CHALLENGES TO AIRFLOW CONTAINMENT IN CRITICAL FACILITIES:
HEALTHCARE & DATA CENTERS

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Introduction

- What is firestop and why it is especially important when designing cable runs in critical facilities?

- How can firestop affect:
  - Spread of airborne disease in a hospital?
  - Server contamination from dust during cabling changes?

- What do designers need to understand?

- To answer these questions we must first understand some basics...
Fire Statistics

- In average, 3,8 million fires occur per year worldwide

- In average, 45,4 thousand deaths occur per year worldwide due to fires

- 3/4 of fire deaths are caused by smoke
  Source: Hall, Jr. John R. NFPA Fire Analysis & Research, Quincy, MA. "Burns, Toxic Gases and other Hazards".

- 57% of fire deaths are not in the room of the fire’s origin
  Source: NFPA Fire Protection Handbook, 18th Ed..

- 47% of survivors caught in a fire could not see more than 3,5 meters
  Source: NFPA Fire Protection Handbook, 18th Ed.
Why passive fire protection is so important in data centers?

7908 $/min

Most non-home electronic equipment room fires (78%) begin with electronic equipment

Sources:
Research published by Ponemon institute in Dec 2013
John R Hall report – Issues Mar 2012
National Fire Protection Association (NFPA) Report
More recent in July 2018

A nearly-complete data center was on fire for 8 hours.

It was comprised of seven levels, three above and four below ground, where the fire started.

Around 300 workers were on site. 5 men died. 50 people were injured.
Why Smoke & Fire are key concerns?

3/4 of all fire deaths are caused by smoke inhalation

Approx. 57% of people killed in fires are not in the room of the fire’s origin

47% of survivors caught in a fire could not see more than 3.5m

Smoke travels 0.6 - 2.2m per second under fire conditions

Sources:
Hall, Jr. John R. NFPA Fire Analysis & Research, Quincy, MA. “Burns, Toxic Gases, and other Hazards”. NFPA Fire Protection Handbook, 18th Ed. Table 8-1P. Pg. 8-17
NFPA Fire Protection Handbook, 18th Ed. Table 1-1P. Pg.1-15.
Estimate based upon ceiling jet velocity calculations for typical ceiling heights and heat release rates.
We can’t rely on a single action to keep people and assets safe

The balanced approach to Fire Protection
The Elements of Compartmentation

The spread of fire can be restricted by dividing a building into separate compartments with **fire-resistive walls and floors** increasing the availability of escape routes for occupants.

Compartmentation protects **escape routes** such as corridors or stairs.
What is Firestop?

• **Firestop systems** (if installed correctly), help *restore the integrity* of a floor or wall as it is penetrated by an object or joint and resist the spread of smoke and fire.

• **Firestop** is part of the *life safety plan* in building structures.
Firestop required by codes and building regulations
Firestop required by codes and building regulations

• Codes in most countries require firestop products to be tested, designed and installed per a testing standard.

• Firestop systems are tested acc. to international standards such as:
  - Europe: EN 1363
  - USA: ASTM E 814 / UL 1479

• A successful test yields an approval or firestop listing.
UAE Fire & Life Safety Code 2018

- Openings in fire rated assemblies where penetrants are passing through a fire-rated construction and where the integrity of the wall and/or floor needs to be maintained.

**UAE LIFE AND SAFETY CODE OF PRACTICE**
Through-penetration firestop system ratings Shall be as:
ASTM E 814, UL 1479, EN 1366-3, FM 4990
Official testing laboratories

- All “Nationally recognized Test Laboratories” are of **equal status** in regulations (code acceptance)

- Each test lab publishes its **own listing directory**
The field of application reflects the interplay between the firestop system, consisting of:

1. a fire-rated **wall or floor** assembly,

2. a **penetrating item** or items passing through an opening in the assembly,

AND

3. the **materials** designed to help prevent the spread of fire through the openings.

**Official approved systems**
What is the average hourly rating of any firestop product?

ZERO

Only Firestop Systems have ratings!
How do you address this application?

Not all firestop applications are tested
What if the site condition deviates from tested design?
In absence of tested system, engineering judgements should be used

- Based upon **interpolations of previously tested** firestop systems (referenced on the form)
- Limited only to the specific conditions upon which it was rendered.
- Site specific; **Not transferrable**
- If no related testing data available, the EJ is unlikely.

**Typical Engineering Judgment Conditions:**

- Annular space larger/smaller than tested
- Irregular hole shape
- Hole shape different than tested...
## Airflow mitigation

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<th>Cooling</th>
<th>Other</th>
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<td></td>
<td>Access &amp; Security Control Cabling</td>
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</table>

✓ Creates largest volume of openings through wall and floor assemblies
✓ Present unique challenge due to continuous cable **re-penetration**
Non-conductive particulates pose a risk to efficient and reliable facility operations.

Contamination from construction activities such as cement and drywall dust, or paper and cardboard fibers can cause problems such as optical interference or obstruct cooling airflow, resulting in:

- lower thermal efficiency and increased cooling costs
- overheating and resultant equipment failure
- shortened electronic equipment life span
- server failures causing enterprise disruption

“Particulate contamination can increase a data center’s power demand by 2% or more”

“The key to keeping airborne contaminants out of the data center is to avoid bringing them in”

Source: „The Threat of Data Centre Contamination“ on datacenterknowledge.com
ASHRAE recommends Data centers meet ISO clean room class 8 standard

"Construction materials and processes have a huge impact on the quantity of contaminants that may be present in the environment."
Cable repenetrations (MAC’s) increase risks to people and assets
Pre-engineered firestop solutions eliminate the risk of human error and ease maintenance

<table>
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<tr>
<th>New construction</th>
<th>Renovation</th>
<th>Solution</th>
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<tr>
<td>• Traditional systems are also the most often <em>incorrectly installed</em></td>
<td>• When repenetrating, there is lack of coordination resulting in <em>wide-open penetrations</em></td>
<td>• Cable pathway devices <em>reduce risk</em></td>
</tr>
<tr>
<td>• Inspection failures are common yet don’t catch all incorrect installations</td>
<td>• Higher risks to fire protection –people and assets-</td>
<td>• Correct firestop, built in</td>
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<tr>
<td></td>
<td>• Increase <em>energy costs</em></td>
<td>• Easy to <em>repenetrate</em>, accommodates future cables → cost-effective maintenance</td>
</tr>
</tbody>
</table>
Solutions should fit application and project needs

Performance Requirements

✓ Minimum Code compliance for firestop system rating
✓ Ensure life safety and property loss prevention
✓ Correct installation
✓ Re-penetrability (MAC work)
✓ Ease of inspection
✓ Prevent airborne disease transmission
✓ Prevent dust contamination
✓ Room pressurization
✓ Reduce cooling and heating costs

Solution

Traditional Firestop System
(generates dust and greater potential to human error)

Pre-formed firestop solutions
(fiber-free for easy cable changes)
Clearly convey your design intent

- Mandate cable pathway devices in Master specs
- Draw cable pathways devices on Datacom or Telecom details
The firestop journey
3 things to remember

1. **Fire & Smoke** are devastating occurrence that happen more often than we think

2. Designers should consider maintenance and **future cable capacity**

3. Reach out to us for **support**!
Thank you

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