

Maintaining Protection: Fire-Resistance Testing

Rich Walke, Consultant to the FCIA

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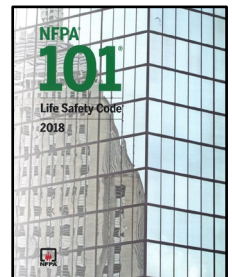
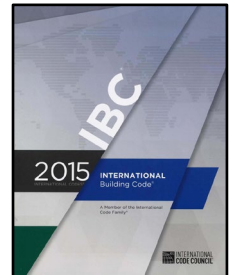
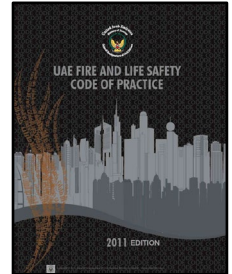
**FCIA Virtual 'DIIM' Firestop & Effective
Compartmentation in Existing Buildings
Symposium Middle East**



**CREATIVE TECHNOLOGY INC.
FIRE PROTECTION
CONSULTING AND TRAINING**

Building & Fire Code Requirements

- UAE Fire and Life Safety Code
 - New and Existing Buildings – Chapter 1
 - Existing Building Maintenance – Chapter 1, Section 21
- International Codes
 - New and Existing Buildings – International Building Code – Chapter 7
 - International Fire Code – Chapter 7
- NFPA
 - New and Existing Buildings – NFPA 5000 & 101 – Chapter 8
 - Fire Code – NFPA 1 – Chapter 12
- ***Minimum requirements - Construction & Maintaining Protection***



IBC Fire and Smoke Protection Features

- Fire-resistance-rated assemblies:
 - *Structural Members*
 - *Exterior Walls*
 - *Fire Walls*
 - *Fire Barriers*
 - *Fire Partitions*
 - *Smoke Barriers*
 - *Horizontal Assemblies*
 - *Shaft Enclosures*
- Smoke-resistant assemblies:
 - *Smoke Barriers* – Intended to “... restrict movement of smoke”
 - *Smoke Partitions* – Intended to “... limit the transfer of smoke”

Code Referenced Test Standard

- **Referenced Test Standards**

- **Structural Elements & Assemblies** – ASTM E119 / UL 263, ISO 834 Series, EN 1365 Series, BS 476 Series
- **Fire & Smoke Barriers** – ASTM E119 / UL 263, ISO 834 Series, EN 1365 Series, BS 476 Series
- **Firestopping** – ASTM E814 / UL 1479, ISO 10295-1, EN 1366-3, ASTM E1966 / UL 2079, ISO 10295-2, EN 1366-4, ASTM E2307, E2837, E3037, ...test method...”
- **Swinging/Rolling Fire Doors** – UL 10B, 10C, NFPA 252, ISO 3008-1, EN 1634-1
- **Fire Rated Glazing** – NFPA 257 / UL 9, ASTM E119 / UL 263, ISO 3009
- **Fire/Smoke/Ceiling Radiation Dampers** – UL 555, UL 555S, UL 555C, ISO 21925-1 & 2, EN 1366-2, EN 1366-10
- **SYSTEM Testing = Suitability statement for use of a product in a specific system/design application**

Fire-Resistance-Rated Construction

Establishing
Fire-Resistance
Ratings



Fire-Resistance

- Expressed as an Hourly Time Period
- Ratings range from 1/2 to 4 hours
- Contain Fire to Room or Floor of Origin and Maintain Structural Integrity



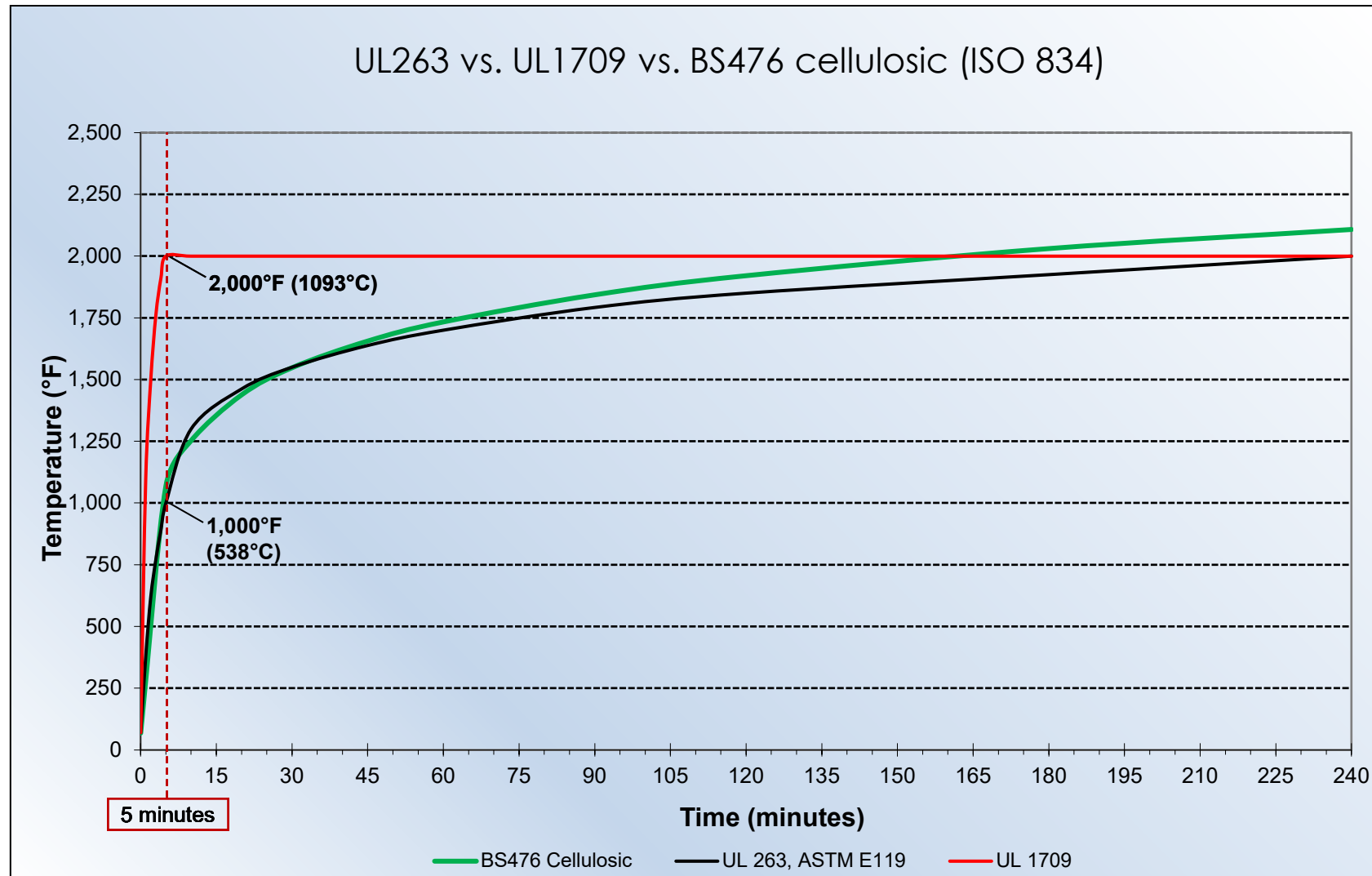
Standards

- US Based Standards
 - UL 263
 - ASTM E119
 - NFPA 251 (Withdrawn)
- ISO, EN and BS Standards
 - ISO 834 Series
 - EN 1365 Series
 - BS 476 Series

Building Components

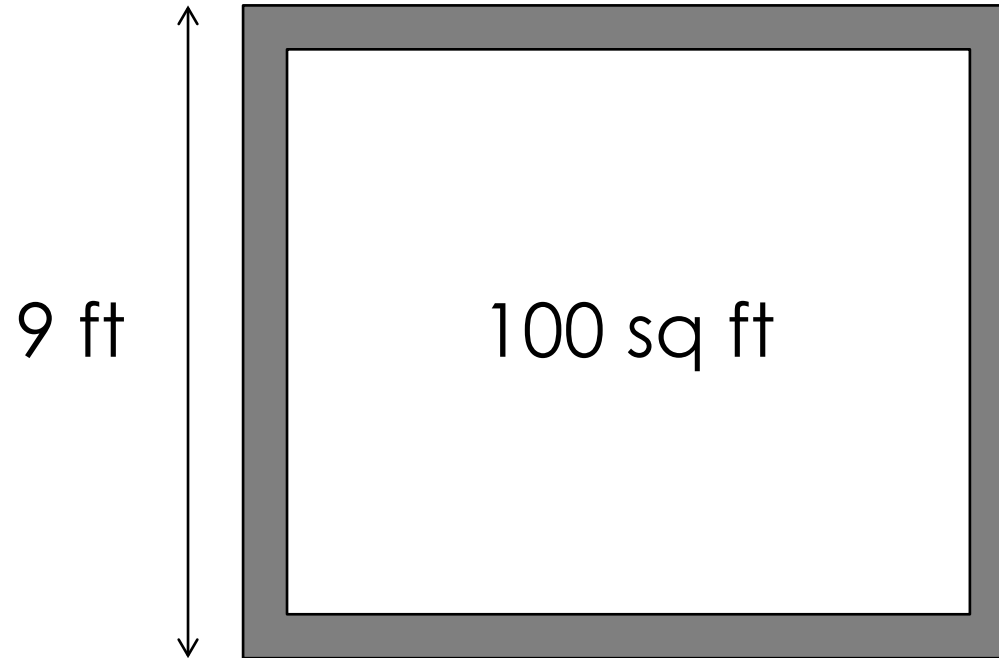
- Columns
- Beams
- Floor/Ceilings or Roof/Ceilings
- Walls

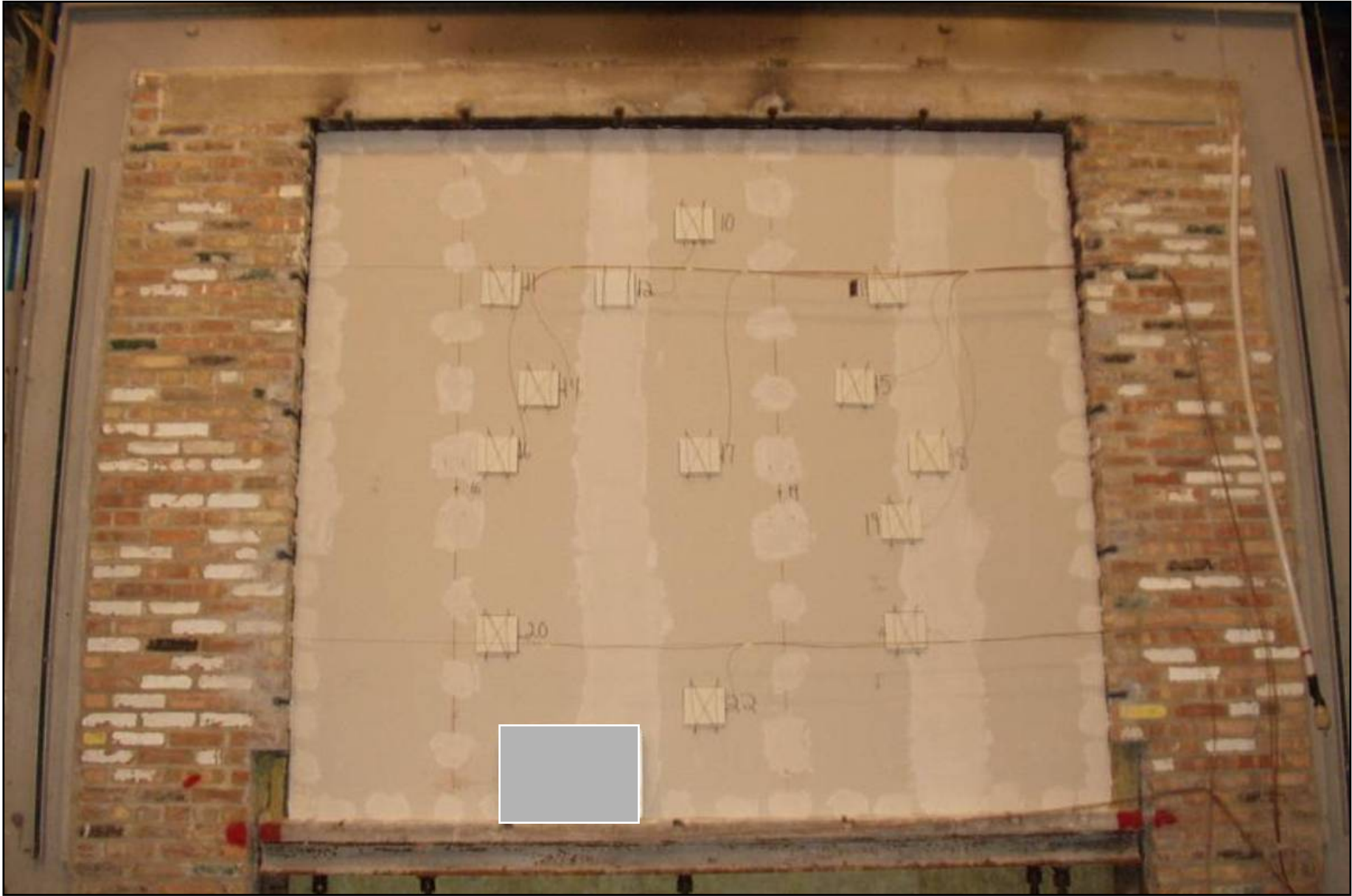
Time - Temperature Curve



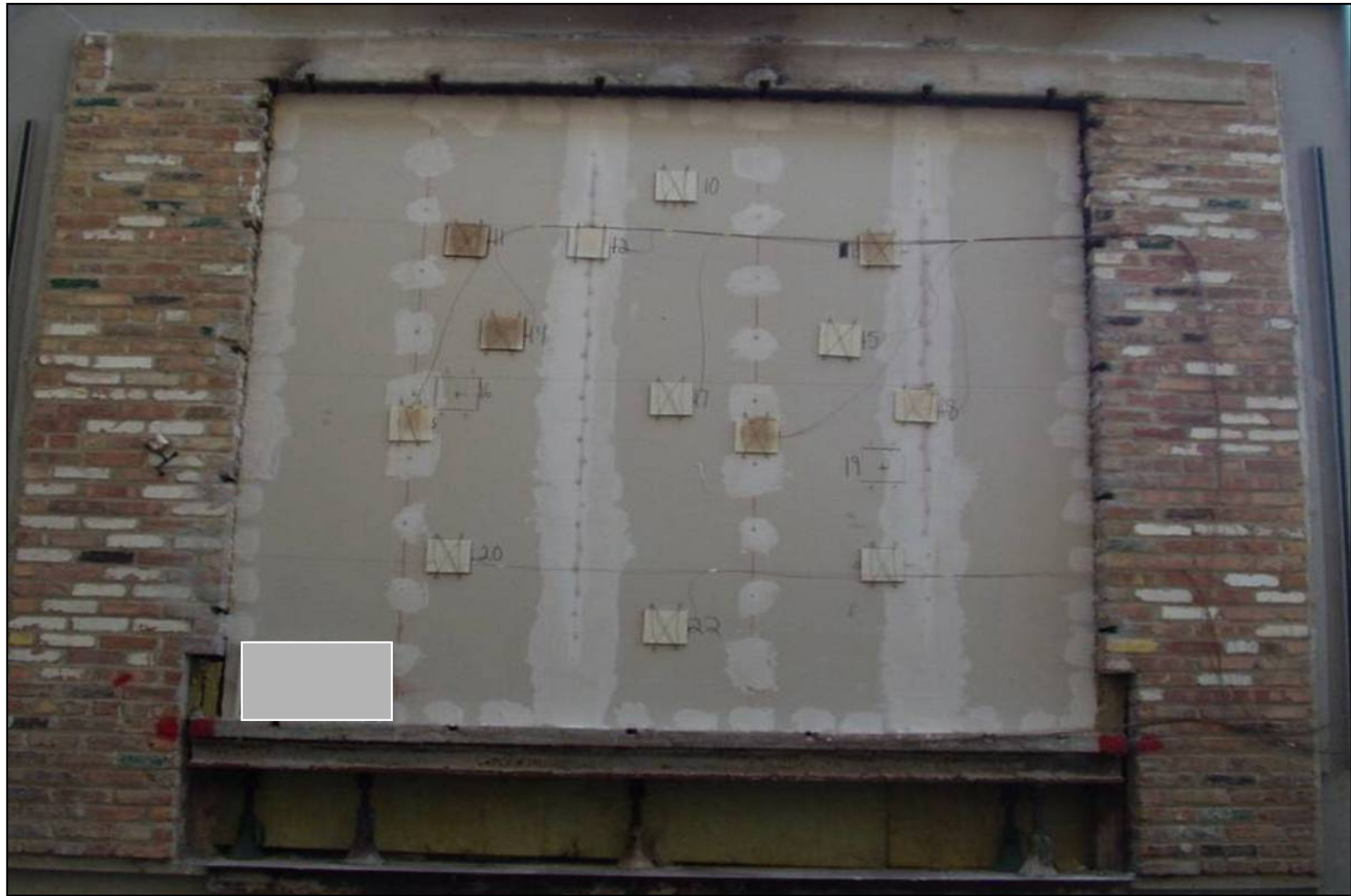
Walls

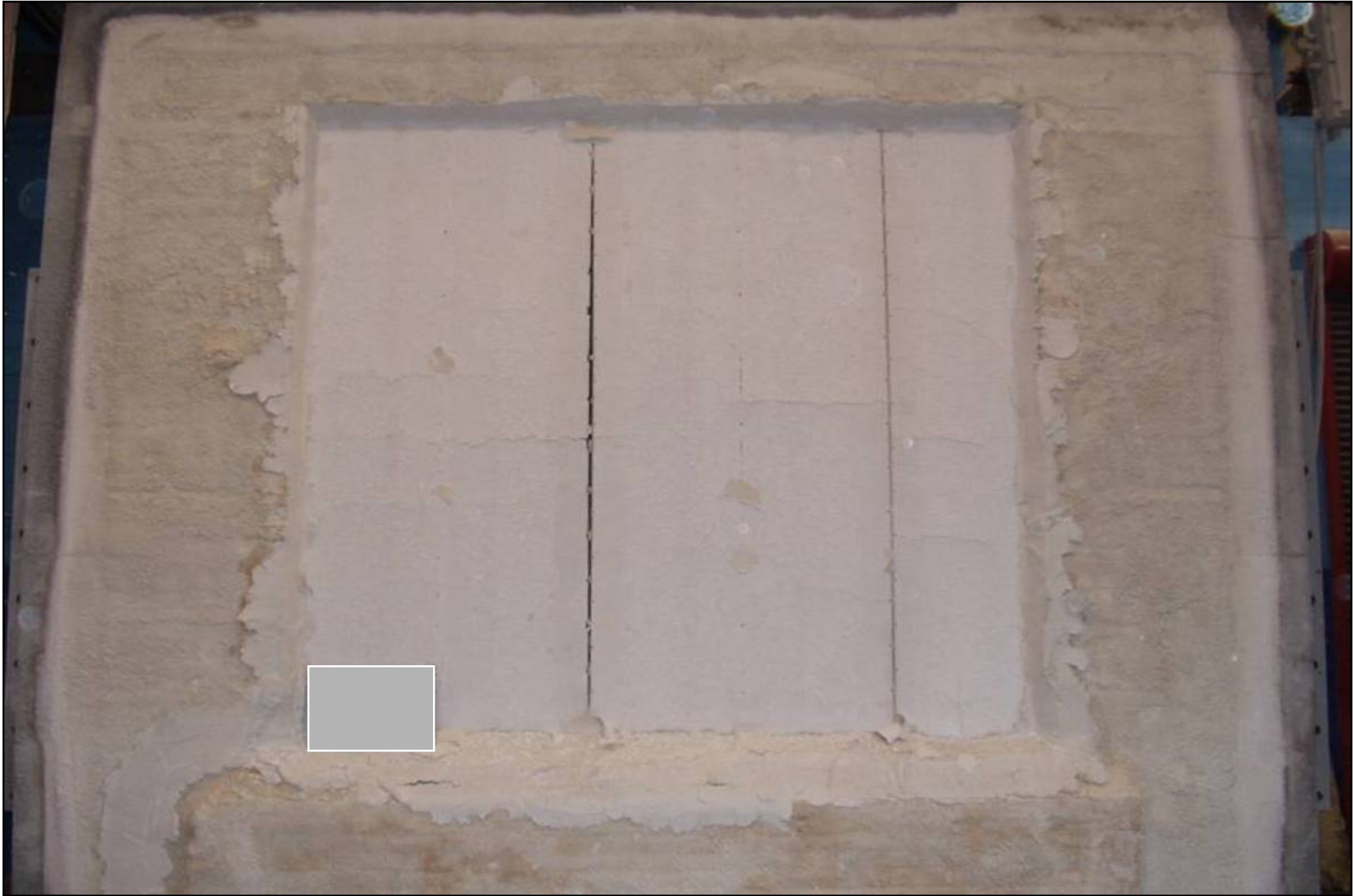
- Sample size - 100 sq ft (9.3 sq m) / 9 ft (2.7 m)
- Load applied - Per design















Conditions of Acceptance – Walls

- Flame passage
- 250°F (140°C) / 325°F (180°C)
- Support load
- Hose stream (North American Standards only)



Breaches in Fire-Resistance-Rated Construction

Penetrations

Joint Systems

Opening Protectives

Ducts and Air Transfer Openings



Requirements for Protecting Breaches

- Each type of breach has a unique fire test standard and a smoke leakage test standard associated with it which compliments use to establish the rating on the basic barrier

Requirements for Protecting Breaches

- **Penetrations**

- Fire / Hose Stream Test Standards

- ASTM E814 / UL 1479, ISO10295-1, EN 1366-3

- Smoke Leakage Standard

- UL 1479

Requirements for Protecting Breaches

- **Fire-Resistant Joint Systems**

- Fire / Hose Stream Test Standards

- ASTM E1966 / UL 2079, ISO 10295-2, EN 1366-4 (Fire Testing of Construction Joints)

- ASTM E2307 (Perimeter Fire Containment)

- ASTM E2837 (Cont. HW Joints)

- Smoke Leakage Standard

- UL 2079

Requirements for Protecting Breaches

- **Opening Protectives**

- Fire / Hose Stream Test Standards

- NFPA 252 / UL 10B / UL 10C, ISO 3008-1, EN 1634-1 (Fire Doors)

- NFPA 257 / UL 9, ISO 3009 (Fire Windows, FPR Glazing)

- ASTM E119 / UL 263, ISO 834 Series, EN 1365 Series, BS 476 Series (FRR Glazing)

- Smoke Leakage Standard

- UL 1784

Requirements for Protecting Breaches

- **Duct and Air Transfer Openings**

- Fire / Hose Stream Test Standards

- UL 555 (Fire, Combination and Corridor Dampers), UL 263 and 555C (Ceiling Radiation Dampers), ISO 21925-1 & 2, EN 1366-2

- Smoke Leakage Standard

- UL 555S (Smoke, Combination and Corridor Dampers), EN1366-10 (Smoke Dampers)

Firestopping for Continuity

Products become **SYSTEMS** Based on Testing

- ‘**Field Erected Construction...Tested to...**’
 - US Based Standards – ASTM E814 / UL 1479, ASTM E2307, ASTM E2837
 - F Rating – Flame & Hose
 - T Rating – Flame, Temperature & Hose
 - L Rating – Smoke
 - W Rating – Water
 - M Rating – Movement
 - ISO, EN, BS Standards
 - Integrity Rating – Flame
 - Insulation Rating – Flame and Temperature



3M Photo

F and Integrity Ratings

- F Rating
 - Passage of Flame
 - Hose Stream
- Integrity Rating
 - Passage of Flame

T and Insulation Ratings

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

L Rating

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

W Rating

- Optional program, applicable to incidental water
- 0.91 M WC (3 Ft 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

Building & Fire

Worldwide Code Requirements

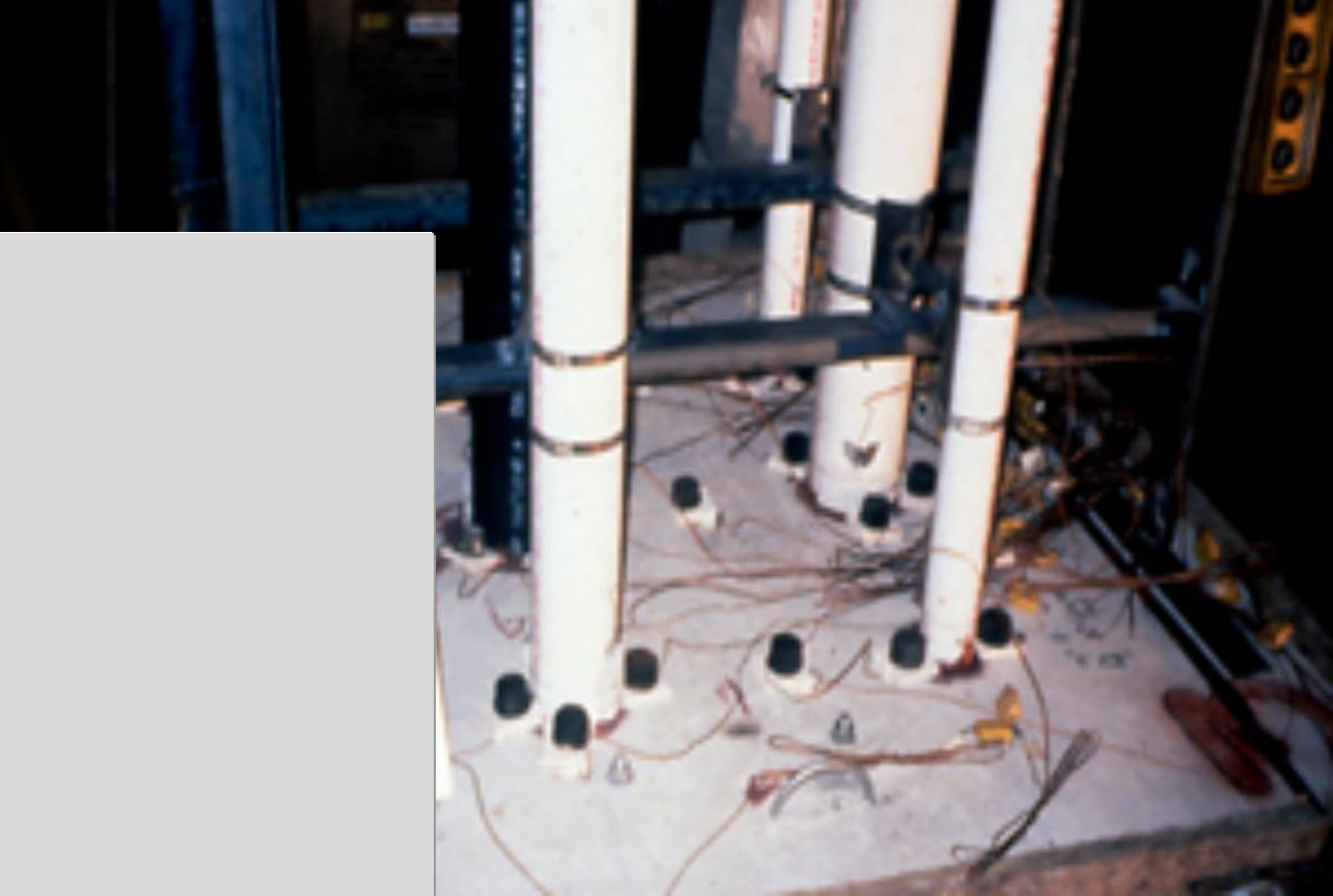
- *Chemical, Biological, Radiation, Explosion, Germ, etc.*
 - Standards?
 - C – Which Chemicals? Check with manufacturer
 - B – Which Agents? Check with manufacturer
 - R – Nuclear Power Plant Standards? Check with manufacturer
 - E – Blast Strength? Check with manufacturer
 - G – Germ – Check with manufacturer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

Fire-Resistance-Rated Construction

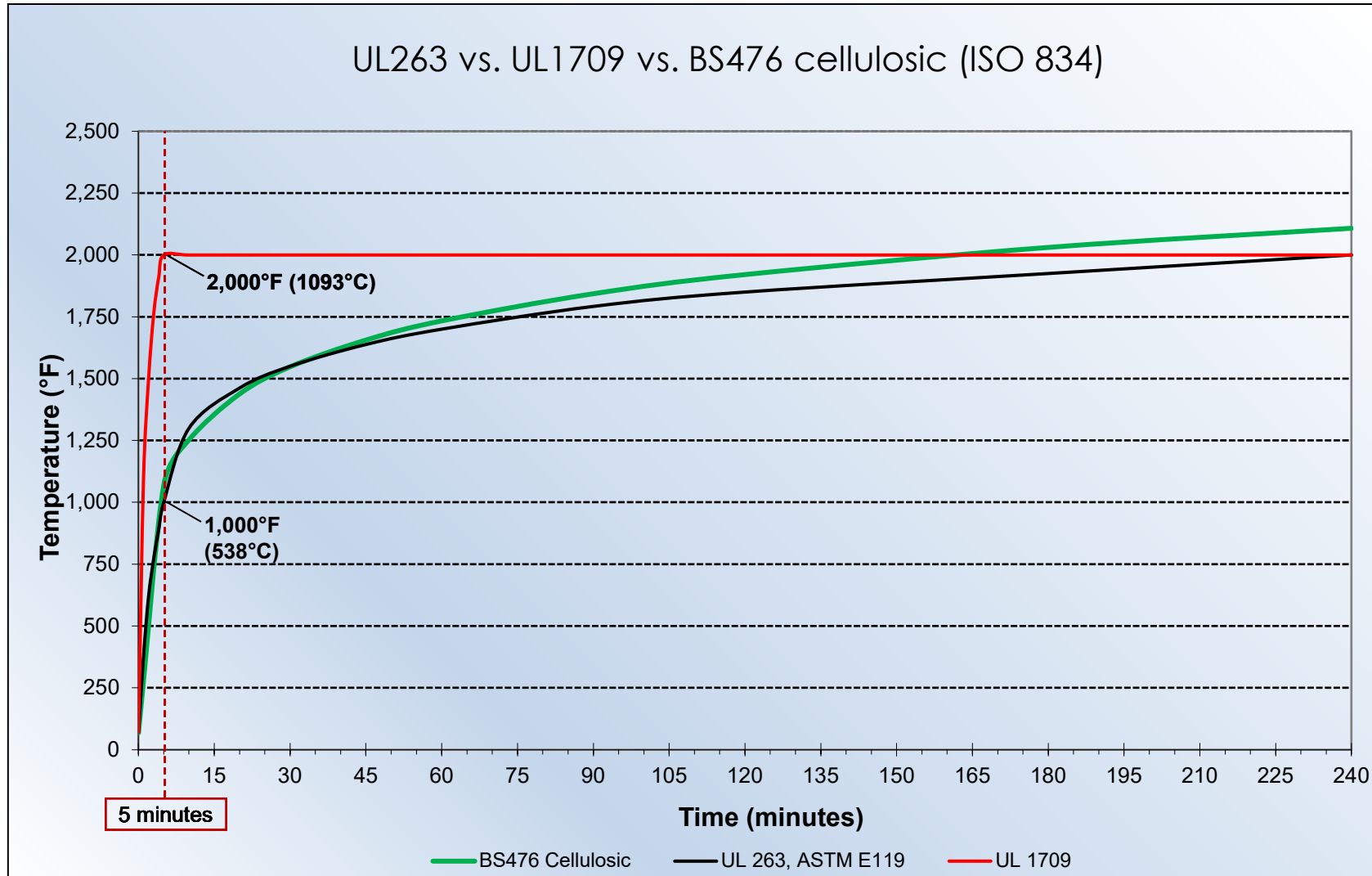
Establishing
F & T Ratings on
Firestop Systems



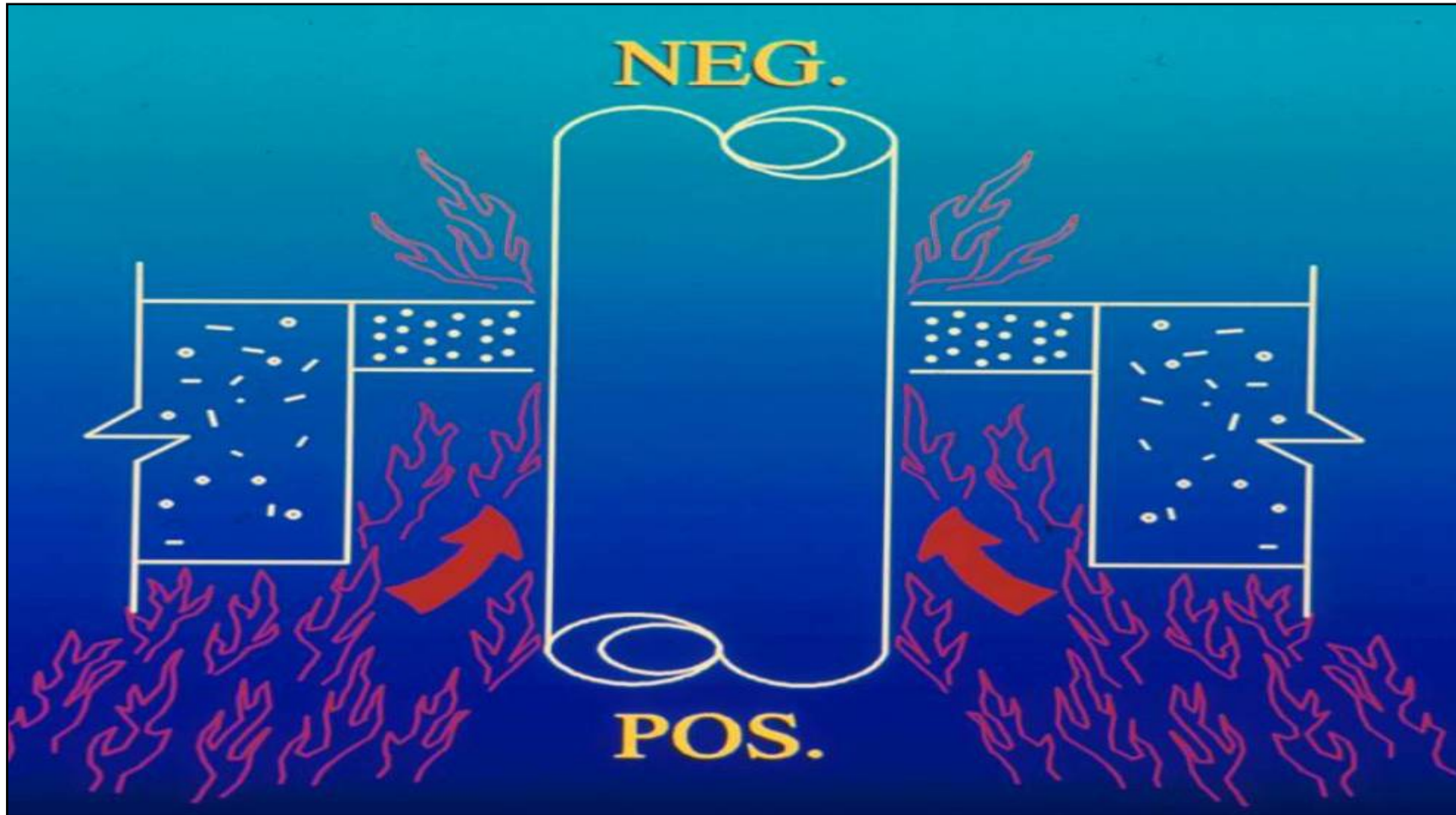
Pre-Test View of Top of Concrete Slab

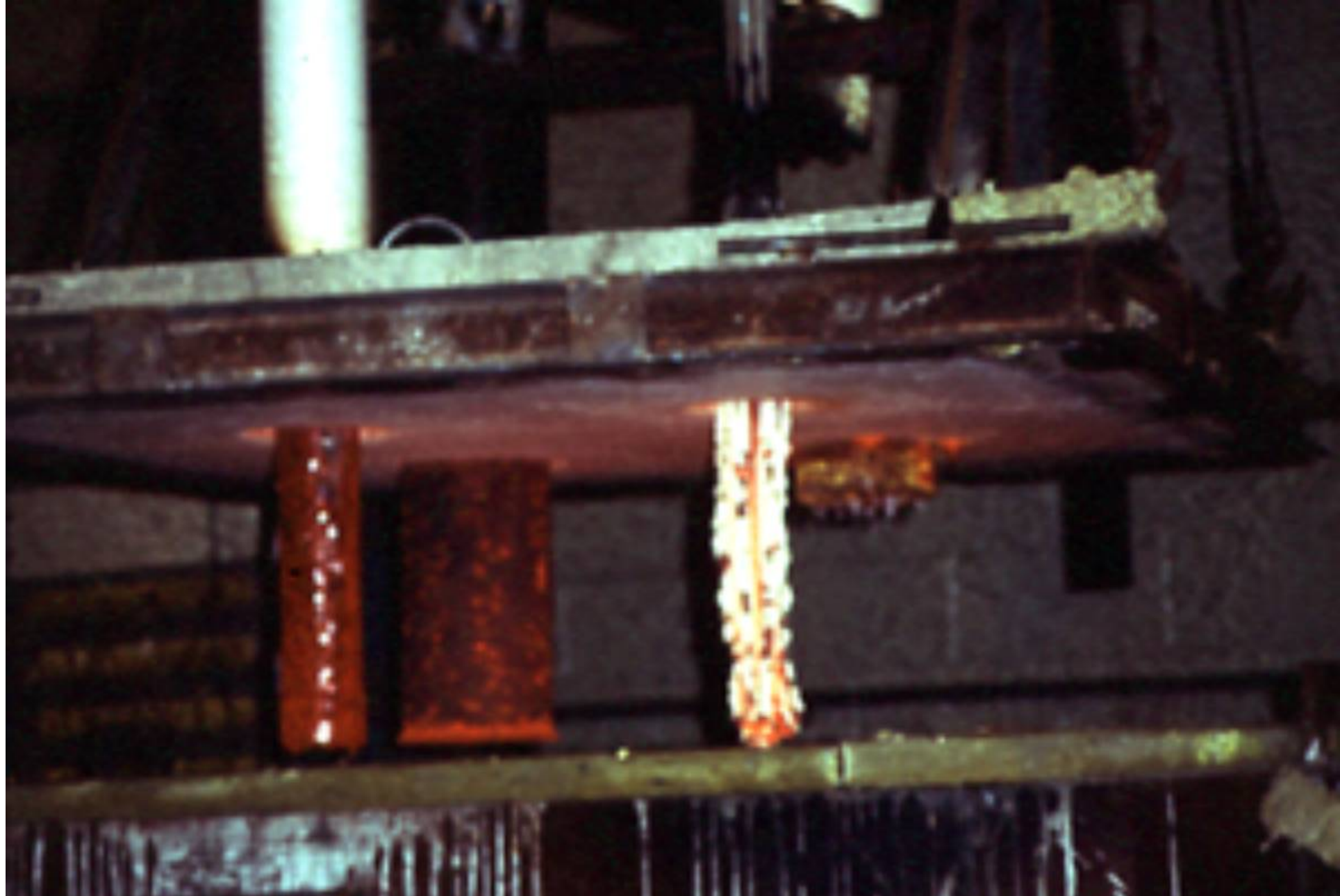


Time - Temperature Curve



Positive Furnace Pressure





Post-Test View of Bottom of Slab

Hose Stream Test



UL Photo

Through- and Membrane-Penetration Firestop Systems

Establishing
an L Rating on
Firestop Systems



L (Air Leakage) Ratings

- Optional L Rating methodology added to ANSI/UL 1479 in 1993
- Leakage determined at 0.3 in. WC (74.7 Pa)
- Tested at Ambient and 400°F (204°C)
- Results published in either CFM (m³/s) or CFM per sq ft (m³/s per m²)

L (Air Leakage) Ratings



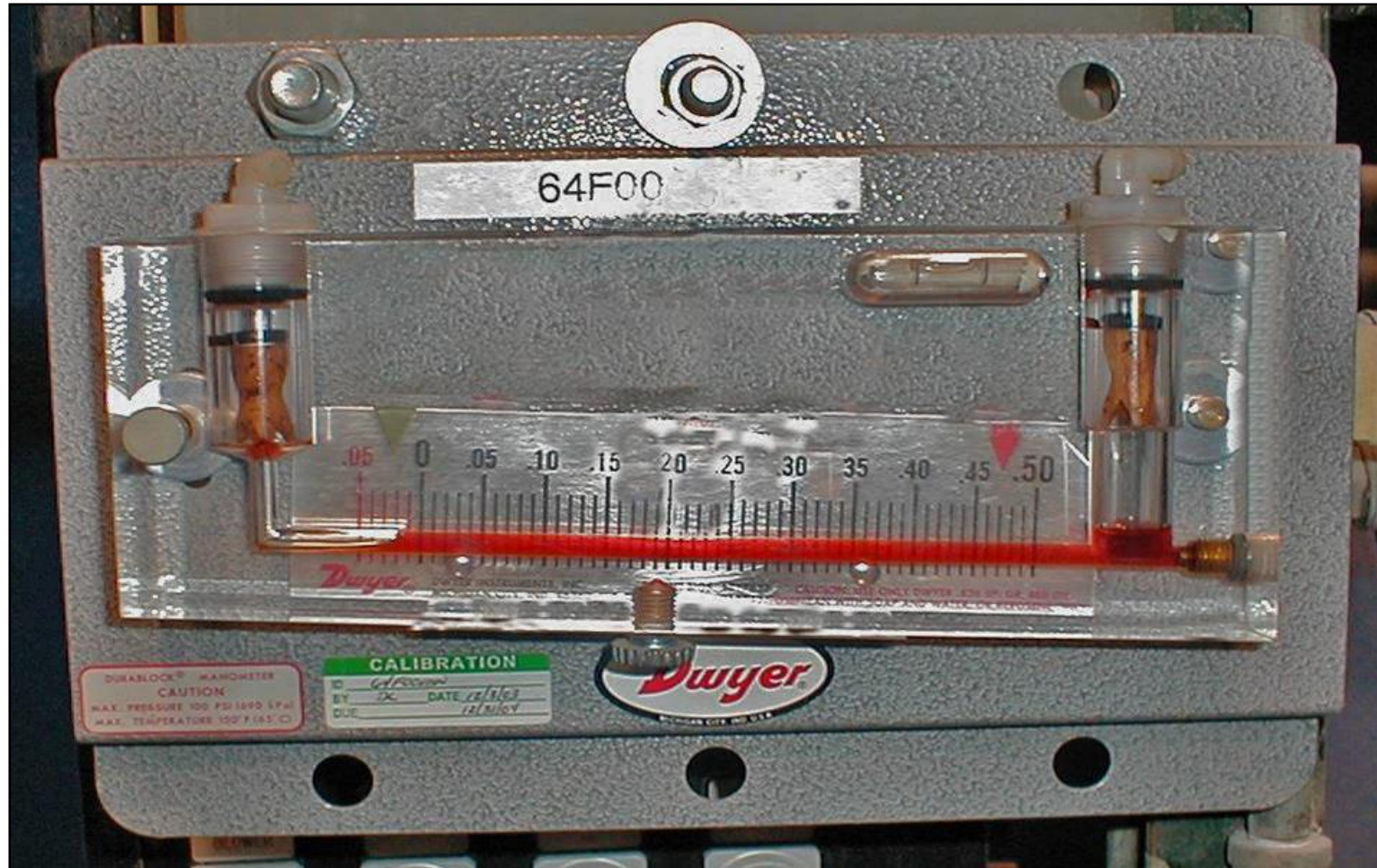
L (Air Leakage) Ratings



L (Air Leakage) Ratings



L (Air Leakage) Ratings



Test Procedure

- Incidental chamber leakage determined using blank slab
- Air leakage of test sample determined at ambient temperature
- Air leakage of test sample determine at 400°F (204°C)
- Incidental chamber leakage rechecked after cooling

Test Procedure Cont.

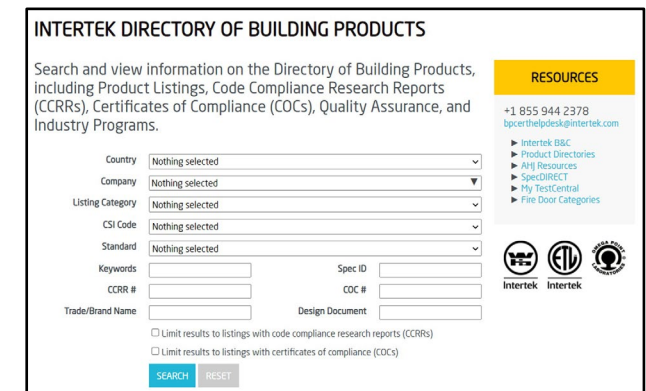
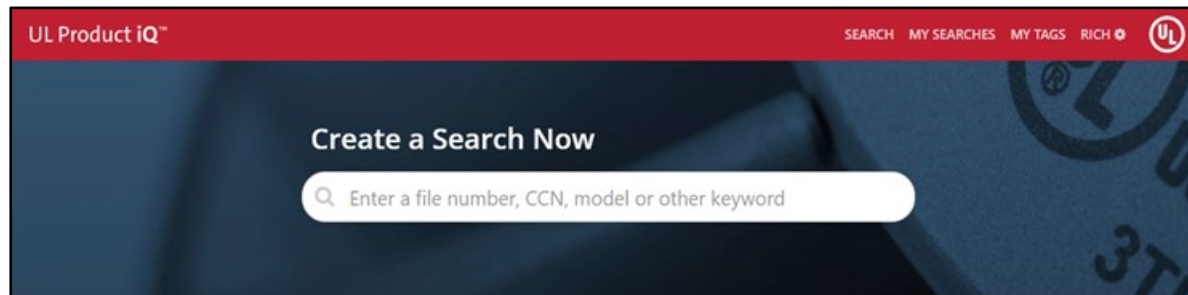
- Firestop system assigned L Rating at ambient and 400°F (204°C), by subtracting incidental chamber leakage from test sample leakage
- L Ratings of firestop systems published along with F and T Ratings

Available Resources

- Online Directories –
 - FM Approval Guide
 - Intertek Listed Products Directory
 - UL Product iQ Online Directory



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



Questions??



Thanks for Attending!!!

Rich Walke, Consultant to the
Firestop Contractors International Association
4415 W. Harrison St., #540
Hillside, IL 60162
(708) 202-1108