Expansion Joint Fire Barriers: Principles, Practices & Problems

EX201

Thursday, June 21, 2018 10:30 – 11:30 PM

1 LU HSW

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to constitute approval, sponsorship or endorsement by AIA of any method, product, service, enterprise or organization.

The statements expressed by speakers, panelists, and other participants reflect their own views and do not necessarily reflect the views or positions of The American Institute of Architects, or of AIA components, or those of their respective officers, directors, members, employees, or other organizations, groups or individuals associated with them.

Questions related to specific products and services may be addressed at the conclusion of this presentation.

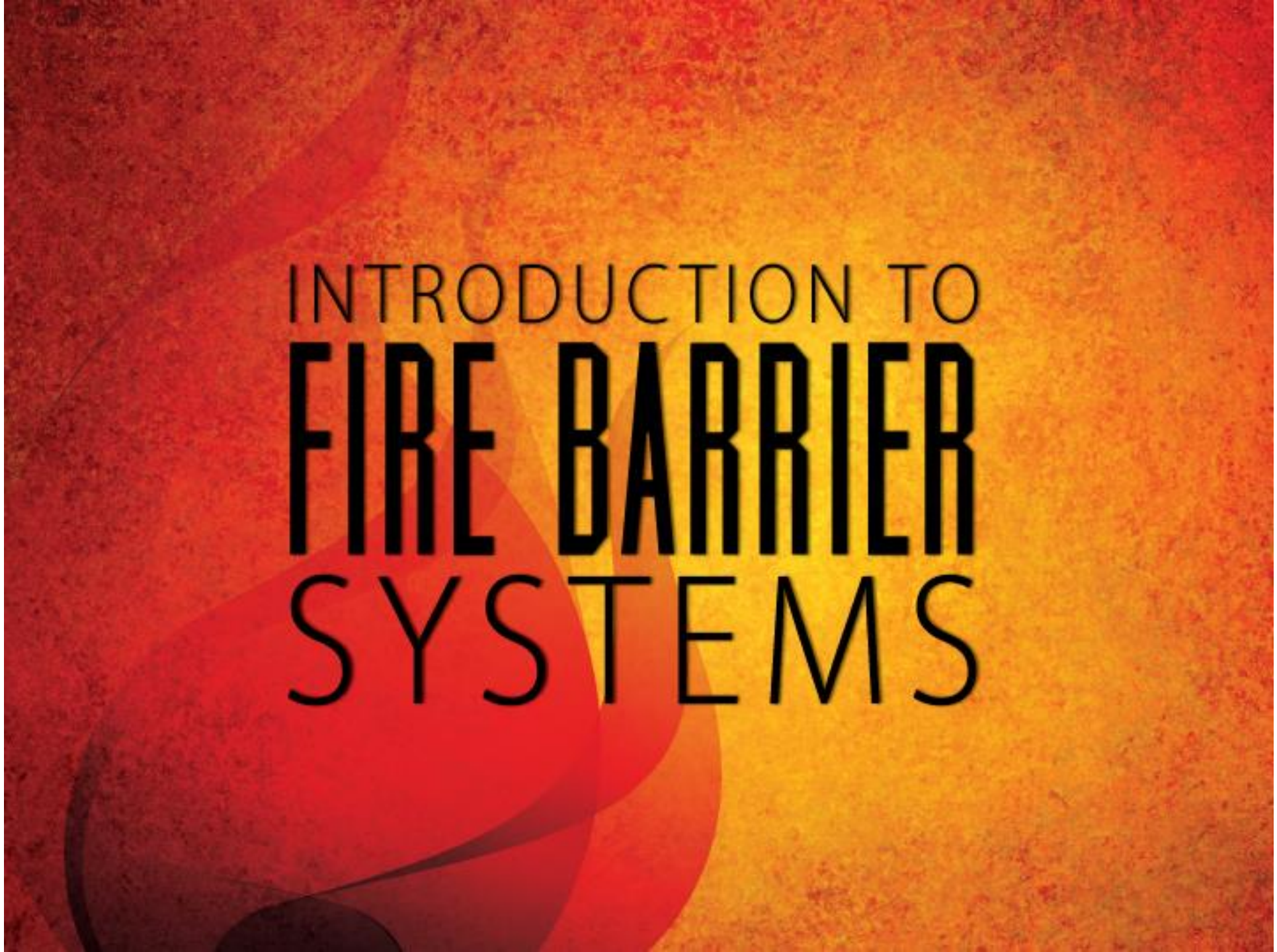
Speaker

Matthew Fisher, LEED-AP, CDT
Senior Product Manager
Expansion Joint Systems

inpro®

Learning Objectives

- Master a basic understanding of fire barriers as related to expansion joint systems.
- Define industry standard fire barrier types, ratings and testing protocols.
- Identify proper barrier detailing of common building conditions.
- Distinguish good barrier installations from those that increase vulnerabilities.
- Examine system failure causes and their remedies.


INTRODUCTION TO
FIRE BARRIER
SYSTEMS

Fire Barrier origins

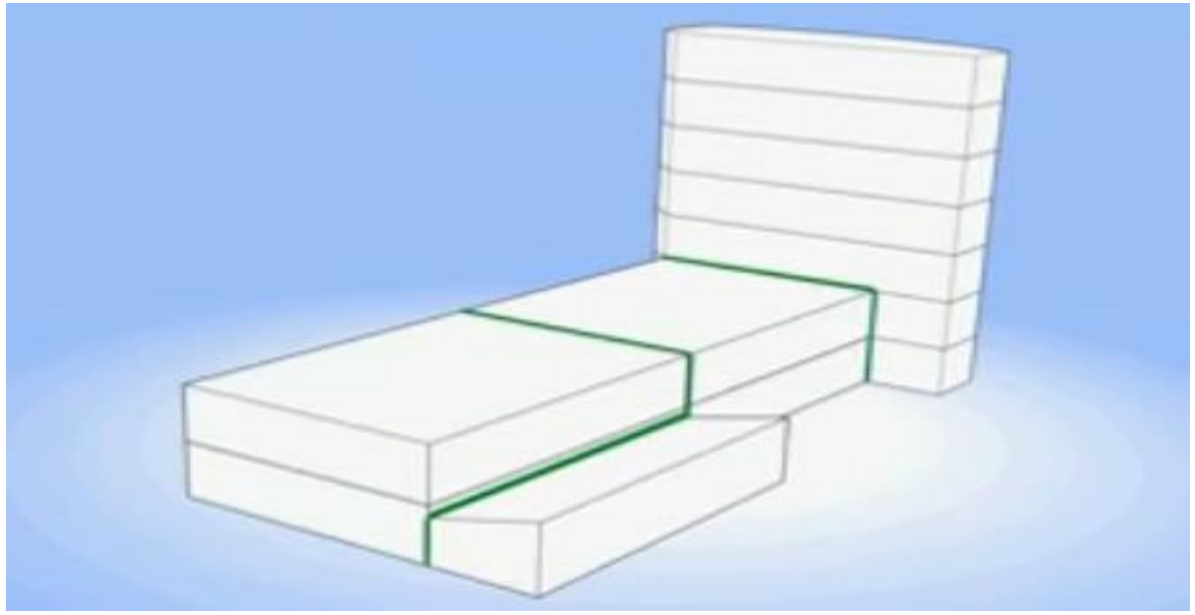
"On the morning of November 21, 1980, 84 people died and 679 were injured as a result of a fire at the MGM Grand Hotel in Las Vegas, Nevada."

The MGM Grand Hotel Fire Investigation Report

Introduction to Fire Barriers

Definition:

A continuous assembly used to prevent fire and smoke from penetrating an expansion joint opening into adjacent spaces. This is required for a specified amount of time while matching the movement requirements of the structure.

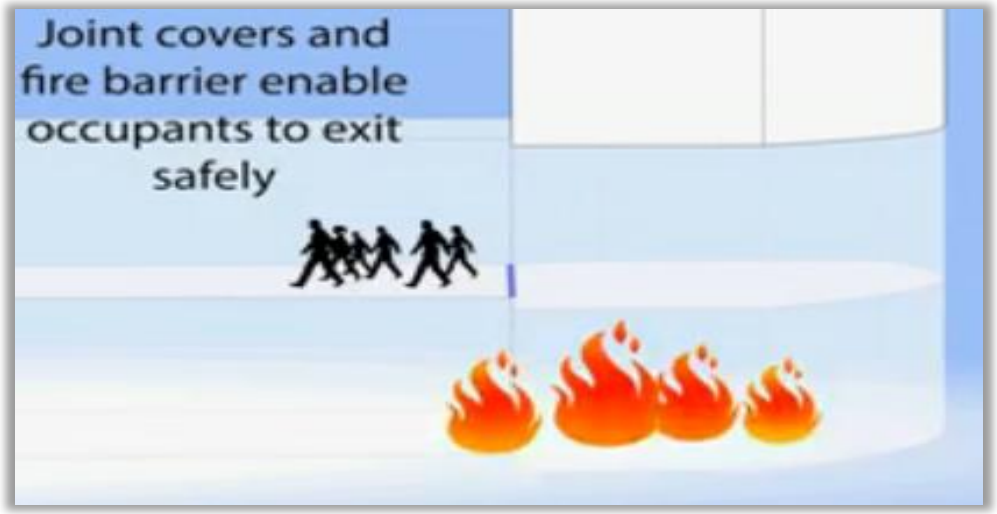


Introduction to Fire Barriers

Purpose:

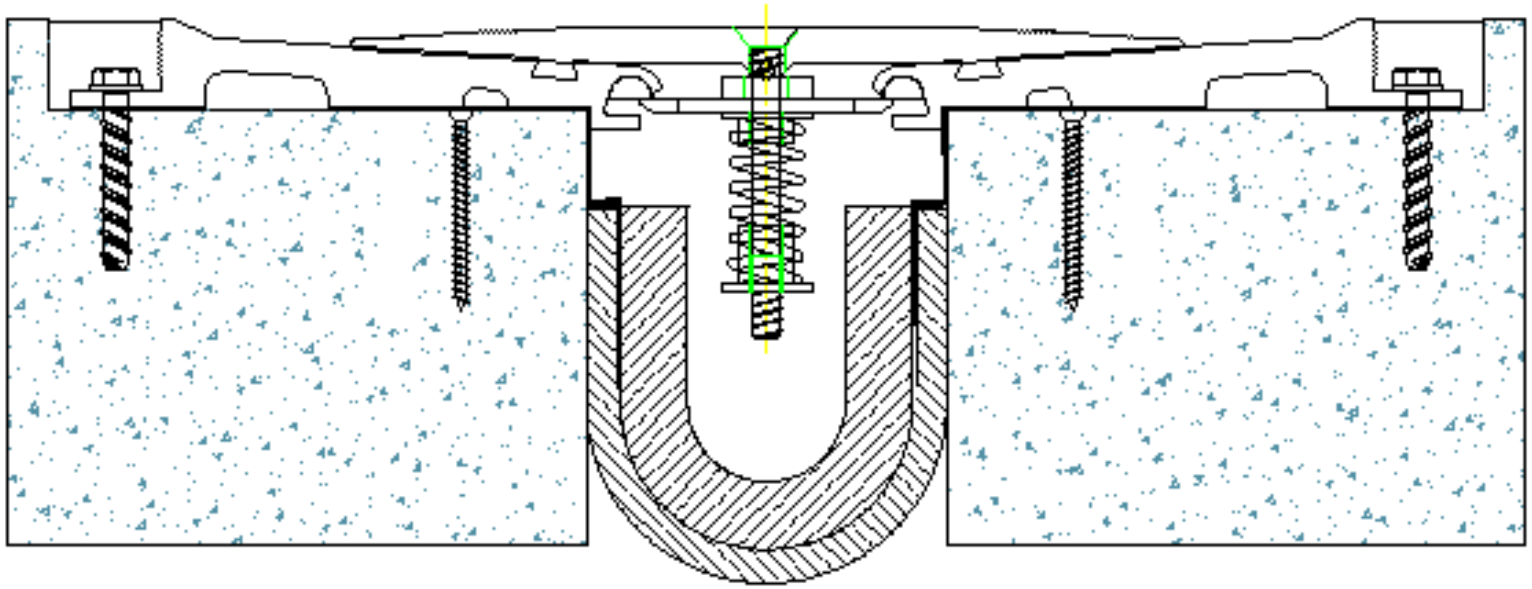
Joints and slab openings inherently create a pathway for fire and smoke to spread throughout the structure.

Fire barriers exist to keep the threat contained – with 1, 2, 3, and 4 hour rated options – to provide for life safety through a means of egress.



Fire Barrier Concepts

“Cool Side”



“Threat Side”
(Fire and Smoke)

FIRE BARRIER

PRODUCT TYPES

Types of Fire Barriers

- *COMPRESSION TYPE*
  - *Typically for 4” and smaller expansion gap widths with little movement*
- *INTUMESCENT TEXTILES*
  - *For 6” and smaller expansion gap widths with larger movement*
- *RATED FOAMS*
  - *For 6” and smaller conditions where abuse is not likely*
- *FIRE BLANKETS*
  - *2 - 32” range applications with high rates of seismic movement*

Types of Fire Barriers

COMPRESSION SYSTEMS

- **Mineral Wool and Sealant**
  - Rock and mineral wool strips held in place through compression.
  - Topped with fire caulk sealant to secure in place and protect from water infiltration
  - Only 20%+- (often less) movement capability
  - For 1-4” (25-125mm) joint gaps only

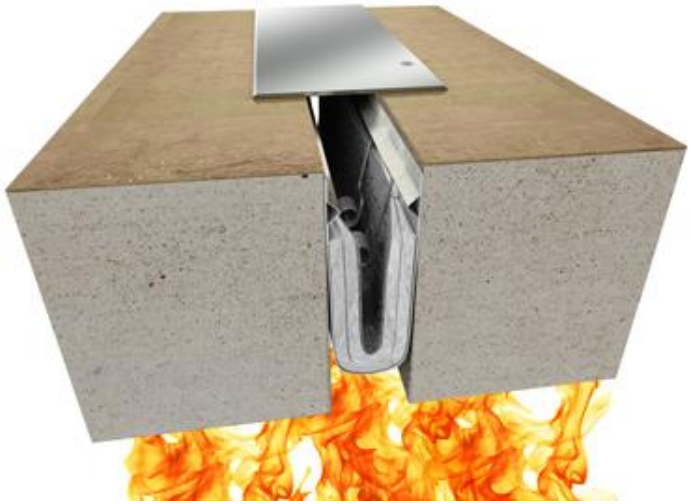
THERMAL CONDITIONS

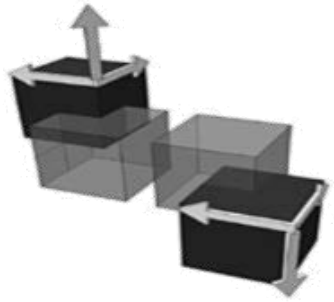
Traits > Cost-effective, non-invasive, and easy to install for the novice on small width joints.
***Limited movement**

Types of Fire Barriers

HYBRID FIRE BARRIERS

- Combination of a Compression system and a Fire Blanket
- Intumescent textile systems also fall within this definition
- Up to 50%+- movement
- 2-6” (25-150mm) joint widths meeting the majority of building needs in moderately active regions





X, Y, Z AXIS MOVEMENT

***Traits > Typically these are thinner walled systems easing fit within the joint throat for a more consistent installation.**

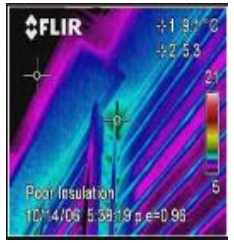
Types of Fire Barriers

FIRE-RATED FOAMS

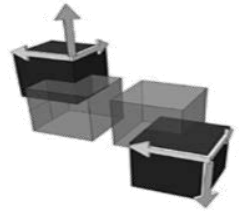
- Open-cell polyurethane foam impregnated with a fire-retardant material with a 50%+- movement capability
- Can be faced with colored silicone
- Addresses Accoustic and R-Values in some cases as well
- Tested in concrete decks and gypsum/ cement-board wall conditions

***Traits > Anchoring through use of epoxy. Great application for projects where minimal environmental interruption is required. Downside is the extremely high cost and susceptibility to abuse.**

SOUND ABSORBING



THERMAL PROPERTIES



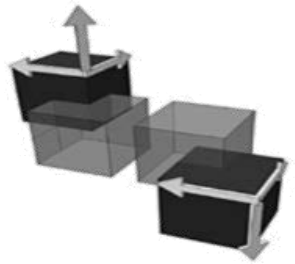
X, Y, Z AXIS MOVEMENT

Types of Fire Barriers

FIRE BLANKETS

- Various types available-
  - Ceramic cloths / Intumescent layering/ SS foil and Insulating Blanket layering
- Typically 50%+- movement although 100%+- compression and expansion available from some Manufacturers
- Addresses gaps from 2-36” (50-900mm)
- Some models are able to retain their Hour Rating throughout lateral shear movement
- Tested in concrete but applicable to a variety of substrate conditions given proper AHJ approval

SEISMIC CAPABLE



X, Y, Z AXIS MOVEMENT

***Traits > Highly versatile system that can meet any project conditions. Note complexity of installation sequence when choosing systems.**

Proper Product Selection- *The 4 Steps*

I. IDENTIFY RATING REQUIREMENTS

- Products available in 1-4 Hour Ratings
- Must match the Deck or Wall Rating
- 2 Hour requirements most common for EJ's

II. CODE & TESTING COMPLIANCE

- Official products carry with them Stamped Certifications specific to their application
- A total Fire Protection solution includes:
  1. A Fire Barrier
  2. The Architectural joint cover
  3. Attachment to the adjacent UL-Rated Assemblies

Proper Product Selection

III. MOVEMENT CRITERIA

- Fire Barrier solution must match the project's structural movement requirements.
- Ensure the EJ cover does not hamper capabilities

  (Industry Standards = 25%+- (Thermal) or 50%+- (Seismic) movement patterns

IV. LIABILITY

- Different Manufacturer Barrier systems *cannot* be co-mingled.
- Include Specification language that requires removal of 10% of the installed coverplates for inspection purposes
- Pay special attention to seams and transitions

LIFE SAFETY TESTING

Fire Rating Standards

UL 2079 combines widely recognized testing methodologies

UL 2079 Related Building standards:

- **ASTM E119 – Adjacent Building Elements**
  Standard Test Methods for Fire Tests of Building Construction and Materials
- **ASTM E1966 – Specific to Expansion Joints**
  Standard Test Method for Fire-Resistive Joint Systems
- **ASTM E1399 – Specific to Building Expansion/ Contraction**
  Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems

Distinct Testing Requirements

Rigorous testing requirements:

1. **Cycle Testing** at 500 cycles at varying rates to attempt to dislodge or break
2. **2000 degree burn** per ASTM Standards dictated for an allotted amount of time
3. **Firefighter Hose Stream** Testing

1

Fire Barrier mounted to cycling apparatus

2

Vertical Oven Testing

Distinct Testing Requirements

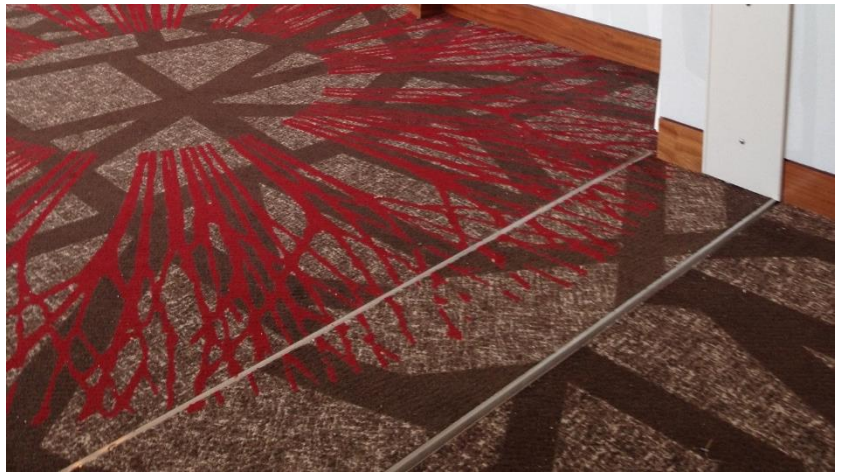
2

Horizontal Oven Testing

3

All vertical fire barriers are to be subjected to the impact, erosion and cooling effects of a hose stream

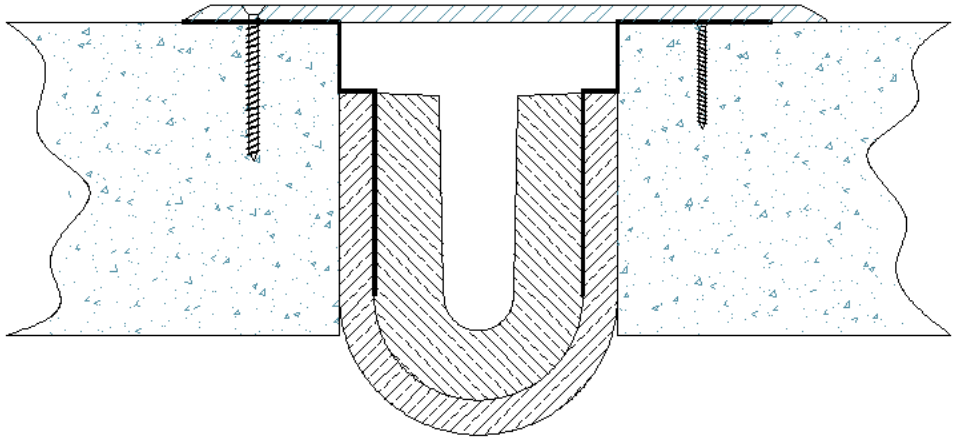
A Word on Coverplates



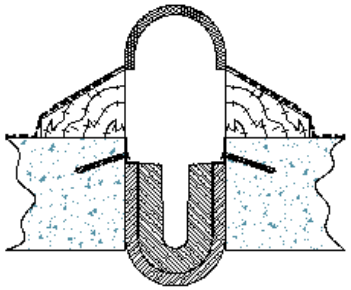
Tested Conditions

Standard Fire Test

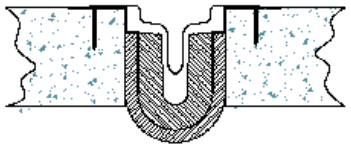
PASSED WITH THE COVERPLATE SECURED DIRECTLY TO BARE CONCRETE



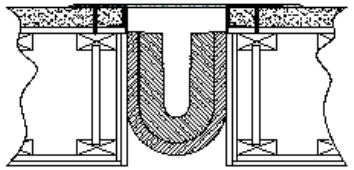
JUDGEMENT REQUIRED CONDITIONS:



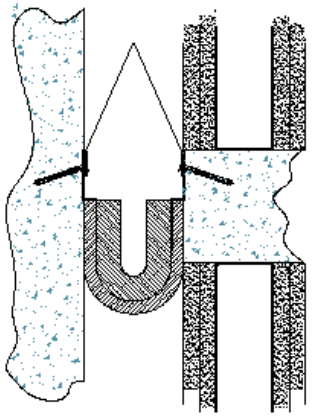
ROOF BELLOWS



SS FOIL BEHIND “SOFT” SEALS



WOOD FRAMING



GALV. STL. CHASE COVER

Approved Testing Agencies – U.S.

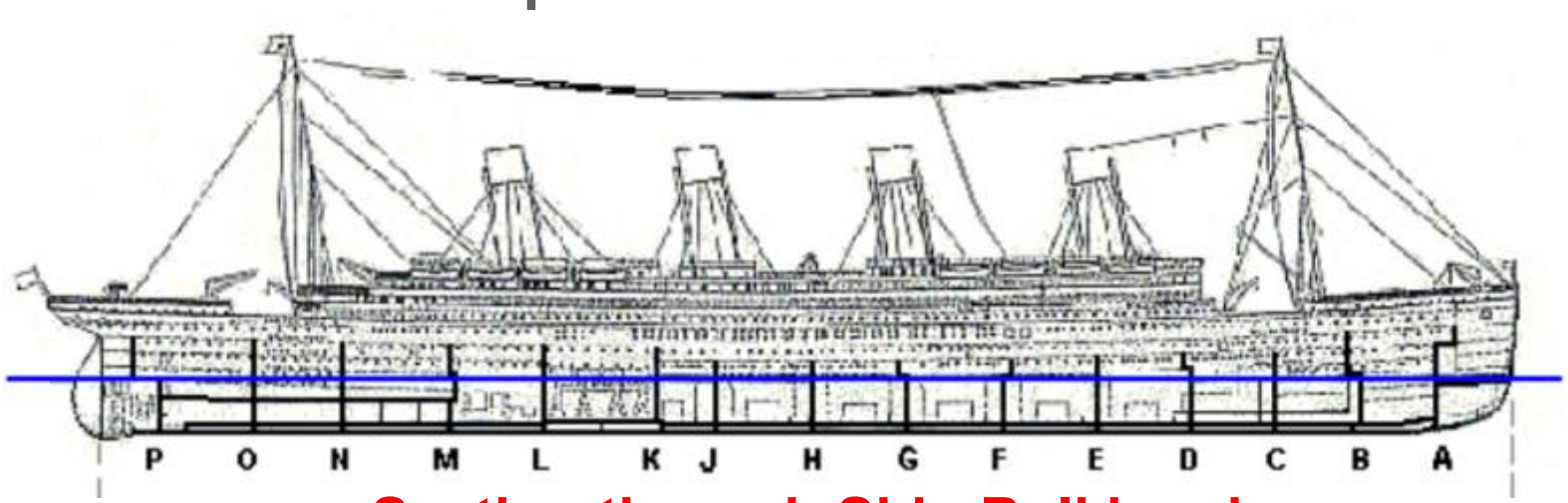
- **Intertek Testing Services**
  - Warnock-Hersey (label of Intertek)
  - Omega Point Laboratories (label of Intertek)
  - www.intertek-etlsemko.com
- **Southwest Research Institute**
  - www.swri.org
- **Underwriters Laboratories, Inc. (UL)**
  - www.ul.com
- **Guardian Fire Testing Laboratories, Inc.**
  - www.firetesting.com/

No design is possible until the materials with which you design with are completely understood

Ludwig Mies van der Rohe

PROPER DETAILING

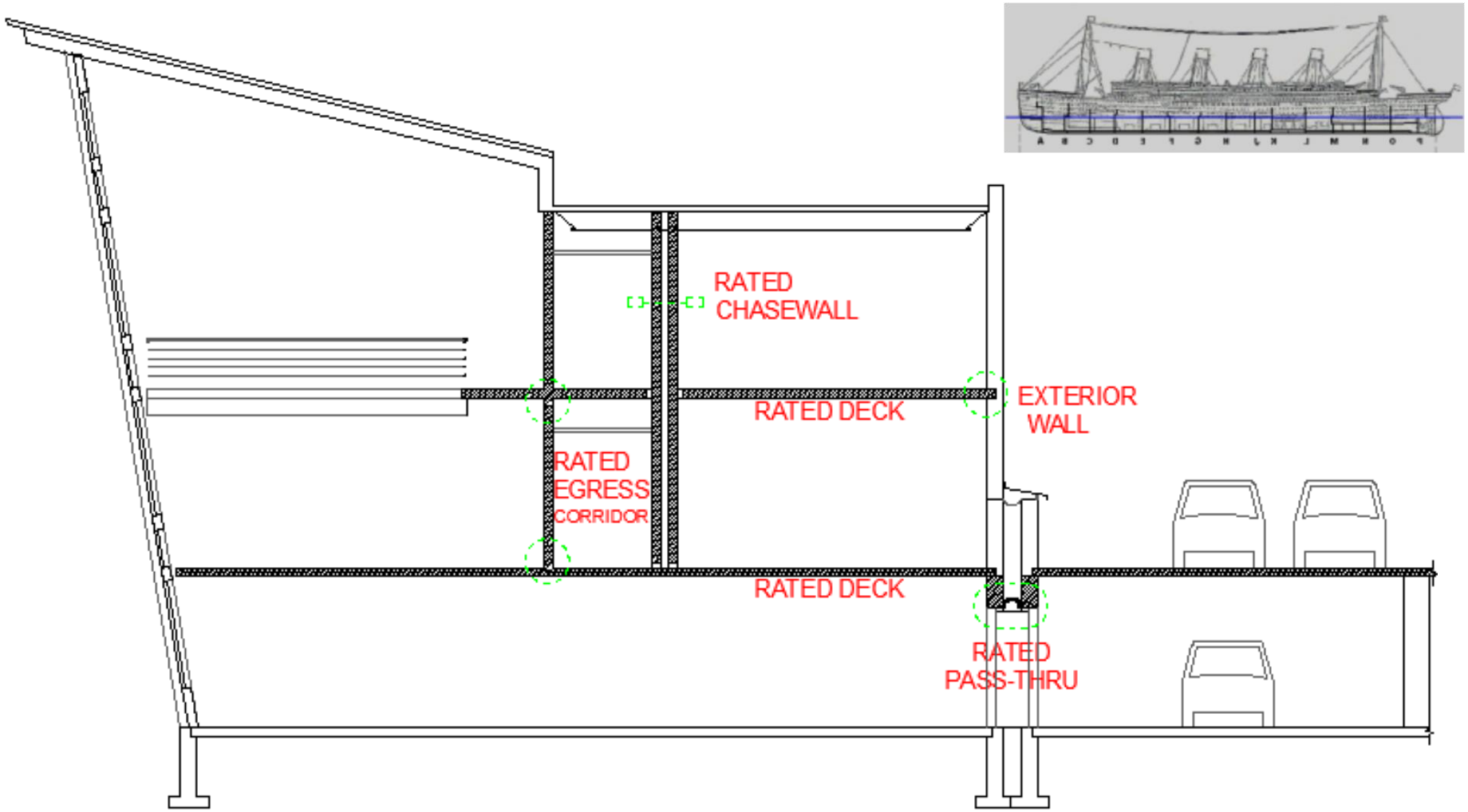
Compartmentalization



Section through Ship Bulkheads

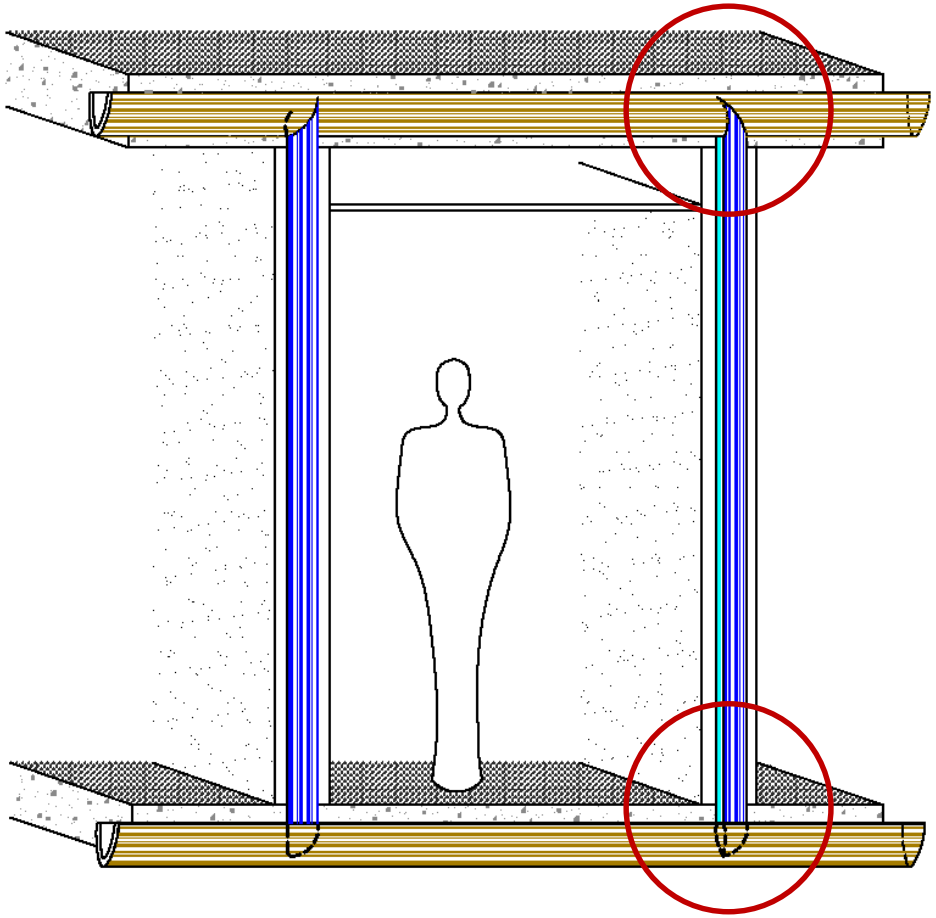
Immense pressure of leaks

Compartmentalization

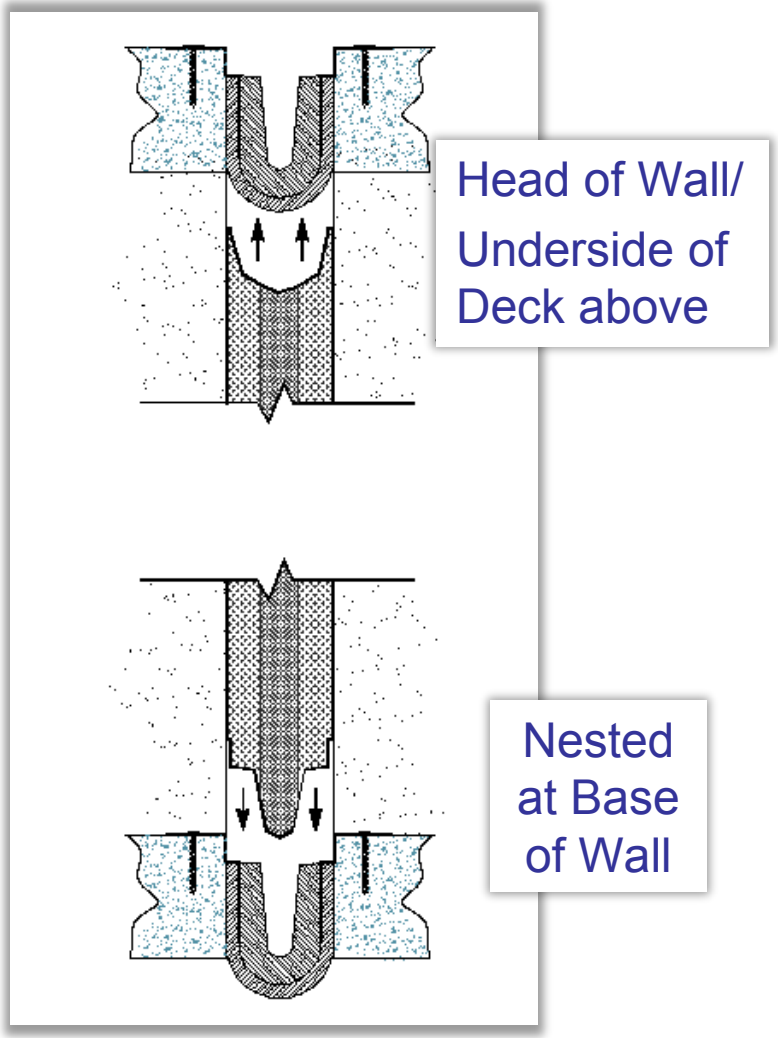


SECTION THROUGH EXPANSION JOINT

Accurate Detailing



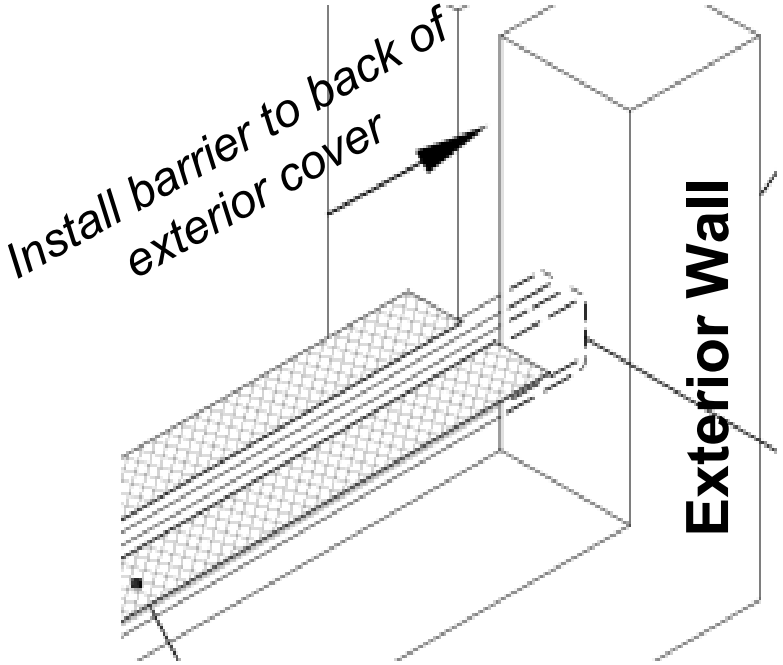
Section through Rated Corridor



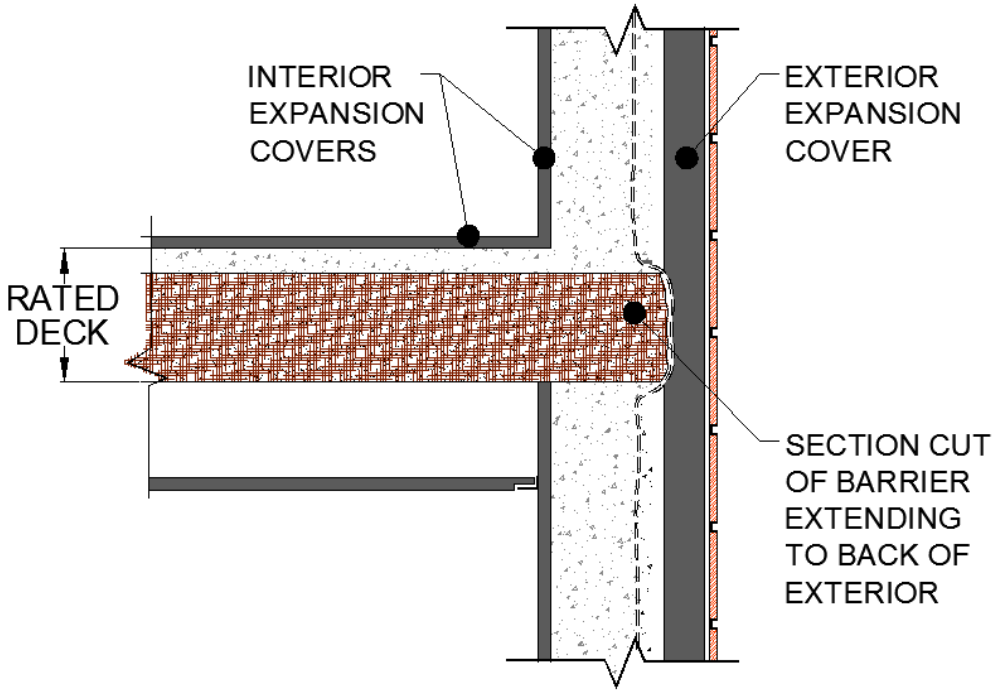
Head of Wall/
Underside of
Deck above

Nested
at Base
of Wall

Accurate Detailing

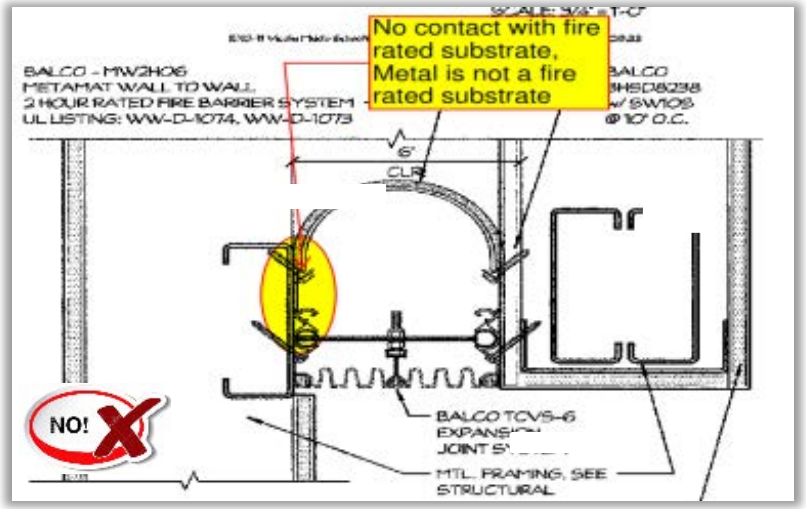


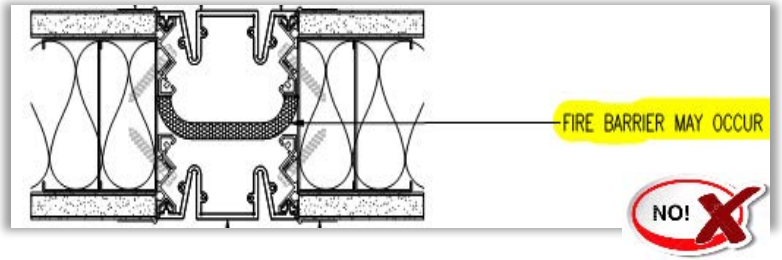
Isometric of
Blanket Termination

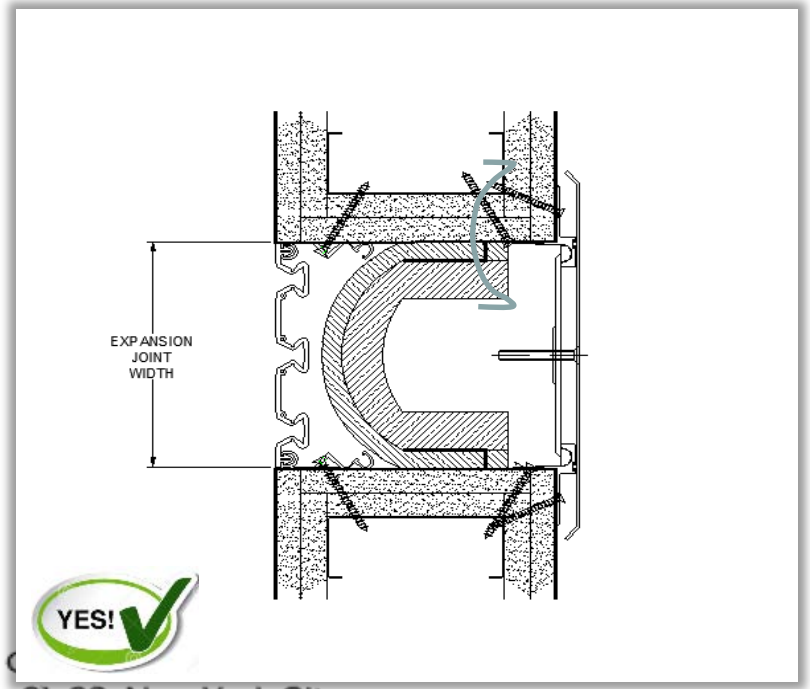


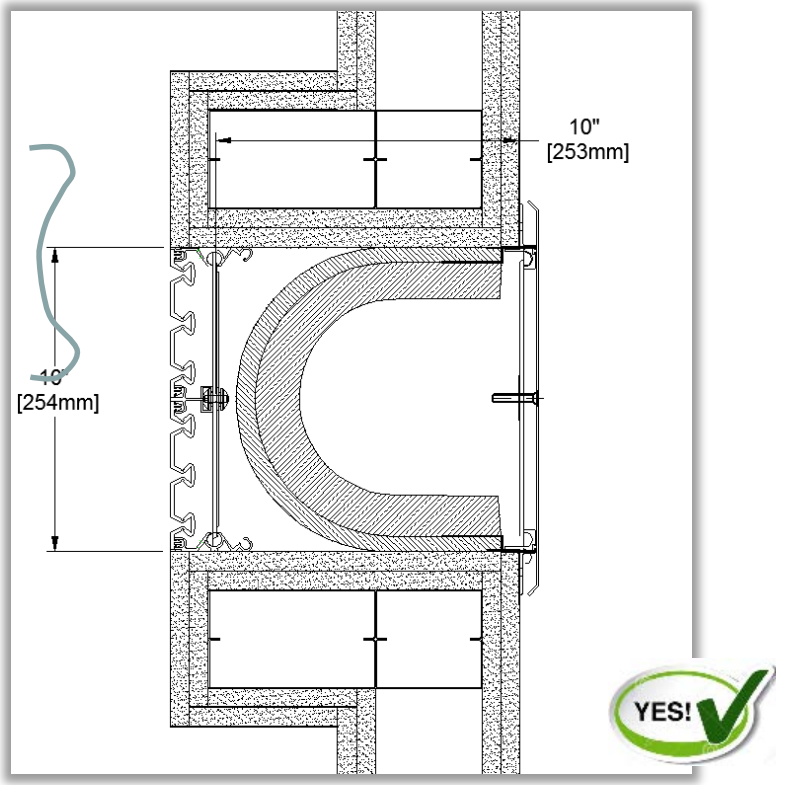
Section of Exterior Wall
Rated Condition

Accurate Detailing

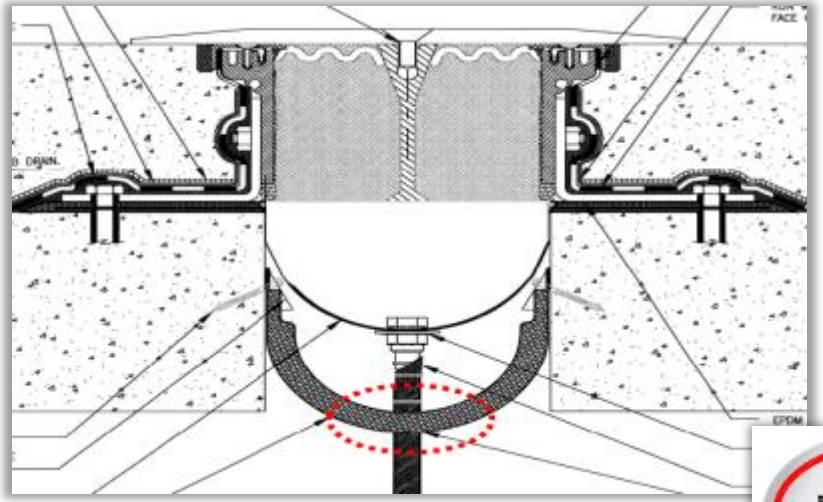




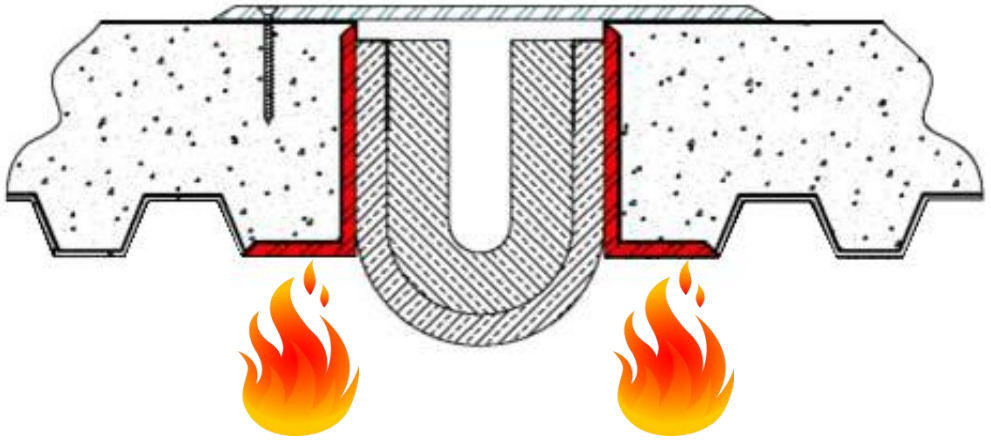




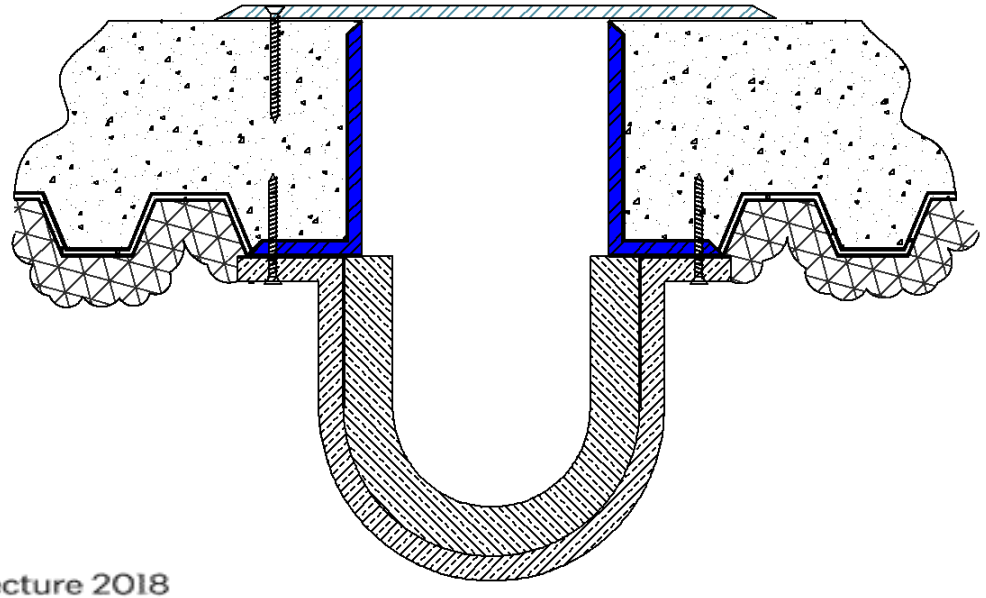
Accurate Detailing



Accurate Detailing



Top and Inside Mount Blanket Systems do not address heat transfer risk



Specify a Bottom Mounted system to properly insulate pour stops


THE GOOD
THE BAD
AND THE UGLY

Case Study – The Good

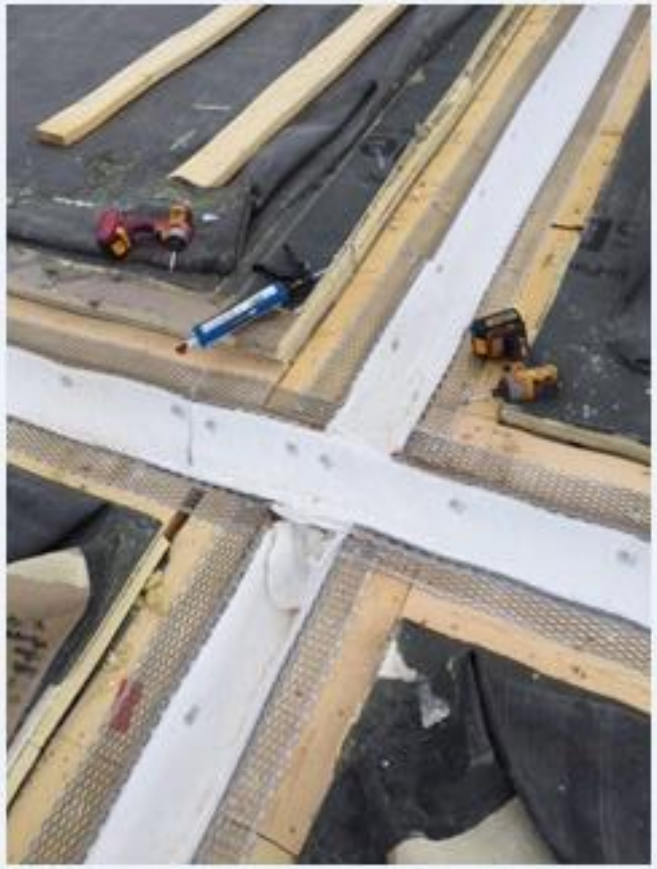
Properly spaced hardware holding flanges tight to substrate

Clean chasewall installation

Case Study – The Good

Corridor wrap horizontal to vertical transitions

Case Study – The Good



Not all products are capable of meeting intersection conditions such as this

Proper substrates ensure code compliance

Case Study – The Bad

Vertical blanket meeting a horizontal with 1” wide gaps

Horizontal protection not continuous. Standard firesafing does not suffice in movement joints

Case Study – The Bad

Flanges not properly securing blanket in place

Case Study – The Bad

Case Study – The Ugly

- **Fire Protection – Parts Missing**

Case Study – The Ugly

Water infiltration in fire barrier **destroys the barrier** and can lead to mold issues.

Case Study – The Ugly

1

2

3

5 Key Factors to Successful Fire Barrier *Installation*

1. A solid, crisp substrate is critical for securing the fire barrier in place. This substrate MUST be of a Rated Construction type.

2. Consider the Fire Barrier as a complete system. Seams, changes in direction, and multi-layered systems are good places to check first.

3. Expansion joint covers matching the tested conditions are a required part of a complete system. Pursue Judgments or align your Specifications with Manufacturers that have completed this for you.

5 Key Factors to Successful Fire Barrier *Installation*

4. Inspect Test documents or request Test Data when writing Specifications to ensure your product can meet the project demands

5. Provide separate details for rated conditions – do not utilize canned or boilerplate details that were not developed with barriers specifically in mind.


CHANGE THE
FUTURE

When it comes to Fire-rated Expansion Joints …

Who **IS** responsible?

Who **IS** liable?

Manufacturers
(Manufactured)

- Create more user-friendly products for ease in installation
- Solve problems especially when as-built field conditions cause products to change
- Work directly with contractors doing the install
- Have superior lead times to handle changes or alterations

Contractors
(Installed)

- Need better specification language for proper installation of expansion joint systems and fire barriers
- Must understand why expansion joints are used and how they work

Contractors
(Installed)

- Need to install fire barriers and install them properly
  - Keep fire barriers dry and clean
  - Wet FB is no longer an approved assembly and has to be replaced
  - Tears and duct tape splices are just disasters waiting to happen

Architects
(Specified)

- Hired to be the watchdog for the owner

- Need to tighten specification language, for example,

"…10% of all expansion joint system cover assemblies installed will be randomly pulled up and entire expansion joint system will be inspected."

When it comes to Fire-rated Expansion Joints …

Who **IS** responsible?

Who **IS** liable?

The answer: EVERYONE throughout the entire design and construction process.

Takeaways from today's presentation …

- A basic understanding of fire barriers as related to expansion joint systems
- Industry standard barrier types and testing protocols
- Proper detailing at common building conditions
- Understanding the keys to proper installation
- System failure causes and remedies.

Contact Information

inpro®

800-222-5556

www.inprocorp.com

Thank you!