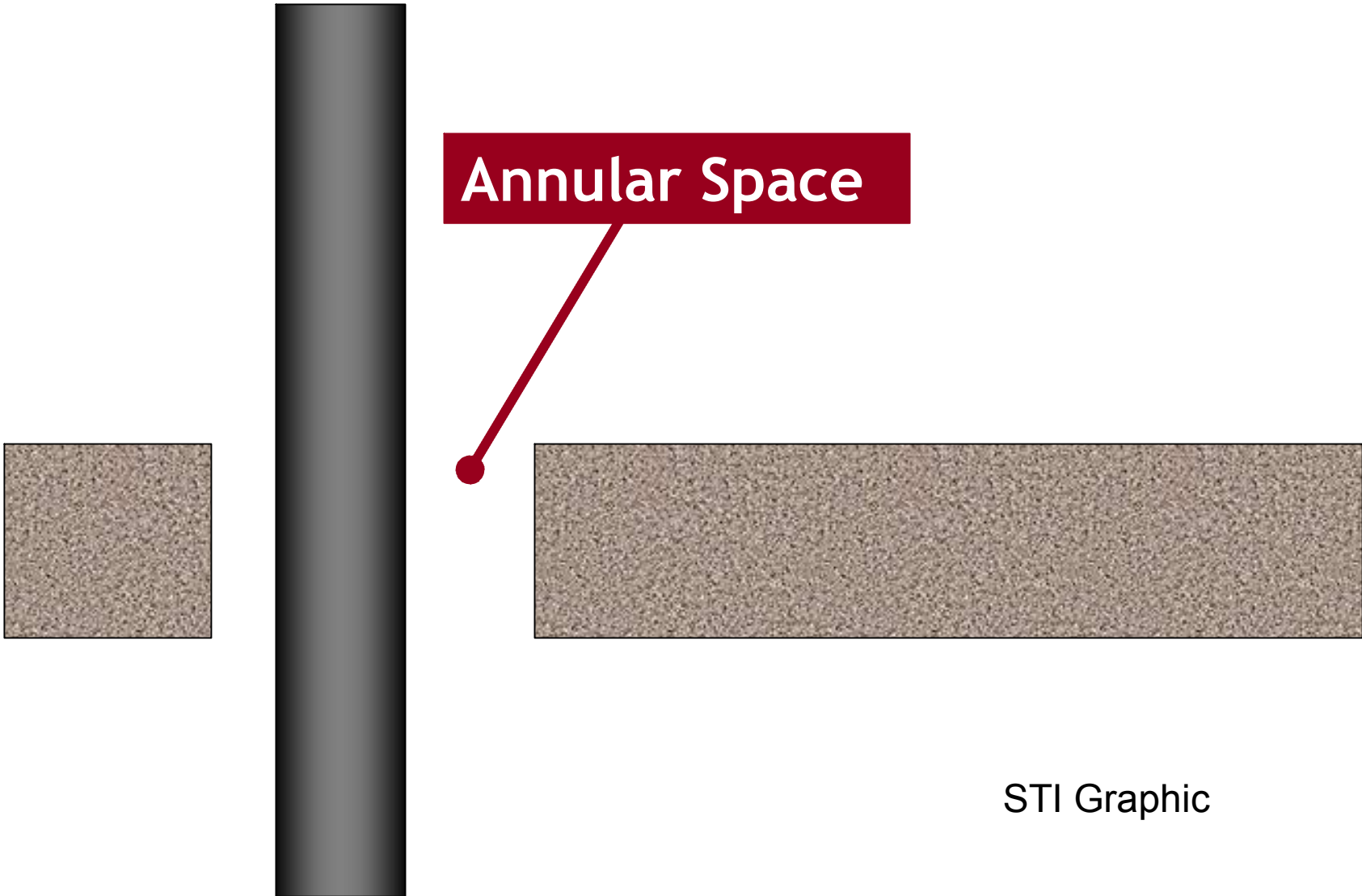
How Installers Select UL Systems

- Wall or Floor Construction Type
- Wall or Floor Thickness
- Penetrating Item, coverings
- Size of the Penetrating Item
- Annular Space, Gap Sizes
- Firestop Fill Material(s)

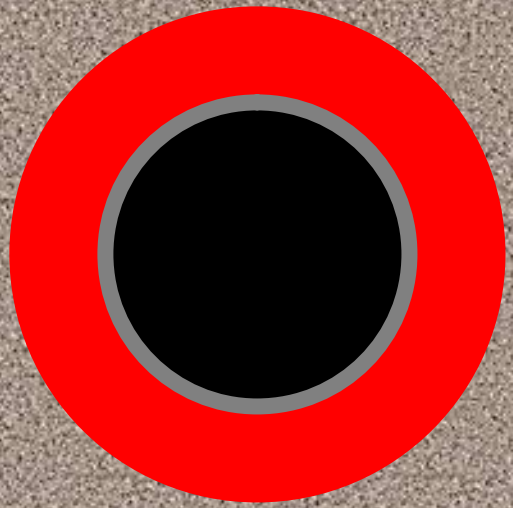


STI Graphic

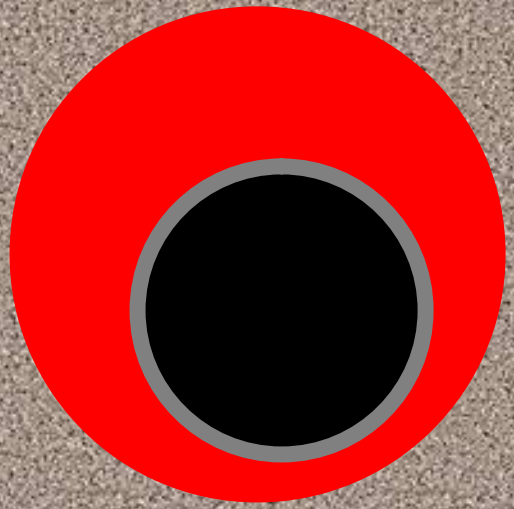
Min/Max Hole Size



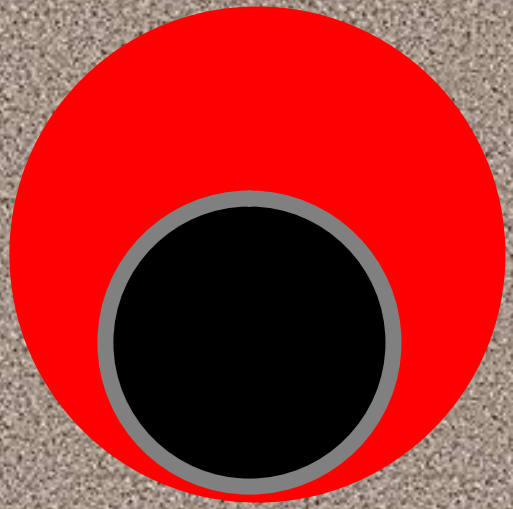
STI Graphic



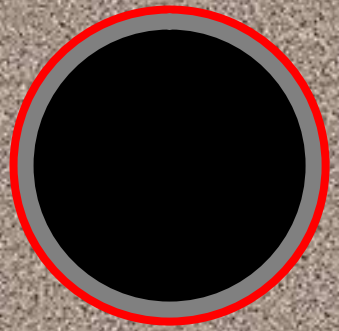
1. Centered



2. Off-Centered



3. Point Contact

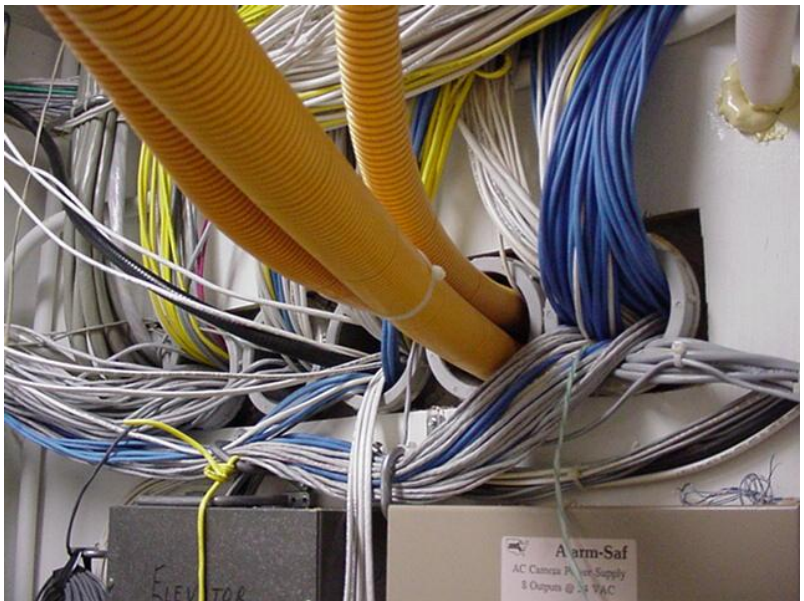


4. Continuous Point Contact

STI Graphic

The Firestopping Process

- Field or other Variances to
  Tested and Listed Systems?
  - Too Many Penetrating Items
  - Annular Space / Gap too large / small
  - Something in the way
  - Oversized penetrating item
  - Oversized Insulation
  - Tolerances??



The Firestopping Process

- Variances to Systems? – Now What…
  - First Action in Process
    - **Find another system** – Same Manufacturer
    - Find another system – Different Manufacturer
  - **If no system exists in either case**….
    - ***Engineering Judgment*** – **"EJ"**
    - ***Equivalent Fire Resistance Rated Assembly*** – ***"EFRRA"***
    - *Based on sound engineering IFC Protocol*

Firestop sealant must be well bonded to penetrating item and surrounding wall or floor

Pack

1

Caulk

2

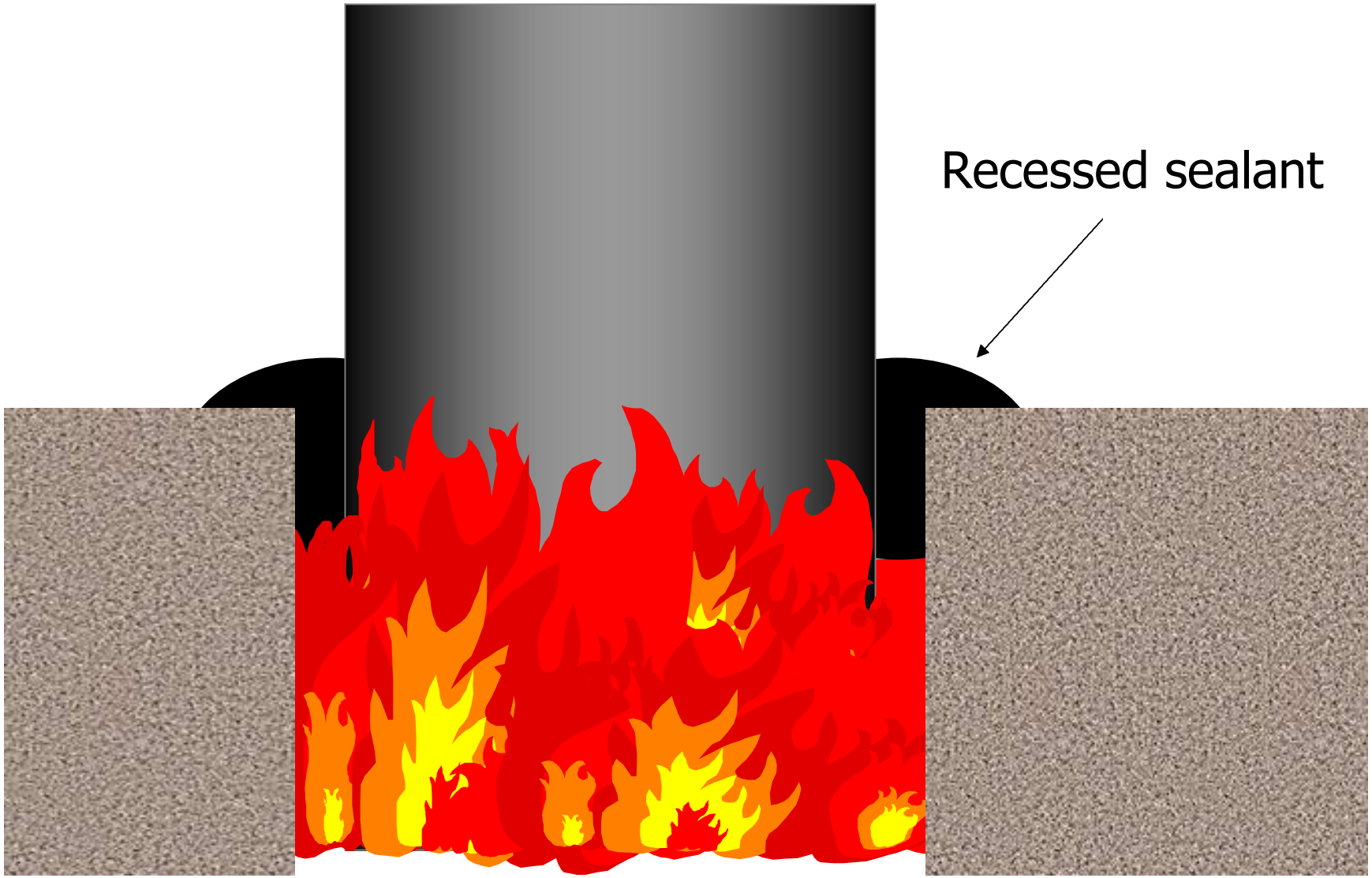
Tool

3

Always Check BOTH SIDES

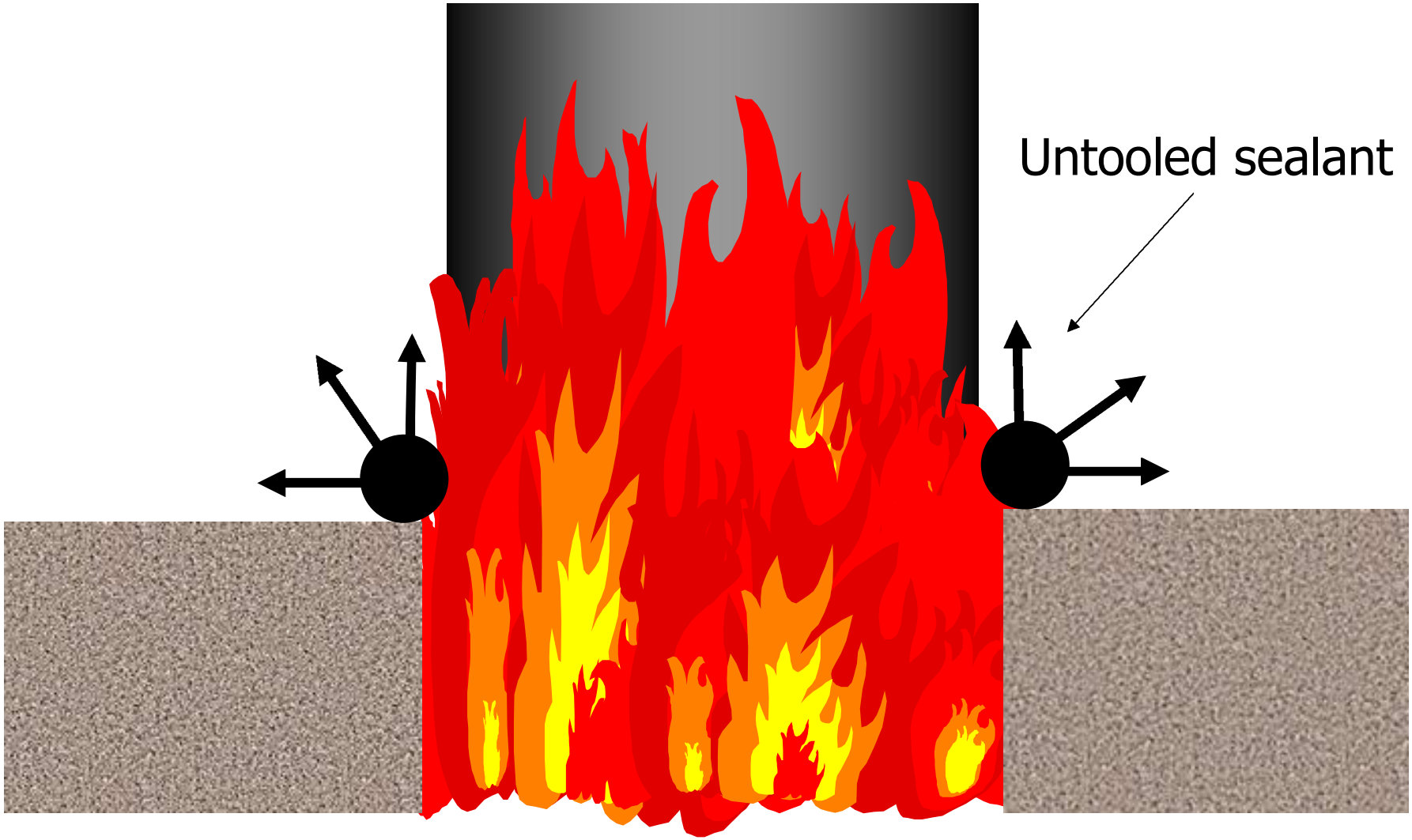
STI Graphic

When the sealant is properly recessed, it will expand inward and work the way it was designed



STI Graphic

Left untooled, the sealant will expand outward during a fire, and likely fail



STI Graphic

Properly Tooled Penetrations

Large Insulated Pipes

Multiple Insulated Pipes

Sleeved Pipes

Correct Collar or Sealant Must Be Selected for Combustible Penetrations

Charred Pipe

Knot formed from Collapsing pipe

Cold-Side View

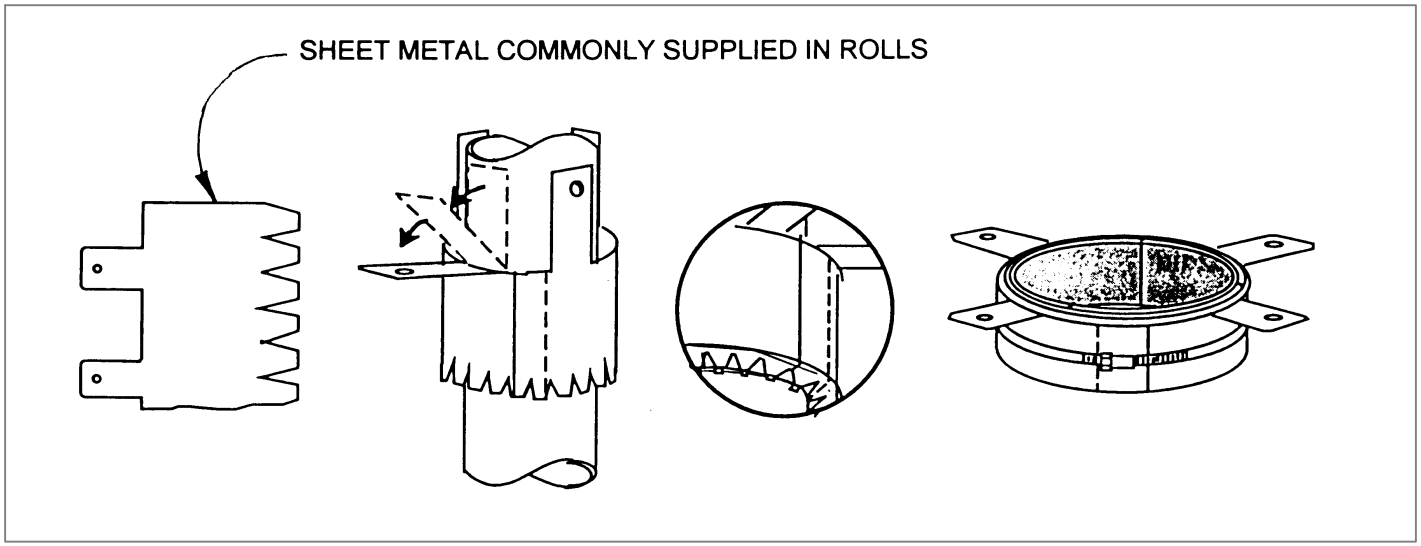
Hot-Side View

- Intumescent sealant expands and fills the void that opens as the combustibles burn away
- Collar expands to crush the pipe

STI Graphic

Intumescent Wrap Strips and Steel Collars

- **Key Points - Restricting Collars**
  - Fastening Tabs – 90 degree bends for expansion
  - Directional Tabs
  - Bands

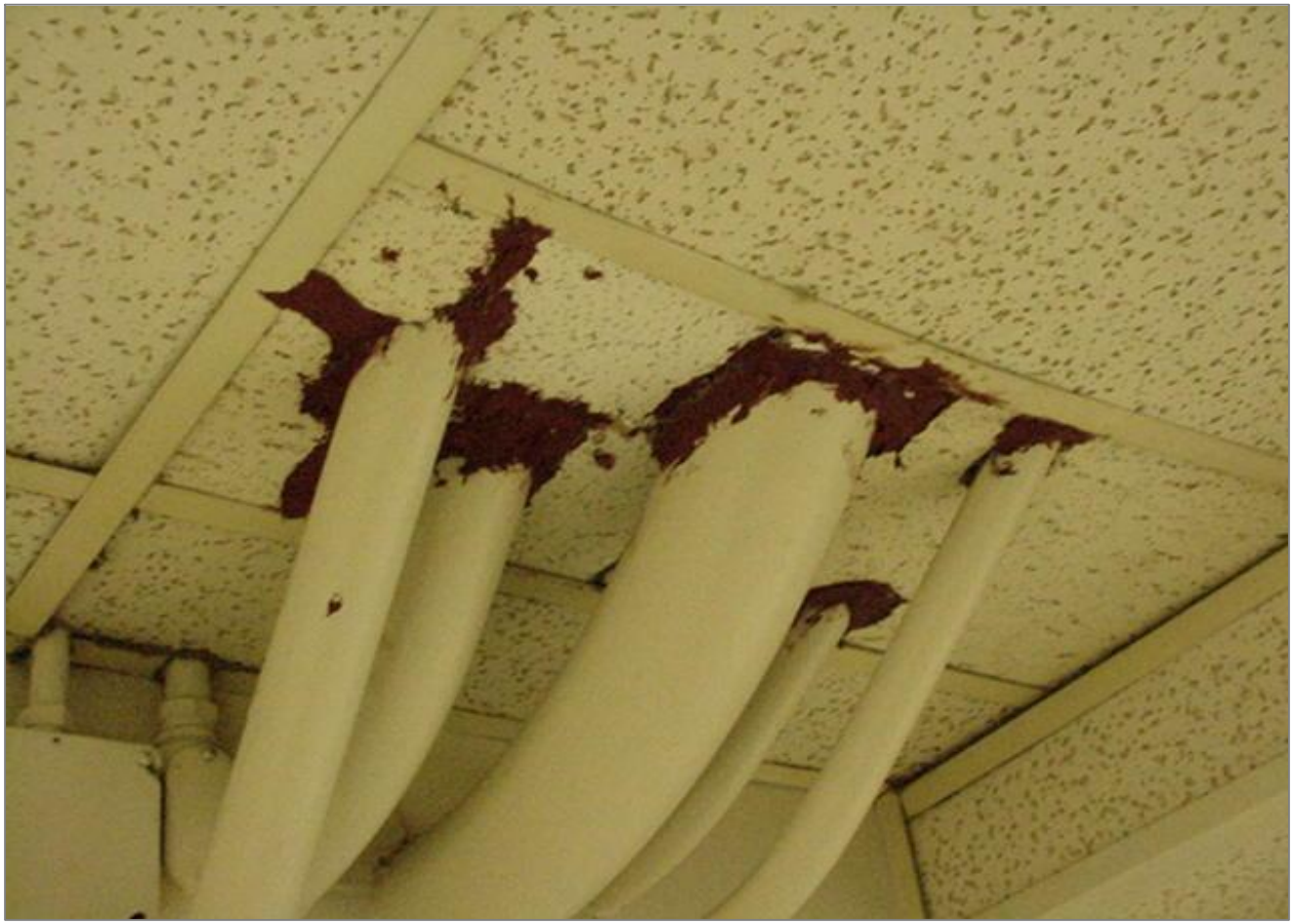


STI Graphic

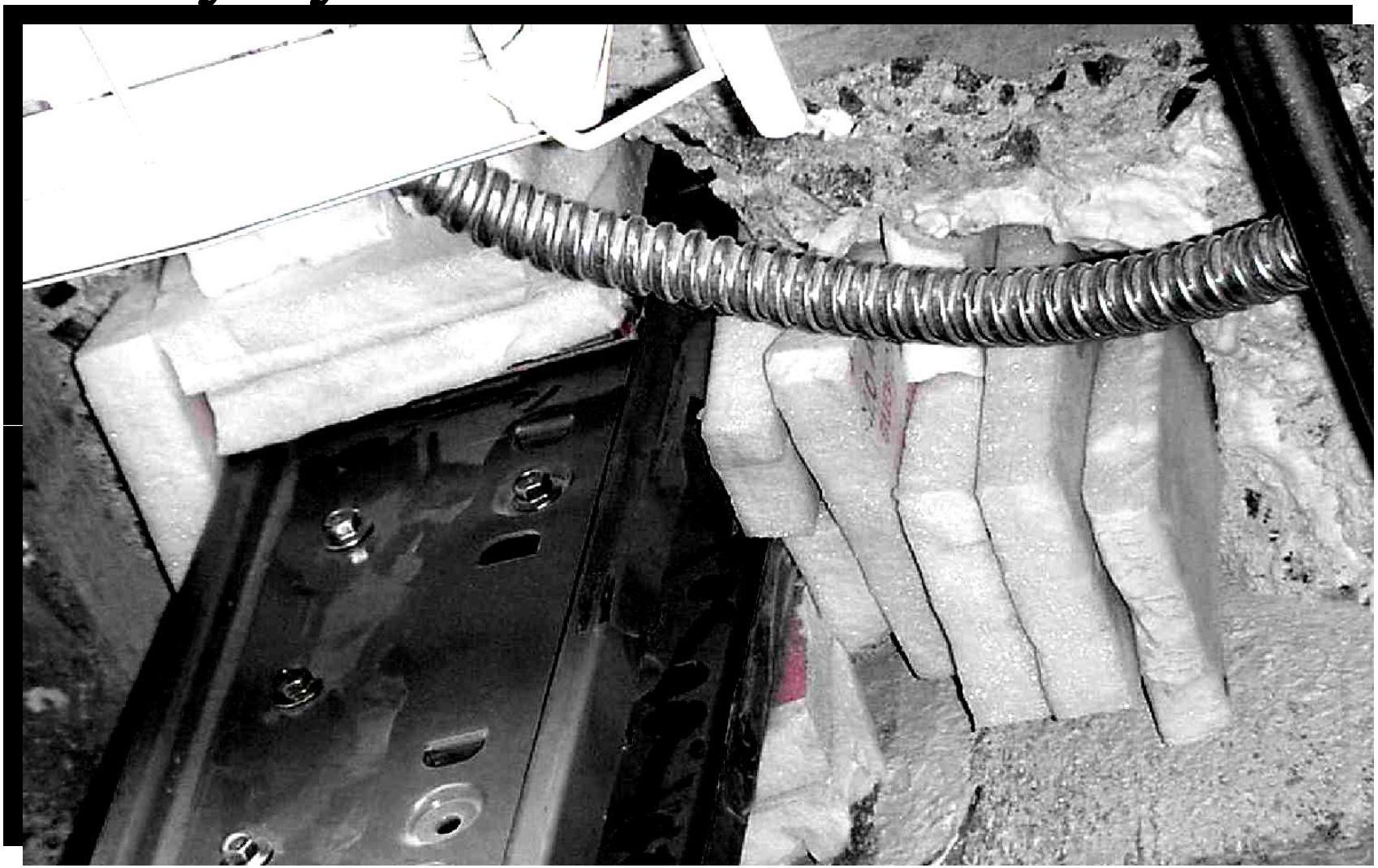
Unlisted, Untested Firestop Systems

Firestop Systems

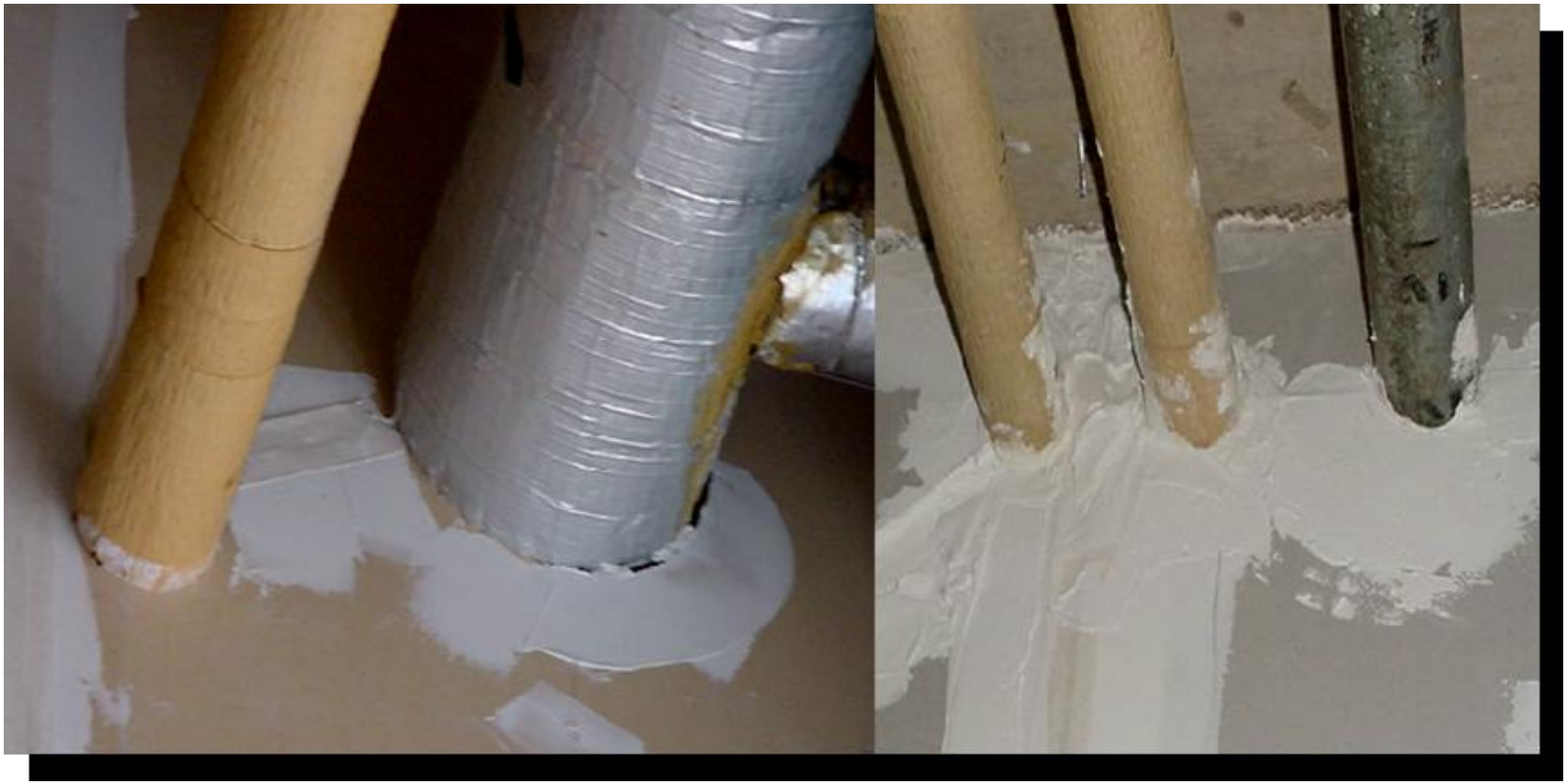
Unlisted, Untested Firestop Systems



Polystyrene Block in CMU Slab



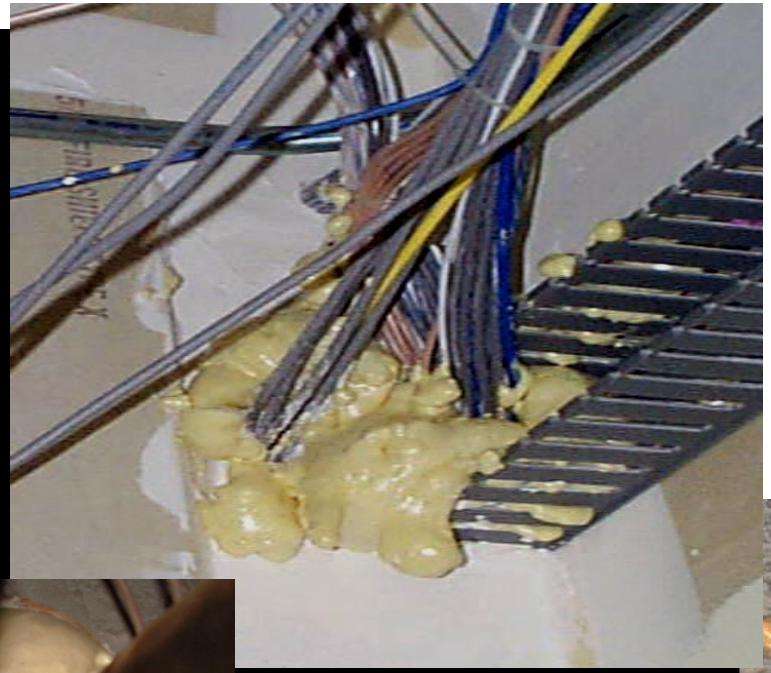
Joint Compound



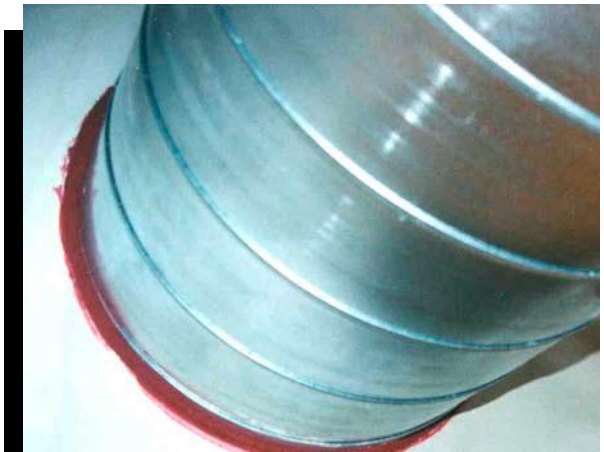
Incomplete is ineffective

Right Product, Incomplete Installation

Great Stuff



Sealant must be applied BEFORE sheet metal flanges in Duct Applications



Fire/Smoke Dampers

- Dampers are UL 555, 555S Listed ***Systems***
- Installed to manufacturer's written instructions (Systems – Angles…no sealants)
- Firestop sealants - not miraculous –
  - Improper hole sizing or poor installation…

Consult the Damper Manufacturer & the Authority Having Jurisdiction

Greenheck Graphic

Fire/Smoke Dampers

- Retaining angles
- 1 in. barrier overlap r
- Attach angles to sleeve only
- All four sides …
- Both sides of barrier is standard
- One side if tested…
- Breakaway Connections

Greenheck Graphic

Fire/Smoke Dampers
Firestop Installation

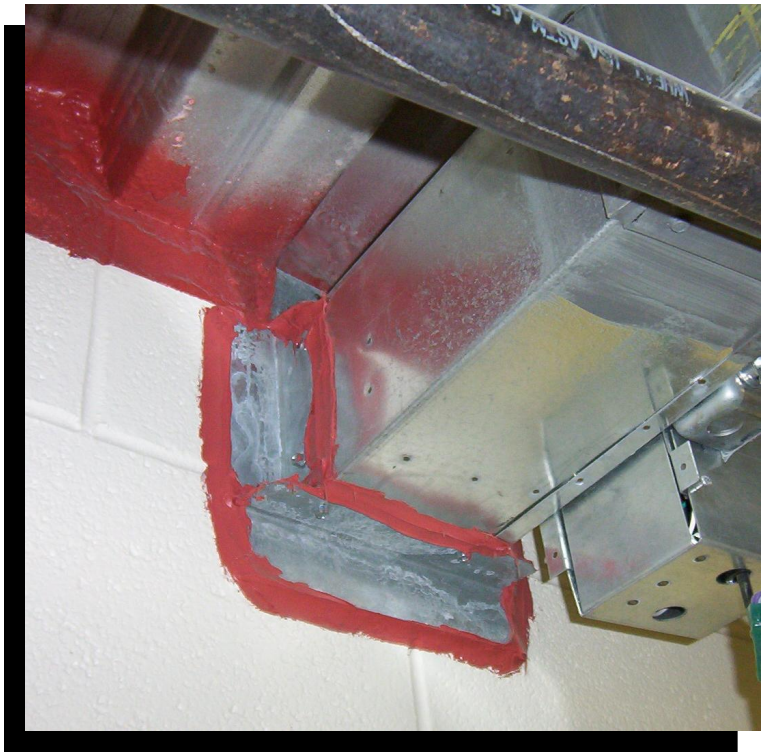
- Combination Fire Smoke Dampers
- Multi-blade Fire Dampers
- Underfloor applications
- Max. size 72” W x 96”

Greenheck Graphic

Fire/Smoke Dampers

- Dampers with sealant provide smoke protection

Consult the Damper Manufacturer & the Authority Having Jurisdiction



Installing an Incorrect System May Void the Fire / Smoke Damper Manufacturer's Warranty

Barriers With Combustible Penetrants

- Plastic Pipe
- Plastic-Jacketed cables
- n

The Firestopping Process

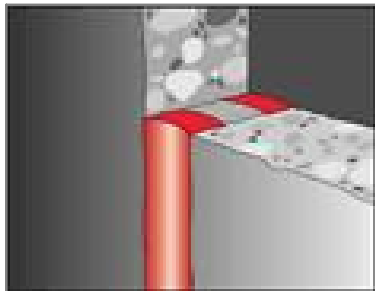
- Firestop Joint Systems Definition – UL 2079
  - "A joint system is a specific construction consisting of adjacent wall and floor assemblies, and the materials designed to prevent the spread of fire through a linear opening between the wall and / or floor assemblies"
  - "ANSI / UL 2079 " – Qualified Joint System

STI Graphic

The Firestopping Process

- Firestop Joint Systems Definition – UL 2079
  - Min. Positive Pressure – .01 Water, 12” below assy.
  - Movement Cycling
    - Class I – min. 500 cycles, min. 1 cycle / minute
    - Class II- min. 500 cycles, min. 10 cycles / minute
    - Class III-min 100 cycles, min. 30 cycles / minute
  - Fire Tested at Maximum Joint Width
  - No Load Bearing Characteristics, unless noted
  - Assembly, L or W Ratings

HILTI Graphic



Good Firestop Applications

Floor to Wall

Top of Wall

Joints and Seams

Top of Wall

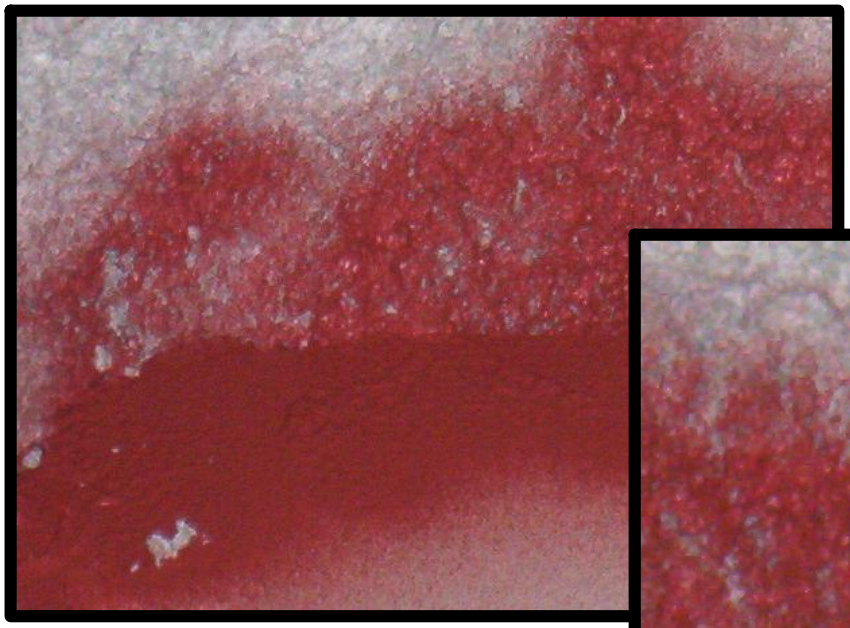
Joints and Seams

I-Beam to Fluted Deck

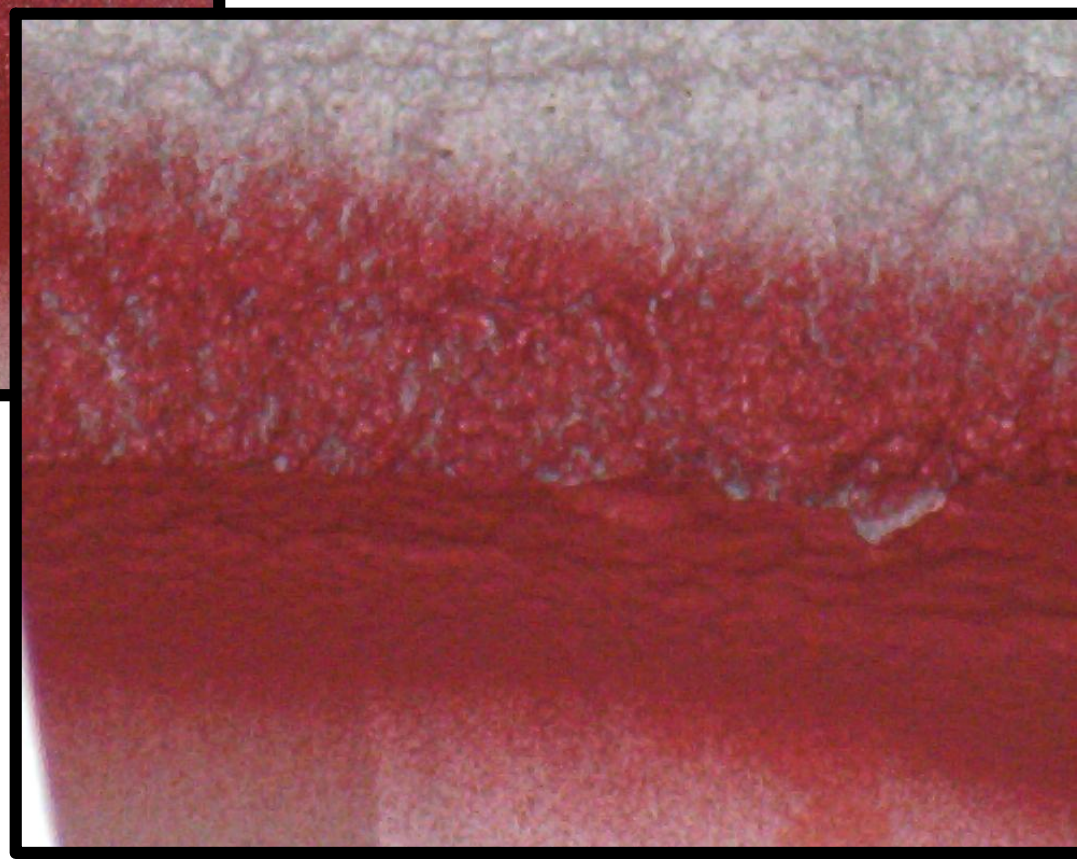
Penetrations with Top of Wall

Unacceptable Substitutes

Unacceptable Substitutes



Insufficient Material?



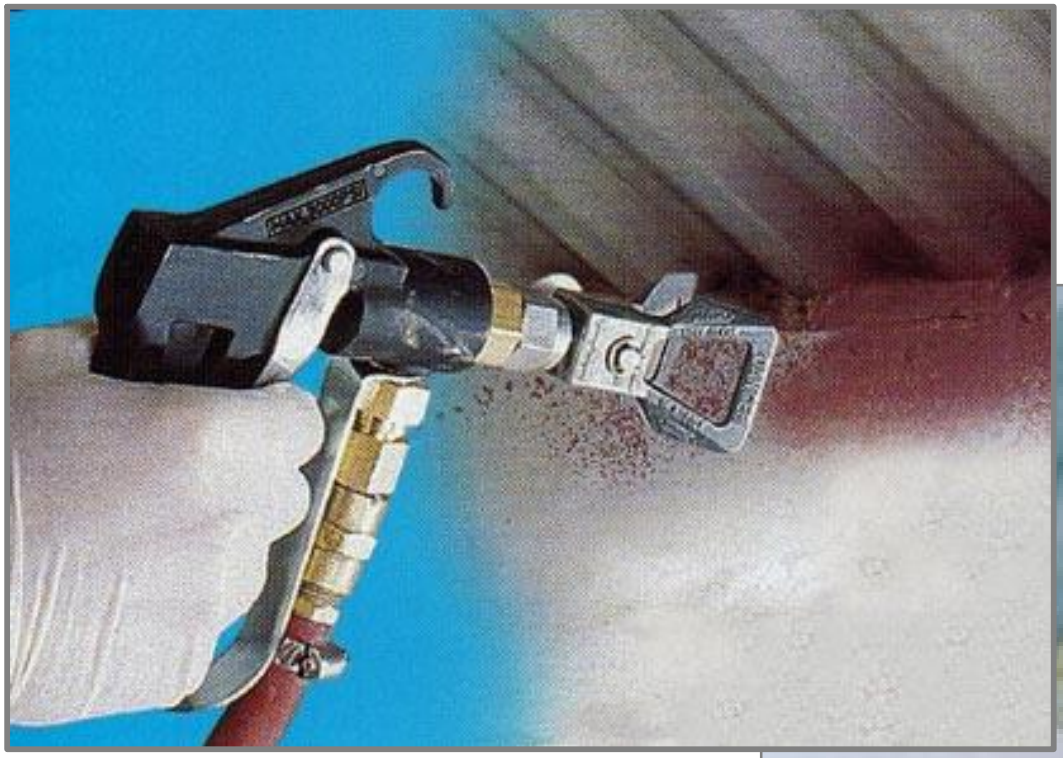
Non Code Compliant!

Unacceptable Substitutes

Spackle is not Firestop

Results of Improperly Installed Mineral Wool

Mineral Wool



With Sealant

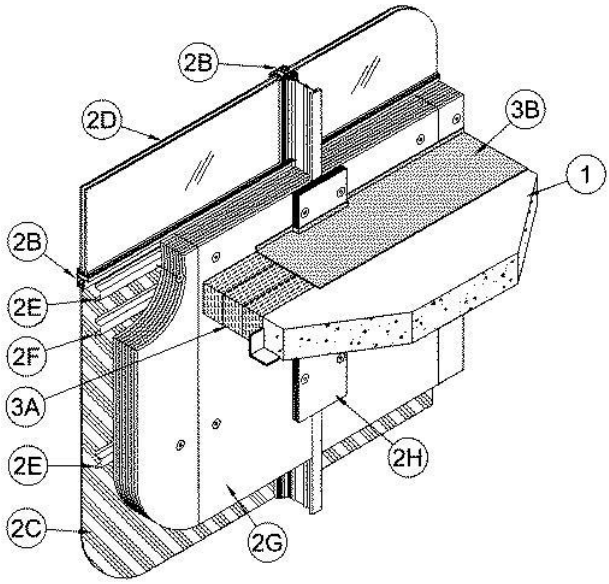
The Firestopping Process

- Firestop Perimeter Systems Definition – ASTM E 2307
  - "A Perimeter Fire Containment System is a specific field erected construction consisting of a floor with a fire resistance rating, and an exterior curtainwall with no hourly resistance rating, and the fill material installed between the floor and the curtain wall to prevent the vertical spread of fire in a building."

The Firestopping Process

- **Firestop Perimeter Systems – ASTM E 2307**
  - Movement Classes = ANSI / UL 2079
  - Fire and Temperature Ratings
    - Integrity – Similar to “F” Rating
    - Insulation – Similar to “T” Rating
    - No “L” Rating, Hose Stream
  - CurtainWall Spandrel Panels
    - Protected with insulation, other systems
    - Interior Fire Spread only – No Leapfrog
    - Testing = 33” above slab for Leapfrog Prevention…

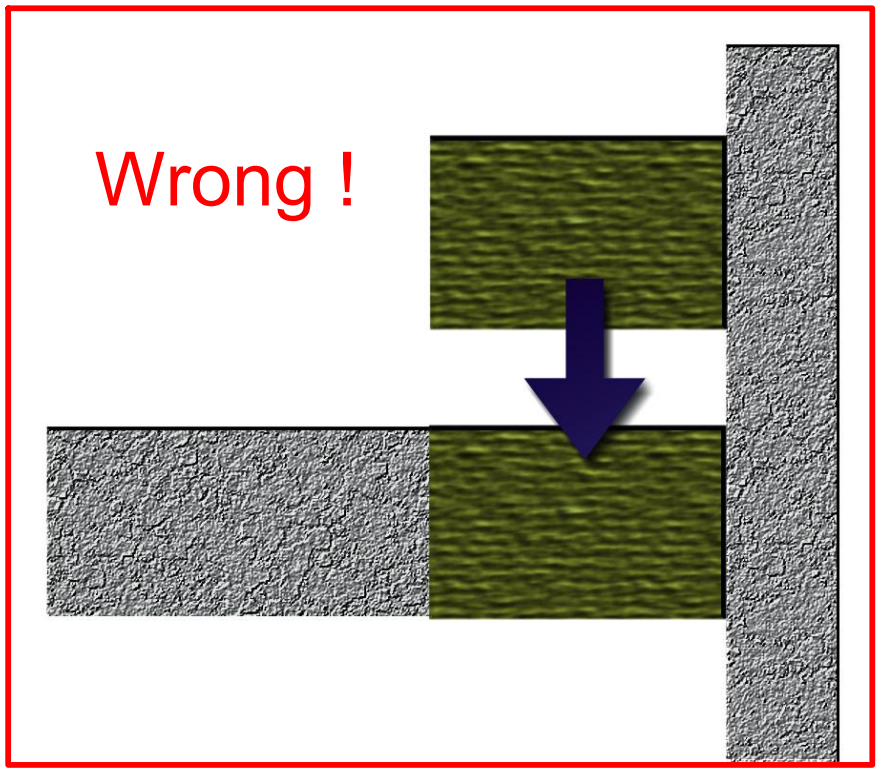
STI Graphic

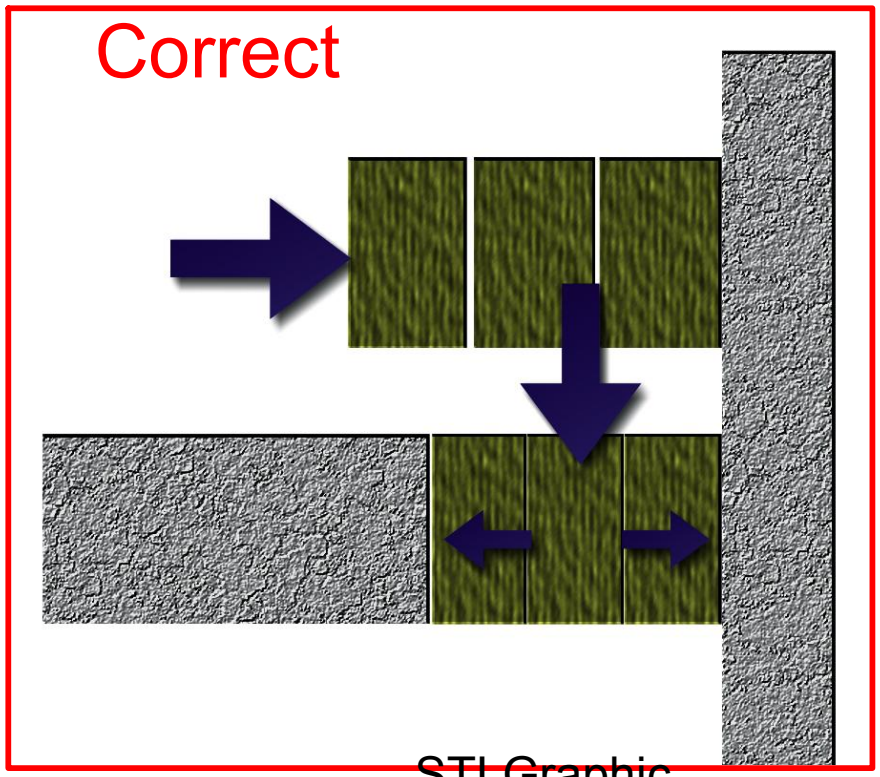


Grace Graphic

Proper Installation of Mineral Wool

- Compressed mineral wool must be inserted perpendicular to the joint to allow for movement between the slab and wall.





STI Graphic

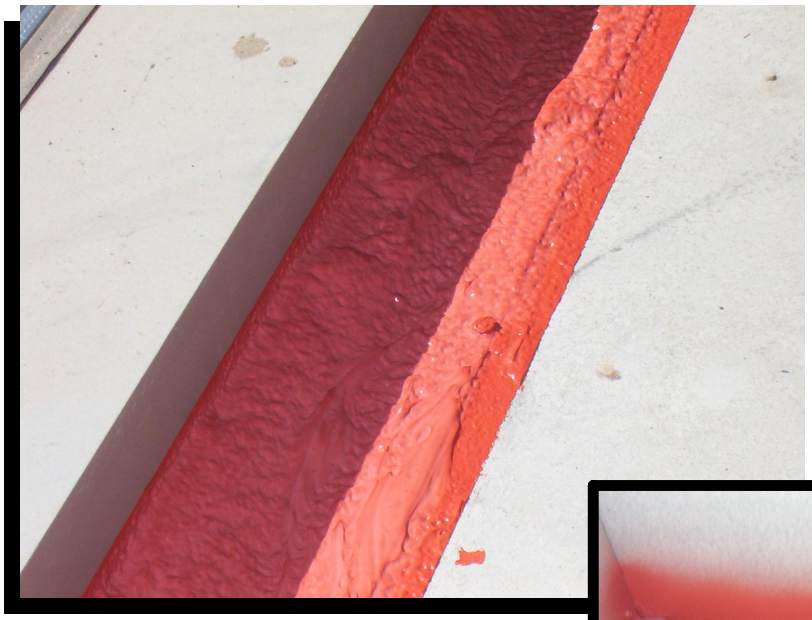

STI Graphic

Properly Installed and Ready to Spray

STI Graphic

Joints and Seams

Edge of Slab

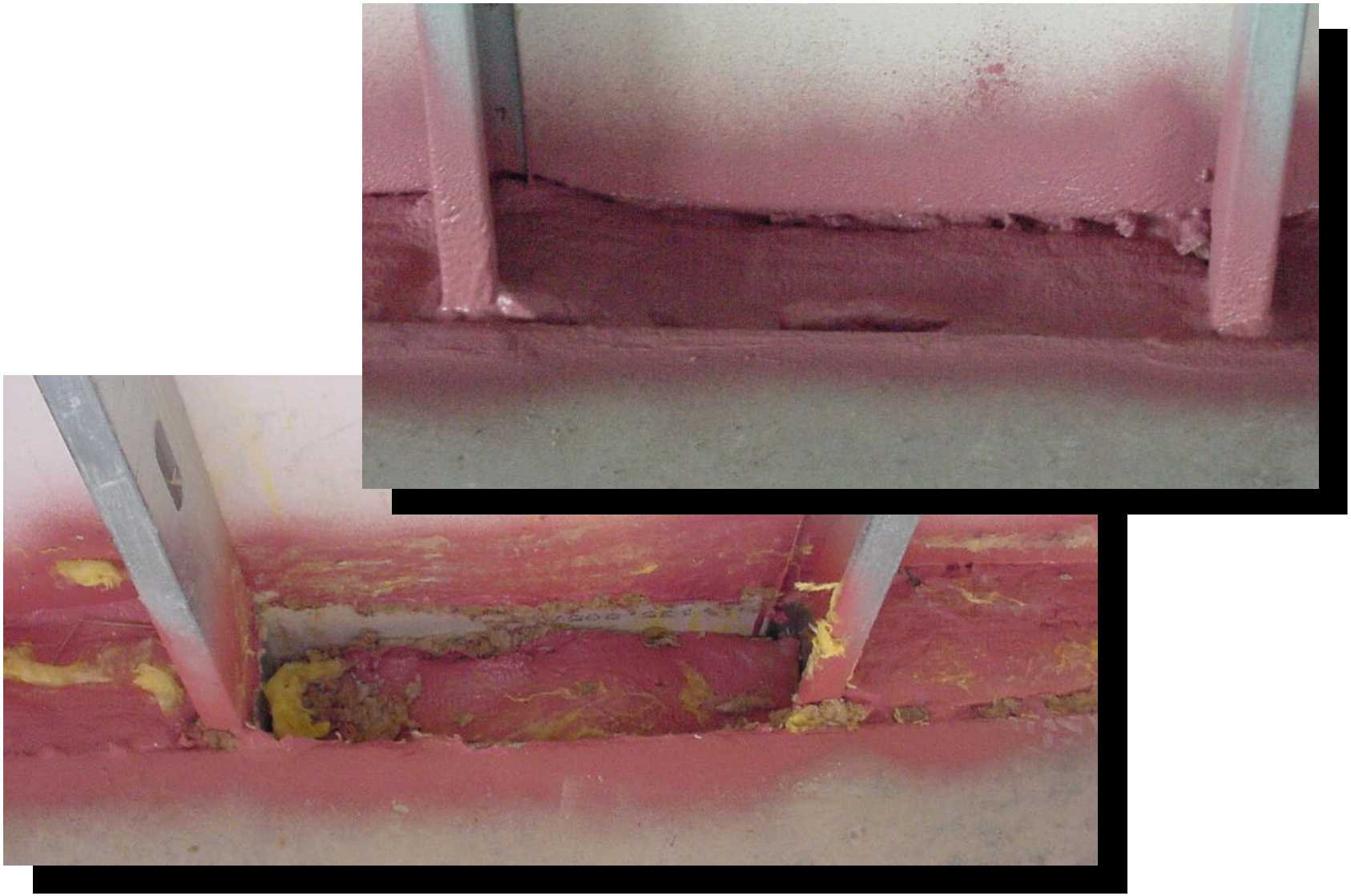


Wall to Wall / Wall to Floor

Caulk and Self Leveling

Floor to Wall: Concrete floor assembly to pre-cast concrete wall assembly

Poor Firestop Installation of Perimeter Barriers



The Firestopping Process

Intertek, 3M Graphic

The Firestopping Process

The Firestopping Process

- ***"Construction Quality Stinks"***

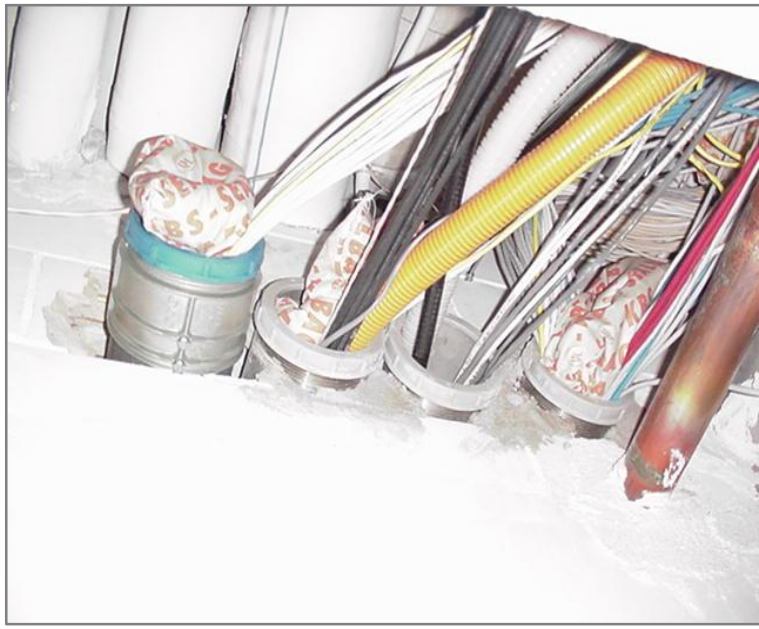
John R. Butler, Jr., Director, Construction Division of the Georgia State Financing and Investment Commission, ***ENR's Viewpoint…***

- ***"Where are the certified firestoppers" Ken Hercenberg, 'The Construction Specifier Magazine'***

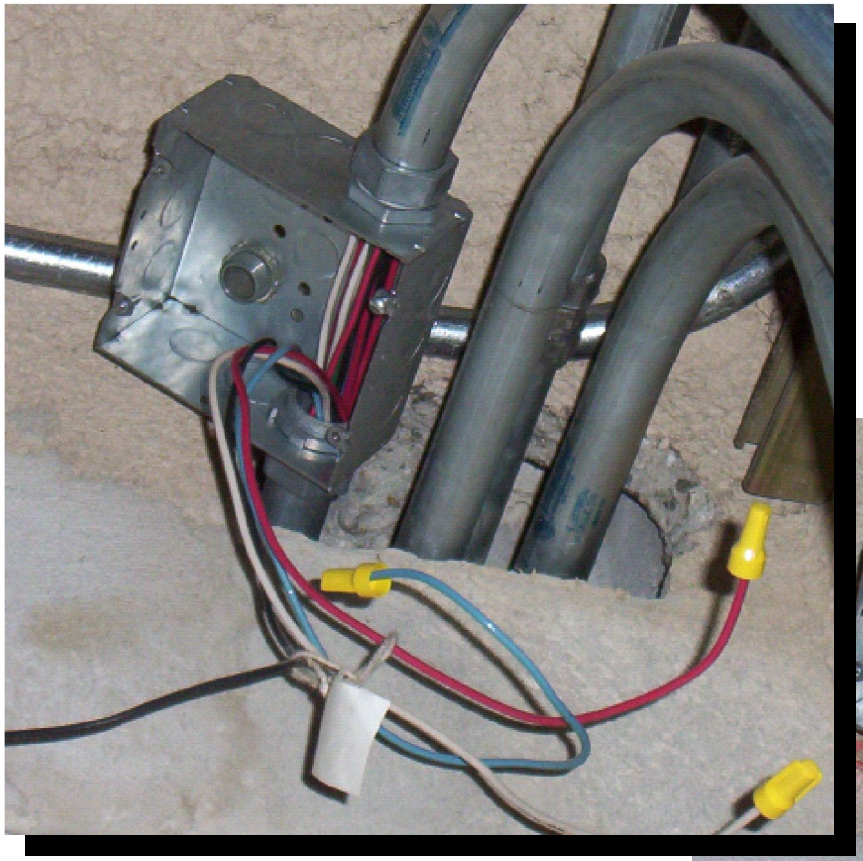
The Firestopping Process

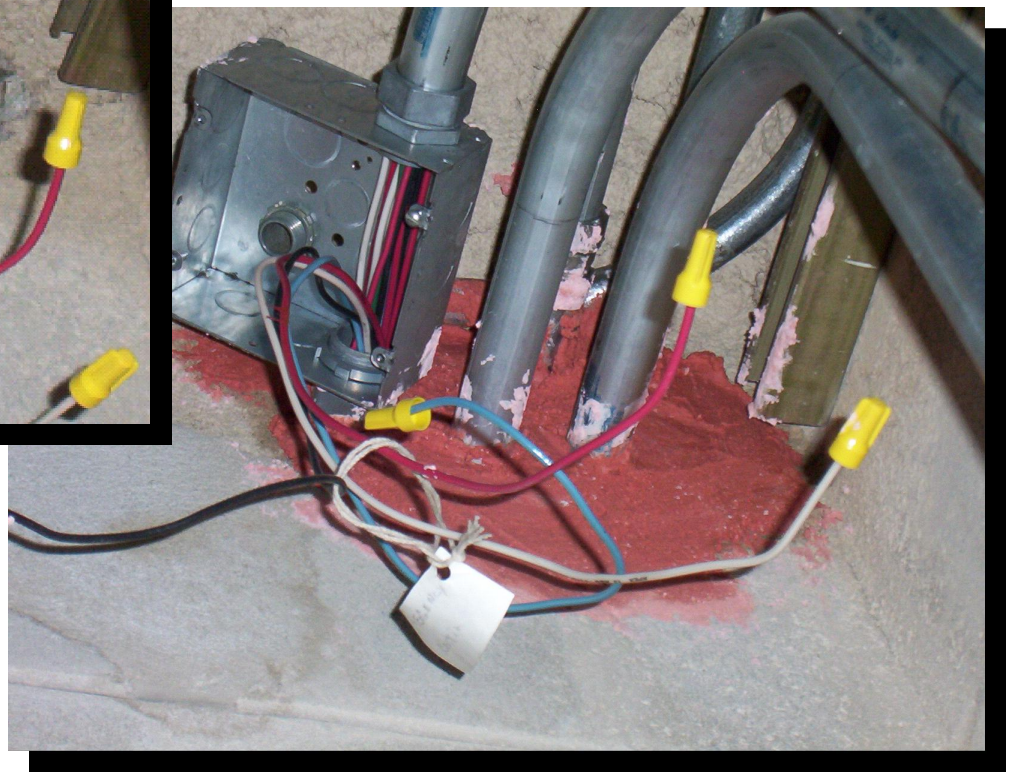
- Results of Non-Qualified Contractor
  - Firestoping wrong, missing
  - Systems Documentation?
  - As Built Documentation??

Conclusion – No Single Firestopping Trade means fire & life safety risk…

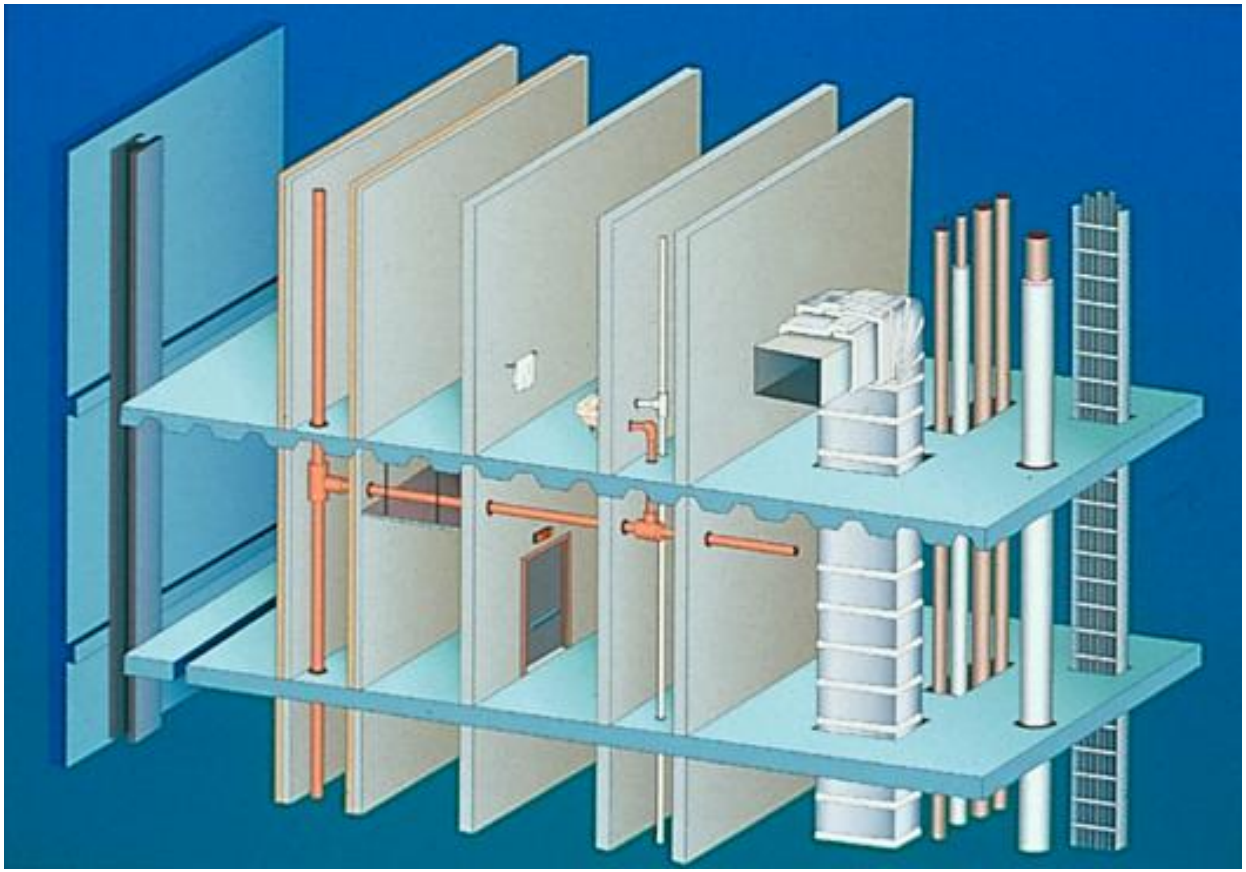


The Firestopping Process





The Firestopping Process
II Installation
Who's Responsible ??



STI Graphic

The Firestopping Process
Firestop Contractors & Installation

- Firestopping Industry Installation Methods
- *3 Types*
  - **All Trades** -"He/She who pokes hole, fills hole"
  - **Multiple Contracts** to Firestop Contractors, Subs,GC/O
  - GC/O - Sub to **Single Source Specialty Firestopping Contractor**
- *Qualifications??*

The Firestopping Process

Qualified - ZERO TOLERANCE PROCESS

- **“F” Fire & “T” Temperature, “H” Hose**
- **“L” Smoke**
- **“W” Water**
- **Insulation/Integrity**
- **Movement Capability**
- **Annular Space Sizes, Gap Sizes**
- **DOCUMENTATION**

The Firestopping Process

FCIA Members, FM Approved, UL Qualified

Zero Tolerance" Quality Control

- Investment in Education
- Investment in Manual of Practice
  - Project Successful Proven Contractor
  - Education, Training, Accountability

= Reduced Risk – Life, Property, Business

www . fcia. org

The Firestopping Process

Quality Process - Contractors

- Designated Responsible Individual (DRI)
- Office Facility & Procedures Audit
- Field Procedures Audit

FM
APPROVED
4991

ULC Underwriters' Laboratories of Canada
Laboratoires des Assureurs du Canada
Qualified Firestop Contractor Program

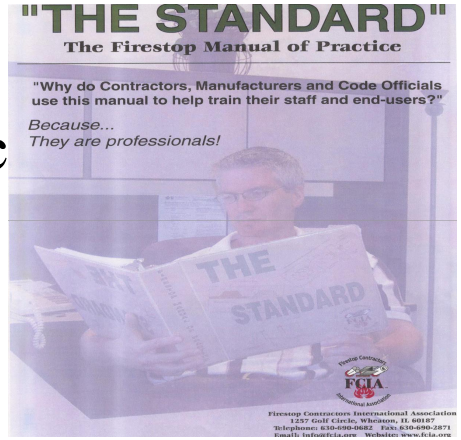
UL Underwriters Laboratories Inc.
Qualified Firestop Contractor Program

The Firestopping Process

UL QFC & FM 4991 Requirements

FM 4991 & UL – DRI's

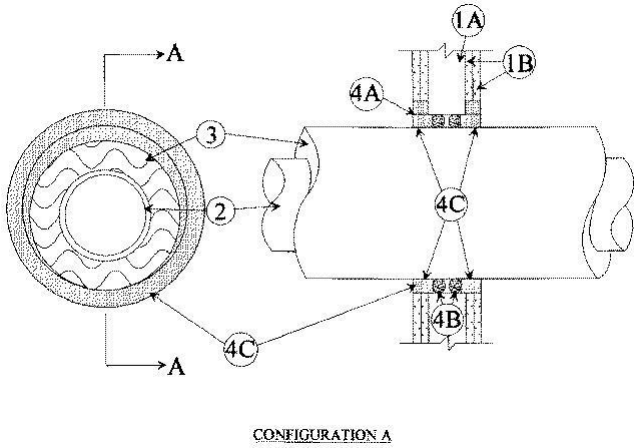
- Pass Rigorous Examination
  - FCIA Manual of Practice
  - Firestop Systems Selection & Protoc
  - Quality Protocol
- Retested every 3 years (FM Only)
- CEU Requirement – 6 ea. 3 yrs.
- One DRI per Approved Contractor Location
  - Installation & Maintenance



The Firestopping Process

Facility and Procedures Audit – Firm Office

- ***Firestopping Firm's Quality Manual***
  - Training & Education
  - Systems Selection
  - Communications to Field
  - Material Controls
  - Systems installation "protocol"
  - Labeling
  - Record keeping - Variance Procedures
  - Non-Conformances
  - Documentation
  - Project closeout



CONFIGURATION A

The Firestopping Process

Initial ***Firm*** Jobsite Audit

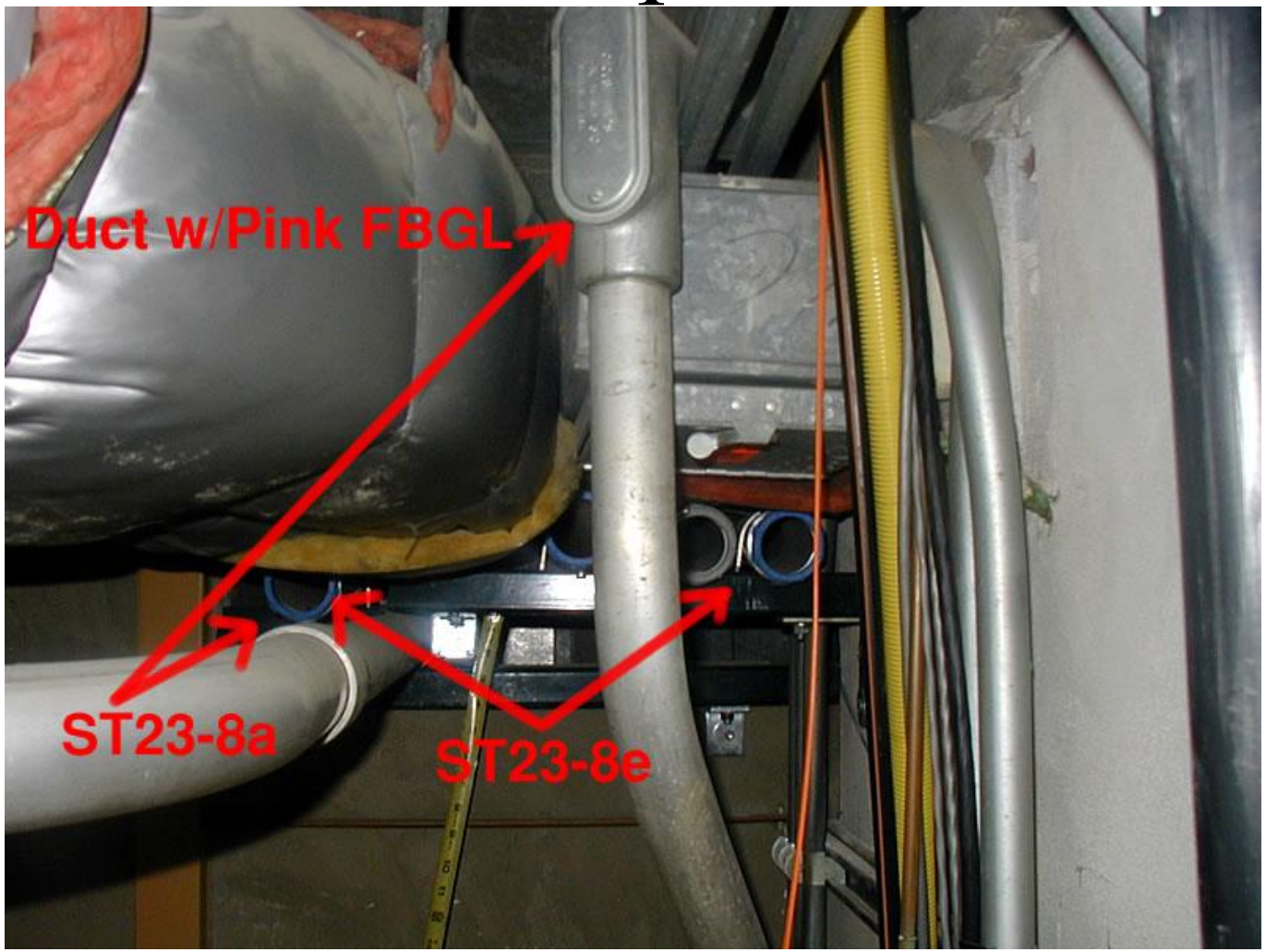
- Verification of firestop systems installation
- Verify Quality Procedures
- Verify “communication”
  - Office to field, field to office
- “Culture of Quality…”

The Firestopping Process

Annual Review

- Continued satisfactory performance
  - Quality Manual
- Documented - Archived record keeping
- Employee Training Documentation
- Jobsite Visit
- DRI CEU Verification

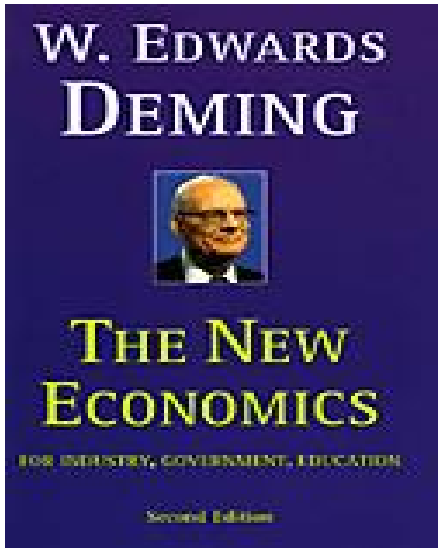
The Firestopping Process
III - Inspection



The Firestopping Process

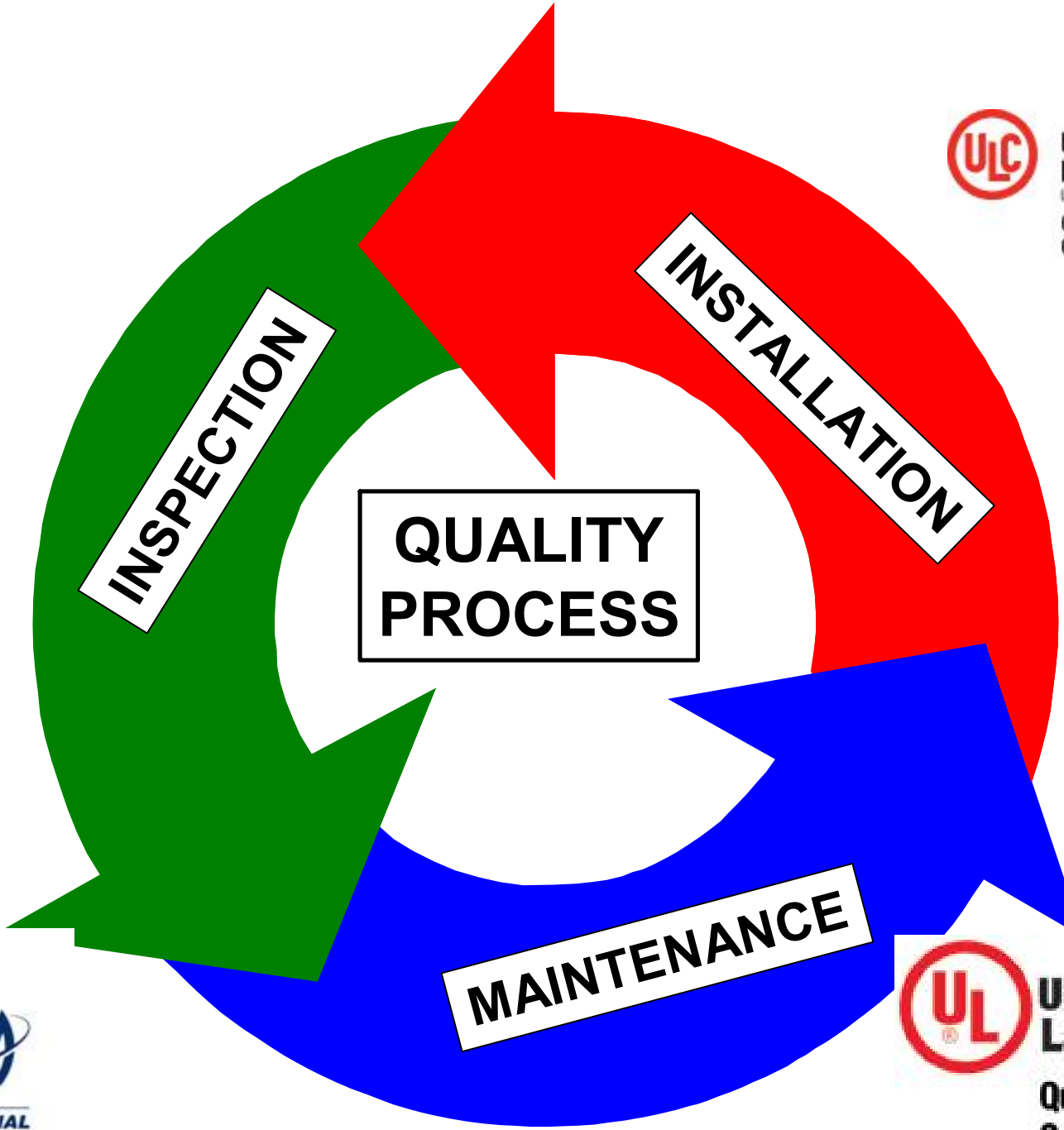
"**Design, manufacture, marketing, service, testing all go on forever in a cycle…..**"

W. Edwards Demming, Quality Expert & Author, "The New Economics"



- ASTM E814, UL S115 Systems,
- Installed by FCIA Member,
- FM 4991 ULQFC Contractor, *Inspected to*
- ASTM E 2174,E 2393 Maintained by FCIA Member Contractor and Building Processes

"The Firestopping Quality Process"



Underwriters' Laboratories of Canada
Laboratoires des Assureurs du Canada
Qualified Firestop Contractor Program

FM
APPROVED
4991

ASTM INTERNATIONAL
Standards Worldwide

Underwriters Laboratories Inc.
Qualified Firestop Contractor Program

The Firestopping Process

- ASTM E 2174 & ASTM E 2393 - "Standard Practice for On-Site Inspection of Installed Fire Stops – Pen's - Joints"
- "Standard Inspection Procedure"
  - Fire Marshals & Code Officials
  - Inspection Firms
  - Architects
  - Other Qualified Firms

The Firestopping Process

- ASTM E 2174/ASTM E 2393 -
  "Inspector Firm Requirements"
  - Inspector NOT Related to Installing firm
    - Distributor, Manufacturer, Competitor, Supplier
  - Meet at least one criteria…..
    - 2 years experience (Construction, Field), education, and credentials acceptable to AHJ
    - Accredited by AHJ
    - Meet ASTM E699
  - FCIA Chairs new committee

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 – "Inspection Process"
  - Pre Construction Meeting
    - Review Documents – Identify Conflicts
    - Materials - ASTM E 814 or UL 1479-S115 Systems
      - "exactly as Identified on inspection documents"

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 – "Inspection Process"
- Pre Construction Meeting
  - Mock Ups
    - Destructive Testing
    - Installation Measurements
  - Discuss Inspection Method
- Required for During/Post Insp. Methods

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 – "Inspection Process"
- During Construction Inspection Method
  - Firestop Installation Start
  - Random witness 10%, each type of Firestop
    - No Less than one

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 – "Inspection Process"
- Post Construction Method –
  - Destructive Testing
    - Minimum 2% , no less than 1, each type per 10,000 SF of floor area
    - If 10% variance per firestop type
      - Inspection stops
      - Installer inspects, repairs
      - Inspector reinspects

The Firestopping Process

- ASTM E 2174/ ASTM E 2393
  "Inspection Process"
- Inspection Forms
  - One for each type of firestop
  - Submit 1 day after inspection to Authorizing Agency
  - Numbered – Controlled
- Required – During/Post Construction Methods

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 –
  "Inspection Process"
- - Final Report – During/Post Inspection Method
  - Name, address, location –
    project, installer, inspector
  - Type and quantity of firestops inspected
  - Verification method
  - Percentage Deviation
  - Copies of all documents sent
    to Authorizing Agency

The Firestopping Process

- ASTM E 2174/ ASTM E 2393 – "Inspection Process"
- Why require ASTM E 2174 / ASTM E 2393
  - Quality Process Cycle
  - Verify Field Installations
  - "Service & Testing"….Demming
  - **Qualifications of Inspectors**
    - FCIA Project

The Firestopping Process

Firestop Contractor Quality

Specifications– 07 84 00… (was 07270)MF95

- 07 84 10 – Through Penetration Firestop Systems
  - Pipes, cables, ducts, cable trays, MEP&C Systems
- 07 84 20 – Fire Resistive Joint Systems
  - Top of Wall
  - Fire Resistance Rated Joints
  - Perimeter Joints (Floor Slab edge/Exterior Wall)
- MF 04 – Multiple Sections

The Firestopping Process

- Specifications– Systems Testing
  - "F" Ratings = Fire Resistance Rated Assy.
  - "T" Ratings = F & T??
  - "H" Ratings – Hose Stream – (Canada)
  - "L" Ratings = Fire & Smoke Resistance Rated Construction
  - "W" Ratings – Floors; Functional when? Floor Loading Capabilities?

The Firestopping Process

- Specifications– Contractor Qualification
  - FCIA Members
    - ***http://www.FCIA . org***
  - FM 4991 Approved Firestop Contractors
  - UL Qualified Firestop Contractors
  - http://www.fcia.org - Specification

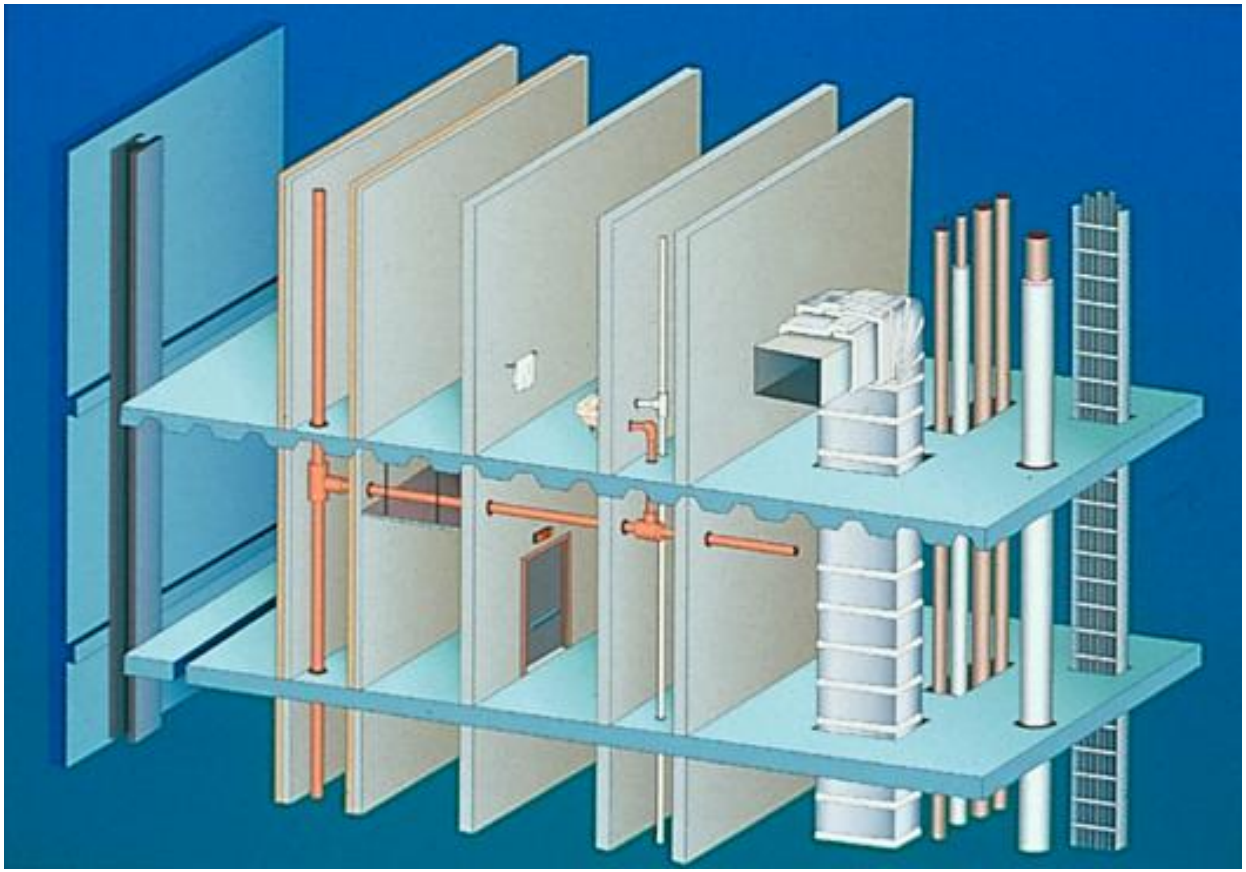
The Firestopping Process

- Specifications– References
  - FM 4991 – Std., Firestop Contractor Approval
  - UL Qualified Firestop Contractor Program
  - ASTM E 2174 & ASTM E 2393
  - FCIA Manual of Practice
  - UL S-115, 1479, ASTM E 814 - Penetrations
  - UL 2079, ASTM E1966 – Joints, Walltops
  - ASTM E 2307 – Perimeter Fire Containment

The Firestopping Process

- Firestopping Quality Process
  - FCIA Member Specialty Firestop Contractors
  - ASTM E 2174 & ASTM E 2393 Inspection
    - Qualifications?
    - FCIA Member Firestop Inspectors
  - Materials – Suitable for applications…

The Firestopping Process
IV Maintenance



STI Graphic

The Firestopping Process

International Fire Code – 2003 & 2006

703.1 Maintenance. The required fire resistance rating of fire-resistance rated construction (including walls, fire stops, shaft enclosures, partitions, smoke barriers, floors, fire resistive coatings and sprayed fire resistant materials applied to structural members and fire resistive joint systems) shall be maintained. Such elements shall be properly repaired, restored or replaced when damaged, altered, breached or penetrated. Openings made therein for the passage of pipes, electrical conduit, wires, ducts, air transfer openings, and hoes made for any reason shall be protected with approved methods capable of resisting the passage of smoke and fire. Openings through fire-resistance rated assemblies shall be protected by self closing or automatic-closing doors of approved construction meeting the fire protection requirements for the assembly.

2007 – 2008 Code Change – "ANNUAL INSPECTION, by owner"

National Building Code of Canada ….

The Firestopping Process

- "TOTAL FIRE PROTECTION
  - Effective Compartmentation -Fire Walls/Floors & Firestopping
  - Fire Dampers, Fire Glass
  - Detection & Alarm Systems
  - Sprinkler Suppression Systems
  - Building Personnel, Occupant and Firefighter Education

The Firestopping Process

Proper ***'DIIM'*** Effective Compartmentation
Means Reliable Systems…

- ***Designed -*** A/E, Firestop Consultant
  - Tested and Listed Systems, FCIA Member Mfr's.
- Properly ***Installed***
  - FCIA Member, "FM 4991, or UL QFC Contractors"
- Properly ***Inspected***
  - ASTM E 2174 & ASTM E 2393 Inspection
- Properly ***Maintained*** –
  - FCIA Member…

FCIA at CSC 2009

Freebies for CSC Member Specifiers, Architects, Building Officials, Building Owners, Government

- ***FCIA Firestop Manual of Practice PDF Email Copy…***
- ***Free Life Safety Digest, the Magazine of Effective Compartmentation Subscription***

FCIA at CSC 2009

More Info??

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