

# Fire Stopping and Closures

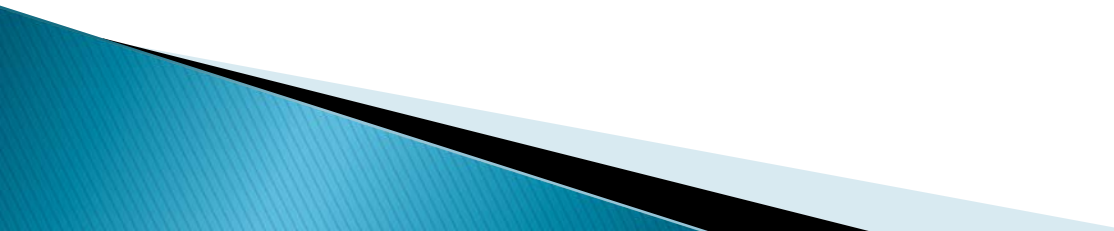
Building :: Municipal Infrastructure :: Transportation :: Industrial :: Power :: Environment



University of Ottawa

 **GENIVAR**  
*constructive people*

# Agenda

- ▶ Building and Fire Codes
  - ▶ Material Testing Standards
  - ▶ Selecting a Fire Stop System
  - ▶ Field Testing Standards
  - ▶ Closures
  - ▶ General discussion and questions
- 

# Building and Fire Codes

- ▶ Ontario Building Code (new construction)
  - Requirements for non-combustible construction [Subsection 3.1.5]
    - Protection of combustible insulation
    - Combustible ducts, piping, plumbing fixtures, wire and cable
    - Decorative wood cladding and millwork

# Ontario Building Code

## ▶ Fire Separations [Subsection 3.1.8.]

- *Fire separation* means a construction assembly that acts as a barrier against the spread of fire.
  - Sometimes required to have a fire-resistance rating.
  - A fire separation without a rating only needs to stop the passage of smoke.
  - A fire separation with a fire-resistance rating is a tested material or assembly.
    - ULC S101 – “Standard Methods of Fire Endurance Tests of Building Construction and Materials”

# Ontario Building Code

- ▶ Closures in Fire Separations [Subsection 3.1.8]
  - *Closure* means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, wired glass and glass block, and includes all components such as hardware, closing devices, frames and anchors.
    - Sometimes required to have a fire-protection rating.
    - A closure in a non-rated separation only needs to stop the passage of smoke.
    - A closure with a fire-protection rating is a tested assembly.
      - CAN4-S104-M, “Fire Tests of Door Assemblies”,
      - CAN4-S106-M, “ Fire Tests of Window and Glass Block Assemblies”, or
      - CAN/ULC-S112-M, “Fire Test of Fire-Damper Assemblies”.

# Ontario Building Code

- Closure ratings [Article 3.1.8.4]
  - Doors, glass block, windows and fire dampers

Fire Separation FRR	Closure FPR
3 hr	2 hr
2 hr	1.5 hr
1.5 hr	1 hr
1 hr	$\frac{3}{4}$ hr
45 min	45 min
30 min	20 min
0 hr (non rated fire separation)	n/a

# Ontario Building Code

- ▶ Fire stopping of service penetrations [Subsection 3.1.9]
  - Services include piping, tubing, ducts, chimneys, cables, totally enclosed non-combustible raceway, outlet boxes and similar equipment
  - Penetration includes that through a fire separation or through a membrane that is part of an assembly required to have a fire resistance rating

# Ontario Building Code

- ▶ Fire stopping of service penetrations  
[Subsection 3.1.9]
  - Required to be fire stopped or be tightly fitting.
    - If fire stopped,
      - System required to have an F rating equivalent to the fire protection rating of closures for that fire separation.
      - System required to have a FT rating where fire separation is a fire wall or horizontal fire separation of a parking garage considered a separate building
      - Rating determined by testing according to ULC S115

# Ontario Building Code (new construction)

## (Requirements for non-combustible construction)

- ▶ Limits on combustibility of equipment that can penetrate a fire separation
  - ▶ Non - combustible

OR

- ▶ Certain wires, cables and outlet boxes [3.1.9.3]
- ▶ Combustible piping [3.1.9.4]
- ▶ Membrane ceiling [3.1.9.5]

## ▶ Ontario Building Code (new construction)

(Requirements for non-combustible construction)

### ▶ Limits on combustibility of equipment that can penetrate a fire separation

#### Combustible jackets around cables permitted where

- ▶ Cables installed in totally enclosed non combustible raceway
- ▶ Wires and cables installed in without a raceway bundled in groups must be smaller than 25 mm in diameter
- ▶ Where individual cable is metal sheathed and larger than 25 mm in diameter it is permitted to be installed without being in a bundle.
- ▶ Cables installed in totally enclosed combustible raceway underground with concrete cover at bottom of slab at least 50 mm
- ▶ Combustible outlet boxes with an area of not more than 0.016 m<sup>2</sup>
- ▶ Outlet boxes to be installed offset on opposite sides of an assembly

## ▶ Ontario Building Code (new construction)

(Requirements for non-combustible construction)

### ▶ Limits on combustibility of equipment that can penetrate a fire separation

#### Combustible piping penetrations

- ▶ Piping so long as both compartments are sprinklered
- ▶ Piping that is not in a vertical shaft and is sealed by a fire stop system with
  - ▶ an F rating at least as much as the fire separation rating, and
  - ▶ a pressure differential of at least 50 Pa with the high pressure on the exposed side.
- ▶ Piping not in a vertical shaft on one side of a vertical fire separation.
- ▶ Drain pipe penetrating a horizontal fire separation provided it leads directly from a non-combustible water closet through a concrete floor.
- ▶ Chlorine gas piping not more than 25 mm in diameter penetrating the fire separation between a chlorine gas service room and the remainder of the building.

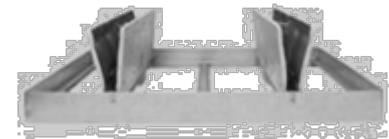
- ▶ Ontario Building Code (new construction)

(Requirements for non-combustible construction)

- ▶ Limits on combustibility of equipment that can penetrate a fire separation

Openings through a membrane ceiling

- ▶ Ceilings forming part of a fire separation with a rating is permitted to be penetrated by openings leading to ducts where they are steel and within the allowable limits for the rating assigned.
- ▶ Fire stop flaps that conform to CAN4-S112.2-M, “Fire Test of Ceiling Firestop Flap Assemblies”



## ▶ Ontario Building Code (new construction)

(Requirements for non-combustible construction)

### ▶ Fire Stops in Concealed Spaces [3.1.11]

- By their nature, they should not be encountered by maintenance staff
- Essentially requires blocking to ensure no spread of fire between compartments through concealed spaces.

# Building and Fire Codes

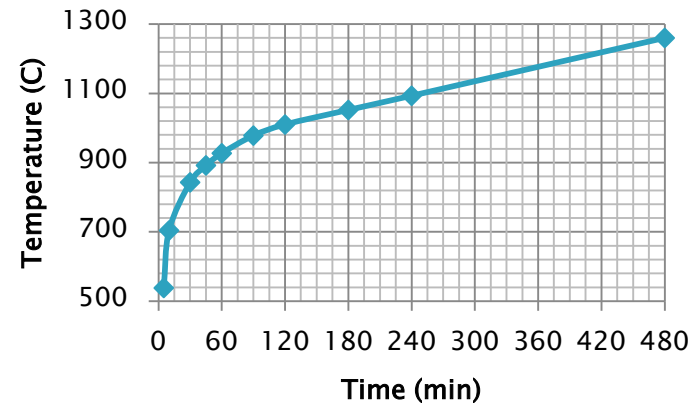
- ▶ Ontario Fire Code (existing buildings)
  - Fire separations between rooms, spaces and major occupancies need to be maintained
    - No advice given as to how
    - Intent is to maintain the integrity of the originally provided separation
    - Provide a new system with the same or higher rating, or
    - Restore the original system using similar materials and methods.

# Material Testing Standard

## ▶ ULC S115

### ◦ Standard Method of Fire Tests of Firestop Systems

- Fire exposure
- Hose test
- Differential Pressure
- Air leakage test

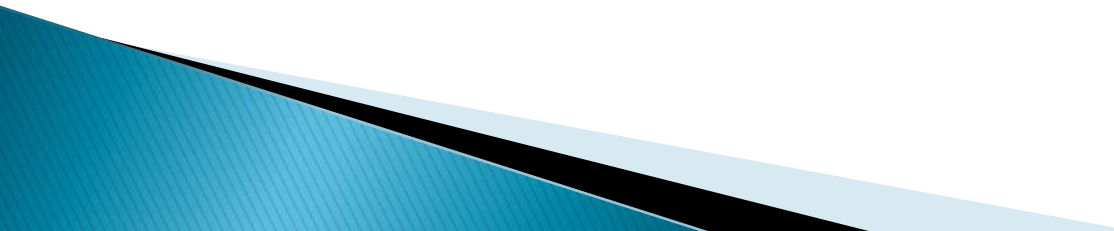


Fire Stop Rating	ULC-S115 Acceptance Criteria
F	System remains in the opening during the fire test without permitting the passage of flame through the opening or the occurrence of flaming on any element on the unexposed side of the system.
FT	Passes F rating criteria <u>and</u> does not permit the unexposed side temperature to rise in excess of 181 °C.
FH	Passes F rating criteria <u>and</u> does not permit develop an opening that would permit a projection of water from the hose stream test beyond the unexposed side.
FTH	Passes <u>both</u> FT and FH rating criteria.

# Selecting a System

- ▶ Contractors
  - If you have an established relationship with a contractor, contact them (A/T, Donalco, Interprovincial, Furoy, Queensway Caulking, Spirito)
- ▶ Manufacturer's database
  - Don't have an established relationship with a contractor ? [3M](#), [Hilti](#), [AD Fire](#)
- ▶ Testing lab database
  - To search listing for systems [UL](#), [ULC](#), [Intertek](#)
- ▶ Custom applications
  - Engineering Opinion

# Selecting a System

- ▶ The four questions to answer
    1. What is penetrating the fire separation?
      - Pipe, cable etc. Sizes and arrangement required.
    2. What is the fire resistance rating of the fire separation?
    3. How much open space is in the opening?
    4. What is composition of the fire separation?
      - Concrete, gypsum etc.
- 

# Products

- Pillows
- Mineral Wool
- Collars
- Wrap Strip
- Collar Strip
- Putty
- Putty Pads
- Electrical Box Inserts
- Intumescent Sealant
- Acrylic Sealant
- Silicone
- Silicone SL
- SprayAcrylic
- Fire Stop Mortar
- Some manufacturers offer other varied specialty fire stop products; such as, cast in place, cable box, bricks etc...

## ASTM E2393 – Inspection of Joints and Perimeter Fire Barriers

### ▶ Title

- ASTM E2393–09 Standard Practice for On–Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

### ▶ Scope

- Procedures for qualified inspector to verify all types of fire stops installed through or into fire resistive assemblies.

### ▶ Contents

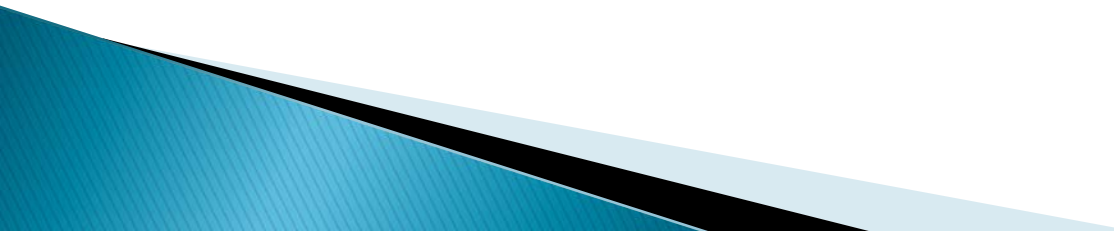
- Very procedural in nature. Clearly outlines roles and responsibilities.

## ASTM E2393 – Inspection of Joints and Perimeter Fire Barriers

### ▶ Inspection Procedures

- Recommends inspector be on site to witness the installation of at least 5% of the total lineal length of each type of joint, or
- Recommends minimum one of the following per 500 lineal feet of joint (except mechanical system).
  - destructive testing
  - disassemble and reassemble system
  - visual inspection, where this can confirm performance
  - other appropriate method

# Engineering Judgements

- ▶ Manufacturer has a product or system they feel will provide the necessary protection but don't have a listing for it.
  - ▶ Engineering opinion required to provide equivalency based on application of fire resistance and heat transfer principles.
- 

Building :: Municipal Infrastructure :: Transportation :: Industrial :: Power :: Environment



Pause

# Ontario Building Code

- ▶ Closures in Fire Separations [Subsection 3.1.8]
  - *Closure* means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, wired glass and glass block, and includes all components such as hardware, closing devices, frames and anchors.
    - Sometimes required to have a fire-protection rating.
    - A closure in a non-rated separation only needs to stop the passage of smoke.
    - A closure with a fire-protection rating is a tested assembly.
      - CAN4-S104-M, “Fire Tests of Door Assemblies”,
      - CAN4-S106-M, “ Fire Tests of Window and Glass Block Assemblies”, or
      - CAN/ULC-S112-M, “Fire Test of Fire-Damper Assemblies”.

# Ontario Building Code

- Closure ratings [Article 3.1.8.4]
  - Doors, glass block, windows and fire dampers

Fire Separation FRR	Closure FPR
3 hr	2 hr
2 hr	1.5 hr
1.5 hr	1 hr
1 hr	$\frac{3}{4}$ hr
45 min	45 min
30 min	20 min
0 hr (non rated fire separation)	n/a

# Ontario Building Code

- ▶ Closures in fire separations
  - Installed in accordance with NFPA 80, “Fire Doors and Other Opening Protectives”
  - labels or classification marks to identify the testing laboratory where required to have a *fire-protection rating*.
  - Limited in area and have maximum dimension limit depending on whether building is sprinklered.
    - Unsprinklered 11 m<sup>2</sup> and 3.7 m max dimension
    - Sprinklered 22 m<sup>2</sup> and 6 m max dimension

# Ontario Building Code

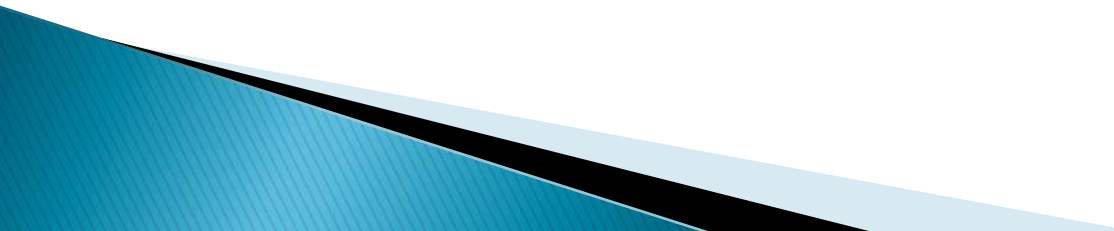
- ▶ Closures in fire separations
  - Closers required
  - Hold open devices permitted
  - Door latches required
  - Temperature rise limits required on some doors

# Ontario Fire Code

## ▶ Closures

- Where closures are damaged so as to affect the integrity of their fire-protection rating, the damaged closures shall be repaired so that the integrity of the closures is maintained. [Article 2.2.3.1]
- No further guidance provided for repairing closures.
- Closures required to be maintained by
  - keeping links or actuation devices free of damage, dirt or paint
  - Keeping guides, rollers and bearings clean and lubricated,
  - Adjusting and repairing hardware,
  - Replacing inoperative parts of hold-open and releasing devices, and
  - Prevent obstructions, remove blocks or wedges that would prevent the intended operation of the closure
- Doors required to be inspected monthly

# Closures in Fire Separations

- ▶ Installation in accordance with NFPA 80
  - ▶ Listed and labelled in accordance with ULC
    - S104, “Fire Tests of Door Assemblies”,
    - S106, “ Fire Tests of Window and Glass Block Assemblies”,  
or
    - S112, “Fire Test of Fire–Damper Assemblies”.
- 

# Fire Door Test Standard

## ▶ ULC S104

- Standard Method of Fire Tests of Door Assemblies
  - Fire exposure same as fire stop systems
  - Hose test conducted after fire test
  - Unexposed side temperature rise recorded

Fire Protection Test Condition	ULC-S104 Acceptance Criteria
Main Test	Assembly remains in the opening during the fire endurance test and the hose stream test.
Flaming on unexposed side	No flaming occurs on the unexposed surface of a door assembly during the first 30 min of the test. Intermittent (less than 5 min) light flames (not more than 150 mm long) permitted after 30 min along door edges.
End of test flaming	Light flaming permitted during the last 15 min of test on unexposed surface of door within 40 mm of vertical door edge and within 75 mm of top door edge or top edge of frame of a vision panel.
Hardware	Hardware evaluated with door to hold the door closed during the entire test. Latch bolt to remain engaged in its intended strike and be in tact after test but need not be operable after test.

# Fire Door Installation Standard

## ▶ NFPA 80

- Field modifications covered under Chapter 5
  - Where a door assembly is listed, modification of the assembly voids the listing unless the listing agency approves the modification.
  - Where a door assembly is damaged, replace parts with listed hardware or hardware from the original manufacturer or replace the assembly.
  - Where hardware is removed due to changes in use of the door install steel fasteners that completely cover the hole or fill the screw or bolt hole with material that matches the door or frame material.

# NFPA 80

- ▶ Builders hardware installation covered under Chapter 6
  - Builders hardware is of the recessed type, consisting of hinges and latches
  - Components. A fire door assembly shall consist of components that are separate products incorporated into the assembly and allowed to have their own subcomponents.
  - All Components must be labelled to be used on a fire door.
  - Appendix note on components
    - The normal components of a fire door assembly include a door, a door frame, hinges, a lock or latch, and a closing device. They also include, but are not limited to, an astragal, a split astragal, an automatic louver, a coordinator, flush or surface bolts, gasketing, a holder/release device, protection plates, and glazing materials.
  - Power-operated fire doors shall be equipped with a releasing device that shall automatically disconnect the power operator at the time of fire, allowing a self-closing or automatic device to close and latch the door regardless of power failure or manual operation.

# NFPA 80

- ▶ Fire door hardware installation covered under Chapter 7
  - Fire hardware is of the surface mount type.
  - Components. A fire door assembly shall consist of components that are separate products incorporated into the assembly.
  - All Components must be labelled to be used on a fire door.

# NFPA 80 vs ULC S104

## NFPA 80 – Appendix K

Except where restricted by individual published listings, a fire door assembly is permitted to consist of the labelled, listed, or classified components of different organizations that are acceptable to the AHJ.

## ULC S104

The construction and size of the test door assembly, consisting of single doors, doors in pairs, special-purpose doors, or multi-sectional doors, shall be representative as to materials, dimensions and finish of both the door and frame and all of their components and parts including hardware and trim, of that for which rating is desired.

However...

## ULC listing documents

- ▶ ULC listing documents have separate categories for
  - Fire doors
  - Fire door hardware
  - Fire exit hardware
  - Builders hardware etc.
- ▶ Listing documents do not specifically list specific hardware on door listings, only that the hardware is to be listed. [example](#)

# Resources

- ▶ Association of the Wall and Ceiling Industries
  - <http://www.awci.org/>
- ▶ International Firestop Council
  - <http://www.firestop.org/default.aspx>
- ▶ Door and Hardware Institute
  - <http://www.dhicanada.ca>

Building :: Municipal Infrastructure :: Transportation :: Industrial :: Power :: Environment



Questions?