Design & Testing of Fire Resistance and Smoke Resistant Barriers

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Fire-Resistance-Rated Construction
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Code Requirements for Fire-Resistance-Rated Construction
Code Requirements

- NBC 3.1.7.1 – Fire-resistance ratings shall be determined on the basis of tests conducted in conformance with CAN/ULC – S101
Code Requirements Cont.

• Types of Assemblies:
  • Fire Wall – Type of fire separation that subdivides a building or separates adjoining buildings to resist the spread of fire and has structural stability to remain intact under fire conditions
    • Noncombustible
  • Creates two separate buildings
Code Requirements Cont.

• Must allow collapse of building on either side without affecting structural integrity of fire wall
• Continuous from ground through roof or to underside of reinforced concrete roof
• Openings shall not exceed 25% of entire length of wall
• Fire Separation – An assembly that acts as a barrier against the spread of fire
  • May be vertical or horizontal
  • Used to separate occupancies, create means of egress, separate suites, etc.
  • Vertical fire separations continuous from floor to roof above
Fire Resistance

• Expressed as an Hourly Time Period
• Ratings range from 1 hour to 4 hours
• Containment of Fire to Room or Floor of Origin
Fire-Resistance-Rated Construction

Establishing Fire-Resistance Ratings
Standards

• CAN/ULC – S101
Building Components

- Columns
- Beams
- Floor/Ceilings or Roof/Ceilings
- Walls
Time - Temperature Curve

- 538°C after 5 Min
- 927°C after 1 Hr
- 1093°C after 4 Hr

Temperature (°C) vs. Time (Hr)
Floor/Ceiling or Roof/Ceilings

• Sample size – 16.8 sq m / 3.66 m
• Load applied – Per design
Conditions of Acceptance
Floor/Ceilings or Roof/Ceilings

• Support load
• Flame passage
• 140ºC / 180ºC
• 593ºC / 704ºC on steel structural elements
Walls

- Sample size – 9.3 sq m / 2.75 m
- Load applied - Per design
Conditions of Acceptance – Walls

- Flame passage
- 140ºC / 180ºC
- Support load
- Hose stream
Where Are UL Listings Found?

**Hard Copy**

- **Fire Resistance Directory Volume 1 2012**
  - With Hourly Ratings for Beams, Floors, Roofs, Columns, Walls and Partitions
  - Certifications in effect as of January 3, 2012

**CD-ROM**

**Online**

- UL 2012 Directories
- Online Certifications Directory
- 2012 Fire Resistance Assemblies and Systems
Where Are ULC Listings Found?

Hard Copy

CD-ROM

Online
ULC and UL Designs

• Each design describes a specific construction and fire-resistance rating achieved if constructed in that manner
• Many designs contain various options and various ratings
• Must be followed exactly for rating to apply
Questions / Comments
Breaches in Fire-Resistance-Rated Construction

• Closure
  • Fire Doors
  • Fire Windows
  • Dampers
• Penetrations
  • Service Penetrations
  • Joint Firestops
Breaches in Fire-Resistance-Rated Construction Cont.

Do breaches really impact the performance of a fire-resistance-rated assembly?

Absolutely!!!
Breaches in Fire-Resistance-Rated Construction Cont.

- Unsealed or improperly sealed breaches cost lives and property!
  - MGM Grand, Las Vegas, NV – Fire confined to 1st floor. Eighty-four fatalities, most on upper floors.
  - Hilton Hotel, Las Vegas, NV – Fire spread from 8th to 23rd floor in 25 minutes at exterior of building. Eight fatalities.
  - First Interstate Bank, Los Angeles, CA – Fire spread from 12th to 16th floor through improperly protected penetrations and through unprotected perimeter joint. One fatality.
  - One Meridian Plaza, Philadelphia, PA – Fire spread from 22nd to 30th floor through improperly protected penetrations and through perimeter joint. Three fatalities.
Code Requirements

- NBC – Breaches shall be protected
  - 3.1.8 – Closures
  - 3.1.9 – Penetrations
- Each type of breach has a unique fire test standard associated with it which compliments CAN/ULC – S101
Through- and Membrane-Penetration Firestop Systems
Penetrations

Code Requirements for Penetrations
Code Requirements

• NBC 3.1.9 – Penetrations shall be protected by fire stop system tested in accordance with CAN/ULC – S115
  • Penetrations of fire separations shall have an F Rating not less than fire-protection rating required for closures in fire separation
  • Penetrations of firewalls and horizontal fire separations shall have an FT Rating not less than the fire-resistance rating for the fire separation
Code Requirements Cont.

• Combustible drain, waste or vent piping systems shall be tested at a differential pressure of 50 Pa to represent stack effect
Ratings

- F – Flame Occurrence
- FT – Flame Occurrence & Heat Transmission
- FH – Flame Occurrence & Hose Stream
- FTH – Flame Occurrence, Heat Transmission & Hose Stream
- L – Leakage (Optional)
Fire-Resistance-Rated Construction

Establishing F, FT, FH and FTH Ratings
Standards

• CAN/ULC – S115
Three Elements of a Firestop System

• Floor or Wall Assembly
• Penetrating Item
• Firestopping Products
Full-Scale Wall Assembly
Small-Scale Wood Floor Assembly
Conduit Through Wood Floor
Time - Temperature Curve

- 538°C 5 Min
- 927°C 1 Hr
- 1093°C 4 Hr
Hose Stream Test
Conditions of Acceptance
F Rating

• Passage of Flame
Conditions of Acceptance
FT Rating

• Passage of Flame
• 180°C Temperature Rise
Conditions of Acceptance
FH Rating

• Passage of Flame
• Hose Stream
Conditions of Acceptance
FTH Rating

- Passage of Flame
- 180°C Temperature Rise
- Hose Stream
L (Air Leakage) Ratings

• L Rating methodology added to ANSI/UL 1479 in 1993
• L Rating subsequently added to CAN/ULC – S115
• Leakage determined at 75 Pa
• Tested at Ambient and 204ºC
• Results published in either cubic liters per second or cubic liters per second per sq meter of opening
L (Air Leakage) Ratings
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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 204°C
• Incidental chamber leakage rechecked after cooling
Test Procedure Cont.

- Firestop system assigned L Rating at ambient and 204ºC, by subtracting incidental chamber leakage from test sample leakage.
- L Ratings of firestop systems published in product directories along with F, FT, FH and FTH Ratings.
Where Are ULC Listings Found?

Hard Copy

CD-ROM

Online
Where Are UL Listings Found?

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CD-ROM

Online
ULC and UL Systems

- Each system describes a specific construction and F, FT, FH, FTH and L Ratings achieved if constructed in that manner
- Many systems contain various options and various ratings
- Must be followed exactly for rating to apply
Questions / Comments
Fire Resistive Construction

ULC’s and UL’s Online Search Tools
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• Online Certifications Directory
Online Certifications Directory

- Helps you achieve code compliance
- Is continuously updated
- Needs no password
- Is free – no charge for use
- ULC’s directory is available at [www.ul.com/canada/eng/pages/](http://www.ul.com/canada/eng/pages/)
- UL’s directory is available at [www.ul.com/database](http://www.ul.com/database)
Questions / Comments
Thank You for Attending!!!

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