Perimeter Fire Containment

Navigating Through the Application and Various Global Standards
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Worked closely with building authorities on local National Building Codes and has firsthand experience of fire protection markets of Asia Pacific, Middle East, Turkey and Africa

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AGENDA

• Perimeter Joint / Curtain wall / Edge of Slab Application Definition
• Fire compartmentation in Perimeter Joint
• International Testing Standards
• Importance of Protection from smoke and Water
• Engineering Judgments in Perimeter Joints
• Common misinterpretations like (Testing Vs Listing, F and T rating)
• Common Design Consideration
• Key Learnings
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Facades firestop solutions differ based on the application...let’s talk today about the curtain wall.
CURTAIN WALL COMPONENTS

Vision
Spandrel

Bracket
Mullion
Transom
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VERTICAL SPREAD OF FIRE IN A BUILDING

Internal Spread – “Chimney Effect”

External Spread – “Leap Frog”

- 2nd Floor
- Floor Slab
- 1st Floor
- Curtain Wall
- Ground Floor

- 3rd Floor
- Spandrel panel (glass, stone, metal...)
- Mullions
- Transoms
FIRE COMPARTMENTATION IN CURTAIN WALLS

We focus on two locations:

- **Horizontal Intersection**
- **Vertical Intersection**

Firestopping the gap between the structure and the curtain wall is a code requirement.
EXTENDING THE FIRE RATED FLOOR TO THE CURTAIN WALL IS MANDATORY

The perimeter joint must be sealed with an approved material or system that extends this rating to the exterior wall surface.

Firestopping the perimeter joint is mandatory.
THE EDGE OF SLAB JOINT IS CONSTANTLY SUBJECTED TO DIFFERENT TYPES OF MOVEMENT

1. Seismic Activity
2. Façade Thermal Movement
3. Live load

The perimeter joint solution will need to accommodate the combination of these movement to prevent the passage of fire & smoke.
WHAT WILL HAPPEN IF A SOLUTION IS MISSED OUT ON THESE MOVEMENT CONSIDERATIONS

Just installed firestop

After few years, firestop will fail to meet the purpose: Prevent the spread of Fire & Smoke

The perimeter firestop solution is not only for Today!
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THE MAIN TEST STANDARDS FOR CURTAIN WALL PERIMETER JOINTS

• **ASTM E2307**: Standard test method for determining fire resistance of perimeter fire barriers using intermediate-scale, multi-story test apparatus.

• **EN 1364-4**: Fire resistance tests for non-load bearing elements - *curtain wall-part configuration* – Non Fire Resistant Glazing.

• **EN 1364-3**: Fire resistance tests for non-load bearing elements - *curtain wall-full configuration* - Fire Resistant Glazing.
**WHY HILTI OFFERS FIRESTOP SYSTEM AS PER ASTM E 2307 STANDARDS:**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>ASTM 2307</th>
<th>BS EN 1364-4</th>
<th>EN 1364-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curtain Wall Assembly</td>
<td>Full configuration</td>
<td>Part configuration</td>
<td>Full configuration</td>
</tr>
<tr>
<td>Glazing</td>
<td>Non Fire Rated</td>
<td>Non Fire Rated</td>
<td>Fire Rated Glazing</td>
</tr>
<tr>
<td>Movement</td>
<td>Cycling requirements</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Fire Rating testing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Equipment</td>
<td>Internal &amp; External Burners</td>
<td>Internal OR External Burner</td>
<td>Internal OR External Burner</td>
</tr>
</tbody>
</table>

**ASTM clearly defines the movement requirements along which no other standard considered.**
EN 1364-4 WHAT’S MISSING…

EN 1364-4

- Part Configuration – Spandrel Panel Only
- Burner Location – One side (Internal Only)

E(Integrity) = I(Insulation) rating is required to pass the Test

ASTM E2307

- Full Configuration- Two-story Test Structure
- Burner Location – 2 sides (Internal & External)

Only F(Integrity) is required to pass the Test
HOW MOVEMENT IS CONSIDERED IN ASTM E2307?

ASTM E2307...All movements are considered and all Prior to Fire testing!

**TABLE 3 Conditions of Test Specimen Cycling**

<table>
<thead>
<tr>
<th>Movement Type</th>
<th>Minimum Cycling Rates (cpm)</th>
<th>Minimum Number of Movement Cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>Wind Sway</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>Seismic</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Combined</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

**Followed by:**

<table>
<thead>
<tr>
<th>Movement Type</th>
<th>Minimum Cycling Rates (cpm)</th>
<th>Minimum Number of Movement Cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>400</td>
</tr>
</tbody>
</table>

*Before testing,* the test specimen was subjected to ±12.5% vertical and ±12.5% horizontal (±0.5 in. vertical and ±0.5 in horizontal) movement through a min. of 100 times at 30 cpm, followed by a min. of 400 cycles at 10 cpm for both vertical and horizontal cycling.

**Firestop Joint Spray CFS-SP WB**

<table>
<thead>
<tr>
<th>Firestop Joint Spray CFS-SP WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-Rating</td>
</tr>
<tr>
<td>T-Rating</td>
</tr>
<tr>
<td>Application Thickness</td>
</tr>
</tbody>
</table>

**Cycling Type IV**

<table>
<thead>
<tr>
<th>Cycling Type IV</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>±12.5%</td>
<td>±12.5%</td>
</tr>
</tbody>
</table>

**L-Rating**

<table>
<thead>
<tr>
<th>L-Rating**</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.0 SCFM/LF</td>
</tr>
</tbody>
</table>

Movement Only applicable to ASTM E 2307 or complete ETAG Approval
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WHY L-RATING?

Because the code says..

1.2.7. Perimeter Barrier
......A single or combination of materials are used to create a firestop assembly at the perimeter gap between a fire resistance rated floor assembly and a non-rated wall assembly, capable of preventing the spread of heat, fire, gases, smoke or other defined hazards through the internal opening in the wall and floor assembly.

How Gases & Smoke?

1.2.13. ' L' Rating
... An L rating is a measure of the ability of a fire-resistive assembly to prevent cold and warm smoke passage through fire stops, joint seals and other resistance rated assemblies, obtained at ambient or elevated temperatures.

Firestop systems need to have an appropriate L-rating limiting the spread of smoke and toxic gases
ANOTHER ATTRIBUTE…WATER RESISTANCE

Because the code says..

1.2.14. ‘W’ Rating

W rating determines the capability of the firestop system to maintain water tightness of the penetration through a floor or wall construction at ambient air conditions under 3 ft. of water pressure head (1.3 psi) for a period of 72 hours.

Why?

Construction Phase + Containment against leakage + Contamination mold/mildew

Only wet system can achieve ‘W’ Rating
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1.2.16. Engineering Judgments (EJ’s)
An evaluation of the field conditions which do not conform to or deviate from an existing tested and listed assemblies...

3.4.2.c. Engineering Judgment (EJ) – Where there is no specific tested and listed firestop system available for a particular configuration, the manufacturer shall provide a site specific EJ, along with Consultant and Firestop system contractor’s stamp and acceptance.

**EJ SHOULD**..

- Be issued only by firestop manufacturer's qualified technical personnel.
- Identify the job name, contractor, and hourly F rating required.
- EJ should be addressed at least by minimum 2 reference listed system(s). **No EJ will be based on only 1 reference listed system.**
- Listed systems should be registered in local authorities directory (Civil defense).
- Engineering judgements should be reviewed by Consultant / Fire Consultant / House of expertise.
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**LISTING VS TESTING**

**Testing** is a definitive procedure that produces a test result done according to a testing standard. Testing is performed by an accredited independent organization.

**Listing** is the certification of a testing published by the certification body to assure quality to the end user. Certification mark will be present on the product to communicate product compliance.

*Not every Testing will be consider as a Listing!*
F & T RATING CONFUSION

4.5.9.3. Fire safing forming the perimeter edge protection must ensure the same performance as the structural floor slab in respect of F and T ratings.

*This does not mean:*  
F rating = T rating of the fire safing

*It means:*  
F rating of fire safing = F rating Slab  
T rating of fire safing = T rating Slab

1.2.12. ‘ T ‘ Rating  
The period of time (in hours or 15 minute increments) a Firestop system has been shown capable of keeping the unexposed surface of the Firestop system from exceeding a 325°F (181°C) above ambient temperature rise.

**According to IBC Code:**  
Section 715.4 Exterior Curtain Wall/Floor Intersection  
......systems shall be securely installed and tested in accordance with ASTM E2307 to provide an F rating for a time period not less than the fire-resistance rating of the floor assembly....

**UAE Fire & Life Safety code 3.2.4.b:**  
.....The perimeter fire barrier shall remain securely in place and provide interior joint protection for the time period no less than the fire resistance rating of the floor assembly.

*Firestop solution need to follow the approved standards ASTM E 2307 Or EN 1364-4*
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DESIGN CONSIDERATIONS FOR PERIMETER FIRESToppers

- Approved Standards
- L Rating
- W Rating
- F Rating
- Design Criteria
- Listed Systems
- EJ
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KEY LEARNINGS

• Movement is Key to Perimeter Joint / Curtain Wall Joint Fire protection and ASTM E 2307 is a comprehensive testing standard where Movement is built as part of the testing
• Protection from smoke is key, so never Ignore L- Ratings
• Always ask for an Engineering Judgment that matches your site conditions
• F and T ratings have different meanings so know your testing standards.
THANK YOU