Testing of Fire Resistance and Smoke Resistant Assemblies

Matt Schumann / UL LLC
Let’s Start with Some Video
Breaches in Fire-Resistance-Rated Construction

• Penetrations
• Joint Systems
• Opening Protectives
• Ducts and Air Transfer Openings
Breaches in Fire-Resistance-Rated Construction Cont.

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

Absolutely!
Each type of breach has a unique fire test standard associated with it which compliments ASTM E 119 and UL 263
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.
Through- and Membrane-Penetration Firestop Systems
Ratings

• F - Flame Occurrence
• T - Heat Transmission
• L - Leakage (Optional)
• W - Water Leakage (Optional)
Fire-Resistance-Rated Construction

Establishing F and T Ratings
Standards

- ANSI / UL 1479
- ASTM E 814
- 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
Cables Through Wood Floor
Conduit Through Wood Floor
Hose Stream Test
Conditions of Acceptance
F Rating

- Passage of Flame
- Hose Stream
Conditions of Acceptance

T Rating

• Passage of Flame
• 325°F Temperature Rise
• Hose Stream
Opening Protectives

- Fire Door Assemblies
- Fire Window Assemblies
Opening Protectives

Establishing Fire-Protection Rating
Standards

• ANSI / UL 10B
• ANSI / UL 10C
• NFPA 252
• CAN/ULC-S104

• ANSI/UL 9
• CAN/ULC-S106
Conditions of Acceptance
Fire Door Assemblies

• Flame Passage
• Hose Stream After Full Duration Fire Exposure
• Deflection and Warpage of Door
Common Ratings

• Doors
  • 20 Min No Hose – US
  • 1/3 hr, ¾ hr, 1 hr, 1-1/2 hr, 3 hr
  • Frames, Door, Hardware and Accessories

• Glass
  • 20 min No Hose – US, only in doors
  • 1/3 hr, ¾ hr, 1 hr, 1-1/2, 3 hr
  • Fire Protective vs Fire Resistive
Comparison of Glazing Materials

- **Fire Protective** –
  - Barrier to Fire Only
  - Thermally “see-thru”
  - Tested to UL 9, UL 10B, UL 10C

- **Fire Resistive** –
  - Barrier to Fire and Thermal Energy
  - Tested to UL 263, equal to a gyp wall

- Glass must be permanently marked!
Marking of Glazing Materials

• Code Driven Requirements in US –
  • Certification Mark
  • Company Identifier – UL File Number or Co. Name
  • Must indicate product use – D, NT, T, W, OH
  • Must indicate product rating in minutes
  • Example – D- NT – 90
  • Formerly indicated hose stream test (NH, H)
Opening Protectives

- Fire Dampers
- Fire and Smoke Dampers
- Smoke Dampers
- Ceiling Dampers
Opening Protectives

Establishing Fire-Protection Rating or Smoke or Heat Passage Depending on Standard
Standards

- ANSI / UL 555
- ANSI / UL 555S
- ANSI / UL 555C
- CAN/ULC-S112
- CAN/ULC-S112.1
- CAN/ULC-S112.2

- Methods evaluate installation as well as products performance
Conditions of Acceptance
Fire Door Assemblies

• Flame Passage
• Hose Stream After Full Duration Fire Exposure
• Gaps Between Blades or Sleeve and Damper or Wall
• Leakage Rate through Damper (Smoke)
• Thermal conductivity into plenum (ceiling)
Fire-Resistance-Rated Construction
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
Standards

• ANSI / UL 263
• ASTM E 119
• CAN/ULC-S101
Building Components

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

- Temperature: 1000°F after 5 minutes
- Temperature: 1700°F after 1 hour
- Temperature: 2000°F after 4 hours

Temperature (°F) vs. Time (Hr)
Columns

• Sample size – Minimum 9 ft
• Tested unloaded
Conditions of Acceptance – Columns

• 1000°F / 1200°F
Beams

• Sample size – Minimum 12 ft
• Load applied – Per design
Conditions of Acceptance – Beams

• Support load
• 1100°F / 1300°F
• Based on restrained/unrestrained
Floor/Ceiling or Roof/Ceilings

- 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 temperatures
Walls

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

• Flame passage
• 250°F / 325°F
• Support load (if loaded)
• Hose stream
Thank You for Attending!!!

Matt Schumann
Building Materials and Suppression
UL LLC
333 Pfingsten Road
Northbrook, IL 60062
Matthew.Schumann@ul.com
(847) 664-1289
THANKS RICH!
www.ul.com