AIAU

Now You Know: Selecting a Perimeter Fire Containment Listing That Is Most Representative of the Project Conditions

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Presenter

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Technical Services Leader

Intro/Overview

Selecting a Perimeter Fire Containment (PFC) design listing that most closely represents project conditions, is the first line of defense for minimizing risk of vertical fire spread. Navigating through hundreds of design listings and choosing the correct system can seem overwhelming. However, understanding how various building materials respond to fire and identifying the design elements needed for successful PFC, designers will be able to confidently select PFC systems that will perform in the event of a fire.

Agenda

1. This webinar will review the necessary design components for successful perimeter fire containment.

2. The program will outline the PFC test methodology- ASTM E2307.

3. The course will identify unique curtain wall conditions and how various perimeter fire containment systems have been designed to address these specific construction types.

4. Instructor will walk through a design listing and identify the key elements for matching the design listing to project conditions, highlighting on the key elements such as safing compression, mechanical fasteners, mullion protection and backer/reinforcement will be addressed.

5. The course will also cover the need for engineering judgments and how to identify a quality EJ.

6. Instructor will outline the key elements needed for successfully documenting, installing and inspecting a PFC System.

What are we protecting?

What is perimeter fire containment?

Definition: a firestop joint system designed to seal the gap between a fire-resistance-rated floor and a non-fire-rated exterior wall assembly

Non-Rated Exterior Curtain Wall

Interior Joint

Rated Floor Assembly

Unprotected Perimeter Joint

Why do we need PFC?

Behavior of Curtain Wall Materials Exposed to Fire

Aluminum- **Melts at 1220°F- 9 minutes** into a fire

- CW Framing
- CW Anchors
- Aluminum Fasteners

Glass- **Breaks out- 5 Minutes** when exposed to fire

Spandrel Insulations-

- Glass Fiber- **Melts within 6 minutes (1050°F)** into a fire
- Plastic Foam Insulations- **Flash Point 300 to 392°F**
- Mineral Wool- **Exposed for 5 hours to 2,020°F-** Remained Fully Intact

Code Requirement

Property Preservation

Occupant Escape Time

Why do we need PFC?

2024 IBC Section 715.4 Code requirement:

"Exterior curtain wall/fire-resistance-rated floor intersection"

- Fire protection requirements for the space where an exterior curtain wall meets a fire-resistance-rated floor assembly.
- Must be filled with an **approved perimeter fire containment system to prevent fire spread through interior joint.**
- Provide an **F rating equal to** or greater than the **fire-resistance rating of the floor** assembly
- Must be **tested per ASTM E2307**.

Exception:

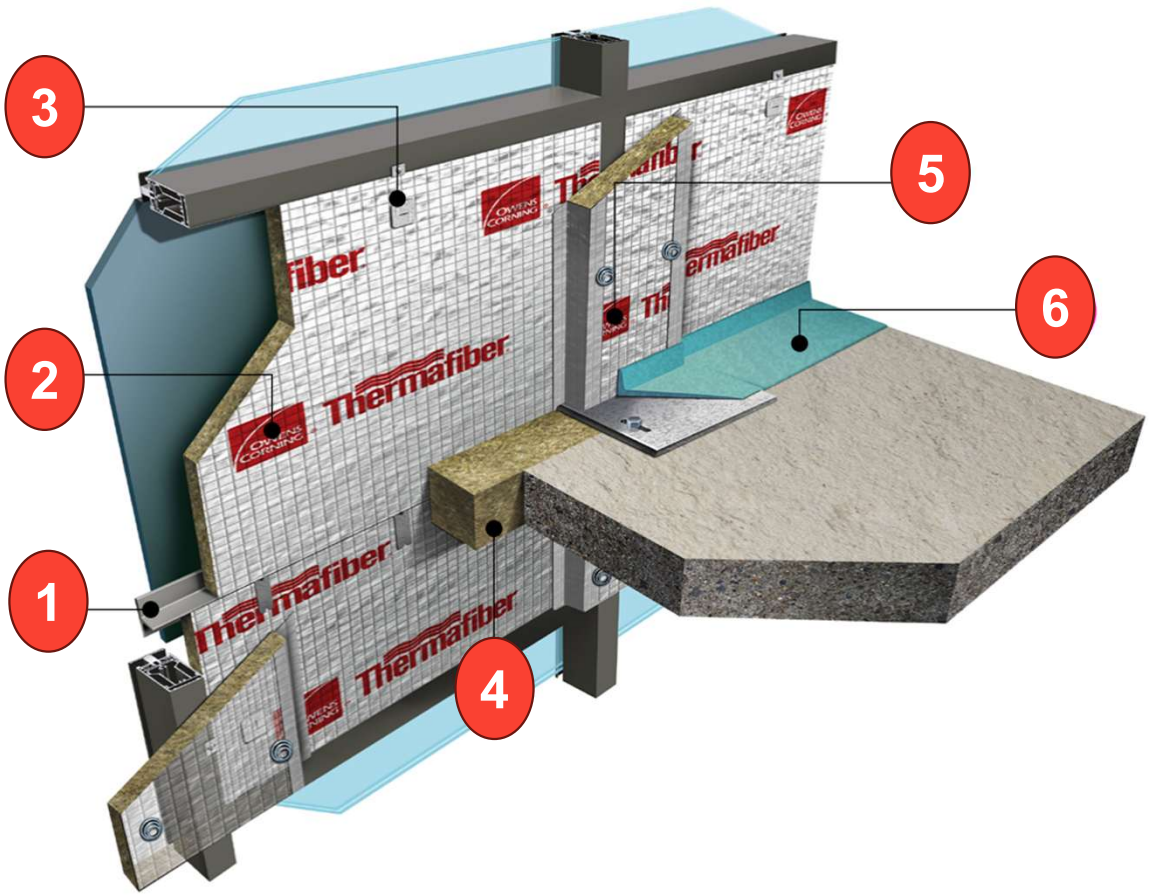
- Where the **vision glass in the curtain wall extends down to the finished floor** levels, the **void can be protected with an approved material tested to ASTM E119** to prevent fire spread.
- Should demonstrate that the **material will stay securely in place for same duration as the floor rating.**
- Note: **No test** where a **non-rated curtain wall** with an **“approved material”** will stay in place **for 2-3 hours**.
- **There are ASTM E2307 Systems available** for window-sill vision glass or zero spandrels that provide safest installation.

Component Breakdown

ASTM E2307

Critical PFC Components

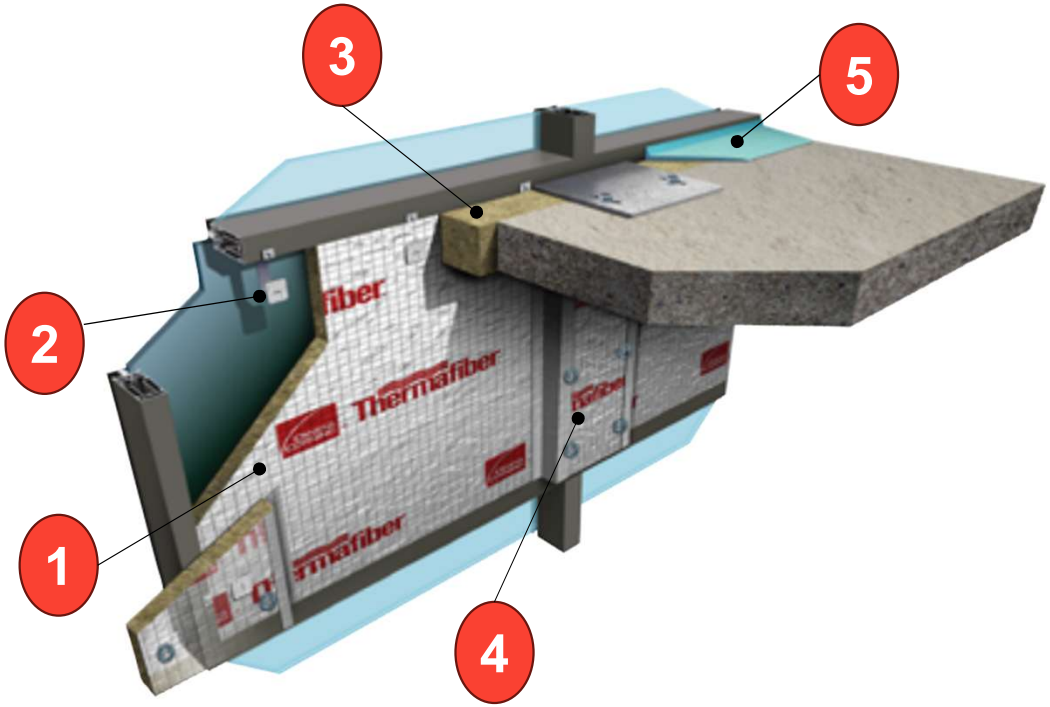
Floor Slab intersects spandrel



1. **Backer/Reinforcement Member**
2. **E2307 Tested Curtain Wall Mineral Wool Insulation**
3. **Mechanical Attachment**
4. **E2307 Tested Safing Mineral Wool Insulation**
5. **Mullion Cover Mineral Wool Insulation- Mechanically Attached**
6. **E2307 Tested Smoke Barrier**

Critical PFC Components

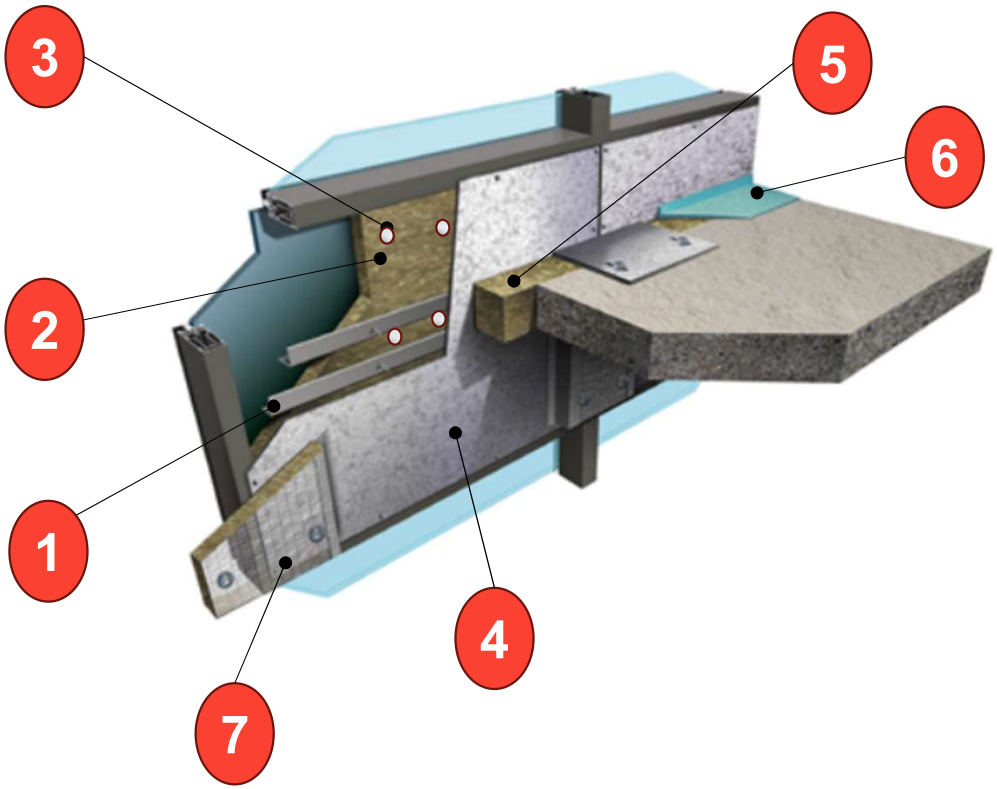
Transom @ close proximity to floor



1. **E2307 Tested Curtain Wall Mineral Wool Insulation**
2. **Mechanical Attachment**
3. **E2307 Tested Safing Mineral Wool Insulation**
4. **Mullion Cover Mineral Wool Insulation- Mechanically Attached**
5. **E2307 Tested Smoke Barrier**

PFC System- Interior Back Pan

Critical PFC Components



1. **Backer/Reinforcement Member(s)**
2. **E2307 Tested Curtain Wall Mineral Wool Insulation (unfaced)**
3. **Cup-Head Weld Pin Mechanical Attachment (12” oc)**
4. **Interior Galv. Steel Back Pan (typical 20-22 ga.) Attached 8” oc.**
5. **E2307 Tested Safing Mineral Wool Insulation**
6. **Mullion Cover Mineral Wool Insulation- Mechanically Attached**
7. **E2307 Tested Smoke Barrier**

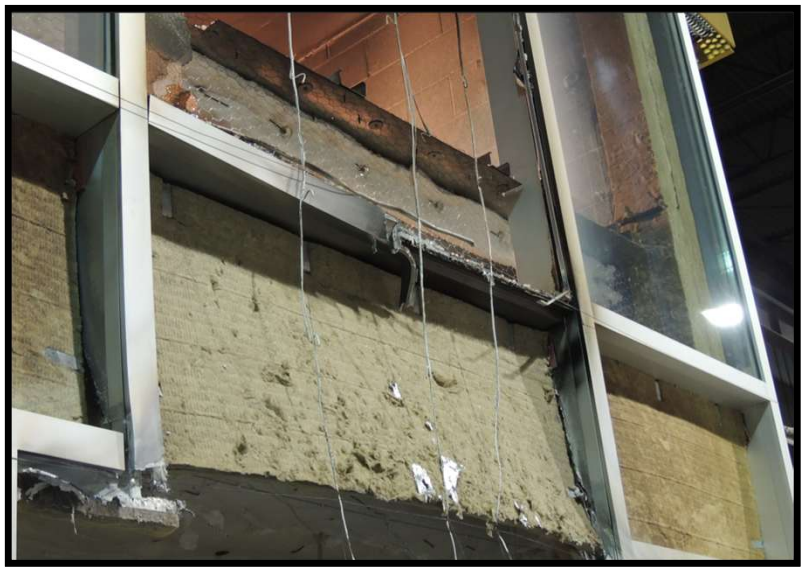
Component Breakdown

E2307 Tested Curtain Wall
Mineral Wool Insulation

Component Breakdown

E2307 Tested Curtain Wall
Mineral Wool Insulation

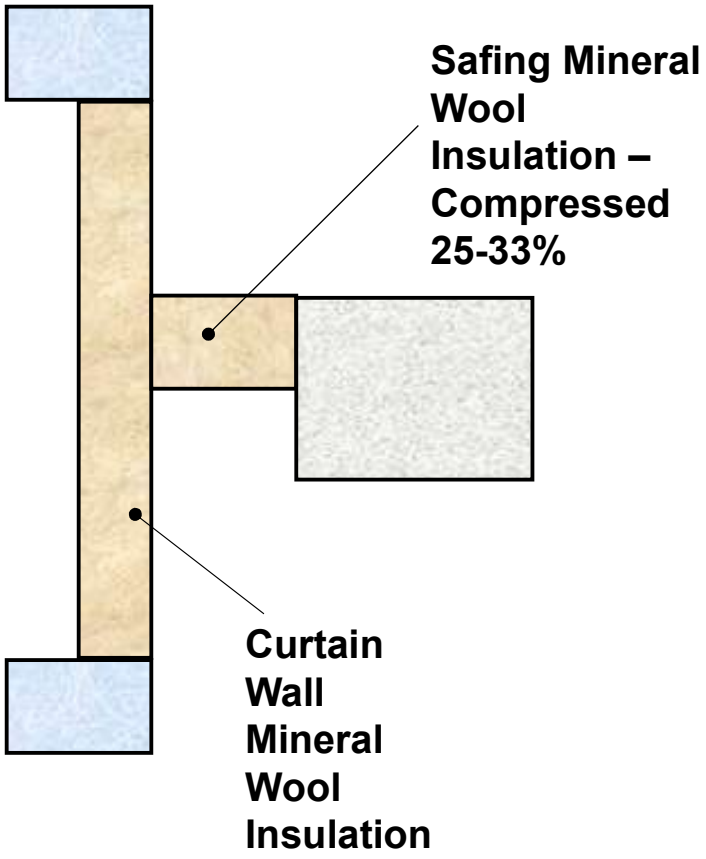
Uncertified
Mineral Wool

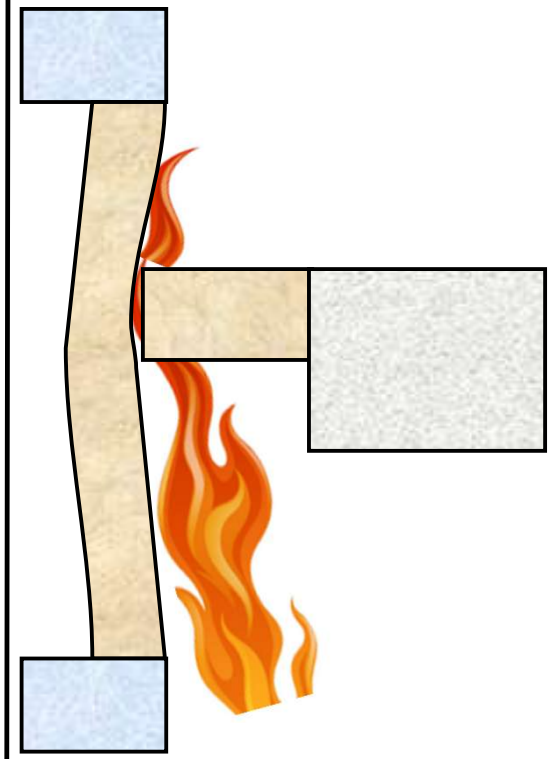


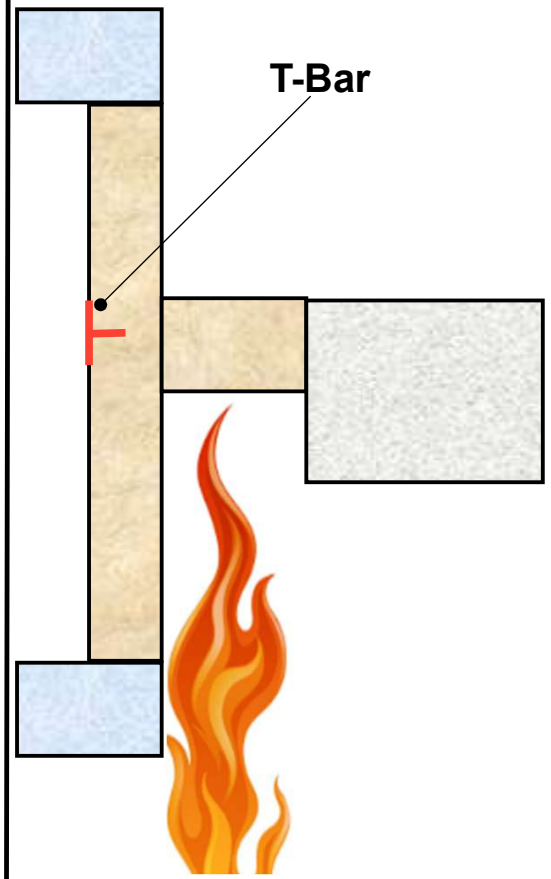
UL/Intertek ASTM E2307
Certified Mineral Wool

Component Breakdown

Backer/Reinforcement Member(s)

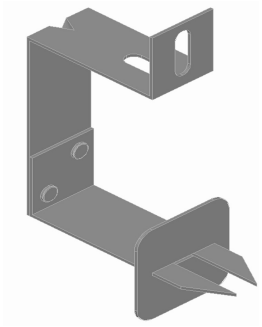




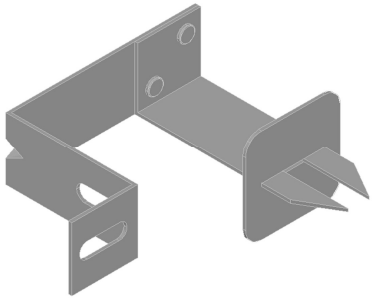


Component Breakdown

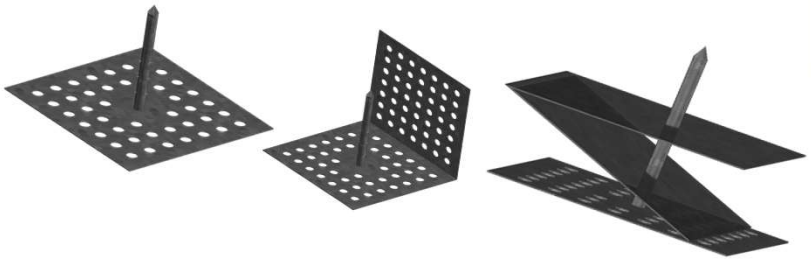
Mechanical Attachment

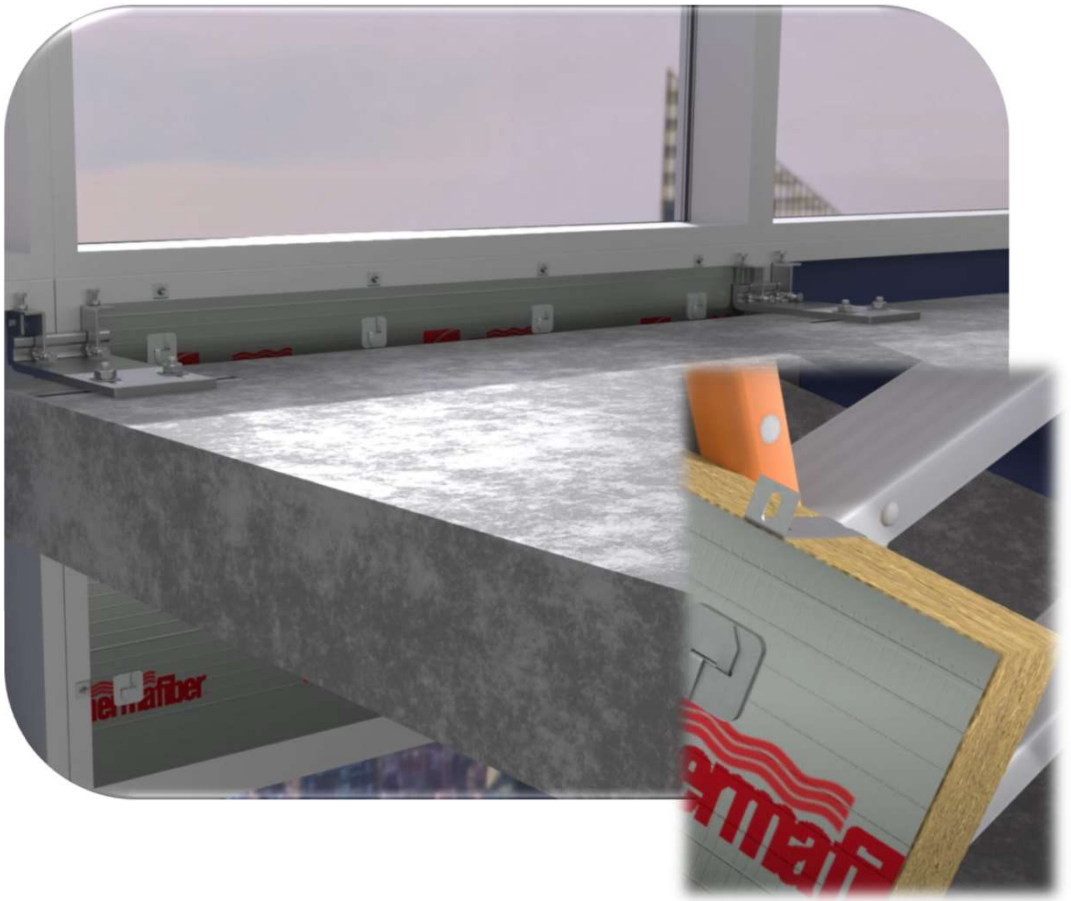


Horizontal Hanger



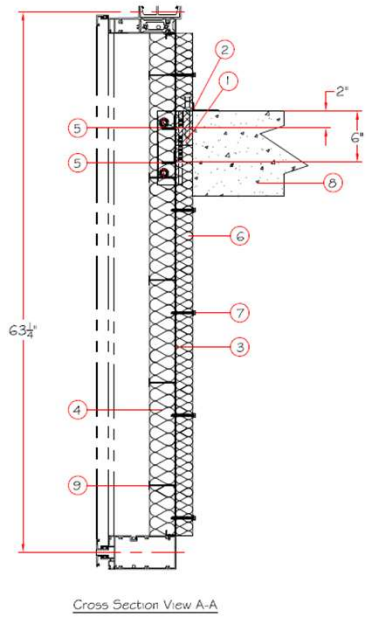
Vertical Hanger



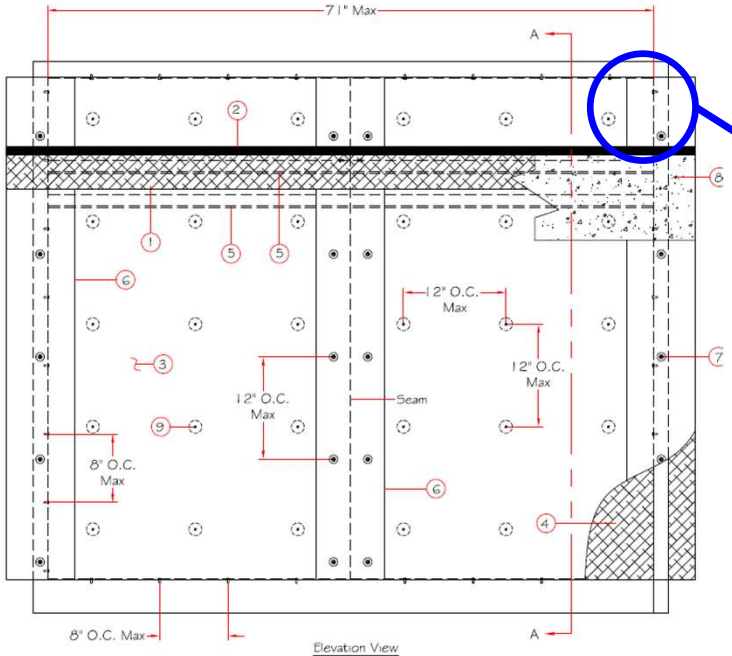


Component Breakdown

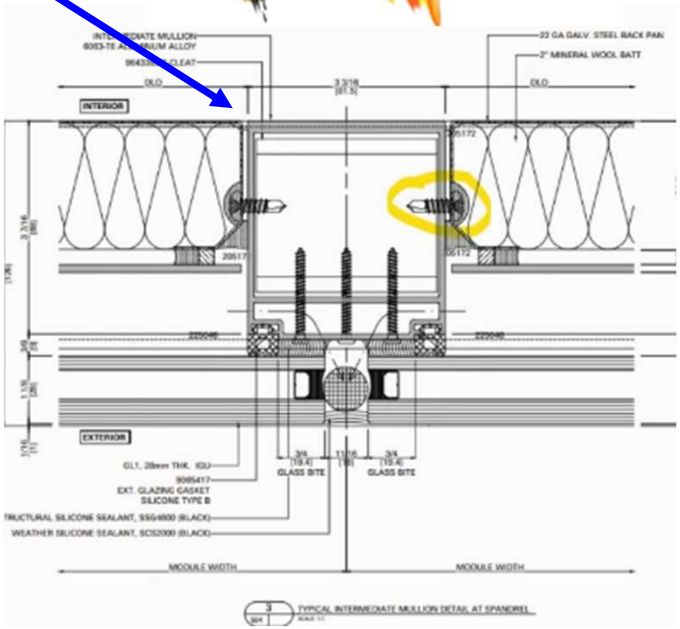
Mechanical Attachment of BP to Curtain Wall Framing



Cross Section View A-A



Elevation View

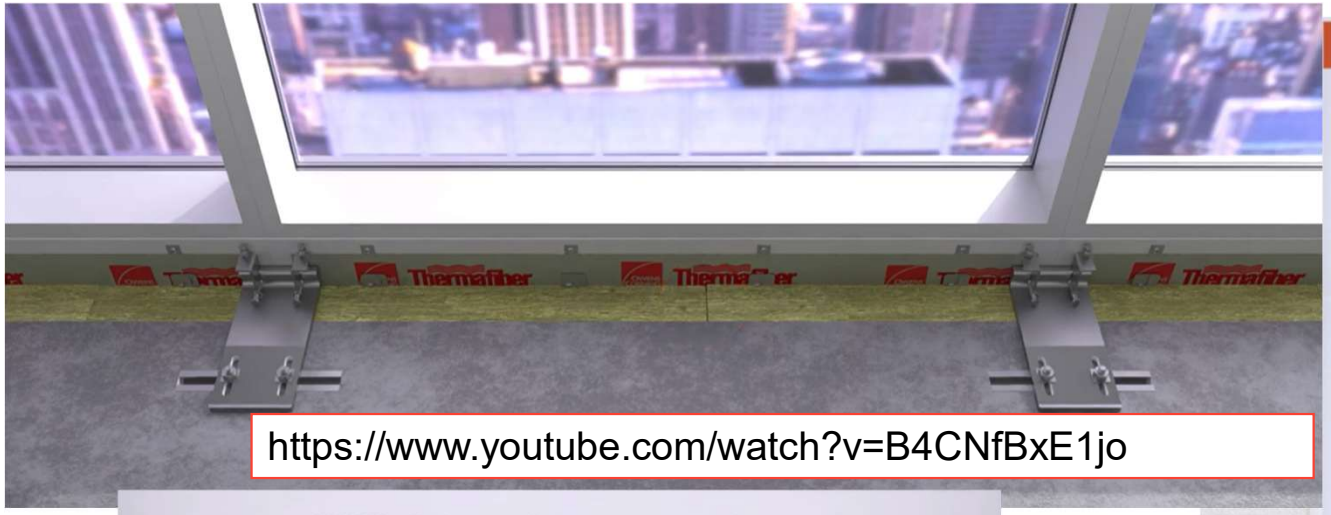


Component Breakdown

Mechanical Attachment of BP to Curtain Wall Framing

Component Breakdown

Compression of Safing Insulation



https://www.youtube.com/watch?v=B4CNfBxE1jo

XHDG - Perimeter-fire-containment Systems

See General Information for Perimeter-fire-containment Systems

System No. CW-D-1014

August 02, 2018

F Rating — 2 Hr

T Rating — 1/2 Hr

Linear Opening Width — 4 In. Max

L Rating At Ambient — Less Than 1 CFM/sq ft

L Rating At 400 F — Less Than 1 CFM/sq ft

Class II Movement Capabilities — 5% Vertical Shear

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Perimeter-fire-containment Systems

Guide Information for Fire-resistance Ratings

USE AND INSTALLATION

This category covers perimeter-fire-containment systems, which are specific constructions consisting of a floor with an hourly fire-endurance rating, an exterior curtain wall with no hourly fire-endurance rating, and material installed to fill gaps between the floor and the curtain wall to prevent the vertical spread of fire in a building. The hourly ratings apply only to the complete systems. The individual components are not assigned ratings and are not intended to be interchanged between systems.

The specifications for materials in a perimeter-fire-containment system and the assembly of the materials are details that directly relate to the established ratings. Information concerning these details is described in the individual systems. Materials used in these perimeter-fire-containment systems are intended to be installed in accordance with the manufacturer's instructions provided with the material. The substitution or elimination of components required in a system should not be made unless specifically permitted in the individual system or in these general guidelines.

When the joint system specifies the insulation material is to be compressed prior to installation into the joint, the uncompressed thickness necessary can be calculated as follows:

$$T_{uncomp} = (W_{nom} \times 100) / (100 - I_{comp})$$

Where:

T_{uncomp} = Uncompressed Thickness Necessary, in.

I_{comp} = Insulation Compression Percentage Specified in System, percent

W_{nom} = Nominal (Installed) Joint Width, in.

EXAMPLE:

$5.33'' = (4 \times 100) / (100 - 25)$

SAFING INSTALLATION

Determine the uncompressed width of safing to be installed into the opening using either;

1) The UL Calculation Equation

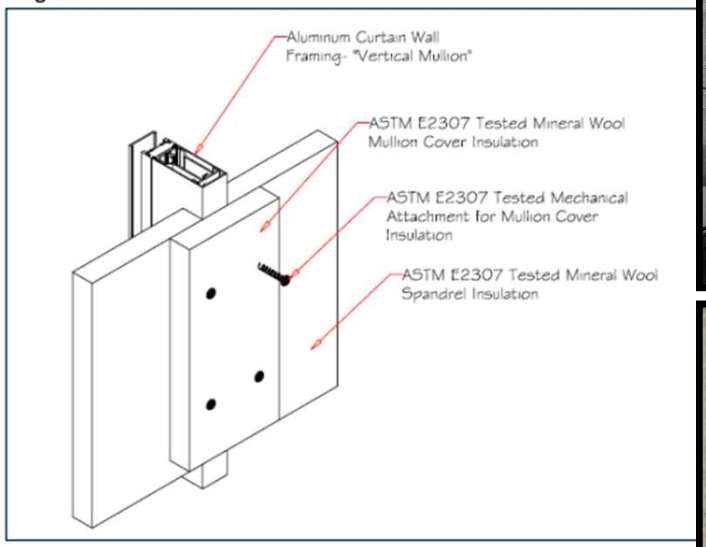
2) Thermafiber® Safing Perimeter Fire Containment Install Instructions and Calculator

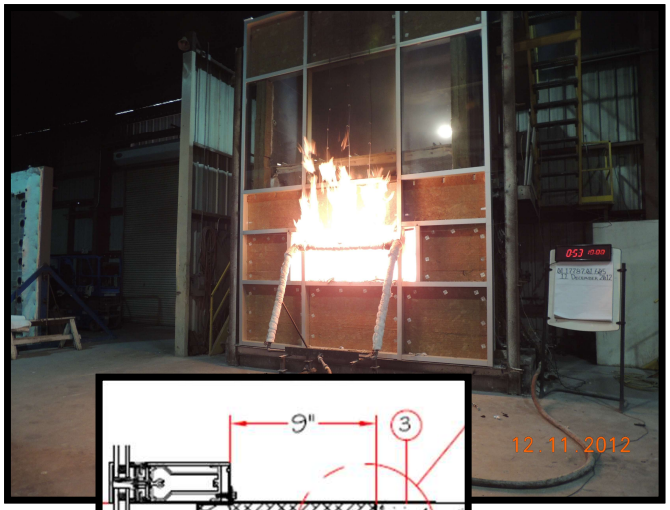
Example: For UL Design Listing CW-D-1014 the Uncompressed Width of safing insulation is 5.33" for a 4" max joint opening width

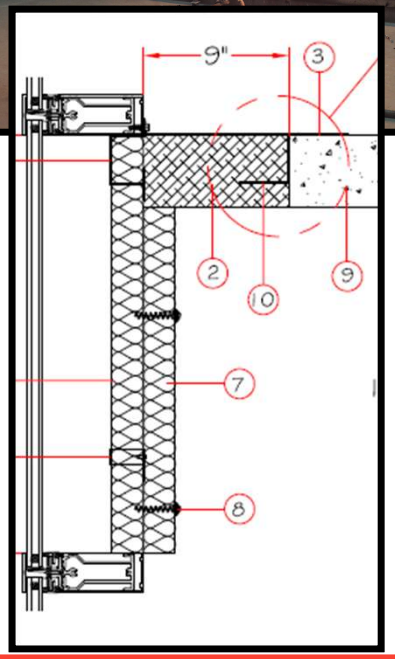
Component Breakdown

Mullion Covers

Figure 2:







Mullion Covers- To Use or Not to Use?

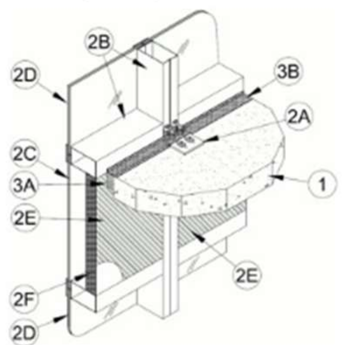
Component Breakdown

XHDG - Perimeter-fire-containment Systems

System No. CW-D-1044

September 30, 2020

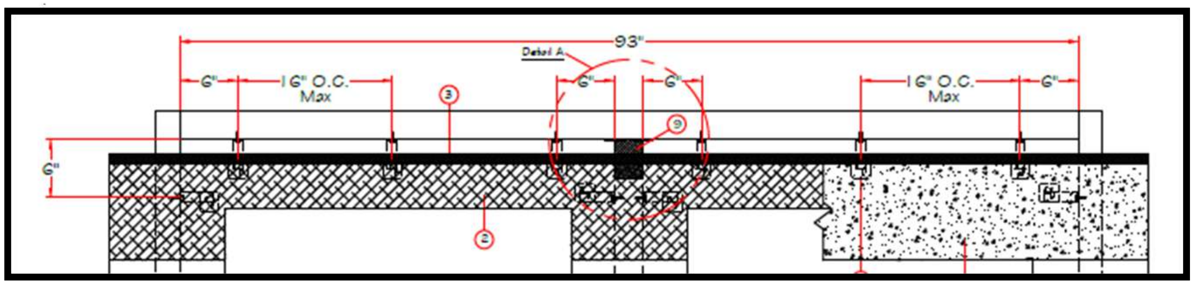
F Rating — 2 Hr
T Rating — 3/4 Hr
Linear Opening Width — 4 In. Max
L Rating At Ambient — Less Than 1 CFM/Lin Ft
L Rating At 400°F — Less Than 1 CFM/Lin Ft
Class II or III Movement Capability — +/-5% Vertical Shear (See Item 3)



3. **Safing System** — Max separation between edge of floor assembly and face of framing member at time of installation is 4 in. (102 mm). The safing system is designed to accommodate vertical shear up to 5 percent of its installed width. The safing system shall incorporate the following construction features:

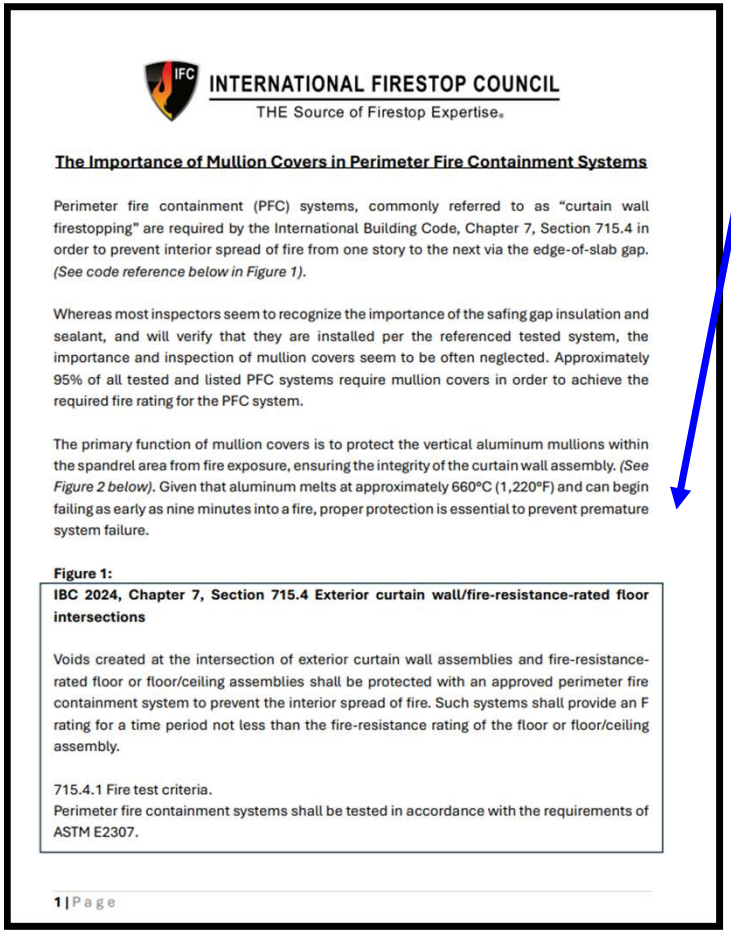
A. **Forming Material*** — Nom 4 pcf (64 kg/m³) density mineral wool batt insulation. Batt sections cut to a width of 4 in. (102 mm) and stacked to a thickness which is min 33 percent greater than the width of the linear gap between the curtain wall insulation and the edge of the concrete floor slab. The forming material is compressed min 25 percent and inserted cut-edge-first into the linear gap such that it is flush with the top surface of the floor assembly. Adjoining lengths of forming material to be tightly butted with butted seams spaced min 18 in. (460 mm) OC. Forming material to be continuous beneath mullion mounting brackets (Item 2A). Insulation depth is to be increased to a min of 6 in. (152 mm) on each side of anchor system, as needed, to maintain min 2 in. (51 mm) insulation block below lowest point of anchor system that lies within perimeter joint. The mullion fist anchor (vertical anchor component secured to the wall) may extend up to 2 in below the forming material.

THERMAFIBER/OWENS CORNING — SAF



Component Breakdown

Mullion Covers- To Use or Not to Use?



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The Importance of Mullion Covers in Perimeter Fire Containment Systems

Perimeter fire containment (PFC) systems, commonly referred to as "curtain wall firestopping" are required by the International Building Code, Chapter 7, Section 715.4 in order to prevent interior spread of fire from one story to the next via the edge-of-slab gap. *(See code reference below in Figure 1).*

Whereas most inspectors seem to recognize the importance of the safing gap insulation and sealant, and will verify that they are installed per the referenced tested system, the importance and inspection of mullion covers seem to be often neglected. Approximately 95% of all tested and listed PFC systems require mullion covers in order to achieve the required fire rating for the PFC system.

The primary function of mullion covers is to protect the vertical aluminum mullions within the spandrel area from fire exposure, ensuring the integrity of the curtain wall assembly. *(See Figure 2 below).* Given that aluminum melts at approximately 660°C (1,220°F) and can begin failing as early as nine minutes into a fire, proper protection is essential to prevent premature system failure.

Figure 1:
IBC 2024, Chapter 7, Section 715.4 Exterior curtain wall/fire-resistance-rated floor intersections

Voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies shall be protected with an approved perimeter fire containment system to prevent the interior spread of fire. Such systems shall provide an F rating for a time period not less than the fire-resistance rating of the floor or floor/ceiling assembly.

715.4.1 Fire test criteria.
Perimeter fire containment systems shall be tested in accordance with the requirements of ASTM E2307.

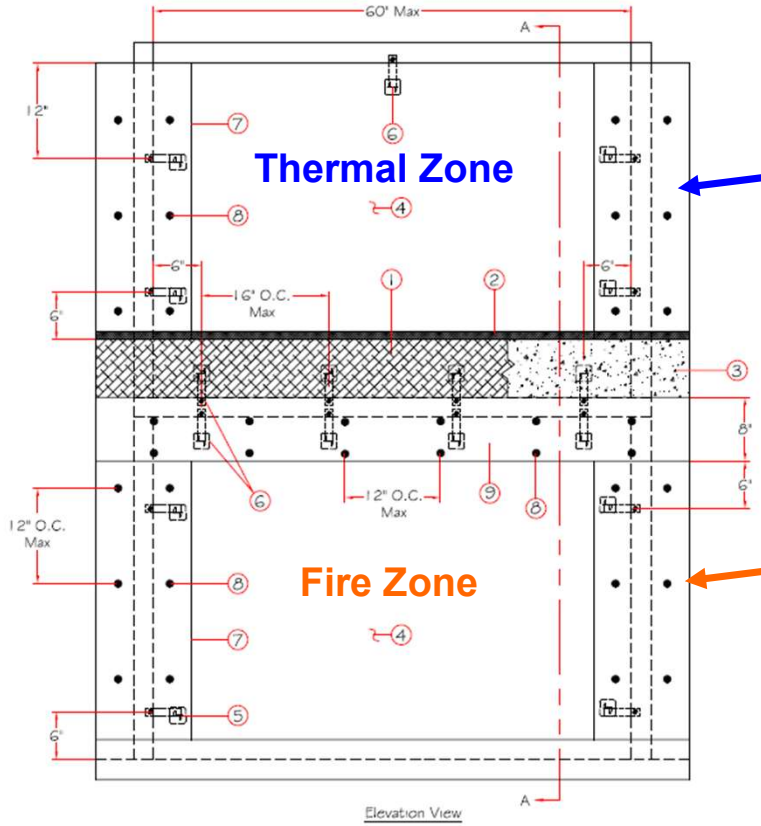
1 | Page

When Mullion Covers Are Not Required

Even though about 95% of all tested and listed PFC systems require mullion covers, a small fraction of available system designs may achieve the desired fire resistance rating without them. Those tested designs demonstrate that alternative methods can provide sufficient protection. It stands to reason that about 95% of engineering judgments (EJs) for perimeter fire containment should probably specify the need for mullion covers, unless the project condition matches a referenced system which does not require the need for mullion protection. Yet an abnormally and surprisingly large proportion of PFC EJs do not specify mullion covers. Those charged with review and approval of PFC EJs should stay aware that proposed EJ's without mullion covers should require careful evaluation and additional scrutiny, considering factors such as spandrel height, additional protective elements, and anchor locations where flame penetration risks may be higher. Don't be afraid to ask for the referenced tests or listings that would support the lack of mullion covers in a PFC EJ.

Component Breakdown

Mullion Covers- To Use or Not to Use?

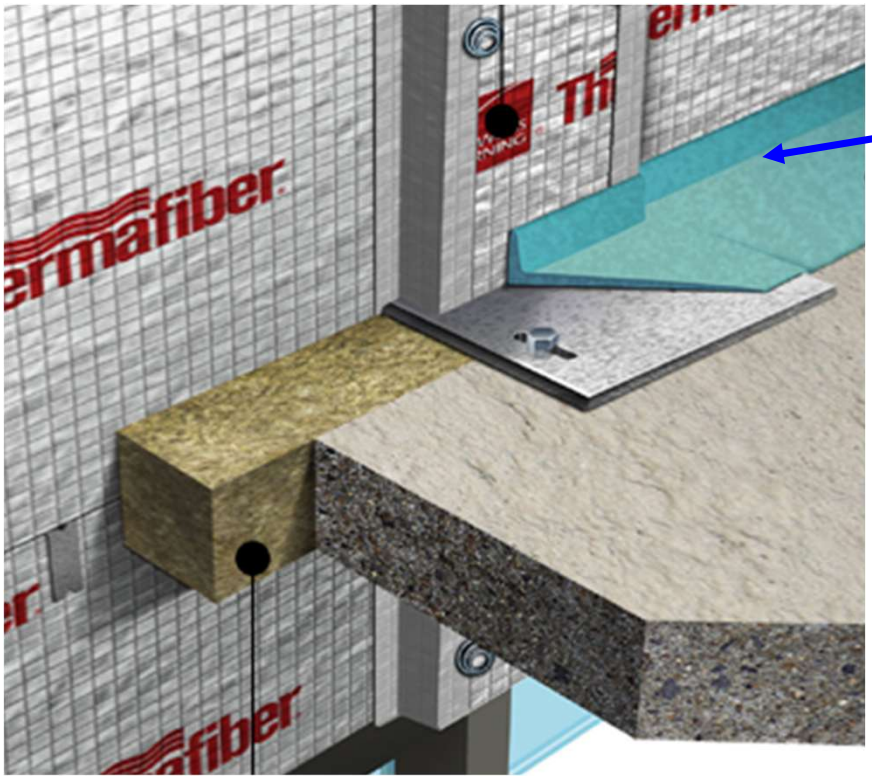


Mullion Covers Optional

95% of Listed Systems Require Mullion Cover Protection

Component Breakdown

E2307 Tested Smoke Barrier



Smoke Sealant: Impedes Passage of Smoke- Not Fire

E2307 Tested Smoke Barrier

Component Breakdown

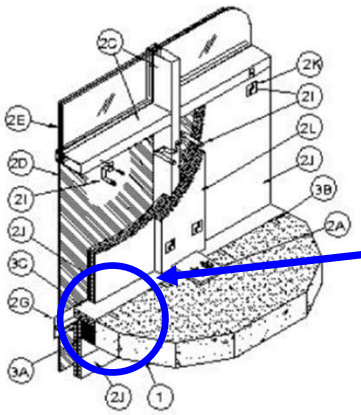
What is needed to stop smoke?

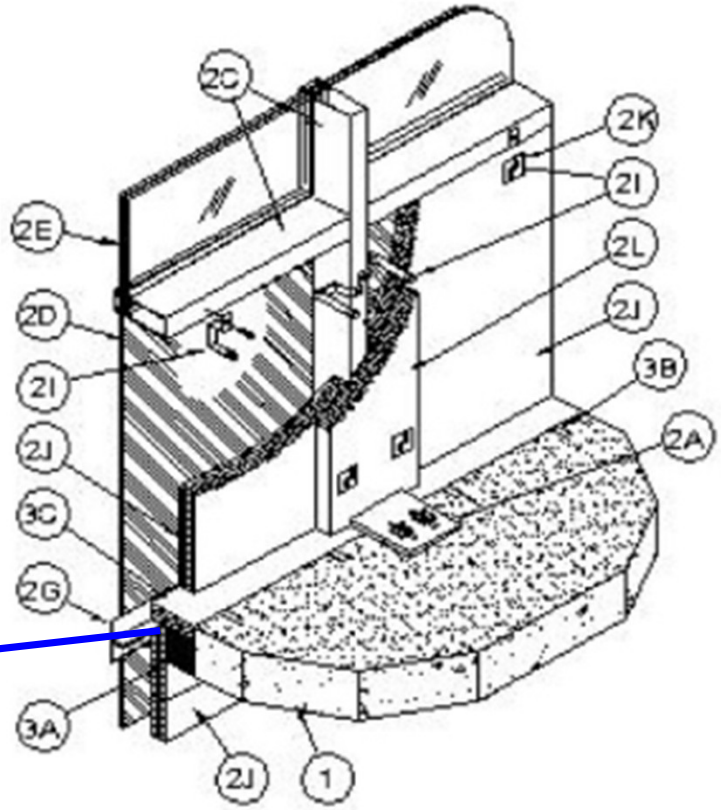
XHDG - Perimeter-fire-containment Systems

System No. CW-D-2036

January 25, 2008

F Rating — 2 Hr
T Rating — 1/4 Hr
Integrity Rating — 2 Hr
Insulation Rating — 1/4 Hr
Linear Opening Width — 4 In. Max
Class II Movement Capabilities — 5% Vertical Shear (See Item 3)





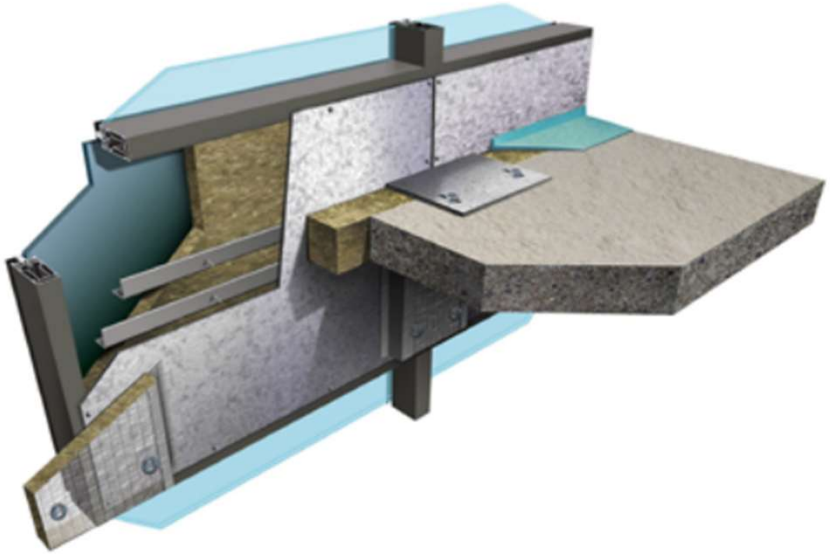
E2307 Tested Smoke Barrier

Component Breakdown

What is needed to stop smoke?

Special CW Conditions

Interior BPs vs. Foil Faced MW Systems



Unitized Back Pan System

Foil Faced MW System

Considerations for Interior BPs

Special CW Conditions

Advantages:

- Galv. Steel pan doesn't melt during fire
- Durable Vapor Barrier
- Keep unitized panel protected
- Can provide structural support to cw

Disadvantages:

- Costlier components
- Requires significant mech. Attachment to CW framing
- Severe oil canning when exposed to fires- requiring additional reinforcement
- Adds weight to PFC system- Impact fire performance
- Most difficult PFC configuration for fire testing
- Panels are cumbersome @ CW anchors
- Impossible to inspect for proper installation of PFC system

Special CW Conditions

Interior BPs vs. Foil Faced MW Systems

Advantages:

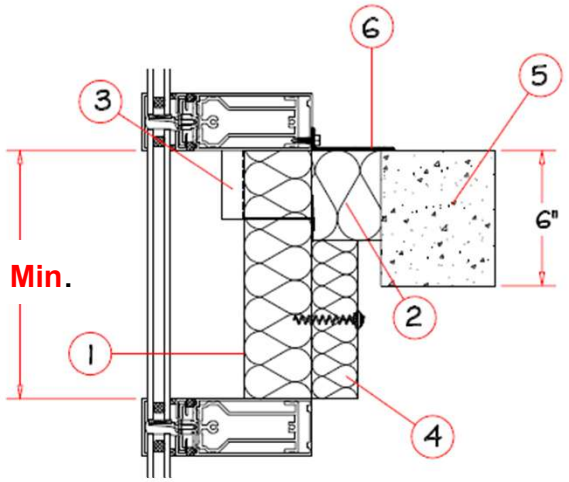
- Foil Facing provides less costly vapor barrier
- Typically, less reinforcement needed
- Fewer mech. attachment to framing
- No worry about oil canning
- Insulation easier to work around CW anchors
- Easier for PFC Inspections

Disadvantages:

- Foil is easy to puncture- compromising vapor barrier
- Requires more taping for continuous VB
- Requires more taping/repair once installed
- Not as protective as paneled systems for outside storage

Special CW Conditions

Spandrel Heights



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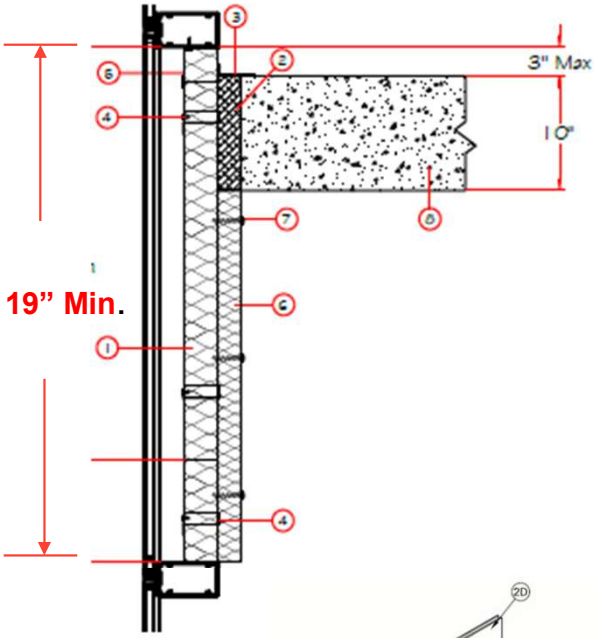
Division 07 – Thermal and Moisture Protection
07 84 00 Firestopping
07 84 53 Building Perimeter Firestopping

Thermafiber, Inc.
Design No. TFI/BPF 180-07
Perimeter Fire Barrier System
Thermafiber® Firespan® 120
Thermafiber® Safing
ASTM E 2307
F-Rating: 180 Minutes
T-Rating: 56 Minutes
Cycling: NA



Perimeter Fire-containment Systems

Fire-containment Systems

System No. CW-D-1014

May 08, 2013

F Rating — 2 Hr

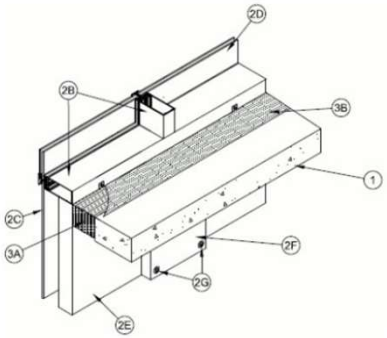
T Rating — 1/2 Hr

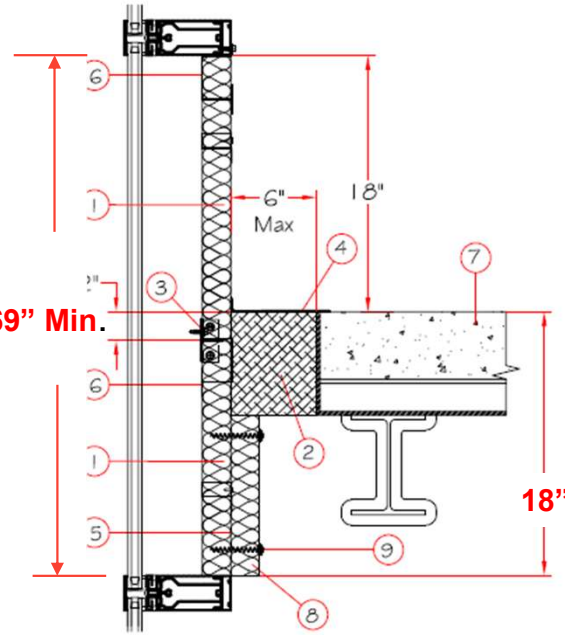
Linear Opening Width — 4 In. Max

L Rating At Ambient — Less Than 1 CFM/sq ft

L Rating At 400 F — Less Than 1 CFM/sq ft

Class II Movement Capabilities — 5% Vertical Shear





Perimeter Fire-containment Systems

eter Fire-containment Systems

System No. CW-D-2039

May 21, 2008

F Rating — 2 Hr

T Rating — 1/4 Hr

Integrity Rating — 2 Hr

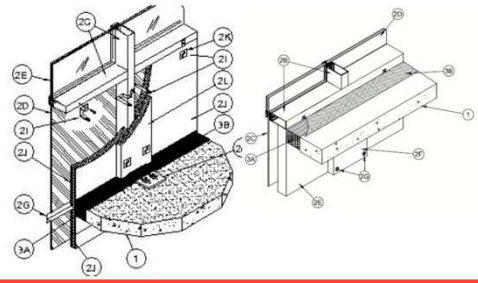
Insulation Rating — 1/4 Hr

Linear Opening Width — 4 In. Max

L Rating At Ambient — Less Than 1 CFM/Lin Ft

L Rating At 400°F — Less Than 1 CFM/Lin Ft

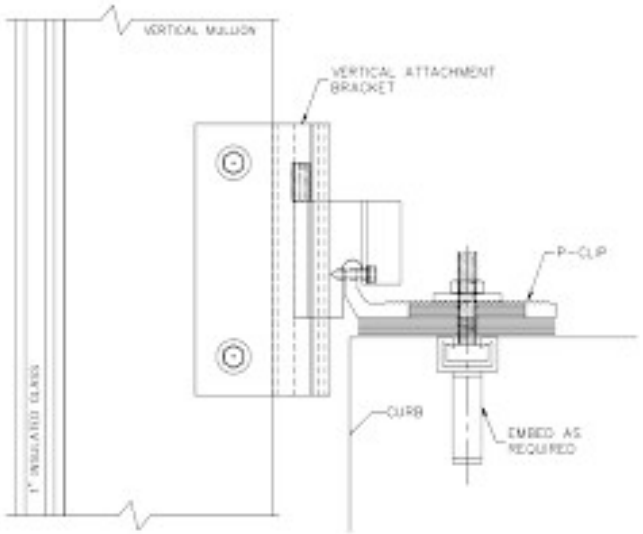
Class II Movement Capabilities - 5% Vertical Shear (See Item 3)

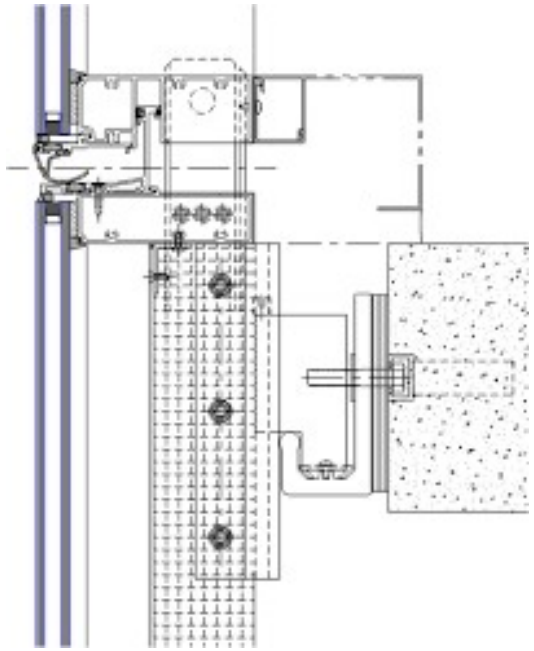


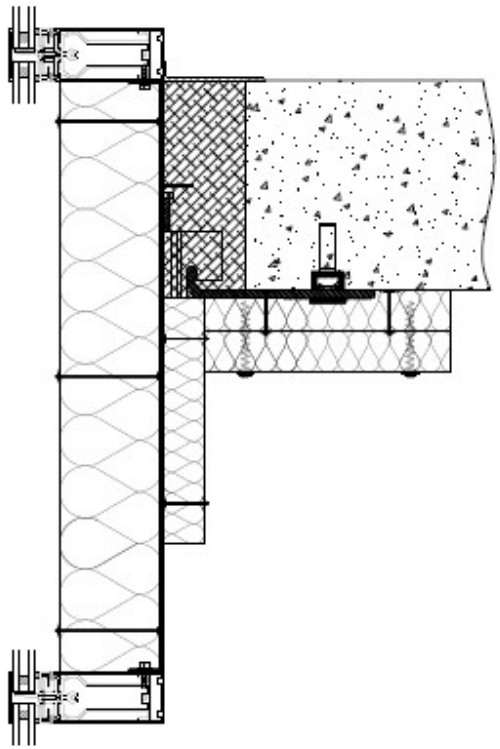
Special CW Conditions

Curtain Wall Anchors

Note: ASTM E2307 does not test a functioning anchor during fire test.







Curtain Wall Anchors

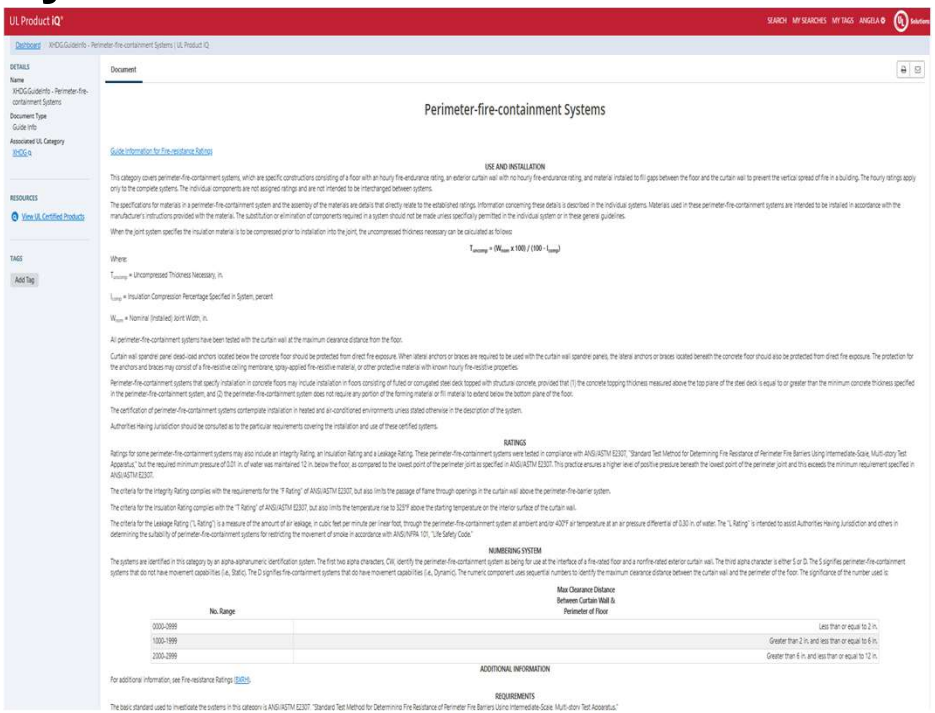
Special CW Conditions

Considerations

- UL Fire Resistance Directory states: “Curtain wall spandrel panel dead load anchors located below the concrete floor should be protected from direct fire exposure.”
  - Unprotected curtain wall anchors exposed below the floor line create a higher probability of complete system failure

- UL has created a new category (XHDI) for perimeter fire barrier accessories, which includes an anchor protection component

UL XHDG- Guide for Perimeter Fire Containment Systems



UL Product iQ

Perimeter-fire-containment Systems

USE AND INSTALLATION

RATINGS

NUMBERING SYSTEM

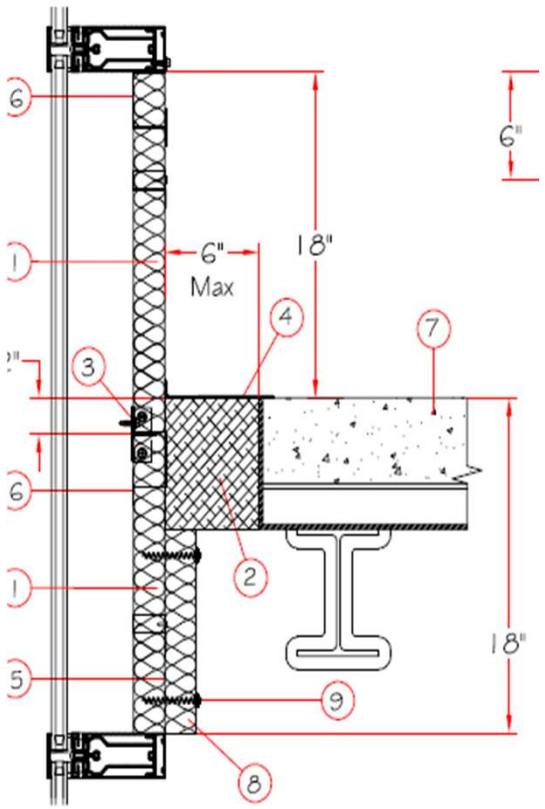
No. Range	Max Clearance Distance Between Curtain Wall & Perimeter of Floor
0000-0999	Less than or equal to 2 in.
1000-1999	Greater than 2 in. and less than or equal to 6 in.
2000-2999	Greater than 6 in. and less than or equal to 12 in.

ADDITIONAL INFORMATION

REQUIREMENTS

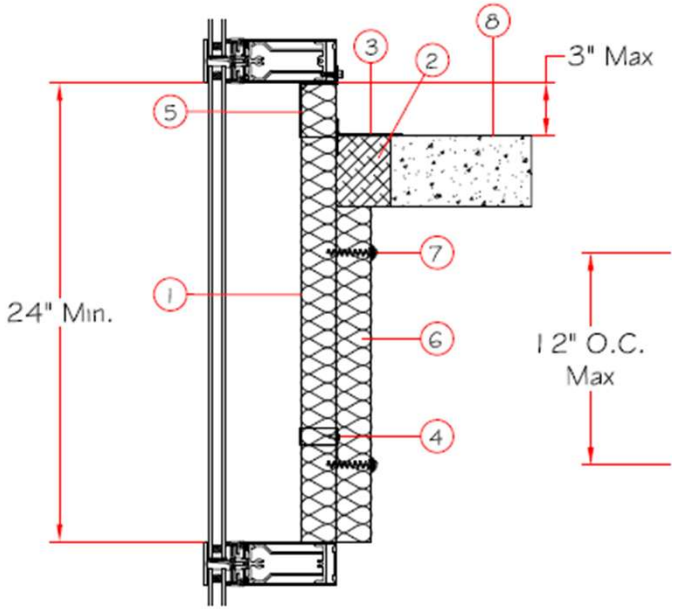
Design Selection

Design Listings



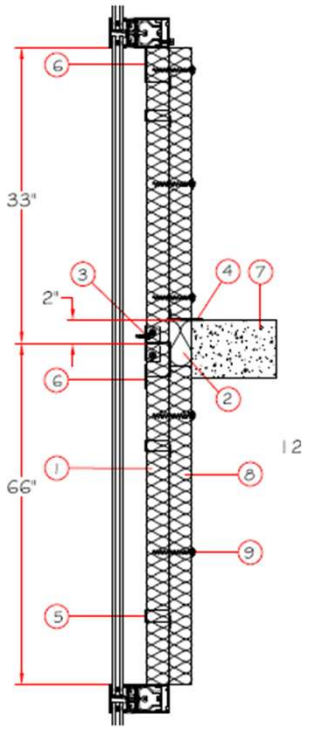
Project Condition

Option A



CW-D-1014

Option B

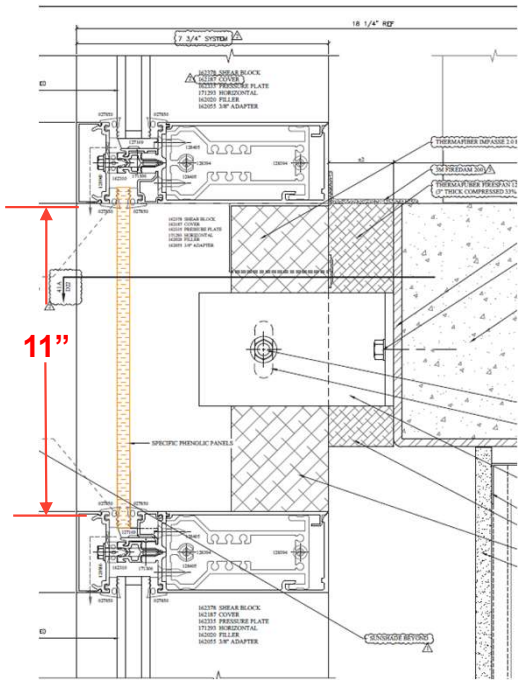


CW-D-2039

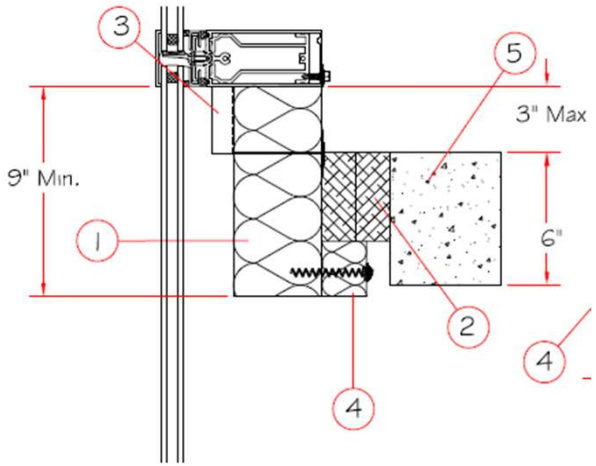
Design Selection

Design Listings

Project Condition

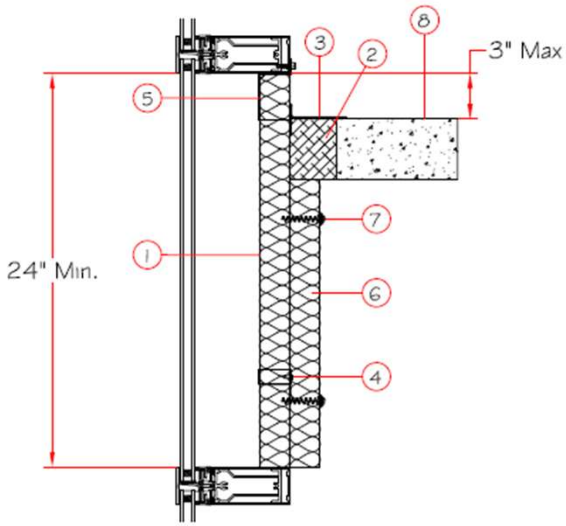


Option A



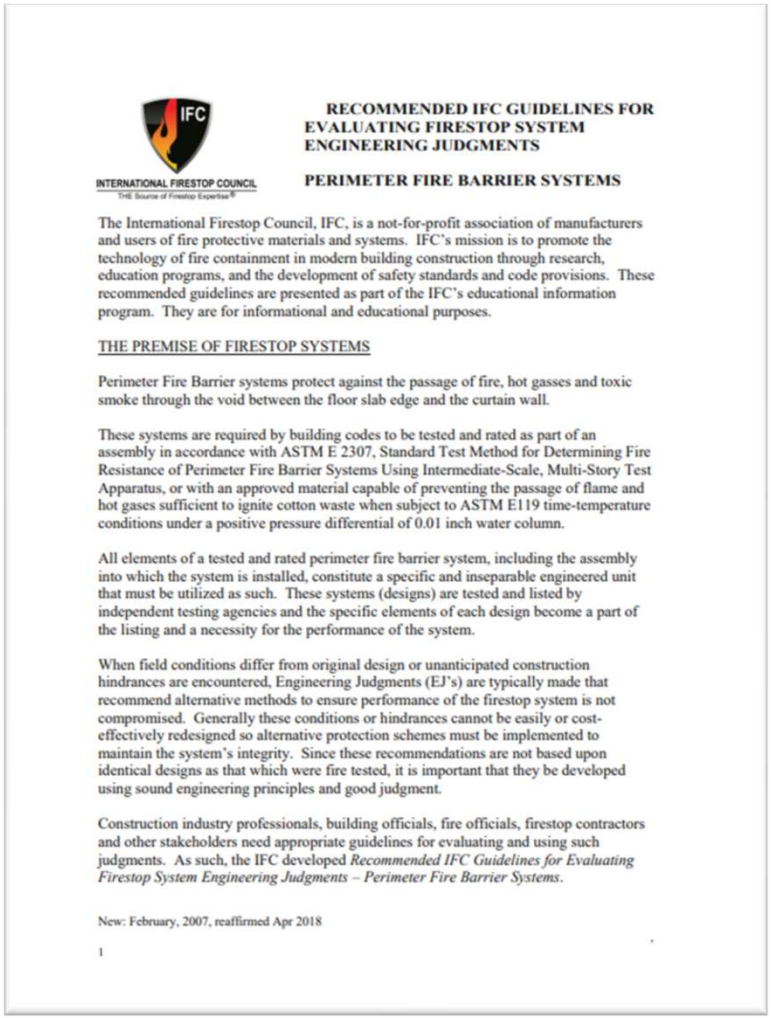
BPF/TFI 120-15

Option B



CW-D-1015

Engineering Judgement (EJs)



INTERNATIONAL FIRESTOP COUNCIL
THE Source of Firestop Expertise®

RECOMMENDED IFC GUIDELINES FOR EVALUATING FIRESTOP SYSTEM ENGINEERING JUDGMENTS

PERIMETER FIRE BARRIER SYSTEMS

The International Firestop Council, IFC, is a not-for-profit association of manufacturers and users of fire protective materials and systems. IFC's mission is to promote the technology of fire containment in modern building construction through research, education programs, and the development of safety standards and code provisions. These recommended guidelines are presented as part of the IFC's educational information program. They are for informational and educational purposes.

THE PREMISE OF FIRESTOP SYSTEMS

Perimeter Fire Barrier systems protect against the passage of fire, hot gasses and toxic smoke through the void between the floor slab edge and the curtain wall.

These systems are required by building codes to be tested and rated as part of an assembly in accordance with ASTM E 2307, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Test Apparatus, or with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subject to ASTM E119 time-temperature conditions under a positive pressure differential of 0.01 inch water column.

All elements of a tested and rated perimeter fire barrier system, including the assembly into which the system is installed, constitute a specific and inseparable engineered unit that must be utilized as such. These systems (designs) are tested and listed by independent testing agencies and the specific elements of each design become a part of the listing and a necessity for the performance of the system.

When field conditions differ from original design or unanticipated construction hindrances are encountered, Engineering Judgments (EJ's) are typically made that recommend alternative methods to ensure performance of the firestop system is not compromised. Generally these conditions or hindrances cannot be easily or cost-effectively redesigned so alternative protection schemes must be implemented to maintain the system's integrity. Since these recommendations are not based upon identical designs as that which were fire tested, it is important that they be developed using sound engineering principles and good judgment.

Construction industry professionals, building officials, fire officials, firestop contractors and other stakeholders need appropriate guidelines for evaluating and using such judgments. As such, the IFC developed *Recommended IFC Guidelines for Evaluating Firestop System Engineering Judgments – Perimeter Fire Barrier Systems*.

New: February, 2007, reaffirmed Apr 2018

1

IFC Engineering Guidelines

Engineering Judgement (EJs)

IFC Engineering Guidelines

Perimeter Fire Barrier system engineering judgments should:

1. **Not be used in lieu of tested systems when tested systems are available**.

2. **Be issued** only by **firestop manufacturer's qualified technical personnel** or, in concert with the manufacturer, by a **knowledgeable registered Professional Engineer**, or Fire Protection Engineer, or an **independent testing agency that provides listing services for the systems.**

3. **Be based upon interpolation of previously tested perimeter fire barrier systems** that are either **sufficiently similar in nature** or clearly bracket the conditions upon which the judgment is to be given.

Engineering Judgement (EJs)

IFC Engineering Guidelines

Perimeter Fire Barrier system engineering judgments should:

4. …It is important to understand that although it is the joint between the slab edge and curtain wall that is evaluated during testing, **the surrounding construction components** and insulation of the system is also important in insuring acceptable joint performance.

5. Be limited **only to the specific conditions and configurations** upon which the engineering judgment was rendered…

6. Be accepted **only for a single specific job** and location and should not be transferred to any other job or location without a thorough review of all aspects of the next job or location's circumstances.

Engineering Judgement (EJs)

IFC Engineering Guidelines

Quality engineering judgements follow IFC guidelines and include:

1. **Letter of judgement**
   - References the specific project's documents and drawings
   - Documents the basis of design
   - References the most closely representative listed design(s) for the given condition(s)
     - If more than one listed design is referenced, the engineering judgement must also include specific design criteria from each referenced design
   - Justifies hourly judgement
     - Where variance exists from the listed systems, we provide descriptive justifications of how the system will provide the hourly ratings

2. **Drawing**
   - Represents the given condition(s)
   - Includes the critical elements required to make the system perform to the Integrity and F ratings
   - Gives a clear understanding of how the assembly should be constructed

Thank you.

Angela M. Ogino

Technical Services Leader

Email: angela.Ogino@owenscorning.com