Firestop Plan Review and Inspection Training

Presented by: Brice Miller

Brice Miller

- 25 years as Building Official, Inspector and Plans Examiner with four International Code Council (ICC) Certifications
- Past President of Colorado Chapter of the ICC
- Proposed approved ICC Firestop Inspector Certification and Developed Firestop Presentations for on line training
- Provided firestop training throughout the US for 12 years
- Served as the Executive Director for International Firestop Council for 2-1/2 years

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Outline of Presentation

- Welcome and Introductions
- Fire Blocking and Draftstopping
- Importance
- Balanced Fire Protection
- Code Requirements and Testing
- Recent Firestop Code Changes
- Penetration Firestop Systems
- Joint Systems
- Perimeter Fire Containment Systems
- Review of Special Inspection requirements
- ASTM Firestop Inspection Standards
- Existing Buildings
- Firestopping in the Real World
- Plan Review / Inspection of Firestopping

What is Firestopping?

Which of the Following is the Definition of Firestopping:

A) That expensive red goop with the UL logo on the tube.

B) The process of restoring the hourly rating to fire barrier walls and floors that have lost their fire rating from penetrations, joints and other openings (using materials tested to ASTM E-814 and UL1479.)

C) A huge pain in the neck.

Answer: All of the above

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How Does Firestopping Work?

- Seals a penetration, or joint in a fire-resistive assembly
- Prevents fire from spreading from one side of the assembly through to the opposite side
- Composed of tested elements (“a system”) to stop fire and hot gases for a prescribed period of time

Fireblocking and Draftstopping

Draftstopping

- To divide a large concealed spaces into smaller compartment (Intent: limit the movement of air w/n the cavity, reducing the potential for rapid fire spread)

Fireblocking

- Installed within concealed spaces to resist or block the migration of fire and hot gases to isolate movement from vertical to horizontal areas

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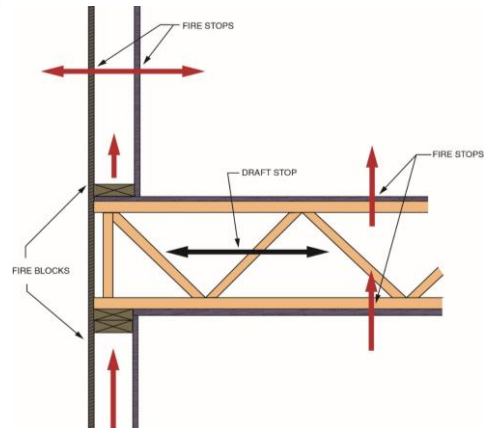
Firestopping , Fireblocking and Draftstopping



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Who's Responsible for Making Certain Firestopping is code compliant?

- Owner
- Design Professional
- Manufacturer
- General Contractor
- Installer
- Plans Examiner
- Firestop Inspector

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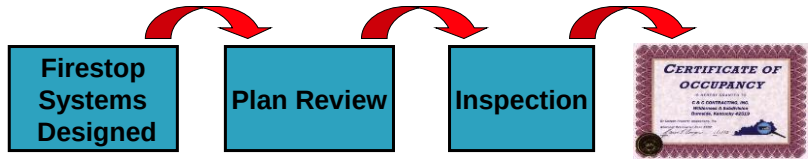
FIRESTOP PROCESS

1. Designed
2. Plan Review
3. Installation
4. Inspection
5. Maintenance



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International Code Council Certified Firestop Inspector?

- The International Code Council (ICC) has approved a new Firestop Inspector Certification that should be implemented in the near future. **OR?**

ICC
INTERNATIONAL CODE COUNCIL

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Course Objectives:

- Plan Review and Firestopping
- Require firestop submittals
- Impact of firestop inspections according to NEW ASTM Standards
- Review firestop inspection tips and techniques
- Recognize common firestop system code violations and provide solutions
- To become comfortable with requirements for inspection of all firestop systems
- Assist code officials with level of firestop enforcement
- Review methods of firestop inspections

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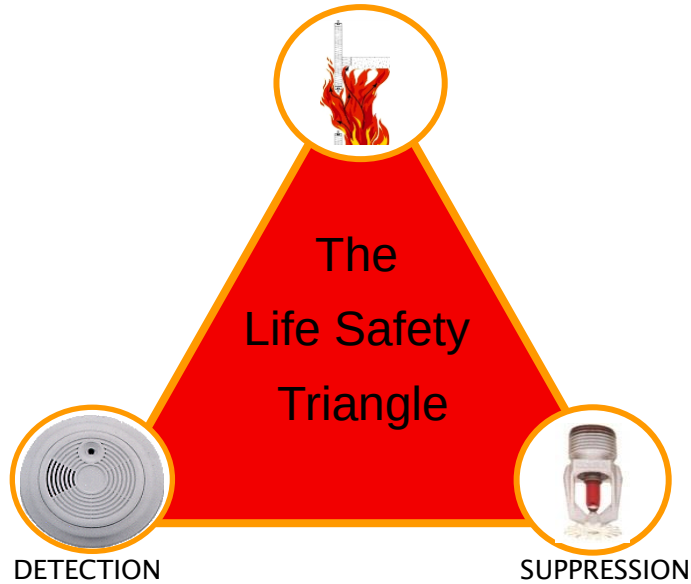
COMPARTMENTATION



DETECTION

SUPPRESSION

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MGM Grand Fire – 1980

- Fire occurred on 1st floor
- Fire never left 1st floor
- 14 victims in casino area
- 64 victims found 20 – 25 floors above
- Total deaths – 84

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Las Vegas Hilton Fire – 1981


HILTON BURNS

Hotel Fire Kills 8; Hundreds Injured

Las Vegas SUN

Nightmare Blaze Spawns Tales Of Horror

- Fire originated on multiple floors from arson
- Fire spread from 8th to 23rd floor in 25 minutes
- Carpet on walls and ceiling of elevator lobbies contributed to rapid spread of fire
- Fire spread through perimeter joints and on exterior of building

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First Interstate Bank – 1988

- On May 4, 1988 a fire occurred on the 12th floor extending to 16th floor (62 story high-rise):
  - "The lack of firestopping between the floor slabs and the skin permitted the fire to spread from floor to floor through this space. Fire was observed spreading through this area even before the glass and mullions failed."
  - "The fire extended upward by…non-firestopped openings between the floor slab and the skin."
  - "The vertical spread was also through poke-through, pipe recesses, and utility shafts."
  - "The automatic sprinkler system was drained and building fire pumps shut off at time of fire."

  Source: Chapman, Elmer F. "High-Rise: An Analysis," Fire Engineering", August 1988.

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Legal Cases

- American States Ins. vs. Hannan Construction
  - Builder allegedly failed to Firestop open plenum
  - Builder found negligent
- Sunlake Apt. Residents vs. Tonti Development
  - Fire destroyed building, residents sued
  - Architect settled then sued government inspectors
- One Meridian Plaza Businesses vs. Owner
  - Fire destroyed 40-story building
  - Tenants and near-by businesses sued owner
  - Building owner sued government officials & GC

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Sprinklers suppress flames, NOT smoke & gasses

75% of all fire deaths are caused by smoke inhalation.

Source: Hall, Jr. John R. NFPA Fire Analysis & Research, Quincy, MA. "Burns, Toxic Gases, and other Hazards".

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Containment in Construction

- Fire-resistance-rated assemblies
  - *Fire Walls – 706*
  - *Fire Barriers – 707*
  - *Fire Partitions – 708*
  - *Smoke Barriers – 709*

  - Family of Walls and firestopping
    - Fire wall is most restrictive and fire Partitions is the least restrictive
    - Fire Barriers include shafts and exit Passageways
    - All Walls have different types of ratings and usages
    - Smoke partitions require joints and penetrations to be filled with an approved material.

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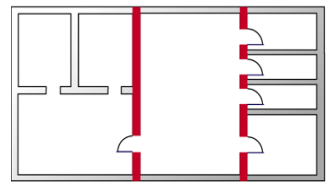
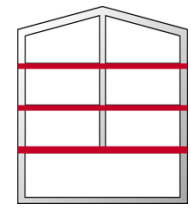
Contain fire, smoke and toxic gases to the point of origin

- Create compartments with fire-resistive walls and floors
- Increases Time Available to Escape (TAE)
- Increases number of escape routes
- Increases structural safety for fire fighters
- Limit property loss

Fire/Smoke Barriers





Fire floors

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Containment In Construction

Through-Penetrations

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Containment in Construction

Membrane-Penetrations

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Containment In Construction

Construction Joints

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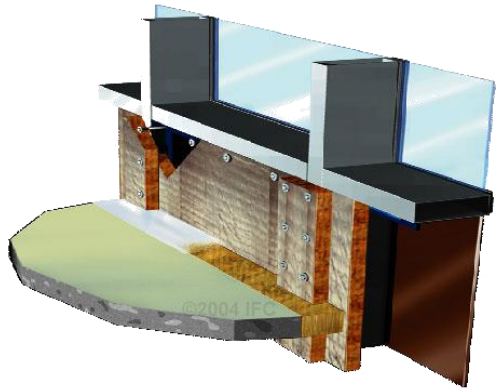
Containment In Construction

Perimeter Containment



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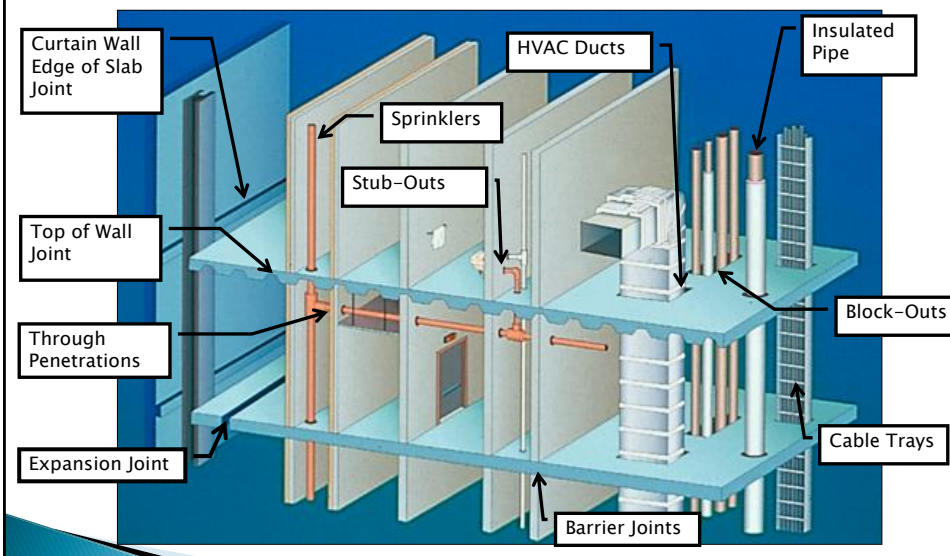
Firestopping needed in many Applications



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International Building Code requires firestop systems to be used in the below locations:

- Fire-resistance-rated wall assemblies
- Fire-resistance-rated floor and roof assemblies
- Joints in fire-resistance-rated assemblies
- Perimeter exterior wall systems

Code Requirements – Firestopping

Minimum requirements for New Construction & Maintenance

- International Building Code – Chapter 7
  - New Construction
- International Fire Code – Chapter 7
  - Existing Buildings
- NFPA 101 – Chapter 8
- NFPA 1 – Chapter 12

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International Fire Code (IFC)

Inspection during life of a building

- **703.1 Maintenance.** The required fire-resistance rating of fire-resistance-rated construction (including walls, firestops, shaft enclosures, partitions, smoke barriers, floors, fire-resistive coatings and sprayed fire-resistant materials applied to structural members and fire-resistant joint systems) shall be maintained.
- 2009: Such elements shall be visually inspected by the owner annually and properly repaired, restored or replaced when damaged, altered, breached or penetrated.

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Firestop Code Requirements – IBC Submittals

- Code provisions provide clear direction for inclusion information on the plans.
  - **107.2.1.** Information on Construction Documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this codes
  - **107.3.4.1 Deferred submittals.** Deferred submittals are defined as those portions of the design that are not submitted at the time of the application and that are to be submitted to the *building official within a specified period.*
  - ***Typically approved* prior to the start of Firestop system installation**

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Firestop Code Requirements
Special Inspections

- **1705.17**. Fire-resistant penetrations and joints. In high-rise buildings or in buildings assigned to *Risk Category III or IV* in accordance with Section 1604.5, special inspections for through-penetrations, membrane penetration firestops, fire resistant joint systems, and perimeter fire barrier systems that are tested and listed
- **1705.1.1 Special cases.** *Special inspections shall be* required for proposed work that is, in the opinion of the *building official, unusual in its nature*
- ASTM standards required in Section 1705.16 for inspection procedures (E2174-04 and E2393-04)

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UL / IFC Video

- **"CLOSE ENOUGH IS NOT GOOD ENOUGH":** A Demonstration of Proper vs. Improper Firestopping

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Code Requirements – IBC

International Building Code Firestop Test Standards

	IBC
Through Penetration	ASTM E814 UL 1479
Joints	UL 2079 ANSI 2079
Perimeter Barriers	ASTM E2307

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Intertek Intertek FM SwRI

Third Party Testing Labs

Underwriters Laboratories Inc.

Intertek (Warnock Hersey & ETL)

FM Global (Factory Mutual)

Southwest Research Institute

Labs Test to Standards

American Society of Testing and Materials (ASTM)

Underwriters Laboratories Inc. (UL)

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Through-Penetration Test
Before

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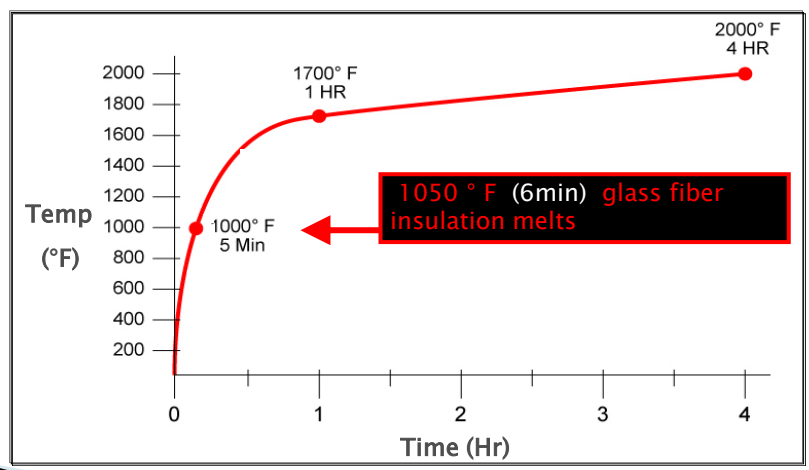
Time – Temperature Curve



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Through-Penetration Test
After

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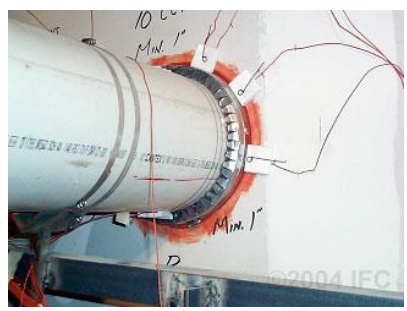
Example of Successful Testing

Construction – 4" PVC Through Drywall

Firestopping – Intumescent Device & Sealant



Before

After

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ASTM E 814 / UL 1479 Test Standards for Through Penetration Firestop Systems

F-Rating
The duration of time in which flames must not pass through the system

T-Rating
The time it takes for the non-fire side to reach 325°F

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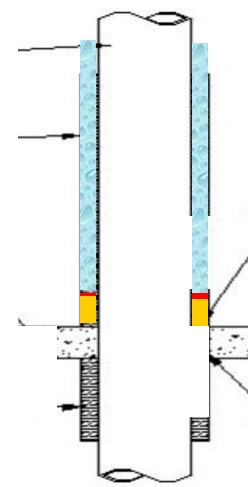
ASTM E 814 / UL 1479 Test Standards for Through Penetration Firestop Systems

- L-Rating
- Rate of air leakage through the system at ambient and 400°F
- Measured in CFM/sq. ft. The lower the number, the better.

- W-rating (currently optional)
- the ability of a system to restrict the flow of water
- Class 1-rated systems resist a 3 foot water column for 72 hours



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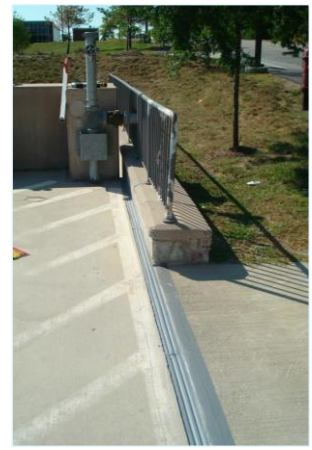
Systems with a W rating



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Conditioning Prior to Fire Test

Movement Class	Min. No. of Cycles	Min. Cycling Rate (Cycles / Minutes)
Class I (Thermal)	500	1
Class II (Wind Sway)	500	10
Class III (Seismic)	100	30

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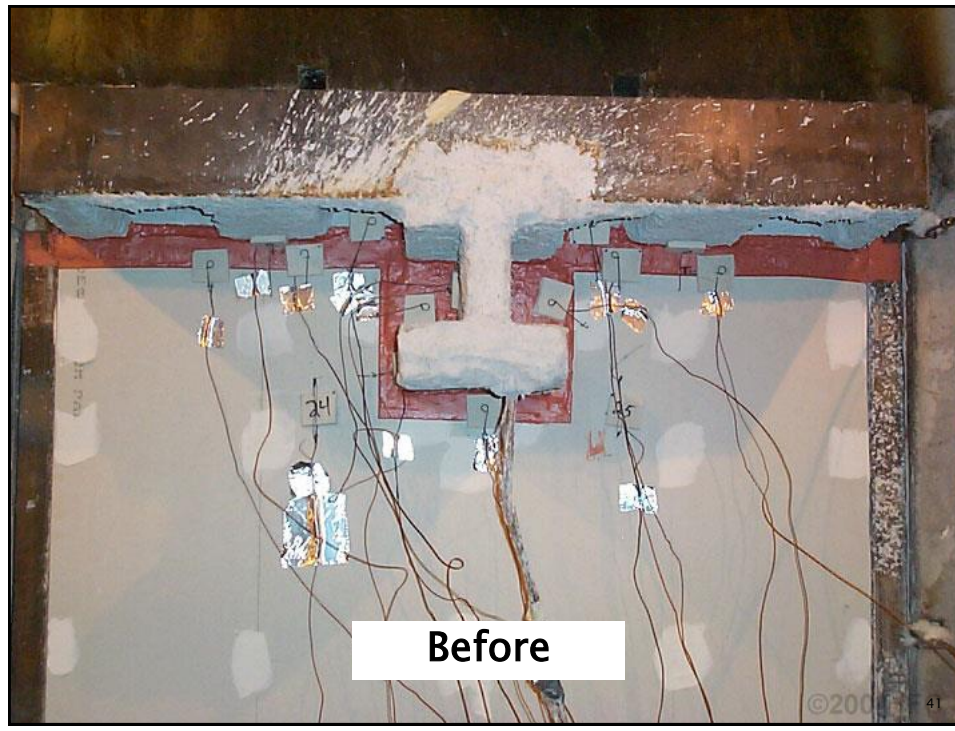
Before
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After Fire Exposure
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Evaluating Firestopping

It is all about the SYSTEMS

Points to remember

- Firestop materials are not systems
- Systems employ Firestop materials
- Products do not receive ratings, "Systems Do"

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What are Some Variances to Tested and Listed Systems?

- Too many penetrating items
- Annular space/gap too large or too small
- Joint width
- Movement
- Oversized penetrating item
- Oversized Insulation
- Backing material

Types of Approved Firestopping

There are two kinds of Classifications:

•*TYPICAL (Tested and Listed)*: Those for which a third-party tested system exists.

•*Engineering Judgement:* Those unique conditions when tested systems do not exist.

Engineering Judgments

- An Engineering Judgment is a letter or report issued by some knowledgeable party which evaluates the construction of some site-specific application which deviates from a tested design, system or assembly and concludes with a judgment of the applicable rating of that assembly
- Engineering Judgments are commonly called EJ's.
- They are also known as:
  - *Certificate of compliance*
  - Engineering *recommendations*
  - *Alternative solutions*

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IBC References Justifying Engineering Judgments

- IBC 104.11 Alternative materials, design and methods of construction and equipment
- IBC 703.2 Fire-resistance ratings
- IBC 703.3 Alternative methods for determining fire resistance

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Who Issues Engineering Judgments?

- Professional engineer
- Fire protection engineer
- Manufacturer
- Testing laboratory

- Must be acceptable to the Building Official or the AHJ

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When are they acceptable?

- When tested *systems do not exist*.
- When modifying the application is unrealistic.
- When existing test data supports the interpolation.
- When the author has experience with the performance of the system and knowledge of the conditions.
- When issued only for a specific jobsite

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IFC Guidelines

- Two Documents
  - Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)
    - Covers firestops, joint systems and grease/air duct assemblies
  - Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs) – Perimeter Fire Barrier Systems
    - Covers perimeter fire barriers systems (a.k.a. perimeter fire containment systems or perimeter joints)

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Questions and General info on EJ's

- Should field inspectors approve Engineering Judgments?
- Is it ever appropriate to accept an Engineering Judgments if there are other tested listed systems?
- If develop policy for EJ's consider charging for each EJ that you review.

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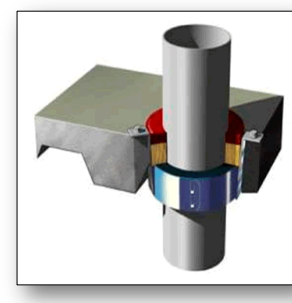
Penetration Firestop System

Consists of:

- Assembly being penetrated
- Penetrating item
- Fill, void or cavity materials (firestopping materials)



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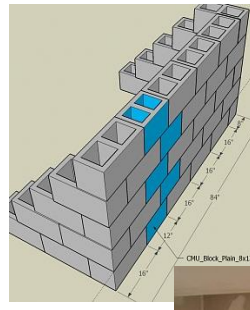
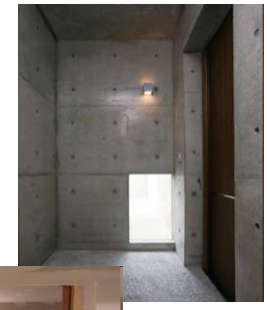
1st Part of a Listed Firestop System:





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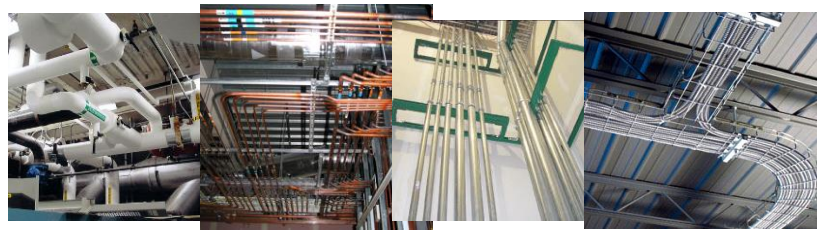
2nd Part of a Listed Firestop System:



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3rd Part of a Listed Firestop System:

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Firestop System Materials

- Sealants
  - Silicone, Latex, Intumescent
- Wrap Strips
  - "Thick, Thin, Wide, Less Wide"
- Putties
- Pillows
- Composite Sheets
- Bricks / Plugs
- Pre Fabricated Kits
- Mortar
- Spray Products

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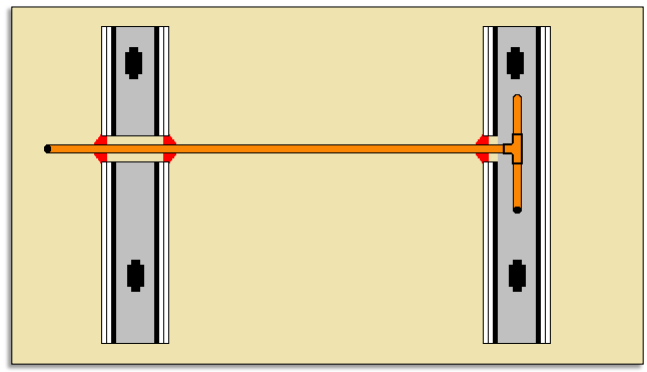
Through and Membrane Penetrations



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Conditions of Acceptance T Rating

- No Passage of Flame
- Not to exceed 325°F Temperature Rise
- Hose Stream

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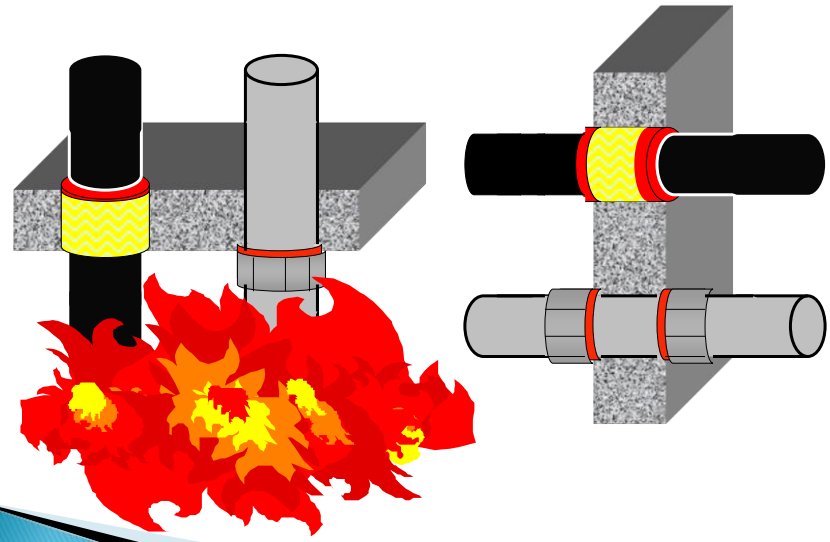
IBC – T Rating



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IBC – T Rating

- Required for through- or membrane-penetrations of horizontal assemblies only
- Floor penetrations contained and located within the cavity of a wall either above or below the horizontal assembly do not require a T rating
- Methods for achieving a T Rating include:
  - Wrap metallic pipe with mineral wool or ceramic insulation
  - A listed device around metallic pipe that will cool pipe during a fire

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Sprinkler Pipe Considerations

Metallic Sprinkler Pipe Penetrations:

- NFPA 13 Annular Space Limitations in Seismic Regions
  - If pipe ≤ 3.5", hole diameter shall be 2 in. larger than nominal pipe diameter
  - If pipe ≥ 4", hole diameter shall be 4 in. larger than nominal pipe diameter

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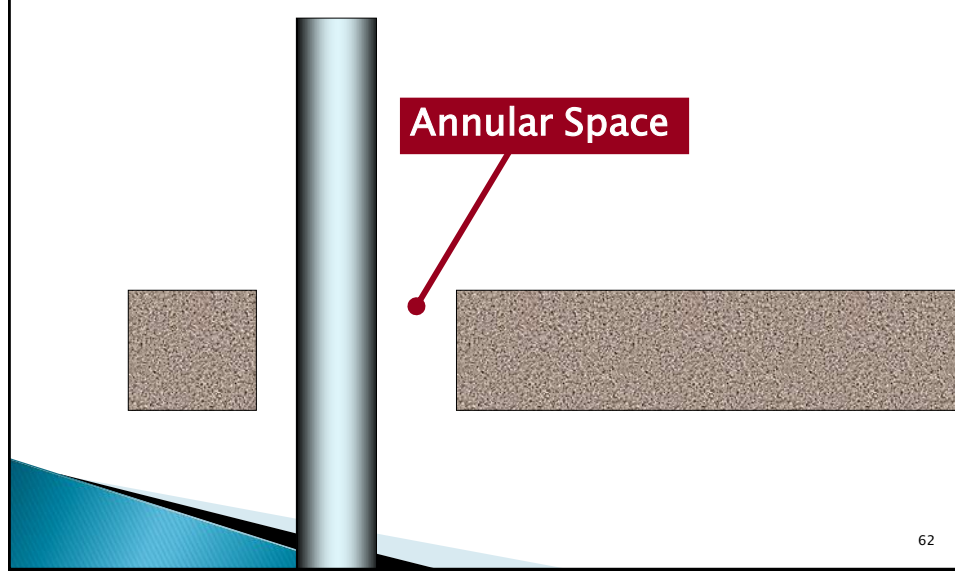

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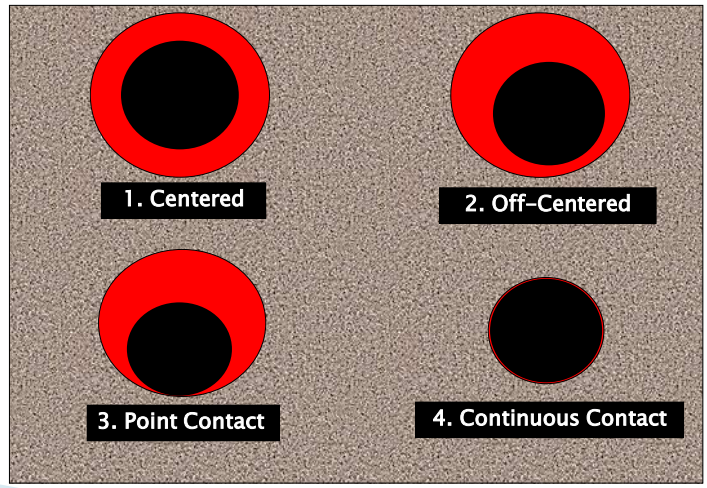
Typical Annular Space



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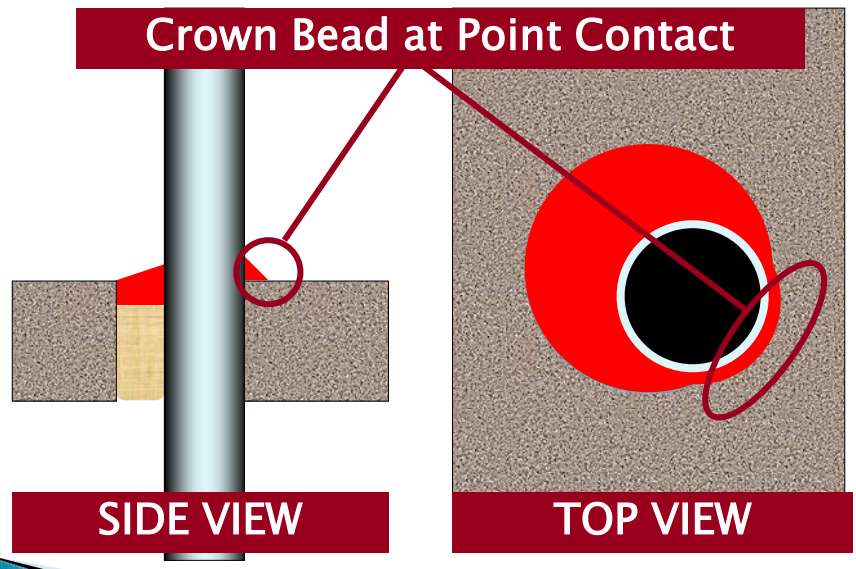

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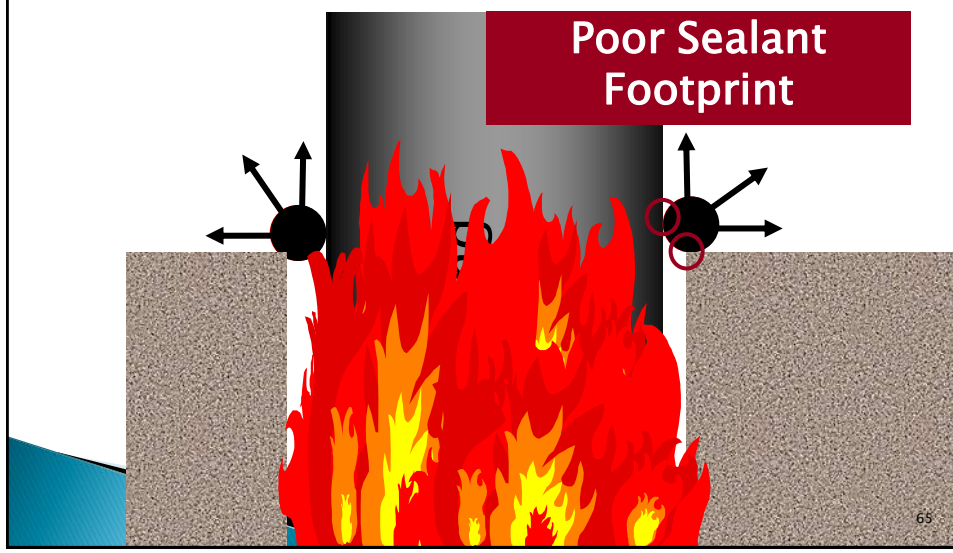
Untooled sealant on the surface will likely fail



Properly recessed and tooled sealant will expand inward as designed.

Properly Tooled Penetrations

- The Firestop sealant must be well bonded to penetrating item and surrounding wall or floor
- Should always inspect both sides

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Sleeves

Sleeves are commonly used where penetration needs to be removed or changed frequently

- The sleeve need to be securely fastened to assembly
- Both the space between penetrant and annular space needs to be firestopped

Steel Collars and Intumescent Wrap Strips

- Intumescent sealant expands and fills the void
- The collar expands to crush pipe

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Evaluating a Penetration

It is all about the
SYSTEMS

Points to remember:

- Firestop materials are not systems
- Systems employ firestop materials
- Products do not receive ratings, "Systems Do"

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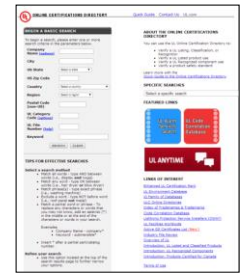
Where Can I Find The Most Current Listings?

www.intertek.com/directories/etl-listed-mark/

www.ul.com/database



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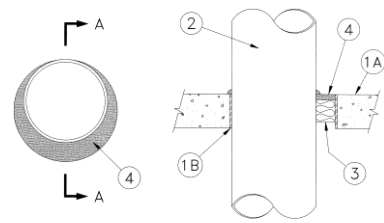
SYSTEM No. C-AJ-1379

F Ratings – 3 Hr
T Ratings – 0 Hr



SECTION 'A–A'

1A. Floor or Wall Assembly – Min 4-1/2 in. thick reinforced normal weight (150 pcf) concrete. Wall may also be constructed of any UL classified **Concrete Blocks***. Max diam of opening is 26-1/2 in.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Rating Directory for names of manufacturers.

1B. Metallic Sleeve (optional) – Nom 16 in. (or smaller), Schedule 10 (or heavier) steel pipe sleeve, cast or grouted into floor or wall assembly.

2. Through Penetrants – One metallic pipe or tubing to be installed concentrically or eccentrically into opening such that the annular space between the pipe and the periphery of the opening is min 0 in. (point of contact) to max 2-1/2 in. Pipe to be firmly supported on both sides of opening. The following types and sizes of pipes may be used:

(a) Nom. 24 in. diam (or smaller) Schedule 30 (or heavier) steel or iron pipe.
(b) Nom. 4 in. diam (or smaller) electrical metallic tubing.

3. Packing Material – Mineral wool insulation of min 4 pcf firmly pressed into opening as a permanent form. Insulation material to be recessed by min depth of 1/2 in. from top surface of floor or both surfaces of wall.

4. Fill, Void, or Cavity Materials* – **Caulk** – Min 1/2 in. thickness of fill material applied within the annulus, flush with top surface of floor or both surfaces of wall. A min 1/4 in. crown of the caulking material shall be applied around the entire circumference of the pipe at the level of the floor surface or both wall surfaces.

Company ABC – SuperDuper Sealant

* Bearing the UL Classification Marking.

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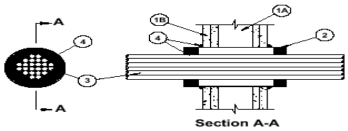
For the Contractor



UL Systems serve two roles:

1. **Wall Assembly** — The 1 or 2 hr fire-rated gypsum wallboard/ stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   - A. **Studs** — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-5/8 in. wide and spaced 24 in. OC.
   - B. **Wallboard, Gypsum*** — 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickne... ...dividual U300 or U400 Series...

   The hourly ... mbly in which it is installed.

1) Evidence of compliance

2. **Steel Sleeve** — Nom 4 in. diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe friction-fit into wall assembly. Sleeve installed such that the ends project 1-1/2 to 2 in. beyond each side of the wall.
3. **Cables** — Aggregate cross-sectional area of cables in sleeve to be max 48 percent of the cross-sectional area of the sleeve. Tight bundle of cables to be centered within the steel sleeve. The annular space within the firestop system shall be a nom 1/2 in. Cables to be rigidly supported on both sides of the wall. Any combination of the following types and sizes of cables may be used:
   - A. Max 2... ...jacketing and insulat...
   - B. Max 3... ...PVC insulation and jacket.
   - C. Max 3... ...s, PVC insulation and jacket.
   - D. Max 7/C No. 2/0 AWG (or smaller) multiconductor power and control cables with XLPE or PVC insulation and XLPE or PVC jacket.
   - E. Max RG59/U (or smaller) coaxial cable with fluorinated ethylene insulation and jacketing.
   - F. Max 62.5/48 fiber optic cable with PVC insulation and jacketing.
   - G. Max 4 pair No. 24 AWG (or smaller) copper conductor data cable with Hylar insulation and jacket.

2) A set of build-instructions

4. **Fill, Void or Cavity Material* — Putty** — Min 1 in. thickness of fill material applied within annulus, flush with both ends of sleeve. A nom 1/4 in. diam continuous "rope" of putty shall be applied around the circumference of the steel sleeve at its egress from both sides of the wall.
   Specified Technologies Inc. — SpecSeal Putty
5. **Fill, Void or Cavity Material* — Sealant** — As an option to the "rope" of putty, a min 1/4 in. diam bead of sealant may applied at the gypsum wallboard/steel sleeve interface on both sides of the wall.
   Specified Technologies Inc. — SpecSeal Series 100 or Series LC Sealant

*Bearing the UL Classification Marking

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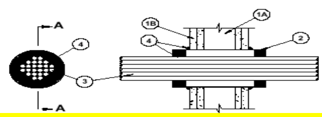
For the Building / Fire Official



UL Systems serve two roles:

T Ratings — 0 Hr

1) Evidence of compliance

2) Document by which to inspect

1. **Wall Assembly** — The 1 or 2 hr fire-rated gypsum wallboard/ stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   - A. **Studs** — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. l...
2. **Steel Sleeve** — Nom 4 in. diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe friction-fit into wall assembly. Sleeve installed such that the ends project 1-1/2 to 2 in. beyond each side of the wall.
3. **Cables** — Aggregate cross-sectional area of cables in sleeve to be max 48 percent of the cross-sectional area of the sleeve. Tight bundle of cables to be centered within the steel sleeve. The annular space within the firestop system shall be a nom 1/2 in. Cables to be rigidly supported on both sides of the wall. Any combination of the following types and sizes of...
   - D. Max 7/C No. 2/0 AWG (or smaller) multiconductor power and control cables with XLPE or PVC insulation and XLPE or PVC jacket.
   - E. Max RG59/U (or smaller) coaxial cable with fluorinated ethylene insulation and jacketing.
   - F. Max 62.5/48 fiber optic cable with PVC insulation and jacketing.
   - G. Max 4 pair No. 24 AWG (or smaller) copper conductor data cable with Hylar insulation and jacket.
4. **Fill, Void or Cavity Material* — Putty** — Min 1 in. thickness of fill material applied within annulus, flush with both ends of sleeve. A nom 1/4 in. diam continuous "rope" of putty shall be applied around the circumference of the steel sleeve at its egress from both sides of the wall.
   Specified Technologies Inc. — SpecSeal Putty
5. **Fill, Void or Cavity Material* — Sealant** — As an option to the "rope" of putty, a min 1/4 in. diam bead of sealant may applied at the gypsum wallboard/steel sleeve interface on both sides of the wall.
   Specified Technologies Inc. — SpecSeal Series 100 or Series LC Sealant

*Bearing the UL Classification Marking

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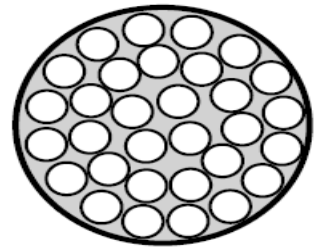
Fig. 2: Cable Loading...

Visually Full... Half Empty By Calculation!



Let's calculate the cable loading of this opening:

Diameter of Opening = 4″

Diameter of Cables = 5/8″ (.625″)

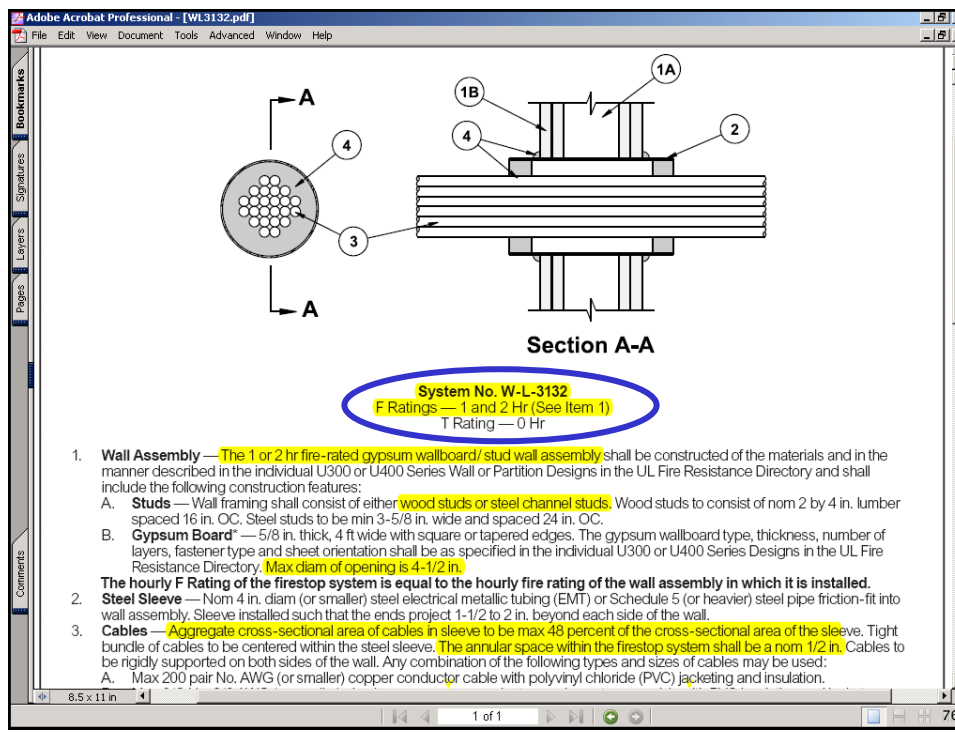
Number of Cables (N) = 21

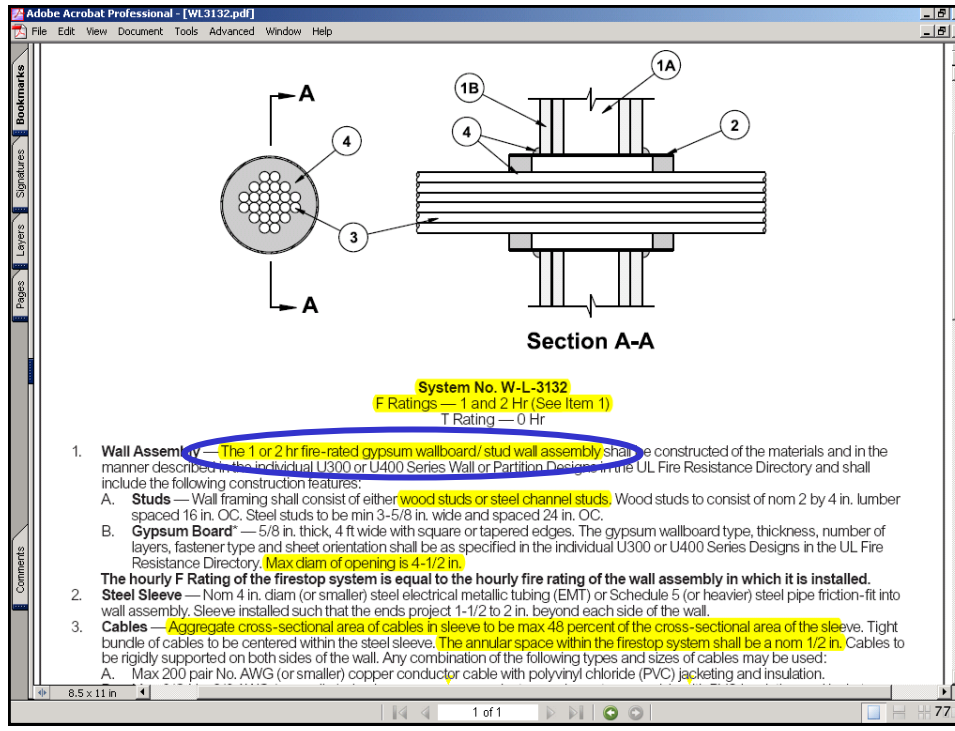
Area of Opening (A) = πr^2 or $3.1416 \times 2^2 = 12.57$ sq. in.

Area of Cables (C) = πr^2 or $3.1416 \times .3125^2 = .307$ sq. in.

Cable Loading = $\frac{C \times N}{A} = \frac{.307 \times 21}{12.57} = 51\%$

75




Adobe Acrobat Professional - [WL3132.pdf]
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Bookmarks
Signatures
Layers
Pages
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A
A
1A
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2
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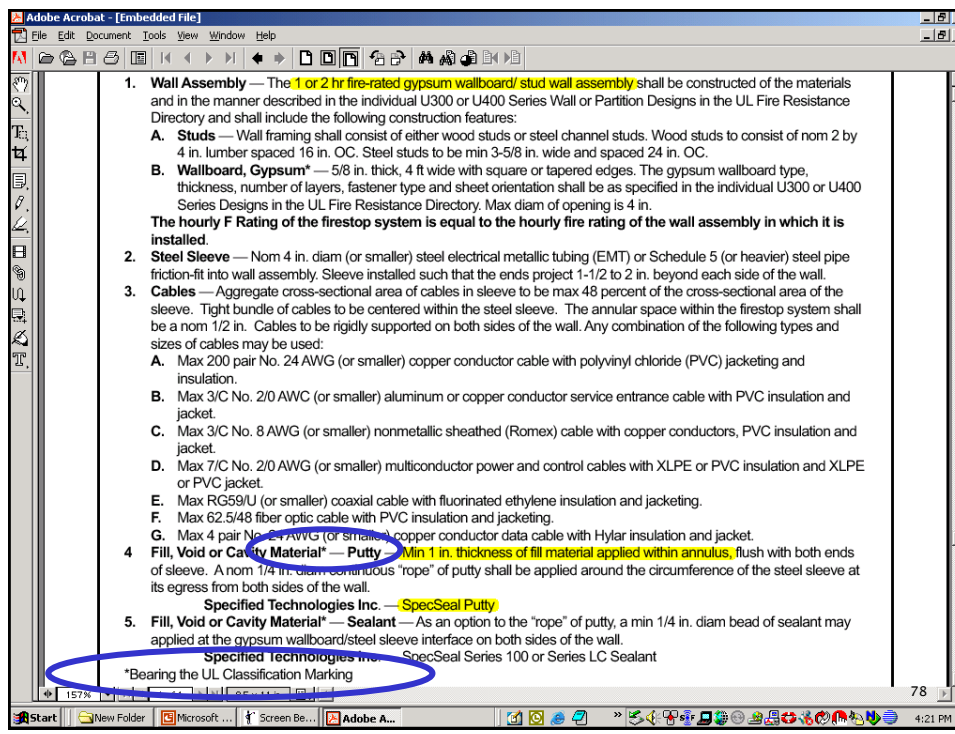
4
Section A-A
System No. W-L-3132
F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr
1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/ stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-5/8 in. wide and spaced 24 in. OC.
B. Gypsum Board* — 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Designs in the UL Fire Resistance Directory. Max diam of opening is 4-1/2 in.
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. Steel Sleeve — Nom 4 in. diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe friction-fit into wall assembly. Sleeve installed such that the ends project 1-1/2 to 2 in. beyond each side of the wall.
3. Cables — Aggregate cross-sectional area of cables in sleeve to be max 48 percent of the cross-sectional area of the sleeve. Tight bundle of cables to be centered within the steel sleeve. The annular space within the firestop system shall be a nom 1/2 in. Cables to be rigidly supported on both sides of the wall. Any combination of the following types and sizes of cables may be used:
A. Max 200 pair No. AWG (or smaller) copper conductor cable with polyvinyl chloride (PVC) jacketing and insulation.
8.5 x 11 in
1 of 1
77


Adobe Acrobat - [Embedded File]
File Edit Document Tools View Window Help
1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/ stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-5/8 in. wide and spaced 24 in. OC.
B. Wallboard, Gypsum* — 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Designs in the UL Fire Resistance Directory. Max diam of opening is 4 in.
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. Steel Sleeve — Nom 4 in. diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe friction-fit into wall assembly. Sleeve installed such that the ends project 1-1/2 to 2 in. beyond each side of the wall.
3. Cables — Aggregate cross-sectional area of cables in sleeve to be max 48 percent of the cross-sectional area of the sleeve. Tight bundle of cables to be centered within the steel sleeve. The annular space within the firestop system shall be a nom 1/2 in. Cables to be rigidly supported on both sides of the wall. 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 3/C No. 2/0 AWC (or smaller) aluminum or copper conductor service entrance cable with PVC insulation and jacket.
C. Max 3/C No. 8 AWG (or smaller) nonmetallic sheathed (Romex) cable with copper conductors, PVC insulation and jacket.
D. Max 7/C No. 2/0 AWG (or smaller) multiconductor power and control cables with XLPE or PVC insulation and XLPE or PVC jacket.
E. Max RG59/U (or smaller) coaxial cable with fluorinated ethylene insulation and jacketing.
F. Max 62.5/48 fiber optic cable with PVC insulation and jacketing.
G. Max 4 pair No. 24 AWG (or smaller) copper conductor data cable with Hylar insulation and jacket.
4 Fill, Void or Cavity Material* — Putty — Min 1 in. thickness of fill material applied within annulus, flush with both ends of sleeve. A nom 1/4 in. diam continuous "rope" of putty shall be applied around the circumference of the steel sleeve at its egress from both sides of the wall.
Specified Technologies Inc. — SpecSeal Putty
5. Fill, Void or Cavity Material* — Sealant — As an option to the "rope" of putty, a min 1/4 in. diam bead of sealant may applied at the gypsum wallboard/steel sleeve interface on both sides of the wall.
Specified Technologies Inc. — SpecSeal Series 100 or Series LC Sealant
*Bearing the UL Classification Marking
157%
78
Start
New Folder
Microsoft ...
Screen Be...
Adobe A...
4:21 PM

Factors Affecting Penetrations

- Floor or wall construction type and thickness
- Size and shape of opening
- Size and type of penetrating item(s)
- Percent fill of cables
- Annular space
- Rating requirement
- Firestopping materials

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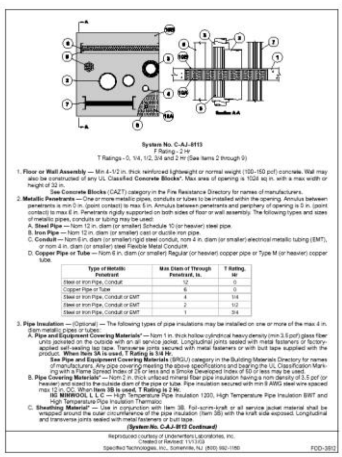
Common method of installation

A Little More Than "Caulk & Walk"



System No. C-AJ-8113
F Rating - 2 Hr
T Ratings - 0, 1/4, 1/2, 3/4 and 2 Hr (See Items 2 through 9)

1. **Floor or Wall Assembly** — Min 4-1/2 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 1024 sq in. with a max width or height of 32 in.
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. **Metallic Penetrants** — One or more metallic pipes, conduits or tubes to be installed within the opening. Annulus between penetrants is min 0 in. (point contact) to max 5 in. Annulus between penetrants and periphery of opening is 0 in. (point contact) to max 6 in. Penetrants 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 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. **Iron Pipe** — Nom 12 in. diam (or smaller) cast or ductile iron pipe.
   C. **Conduit** — Nom 6 in. diam (or smaller) rigid steel conduit, nom 4 in. diam (or smaller) electrical metallic tubing (EMT), or nom 4 in. diam (or smaller) steel Flexible Metal Conduit#.
   D. **Copper Pipe or Tube** — Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe or Type M (or heavier) copper tube.

Type of Metallic Penetrant	Max Diam of Through Penetrant, in.	T Rating, Hr
Steel or Iron Pipe, Conduit	12	0
Copper Pipe or Tube	6	0
Steel or Iron Pipe, Conduit or EMT	4	1/4
Steel or Iron Pipe, Conduit or EMT	2	1/2
Steel or Iron Pipe, Conduit or EMT	1	3/4

3. **Pipe Insulation** — (Optional) — The following types of pipe insulations may be installed on one or more of the max 4 in. diam metallic pipes or tubes:
   A. **Pipe and Equipment Covering Materials*** — Nom 1 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. **When Item 3A is used, T Rating is 3/4 Hr.**
   See Pipe and Equipment Covering Materials (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
   B. **Pipe Covering Materials*** — Nom 2 in. thick unfaced mineral fiber pipe insulation having a nom density of 3.5 pcf (or heavier) and sized to the outside diam of the pipe or tube. Pipe insulation secured with min 8 AWG steel wire spaced max 12 in. OC. When **Item 3B is used, T Rating is 2 Hr.**
   IIG MINWOOL L L C — High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT and High Temperature Pipe Insulation Thermaloc
   C. **Sheathing Material*** — Use in conjunction with Item 3B. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe insulation (Item 3B) with the kraft side exposed. Longitudinal and transverse joints sealed with metal fasteners or butt tape.

(System No. C-AJ-8113 Continued)

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1

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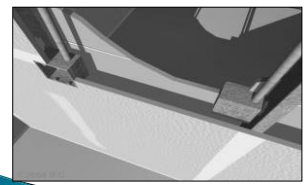
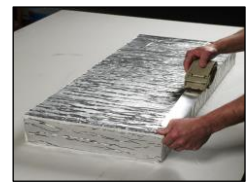
Membrane Penetrations – Exceptions for Walls

- Electrical boxes
- Boxes other than electrical such as washing machine hose connections, manual fire alarm pull boxes, dryer exhaust boxes, electrical panel boards, etc.
- Sprinkler penetrations





Membrane Penetrations – Exceptions for Horiz. Assemblies

- Steel, ferrous or copper conduits, pipes, tubes or vents of small sizes
- Electrical boxes
- Sprinkler penetrations
- Noncombustible cast-in-place elements
  - Double top plates of 1 or 2 hr walls sheathed with Type X gypsum board with protected penetrations
  - Listed luminaire and luminaires protected with listed materials

Membrane Penetration – Sprinkler Penetrations

- Fire sprinkler with a metal escutcheon plate covering annular space
- Needs to be firestopped if air leakage rating is required

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Membrane penetrations by boxes other than electrical boxes Exception 4

- Such as washing machine hose connection boxes, hose cabinets, manual fire alarm pull boxes, dryer exhaust boxes, electrical panel boards, etc.
- As tested in accordance with ASTM E814 or UL 1479
- Requires both an F and a T rating
- Be installed in accordance with their listing.

Code Requirements Wall Assemblies

- **714.4.2.** Installed such that the required fire resistance will not be reduced:
  - Metallic boxes installed per prescriptive information, or as tested and listed
  - Nonmetallic boxes installed as tested and listed
  - Note: There are no approved systems for Electrical boxes that are back to back

85

Metallic Electrical Outlet Boxes in Walls

- Metallic boxes installed per code
  - Maximum 16 sq in. outlet box
  - Maximum 100 sq in. of opening on each side of wall per 100 sq ft of wall area
  - Maximum 1/8 in. annular space between wall membrane and box
  - Boxes on opposite sides of wall shall be separated
    - Horizontally by minimum 24 in.,
    - Horizontally by a distance not less than the depth of the wall where the cavity is filled with cellulose loose-fill, rockwool or slag mineral wool, or
    - By fireblocking

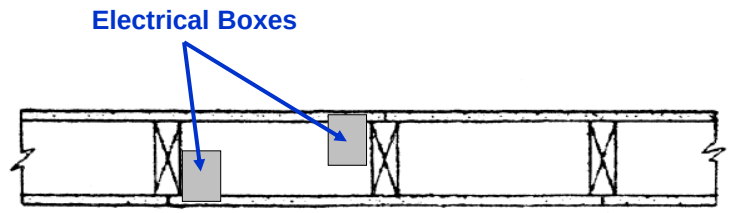
86

Metallic Electrical Outlet Boxes in Walls Cont.

- Installation not complying with these prescriptive requirements shall be installed as tested and listed
  - Putty pads
  - Other listed materials and methods
    - Insert pads
    - Gaskets

87

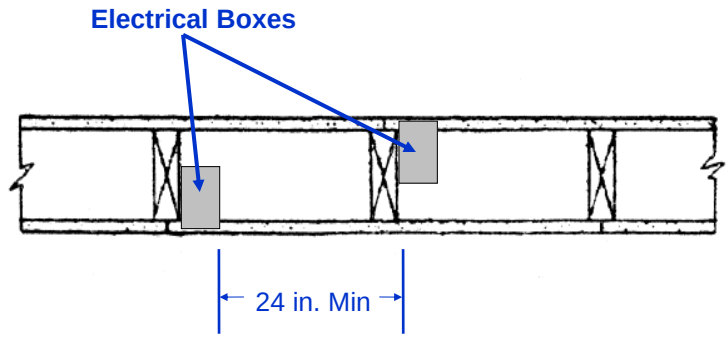
Metallic Electrical Boxes in Wall with Less than 24 in. Spacing



Non-Compliant

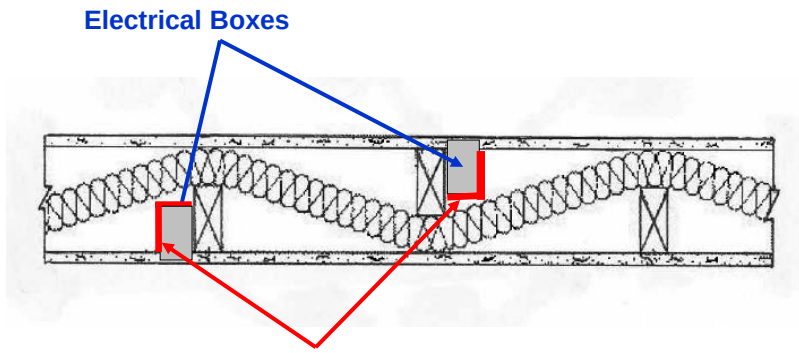
88

Metallic Electrical Boxes in Wall with Minimum 24 in. Spacing



89

Metallic Electrical Boxes in Staggered Stud Walls with Protection

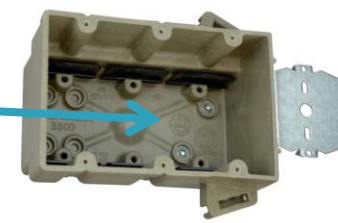


90

Electrical Box Protection
Intumescent Putty Pads



UL Marking on Nonmetallic Outlet Boxes

Box will have the hourly rating and F, W, and/or C, where:

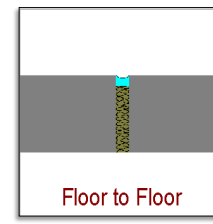
- W = Wall boxes
- C = Ceiling boxes
- F = Floor boxes

Building Code Requirements 2018 IBC – Joints

- **715.2.** Fire-resistant joint systems shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gasses
- **715.3.** Joints shall be tested to ANSI/UL 2079 or ASTM E1966"

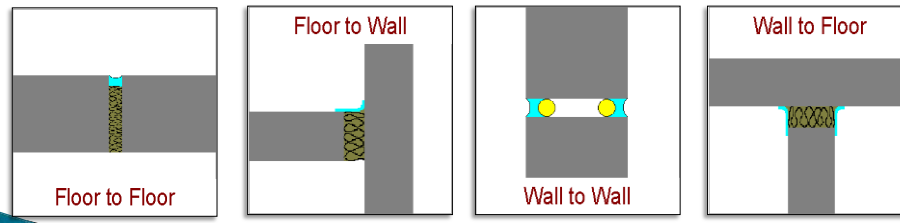
2018 IBC – Definition

- Joint – The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading. (IBC)



4 Types of Rated Joint Systems

- Floor-to-Floor (Expansion Joint)
- Floor-to-Wall (Slab/Shaft)
- Wall-to-Floor (Top & Bottom of Wall)
- Wall-to-Wall (Vertical Control Joint)



95

Construction Joint Terminology

- Nominal Joint Width
- Assembly Rating
- Movement
- Extension
- Compression
- Percent (%) Extension / Compression
- Mineral Wool Compression
- Sealant Depth

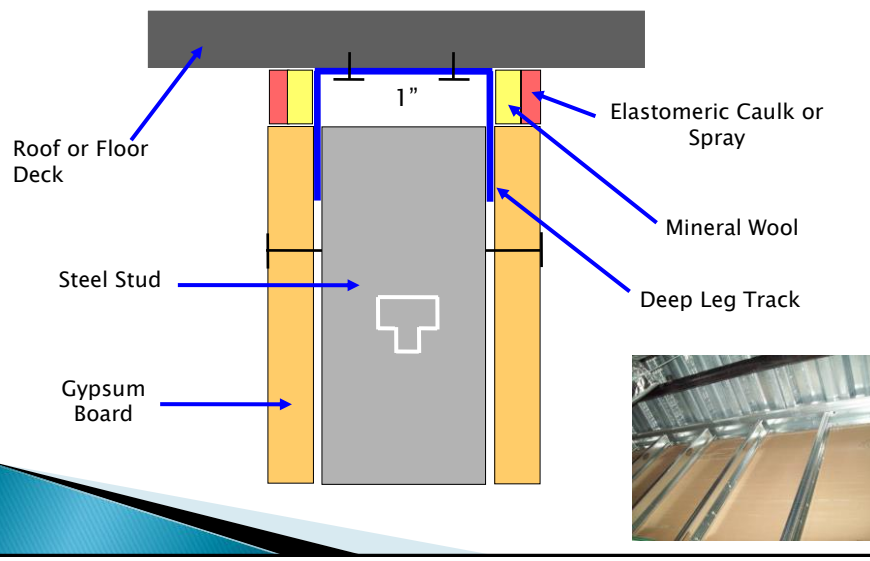
96

Categories of Fire-Resistive Joints

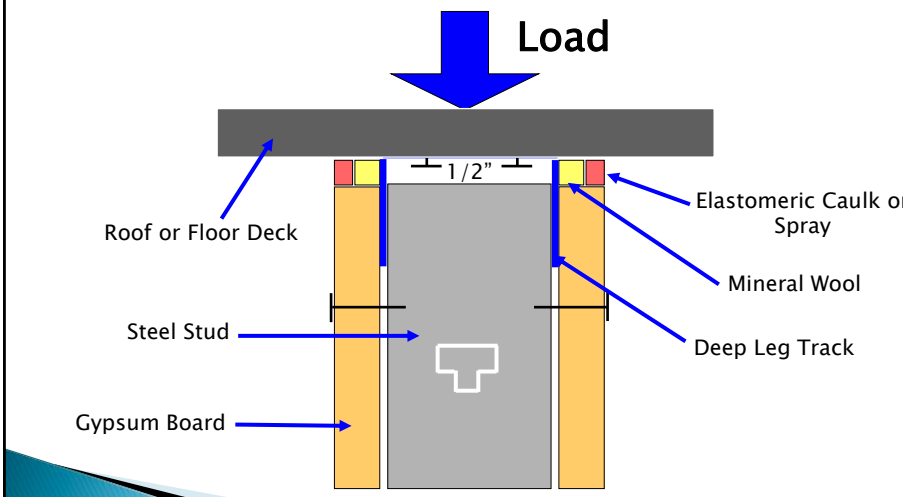
- Sealant Systems (Caulks)
- Sprayed /Elastomeric Membranes (Sprays)
- Mechanical Joints

97

Typical Head of Wall Joint System With Nominal Joint Width

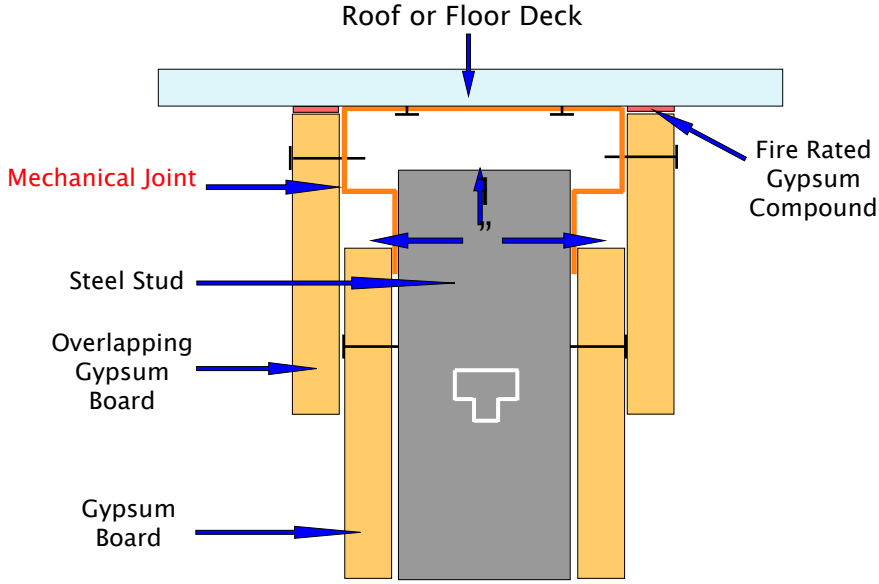


Typical Head of Wall Joint System



99

Mechanical Joint



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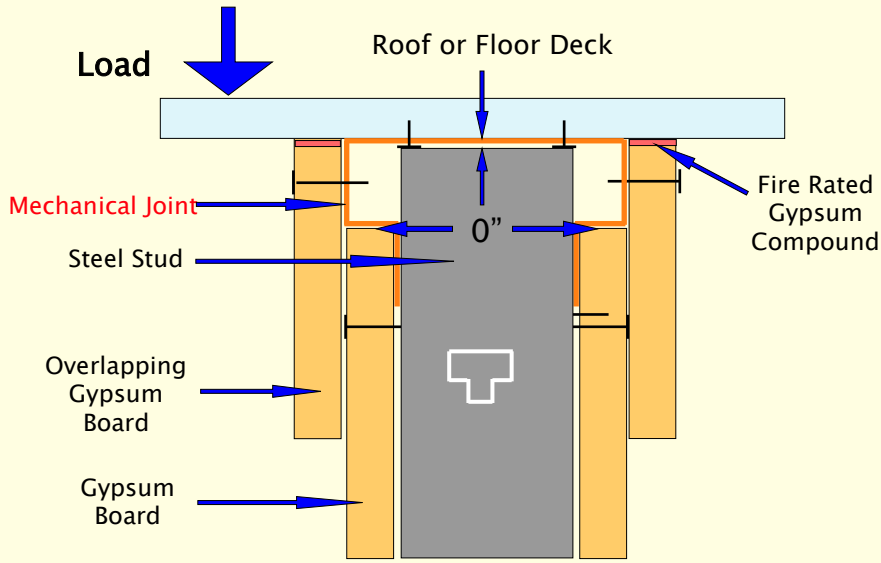
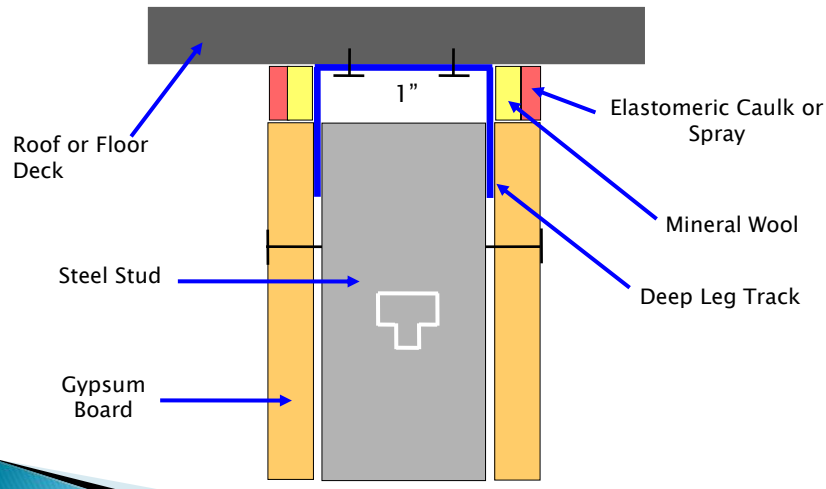


101

Overlapping Wallboard Mechanical Joint

102

Common Violation of Head of Wall Joint System



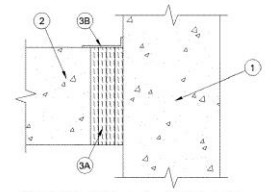
103

1. Wl ○
2. Wl fr ○
3. Wl ○
4. Wl
5. Hc ○
6. Ar ○

oint? ling ed size) osure

System No. FW-D-0001

Assembly Rating - 1 Hr
L Rating at Ambient — Less than 1 CFM/Lin Ft
L Rating at 400 F — Less than 1 CFM/Lin Ft
Nominal Joint Width - 2 In.
Class II Movement Capabilities - 12.5% Compression or Extension



1. **Wall Assembly** — Min 4-1/2 in. thick reinforced lightweight or normal weight (100 - 150 pcf) structural concrete. Wall may also be constructed of any UL Classified **Concrete Blocks***.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. **Floor Assembly** — Min 2-1/2 in. thick reinforced lightweight or normal weight (100 - 150 pcf) structural concrete.

3. **Joint System** — Max separation between edge of floor and face of wall (at time of installation of joint system) is 2 in. The joint system is designed to accommodate a max 12.5 percent compression or extension from it's installed width. The joint system shall consist of the following:

A. **Forming Material*** — Min 4 pcf mineral wool batt insulation installed in joint opening as a permanent form. Pieces of batt cut to min width of 2-1/2 in. and installed edge-first into joint opening, parallel with joint direction, such that batt sections are compressed min 50 percent in thickness and that the compressed batt sections are flush with top surface of the floor. Adjoining lengths of batt to be tightly-butted with butted seams spaced min 24 in. apart along the length of the joint.

ROXUL INC — SAFE Mineral Wool

THERMAFIBER L L C — SAF Mineral Wool

B. **Fill, Void or Cavity Material* - Spray** — Min 1/8 in. wet thickness of fill material applied on top surface of floor to completely cover the mineral wool and overlap a min 1/2 in. onto concrete floor and side of wall.

ABC FIRESTOPPING CO. — SuperDuper Firestop Spray

*Bearing the UL Classification Mark

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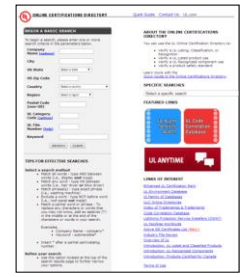
Where Can I Find The Most Current Listings?

www.intertek.com/directories/etl-listed-mark/

whdirectory.intertek.com/

www.ul.com/database



HW-D-0060

HW = Head of Wall

D = Dynamic
(Subject to Movement)

Starts with “0” (0000 - 0999) = Nom. Joint Width ≤ 2”

Starts with “1” (1000 - 1999) = Nom. Joint Width > 2” and ≤ 6”

Listings Nomenclature

Navigating the UL Directory:

HW – D – 0060

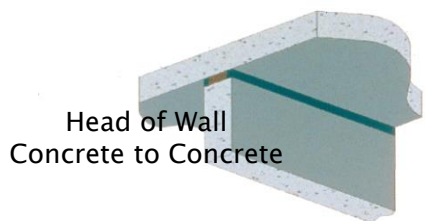
JOINT SYSTEMS (XHBN)

Third Alpha Character identifies the movement capabilities of the system:

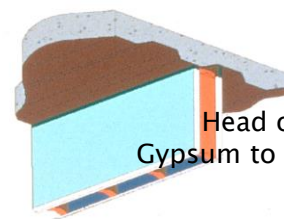
D = Dynamic (movement capabilities)
S = Static (no movement capabilities)

107

Typical Joint Types

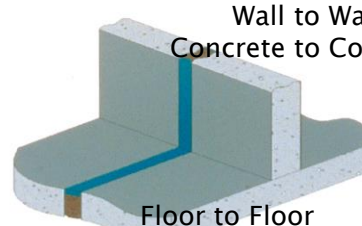


Head of Wall
Concrete to Concrete



Head of Wall
Gypsum to Fluted Deck

Floor to Wall
Concrete to Concrete



Wall to Wall
Concrete to Concrete

Floor to Floor
Concrete to Concrete

108

Plans Examiners and Firestop Submittals

- Recommend building departments or agency include firestop drawings to be submitted before system installation.
- Include all Firestopping details with tested and listed systems or Engineering Judgments.
- Include location of each firestops system.
- Plan review for Joints are very important to reduce delays of projects

How to provide plan reviews for Firestop Submittals

- A plans examiner should provide a spot check to determine if the Firestop submittal is to code.
- Penetration review steps include areas like: Ratings, Assembly, Penetration Type, Opening Size and Type
- Note: As a design professional there are common steps to find the correct firestop systems

Review of Joint Systems

- What type of joint is being protected?
- What is the required hourly rating?
- What is the width of the joint (nominal installed width)?
- How much movement is required?
- Is an L Rating required?
- Is submitted system consistent with the above requirements?

111

Recommended Joint System Correction Notice

- Deflection is required to be installed with an approved joint system per Section 715 of the IBC. The assemblies need to be designed to allow joints to compress and extend with movement of structure while maintaining the fire-rating of the assemblies.
- Please clarify building deflection by listing the Maximum and Minimum building deflection movements to determine movement capabilities of assembly and identify listed assemblies for all joint systems.

112

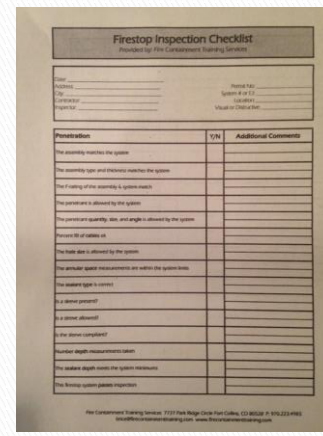
Inspection of Joint Systems

- Inspect joints at framing inspection
- What type of building assemblies form the joint (type and thickness)?
- What materials are the assemblies constructed from?
- Are there any special considerations? (EJ's)

113

Recommended Inspection Checklist

- Checklist
  - Penetration
  - Joint
  - Curtain Wall

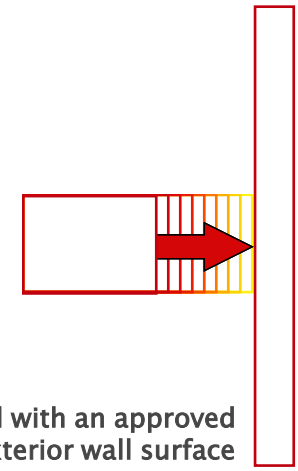

Firestop Inspection Checklist

Penetration	Y/N	Additional Comments
The assembly matches the system		
The assembly type and thickness matches the system		
The F rating of the assembly & system match		
The penetrant is allowed by the system		
The penetrant quantity, size, and angle is allowed by the system		
Percent fill of cables ok		
The hole size is allowed by the system		
The annular space measurements are within the system limits		
The sealant type is correct		
Is a sleeve present?		
Is a sleeve allowed?		
Is the sleeve compliant?		
Number depth measurements taken		
The sealant depth meets the system minimums		
This firestop system passes inspection		

114

Extending the Floor to the Wall...

MANDATORY!



The perimeter joint must be sealed with an approved material or system that extends to the exterior wall surface

115

Code Requirements

- 715.4.1 "Voids created at the intersection of exterior curtain wall assemblies and non-fire resistance-rated floor or floor/ceiling assemblies shall be sealed with an *approved material* ***or*** *system to retard the* interior spread of fire and hot gases between *stories."*

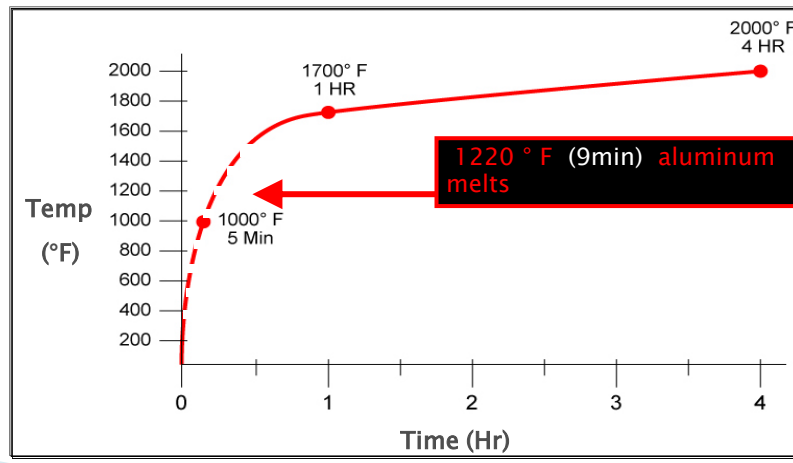
116

ASTM E2307

Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus

117

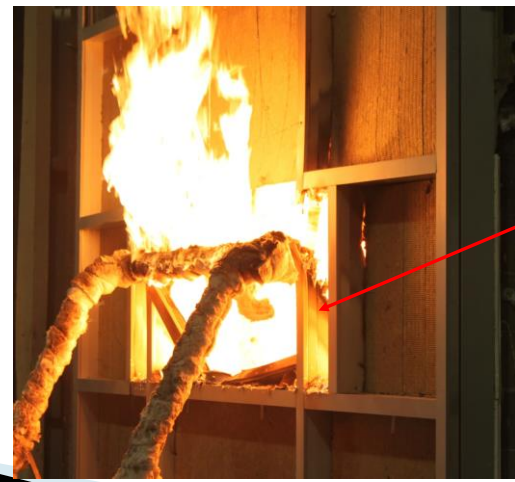
Time – Temperature Curve



118

Fire Performance

Mullion exposure to fire test

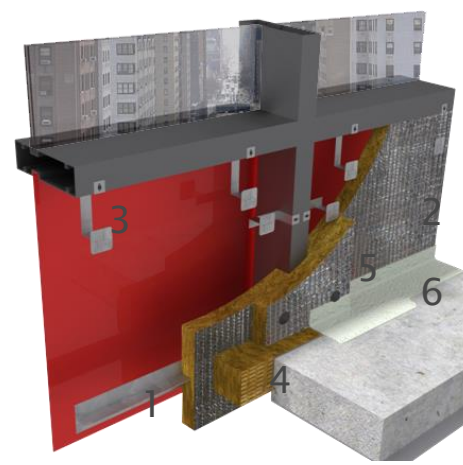


Exposed side of vertical mullion almost completely melted out.

119

Curtain Wall Fire Containment Six Components of System

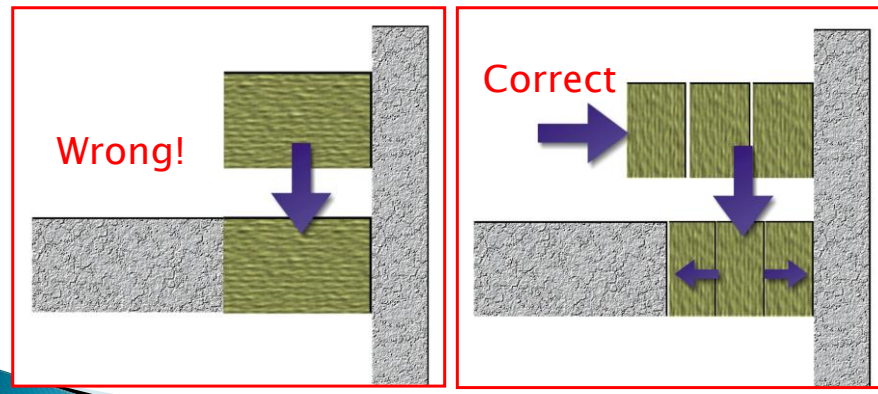
1. Reinforcement Member
2. Mineral Wool Insulation
3. Mechanically Attached
4. Compression Fit Safing
5. Protect Mullions
6. Smoke Barrier



120

Typical Curtain Wall System Cont

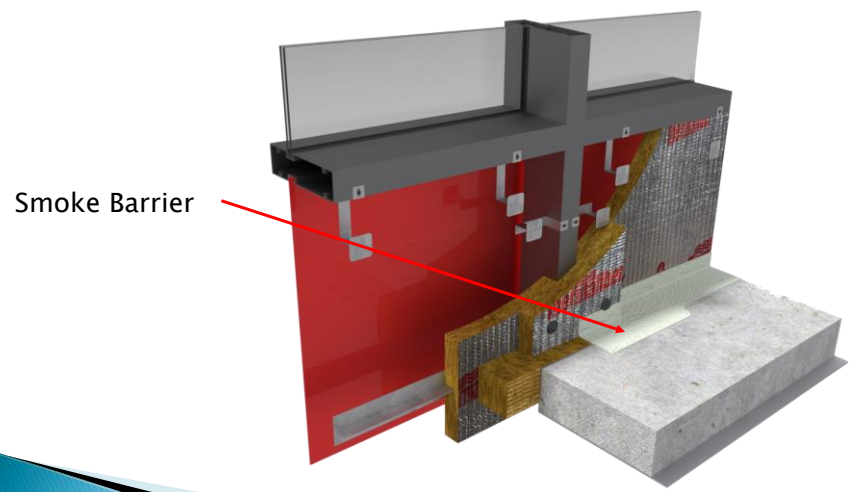
- To allow for movement between the slab and wall mineral wool must be inserted perpendicular to the joint and compressed to the proper %



STI Graphic

121

Typical Curtain Wall System Cont.



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PERIMETER FIRE CONTAINMENT SYSTEMS (XHDG)

Third Alpha Character identifies the movement capabilities of the system:

D = Dynamic (movement capabilities)
S = Static (no movement capabilities)

123

Nonrated floor and the Curtain Wall

- No Guidance for the code
- If utilize an approved curtain wall joint the Building Official will need this documented.
- If use tested system will need to address similar to Engineering Judgment.

NOTE: The perimeter joint must be sealed with an approved material or system that extends to the exterior wall surface

Inspection of Perimeter Containment

- Read the details!
- Remember compression and orientation of mineral wool
- Spray depth
- Read the details!

125

Inspection of Perimeter Fire Containment cont.

•Should a separate inspection be required for mineral wool?
•Always make sure the mineral wool installed to the correct compression and according to the correct orientation

126

Firestopping is a Headache

- "There is no other code-required work anywhere in construction that is installed by every trade".

- These 10 different Trades typically do not take ownership for firestopping.

- Many trades consider firestopping a *necessary evil*, rather than a critical element of the fire-safety envelope.

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Firestop Installations

- All Trades – "Person who pokes hole, fills hole"
- Multiple Contracts – Multiple Firestop Contractors or Subs
- Single Source Firestop Contractor – One specialty contractor covers entire project

UL Qualified and FM Approved Contractor Programs

Two Qualified Contractor Programs

- UL Qualified Firestop Contractor Program
- FM 4991 Approved Contractor Program

Underwriters Laboratories
Qualified Firestop Contractor Program

FM Approvals
Member of the FM Global Group

129

DEFINITION
Continuity Head-of-Wall Joint

- **Continuity Head-of-Wall Joint System** – Material or devices, or both, installed to resist the spread of fire for a prescribed period of time through the joint opening between a fire-resistance rated wall assembly below and a nonrated horizontal assembly above. (ASTM)

130

2015 IBC Requirement

- 707.9 – The voids created at the intersection of a fire barrier and a non-fire resistance rated roof assembly shall be filled. An approved material or system shall be used to fill the void, shall be securely installed in or on the intersection for its entre length so as not to dislodge, loosen or……

131

IBC 2009/2012 Code Changes

- 2009 IBC Section 703.7 Marking and Identification.
  - *Fire walls, fire barriers, fire partitions, smoke barriers* and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling.

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IBC 2009/2012 Code Changes

Such Identification shall be located in accessible concealed floor, floor ceiling or attic spaces.

- Within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition
- Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording:
- FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS

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International Fire Code (IFC)

Inspection and Maintenance of Buildings

- **703.1 Maintenance.** The required fire-resistance rating of fire-resistance-rated construction (including walls, firestops, shaft enclosures, partitions, smoke barriers, floors, fire-resistive coatings and sprayed fire-resistant materials applied to structural members and fire-resistant joint systems) shall be maintained.

- In 2009 IFC added provisions requiring building owners to annually inspect firestops and joint systems and properly repaired, restored or replaced when damaged, altered, breached or penetrated

Firestopping Special Inspections And the IBC

- **1705.17 Fire-resistant penetrations and joints.** special inspections for through-penetrations, membrane penetration firestops, fire resistant joint systems, and perimeter fire barrier systems that are tested……
- Required for buildings over 75 ft. and for Category 3 and 4 buildings
- ASTM Inspection Standards ASTM E 2174 and ASTM E 2393 are required

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RISK CATEGORY III BUILDINGS

- Public assembly over 300 occupants
- Schools over 250 occupants
- Prisons and Jails
- Buildings over 5,000 occupants
- Water and waste treatment facilities

- *Note: Category lll represent a substantial hazard to human life*

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RISK CATEGORY IV BUILDINGS

- Buildings designed as essential facilities
- Group I-2 with emergency treatment
- Fire, rescue and police stations
- Emergency shelters and operation centers
- Aviation towers and control centers

Note: Essential Facilities: Buildings and other structures that are intended to remain operational in the event of a major disaster

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QUESTION FOR THE BUILDLING OFFICIAL

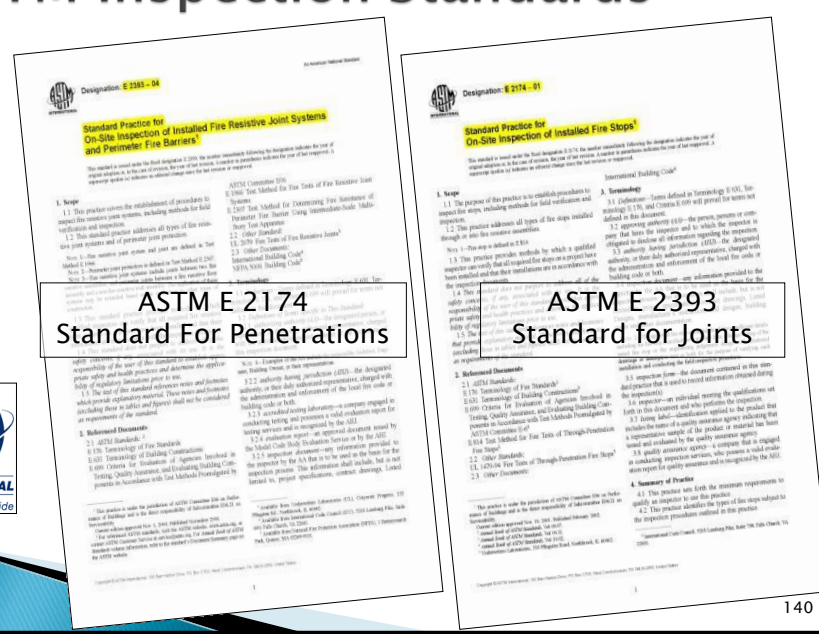
- Does the AHJ Have the authority to require Firestop Special Inspections on large projects in their jurisdiction beyond section 1705.17 that Requires High Rise buildings and Category 3 and 4 buildings

The answer is YES! 1705.1.1 Special cases gives you that authority

1705.1.1 Special cases. *Special inspections* and tests shall be required for proposed work that is, in the **opinion of the building official, unusual in its nature,** such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

ASTM Inspection Standards



ASTM E 2174
Standard For Penetrations

ASTM E 2393
Standard for Joints

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ASTM
Firestop Inspection Standards Overview

- Addresses all types of firestop systems
- Documents must go through a plan review
- Scheduling of firestop inspections
- Covers inspector qualifications
- Provides forms, reports and documents
- Inspection methods are identified

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ASTM E2174 and E2393
General Requirements

- Inspection documents submitted 10 days prior to field inspection
- Installer and inspector must agree upon schedule
- If mechanical systems are used they need to be inspected after installation
- Inspector **shall** provide visual and/or destructive testing for a percentage of the systems
- Must observe all firestop systems

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ASTM E2174 and ASTM E2393

Reporting/Inspection

- The Standards calls for the Inspector to verify that the materials bear a Listing Label
- Manufacturer's container labels shall include
  - Manufacturer's name
  - Product name
  - Manufactured Date or Expiration Date
- Where the material is being stored, does it comply with Manufacturer guidelines

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ASTM E 2174 and ASTM E 2393

Reporting/Inspection

- The Inspector shall advise the contractor of any deficiencies found within one working day.
- If deficient the standards will require a Percent of additional systems to be inspected
- After the Non-compliance Report is issued the contractor will repair the deficiencies and QC their work, then call for a Re-Inspection

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ASTM E2174 and ASTM E2393

Final Report

- Report should contain:
  - Cover Page
  - Name and Address of Inspector
  - Name and Address of each firestop Installer, as well as the prime contractor
  - Name and Address of the AA
  - Name and Address of the AHJ
  - Executive Summary outlining verification method used to ascertain compliance
  - Notarized written statement of Conflict of Interest
  - Summary of contain percentages of deficiencies
  - All daily inspection reports

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ASTM Inspection

- 10.12.2.1 The method shall be approved by the AA and the AHJ, which shall require one of the following methods:
  1) Destructive type
  2) Disassembly or
  3) Visual inspection
  4) Other appropriate methods
- 10.14 All observed deficiencies shall be documented and marked on the inspection forms.

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ASTM E2174

Onsite Inspection of Installed Firestop Penetrations

- 2 Different type of inspections
  - Visual Inspection: randomly witnessing a minimum of 10% of each type of firestop system installed *OR*
  - Destruction Testing: destructively sampling of 2% but not less than one per floor, of like firestop systems within a 10,000 sq ft. area or less
  - Can not interfere or direct installation

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ASTM E2393

On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

- 2 Different Type of Inspection
  - Visual Inspection: observing installation process of a minimum of 5% of the total lineal ft. *OR*
  - Destructive Inspection: destructively sampling a minimum of one sample per type of joint system per 500 lineal ft.
  - Can not interfere or direct installation

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ASTM
Firestop Inspector Qualifications

- Have a minimum of 2 years experience in construction field inspection and have education, credentials, and experience acceptable to the AA. OR
  - Be a Quality Assurance Agency accredited by the AHJ. OR
  - Meet the criteria contained in ASTM E699 "Standard Practice for Evaluation of Agencies Involved in Testing Quality Assurance, and Evaluating of Building Components"
    - NOTE: Authorizing Authority (AA) is a designated person charged with administration of the ASTM Inspection Standards. This person could be an architect, Engineer or owner

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Approved Agency
1703.1

- An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements.

Independence 1703.1.1

- An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected.
- The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

Special Inspector Qualifications 1704.2.1

- The special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training.
- Experience or training shall be considered relevant when the documented experience or training is related in complexity to the same type of special inspection activities for projects of similar complexity.
- These qualifications are in addition to qualifications specified in other sections of this code. (Standards)

Access for special inspection 1704.2.2

- The construction or work for which special inspection is required shall remain accessible and exposed for special inspection purposes until completion of the required special inspections.

Report requirement 1704.2.4

- If they are not corrected, the discrepancies shall be brought to the attention of the building official .
- A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted to the *Building Official*

Is there a Firestop Inspector Certification?

- **At This time NO**
- The International Code Council (ICC) has approved a new Firestop Inspector Certification that should be implemented in the near future. **OR?**
- ICC Firestop Inspector Certificate of Learning Achievement (CLA) to be implemented in the Fall of 2019
- *CLA students will help determine if ICC develops a firestop Certification exam*

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Is there a credential specifically for Firestop Special Inspectors?

- **The answer is YES**
- **Firestop Inspector Exam With the International Firestop Council (IFC)**
  - Only exam specifically for Firestop Special Inspectors
  - Website: (www.firestop.org)
  - Intertek IQP Program
  - International Accreditation Service (IAC) AC 291 Covers the firestop company. **Now accepts IFC exam**

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About the IFC Inspectors Exam

- All study material is on line
- 85 multiple-choice questions
- 2 hrs max
- Passing grade: 80% (68 out of 85 questions)
- Listing on IFC website

Inspector Qualifications

Recommendations

- How do code officials determine if third party firestopping inspectors are qualified?
- Inspector Oversight recommendations:
  - **Require the International Firestop Council Exam and Confirm they know**:
    - All aspects of this Training Program
    - ASTM Inspection Standards
    - Ratings such as “F” , “T” and “L”
    - Movement Capability
    - Firestop product training certificates

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Firestop Inspection General Requirments

- Have clearly marked set of drawings highlighting fire and smoke walls along with approved firestop submittals
- Need to ensure EJ.s are documented and inspected
- Confirm you are Inspecting at the correct phase of construction
- Systems meets code requirements

Firestop Inspection Recommendations

- Per Construction Firestop Meeting with all Trade firestop installers to make sure the inspection process works properly.
- **Consider requiring fill material and annular space inspection before sealant inspection.**

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Fill Material Inspection

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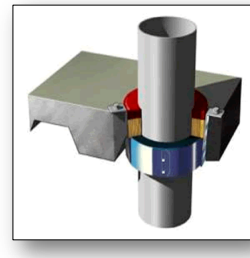
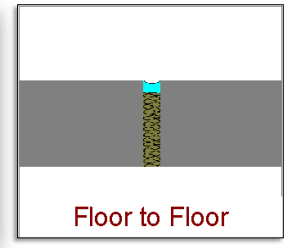
Sealant Inspection



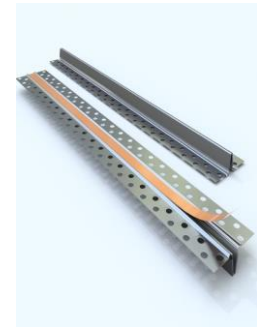


162

There are systems that can be <u>installed at one time</u>. How do we inspect these systems

Walls

Special Conditions



Floors and decks

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Inspection of joints and pre formed devices

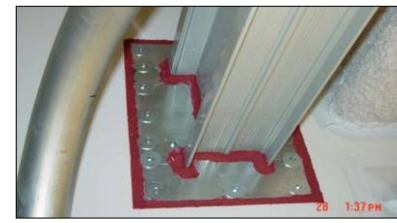
FILL MATERIAL INSPCTION:

- Will lay out all of the joints and devices to be installed
- Will observe the fill material is installed and the nominal width is according to the tested and listed system if required.

Inspection of joints and pre formed devices

SEALANT INSPCTION:

- Systems need to be installed with the tested listed systems available for our inspection



Firestop Visual Inspection

- This Witness Verification method is generally Not the Preferred Method of firestop inspections

- PENETRATIONS
  - Review the assembly of the Firestop System
  - Checking the Annular Space
  - Observing the backing material installation
  - Witnessing the firestop material installation

Visual Inspection of Curtain Wall

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Firestop Joint Inspections

- Is the nominal joint width installed per the listing?
- Does the joint width fall within the system limits? (Compression and/or Extension)
- Is backing material required by the system?
- Is the backing compression ratio correct?
- Does the sealant depth match the system requirements?

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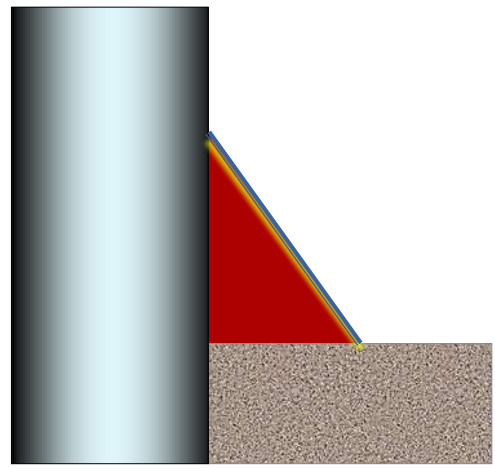
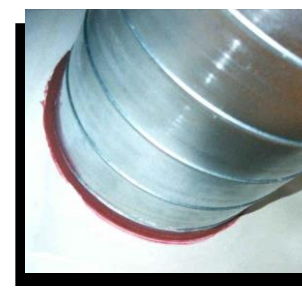
Inspection of Penetrations
Measuring the Crown



169

Inspection of Penetrations
Duct Inspections

Was the Sealant applied Before sheet metal flanges were installed?



Graphics – Firestop Solutions

170

Inspection of Penetrations

- Penetrating item and opening size must match the tested and listed system
- Are the ANNULAR SPACE measurements within the system limits?
- Is the HOLE SIZE allowed by the system?
- Be aware of minimums and maximums. The distance between item and side of hole

171

Inspection of Penetrations

- Understand some sealants may shrink when installed and the amount of shrinkage may be in the listing
- If a sleeve is present confirm it is allowed
- Make certain the system indicates point of contact if needed.

172

Recommendations for Firestop Inspections

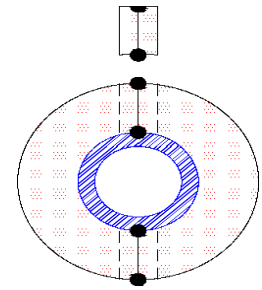
- Require to see all submitted firestop plans 10 or more days before first inspection (before system Installation)
- Contractors to Identify all firestop systems.
- Request to have firestop mock ups meeting field conditions.

MOCKUP'S CONSTRUCTED IN THE FIELD

- Mockup's are not required by code; however, it is highly recommended
- Prior to installing firestop systems it is recommended to erect mockups for each different firestop system
- The AHJ's should approve the mockups before start of firestop installation.
- Mockups should be retained and maintained during construction.

Firestop Destructive Testing Inspection Techniques Penetrations

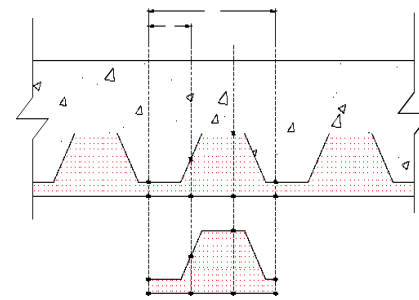
- Penetrations less then 2 inches measure in one to two locations
- **Recommendations**



175

Firestop Destructive Testing Inspection Techniques Joints

- For coatings applied in joint systems need to take measurements within 6 to 12 inch for every 500 lineal feet
- **Recommendation**



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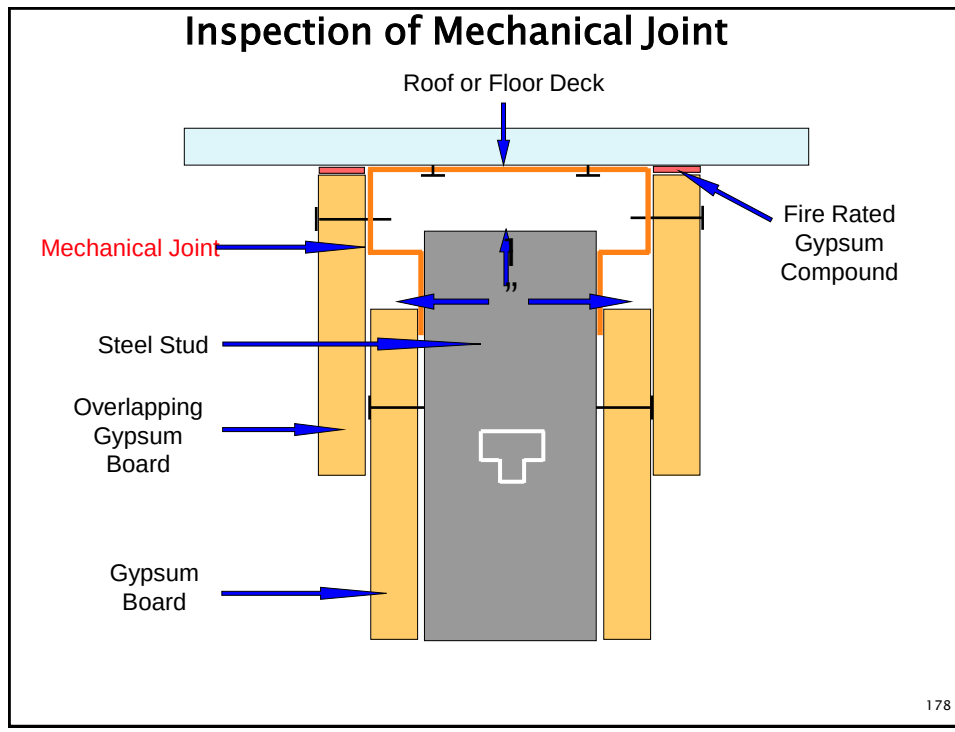
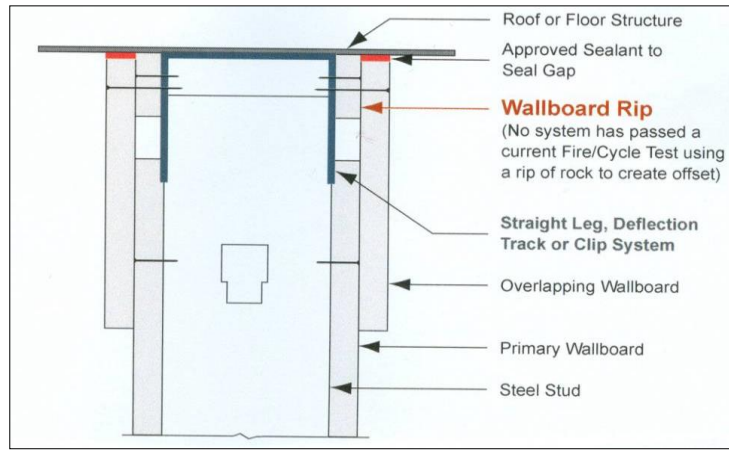

Inspection of Mechanical Joint
Roof or Floor Deck
Fire Rated Gypsum Compound
Mechanical Joint
Steel Stud
Overlapping Gypsum Board
Gypsum Board
178

Non-Code Compliant Head-of-Wall Joint



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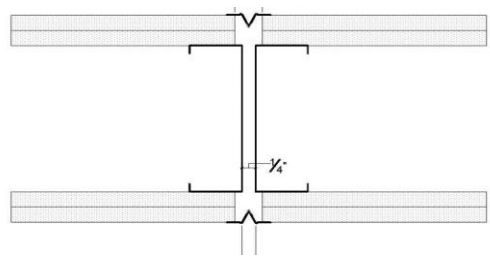
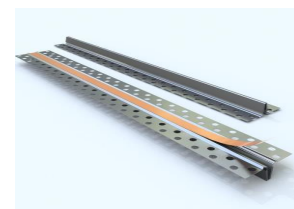
Wall to Wall Inspections





Inspection Practices for Firestopping Cont.

- During framing inspection observe that joints are installed in manner that required movement can be achieved
- Observe the products, empty containers or boxes for label with name, description and approved testing agency
- Installer, repairs after inspection
- Must observe all firestop systems
- Have your inspection tools such as a flashlight, coring device, wire, drill bit, tape m
  calipers, camera and other appropri

Firestop Tools

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Firestop Tools Cont.

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Do Code officials really need to understand firestop materials?

- The answer is yes!
- Code officials need to know where to go to clarify storage of materials, effects of weather, and if inspection could damage the devices or firestop materials.

Firestop Inspection Issues

- Pre-formed firestop devices (Collars)
- Movement during Cure and the life of the building
- Mechanical Joints
- Aging of firestop material
- Painting firestop material
- Firestop sealant shrinkage
  - Wet sealant depth
  - Dry sealant depth

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Firestop Materials

- **Sealants**
  - Silicone, Latex, Intumescent
- **Wrap Strips**
  - "Thick, Thin, Wide, Less Wide"
- **Putties**
- **Pillows**
- **Composite Sheets**
- **Bricks / Plugs**
- **Pre Fabricated Kits**
- **Mortar**
- **Spray Products**

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FIRESTOP BACKING MATERIALS

- Mineral Wool
- Ceramic Fiber
- Backer Rod
- Others

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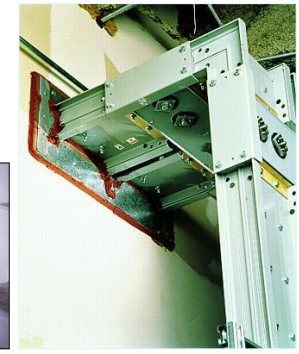
Firestop System Materials
Firestop Composite Sheets

- Sheet metal laminated to intumescent material with foil and metal scrim on the other side



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Firestop Collars

- Through Wall "Cans" allow angled pipes
- Clearance required away from walls, floors

189

Firestop Pre-formed Devices

- "Pre assembled, preformed molding kits in stainless steel frames, mechanically sealed"
- "Pre-assembled Open Pathway Devices

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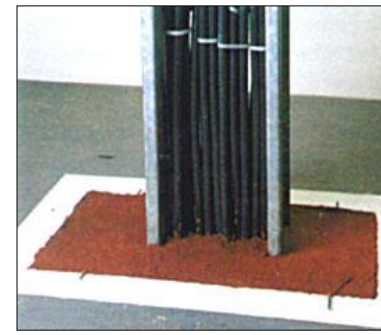
Firestop Mortars

- Lightweight Aggregate Concretes
- Unexpanded Vermiculite or Perlite Concrete
- Specialty Foam Concretes
- Gypsum / Iron Ore Mortar



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Firestop Pillows or Bricks

- Review specifications on stacking
- Special attention to Floors
- Question the water seal
- Is Metal Lath required

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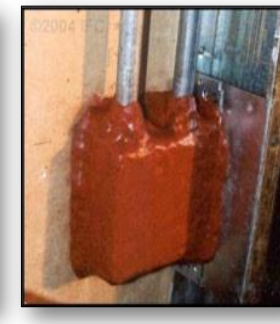
Electrical Box Protection

Intumescent Putty Pads



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Pre-Construction Meeting

- Review Design Drawings Submittals
- Obtain Pre-Approved Engineering Judgments
- Establish inspection guidelines and expectations
- Review qualifications/experience of firestop installers
- Schedule firestop Inspections with the firestop contractor if possible

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PROCESS

Building Department Submittals

- 107.1.1 – Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and **show in detail that it will conform to the provisions of this code**

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PROCESS

Plans Examination/Review

- Firestop systems details should be included on the plans and specifications (Project Documents)
- Who should select firestop systems?
  - Design Professional
  - Firestop Contractor
  - Manufacturer
  - AHJ

PROCESS

Plans Examination/Review Cont.

- All firestop systems for fire rated construction need to be reproduced on the plans as tested by an approved testing laboratory
- Schedule of tested and listed systems by assembly, penetration or joint
  - Show system details with location of the firestopping
  - Review systems that may need engineering judgments

PROCESS

Plans Examination/Review Cont.

- May request manufactures product data sheets to make sure they meet all regulations
- For unique conditions have policy for Engineering Judgments
- The structural engineer should provide the amount of movement required for all joints
- *Is it ok to require a single source primary firestop manufacturer?*

Why Firestopping can Fail in Existing Buildilngs

- Improper installation
- Building movement
- Effects of paint and water
- System selection not done properly
- Lack of maintenance

Inspection and Maintenance of Buildings

International Fire Code: 703.1 Maintenance.

- In 2009 IFC added provisions requiring building owners to annually inspect firestops and joint systems and properly repaired, restored or replaced when damaged, altered, breached or penetrated

- Trend toward requiring documentation of yearly inspections for all commercial buildings

Existing Building Firestop Inspections

- The International Fire Code requires building owners to annually inspect firestopping
  - Firestop systems needs to be documented and labeled with procedure to re-firestop holes that the "cable guy" or others made.
  - Firestopping needs to be properly repaired, restored or replaced when damaged, altered, breached or penetrated.
  - QUESTION: Does your jurisdiction require existing commercial building inspections? If required how often are they inspected and do they inspect above the ceiling?

When Inspecting Existing Buildings

- You will walk past problems
  - Poor original installations
  - Building changes over time

Fire-rated corridor:
The way you might find it

Fire-rated corridor:
The way it should be

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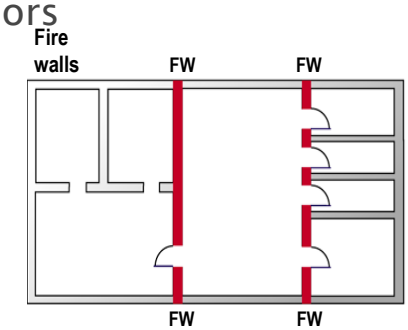
When Inspecting Existing Buildings

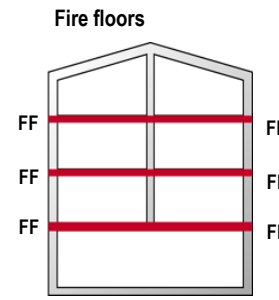
- Ask to walk with someone who knows the building
- Report/discuss the problems you see
  - Refer to your fire prevention bureau
  - Refer to the building department

When Inspecting Existing Buildings

- Understand occupancies with fire-rated (protected) corridors, separation walls and floors



FW = Fire Rated Wall



FF = Fire Rated Floor

Where To Look In Existing Buildings

- Check electrical/mechanical closets
- Spot check by popping ceiling tiles
- Check walls between occupancies
- Look for rated doors
- Look for concrete block walls
- Look for fire/smoke dampers in ducts
- Walls with wire glass

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Rated openings

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Systems that can be Installs entirely from the accessible side of floor or wall

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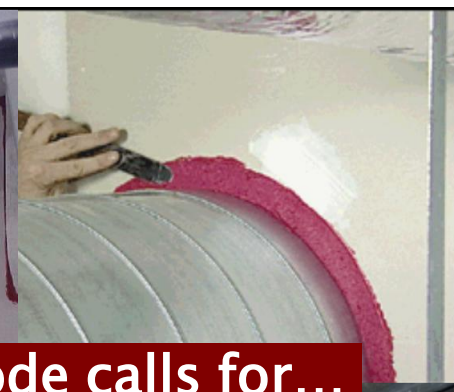
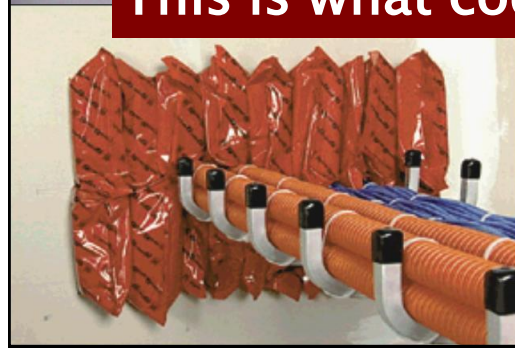
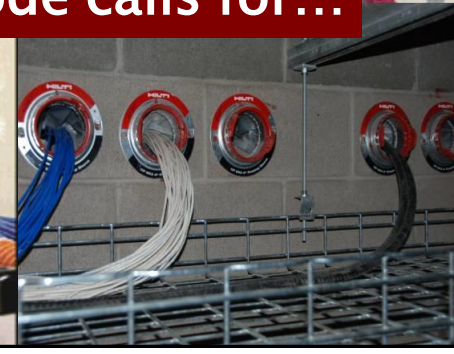


This is what code calls for…





Firestopping in the Real World

- Firestop system details are hardly ever on the plans
- Firestopping is not included in the Plan Check Submittal checklist
- Code Officials generally do not ask for copies of Tested and Listed firestop systems

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Firestopping in the Real World

- Building departments generally do not have the resources to provide **visual** inspections according to standards
- Code officials are not accustomed to providing **destructive** testing according to the standards
- Joints are generally not inspected during the framing inspection and installed to provide movement

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Firestopping in the Real World Cont.

- Engineering judgments are being used when there are tested and listed systems available
- Firestopping is the only code required work on a project that is **installed by every trade**.
- Tested/Listed systems rarely installed correctly
- Most users are untrained

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Fire Officials and Contractors are starting to understand that

"WITH FIRESTOPPING YOU GET
WHAT YOU INSPECT,
NOT WHAT YOU EXPECT"

Question for the Building Official

- What is your Building Department's Plan Review and Building Inspection Policy and Procedure for Firestopping?

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IF AHJ CHANGES FIRESTOP POLICY AND PROCEDURE

- Different levels of enforcement
  - A. AHJ Will provide all firestop enforcement
  - B. *According to IBC firestop special inspections section 1705.17*
  - C. *Large projects provided by 3rd party and other projects by staff*
  - D. 3rd party will provide all firestop enforcement

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Building Departments can require firestop special inspectors beyond Section 1705.17

- Your Building Department can utilize section 1705.1.1 to require other buildings to the list of required firestop special inspections.
- **1705.1.1 Special cases.** *Special inspections shall be* required for proposed work that is, in the opinion of the *building official, unusual in its nature*

IF AHJ CHANGES FIRESTOP POLICY AND PROCEDURE

Common consideration for AHJ

Large projects provided by 3rd party and other projects by staff

Common QUESTION: What size of project should our department require firestop special inspectors?

- ❑ Three stories or greater in height
- ❑ Occupant load over 250 or BO sets OC
- ❑ Square footage of building
- ❑ Type of Occupancy
- ❑ Type of Construction

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RECOMMENDED STEPS IF AHJ CHANGES FIRESTOP POLICY AND PROCEDURE CONT.

- Discuss **level of training** that personnel will utilize (if needed)
  A. Resources from this presentation
  B. Further hands on and code driven firestop training
  C. Organizations (IFC) that can assist with video's and other training tools
  D. ICC Firestop training with CLA or Book on firestopping.
- *If need further assistance feel free to contact Fire Containment Training Services

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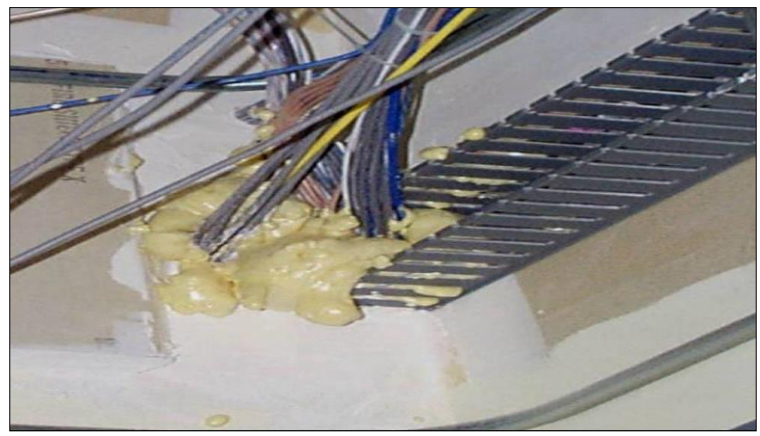
Improper Firestop Installations



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Improper Firestop Installations

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Repair of Fire Rated Wall Assembly Gypsum Association (GA-225-08)

Figure 1. Damaged Gypsum Board

Figure 2. Square-Off Damaged Area

Figure 3. Frame Cutout

Figure 4. Apply Gypsum Board Patch

Figure 5. Tape and Finish Patched Area

Figure 6. Redecorate Patched Area

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Correct Firestop Installations

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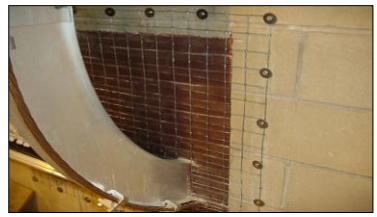
Correct Firestop Installations



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Available Resources

Joints (Walls and Floors)
www.emseal.com

Joints (Head of wall)
www.firetrak.com

Available Resources General

- **International Firestop Council (IFC)**
  www.firestop.org
- Firesafe North America
  www.firesafenorthamerica.org
- Firestop Contractors International Association
  www.fcia.org
- ASTM International standards
  www.astm.org

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Reference Materials

- ASTM E 2174 & ASTM E 2393 "Standard Practice for On-Site Inspection of Installed Fire Stops"
- **UL-IFC Video** "CLOSE ENOUGH IS NOT GOOD ENOUGH": (YouTube: UL and IFC Video)
- ICC/IFC Pocket Guide for Inspectors
- ICC Firestop and Damper book by Jay Woodward

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THANK YOU

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FCTS APPRECIATES THE OPPORTUNITY

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