Testing of Fire Resistance and Smoke Resistant Assemblies

Jon Roberts
UL Codes and Advisory Services
Fire Containment

- Fire Resistance Rated Construction
- Breaches in Resistance Rated Construction
- Through and Membrane Penetration Fire Stop Systems
- Opening Protectives
- Where To Find Related Information
Fire-Resistance-Rated Construction
Fire-Resistance-Rated Construction

Code Requirements for Fire-Resistance-Rated Construction
Code Requirements

• IBC Section 703.2 – Fire-resistance ratings shall be determined in accordance with ANSI/UL 263 or ASTM E119

• LSC 8.2.3.1 – The fire resistance of structural elements and building assemblies shall be determined in accordance with test procedures set forth in NFPA 251 (i.e. ANSI/UL 263 or ASTM E119)
Fire Resistance

- Expressed as an Hourly Time Period
- Ratings range from 1/2 to 4 hours
- Containment of Fire to Room or Floor of Origin
Fire-Resistance-Rated Construction

Establishing Fire-Resistance Ratings
Test Standards

• ANSI/UL 263
• ASTM E119
• NFPA 251 (Withdrawn)
Building Components

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

- 2000°F (4 HR)
- 1700°F (1 HR)
- 1000°F (5 Min)

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

- Minimum Sample size – 180 sq ft / 12 ft
- Load applied – Per design
Conditions of Acceptance
Floor/Ceilings or Roof/Ceilings

• Support load
• Flame passage
• 250°F / 325°F
• Support structure temp - 1100/1300
Walls

- Minimum Sample size - 100 sq ft / 9 ft
- Load applied - Per design
Conditions of Acceptance – Walls

- Flame passage
- 250°F / 325°F
- Support load
- Hose stream
Where Are Listings Found?

Hard Copy

CD-ROM

Online
Questions / Comments
Breaches in Fire-Resistance-Rated Construction

• Penetrations
• Joint Systems
• Opening Protectives
• Ducts and Air Transfer Openings
Code Requirements

- IBC – Breaches shall be protected
  - Section 714 – Penetrations
  - Section 715 – Fire-Resistant Joint Systems
  - Section 716 – Opening Protectives
  - Section 717 – Ducts and Air Transfer Openings
- Each type of breach has a unique fire test standard associated with it which compliments ANSI/UL 263 and ASTM E119
Code Requirements

• LSC – Breaches shall be protected
  • Penetrations
  • Joint Systems
  • Opening Protectives
  • Ducts and Air Transfer Openings
• Each type of breach has a unique fire test standard associated with it which compliments NFPA 251
MGM Grand  
Las Vegas, NV – 1980

- Fire confined to 1st floor  
- 46 Stories  
- 679 injured, 85 fatalities.  
- Most on upper floors.
Hilton Hotel
Las Vegas, NV – 1981

• Fire spread from 8th to 23rd floor in 25 minutes at exterior of building.
• 8 fatalities.
First Interstate Bank
Los Angeles, CA -1988

- Fire spread from 12th to 16th floor through improperly protected penetrations and through unprotected perimeter joint.
- Lunch bags were used to protect penetrations.
- One fatality.
One Meridian Plaza
Philadelphia, PA – 1991

• Fire spread from 22\textsuperscript{nd} to 30\textsuperscript{th} floor through improperly protected penetrations and through perimeter joint.
• Three fire fighter fatalities, 24 FF injuries.
Breaches in Fire-Resistance-Rated Construction

Does a breach really impact the performance of a fire-resistance-rated assembly?  

Absolutely!!!

Unsealed or improperly sealed breaches cost lives and property!
Questions / Comments
Through- and Membrane-Penetration Firestop Systems
Three Elements of a Firestop System

- Floor or Wall Assembly
- Penetrating Item
- Firestopping Products
Penetrations

Code Requirements for Penetrations
Code Requirements

• IBC Section 714 – Firestop systems shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479

• LSC – Firestop systems or devices shall be tested in accordance with ASTM E814 or UL 1479
Ratings – E814

• F - Flame Occurrence
• T - Heat Transmission (+325 °F)
Ratings - ANSI/UL 1479

- **F** - Flame Occurrence
- **T** - Heat Transmission (+325 °F)
- **L** - Leakage (Optional)
- **W** - Water Leakage (Optional)
Fire-Resistance-Rated Construction

Establishing an L Rating
L (Air Leakage) Ratings

• L Rating methodology added to ANSI/UL 1479 in 1993
• Leakage determined at 0.3 in. WC
• Tested at Ambient and 400°F
• Results published in either CFM or CFM per sq ft
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 400°F
• Incidental chamber leakage rechecked after cooling
Test Procedure Cont.

• Firestop system assigned L Rating at ambient and 400°F, by subtracting incidental chamber leakage from test sample leakage
• L Ratings of firestop systems published in UL Fire Resistance Directory along with F and T Ratings
Where Are Listings Found?

- Hard Copy
- CD-ROM
- Online
Questions / Comments
Opening Protectives

- Fire Door Assemblies
- Fire Window Assemblies
Opening Protective Code Requirements for Fire Door Assemblies
IBC Code Requirements

• Section 716
  
  • 716.5.1 – Side-hinged or pivoted swinging doors shall be tested to ANSI/UL 10C or NFPA 252
  
  • 716.5.2 – Other types of doors shall be tested to ANSI/UL 10B or NFPA 252
IBC Code Requirements

• 716.5.3.1 – Doors in corridors and smoke barriers required to have leakage rating of 3 cfm per sq ft of door opening when tested to UL 1784

• 716.5.5 – Doors in exit enclosures and exit passageways shall have maximum transmitted temperature end point of not more than 450°F for 30 minutes
Life Safety Code Requirements

• Fire protection ratings shall be determined in accordance with NFPA 252, UL 10B or UL 10C
Opening Protectives

Establishing Fire-Protection Rating
Standards

- ANSI / UL 10B
- ANSI / UL 10C
- NFPA 252
Time - Temperature Curve

- 1000°F in 5 Min
- 1700°F in 1 HR
- 2000°F in 4 HR
- Inside the test furnace
• Hose Stream Test
• After Full Duration Fire Exposure
Conditions of Acceptance
Fire Door Assemblies

• No Flame Passage
• No Water Penetration
Where Are Listings Found?

Hard Copy

CD-ROM

Online
Questions / Comments
Fire Resistive Construction

UL’s Online Search Tools
UL’s Online Search Tools

• Online Certifications Directory
• Product Spec
Online Certifications Directory

• Helps you achieve code compliance
• Is continuously updated
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Product Spec

- Supplements OCD
- Identify designs meeting certain parameters
- Needs no password
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Summary

• Fire Resistance Rated Construction
• Breaches in Resistance Rated Construction
• Through and Membrane Penetration Fire Stop Systems
• Opening Protectives
• Where To Find Related Information
Thank You for Attending!!!

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