Maintaining Protection: Fire-Resistance Testing

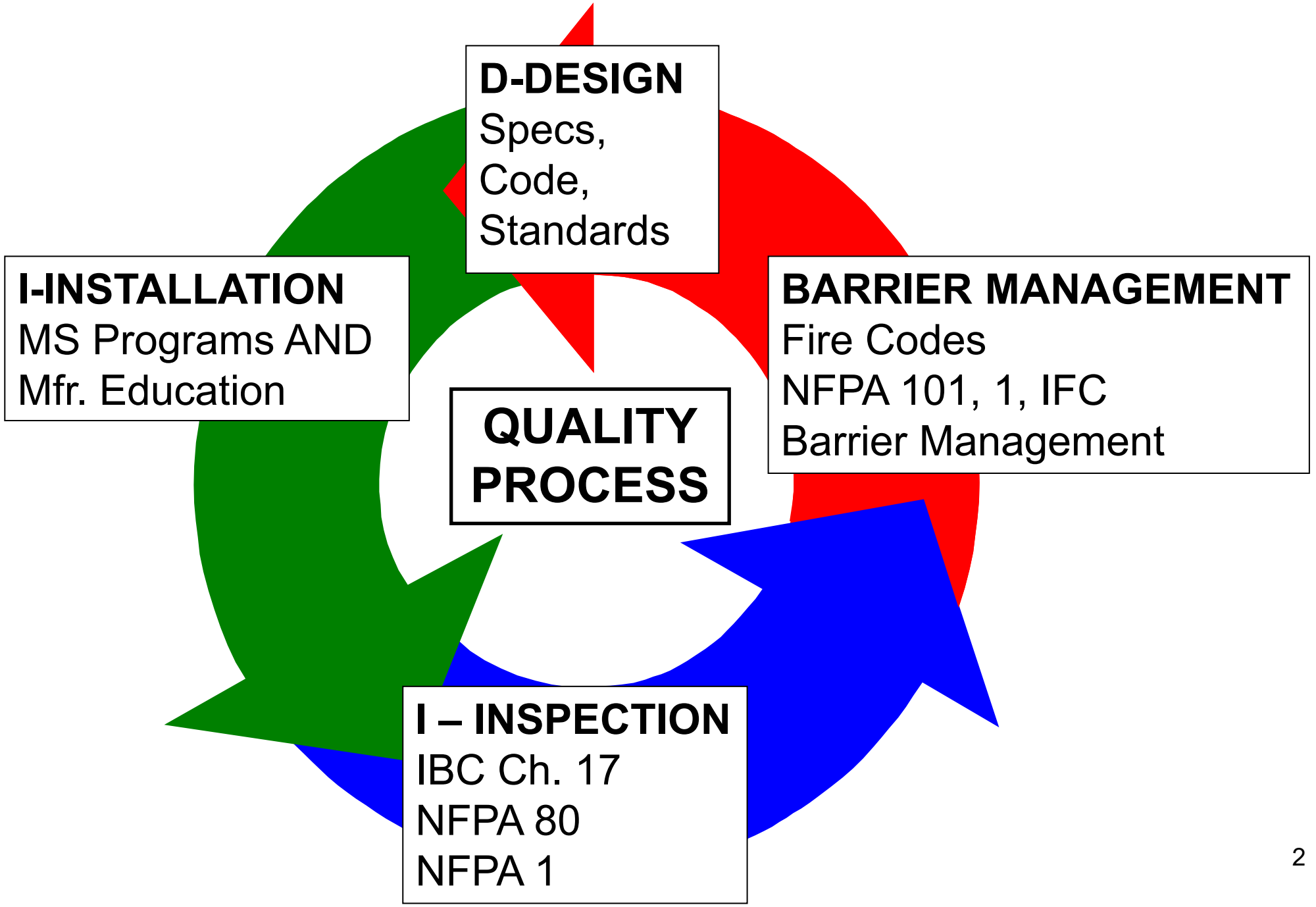
- Design
- Installation
- Inspection
- Maintenance & Management

FCIA Virtual ‘DIIM’ Symposium Canada

Rich Walke, Consultant to FCIA

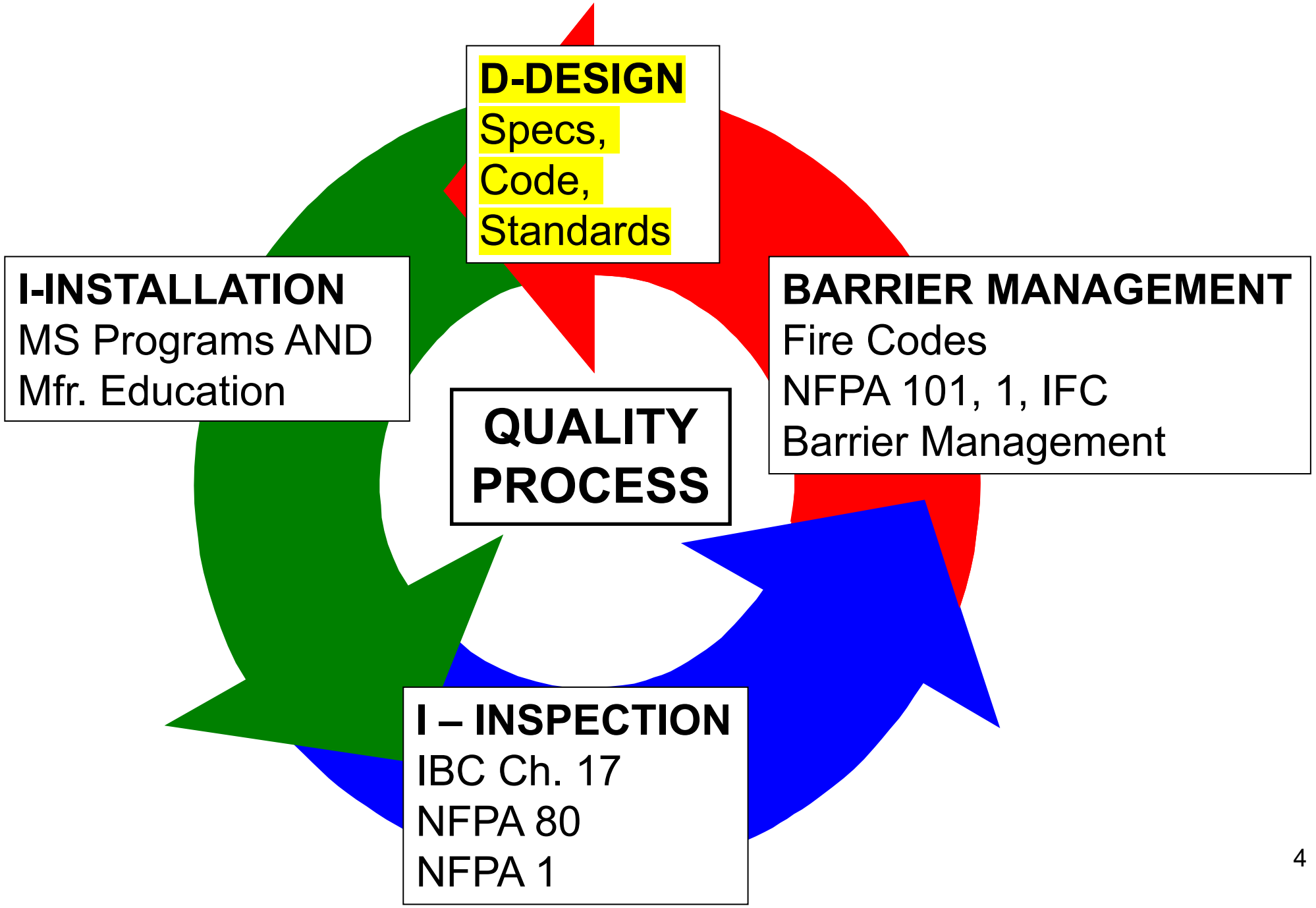
FCIA
Firestop Contractors International Association

October 20, 2021


D-DESIGN
Specs,
Code,
Standards
I-INSTALLATION
MS Programs AND
Mfr. Education
BARRIER MANAGEMENT
Fire Codes
NFPA 101, 1, IFC
Barrier Management
QUALITY
PROCESS
I – INSPECTION
IBC Ch. 17
NFPA 80
NFPA 1

“DIIM”

- Fire Resistance & Smoke Resistant Systems
  - Properly ***Designed*** and Specified Firestopping FCIA – 07-84-00 – Specification – ***RSW, CCS***
    - ***Tested and Listed Systems*** **– CAN/ULC-S101, S115, S104, S106, S112, ASTM E2307, E2837…. Smoke (L), Water (W), Movement (M)**
  - Professional ***Installation*** – FCIA Member, ULC Qualified Contractors, FM 4991 Approved
  - Properly ***Inspected*** – to….ASTM E2174 / E2393 Protocol by IAS AC 291 Accredited Inspection Agencies, ULC, IFC, FM Firestop Exams
  - ***Maintained*** – Annually – by FCIA Members – **National Fire Code of Canada http://www.constructioncanada.net/firestopping-and-effective-compartmentation/**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Barrier Continuity SYSTEMS

- **Products Become Systems – Test Standards**
  - **Structural Elements & Assemblies – CAN/ULC-S101,** ASTM E119 / UL 263
  - **Fire & Smoke Barriers – Fire Separations – CAN/ULC-S101,** ASTM E119 / UL 263
  - **Firestopping – CAN/ULC-S115,** ASTM E814 / UL 1479, UL 2079 / E1966, E2307, E2837, E3037, …test methods…”
  - **Swinging/Rolling Fire Doors – CAN/ULC-S104, S105 Frames, S113 for 20 minute wood doors,** UL 10B, UL 10C, NFPA 252
  - **Fire Rated Glazing – CAN/ULC-S106, S101,** UL 9, ASTM E119 / UL 263
  - **Fire/Smoke/Ceiling Dampers – CAN/ULC-S112, S112.1, S112.2,** UL 555, UL 555S
- **SYSTEM Testing = Suitability Statement**

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

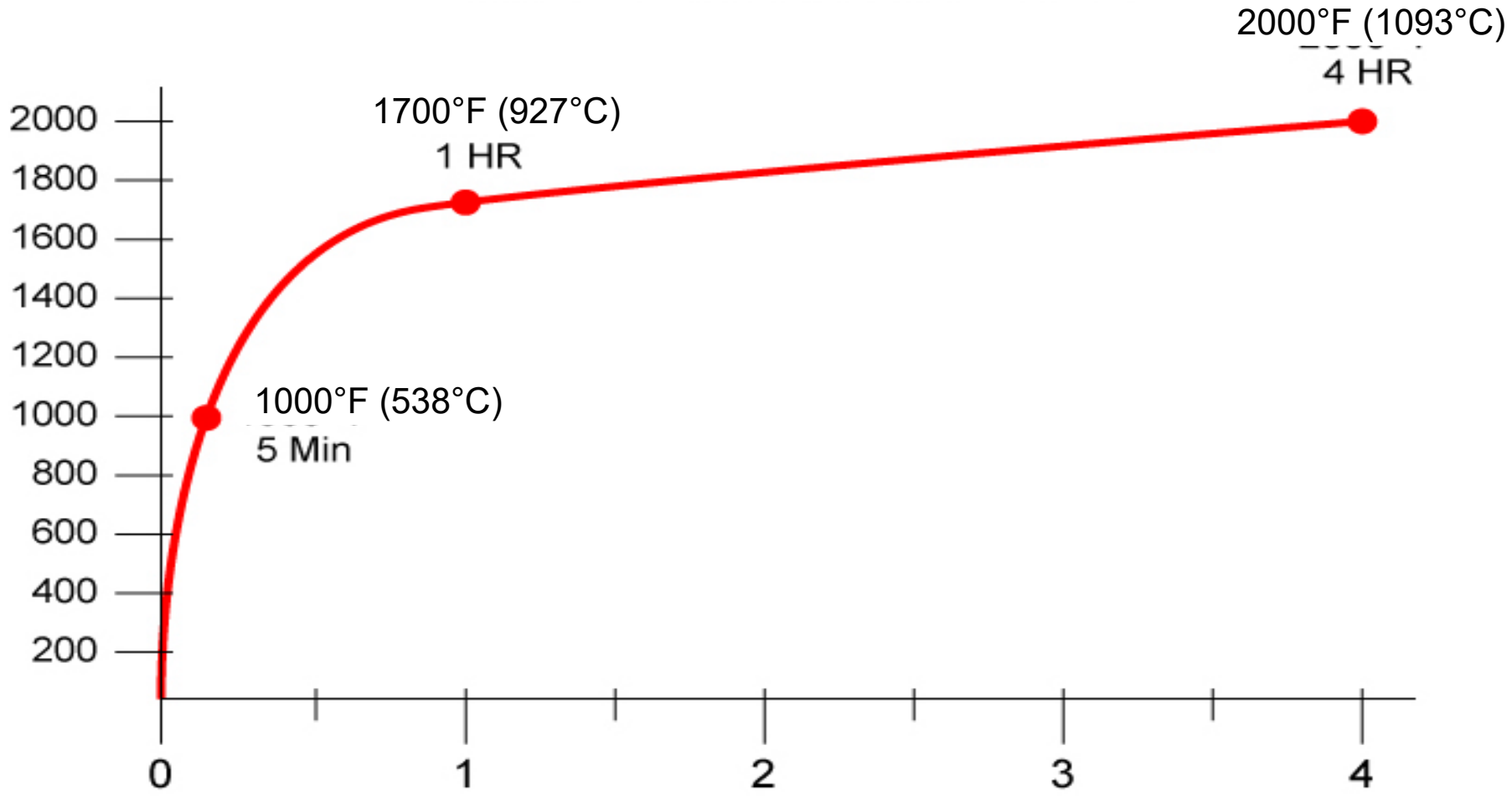
Standards

- CAN/ULC-S101
  - UL 263
  - ASTM E119
  - NFPA 251 (Withdrawn)

Building Components

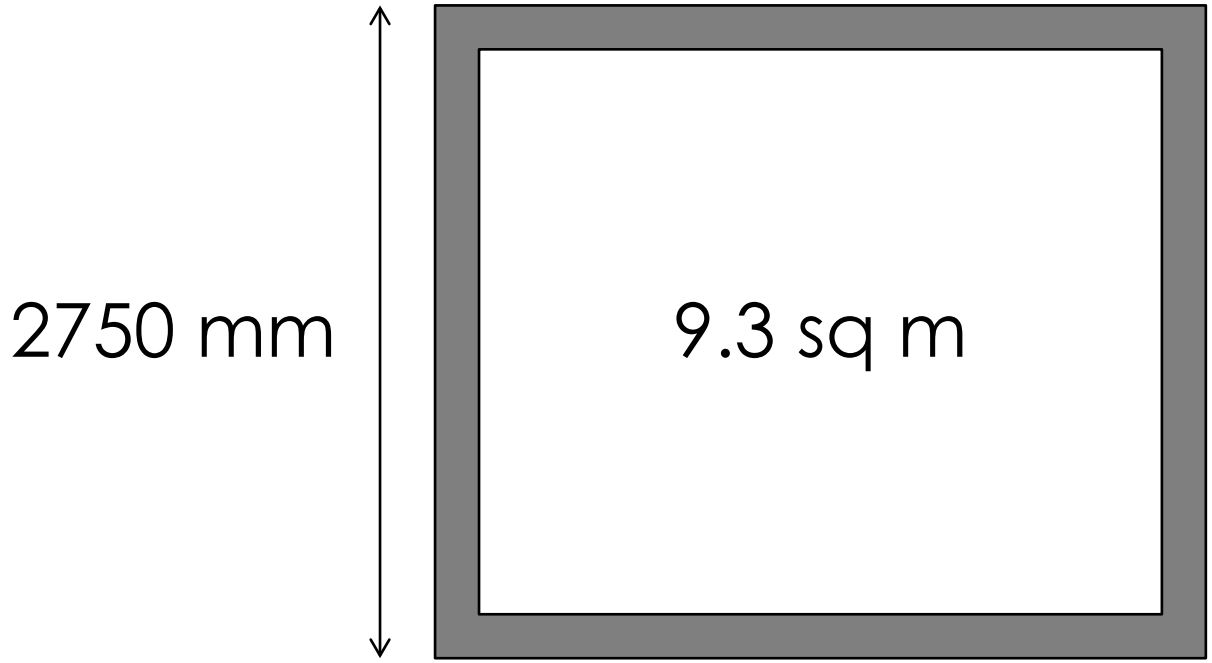
- Columns
- Beams
- Floor/Ceilings or Roof/Ceilings
- Walls

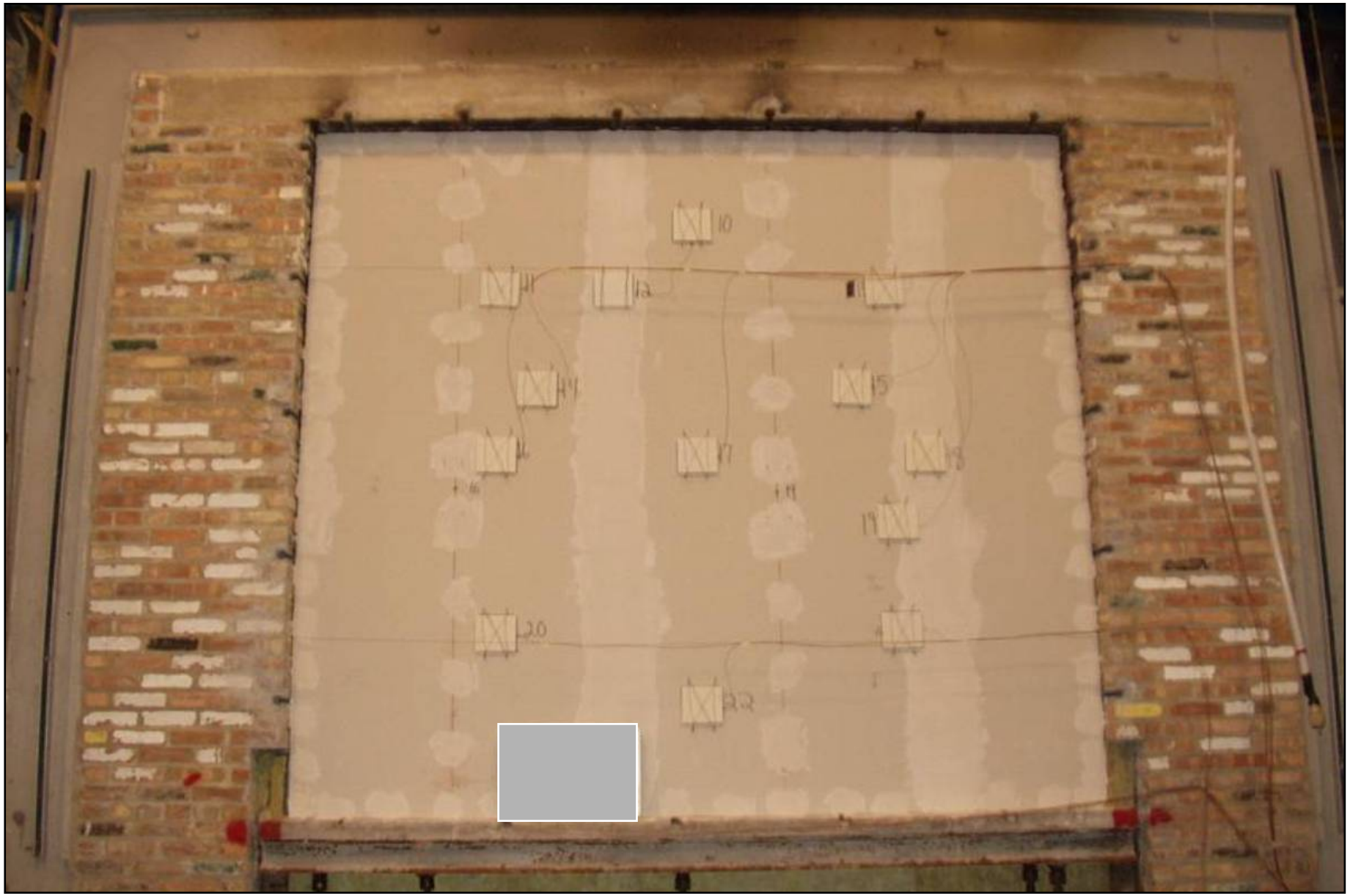
Time - Temperature Curve

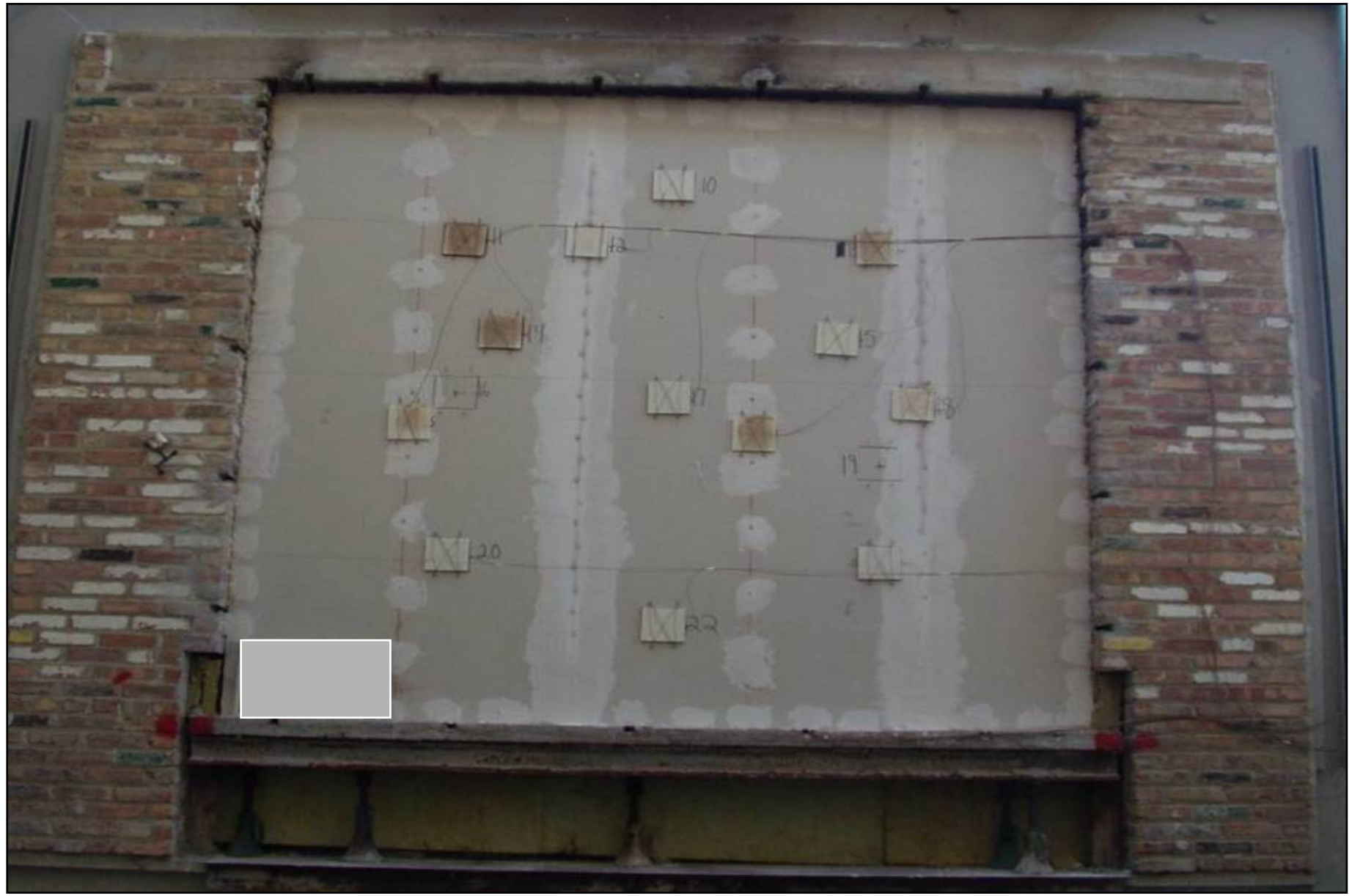


Walls

- Sample size – 9.3 sq m / 2750 mm
- Load applied – Per design



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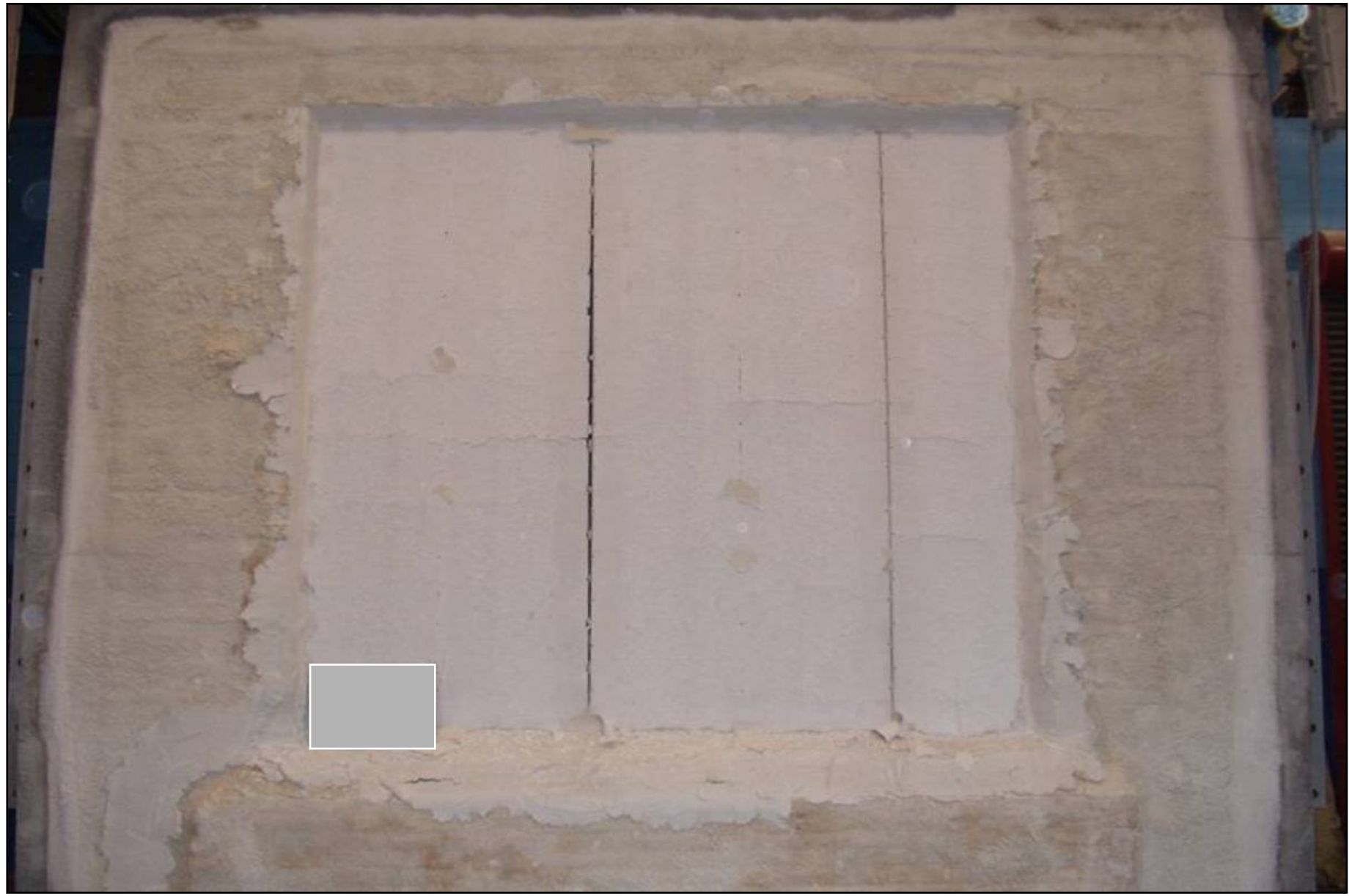
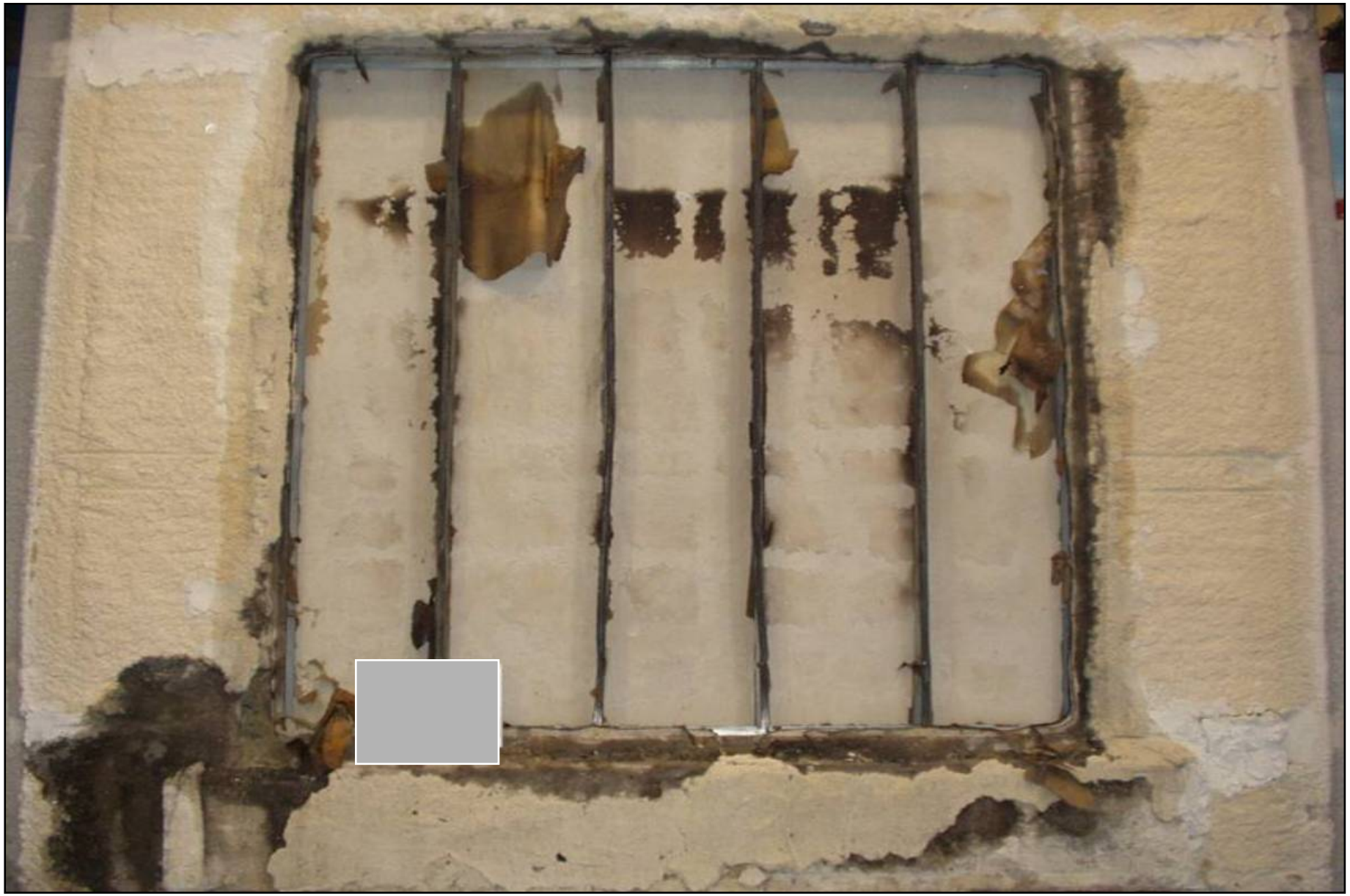




Conditions of Acceptance – Walls

- Flame passage
- 140ºC / 180ºC
- Support load
- Hose stream

Breaches in Fire-Resistance-Rated Construction

- Firestop Systems
  - Penetration Firestop Systems
  - Joint Firestop Systems
  - Perimeter Joint Firestop 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 CAN/ULC-S101

Requirements for Protecting Breaches

- **Penetrations**
  - Fire / Hose Stream Test Standards
    - CAN/ULC-S115
  - Smoke Leakage Standard
    - CAN/ULC-S115

Requirements for Protecting Breaches

- **Joints**
  - Fire / Hose Stream Test Standards
    - CAN/ULC-S115 (Construction Joints), ASTM E2307 (Perimeter Fire Containment), ASTM E2837 (Cont. HW Joints)
  - Smoke Leakage Standard
    - CAN/ULC-S115

Requirements for Protecting Breaches

- **Opening Protectives**
  - Fire / Hose Stream Test Standards
    - CAN/ULC-S104 (Fire Doors), CAN/ULC-S113 (20 min Wood Fire Doors), CAN/ULC-S105 (Fire Door Frames), CAN/ULC-S106 (Fire Windows, FPR Glazing, Glass Blocks), CAN/ULC-S101 (FRR Glazing)
  - Smoke Leakage Standard
    - UL 1784

Requirements for Protecting Breaches

- **Duct and Air Transfer Openings**
  - Fire / Hose Stream Test Standards
    - CAN/ULC-S112 (Fire and Combination Dampers), CAN/ULC-S112.2 (Ceiling Firestop Flap Assemblies)
  - Smoke Leakage Standard
    - ULC-S112.1 (Smoke and Combination Dampers)

Firestopping for Continuity
Products become SYSTEMS Based on Testing

- **'Field Erected Construction…Tested to…'**
  - Standards – CAN/ULC-S115, ASTM E2307, ASTM E2837
  - F Rating – Flame
  - FT Rating – Flame & Temperature
  - FH Rating – Flame & Hose
  - FTH Rating – Flame, Temperature & Hose
  - 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
- 180ºC (325ºF) Temperature Rise

Conditions of Acceptance
FH Rating

- Passage of Flame
- Hose Stream

Conditions of Acceptance
FTH Rating

- Passage of Flame
- 180ºC (325ºF) Temperature Rise
- Hose Stream

L Rating

- Air Leakage Rate at Ambient Temperature
- Air Leakage Rate at 204ºC (400ºF)

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

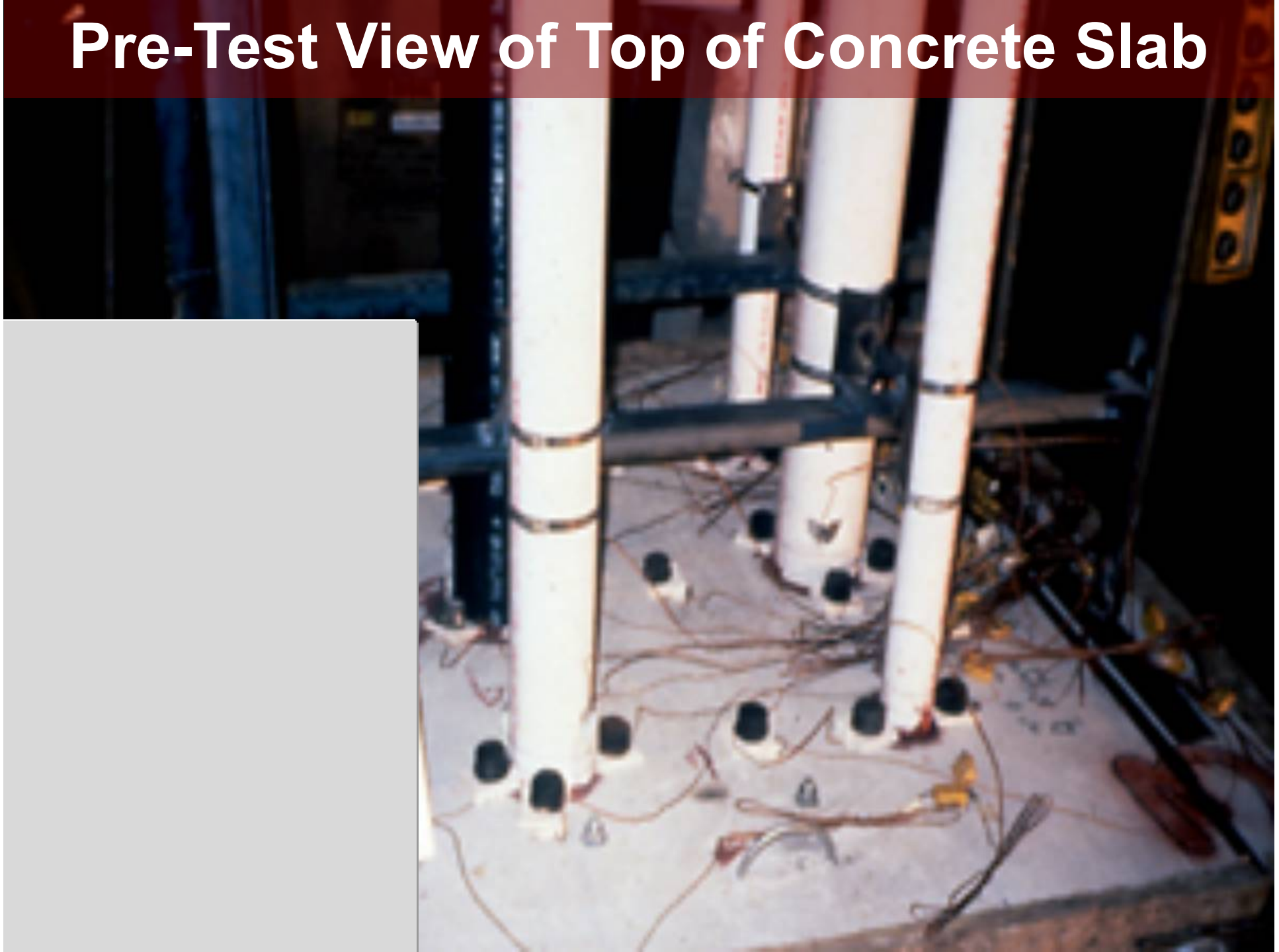
Building & Fire
Worldwide Code Requirements

- *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?

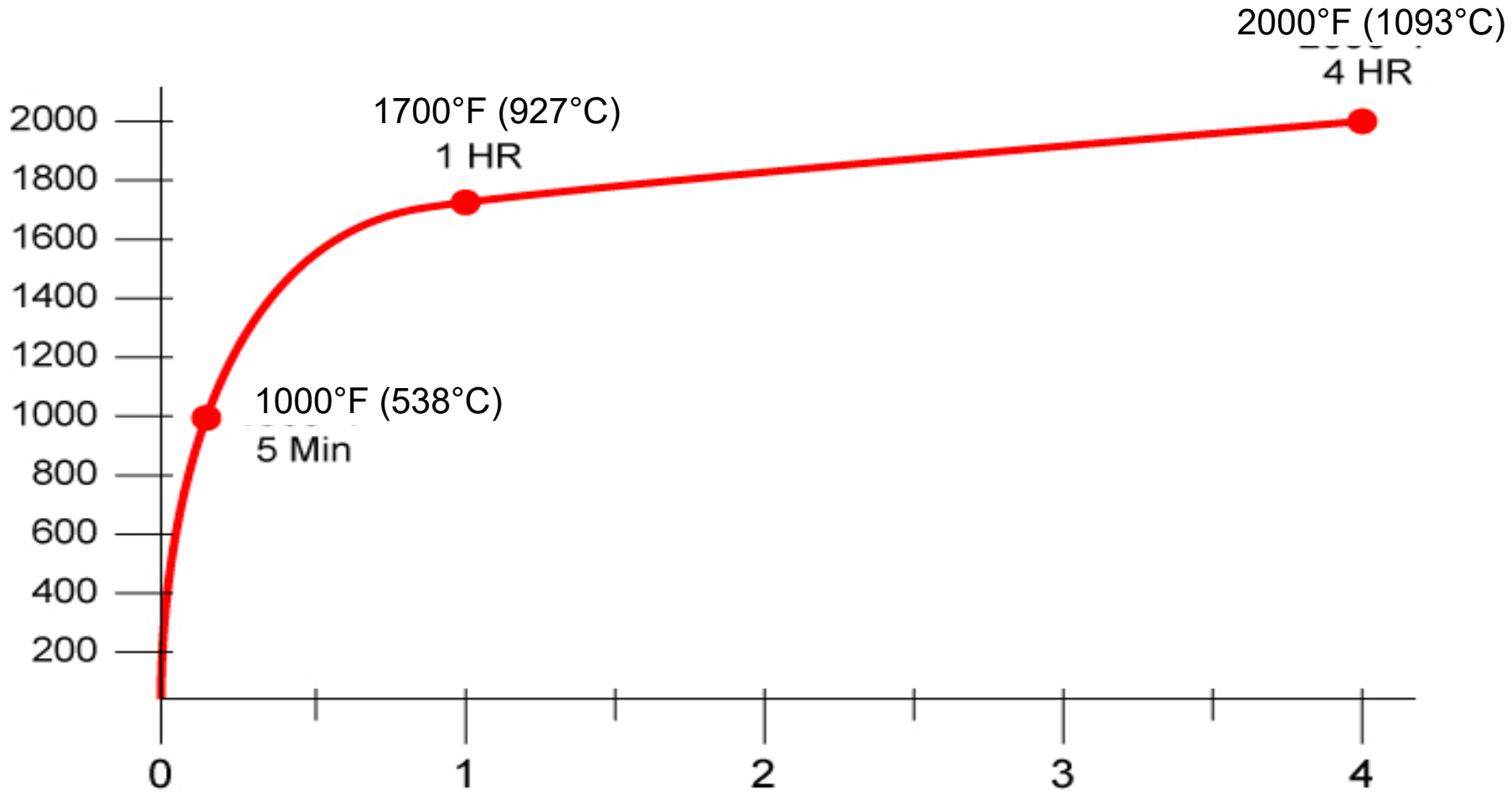
Fire-Resistance-Rated Construction

Establishing Penetration Firestop System Ratings

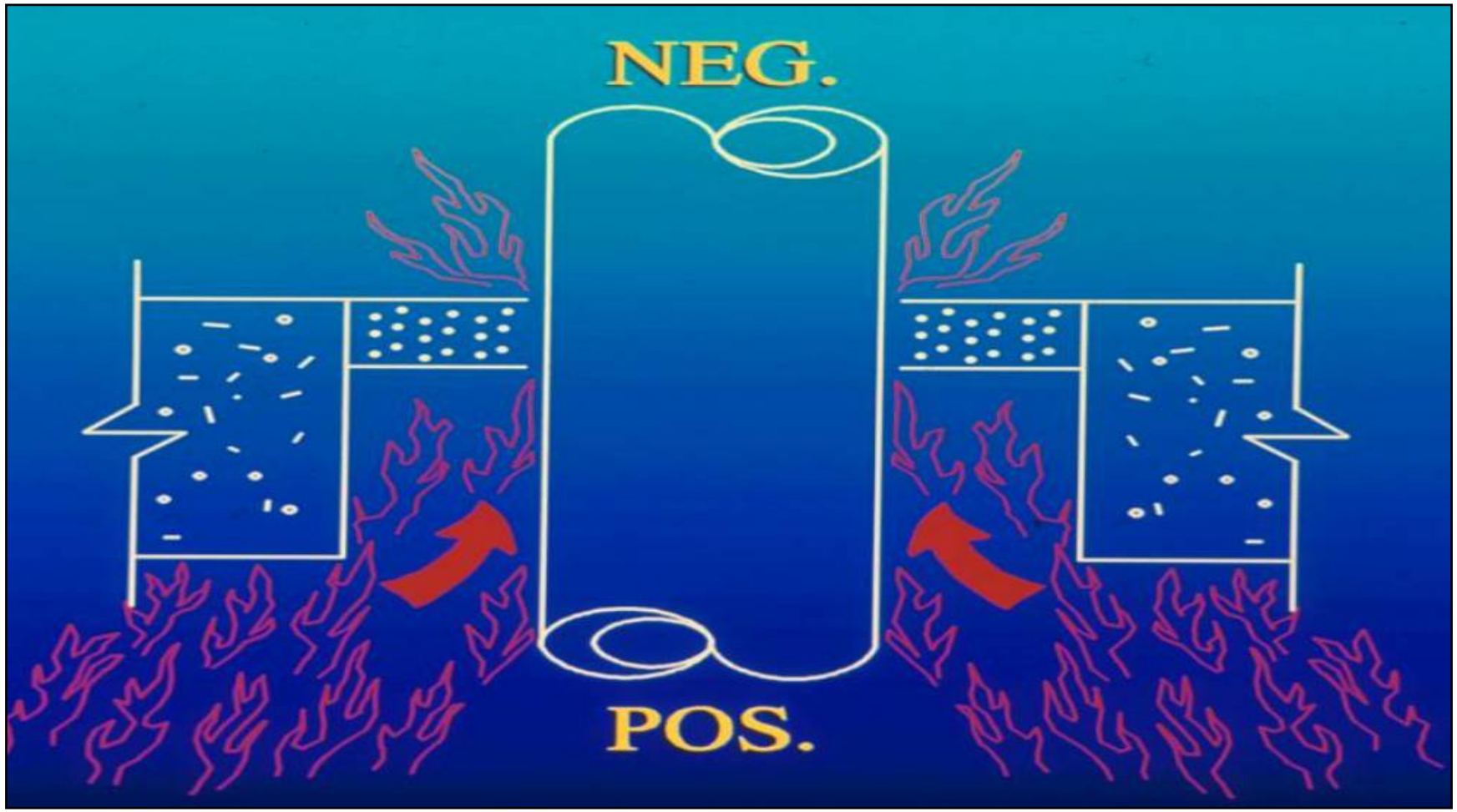
Pre-Test View of Top of Concrete Slab



Time - Temperature Curve



Positive Furnace Pressure



Post-Test View of Bottom of Slab

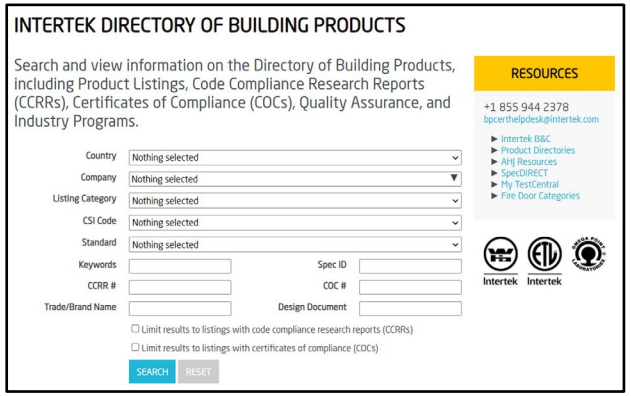
Hose Stream Test

UL Photo

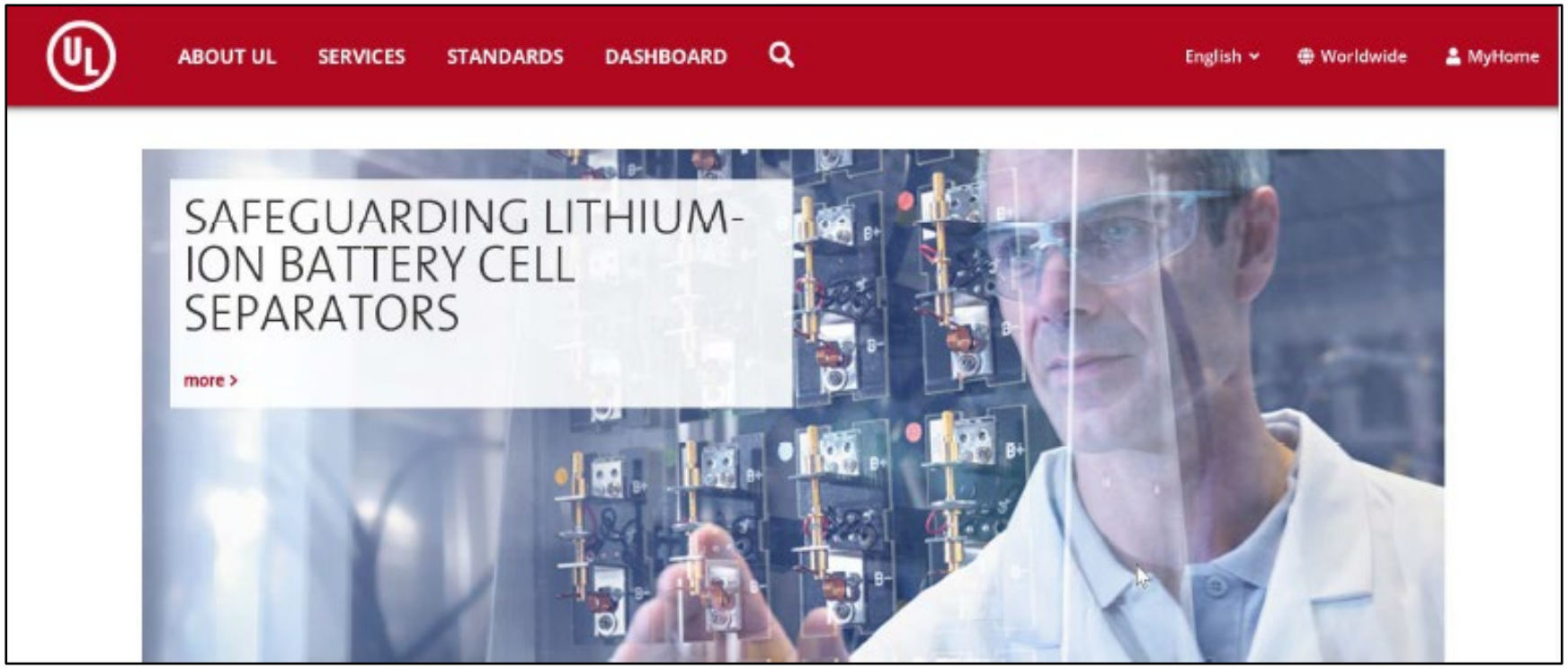
Barrier Continuity
Products become SYSTEMS

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

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



UL Product iQ – www.ul.com



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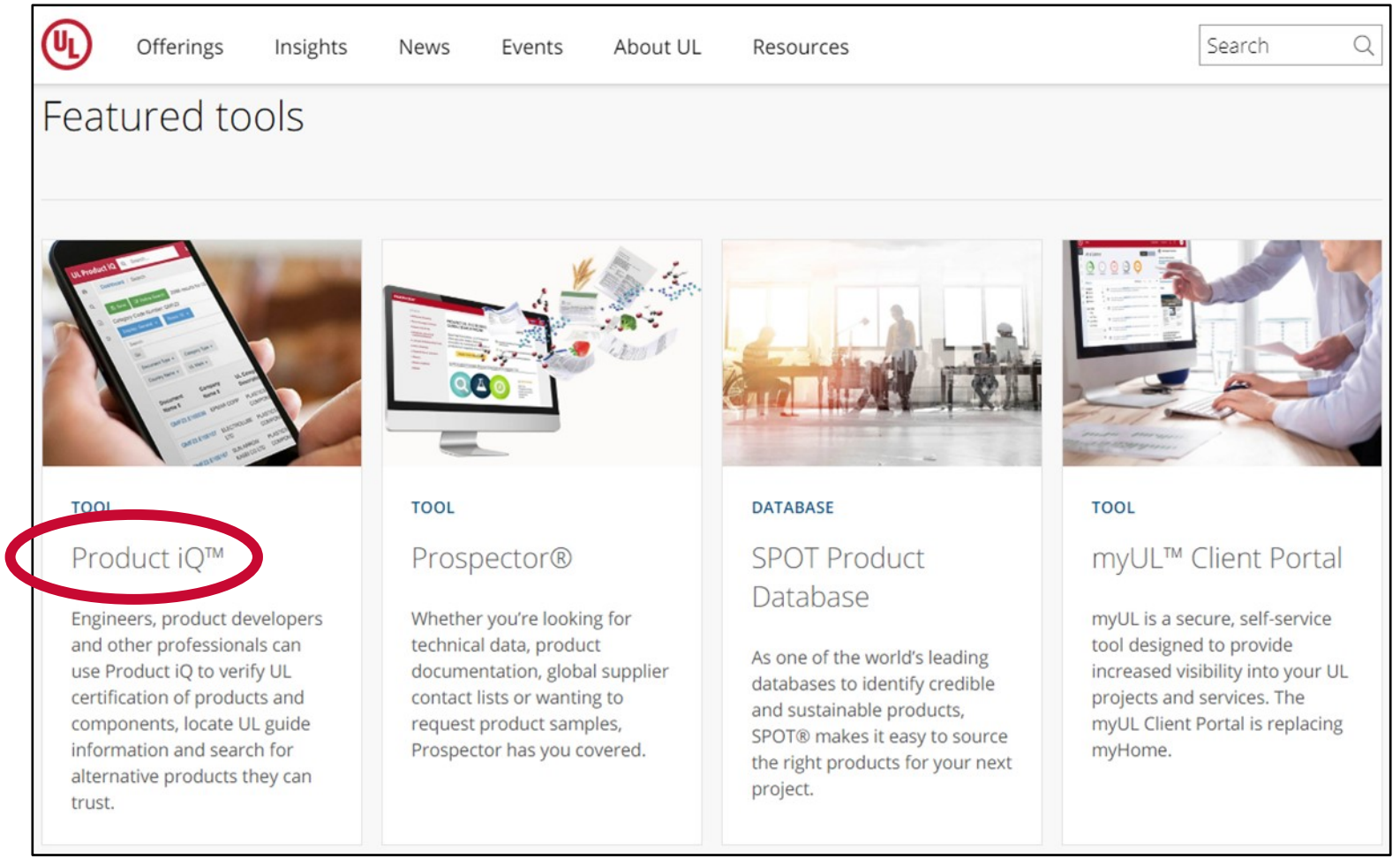

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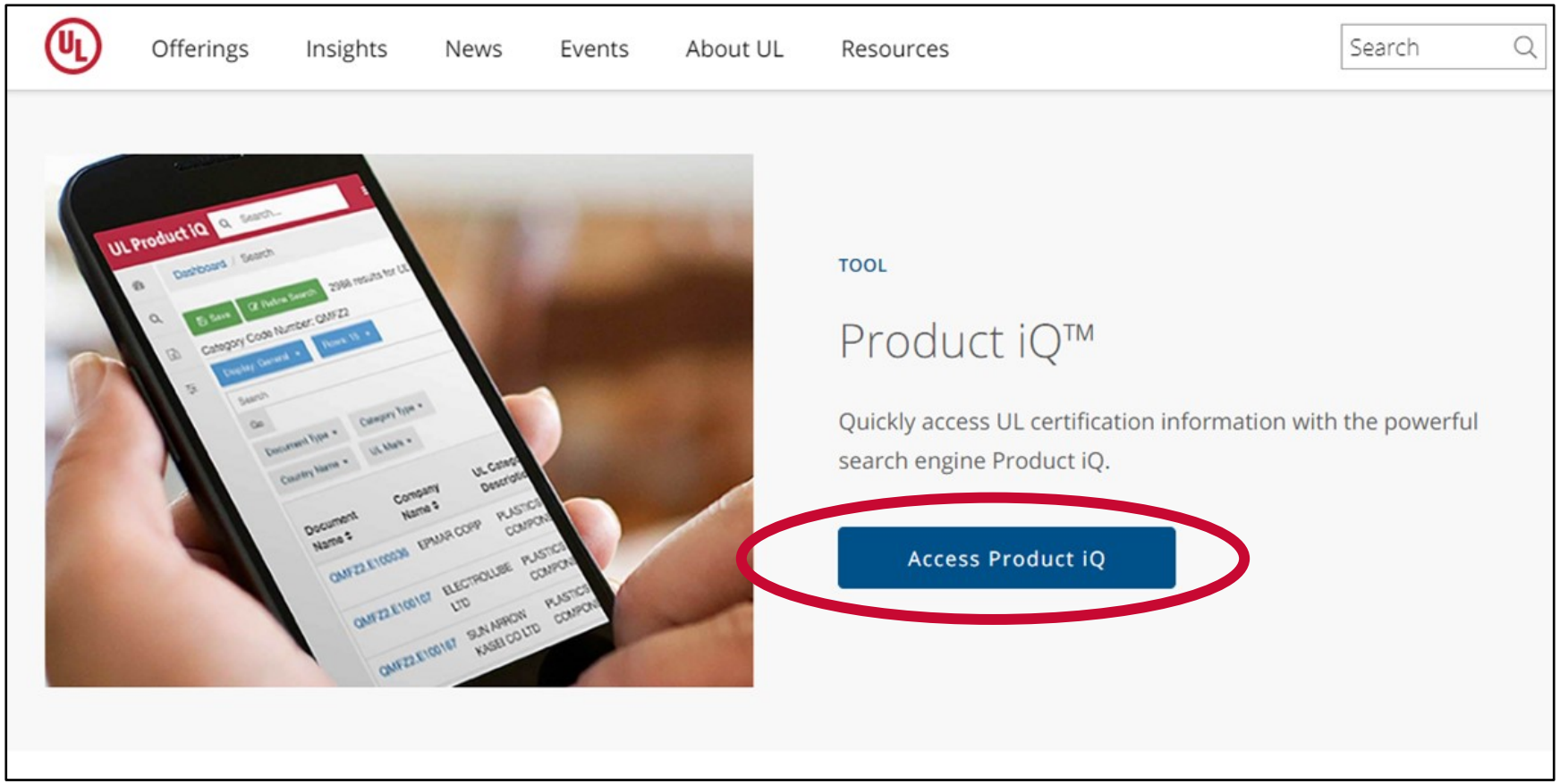
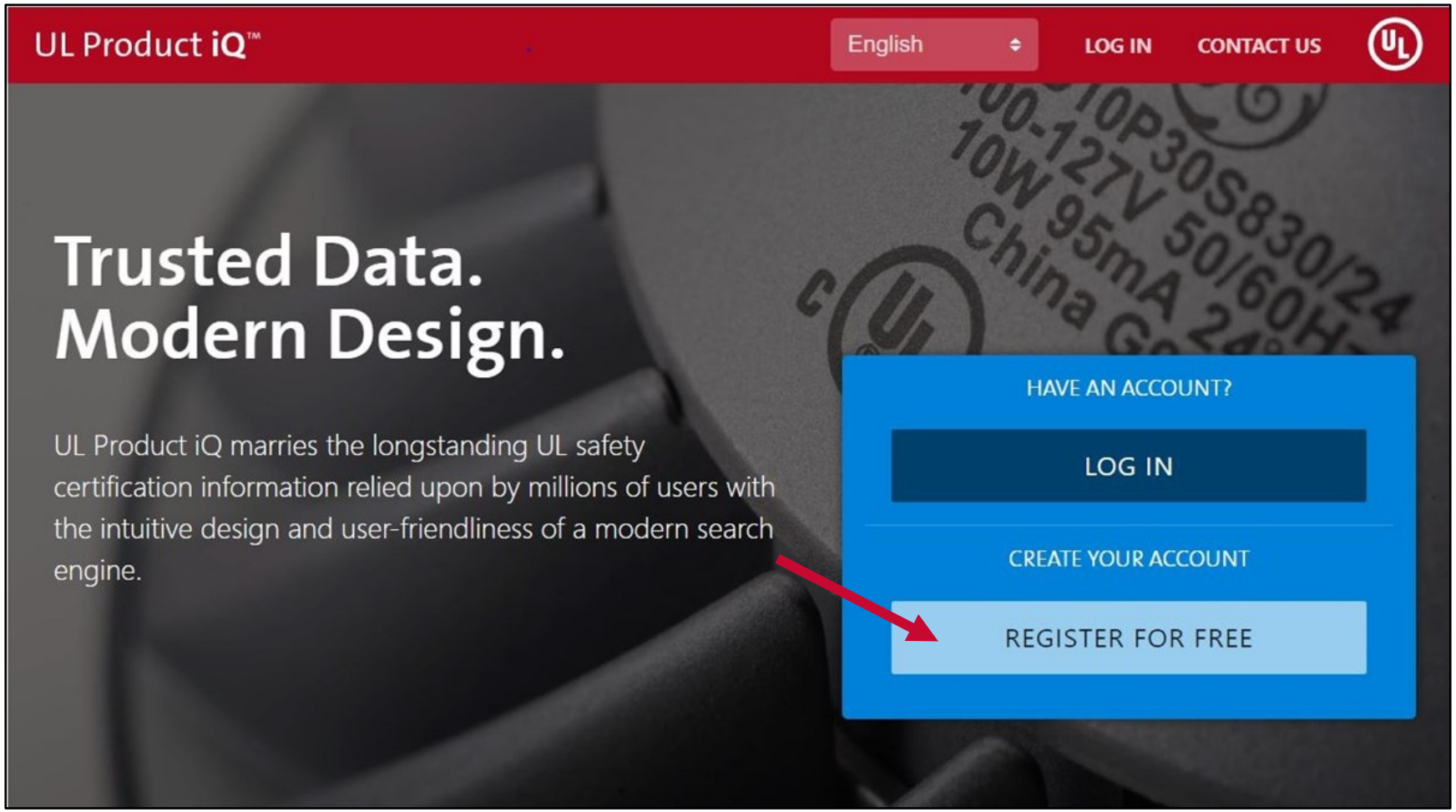


UL Product iQ – www.ul.com/PiQ



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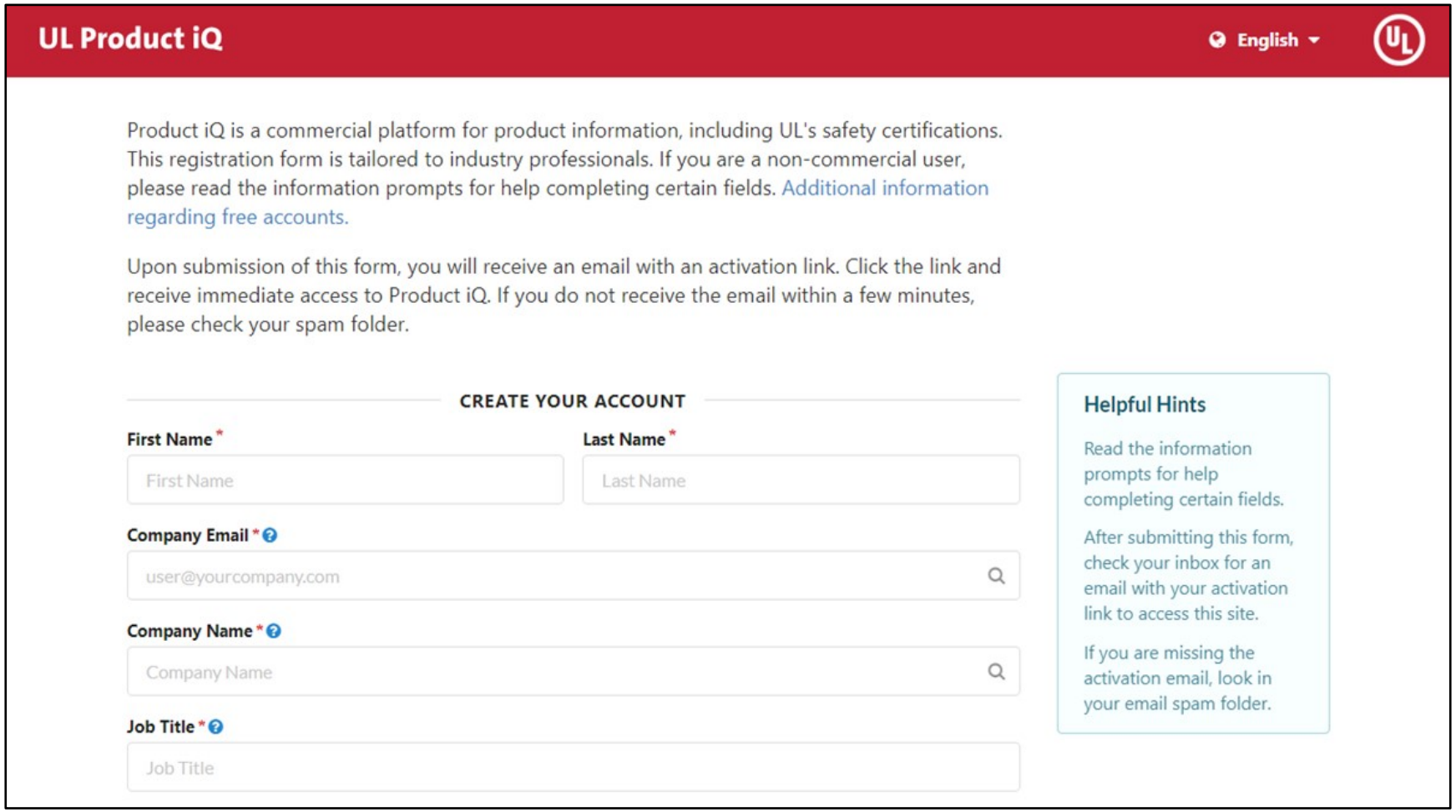

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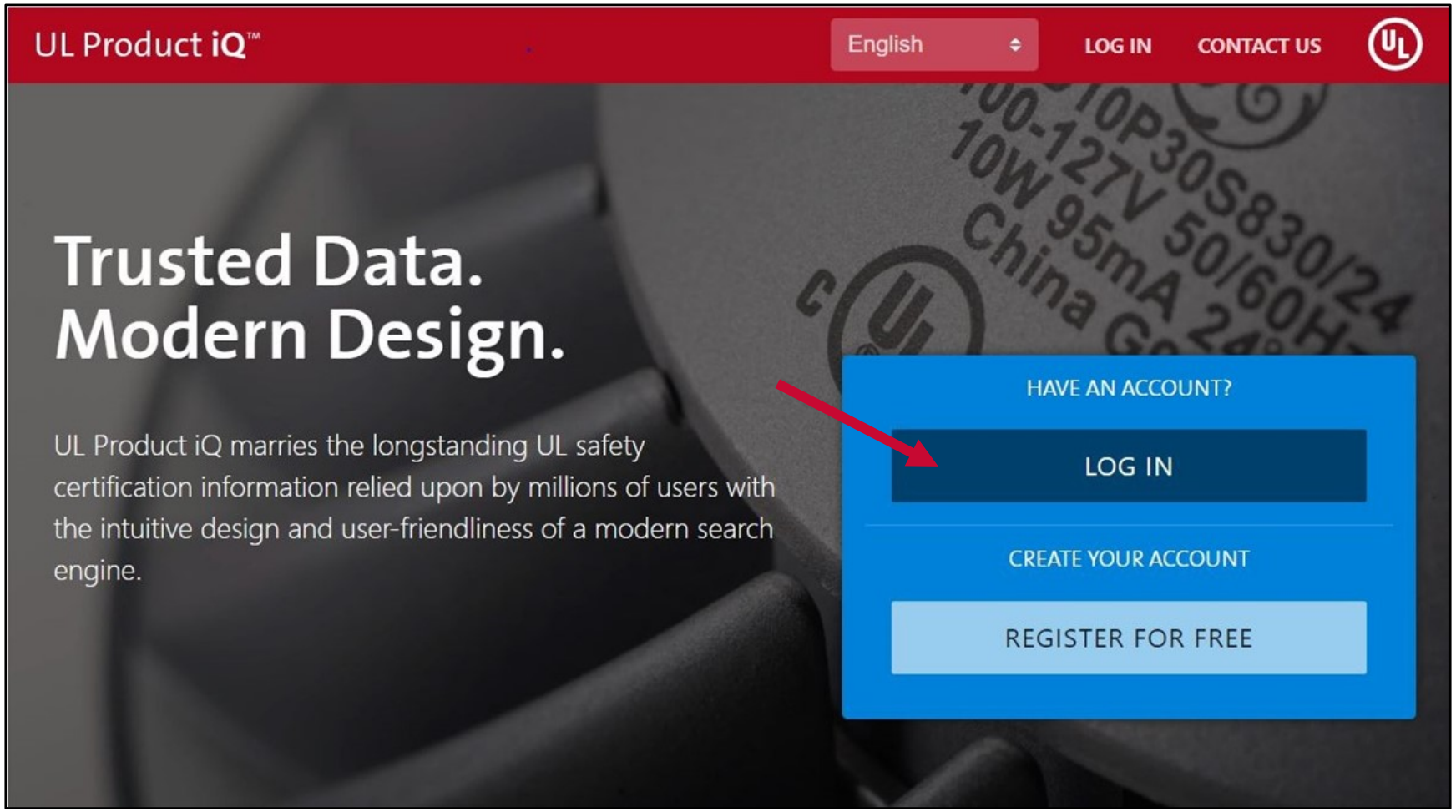
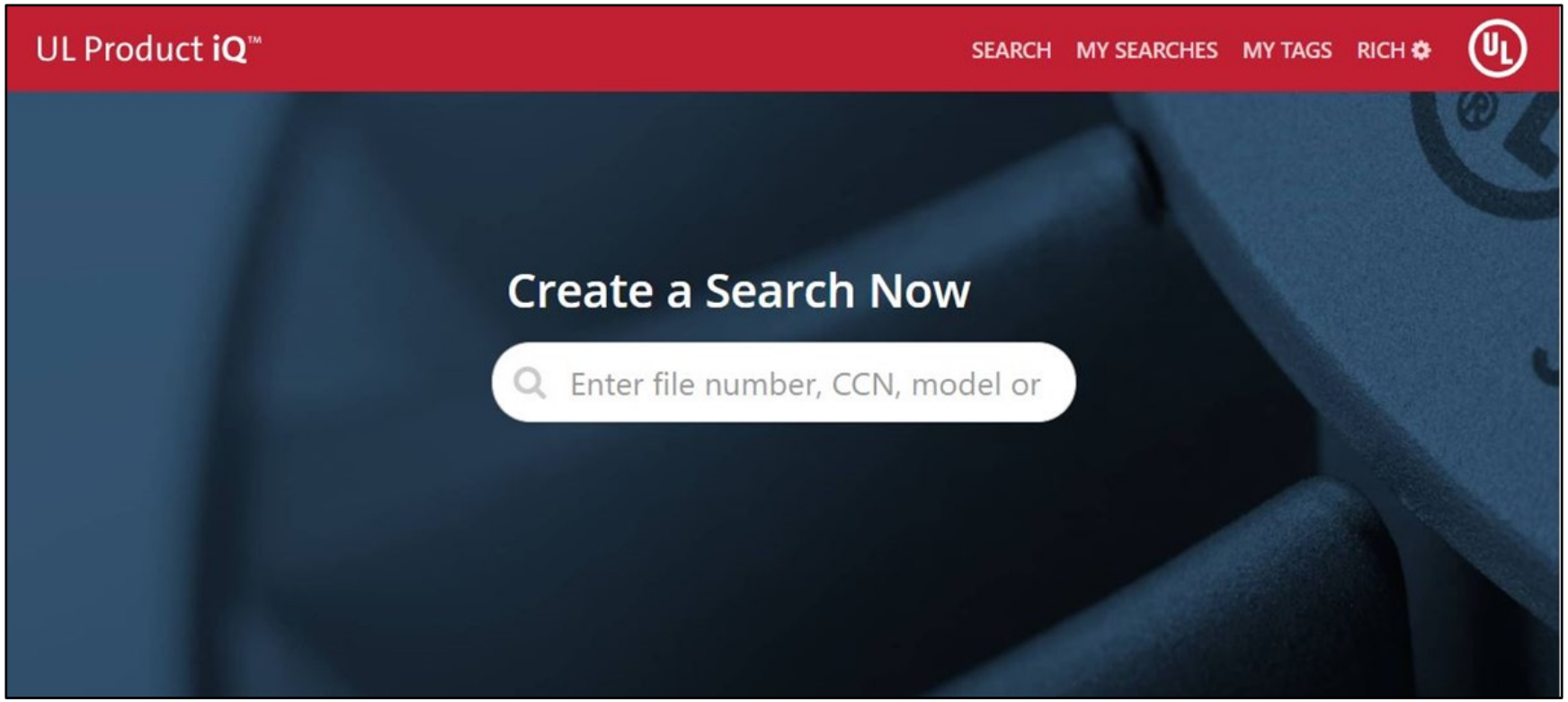
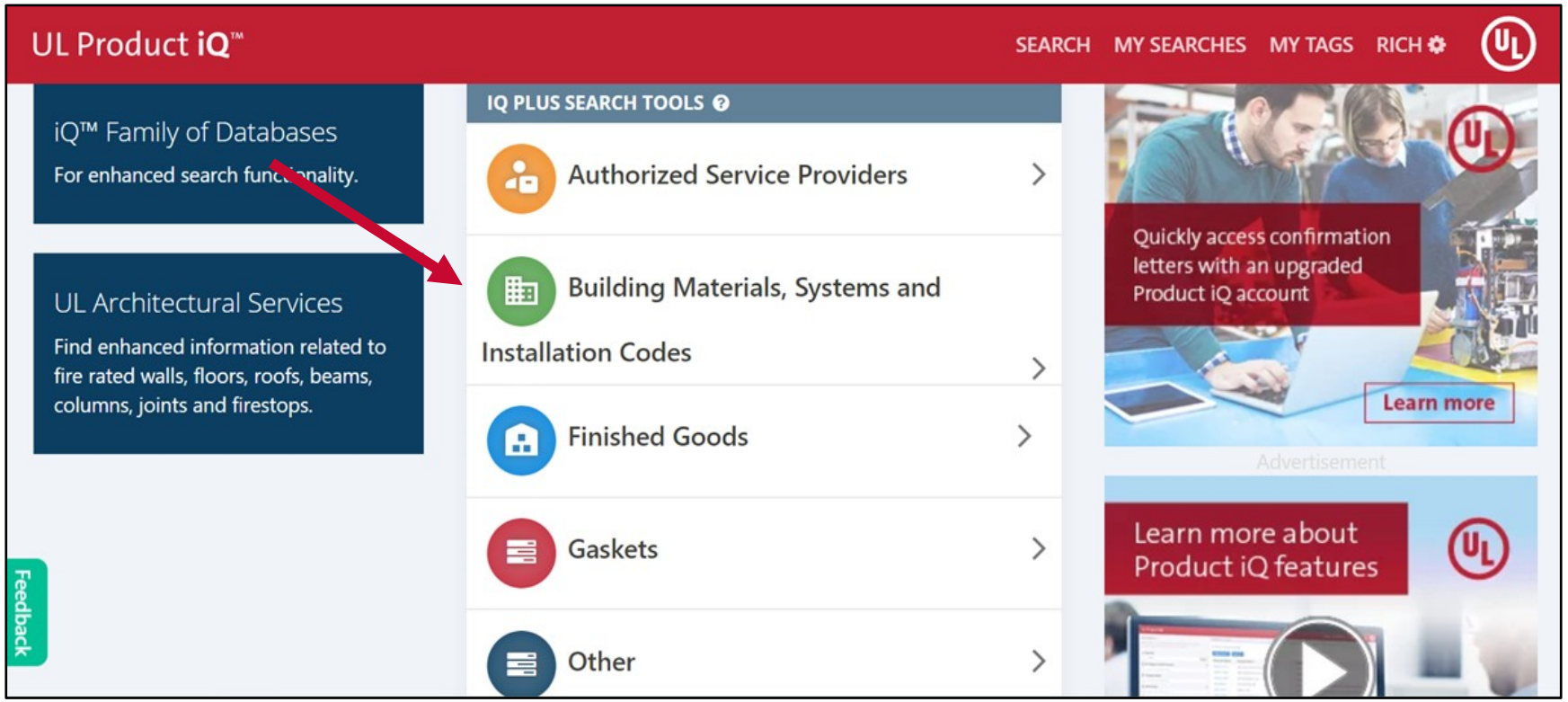


UL Product iQ Cont.

UL Product iQ Cont.
Smart Search



UL Product iQ Cont.
iQ Plus Search



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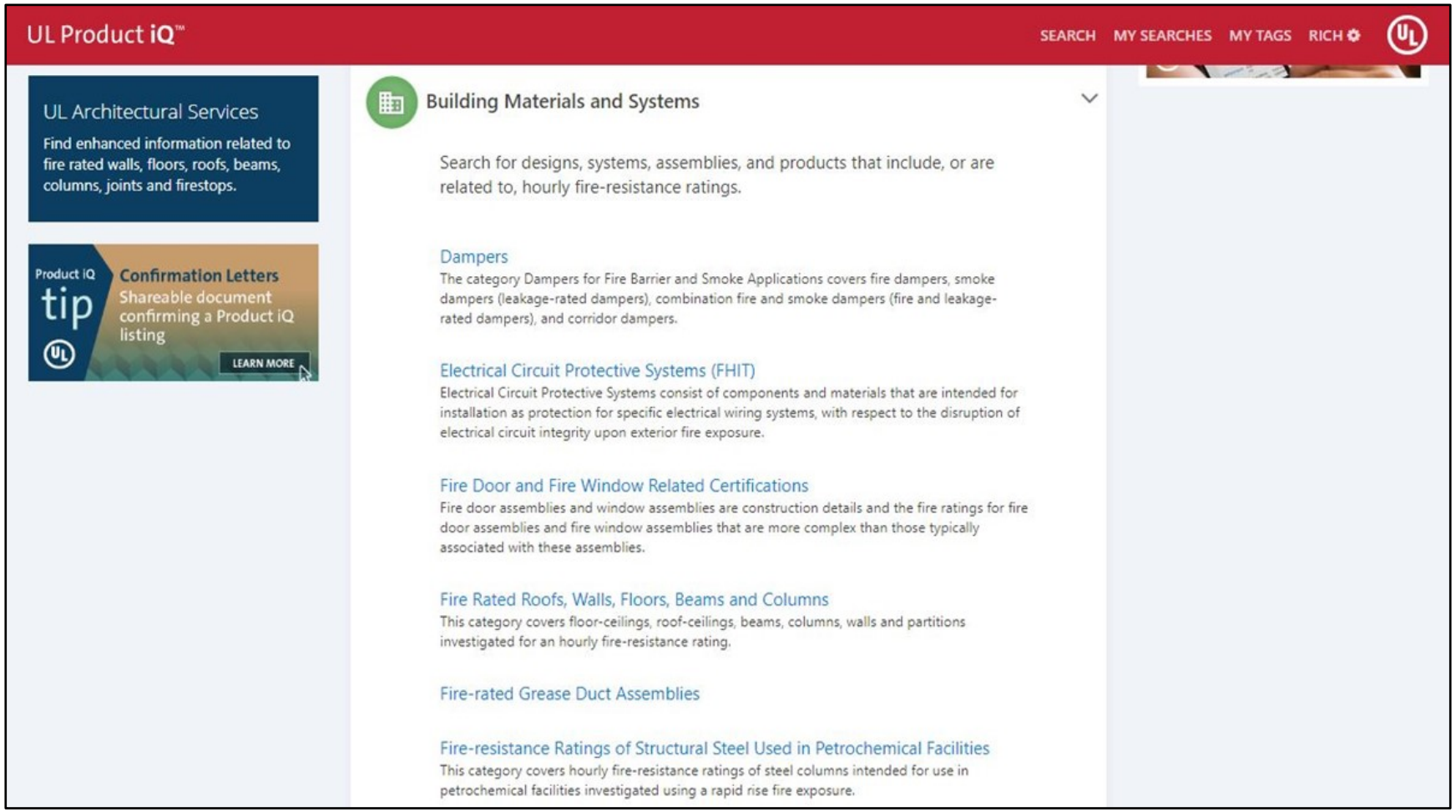

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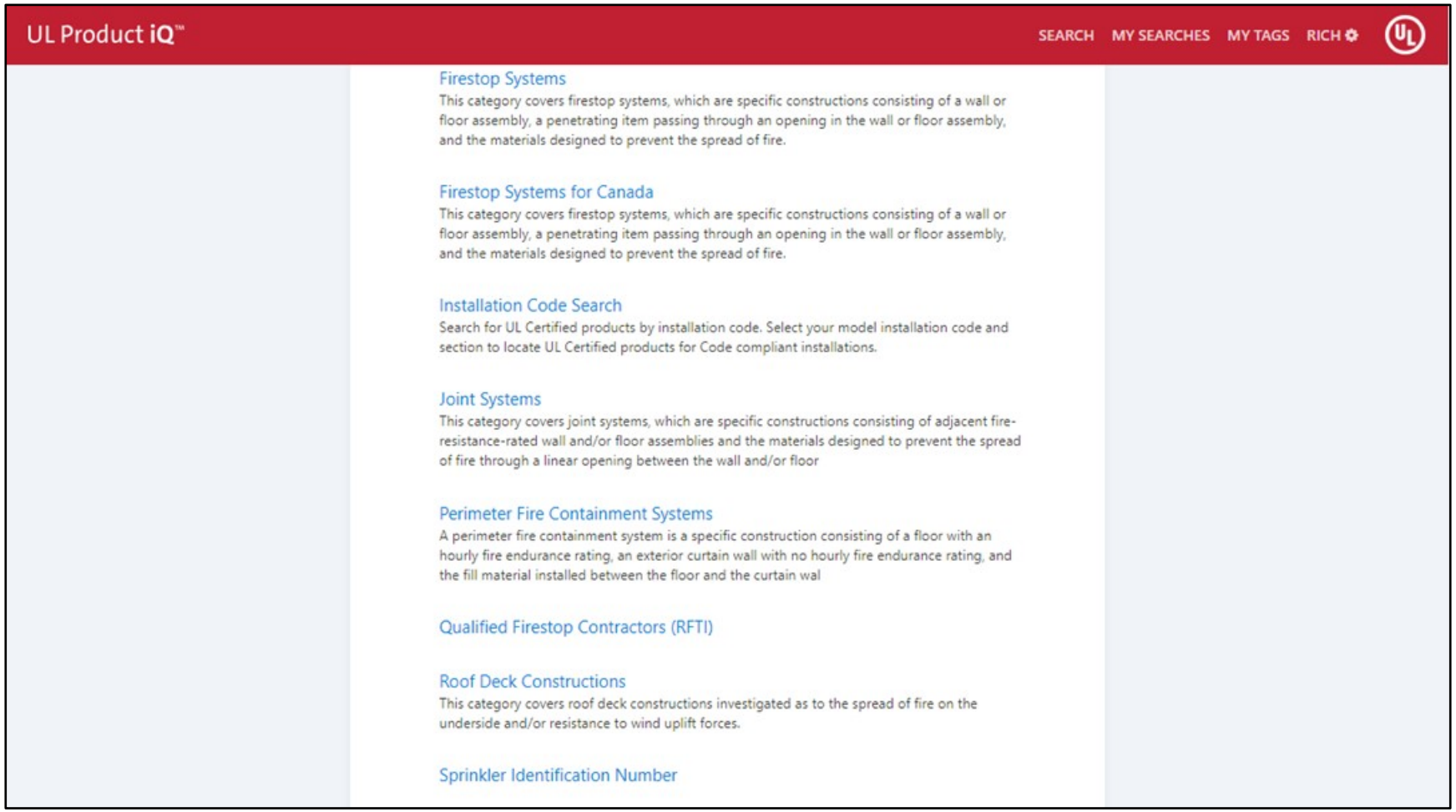

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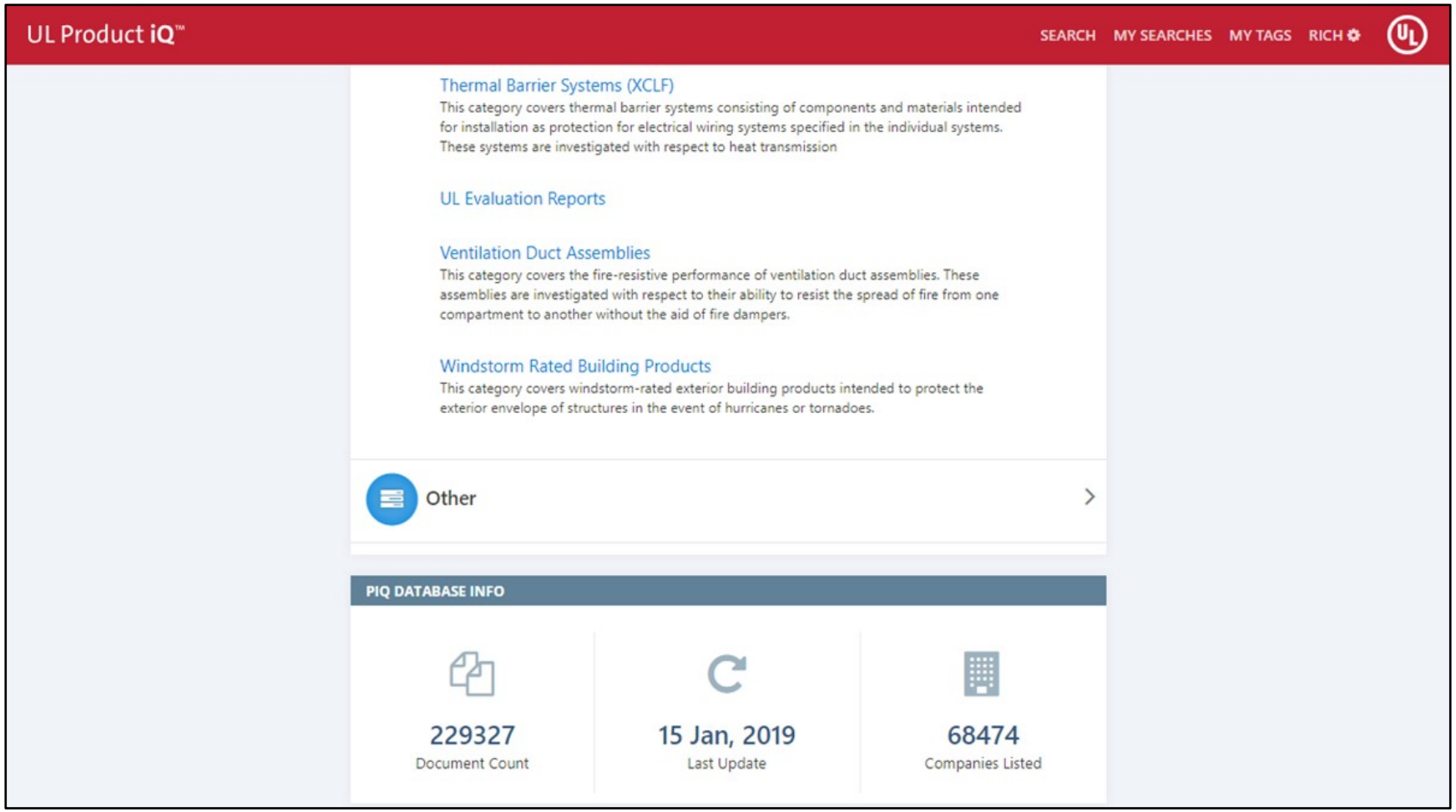

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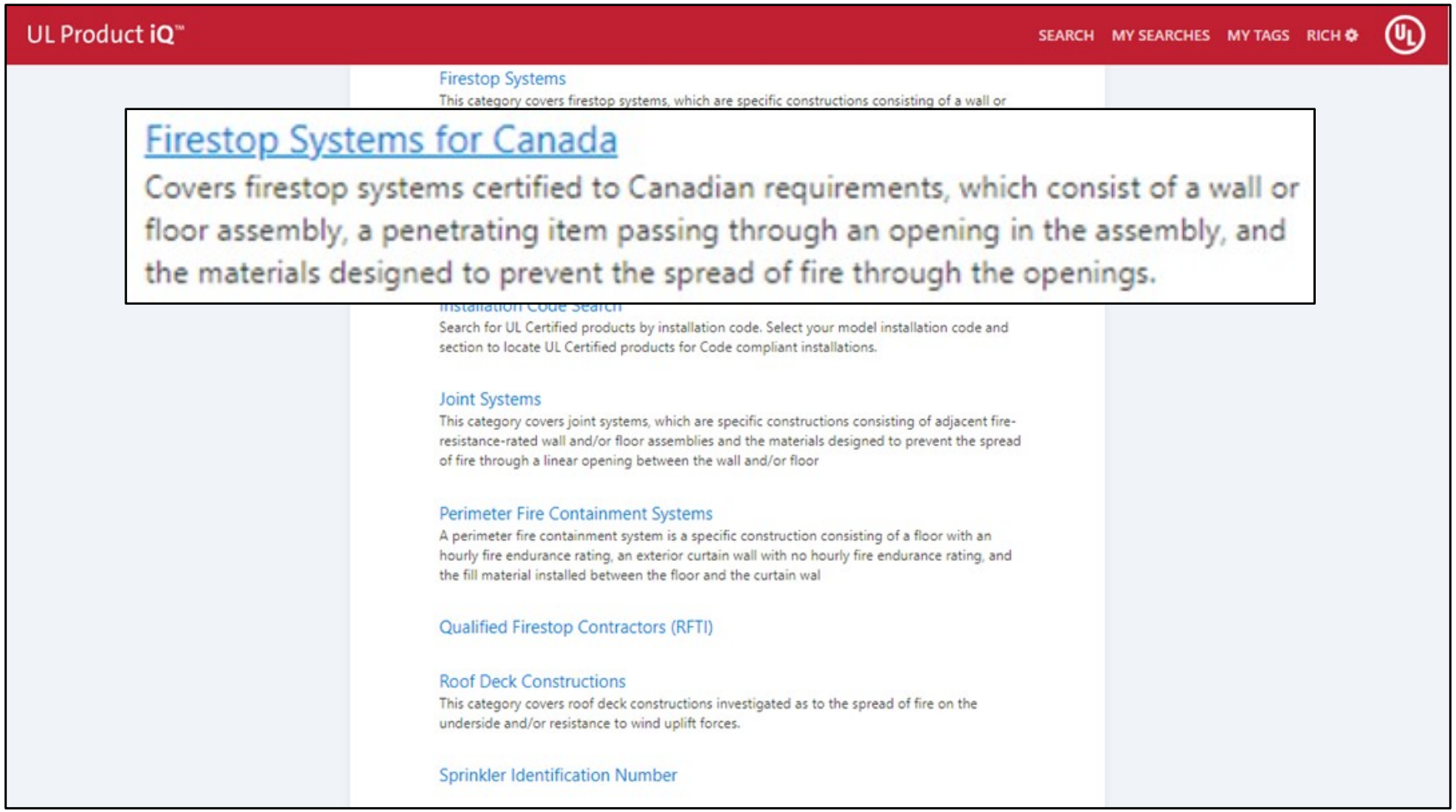

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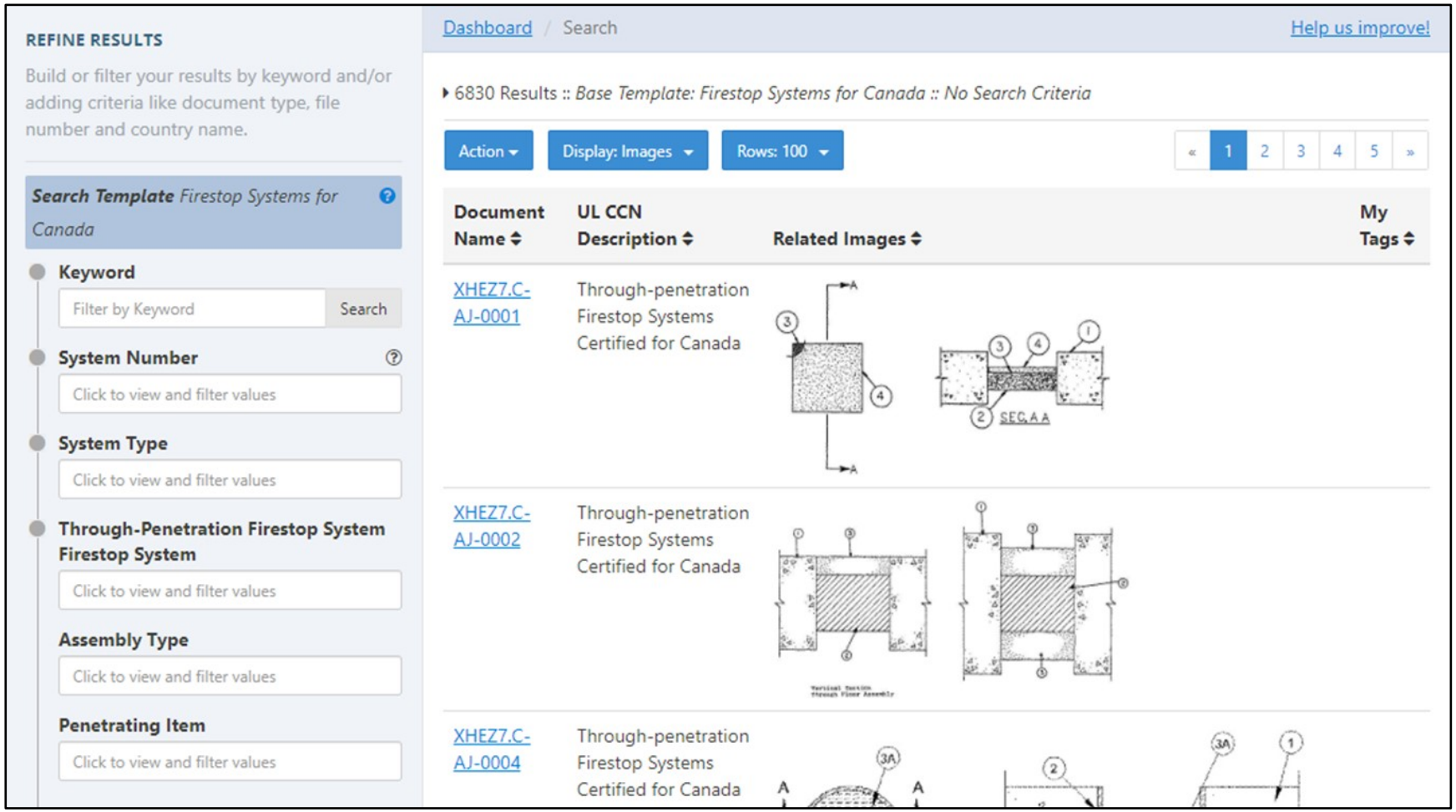

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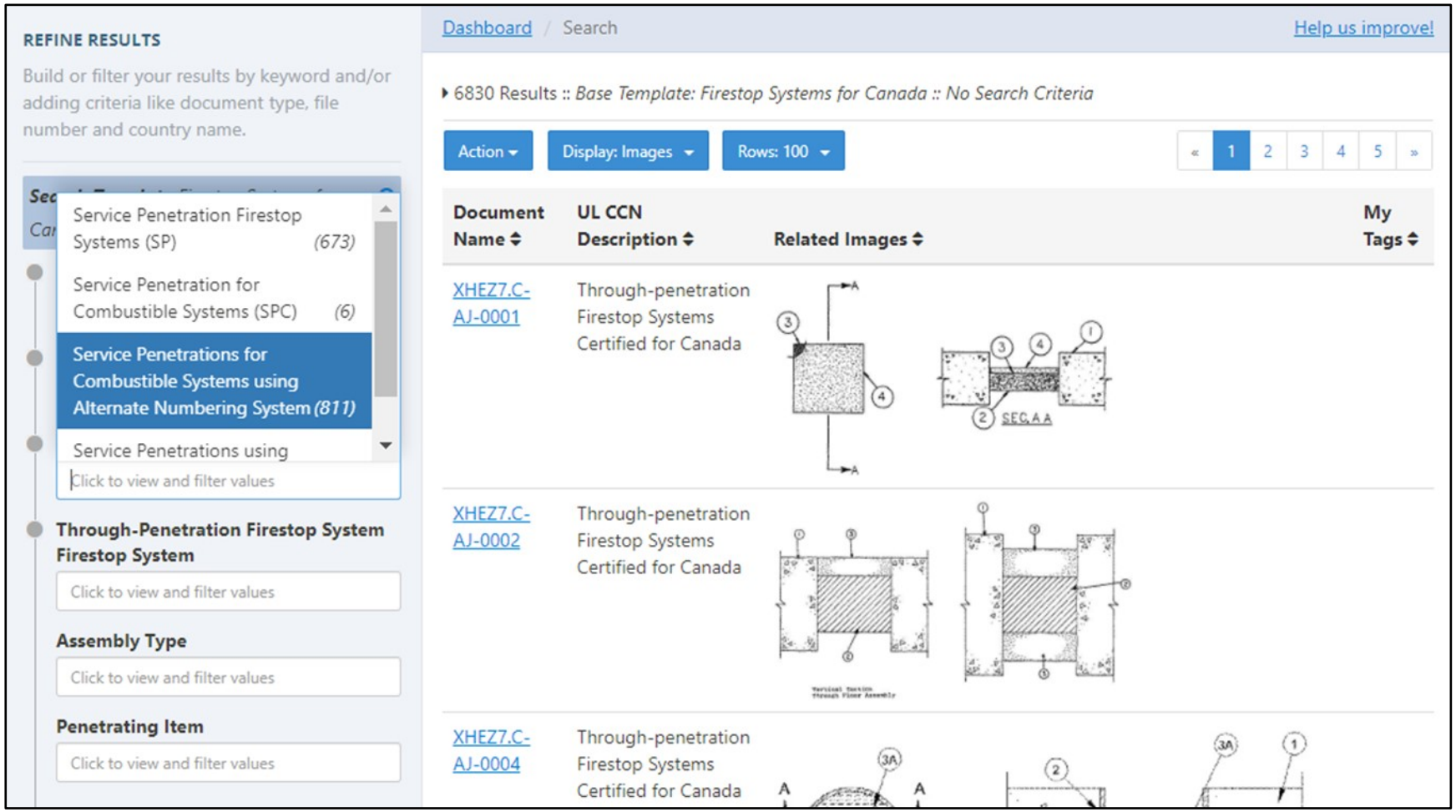

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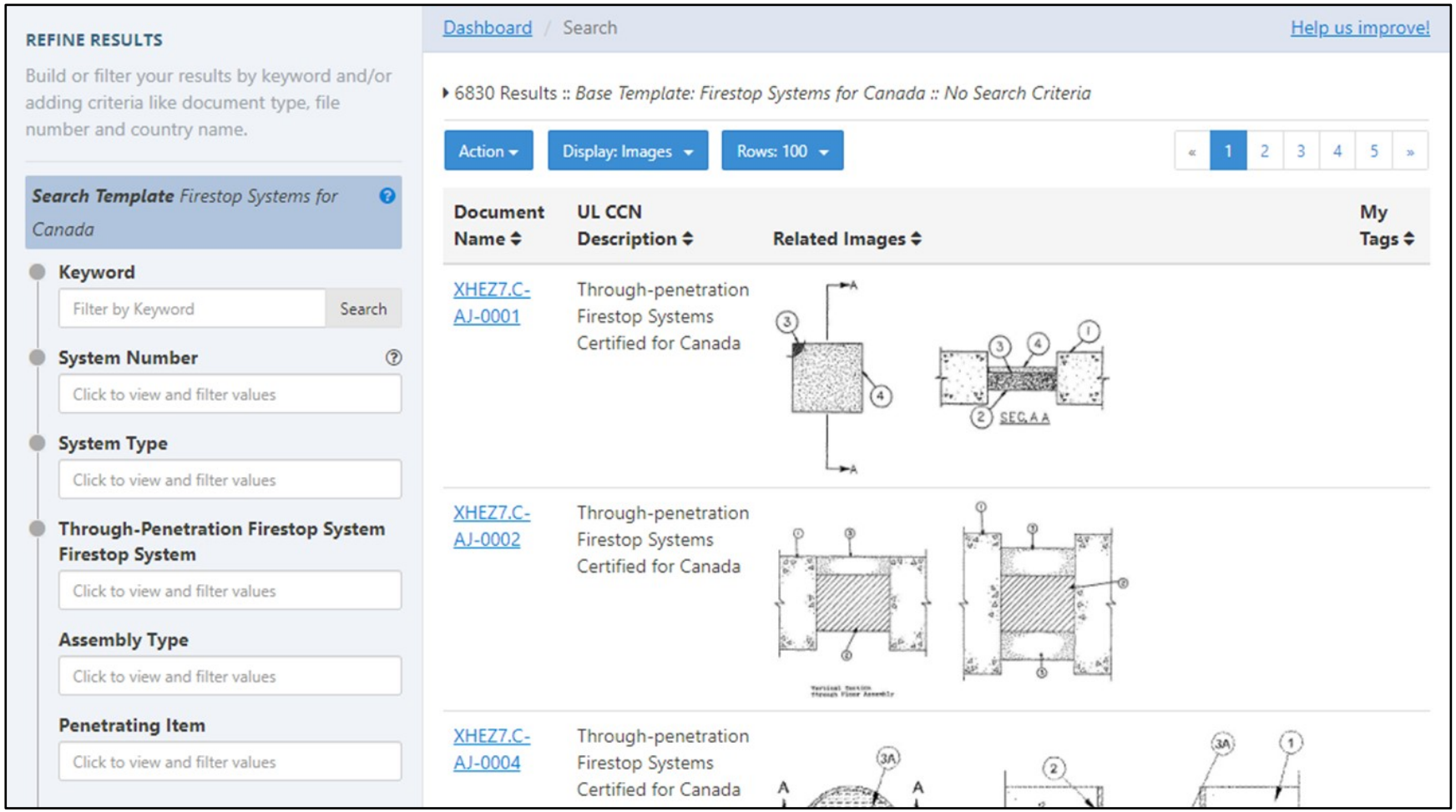

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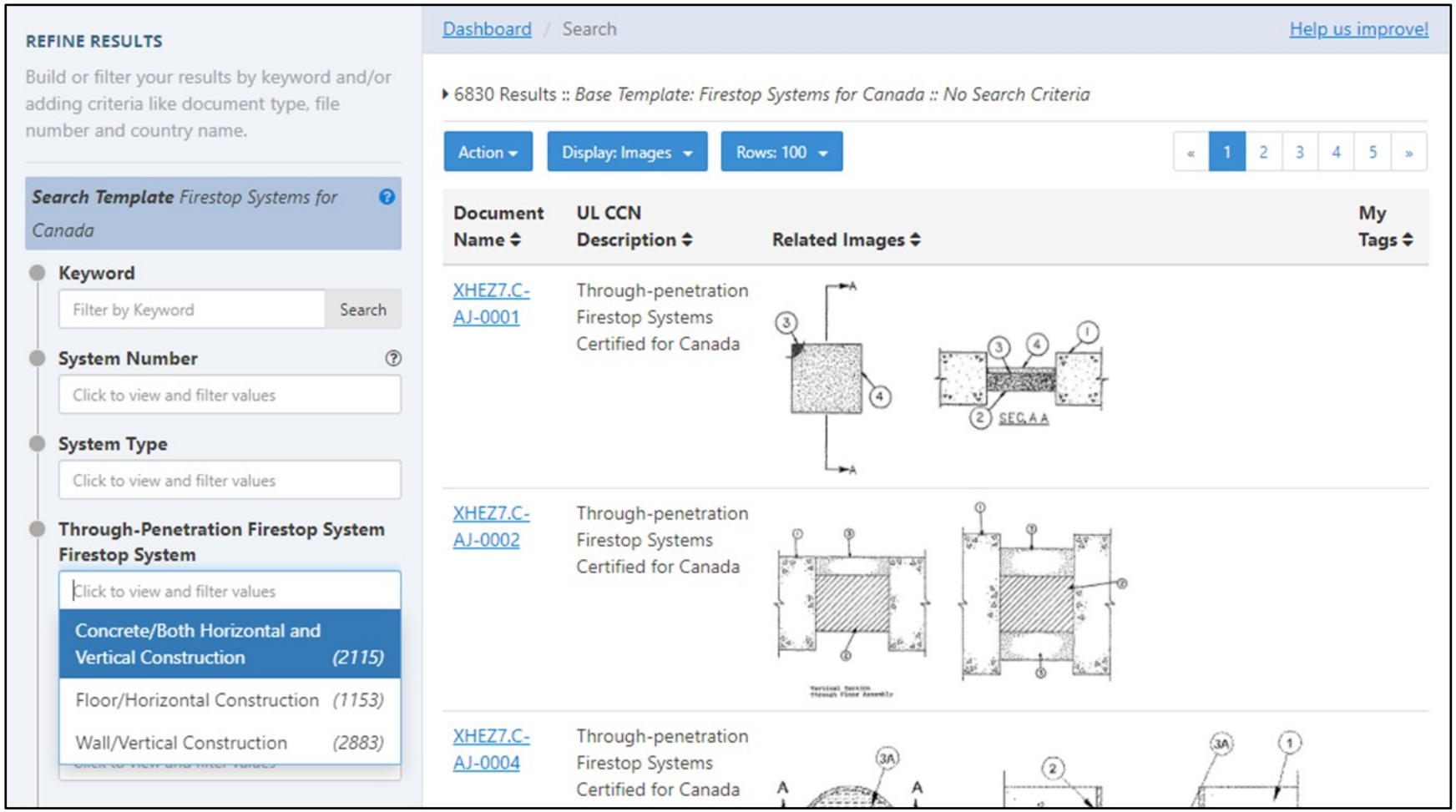

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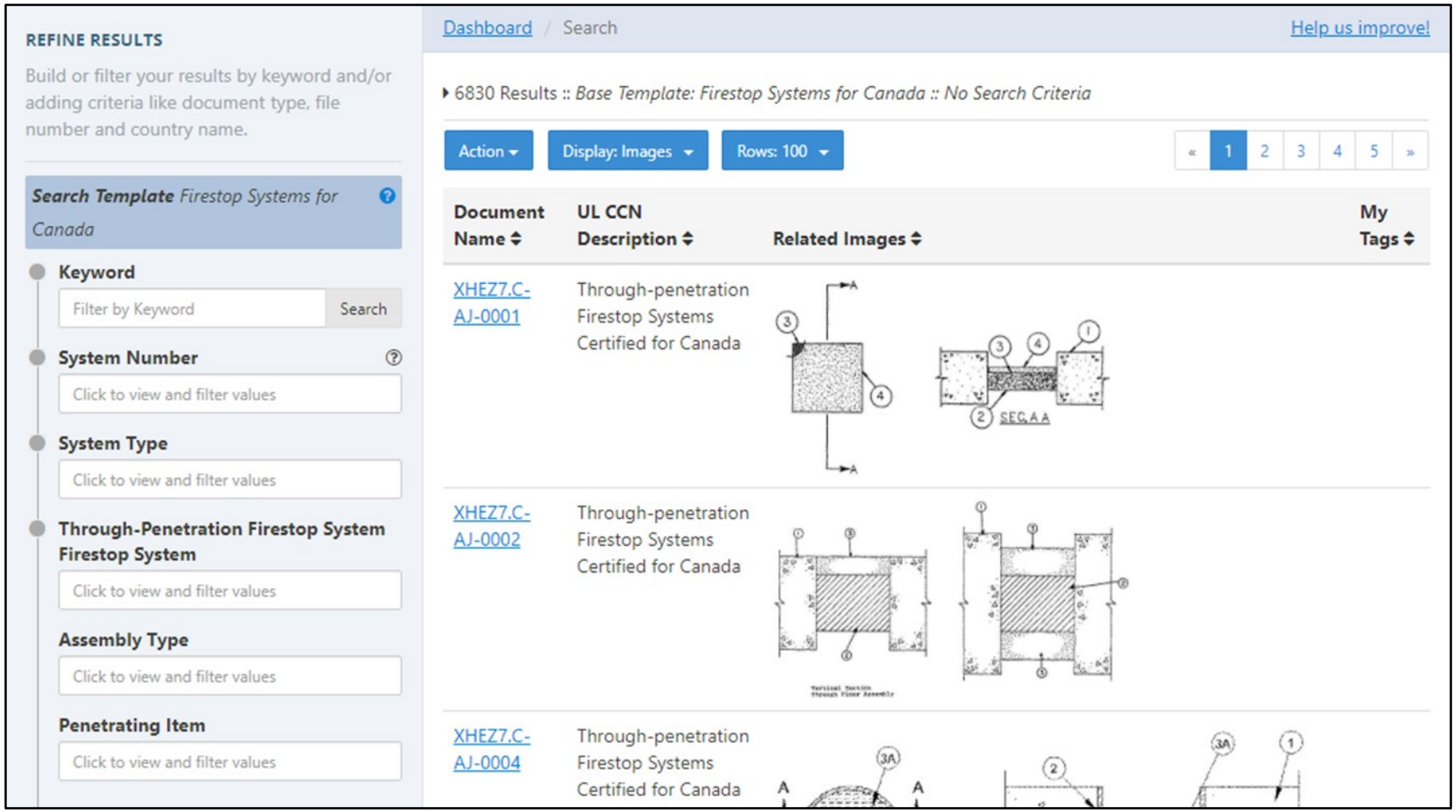

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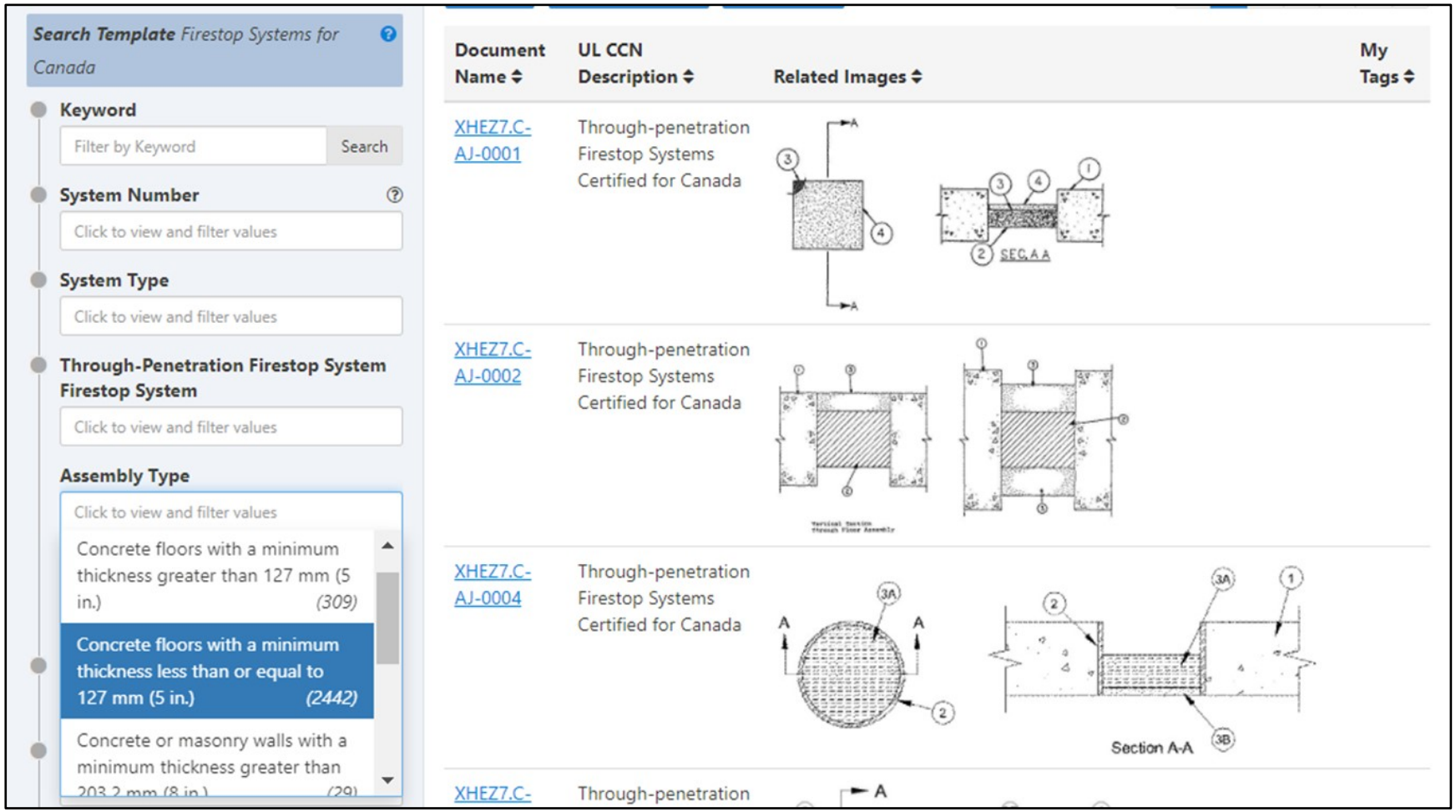


Engineering Judgments/EFRRA

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

Engineering Judgments/EFRRA

International Firestop Council – Manufacturers – www.firestop.org

IFC Guidelines for Evaluating Engineering Judgment Guidelines

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

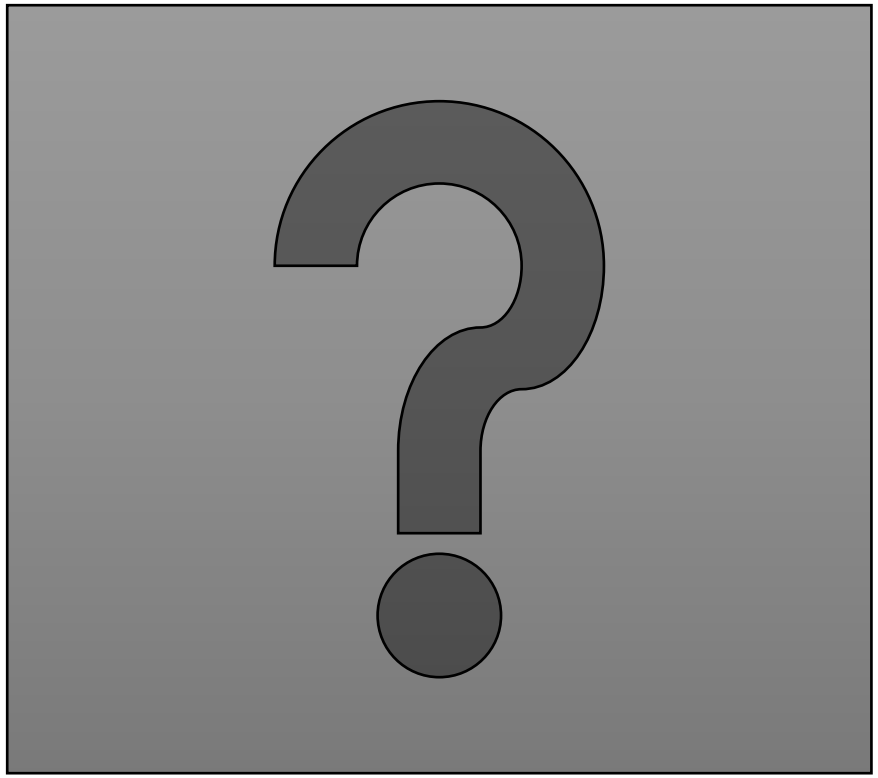
As such, IFC developed *Recommended IFC Guidelines for Evaluating FireStop Systems in Engineering Judgments.*

Engineering Judgments/EFRRA

IFC EJ Guidelines - Engineering Judgments for firestop systems should:

- Emphasizes importance of tested designs
- Not a substitute for existing 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

Questions??



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