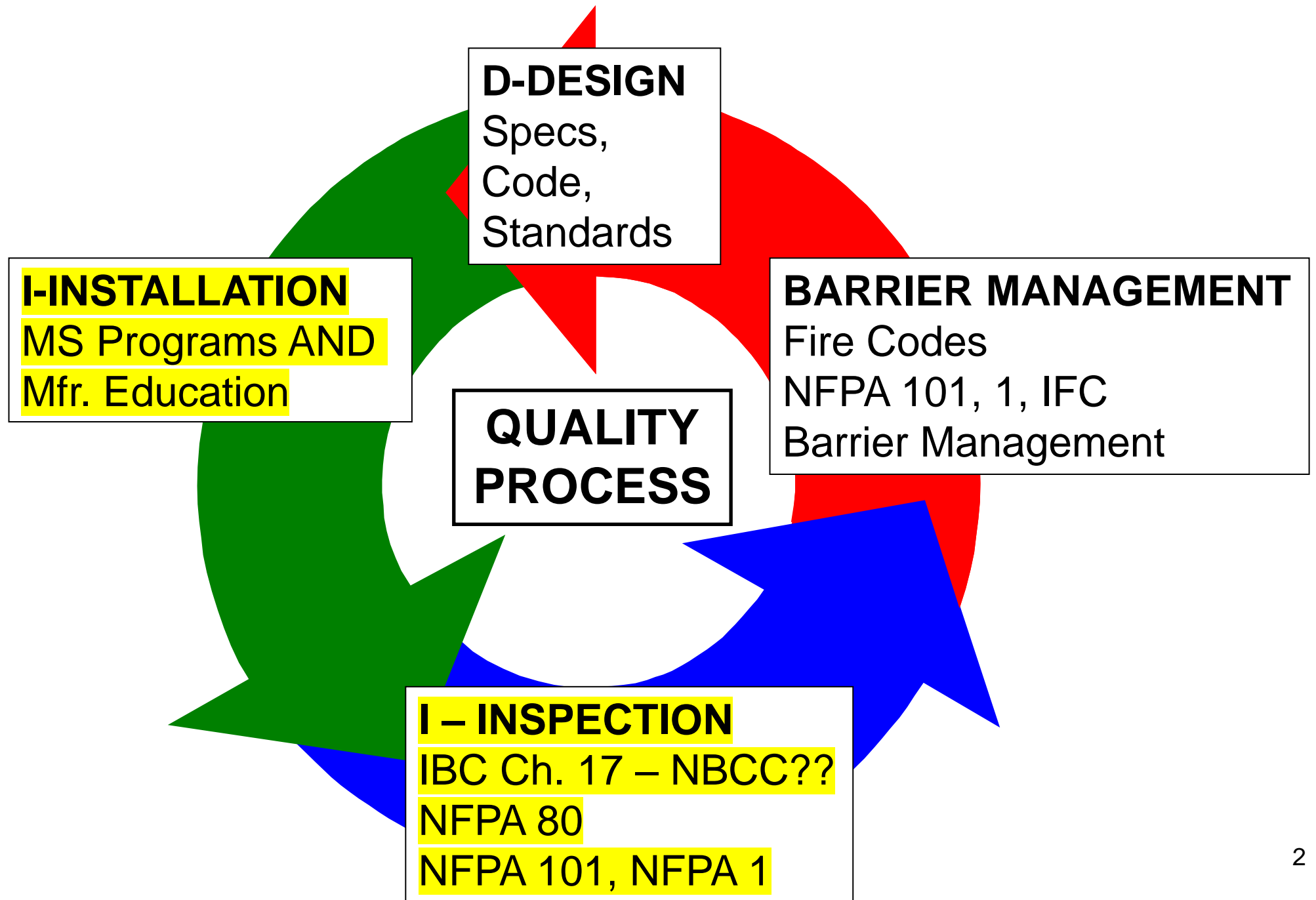


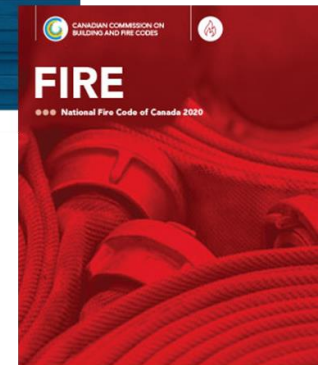
INSTALLATION & INSPECTION

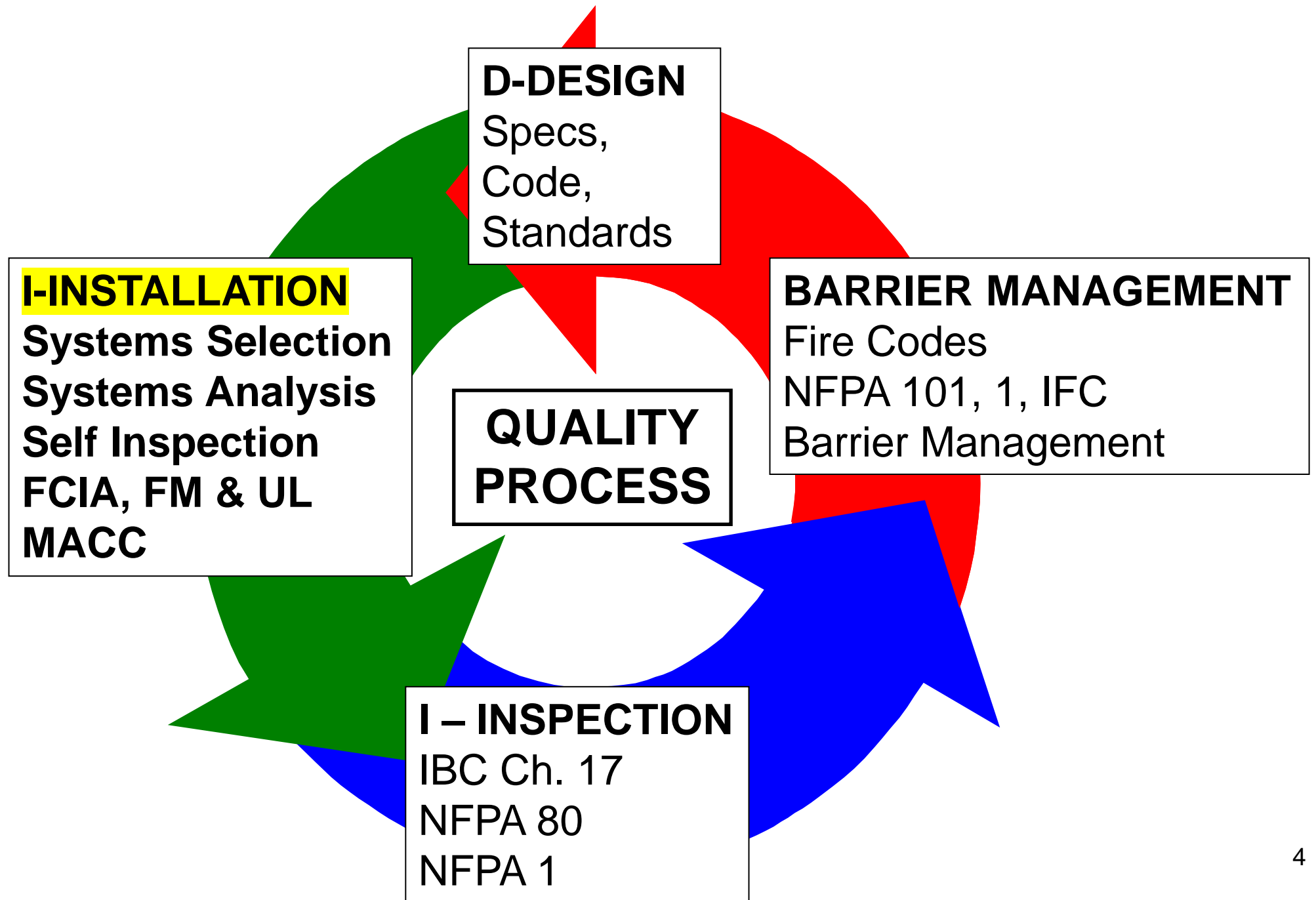




Firestopping & Compartmentation for Safety

- Compartmentation Codes – Canada
- ***National Building Code of Canada***
 - NBCC Exec. Committee - “No Objective for Firestop Inspection”
 - FCIA – “Why is there inspection for sprinklers??”





Understand Building Requirements



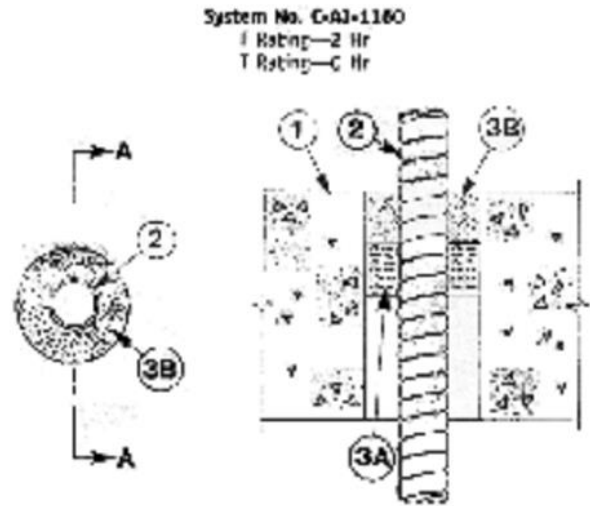
Firestop Products Become SYSTEMS – Sealant, Tape, Spray & MW Mineral Wool

- Backing/Damming/Packing AND
- Sealants
 - Silicone, Acrylic/Latex, Intumescent
- Wrap Strips & Collars
 - “Thick, Thin, Wide, Less Wide”
- Putties
- Pre Fabricated MCT Devices
- Fire Pillows
- Firestop Mortar
- Composite Sheets
- Bricks / Plugs
- Spray Products
- Tape, Strips



Firestopping for Continuity

I – Classified Systems

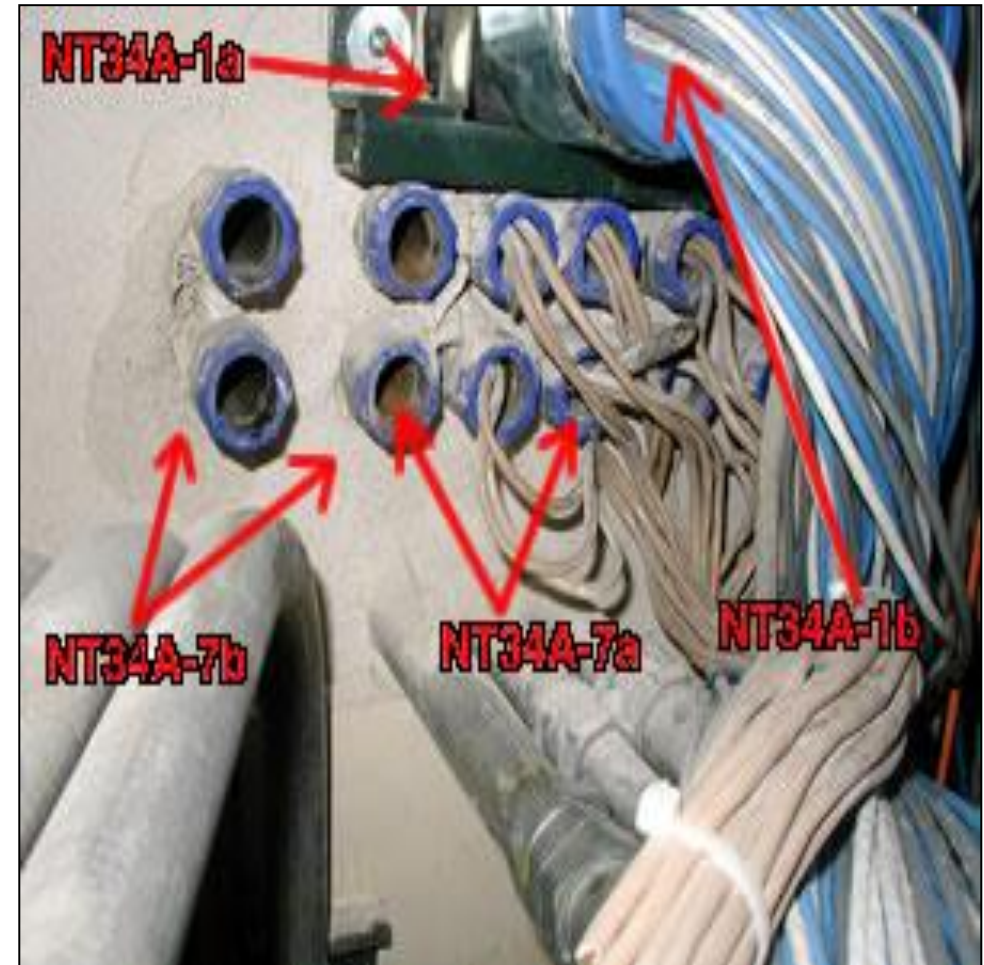


SECTION A-A

1. Floor or Wall Assembly—Min. 4-1/2 in. thick lightweight or normal weight (100 to 150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Block*. Size of circular through opening in floor or wall assembly to be 1 1/2 in. to 1-1/2 in. larger than diam of flexible metal conduit (item 2) installed in through opening. Max diam of opening is 6 in. See Concrete Block (CA2) category in the Fire Resistance Directory for names or manufacturers.
2. Through Penetrating Product*—Max 4 in. diam (or smaller) steel or max 3/4 in. diam (or smaller) aluminum flexible metal conduit. Max one flexible metal conduit to be installed per center or circular through opening in floor or wall assembly. Flexible metal conduit to be rigidly supported on both sides of floor or wall assembly.
3. Packing Material—Non 1 hr. thickness of ceramic (plastic) slugs* per Markel or mineral wool batt insulation. Fully packed into opening on a permanent form. Packing material to be recessed min. 1 in. from top surface of floor or from both surfaces of wall.
4. Fill, Void or Cavity Material*—Grout—Applied to fill the annular space around the flexible metal conduit. In floor, a min 2 in. depth of fill material to be installed flush with top surface of floor. In walls, a min 1 in. depth of fill material to be installed flush with wall surface on both sides of wall assembly.

Minnesota Mining & Mfg. Co.—TF 27506

*Bearing the UL Classification Marking
 (Bearing the UL Listing Mark)



Firestopping for Continuity

Products become **SYSTEMS** Based on Testing

- ‘Field Erected Construction...Tested to...’
 - Standards – **CAN/ULC-S115**, ASTM E814 / UL 1479, UL 2079, ASTM E1966, ASTM E2837, ASTM E2307, FM 4990
 - F Rating – Flame
 - FT Rating – Temperature
 - FH Rating – Hose
 - FTH Rating
 - L Rating – Smoke
 - W Rating – Water
 - M Rating – Movement



3M Photo

Conditions of Acceptance F Rating

- Passage of Flame

Conditions of Acceptance

FT Rating

- Passage of Flame
- 325°F (180°C) Temperature Rise

Conditions of Acceptance FH Rating

- Passage of Flame
- Hose Stream

Conditions of Acceptance FTH Rating

- Passage of Flame
- 325°F (180°C) Temperature Rise
- Hose Stream

L Rating

- Air Leakage Rate at Ambient Temperature
- Air Leakage Rate at 400°F (204°C)

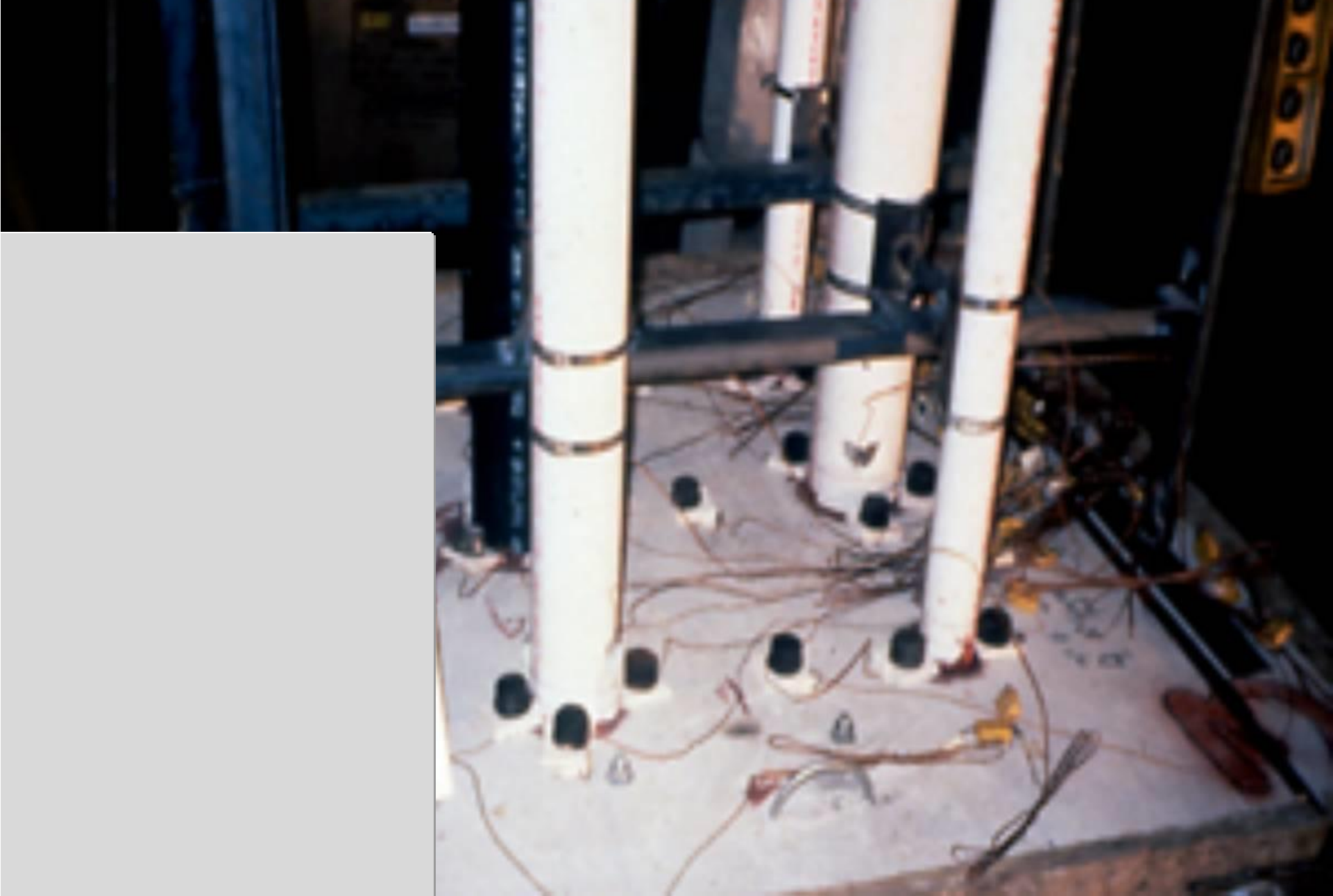
W Rating

- Optional program, applicable to incidental water
- 3 Ft WC (0.91 M WC) Pressure Head / 72 Hr Exposure
- Firestop subjected to water exposure, followed by standard fire and hose stream tests
- Firestop systems assigned a W Rating

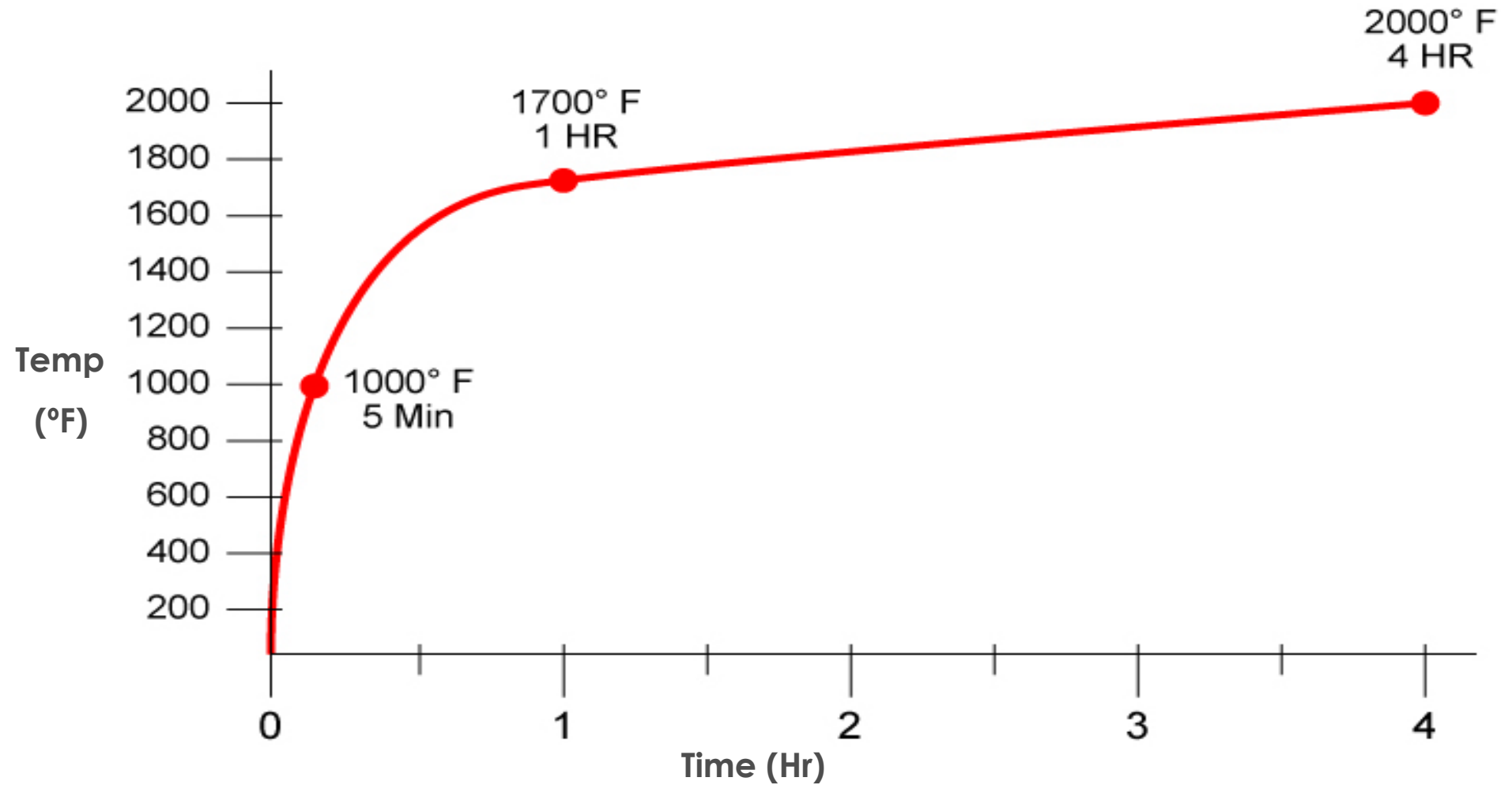
M Rating

- Optional program, applicable to movement of penetrating item
- Penetrating item move perpendicular and/or in plane of barrier in accordance with ASTM E3037
- After movement, firestop system subjected to standard fire and hose stream tests
- Firestop systems assigned a M Rating
 - Rating within plane based on percentage of annular space
 - Rating perpendicular to barrier based on dimension

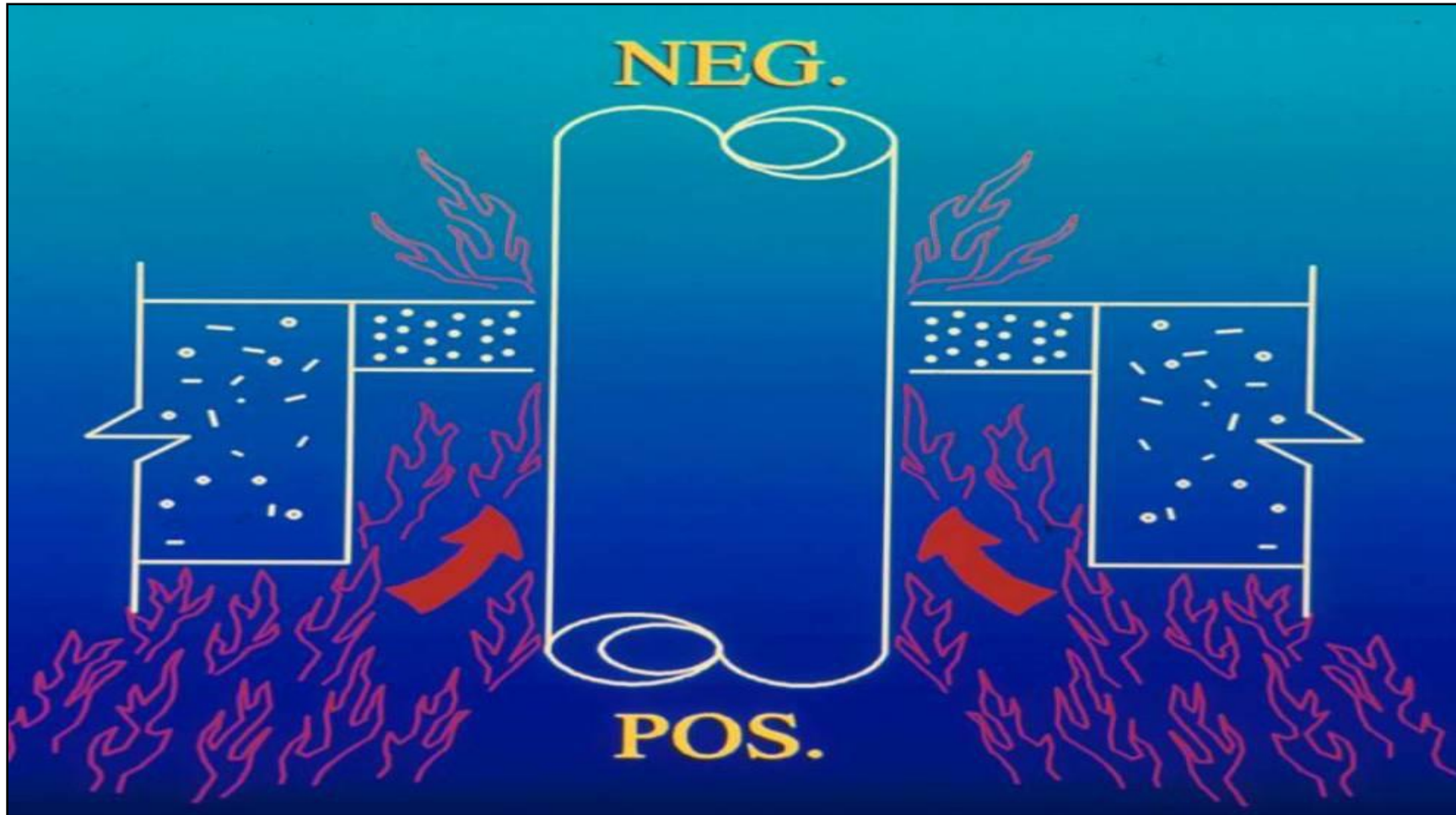
Pre-Test View of Top of Concrete Slab

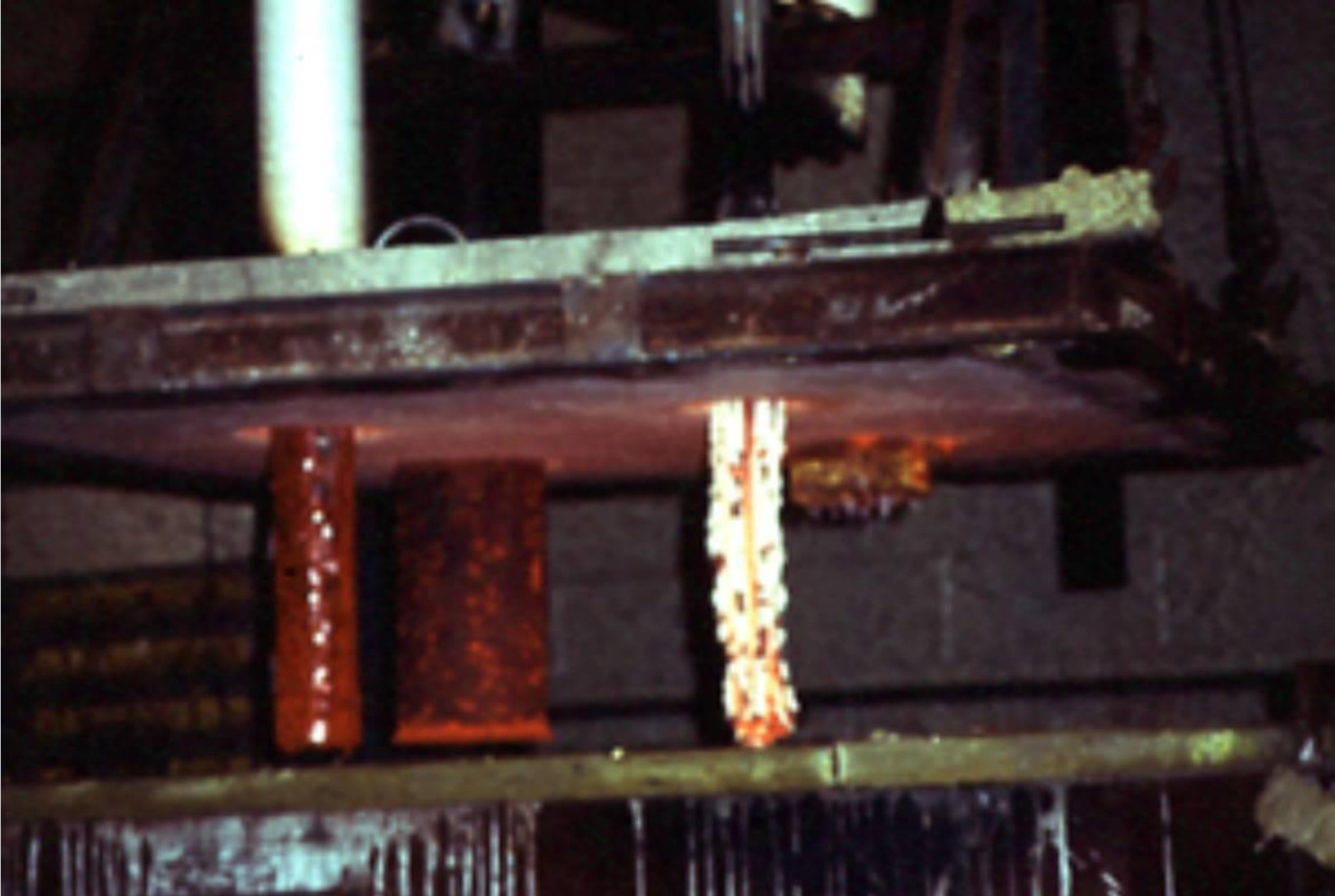


Time-Temperature Curve



Positive Furnace Pressure





Post-Test View of Bottom of Slab

Hose Stream Test



UL Photo

Building & Fire

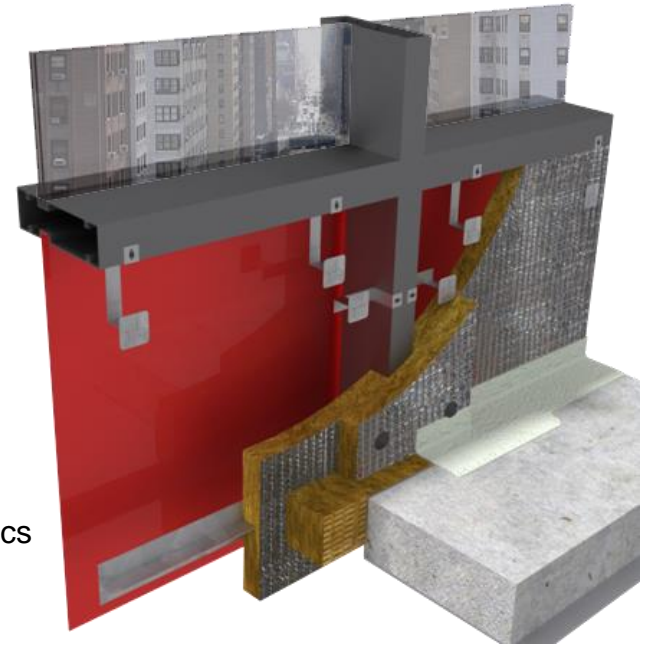
Worldwide Code Requirements

- *Chemical, Biological, Radiation, Explosion, Germ, etc.*
 - Standards?
 - C – Which Chemicals? Check with manufacturer
 - B – Which Agents? Check with manufacturer
 - R – Nuclear Power Plant Standards? Check with manufacturer.
 - E – Blast Strength? Check with manufacturer
 - G – Germ – Check with manufacturer & industrial hygienist
 - How to Regulate for Unexpected Events?
 - Due Diligence - Review Required by code?

IBC & Curtain Walls

- **ASTM E2307**
- **Prevent Fire Spread – Interior Safing Slot**
 - Interior Flame
 - Exterior Flame Plume from Window
 - Time & Temperature
 - Tested Systems....
- **Leapfrog Testing (ASTM E2874)?**
- **More on this by**
 - **Rick Roos, Tony Crimi, Angie Ogino**

OCF/Thermafiber Graphics

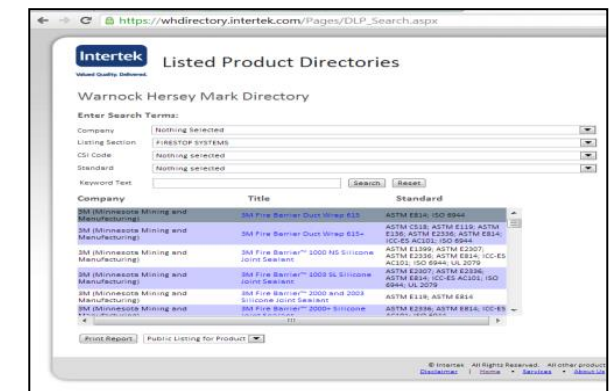
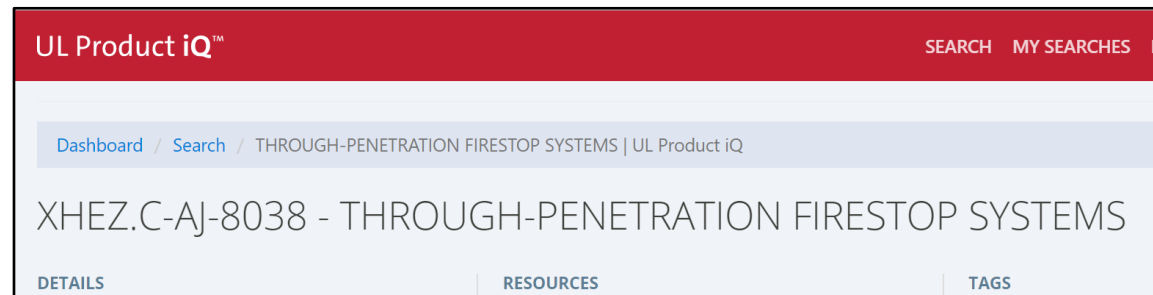


Barrier Continuity Products become SYSTEMS

- Fire Rated Systems Directories –
 - FM Approvals
 - Intertek
 - UL/ULC Product iQ Online Directory



Systems Selection & Analysis...Not as easy as it looks...



Sleeved Pipes



Fire/Smoke Dampers & Firestops

- Dampers – **CAN/ULC-S112, S112.1**, UL 555, 555S
 - Listings - ***Systems***
 - Installed to manufacturer's written instructions
 - Systems – Angles...no sealants required.
- Firestop sealants – ULC-S115, UL 1479
 - Improper hole sizing or poor installation...

Consult the Damper
Manufacturer & the
Authority Having
Jurisdiction

Greenheck Photo



Engineering Judgments/EFRRA

IFC EJ Guidelines for the Evaluation ...

Engineering Judgments for firestop systems should:

- Not a substitute for existing designs
- Emphasizes importance of tested designs
- Should be issued only by those who know the components
- Based on sound engineering practices and knowledge of performance of the designs
- Based on interpolation of previous testing
- Issued only for a specific jobsite
- Presented in clear detail



Engineering Judgments/EFRRRA

International Firestop Council – Manufacturers Protocol

www.firestop.org

IFC Recommended Guidelines for Evaluating Firestop Systems in Engineering Judgments.

‘Construction industry professionals, building officials, fire officials, firestop contractors and other stakeholders need appropriate guidelines for evaluating and using such judgments....’

FCIA RECOMMENDS CONTRACTOR REQUEST MANUFACTURER STATEMENT FOR ALL EJ”s...

Engineering Judgments/EFRRRA

***FCIA RECOMMENDS CONTRACTOR REQUEST MANUFACTURER
STATEMENT FOR ALL EJ"s....***

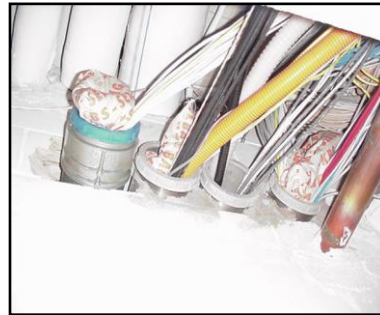
***"Manufacturer attests this EJ will pass applicable firestop fire test with
hose stream if subjected..."***

Installation – Who?

- Firestopping wrong, missing
- Systems Documentation?
- As Built Documentation??

***Conclusion –
Without Single Firestop Installation
Contractor....***

Fire & life safety risks



Adler Photo

3 Firestop Installation Methods

- **Each Trade**
 - “He/She who pokes hole, fills hole”
- **Multiple Contracts**
 - Firestop Contractors, Trades
- **Single Source Firestop Contractor**
 - *FCIA Member in Good Standing*
 - *FM 4991, UL, ULC Qualified*

Why Contractor Qualifications?

- **Firestopping** Ratings - F, FT, FH, FTH, L, W, M
- **Zero Tolerances?**
 - Annular Space Sizes, Gap Sizes
- **Product Properties**
 - Movement
 - Compatibility
 - Storage, Application, Curing Temps
- **SYSTEMS DOCUMENTATION**

Spec Contractor Qualifications

- FM 4991 – Standard for the Approval of Firestop Contractors
- UL Qualified Firestop Contractors
- Other Industries???
- ***FM 4991 / UL-ULC CONTRACTORS UNDERSTAND SYSTEMS, INVENTORY & DOCUMENTATION***



Why Contractor Qualifications?

- **Built right the first time...**
- **Documentation**
- **SYSTEMS Selection, Analysis, As-Builts**
 - F, T, L, W Rated Systems
 - Tolerances - Annular Space Sizes, Angles
 - Gap Sizes - Undercuts - Framing
 - Anchors - Spacing – Hardware
 - Closers - Activation Sensors, more...

FM 4991 & ULC QFC

- **ULC Firestop Exam @ 80% min.**
- **Management System (MS) Written**
- **MS Procedures implemented**
- **Audit**
 - Contractor Office – Records & Documents
 - Jobsite – Observation, possible destructive
- **DRI – Appointed by Contractor, CEU's**

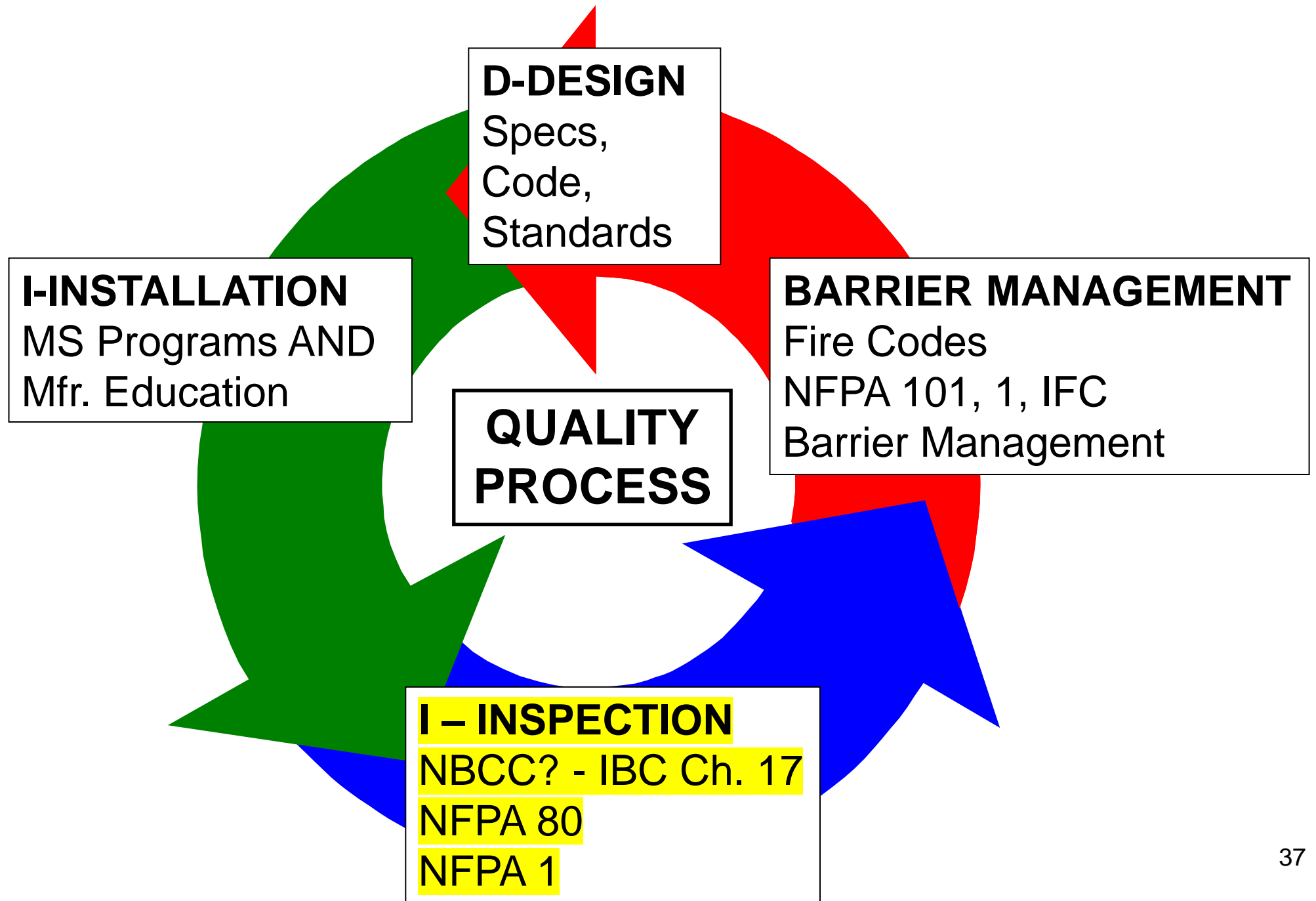
Listed at www.UL.com – www.FCIA.org
More from UL/ULC's Ruben Sandoval.....

Management System – ULC, FM

- **Facility Tour**
- **Review MS Manual**
- **Construction Documents Requirements and Review**
 - **Systems Selection & Analysis**
- **Procurement**
- **Storage, Handling, Preservation and Delivery**
- **Installation, Application and Field Quality Assurance Procedures**
 - **Systems Installation, Self Inspection/Survey**

Management System – ULC, FM

- **Inspection, Testing and Calibration**
 - Tape Measures
- **Control of Nonconforming Product**
- **Training and Qualification of Staff**
 - DRI's, Workforce
- **Corrective/Preventive Action**
- **Quality System Monitoring and Improvement**
- **Documentation and Record Keeping**
 - 7 years



Firestop & Inspection

- ASTM E2174 / ASTM E2393 – “*Inspection Process*”



I – Inspection – Options

- **Contractor Self Inspection**
 - Verify Management System validity
 - Not 2%, 10%
 - Required for FM & UL, ULC Contractors
- **Manufacturer Inspection**
 - Does not exist ... Survey, maybe
- **ASTM E2174 & ASTM E2393**
 - Independent 3rd Party
 - Destructive, Non Destructive
 - Specified Frequency

I – Inspection – Scope

- **ASTM E2174 & ASTM E2393**
 - Firestopping
- Other Scopes—Possibilities for IA's
 - Walls, Horizontal Assemblies
 - Fire Dampers
 - Fire Rated Glazing
 - Fire Doors

I – Inspection – IBC Code Requirements (Not in NBC)

- Required, International Building Code – Chapter 17
- Not Required in NBC
- NBC Code Proposal – 2020 ... and 2025

I – Inspection – IBC Code Requirements

Definitions – Chapter 17, IBC

[A] APPROVED AGENCY. An **established and recognized agency** regularly engaged in conducting tests or furnishing inspection services, when such agency has been *approved*. [IBC 202 Definitions]

[A] APPROVED. Acceptable to the *building official* or authority having jurisdiction. [IBC 202 Definitions]

I – Inspection – IBC Code Requirements

SPECIAL INSPECTOR. A qualified person **employed or retained by an approved agency** and *approved* by the *building official* as having the competence necessary to inspect a particular type of construction requiring *special inspection*. [IBC 202. Definitions]

I – Inspection – Code Requirements

1705.16.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.3.1.2 and 714.4.1.2 shall be conducted by an approved inspection agency in accordance with ASTM E2174.

1705.16.2 Fire-resistant joint systems. Inspection of fire resistant joint systems that are tested and listed in accordance with Sections 715.3 and 715.4 shall be conducted by an approved inspection agency in accordance with ASTM E2393. [IBC 1705.17.1.2]

Firestop Inspection in Codes

ASTM E2174 - ASTM E2393

- NFPA 101 / 5000 - Chapter 8 - Annex
- 2012 – 2018 International Building Code
 - CH 17 – Special Inspections
 - Buildings 75' & higher above Fire Department Access
 - Occupancy Type III, IV, Chapter 16 Table 1604.5
- Abu Dhabi International Building Code

Firestop Inspection in Codes

- **Table 1604.5 – Risk III** – *Buildings and other structures that represent a substantial hazard to human life in the event of failure, include but are not limited to:*
 - **Public Assembly, Occupant Load > 300**
 - **Bldgs. Containing Elem., 2ndary', day care, > 250**
 - **I-2, > 50, no surgery, emergency**
 - **I-3**
 - **Occupancy load > 5,000**
 - **Power-gen, H2O treatment, wastewater treatment, public utilities, not in IV**
 - **Buildings not in IV, with toxic or explosives [IBC 1604.5]**

Firestop Inspection in Codes

- **Table 1604.5 – Risk IV – *Buildings and other structures designated as essential facilities, including but not limited to:***
 - *Group I-2 occupancies having surgery or emergency treatment facilities.*
 - *Fire, **rescue, ambulance/police stations**, emergency vehicle garages.*
 - *Designated earthquake, hurricane or other **emergency shelters**.*
 - *Designated emergency prep, communications and operations centers and other **facilities required for emergency response**.*
 - *Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.*
- [IBC 1604.5]

Firestop Inspection in Codes

- **Table 1604.5 – Risk IV** – *Buildings and other structures designated as essential facilities, including but not limited to:*
 - ***Buildings and other structures containing quantities of highly toxic materials that:***
 - *Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the International Fire Code, and are sufficient to pose a threat to the public if released.*
 - *Aviation control towers, air traffic control centers and emergency aircraft hangars.*
 - *Buildings and other structures having critical national defense functions.*
 - *Water storage facilities and pump structures required to maintain water pressure for fire suppression.*
 - *[IBC 1604.5]*

Firestop Systems Inspection

ASTM E2174 - ASTM E2393

- “Standard Practice for On-Site Inspection of Installed Fire Stops – Penetrations - Joints”
 - Standard Inspection Procedure
 - Special Inspection Agency Companies
 - Other Qualified Firms
 - Hired by & Report to Building Owner, Architect, Owners Rep, other than GC.
 - = Authorizing Authority

Firestop Inspection Firm & Individual Qualifications – ASTM E2174 - ASTM E2393

- Inspector Firm & Inspectors
 - **‘Independent of, and Divested from ’** Installing firm, Distributor, Manufacturer, Competitor, Supplier...
 - **‘Not a Competitor** of the Installer, contractor, manufacturer, or supplier
 - **Other than the contractor...**
 - **Submit notarized statements of ...**

Firestop Inspection Firm & Individual Qualifications – ASTM E2174 - ASTM E2393

- Inspector Personnel meet at least one criteria.....
 - 2 years experience (Construction, Field), education, and credentials acceptable to AHJ
 - Accredited by AHJ
 - Meet ASTM E699
- **Inspection Agency Company Qualification – IAS AC 291 – w / Individual Certs.**



Firestop Inspection Firm & Individual Qualifications – IAS AC 291

- **Inspection Firm shall have staff..**
 - PASS UL or FM Firestop Exam, IFC Exam
 - 1 year Quality Assurance
 - Or...*
 - PASS UL/FM Firestop Exam, IFC Firestop Exam, *and* PE, FPE, Registered Architect, or
 - PASS UL/FM Firestop Exam, IFC Firestop Exam, *and* Education by Certified Agency

Firestop Inspection Firm and Individual Qualifications – IAS AC 291

- **Specify IAS AC 291 –**
 - Quantified Qualifications
 - Helps AHJ with “Approved Agency”
 - Not in ASTM Standards, Code
- **Specify Individual Certifications**
 - 3rd Party, Independent Exams verify Knowledge
 - FM Firestop Exam,
 - OR
 - UL Firestop Exam,
 - AND
 - IFC Exam



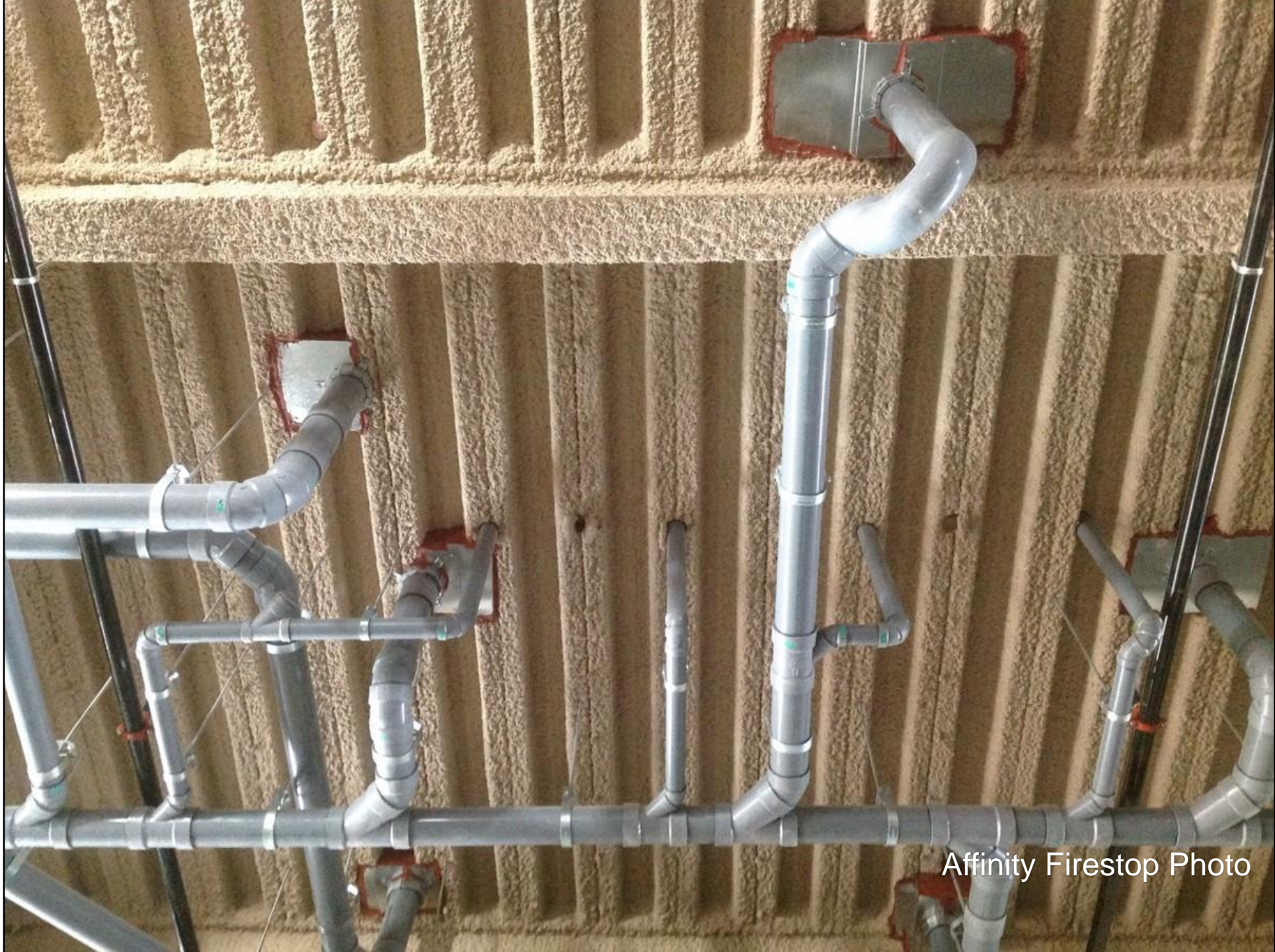
Affinity Firestop Photo



Affinity Firestop Photo



Affinity Firestop Photo



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Firestop Inspection Process

- Inspection Agency & Inspector
 - Independent
 - Hired after systems submitted, etc.
 - Hired by building owner and manager or representative
 - Scope of work directed by AA
 - AHJ approval

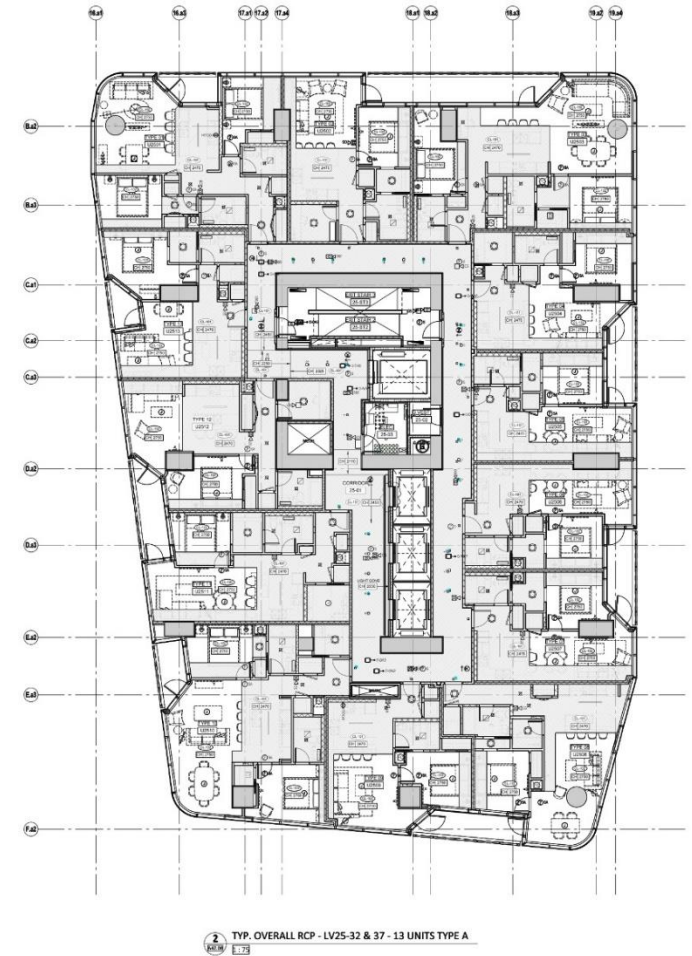


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Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Pre-Construction Meeting
 - Review Documents
 - Identify Conflicts
 - Review Materials Systems
 - **CAN/ULC-S115, ASTM E814 or UL1479, FM 4990, ASTM E1966, UL 2079, ASTM E2307 Systems**



Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Inspection Documents
 - Specifications and Drawings
 - Manufacturer Product Data Sheets and Installation Instructions
 - Listed Systems and EJ's/EFRRA's

| | | |
|--|--------------------------------------|---|
| FIRESTOP CONTRACTOR (204) 555-0101 | |  |
| WARNING | | |
| This is an approved Firestop System and shall NOT be disturbed except by Authorized Personnel. | | |
| Well Plate Penetration No.: <u>M-2081-1</u> | Fire Rating Required: <u>1.0 F</u> | |
| Floor Level: <u>LEVEL 200</u> | Room No.: <u>201</u> | |
| Installer's Name: <u>JOHN SMITH</u> | Product: <u>FS-ONE</u> | |
| Installation Date: <u>APRIL 1, 2013</u> | System Design No.: <u>C-AJ-1022a</u> | |
| Re-penetrated by: | | |
| Company | Installer | Date |
| _____ | _____ | _____ |
| _____ | _____ | _____ |



Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Pre-Construction Meeting
 - Mock Up Review
 - Observation or Destructive Review (Testing)
 - Inspection Type Methodology
 - Frequency of reviews
 - Description of reviews
 - Specification and drawings
- Meeting(s) are required
 - During and Post Inspection



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Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Inspection Schedule
 - Notifies Inspector
 - Inspections within 2 days
 - Inspector verifies installation
 - Is in accordance with Documents
 - Meets Manufacturers Installation Instructions

Affinity Firestop Photo



Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Observation Reviews
 - Performed during construction
 - Witnessed randomly of the installed systems on each floor
 - E2174 - 10%, each **type** of Service Penetration Firestop System
 - **Type = By System, By Contractor**
 - E2393 - 5% of Total Lineal Feet for each type of Fire Resistance Rated Joint System
 - **Type = By System, By Contractor**



Affinity Firestop Photo

Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Destructive Reviews (Testing)
 - Performed Post-Construction
 - **E2174 - Minimum 2% , no less than 1, each type per 930 m² (10,000 SF) of floor area**
 - **Type = By System, By Contractor**
 - **E2393 - Minimum 1 / 152 LM (500 LF) of Joint Area, by type, mandatory; Exception mechanical joints**
 - **Type = By System, By Contractor**



Affinity Firestop Photo

Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Variances / Deviations
- ASTM E2174 & ASTM E2393
 - FS Contractor is notified of any deficiencies within one day
- IBC 1704.2.4
 - Work is in conformance to the documents
 - Otherwise it is immediately brought to the attention of the FS Contractor
 - If not corrected, AHJ and AA will be informed to take action



Affinity Firestop Photo

Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Both Methods
 - If any type does not comply
 - Repair
 - Replace
 - 1 additional inspection
 - If 10% variance per firestop type
 - Inspection stops
 - Installer inspects, repairs
 - Inspector re-inspects
- Document all Deficiencies



Affinity Firestop Photo

Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Inspectors shall
 - **Not supervise or direct FS Contractors**
 - Commence reviews at the start of FS installation
 - Review installation based on manufacturers and system requirements



Affinity Firestop Photo

Firestop Inspection Process

ASTM E2174 - ASTM E2393

- Equipment –
 - Tapes
 - Tablets w/Systems
 - Borescope to explore areas that are concealed or partially
 - NOT MICROMETERS



Firestop Evaluation & Repairs

- Evaluations of Manufacturers Installation Instructions
 - Manufacturers instructions evaluating installed systems
 - Acceptable methods to review installed systems
 - Listed SYSTEM requirements for installations
 - ***IFC Document on Sealant Thickness Measurement***



Firestop Repairs

- Repairs
 - Instruction requirements by manufacturer
 - Listed systems
 - Patch/infilling
 - Adhesion
 - Movement
 - F, FT, FH, FTH, L, W Ratings
 - ***As recommended by MFR***

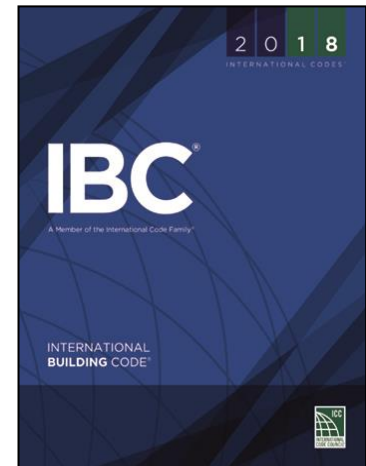


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Firestop Inspection Forms

Variance Notices

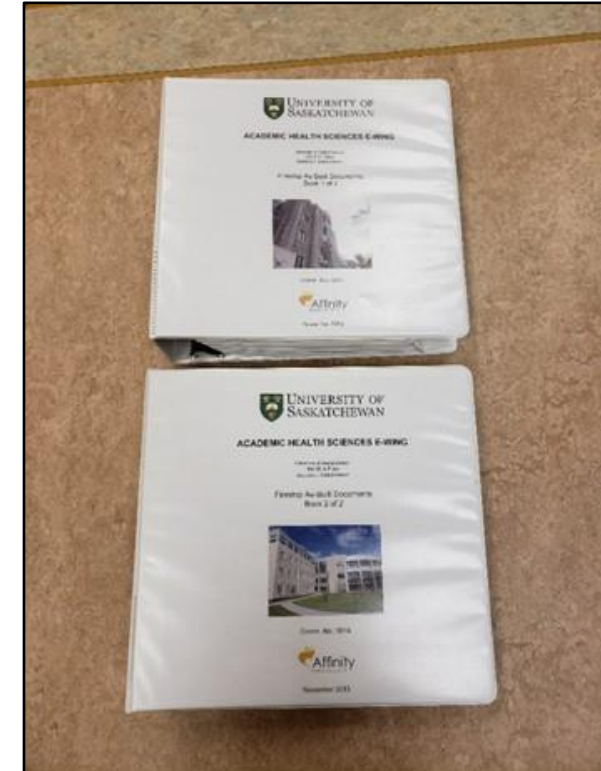
- Minimum one FS system for each type;
- ***(By Type of System, By Contractor)***
- ASTM E2174 and ASTM E2393 require reports to be submitted to AA one day after review
- **IBC requires IMMEDIATE NOTICE**
- Numbered – Controlled
- Required – During/post construction methods



Firestop Inspection Final Report

ASTM E2174 - ASTM E2393

- Project name and location
- Project team contact info
- Firestops reviewed (inspected)
 - Type and quantity
 - Verification method
 - Percentage of total deficiencies
- All documents submitted to AA



Affinity Firestop Photo

Firestop Special Inspection

ASTM E2174 - ASTM E2393

- Inspection Documents
 - Identify System, Materials
- Identification Systems (Labels)
 - Firestop Contractor Installed
 - Speeds System Evaluation

