Fire Separations, Firestopping and Code Requirements

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CREATIVE TECHNOLOGY INC.
FIRE PROTECTION
CONSULTING AND TRAINING

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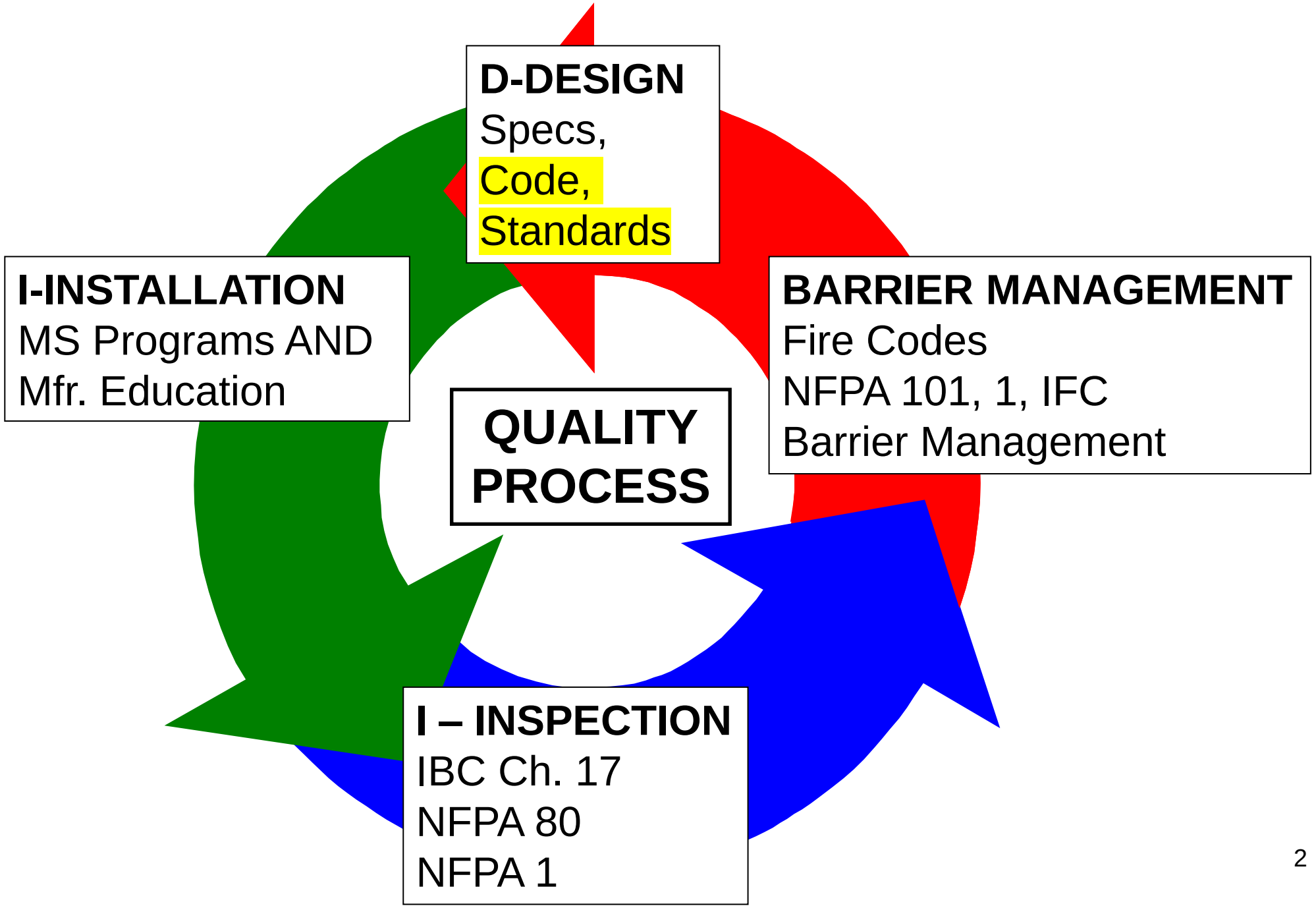
FCIA

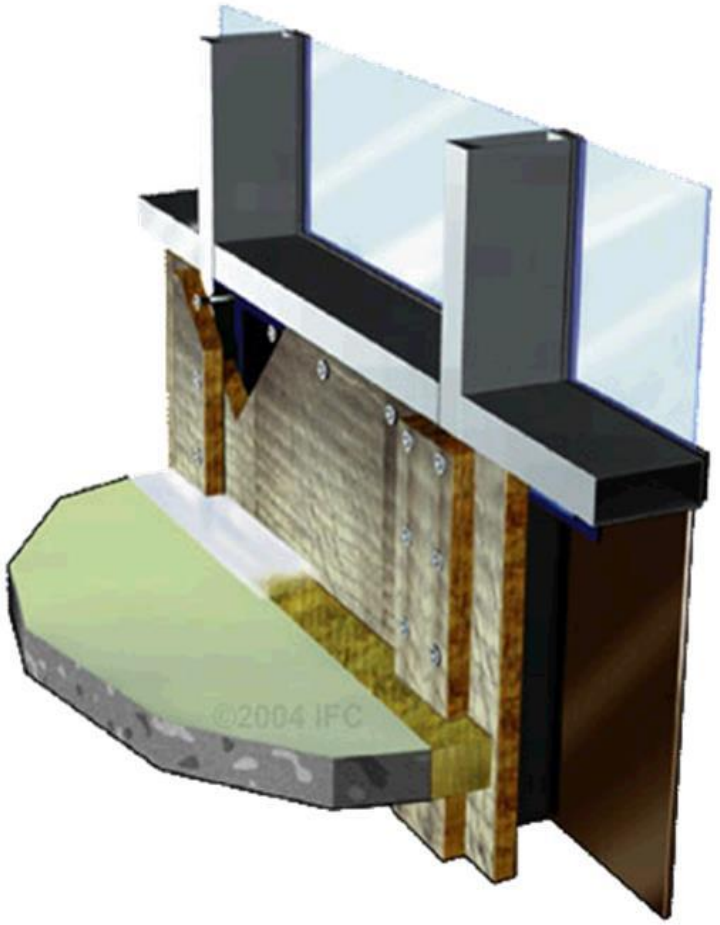

D-DESIGN
Specs,
Code,
Standards
I-INSTALLATION
MS Programs AND
Mfr. Education
BARRIER MANAGEMENT
Fire Codes
NFPA 101, 1, IFC
Barrier Management
QUALITY
PROCESS
I – INSPECTION
IBC Ch. 17
NFPA 80
NFPA 1

“FCIA’s DIIM”

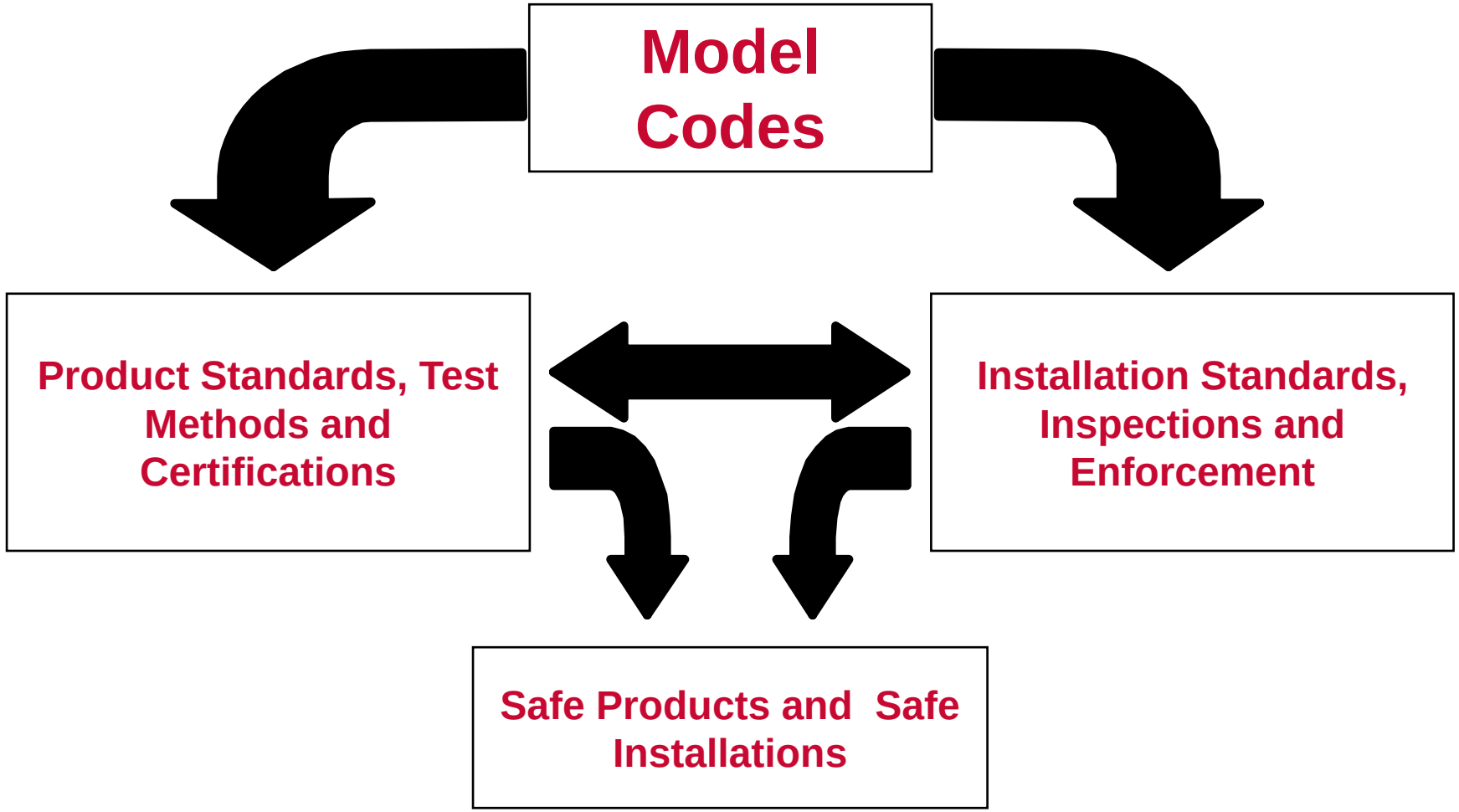
- Fire Resistance & Smoke Resistant Systems
  - Properly ***Designed*** and Specified Firestopping FCIA - 07-84-00 – Specification – ***RSW, CCS***
  - ***Tested and Listed Systems*** – **CAN/ULC-S101, S115, S112, S104, ASTM E2307, E2837, E3037-Movement, UL1479-Smoke (L), Water (W)**
  - Professional ***Installation*** – FCIA Member, ULC/UL Qualified Contractors, FM 4991 Approved
  - Properly ***Inspected*** – ASTM E2174 / E2393 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/**

Fire Separations, Firestopping and Code Requirements

Introductory Comments



The US and Canadian Safety System



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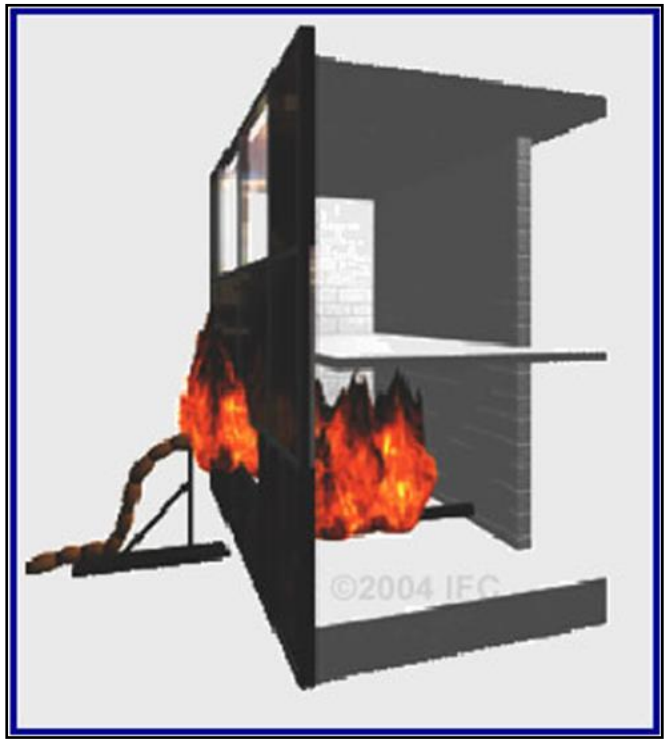
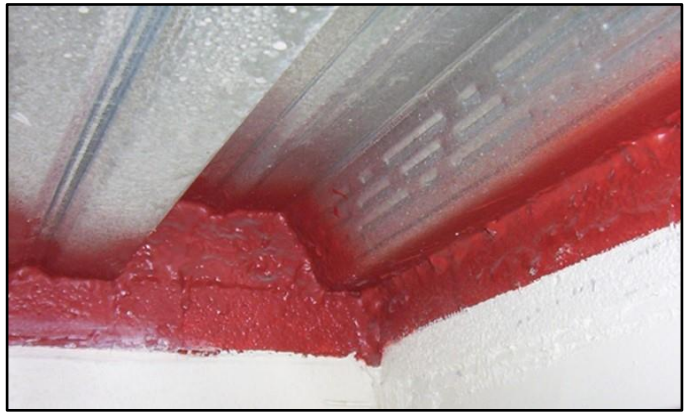
Standards



Affinity Firestop Photo



Firestop Solutions Photo

Compartmentation Codes – NBC

- **Products Become Systems Based on Testing**
  - **Fire & Smoke Barriers – Fire Separations**
    - **CAN/ULC-S101,** ASTM E119 / UL 263
  - **Firestopping – CAN/ULC-S115,** ASTM E814 / UL 1479, ASTM E1966 / UL 2079, E2307, E2837, **…**test methods…”
  - **Swing/Rolling Fire Doors – CAN/ULC-S104, S105 Frames, S113 for 20 minute wood doors**, UL 10B/C / NFPA 252, UL 1784
  - **Fire Rated Glazing – CAN/ULC-S106, S101, S104,** UL 9 / NFPA 257, ASTM E119 / UL 263
  - **Fire/Smoke/Ceiling Dampers – CAN/ULC-S112, S112.1, S112.2,** UL 555, UL 555S, UL 555C
- **SYSTEM Testing = Suitability Statement**

Standards Development Process

- Administered by ULC
  - Proposals initially developed and discussed through Task Groups focused on standard in question
  - Final voting and approval done by ULC Standards Committee on Fire Tests
  - Audit Committee then ensures all processes were appropriately followed
  - As of April, 2022, Standard designation will include year of publication: CAN/ULC-S115:2018A

Significant Changes to ULC-S101-14-R2019

- Scope excludes durability requirements
- No other significant changes

Significant Changes to ULC-S115:2018

- Replaces ULC-S115-11-R2016
- New requirements for placement of thermocouples (TC) for membrane penetrations
  - Min two TCs placed opposite membrane penetration and two TC near top of wall

Significant Changes to ULC-S115:2018 Cont.

- New Section 9 covering Perimeter Joint Firestop Systems
  - 9.1.1 Perimeter Joint Systems shall be tested in accordance with the requirements in ASTM E2307, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus.

Significant Changes to ULC-S115:2018 Cont.

- ULC-S115 makes minor adjustments in the test procedures described in ASTM E2307
  - Protection and Conditioning requirements of ULC-S115 also apply
  - After 30 minutes, the furnace temperature curve shall follow ULC-S101
  - Differential pressure shall be 2.5 PS at a distance of 305 mm below the horizontal assembly (i.e. the 50 Pa pressure does not apply)
- For joint firestop systems, allowance added deforming the TC pad and reducing it’s size based on unique characteristics of the system

Significant Changes to ULC-S115:2018 Cont.

- ULC-S115:2018 open for proposed changes
  - FCIA will be making multiple proposals

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 (Optional) – Smoke
  - W Rating (Not in Std) – Water
  - M Rating (Not in Std) – Movement

3M Photo

Fire Separations, Firestopping and Code Requirements

Canadian Building and Fire Codes

Building & Fire Code Requirements

- Canadian Codes
  - National Building Code of Canada
  - National Fire Code of Canada
- International Code Council Codes –
  - New and Existing Buildings – International Building Code – Chapter 7
  - Maintenance – International Fire Code – Chapter 7
- NFPA 5000 / 101 – Chapter 8
- UAE Fire and Life Safety Code – Chapter 1, Section 21
- Saudi Fire and Life Safety Code
- Other Worldwide Codes
- ***Minimum Requirements*** – ***Construction*** & ***Maintaining Protection***

Building & Fire Code Requirements

- **National Building Code of Canada (NCC)**
  - Covers among other things, new construction requirement
- **National Fire Code of Canada (NFC)**
  - Covers among other things, maintenance of fire resistive construction
- **Provincial Codes based on National Code**
- **Adopted with Amendments**
- ***Codes represent the minimum requirements for construction & maintenance***

Building & Fire Code Requirements

National Building Code of Canada (NCC)

National Fire Code of Canada (NFC)

- **The Canadian Commission on Building and Fire Codes (CCBFC) oversees the code development system**
  - Volunteers appointed by NRC
  - Regulators, construction industry & public interest
  - 2020 Cycle Finished…published November 2010
  - 2025 Cycle Underway…
  - FCIA to participate

Why Fire Resistance in Buildings?

OS1 Fire Safety

An objective of this Code is to **limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an acceptable risk of injury due to fire.** The risks of injury due to fire addressed in this Code are those caused by—

OS1.1 – fire or explosion occurring

OS1.2 – fire or explosion impacting areas beyond its point of origin

OS1.3 – collapse of physical elements due to a fire or explosion

OS1.4 – fire safety systems failing to function as expected

OS1.5 – persons being delayed in or impeded from moving to a safe place during a fire emergency

Why Fire Resistance

OS2 Structural Safety

An objective of this Code is to limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to **structural failure**. The risks of injury due to structural failure addressed in this Code are those caused by—

OS2.1 – loads bearing on the building elements that exceed their load bearing capacity

OS2.2 – loads bearing on the building that exceed the load bearing properties of the supporting medium

OS2.3 – damage to or deterioration of building elements

OS2.4 – vibration or deflection of building elements

OS2.5 – instability of the building or part thereof

OS2.6 – collapse of the excavation

Why Fire Resistance

Functional Statements

1) The objectives of this Code are achieved by measures, such as those described in the acceptable solutions in Division B, that are intended to allow the building or its elements to perform the following functions (see Appendix A):

F01 To minimize the risk of accidental ignition.

F02 To limit the severity and effects of fire or explosions.

F03 To retard the effects of fire on areas beyond its point of origin.

F04 To retard failure or collapse due to the effects of fire.

F05 To retard the effects of fire on emergency egress facilities.

National Building Code Requirements

Compartmentation Codes
NBC - Division A, Part 1, Section 1.4.1.2

- **Back to the Basics**
- ***Fire resistance rating*** *means the time in minutes or hours that a material or assemblies of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived therefrom as prescribed in this Code.*

- ***ULC-S101*** **–** *Standard Methods of Fire Endurance Tests of Building Construction Materials*

National Building Code Requirements Cont.

- Fire-Resistance-Rated Barriers – NBC Defined Terms
  - *Fire Wall*
  - *Fire Separation*

National Building Code Requirements Cont.

- ***Firewall*** means a type of *fire separation* of *noncombustible construction* that subdivides a *building* or **separates adjoining *buildings*** to resist the spread of fire and that has a *fire-resistance rating* as prescribed in this Code and has **structural stability** to remain intact under fire conditions for the required fire-rated time.

National Building Code Requirements Cont.

- Continuity of Firewalls
- [F03-OS1.2] Applies to portion “A *firewall* shall extend from the ground continuously through, or adjacent to**, all *storeys* of a *building* or *buildings* so separated …**
- ***Terminates –***
  - @ Reinforced Concrete Roof Slab – 1hr/2hr; 2hr/4hr
  - 150 mm above roof – 2 hr
  - 900 mm above roof – 4 hr

National Building Code Requirements Cont.

- *Fire Separation* - A construction assembly that acts as a barrier against the spread of fire.
  - *Fire-resistance-rated* or Non-rated
  - Combustible or Noncombustible Construction
  - Horizontal or Vertical
  - Load Bearing or Nonload Bearing
  - Continuity
    - Outside wall to outside wall
    - Floor to floor/roof above
  - Protected openings, penetrations and joints

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.7.5 – Rating of Supporting Construction

1) Except as permitted by Sentence (2) and by Articles 3.2.2.20. to 3.2.2.92. for mixed types of construction, all *load bearing* walls, columns and arches in the ***storey*** **immediately below a floor or roof assembly required to have a *fire-resistance rating* shall have a *fire-resistance rating* not less than that required for the supported floor or roof assembly.**

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.8.1 – General Requirements

1) Any wall, partition or floor assembly required to be a fire separation shall

   a) except as permitted by Sentence (2), be constructed as ***continuous*** element, and

   b) as required in this part, have a fire-resistance-rating as specified (see appendix A).

2) Openings in a *fire separation* shall be protected with closures, shafts or other means in conformance with Articles 3.1.8.4-19.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section A-3.1.8.1.(1)(b)

- Although a *fire separation* is not always required to have a fire-resistance rating, the **fire separation** should act as a **barrier to the spread of smoke and fire** until some response is initiated.
- **If the fire-resistance rating of a fire separation is waived** on the basis of the presence of an automatic **sprinkler system**, it is intended that the ***fire separation will be constructed so that it will remain in place and act as a barrier against the spread of smoke for a period of time*** until the sprinklers have actuated and controlled the fire.
- **UL-S115** Listed Systems **– NOTE: Smoke = L-Rating**

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.8.3 – Continuity of Fire Separations

4) Except as provided in Sentence (5), joints located in a horizontal plane between a floor and an exterior wall shall be sealed by a *firestop* that, when subjected to the fire test method in ASTM E2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus,” has an F rating not less than the *fire-resistance rating* of the horizontal *fire separation*.

- New for the 2020 NBC
- Consistent with US based requirements

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section A-3.1.8.3(2) – Continuity

- The continuity of a *fire separation* with a fire-resistance rating is maintained by installing a firestop system at the juncture where it abuts another fire separation, a floor, a ceiling, a roof assembly. The continuity of a fire separation without a fire-resistance rating that abuts another fire separation is maintained by filling all openings at the juncture of the assemblies with a fire-resistance-rated joint firestop system that will ensure the integrity of the fire separation at that location.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

1) Except as required by Sentences (2) to (7), and Article 3.1.9.1 penetrations of a *fire separation* or membrane forming part of an assembly required to have a *fire-resistance rating* shall be

   a) sealed by a *firestop* that, when subjected to the fire test method in **UL-S115, "Fire Tests of Firestop Systems,"** has an F rating not less than the fire-resistance rating of the fire separation, or

   b) cast in place, where the item penetrating the *fire separation* is steel, ferrous, copper, concrete or masonry

- **Both provisions revised for 2020. a) previously rating related to closures. b) now limited to noncombustible penetrants.**

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

2) Except as permitted in Sentence (6), penetrations of a *fire wall* or horizontal *fire separation* that is required to have a *fire-resistance rating* in conformance with Article 3.2.1.2 shall be sealed at the penetration by a firestop that, when subjected to the fire test method CAN/ULC-S115, “Fire Tests of Firestop Systems”, has an FT Rating not less than the *fire-resistance rating* of the *fire separation*.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

3) Except as permitted in Sentence (6) and (7), penetrations of a *fire separation* in conformance with Section 3.6.4.2.(2) (horizontal service space) shall be sealed by a firestop that, when subjected to the fire test method CAN/ULC-S115, “Fire Tests of Firestop Systems”, has an FT Rating not less than the *fire-resistance rating* of the *fire separation*.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

4) Sprinklers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *firestop* requirements of sentences (1) to (3), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, “Installation of Sprinkler Systems”.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

5) **Unless specifically designed with a *firestop, fire dampers* are permitted to penetrate a *fire separation* or a membrane** forming part of an assembly required to have a *fire-resistance rating* without having to meet the *firestop* requirements of Sentences (1) to (3), provided the *fire dampers* is installed in conformance with NFPA 80, “Fire Doors and Other Opening Protectives”.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

6) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentences (2) and (3) that are contained within the cavity of a wall above and below the horizontal *fire separation* are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” has an F rating not less than the *fire-resistance rating* for the *fire separation*.

- New for 2010 NBC

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.1 – Penetrations

7) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentence (3) are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the *fire-resistance rating* for the *fire separation*, provided the penetration

a) is contained within the concealed space of a floor or ceiling assembly having a *fire-resistance rating*,

b) is located above a ceiling membrane that is a horizontal *fire separation*, or

c) is contained within a *horizontal service space* conforming to Subsection 3.6.4.2 (horizontal service space) that is directly above or below the floor.

- New for 2010 NBC

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.3 – Penetrations by Outlet Boxes

2) *Combustible* outlet boxes are permitted to penetrate the membrane of an assembly required to have a *fire-resistance rating*, provided they are sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

- New for 2020 NBC. Removes allowance for unprotected nonmetallic outlet boxes.

National Building Code Requirements Cont.

Compartmentation Codes

NBCC - Division B, Part 3, Section 3.1.9.3 – Penetrations by Outlet Boxes

2) Outlet boxes on opposite sides of a vertical *fire separation* having a *fire-resistance rating* shall be separated by

a) a horizontal distance of not less than 600 mm,

b) a *fire block* conforming to Article 3.1.11.7., or

c) a *firestop* installed on each outlet box that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems.”

- Item c) new for 2020 NBC. Allows protection in lieu of spacing.

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.4 – Combustible Piping Penetrations

4) Combustible drain, waste and vent piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or membrane that forms part of an assembly required to have a *fire-resistance rating,* provided

a) except as provided in Clause (b), the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating required for the fire separation* when subjected to the fire test method in CAN/ULC-S115, Fire Tests of Firestop Systems,”

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.4 – Combustible Piping Penetrations

b. In buildings more than 3 storeys in building height, the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the fire separation when subjected to the fire test method in CAN/ULC-S115 with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

c. the piping is not located in a vertical service space.

- Item b) revised to now reference more than 3 storeys in 2020 NBC

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.4 – Combustible Piping Penetrations

7) Except as provided in Sentence (8), penetrations of a *fire separation* that incorporate transitions between *combustible* and *noncombustible* drain, waste and vent piping shall be sealed by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

- New for 2020

National Building Code Requirements Cont.

Compartmentation Codes

NBC - Division B, Part 3, Section 3.1.9.4 – Combustible Piping Penetrations

8) Transitions between vertical *noncombustible* drain, waste and vent piping and *combustible* branches for drain, waste and vent piping are permitted on either side of a *fire separation*, provided they are not located in a *vertical service space*.

- New for 2020 NBC

Summary of Requirements for Protecting Breaches

- Each type of **breach** has a unique fire test using a ULC standard and a smoke leakage test standard associated with it which compliments ULC-S101

Summary of Requirements for Protecting Breaches

- **Penetrations**
  - Fire / Hose Stream Test Standards
    - ULC-S115 (UL 1479)
    - PLASTIC PIPES – ASTM E814 DOES NOT = ULC-S115
    - 50 Pa vs. 2.5 Pa Pressure = DIFFICULTY PASSING
  - Smoke Leakage Standard
    - ONLY in ULC-S115
    - Any lab can perform leakage test, but ULC-S115 is the standard

Requirements for Protecting Breaches

- **Joints**
  - Fire / Hose Stream Test Standards
    - ULC-S115 (Joint Firestops)
      - ASTM E2307 (Perimeter Joint Firestops)
      - ASTM E2837 (Cont. HW Joints)
  - Smoke Leakage Standard
    - ULC-S115

Requirements for Protecting Breaches

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

Requirements for Protecting Breaches

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

Fire Separations, Firestopping and Code Requirements

Listings

Where Can I Find The Most Current Listing?

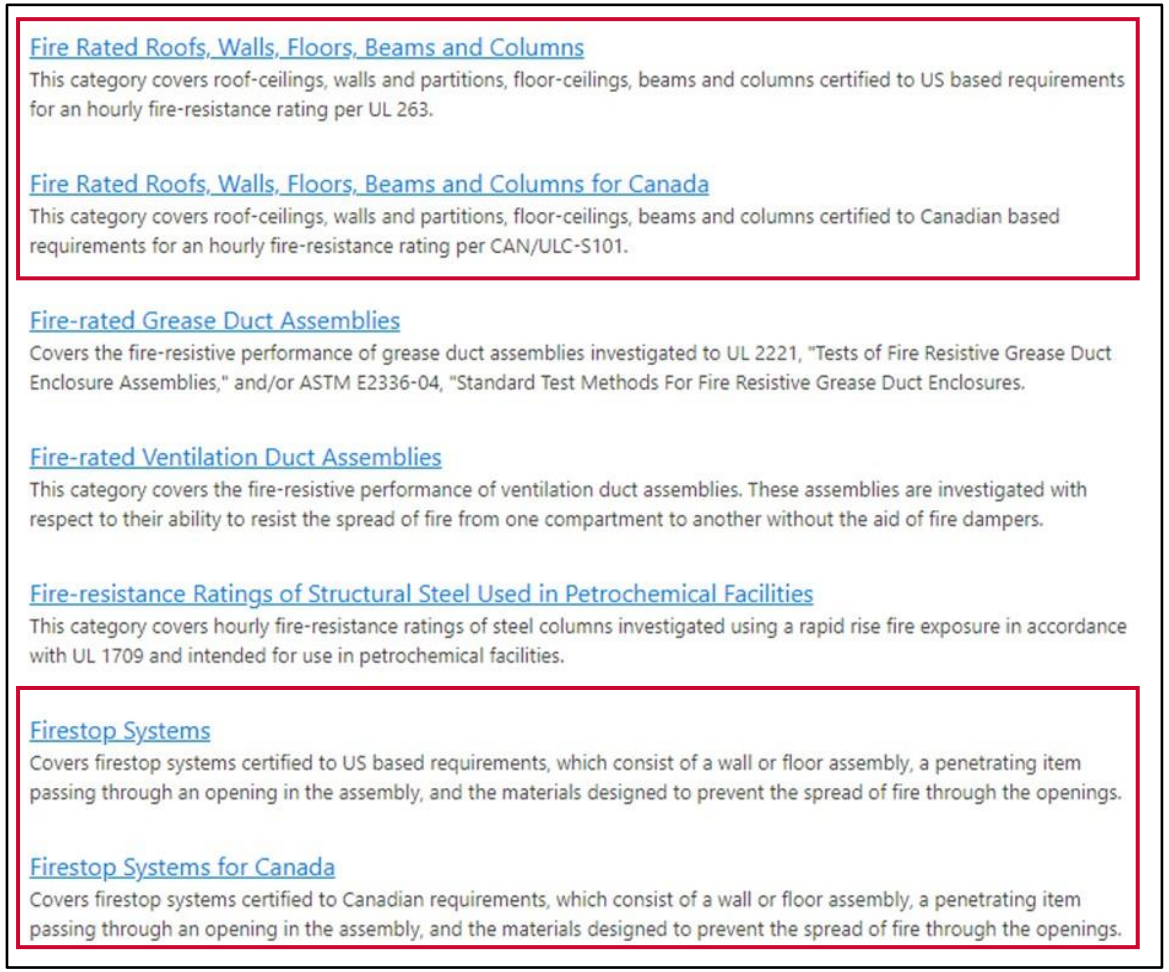
- Directories of the Nationally Recognized Testing Laboratories
  - FM Global Approval Guide
  - Intertek Directory of Building Products
  - UL/ULC Product iQ Online Directory

Products become systems based on testing!!!

UL/ULC Product IQ

www.UL.com/PiQ

- Listings for fire resistance, penetration firestop systems and joint firestop systems are sorted by US and Canadian requirements



Engineering Judgments/EFRRA

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

J. Sharp – ProFirestop Photo

C. Zussman – Pepper Photo

Engineering Judgments/EFRRA

- **EJ Process….**
  - ***Reviewed by Designer,***
  - ***Possibly Fire Consultant***
  - ***P. Eng. Stamp?***
  - ***AHJ after Architect Approval***
  - ***Signoff by EOR, FS Manufacturer??***
- ***IFC Protocol….***

J. Sharp – ProFirestop Photo

C. Zussman – Pepper Photo

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 and listed systems 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

Manufacturer – "EJ will pass fire test, if subjected…"

National Fire Code of Canada

NFC - Division B, Part 2, Section 2.2.1.2 – Damage to Fire Separations and Fire Protection Materials

1) Where *fire separations* are damaged so as to affect their integrity, they shall be repaired so that the integrity of the *fire separation* is maintained…

2) Where materials used to provide fire protection are damaged or removed, they shall be repaired or replaced so that the integrity of the fire separation is maintained.

Includes Fire Dampers, Fire Doors…and Continuity

More Later Today

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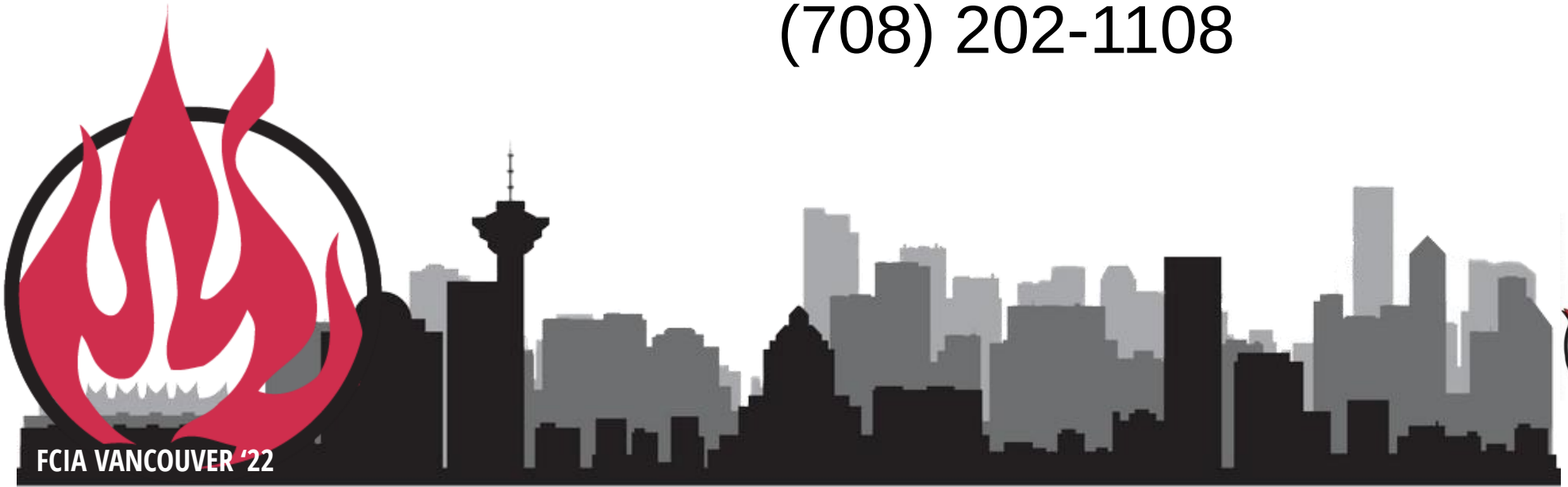

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