An Introduction to Passive Fire Protection and Code Requirements for Ongoing Inspection

Presented by Michael B. Lohr
1. Define passive fire protection and its importance to a comprehensive life safety program

2. Understand the codes related to the inspection of Passive Fire Protection Systems

3. Impact on:
   - Facility occupants
   - First responders

4. What to look for:
   - Documentation
   - Qualifications of inspector
What is Passive Fire Protection? (PFP)

Collective components that contain fire to its point of origin and slows the spread of fire, smoke and toxic gasses—aka containment / compartmentalization

1. **Opening Protectives** – *Fire doors/window, fire dampers and smoke dampers* are installed in barriers and partitions to maintain their integrity.

2. **Firestop Material** – Used to prevent the spread of fire through penetrations in the fire barrier.

3. **Structural Fire Protection** – Guards the structural components of a building in a fire. Accomplished via fireproofing so the structural integrity of a building is maintained during a fire.
Components of Passive Fire Protection?

1. Fire and smoke barriers
2. Structural fire-resistant elements
   Beams, columns, trusses
3. Fire-resistant doors
4. Smoke doors
5. Fire-resistant shutters
6. Fire-resistant glazing
7. Access panels and hatches
8. Ducts and dampers
9. Fire stopping of service penetration and control joints

Source: http://rfidams.wordpress.com/
The Total Fire Protection Plan

- Sprinkler Systems
- Detection & Alarm
- Fire Stopping
- Education
- Suppression
- Fire Walls & Floors
- Smoke/Fire Doors
- Smoke/Fire Dampers

Red Hawk Fire & Security
Passive Fire Protection: Importance to First Responders

The Last Line Of Defense

• Passive Fire Protection helps ensure that the fire is contained to a specific area of a building

• Proper compartmentalization gives you more time to efficiently put out the fire

• Proper compartmentalization helps limit structural damage and saves lives

• Isolating the fire helps lessen the risk of firefighters getting hurt
What causes most deaths in Building Fires?

- Almost 70% of all building deaths are associated with smoke inhalation
- Most victims are not located in the same room as the fire’s origin
- Smoke travels 120-420 feet per minute under fire conditions

Passive Fire Protection helps slow the spread of toxic gas and black smoke

Source: NFPA
Why Passive Fire Protection Matters

Life Safety Systems do not always work as designed

• Lack of maintenance
• Tampering (e.g. college dorms)
• System malfunction
• Problems with water supply (frozen pipes, earthquake, shut off by maintenance staff, inadequate water pressure)

Passive fire protection is meant to work in concert with active fire protection systems (e.g. sprinkler systems) not in lieu of them.
Why Passive Fire Protection Matters

New York City 1970 - 1 New York Plaza: Two people killed and 35 injured. The deaths were caused after an occupied elevator was "summoned" to the burning floor when one of the thermally activated call buttons - designed to react to a warm finger tapping it - reacted instead to the heat of the fire on that floor. Fire spread due to inadequate fire stopping.

Las Vegas 1980 - MGM Grand
679 injuries, 84 deaths. Openings in vertical shafts and joints allowed smoke to spread throughout the hotel. Lack of functional smoke dampers in risers and proper firestopping. FA system failure.

Los Angeles 1980 - First Interstate Bank Building
Took 15 minutes for alarm to be initiated and by that time flame had spread from 9th floor to 13th floor due to improper passive fire protection. Multiple injuries, and one death.

Chicago 2004 - LaSalle Bank Building
Fire initiated on 29th floor and according to investigators the fire was contained to only the 29th and 30th floors during the 6 hour blaze due to good firestopping. However, there were 6 deaths largely attributed to inoperable and/or locked fire doors.
All of the components must work for the plan to be effective. Even a fully sprinkled building needs other lines of fire safety defense.

Ed Comeau, Director of The Center for Campus Fire Safety has stated that the most common factors of fatal fires in student housing are:

- Missing or Disabled smoke alarms
- Lack of automatic sprinklers
- Careless disposal of smoking materials
- Impaired judgment from alcohol consumption

This heightens the need for a functional compartmentalization to lessen the spread of fire, smoke, and toxic gases.
Key Vertical Markets Served

**Healthcare**
- Hospitals
- Nursing homes
- Extended Care
- Medical Office Buildings (MOB’s)

**Education**
- Colleges
- Universities
- K-12

**Assembly**
- Office Buildings
- Arenas
- Concert Halls
- Museums

**Hospitality**
- Casinos
- Resorts
- Hotels

**Mfg/Govt**
- Military Bases
- Courthouses
- Plants

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Organizations Requiring Damper & Fire Door Testing

National Fire Protection Association (NFPA)
International Code Council (ICC)
Underwriters Laboratory (UL)
The Joint Commission
Safety of Life at Sea (SOLAS)
Local AHJs
Insurance Companies
Risk Auditors
Damper Manufacturers
FIRE AND SMOKE DAMPERS
NFPA 80 and 90A mandate the testing of fire dampers

- Each damper shall be tested at commissioning
- Each damper shall be inspected 1 year after installation
- Testing frequency shall then be every 4 years thereafter except in hospitals (every 6 years)

NFPA 105

Virtually identical requirements but for smoke dampers
Importance of Fire and Smoke Dampers

- Maintains the integrity of the fire and smoke wall
- Without operational fire and smoke dampers, fire and smoke walls can be rendered useless

Fire damper in rated wall

Smoke damper in rated wall
What Is A Fire Damper?

What is the purpose?

✓ Maintains required ratings of fire barriers
✓ Considered part of fire rated barrier
✓ Prevents spread of flames through barrier

How do they work?

✓ Closes when fusible link melts at 165 or 212 degrees Fahrenheit
✓ Certified by UL to carry hourly resistance rating (typically 1.5 – 3 hours)
Types Of Fire Dampers

Two Basic Types of Fire Dampers

**Static Rated**

**NOT** tested with airflow through the damper. Installed in systems where the fans will shut off in the event of a fire. “Fan off System” dampers fall due to gravity

**Dynamic Rated**

Tested with heated airflow through the damper. A “fans on system” – these dampers will slam shut due to the spring loaded design. They need to be installed in vertical barriers
What is the purpose?

- Used in ductwork/air transfer openings to resist passage of air and smoke
- Considered part of duct work

How do they work?

- Typically operates by smoke detectors in ductwork
- Closure of damper done by actuator (electric or pneumatic)
“My alarm company does that.”

Fire dampers are operated manually and are not connected to an alarm panel. Therefore, the alarm company would not test them. In an emergency, the fire damper closes when the fusible link melts at the specified rating per link.

Fire dampers are tested and inspected by safety technicians who release the link making sure it operates. Thereby ensuring compliance with NFPA 80.
Common Misconceptions: “My alarm company does that.”

**Fire Damper**

Fire dampers are operated manually and **are not** connected to an alarm panel therefore the alarm company would **not** test them. In an emergency the fire damper closes when the fusible link melts at specified rating per link.

---

Fire dampers **Tested by**

Fire dampers are tested and inspected by **LSS Life Safety Services.** Our technicians manually release the link making sure the damper operates. Ensuring compliance with **NFPA 80.**
Importance of a Passive Fire Protection Specialist

- Dampers are not visible, so knowing where the devices should be located is imperative.
- Missed dampers puts property owner, occupants, and first responders at substantially greater risk.
- Qualified Inspectors and Technicians find more dampers, perform inspections without activating alarms, are educated in infectious disease control, etc.

*Finding additional dampers helps facility managers and end users reduce liability and contributes to firefighter safety.*
Best Practice Documentation

- Detailed inventory of every damper
  - Location of damper
  - Type of damper (smoke, fire, combination)
  - Damper number
  - Result of inspection (pass, fail, inaccessible)
    - If damper failed, why did it fail
    - Corrective action needed
- Locations of dampers marked on as-built plans or CAD drawings

*Educating facility managers and end users on what documentation is required helps limit business disruption, reduces liability and contributes to firefighter safety*
Best Practice Documentation

All reports made available on customer web portal
Service Invoice

Service Date: 11/31/12

Materials

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</table>

Labor

MILEAGE

TOTAL DUE: $
Dampers frequently fail. Periodic inspection is the only way to confirm full functionality. (The primary notification of damper failure are complaints of ‘temperature issues’.)

10% **Failure Rate** – averages based on history for facilities performing periodic inspections

35% (+/-) **Failure Rate** – averages based on history for facilities not performing periodic inspections

*LSS historical statistics*
Damper Deficiencies

- Propped open
- Rusted open
- Wire going through damper (obstruction) preventing closure
- Installed upside down
- Wired open
Main Damper Failure Causes

Top Fire and Smoke Damper Deficiencies

1. Inoperable actuator
2. No power to actuator
3. No air to actuator
4. Screw(s) in tracks
5. Linkage out of alignment or broken
6. Bound in tracks (racking)
7. Damper rusted open

8 out of 10 non-Healthcare facilities have not inspected their dampers *

*LSS historical statistic
Inspection, Testing and Maintenance of Swinging Fire Doors
Fire Door Doing its Job

Red Hawk Fire & Security

Photo: NFPA
Fire Door Doing its Job
NFPA 80 – 2007 Edition

- **5.1.1.2** The requirements of this chapter shall apply to new and existing installations

- **5.2.1** Fire door assemblies shall be inspected and tested not less than annually, and a written record of the inspection shall be signed and kept for inspection by the AHJ.

- **5.2.4.2** As a minimum, the following items shall be verified:
  1. No open holes or breaks exist in surfaces
  2. Glazing, vision light frames, and glazing beads are intact
  3. The door, frame, hinges, hardware, and noncombustible threshold are secured, aligned, and in working order
  4. No parts are missing or broken
NFPA 80 – 2007 Continued:

5. Door clearances do not exceed the clearances listed:

4.8.4.1 and 6.3.1.7 - Door clearances at the door edge to the frame, on the pull side of the door, do not exceed clearances

6.3.1.7 - Hollow metal door - 1/8” (+/- 1/16”), door to frame and at meeting stiles of pairs

6.3.1.7 - Wood door - 1/8” maximum, door to frame and at meeting stiles of pairs

4.8.4.1 - 3/4” between bottom of door and floor or threshold
NFPA 80 – 2007 Continued:

6. The self-closing device is operational

7. If a coordinator is installed, the inactive leaf closes before active leaf

8. Latching hardware operates and secures the door when it is in the closed position.

9. Auxiliary hardware items that interfere or prohibit operation are not installed

10. No field modifications to the door have been performed

11. Gaskets and edge seals are inspected
Documentation – Door Score

LSS DOOR SCORE™

The LSS DOOR SCORE™ is a proprietary scoring system which takes into account how the door performs in a variety of key areas, and is designed to help analyze the performance of doors in various environments. The system is based on a scale of 0 to 100, with higher scores indicating better performance. The LSS DOOR SCORE™ is used in a variety of industries, including healthcare, education, government, and more.

LSS DOOR SCORE™ Tips:

- Avoid using volatile organic compounds (VOCs) near the door.
- Use proper ventilation when painting or applying any materials near the door.
- Regularly maintain the door, including lubrication and cleaning.

LSS DOOR SCORE™ Exclusions for Fire Doors:

- Glazing
- Hardware
- Accessories
- Insulation
- Weatherstripping
- Finishes
- Paints
- Adhesives
- Glues
- Caulks

LSS DOOR SCORE™ DISCLAIMER:

This information is provided for informational purposes only and is subject to change without notice. LSS Fire & Security does not warrant the accuracy or completeness of this information. Always consult with a professional before making any decisions regarding your doors or related materials. LSS Fire & Security is not liable for any errors or omissions in this information, nor for any actions taken based on the information provided.
How well are facilities maintaining fire and smoke doors?

What do you think 90%+ of facility managers do in regard to inspection of their fire rated doors?

• Check to see if the door latches
• Maybe check for a door label
• Maybe check the gaps

Does making sure a door latches meet the code? – NO

• NFPA 80 has (11) eleven inspection components, and while latching is obviously crucial, if the other moving parts of the door are not working properly the door may not always latch.
Why are so many facilities not properly maintaining their doors?

Assume it’s already being inspected

- Assume the maintenance staff, locksmith, or fire alarm company is taking care of them

Lack of Code knowledge

- Didn’t know there was a code to inspect doors
- Thought all they had to do was make sure the door latched

Apathy

- “Nobody makes me”
- “I haven’t been written up for it yet”
- “My AHJ doesn’t require it”
# Top Fire and Smoke Door Deficiencies

<table>
<thead>
<tr>
<th>Deficiency</th>
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</thead>
<tbody>
<tr>
<td>1. Painted or missing fire door labels</td>
</tr>
<tr>
<td>2. Poor clearance dimensions around the perimeter of the door in the closed position</td>
</tr>
<tr>
<td>3. Kick down door holders</td>
</tr>
<tr>
<td>4. Auxiliary hardware items that interfere with the intended function of the door (barrel bolts and dead bolts, etc.)</td>
</tr>
<tr>
<td>5. Fire doors blocked to stay in the open position</td>
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<tr>
<td>6. Area surrounding the fire door assembly blocked by furniture, equipment and/or boxes</td>
</tr>
<tr>
<td>7. Broken, defective or missing hardware items (latch bolts and/or strike plated, closer arms, cover plates, etc.)</td>
</tr>
<tr>
<td>8. Fire exit hardware installed on doors that are not labeled for use with fire exit hardware</td>
</tr>
<tr>
<td>9. Missing or incorrect fasteners</td>
</tr>
<tr>
<td>10. Bottom flush bolts that do not project 1/2” into the strike</td>
</tr>
</tbody>
</table>

Over 50% of Fire Rated Doors inspected by LSS are not in compliance with NFPA 80
What is Fire Stopping?

Contains a fire to its point of origin and slows the spread of fire and smoke.

How is this accomplished?

**Compartmentalization** – (floor-to-ceiling) fire walls, partitions, smoke barriers, floors, and ceilings. Used to contain the spread of fire and increase the availability of escape routes for occupants.

“Defend in place”
What is Firestopping?

“A process whereby certain materials, some of them specially manufactured, are used to resist (or stop) the spread of fire and its byproducts through openings made to accommodate penetrations in fire-rated walls, floors and floor ceiling assemblies.”

......International Fire Stop Council
How Does Firestopping Work?

• Through-penetration firestop products work by filling the voids around penetrating items in fire rated walls and floors

• Some firestop products intumesce (expand in the presence of heat)

• The intumescent action seals and stops the spread of flames and smoke to other floors and rooms for penetrations that melt or change shape in a fire (e.g. plastic pipe)
Through-Penetrations

Containment in Construction

Photos: IFC
Membrane-Penetrations

Containment in Construction

Courtesy of IFC

Red Hawk Fire & Security
Construction Joints

Containment in Construction

Photos: IFC
Building Codes Requiring Firestopping

Fire Walls, Smoke Walls, Fire Barriers

Model Building Codes That Require Firestopping

- International Building Code (IBC)
- Uniform Building Code (ICBO)
- Standard Building Code (SBCCI)
- National Building Code (BOCA)
- Life Safety Code (NFPA 101)
- National Electrical Code (NFPA 70)
- NFPA 5000 (NFPA Building Code)
Intumescent Firestop Example

FireBloc
Fire Suppression Gasket
Within 4x4 Box

Expanded
FireBloc Gasket

Courtesy of Intumescent Technologies LLC
Firestopping Products

Sealants
  Silicone, Latex, Intumescent

Wrap Strips
  “Thick, Thin, Wide, Less Wide”

Putties

Pillows

Composite Sheets

Bricks / Plugs

Pre Fabricated Kits

Mortar

Spray Products

Photos: STI, 3M, A/D, HILTI, Nelson, FCIA
UL Listed Firestop Systems

3M Firestop Systems Selector
Browse hundreds of systems approved by UL and other independent testing laboratories
- Joists
- Preventive Wraps
- Miscellaneous
- Through Penetrations

UL / OPL Firestop System Nomenclature

UL Nomenclature - Through Penetrations
C-AJ-1226
1. First letter represents WHAT is being penetrated:
   - F: Floors
   - W: Walls
   - C: Floors and walls (combined)
2. Second letter(s) provide more info on Wall/Floor:
   - A: Concrete Floors ≤ 5 inches thick
   - B: Concrete Floors > 5 inches thick
   - C: Framed Floors - Floor/Ceiling Assemblies
   - D: Steel Deck Construction
   - J: Concrete or Masonry Walls < 8 inches thick
   - K: Concrete or Masonry Wall > 8 inches thick
   - L: Framed Walls - Gypsum Wallboard Assemblies
3. 1st digit describes the penetrating item(s):
   - 0: Blank Openings
   - 1: Metal Pipe, Conduit, or Tubing
   - 2: Nonmetallic Pipe Conduit or Tubing
   - 3: Cables
   - 4: Cable Trays
   - 5: Insulated Pipes
   - 6: Miscellaneous Electrical (Busways)
   - 7: Miscellaneous Mechanical (Ductwork)
   - 8: Mixed penetrating items
   - 2nd - 4th digits are sequential test numbers

UL Nomenclature - Construction Joints
HW-D-0042
1. First 2 letters represent type of joint system:
   - C: Curtain Wall
   - FF: Floor to Floor
   - FW: Floor to Wall
   - HW: Head of Wall / Top of Wall
   - WW: Wall to Wall
2. The next letter represents movement capabilities of the system:
   - S: Static System
   - D: Dynamic System
3. The first number represents nominal joint width:
   - 0: Nominal Joint Width ≤ 2 in.
   - 1: Nominal Joint Width > 2 in. and ≤ 6 in.
   - 2: Nominal Joint Width > 6 in. and ≤ 12 in.
   - 3: Nominal Joint Width > 12 in. and ≤ 24 in.
   - 4: Nominal Joint Width > 24 in.

ETL (OPL) Nomenclature (CEJ ###P)
- CEJ = Construction/Expansion Joint
- P = Perimeter (OPL Nomenclature)
Min/Max Hole Size

Annular Space

Courtesy of FCIA-STI Graphic
Proper Installation – Annular Space

Photo: FCIA-STI Graphic
Improper Installation – Annular Space
Properly Tooled/Smoothed Penetrations

Photo: FCIA-STI Graphic
Penetrations: Large Insulated Pipes

Courtesy of FCIA
Penetrations: Sleeved Pipes

Photo: FCIA
Proper Installation (collar, sealant) for Combustible Penetrations

- Intumescent sealant expands and fills the void that opens as the combustibles burn away
- Collar expands to crush the pipe
Best Practice – Fire Stopping

Firestop Survey (‘Caulk and Walk’)

• 90% of fire stopping issues can be resolved with a caulk and walk survey

• Minor repairs - any penetrations under 2” annular space repaired, labeled

• Larger penetrations photographed and solutions developed separately

• Digital photos of all issues
# Documentation

## Project Summary

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<th>Floor</th>
<th>Issues Surveyed</th>
<th>Corrective Actions Suggested</th>
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## Project History

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<td>Through Penetration</td>
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**FIRE STOP SURVEY FOR:**

North Campus - Building A

July 01, 2011 - July 04, 2011

**Contracted By:** ABC Medical Center
**Building Name:** Building A
**Inspection Date:** July 01, 2011 - July 04, 2011
**Survey Completed By:** Ted Keating

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<tr>
<th>Item</th>
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<th>Issue</th>
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**Location:** At double doors leading into Conference Room #206

**Recommended Corrective Action:**

Installation of UL System

**M-4-8923**

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**Corporate Office:**

Life Safety Services
8759 Florence Rd
Louisville, KY 40218

**LSS SAFETY SERVICES:**

ASSOCIATE FIRE PROTECTION SPECIALISTS
N-V-200FP-09-05-10

**www.lifesafetyservices.com**
‘Real World’ Firestopping

Examples of Firestopping / Firewall Problems in the field

Partial Fire Stopping

Mixed Manufacturer’s Product
‘Real World’ Firestopping

Examples of Firestopping / Firewall Problems in the field
Unlisted, Untested Firestop Systems
Improper Installation – FS Caulk

Photos: FCIA
Improper Installation: Joint Compound
Incomplete is Ineffective

Photos: FCIA
Open Penetrations / Poor Installation

- Contractors (plumbing, HVAC, electrical, IT, or in-house staff are creating penetrations through the fire walls/barriers) and not firestopping or incorrectly firestopping the penetrations
- Wrong UL Listed firestop system used
- Untrained staff / technicians

Common firestop code violations article
http://bsj.iccsafe.org/june/features/firestop.html
Out of sight out of mind

• Don’t see the penetrations in the fire walls above ceiling so never bother to maintain them

Lack of knowledge

• Didn’t know what the code says
• Thought contractors fixed holes they made as they went along
• “My maintenance staff takes care of that.”

*The Joint Commission lists unsealed penetrations as one of the top causes for recommendation for their Environment of Care.*
Questions?

Mike.Lohr@RedHawkUS.com