Our Purpose
We passionately create enthusiastic customers and build a better future!

We live our values
The foundation of our culture is integrity, courage, teamwork and commitment.

Enthusiastic customers
We create success for our customers by identifying their needs and providing innovative and value adding solutions.
Objectives

Understand what firestopping is and why it's needed

Know the Applicable Code Requirements

Understand Firestop System Testing and Listing
  - Penetrations, Joints and Perimeter Fire Barrier

Understand how firestopping fits into the specification, design and construction process

Consequences of fires compared to other perils

Source: U.S. Fire Administration.
Fires affecting structures

Over 1.5 Million fires in the US in 2007

A Fire Department responds to a fire every 20 seconds

Almost 9/10 civilian deaths caused by fire were in structure fires

Source: U.S. Fire Administration.

Consequences of fires (US - 2007)

Direct property loss $14.6 Billion

Civilian deaths 3,430 lost their lives

17,675 civilian injuries

118 firefighters killed

Source: U.S. Fire Administration.
What is the leading killer in fires?

Smoke & Toxic Gases

Fire Statistics

Why must we contain Smoke, Toxic Gases and Fire?

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

Visibility: 47% of survivors caught in a fire could not see more than 12 feet.

Source: Hall, Jr. John R. NFPA Fire Analysis & Research, Quincy, MA. “Burns, Toxic Gases, and other Hazards”.

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

Source: NFPA Fire Protection Handbook, 18th Ed. Table 8-1P. Pg. 8-17.

Smoke travels 120-420 feet per minute under fire conditions

Source: Estimate based upon ceiling jet velocity calculations for typical ceiling heights and heat release rates.
We can’t rely on any single action or safeguard to keep people safe.

The Balanced Approach to Fire Protection

One globally applied principle for fire safety: **Compartmentation** (fire compartments)

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.

**Fire walls**

**Fire floors**

FW = Fire-Rated Wall

FF = Fire Rated Floor
Areas that can allow for fire/smoke spread:

- Unsealed/Open Joints
- Unsealed Cable Penetrations/Ducts
- Unsealed Pipe Penetrations/Ducts
- Doors
- Gaps at edge of slab
- Membrane (one-sided) penetrations

What is Firestopping?

- Firestop systems, if installed correctly, will help restore the rating of a floor or wall as it is penetrated by an object or joint and resist the spread of smoke and fire.

Why is it necessary?

- A part of the life safety plan in structures
  - Also included
    - air ducts with dampers
    - smoke and fire alarms
    - wired glass
    - fire rated doors
    - sprinkler systems
  - Provide additional time for safe egress
  - Mandated by Codes
    - IBC, NFPA, NEC
Fire Incident Example

One Meridian Plaza Businesses vs. Building Owner

- Fire destroyed 40-story building
- Tenants sued owner
- Affected businesses within one block also sued
- Three fire-fighters killed; numerous injuries reported
- Claimed potential exposure: $800 million
- Building owner sued approx. 25 defendants
  - Including the general contractor, sub-contractors and manufacturers

Series of errors during fire

- Filler Type Foam used to firestop openings
- Fire spread quickly, knocking out power
- Water pressure inadequate for fire department hose streams
- Back-up generator failed
One Meridian Plaza Businesses vs. Building Owner

- Building owner collected $110 million:
  - GC paid over $40 million
    - Claimed failure to supervise, install and inspect the fire protection system
  - Alarm manufacturer and servicer paid $10 million
    - Claimed inadequate alarm system
  - Back-up generator manufacturer
    - Claimed faulty wiring
  - Others settled out of court

What is firestopping and why is it needed

Key Points to Remember

- US annual fire losses:
  Thousands die, over ten thousand are injured, over ten billion in property loss

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

- If gaps are not properly sealed (firestopped), fire rated assemblies may fail to contain fire and smoke
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Firestopping not new:
Required by all current and legacy codes
International Building Code (2006 IBC)

Section 712.3.1.2 (Walls) – Through-penetration Firestop systems
“Through-penetrations shall be protected by an approved penetration Firestop system installed as tested in accordance with ASTM E 814 or UL 1479…”

Section 712.4.1.1.2 (Floors) – Through-penetration firestop system
“Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E 814 or UL 1479.…
“The system shall have an F-rating and a T-rating of not less than 1 hour but not less than the required rating of the floor penetrated
Exception: Floor penetrations contained and located within the cavity of a wall do not require a T- rating.

Section 712.3.2 – Membrane penetrations
“…Outlet boxes on opposite sides of the wall shall be separated by a horizontal distance of not less than 24 inches…or other listed materials and methods”

International Building Code (2006 IBC)

Section 713.3 – Fire resistant joint systems
“Fire resistant joint systems shall be tested in accordance with the requirements of either ASTM-E1966 or UL 2079…”

Section 713.4 – Exterior Curtain wall/floor intersection
“…Shall be sealed with an approved material or system to prevent the interior spread of fire…installed and tested in accordance with ASTM E2307 ”
New for 2009 International Fire Code: Annual inspection of rated assemblies

703.1 Maintenance. The required fire-resistance rating of fire-resistance-rated construction (including walls, firestop, shaft enclosures, partitions, smoke barriers, floors, fire-resistive coatings and sprayed fire-resistant materials applied to structural members and fire-resistant joint systems) shall be maintained. Such elements shall be visually inspected by the owner annually and properly repaired, restored or replaced when damaged, altered, breached or penetrated. Where concealed, such elements shall not be required to be visually inspected by the owner unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or similar movable entry to the space.


8.3.5.1* Firestop Systems and Devices Required. Penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents and exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a wall, floor, or floor/ceiling assembly constructed as a fire barrier shall be protected by a firestop system or device.

The firestop system or device shall be tested in accordance with ASTM-E 814...

8.3.6.5* Joints made within or between fire resistance–rated assemblies shall be protected with a joint system that is designed and tested to prevent the spread of fire for a time period equal to that of the assembly in which the joint is located. Such materials, systems, or devices shall be tested as part of the assembly in accordance with the requirements of ASTM E 1966, *Standard Test Method for Fire-Resistive Joint Systems*, or ANSI/UL2079, *Standard for Tests for Fire Resistance of Building Joint Systems*.

National Electrical Code (NFPA 70) also mandates firestopping

300-21 – Spread of Fire or Products of Combustion
“Openings around electrical penetrations through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.”
Code Requirements

Key Points to Remember

- Firestopping is required by the Building Codes, Fire Codes, Life Safety Code and Electrical Code
- All fire rated assemblies require joints and penetrations to be firestopped with tested and approved systems
- 2009 IFC requires building owners to annually inspect fire-rated assemblies and make repairs if necessary

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Firestopping: An Unofficial Definition

Precisely tested means and methods to restrict the spread of fire and smoke* through a breach or gap in a fire-resistance rated assembly.

*Degree of smoke restriction dependant on L-rating

All listed through-penetration and joint firestop systems are tested to ASTM E119 time-temperature curve

Temperature at 10 minutes = 1300 °F

Melting Points (approx.):
- Aluminum - 1220 °F
- PVC plastic pipe - 413 °F
- Fiberglas® insulation - 1100 °F

Sources:
1. NFPA Fire Protection Handbook, 18th Ed. Table 4-16A. Pg 4-183.
2. SFPE Handbook of Fire Protection Engineering, 1st Ed. Table 1-12.1. Pg. 1-166.
3. Owens Corning SSL I or II Fiberglas Insulation specification sheet.
Testing through-penetrations

Typical through-penetration applications
Through Penetration Firestop Systems tested to
ASTM E 814 / UL 1479

**F-Rating**
Time during which flames do not pass through the system

**T-Rating**
Time during which temp on non-fire side is < 325°F (163°C) above initial (pre-test) temperature
Includes temp of penetrating item
→ Not a pass/fail criterion

**L-Rating** (optional)
- Air leakage through firestop system at ambient and at 400°F
- Indicates ability to restrict movement of smoke
- Reported in CFM/cu. ft. or CFM/penetration

To obtain F-rating, must also pass hose stream

Verifies mechanical integrity after fire
Stream delivered through 2-1/2 inch hose with a straight-bore nozzle at:
- 30 psi - 1, 2 & 3-hour tests
- 45 psi - 4-hour test
ASTM/UL test apparatus

Video demo of ASTM/UL through-penetration test
Extreme conditions after 1 hour test

Combustible penetrating items during fire test
Combustible penetrating items after fire test

Factors Affecting Firestop Performance

- Size and type of penetrating item(s)
- Size and shape of opening
- Desired fire rating (hrs)
- Stud width for gypsum walls
- Floor or wall construction type and thickness
- Annular space
- Percent fill (cables)

Firestop performance can change completely with small change in any parameter.
Joint System Testing

Typical joint applications
ASTM E 1966 / UL 2079 Test Standards for Construction Joint Firestop Systems

Assembly Rating
- Measures both fire and temperature ratings on non-fireside
- Hose stream only required for top-of-wall and wall-to-wall joints
- Joint cycled prior to fire testing

L-Rating (optional)
- Amount of air leakage through firestop system at ambient and 400°F
- Indicates ability to restrict movement of smoke
- Measured in CFM/lin. ft.

ASTM E 1966 joint cycling test

Non-compliant joint seal

Code-compliant joint system

Almost all construction joints will be dynamic
Factors Affecting Joint System Performance

- Joint width
- Movement requirements (% of joint width)
- Desired fire rating (hrs)
- Floor and wall construction type
- Stud width for gypsum walls
- Floor and wall thickness

Perimeter Fire Barrier Testing
Typical perimeter fire barrier applications
ASTM E 2307
Test Standard for Perimeter Fire Barrier Systems

Use of Intermediate-Scale Multistory Apparatus (ISMA) simulates a possible fire exposure on interior and exterior of building.

**F-Rating** (integrity rating)
The duration of time in which flames do not pass through perimeter fire barrier system or around its boundaries

**T-Rating** (insulation rating)
The time it takes for the non-fire side to reach approximately 400 °F (325ºF above ambient)

Perimeter fire barrier extends the fire rating of the floor to the exterior wall
Factors Affecting Perimeter Fire Performance

Floor

Curtain wall
- Spandrel height
- Spandrel panel material
- Insulation of spandrel

Supports

Safing insulation
- Type
- Compression
- Fiber direction
- Method of attachment

Sealant
- Type
- Thickness

Results of fire tests published by listing agencies

Intertek
(listings from ex-Omega Point Laboratories)

Underwriters Laboratories Inc.

Warnock Hersey

Factory Mutual Standards Laboratories

All listed systems tested to the appropriate code-mandated fire test standards
Where to find firestop systems

www.us.hilti.com/firestopapprovals

The Printed UL Directory
What is the hourly rating of any Firestop Product?

ZERO

Only Firestop Systems have ratings!

Tested firestop systems are “listed”

Products used in listed systems are “Classified”

Firestop System Testing

Key Points to Remember

- Testing requirements differ for each major application type
- Each application has key variables that will significantly effect the fire resistance of the tested system
- The tests develop ratings for F,T,L,W, and hose stream, some of which are optional
- The purpose of all this testing is to provide documentation via accredited laboratory listings to meet code requirements
- The systems have ratings, not the products
- Tested systems can be found in the listing directories published by the major accredited test labs: UL, FM, Intertek (Omega Point)
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Complying with code requirements

IBC 2006 Section 106.1.1 – Information on construction documents
“Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.”

Suggested detail(s) that should be included in the construction documents for plan review process (sample provided):
• Schedule of systems by assembly, penetration or joint
• Sample UL System details – most common applications
• Specifications to include current standards relative to issue date of the construction documents
Sequencing of inspection with wall and ceiling construction

Section 109.3.6 – Fire-resistant penetrations
“Protection of joints and penetrations in fire-resistance-rated assemblies shall not be concealed from view until inspected and approved.”

Section 109.6 – Approval required
“…Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.”

Engineering Judgments (EJs) for situations when no tested system available
Recommendation from the manufacturer of firestop products when no tested/listed system meets actual field conditions
EJ Evaluation guidelines from International Firestop Council
www.firestop.org
Typical EJ situations

- Annular space larger/smaller than tested
- Irregular hole shape
- Hole shape different than tested
- Curtain wall construction not identical to that tested
- More penetrating items in hole than system allows
- Access to one side only
- Oversized or exotic insulation types
- Structural member penetrations
- *Intersections of rated assembly with non-rated assembly (e.g. roof deck)*

Sample conditions requiring EJ
Pre-Construction Meetings: Key firestop details

- Review Contract Document Requirements
- Review Firestop Submittal/s
- Coordination of Trades (if no single FSC)
- Color code wall types in field
- Review applications for Engineering Judgments
  - Obtain approvals
  - Discuss constructability issues
- Establish Inspection Guidelines & Expectations
  - Mock-up of each application for reference
  - Submittal with UL Details available for every inspection
- Schedule installer training (if no single FSC)
Firestopping in the specification, design and construction process

**Key Points to Remember**

- The IBC requires that details be provided to show code compliance
- Engineering Judgments can be requested when no tested system exists
- Pre-construction activities can help ensure code compliant firestopping

**Summary**

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Understand how firestopping fits into the specification, design and construction process
Hilti offers more than just product

- Over 100 Fire Protection Specialists and Field Engineers
- More than 1000 highly trained Account Managers
- Support staff with degrees in Fire Protection Engineering Technology
- Nationwide network of independent Hilti Accredited Firestop Specialty Contractors
- Engineering Judgments based on tested UL systems and the IFC Guidelines
- Online Firestop Design Center
- Online submittal builder (www.HiltiFirestopSubmittals.com)