FIRESTOPPING, for Integrity and Continuity of Fire Separations - Design, Testing & Code Requirements

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Falconer Engineering and Testing
September 21, 2016
Executive Summary:

• Introduction
• Fire Separations & Compartmentation
  ➢ Fundamentals
  ➢ Continuity = Joint Fire Stops
  ➢ Integrity = Penetration Fire Stops
• Issues and Opportunities
  ➢ The perimeter joint conundrum
  ➢ Some Design considerations
• Questions
Introduction

PROJECT STUDY:
Harmony Public School, Corbyville, ON

- 5,100 sq m (55,000 sq ft.)
- Rural
- Unsprinklered
- 5,100 sq m (55,000 sq ft.)
- Rural
- Unsprinklered

626 Harmony Road
Harmony Rd
Harmony Rd

Sept. 21, 2016
Fire Separations / Compartmentation

- an historic means of controlling fire
- Nero decreed after great fire of Rome 64 AD
- London, regulations date back to 1189
- London, after Great Fire of 1666 - new building regulations required stone and brick houses to have fire-resisting party walls
- All modern codes require fire compartments formed of fire-resistive floors, walls, and roofs to mitigate the risk of fire to life and property.
Fundamentals - Compartmentation

Definitions (2015 NBCC & 2014 ABC)

- **Fire Compartment** means a space in a *building* that is enclosed by exterior walls or separated from all other parts of the *building* by enclosing construction providing a *fire separation* having a *fire-resistance rating*.

- **Fire Resistance Rating** means the time in minutes or hours that a material or assembly 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.
Fundamentals - Compartmentation

Definitions (2015 NBCC & 2014 ABC)

- **Fire Separation** means a construction assembly that acts as a barrier against the spread of fire. (See Note A-1.4.1.2.(1).)

- **Fire Stop** means a system consisting of a material, component and means of support used to fill gaps between fire separations or between fire separations and other assemblies [joints], or used around items that wholly or partially penetrate a fire separation [penetrations].
Fundamentals - Compartmentation

Definitions (2015 NBCC & 2014 ABC)

- **Noncombustible** means that a material meets the acceptance criteria of CAN/ULC-S114, “Test for Determination of Non-Combustibility of Building Materials.”

- **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.
## Table 3.1.2.1. Major Occupancy Classification
Forming Part of Sentences 3.1.2.1.(1) and 3.1.2.2.(1)

<table>
<thead>
<tr>
<th>Group</th>
<th>Division</th>
<th>Description of Major Occupancies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Assembly occupancies intended for the production and viewing of the performing arts</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Assembly occupancies not elsewhere classified in Group A</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Assembly occupancies of the arena type</td>
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<tr>
<td>A</td>
<td>4</td>
<td>Assembly occupancies in which occupants are gathered in the open air</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>Detention occupancies</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>Treatment occupancies</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>Care occupancies</td>
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<tr>
<td>C</td>
<td>—</td>
<td>Residential occupancies</td>
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<tr>
<td>D</td>
<td>—</td>
<td>Business and personal services occupancies</td>
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<tr>
<td>E</td>
<td>—</td>
<td>Mercantile occupancies</td>
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<td>F</td>
<td>1</td>
<td>High-hazard industrial occupancies</td>
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<td>Medium-hazard industrial occupancies</td>
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<td>F</td>
<td>3</td>
<td>Low-hazard industrial occupancies</td>
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## Fundamentals - Compartmentation

Table 3.1.3.1.
**Major Occupancy Fire Separations**
Forming Part of Sentence 3.1.3.1.(1)

<table>
<thead>
<tr>
<th>Major Occupancy</th>
<th>A-1</th>
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<th>A-3</th>
<th>A-4</th>
<th>B-1</th>
<th>B-2</th>
<th>B-3</th>
<th>C</th>
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</tbody>
</table>
1) A building classified as Group A, Division 2 is permitted to conform to Sentence (2) provided
   a) it is not more than 2 storeys in building height, and
   b) it has a building area not more than the value in Table 3.2.2.25.

<table>
<thead>
<tr>
<th>No. of Storeys</th>
<th>Maximum Area, m²</th>
<th>Facing 1 Street</th>
<th>Facing 2 Streets</th>
<th>Facing 3 Streets</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>1 600</td>
<td>2 000</td>
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<tr>
<td>2</td>
<td></td>
<td>800</td>
<td>1 000</td>
<td>1 200</td>
</tr>
</tbody>
</table>

2) The building referred to in Sentence (1) is permitted to be of combustible construction or noncombustible construction used singly or in combination, and
   a) floor assemblies shall be fire separations and, if of combustible construction, shall have a fire-resistance rating not less than 45 min,
   b) mezzanines shall have, if of combustible construction, a fire-resistance rating not less than 45 min,
   c) roof assemblies shall have, if of combustible construction, a fire-resistance rating not less than 45 min, except that in a building not more than 1 storey in building height, the fire-resistance rating is permitted to be waived provided the roof assembly is constructed as a fire-retardant-treated wood roof system conforming to Article 3.1.14.1., and the building area is not more than
      i) 800 m² if facing one street,
      ii) 1 000 m² if facing 2 streets, or
      iii) 1 200 m² if facing 3 streets, and
   d) loadbearing walls, columns and arches supporting an assembly required to have a fire-resistance rating shall
      i) have a fire-resistance rating not less than 45 min, or
      ii) be of noncombustible construction.
Fundamentals - Compartmentation

Harmony PS Suite Separations Also Regulated By:

3.3 Safety Within Floor Areas
3.3.1.1. Separation of Suites (3/4/h)
3.3.1.3. Means of Egress
3.3.1.4. Public Corridor Separations (3/4 h)
3.3.1.5. Egress Doorways (max 15 m distance to egress)
3.3.1.6. Travel Distance
3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

(1) Except as permitted by Sentence (2) and Articles 3.1.7.2. and 3.6.3.5., the rating of a material, assembly of materials or a structural member that is required to have a fire-resistance rating, shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials”.

Sept. 21, 2016
STANDARD METHODS OF FIRE ENDURANCE TESTS OF BUILDING CONSTRUCTION AND MATERIALS
FIGURES

FIGURE 1
STANDARD TIME-TEMPERATURE CURVE
(Reference: Clauses 5.1.1, 5.2.5)
**Fundamentals - Compartmentation**

**Code References**

**CAN/ULC-S101 – Rating Criteria**

- Sustain the applied load (loadbearing assemblies)
- No passage of flame or gases hot enough to ignite cotton pads
- Limiting unexposed surface temperature-rise (140 C average / 180 C at any point)
- No passage of hose stream (wall & partitions)
- Limiting structural steel temperatures
3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

(2) A material, assembly of materials or a structural member is permitted to be assigned a fire-resistance rating on the basis of Appendix D.
Fundamentals - Compartmentation

Code References

NBCC Appendix D, Fire-Performance Ratings

- Generic materials i.e. concrete assemblies, Type X gypsum wallboard membranes, etc.
- i.e. gypsum board partition
  15.9 mm Type X gypsum on the fire side = 40 minutes
  + steel studs @ 400 mm OC = 10 minutes
  Rating = 50 minutes
- No proprietary materials like firestopping or SFRM
3.1.7. Fire-Resistance Ratings

3.1.7.3. Exposure Conditions for Rating

(1) Floor, roof and ceiling assemblies shall be rated for exposure to fire on the underside.

(2) Firewalls and interior vertical fire separations shall be rated for exposure to fire on each side.

(3) Exterior walls shall be rated for exposure to fire from inside the building.
3.1.8. Fire Separations and Closures

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 a continuous element, and

(b) as required in this Part, have a fire-resistance rating as specified

(2) Openings in a fire separation shall be protected with closures, shafts or other means in conformance with Articles 3.1.8.4. to 3.1.8.19. and Subsections 3.1.9. and 3.2.8.
Fundamentals - Compartmentation

Definitions (2015 NBCC)

- **Closure** means a device or *assembly for closing an opening through a fire separation or an exterior wall*, such as a door, a shutter, a damper, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.
3.1.8.3. Continuity of Fire Separations

(4) The continuity of a fire separation shall be maintained where it abuts another fire separation, a floor, a ceiling, a roof, or an exterior wall assembly. (See Note A-3.1.8.3.(4).)

Explained as …

A-3.1.8.3.(4) Fire Separation Continuity. The continuity of a fire separation where it abuts against another fire separation, a floor, a ceiling or an exterior wall assembly is maintained by filling all openings at the juncture of the assemblies with a material that will ensure the integrity of the fire separation at that location.
“11.1
While the NBCC does not make specific mention of fire stops for construction joints, their need is clearly implied through the requirements for continuity of fire separations...”
Fire Stops in Canadian Codes

**CAN/ULC-S115 IN A NUTSHELL**

- Same fire exposure conditions (Time-temperature curve) as CAN/ULC-S101
- Covers tests of:
  - through-penetration fire stops
  - outlet boxes in wall assemblies
  - joint firestop systems
Fire Stops in Canadian Codes

CAN/ULC-S115 IN A NUTSHELL

- **F**: remains in opening with no passage of flame or occurrence of flaming on the unexposed side
- **FT**: F + no unexposed surface temperature rise more than 181°C above initial temperature
- **FH**: F + no openings that permit projection of water from hose stream beyond unexposed side
- **FTH**: F + H + T
- **L**: leakage rate from air leakage tests
# Fire Stops in Canadian Codes

## Joint Fire Stops

### UL/ cUL Numbering System - Joint Fire Stops

<table>
<thead>
<tr>
<th>Alpha Characters</th>
<th>Description of Joint System</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
<td>Floor-to-floor</td>
</tr>
<tr>
<td>WW</td>
<td>Wall-to-wall</td>
</tr>
<tr>
<td>FW</td>
<td>Floor-to-wall</td>
</tr>
<tr>
<td>HW</td>
<td>Head-of-wall</td>
</tr>
<tr>
<td>BW</td>
<td>Bottom-of-wall</td>
</tr>
<tr>
<td>CG</td>
<td>Wall-to-wall joints intended for use as corner guards</td>
</tr>
</tbody>
</table>

Sept. 21, 2016
## Fire Stops in Canadian Codes

### Joint Fire Stops

**System No. HW-D-0252**

April 08, 2015

<table>
<thead>
<tr>
<th>ANSI/UL2079</th>
<th>CAN/ULC S115</th>
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</thead>
<tbody>
<tr>
<td>Assembly Ratings — 1 and 2 Hr (See Item 1)</td>
<td>F Ratings — 1 and 2 Hr (See Item 1)</td>
</tr>
<tr>
<td>Nominal Joint Width - 3/4 or 1-1/2 in. (See Item 3).</td>
<td>FT Ratings — 1 and 2 Hr (See Item 1)</td>
</tr>
<tr>
<td>Class II Movement Capabilities — 50% or 100% Compression or Extension (See Item 3)</td>
<td>FH Ratings— 1 and 2 Hr (See Item 1)</td>
</tr>
<tr>
<td>L Rating At Ambient — Less Than 1 CFM/sq ft</td>
<td>FTH Ratings — 1 and 2 Hr (See Item 1)</td>
</tr>
<tr>
<td>L Rating At 400 F — Less Than 1 CFM/sq ft</td>
<td>Nominal Joint Width - 3/4 or 1-1/2 in. (See Item 3)</td>
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<td></td>
<td>Class II Movement Capabilities — 50% or 100% Compression or Extension (See Item 3)</td>
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<td>L Rating At Ambient — Less Than 1 CFM/sq ft</td>
</tr>
<tr>
<td></td>
<td>L Rating At 400 F — Less Than 1 CFM/sq ft</td>
</tr>
</tbody>
</table>
1. Floor Assembly — The fire-rated fluted steel deck/concrete floor assembly shall be constructed of the materials and in the manner described in the individual D700, D800, or D900 Series Floor-Celling Design in
D. Spray-Applied Fire Resistive Material* — After installation of the steel attachment clips (Item 2B), steel floor units and structural steel support to be sprayed with the min thickness of material specified in the individual D700, D800, or D900 Series Design. The flutes of the steel floor units are to be filled with material across the entire top flange of the steel beam. Additional material shall be applied to the web of the steel beam on each side of the wall. For a 1 hr Assembly Rating, the thickness of material applied to each side of the steel beam web shall be 13/16 in. (21 mm). For a 2 hr Assembly Rating, the thickness of material applied to each side of the steel beam web shall be 1-3/8 in. (35 mm).

SOUTHWEST FIREPROOFING PRODUCTS CO — Type 5, Type 5GP

W R GRACE & CO - CONN — Type MK-6/HY
3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

3.1.9.1. Fire Stops

(1) Except as required by Sentences (2) to (5) and Article 3.1.9.4., penetrations of a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating shall be

(a) sealed by a fire stop that, when subjected to the fire test method in CAN/ULC-S115, “Fire Tests of Firestop Systems”, has an F rating not less than the fire-protection rating required for closures in the fire separation in conformance with Table 3.1.8.4., or...
**Fire Stops in Canadian Codes**

**NBCC ‘15 - PENETRATION FIRE STOPS**

**Table 3.1.8.4.**

**Fire-Protection rating of Closure**

Forming Part of Sentence 3.1.8.4.(2) and Clause 3.1.9.1.(1)(a)

<table>
<thead>
<tr>
<th>Fire-Resistance rating of Fire Separation</th>
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<td>4 h</td>
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</table>
Fire Stops in Canadian Codes

3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

3.1.9.1. Fire Stops

or (b) Cast in place (see Note A-3.14.9.1.(1)(b)).

Explained as …

A-3.1.9.1.(1)(b) Penetration. The intention behind the use of the term “cast in place” is to reinforce that there are to be no gaps between the building service or penetrating item and the membrane or assembly it penetrates. The term “cast in place” describes a typical means of fire stopping for a service penetration through a concrete slab or wall.
3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

3.1.9.1. Fire Stops

(2) Penetrations of a firewall or a 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 fire stop that, when subjected to the fire test method in CAN/ULC-S115, “Fire Tests of Firestop Systems”, has an FT rating not less than the fire-resistance rating required for the fire separation.
Penetrations of a fire separation in conformance with Sentence 3.6.4.2.(2) shall be sealed by a fire stop that, when subjected to the fire test method in CAN/ULC-S115, “Fire Tests of Firestop Systems”, has an FT rating not less than the fire-resistance rating for the fire separation of the assembly.

[3.6.4.2.(2) pertains to a horizontal service space above a vertical fire separation]
3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

3.1.9.1. Fire Stops

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 fire stop requirements of Sentence (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”.
3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

3.1.9.1. Fire Stops

(5) Unless specifically designed with a fire stop, 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 fire stop requirements of Sentences (1) to (3), provided the fire damper is installed in conformance with NFPA 80, “Fire Doors and Other Opening Protectives.”
3.1.9.2. Combustibility of Service Penetrations

(1) Except as permitted by Articles 3.1.9.3. and 3.1.9.5., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a fire-resistance rating shall be noncombustible unless the assembly has been tested incorporating that service equipment.

3.1.9.3.(1) through (5) – exceptions for wires, cables, raceways, metal sheathed cables and outlet boxes of limited dimensions and spacing
3.1.9.4. Penetration by Outlet Boxes

(1) Except as provided in Sentence (2), 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 fire stop 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, “Fire tests of Firestop Systems.”
3.1.9.4. Penetration by Outlet Boxes

2) Except as provided in Sentence 3.1.9.1.(2) and (3), noncombustible outlet boxes that penetrate a vertical fire separation or a membrane forming part of an assembly required to have a fire-resistance rating are permitted to be waived, provided:

a) they do not exceed
   i) 0.016 m² in area, and
   ii) an aggregate area of 0.065 m² in any 9.3 m² of surface area,

and
3.1.9.4. Penetration by Outlet Boxes

and

b) the annular space between the membrane and the noncombustible electrical outlet boxes does not exceed 3 mm.

3) In addition to the requirements of Sentence (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, or

b) a fire block conforming to Article 3.1.11.7.
3.1.9.5. Combustible Piping Penetrations

1. **Combustible sprinkler piping** is permitted to penetrate a fire separation provided the fire compartment on each side of the fire separation are sprinklered.

2. **Combustible water distribution** piping is permitted to penetrate a fire separation that is required to have a fire-resistance rating without having been incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the piping is protected at the penetration with a fire stop in conformance with Sentence (4).
3.1.9.5. Combustible Piping Penetrations (3) Except as permitted by Sentences (4) to (5), combustible piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates:

a) a fire separation required to have a fire resistance rating, or

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

a) the piping is sealed at the penetration by a fire stop 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”, with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

b) the piping is not located in a vertical service space.
3.1.9.5. Combustible Piping Penetrations

6) **Combustible** piping for central vacuum systems is permitted to penetrate a *fire separation* provided the installation conforms to the requirements that apply to *combustible* drain, waste and vent piping specified in Sentence (4).
## Fire Stops in Canadian Codes

### NBCC ‘15 - FIRE STOPS

#### SUMMARY - Penetration Fire Stops

<table>
<thead>
<tr>
<th>Penetration Type</th>
<th>NBCC ‘15 Clause</th>
<th>Construction Condition</th>
<th>Fire Stop Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncombustible</td>
<td>3.1.9.1.(1)(a)</td>
<td>-</td>
<td>F = Closure Rating</td>
</tr>
<tr>
<td></td>
<td>3.1.9.1.(2)</td>
<td>Firewall or 3.2.1.2 type Floor</td>
<td>FT = Firewall Rating</td>
</tr>
<tr>
<td></td>
<td>3.1.9.1.(3)</td>
<td>Horizontal Service Space</td>
<td>FT = Fire Separation</td>
</tr>
<tr>
<td>Combustible Pipe</td>
<td>3.1.9.4.(2)&amp;(4)</td>
<td>-</td>
<td>F = FRR + 50 Pa</td>
</tr>
<tr>
<td>Combustible central vac pipe</td>
<td>3.1.9.5.(6)</td>
<td>-</td>
<td>F = FRR + 50 Pa</td>
</tr>
</tbody>
</table>

Note: Significant differences between 2015 NBCC and 2012 OBC - OBC relaxes 50 Pa test pressure differential for sprinklered buildings.

Sept. 21, 2016
Fire Stops in Canadian Codes

The Perimeter Joint Conundrum

- Most roofs and exterior walls are not fire-resistance rated, but 3.1.8.1.(1)(a) and 3.1.8.3.(4) require continuity of fire separations at roofs and exterior walls = joint fire stop system

- **CAN/ULC-S115** scope is limited to:
  - 1.7.D Materials and construction intended for use in linear openings between adjacent fire resistive structures.
  - 1.8 This test method is not applicable to a joint firestop system placed into a perimeter joint located between a fire resistance rated floor and a non fire resistance rated exterior wall.
Fire Stops in Canadian Codes

The Perimeter Joints Conundrum

• Solutions?
  ➢ Alternative Solutions (EJs) based upon:
    • cUL CW Systems (ASTM E 2307)
    • ITS PHV designs (formerly OPL CEJ designs)
    • cUL FW, HW or WW Systems for similar construction
    • ULC JF or PJ Systems for similar constructions

Note: There are no systems tested in accordance with CAN/ULC-S115 for edge-of-slabs or walls to non-rated curtain walls or roofs.
1.2.1.1. Compliance with this Code

(1) Compliance with this Code shall be achieved by,
   (a) complying with the applicable acceptable solutions in Division B, or
   (b) using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions.

[alternative solution = formal sealed engineering judgment]
Fire Stops in Canadian Codes

Common Deficiencies

• Joint design movements not clearly specified
• Joint movement ignored in system selection and installation
• Mineral Wool -
  ➢ Inadequate compression
  ➢ Wrong orientation
  ➢ Incorrect density
Fire Stops in Canadian Codes

Common Deficiencies

- Inadequate compression of mineral wool

To calculate minimum thickness needed:

\[ T_{\text{uncomp}} = \frac{(W_{\text{nom}} \times 100)}{(100 - I_{\text{comp}})} \]

Where:

\( T_{\text{uncomp}} \) = Uncompressed Thickness Necessary, in.
\( I_{\text{comp}} \) = Insulation Compression Percentage Specified in System, percent
\( W_{\text{nom}} \) = Nominal (Installed) Joint Width, in.
Calculating thickness of mineral wool

Example:

4” HW joint, HW-D-1059, Item 3a specifies min. 37% compression of 8 pcf mineral wool

\[ T_{\text{uncomp}} = \frac{W_{\text{nom}} \times 100}{100 - I_{\text{comp}}} \]

\[ T_{\text{uncomp}} = \frac{4 \times 100}{100 - 37} \]

\[ = \frac{400}{63} = 6.4” \]

Need to compress minimum 6-1/2” of the 8 pcf MW into the nominal 4” joint to comply with HW-D-1059.
Fire Stops in Canadian Codes

Common Deficiencies

- Proper orientation of mineral wool

Always Compress Against Grain
Fire Stops in Canadian Codes

Common Deficiencies

• **Proper Density of mineral wool**
  - cUL/ULC systems usually specify min. 4 pcf
  - If proprietary, **must** use the listed material
  - Using a higher density material may make it difficult to achieve the specified compression
  - Caution with industrial insulations
    - i.e. ProRox SL 930 Nom. 4 pcf: **Actual 3.5 pcf** does not satisfy cUL 4 pcf minimum
**Fire Stops in Canadian Codes**

**Joint Movement Capability**

- Floor deflections, thermal, wind, seismic

<table>
<thead>
<tr>
<th>Movement Class</th>
<th>Min Number of Cycles</th>
<th>Min Cycling Rate (cycles per minute)</th>
<th>CAN/ ULC-S115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>Class I</td>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>Wind</td>
<td>Class II</td>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>Seismic</td>
<td>Class III</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

- Wind Class II minimum cycling rate is specified as a range, with a minimum value of 10 cycles per minute.
Fire Stops in Canadian Codes

Joint Movement Capability

• Most joints are subject to some movement – must be designed and built accordingly
• If not specified, ask before you select system & install
• Harmony PS Example:
  ➢ 38 mm (1-1/2”) max snow deflection for roof
    a) +/- 50 % system requires a $1\frac{1}{2} / 0.5 = 3$” joint
    b) +/- 25 % system requires a $1\frac{1}{2} / 0.25 = 6$” joint

Problem: limited number of systems for these combinations
PROJ ECT STUDY:
Harmony Public School, Corbyville, ON

Factors:

- Large unsprinklered building
- Suite and corridor separation requirements and egress distances required the architect to treat the classrooms as suites with $\frac{3}{4}$ h fire separations
- Suite fire separation walls aligned with roof trusses!

Sept. 21, 2016
PROJECT STUDY:
Harmony Public School, Corbyville, ON
• 5,100 sq m (55,000 sq ft)
• Rural
• Unsprinklered
PROJECT STUDY:
Harmony Public School, Corbyville, ON

Factors:
- 1-1/2” max roof deflection for snow load
- Services hung from roof above classroom ceilings run length of building penetrating the fire separations
- Installation began with materials and systems that did not accommodate 1-1/2” roof deflection
1-1/2” Max Snow Load Roof Deflection
Professional Engineering Judgments and Verification were requested by the Architect (and AHJ).
3/4 HR. RATED CLOSURE @ OWSJ

TD3  A101
N.T.S.
FIRE STOPPING BASED ON cUL SYSTEM #HW-D-1066 AND FALCONER EJ#062414-1

102 CONTINUOUS CEILING RUNNER WITH MINIMUM 89mm LONG VERTICAL LEGS FASTENED TO UNDERSIDE OF ROOF DECK AT MAX. 610mm C/C

25 GYPSUM SHAFTLINER BOARD IN 102 C-1 SHAFTWALL STUDS @ 610 O.C.
16 GYPSUM FIRECODE C BOARD
ULC DESIGN # W452 SYSTEM A
NOTE: STUDS TO BE CUT MIN. 35MM SHORTER THAN ASSEMBLY TO PERMIT MOVEMENT.

LATERAL SUPPORT ANGLES (BOTH SIDES)

190 STANDARD CONCRETE BLOCK WITH EQUIVALENT THICKNESS OF 108mm.
(EQUIVALENT FIRE RESISTANCE RATING OF 1.5 HOURS BASED ON 80C, S3-2, 2.1)

3/4 HR. RATED CLOSURE @ OWSJ OFFSET FROM WALL
ELEVATION OF PIPE/ CONDUIT PENETRATIONS
N.T.S.

NOTES:

1. CFS-SP WB FIRESTOP JOINT SPRAY SEALANT SHALL BE APPLIED IN ACCORDANCE WITH HILTI'S WRITTEN INSTALLATION INSTRUCTIONS.
2. ALL MINERAL WOOL SHALL BE MINIMUM 64 kg/cu.m (4 pcf), AND SHALL BE COMPRESSED NOT LESS THAN 50 PERCENT AGAINST THE GRAIN OF THE WOOL.
3. PENETRATING ITEMS SHALL NOT BE SLEEVED. EXISTING SLEEVE SHALL BE REMOVED FROM THE WALL.
Fire Stops in Canadian Codes

Opportunities

• Many design deficiencies and variations from tested systems are discovered during the construction process. i.e. walls aligned with joists
• The FCIA contractor is viewed as the firestopping expert on the job, and is looked to for solutions
• The FCIA contractor may be in position to recommend a Fire Protection Engineer and Engineering Judgment(s)
• The Engineered solutions (EJs) will likely add $value to the FCIA contractor's scope of the work
Questions?

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THE END