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https://training.firestop.org/p/ifc-firestop-108-online-firestop-inspection-and-plan-review-noceu

CONSTRUCTION JOINTS
REF FRJ3

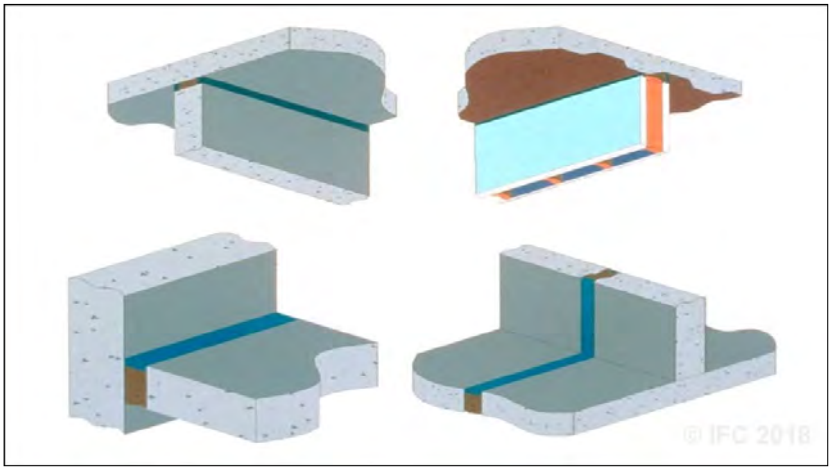
Fire resistive joint systems (IBC section 715)

IBC Definition of JOINT

- The opening in or between adjacent assemblies that is created due to building tolerances or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

Types of joint systems
Juncture of two fire-rated assemblies

Head of Wall
(Flat Deck)



Head of Wall
(Fluted Deck)

Floor to Wall

Floor to Floor
and
Wall to Wall

Floor-to-floor building expansion joints
(Typically large)

- Must support full live loads
  - Not applicable:
    "Stuff and spray or caulk" joint systems used for small joints
  - Examples:







Categories of Fire-Resistive Joint systems

- Sealant Systems (Caulks)
- Sprayed /Elastomeric Membranes (Sprays)
- Mechanical Joints
- Pre-formed joint systems
- Fire resistive expansion joints (large, support live loads)



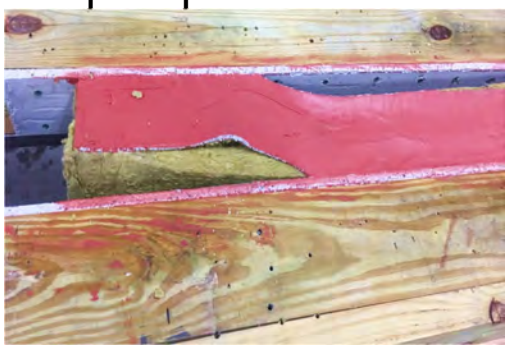




Expansion joint movement requirements exceed typical firestop capabilities

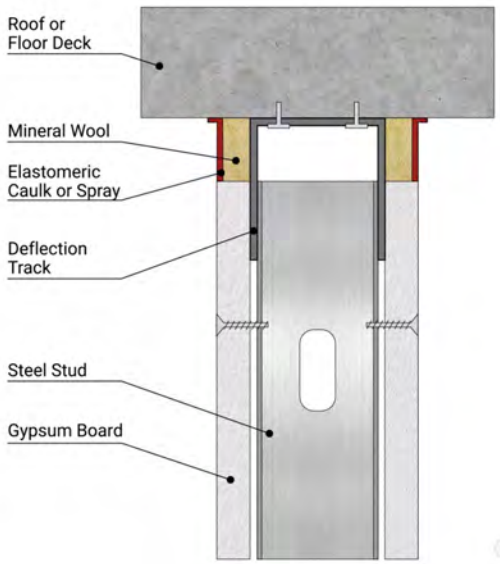


Common Mineral wool and intumescent spray application at exterior perimeter of slab, top of wall...



Failure> Most perimeter joint firestop sealants and systems achieve an average of 12%+- movement, - well short of Expansion Joint cycling requirements 25% -100% expansion + compression

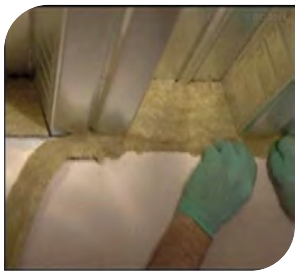
Typical Head of Wall Joint System



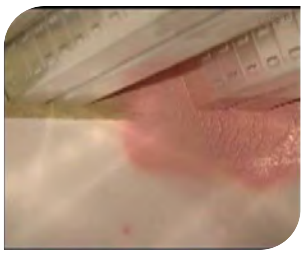
Head-of-Wall Spray Application



Flutes are packed with mineral wool per listed system.

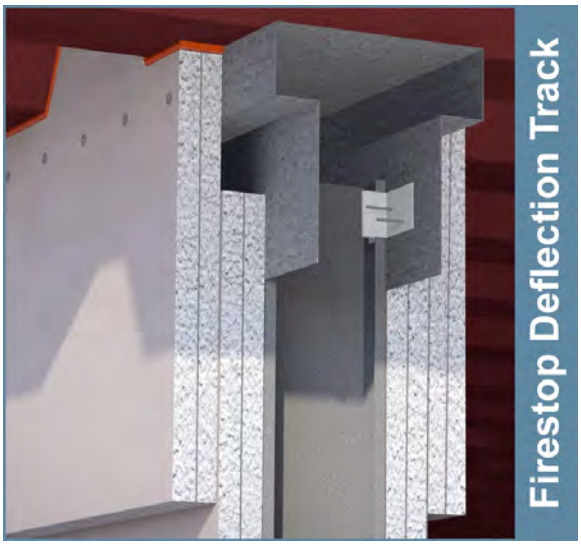


Remaining joint is packed with mineral wool per listed system.

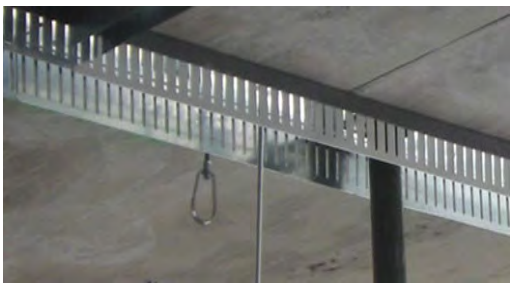


Firestop spray is applied to both sides of wall per listed system.

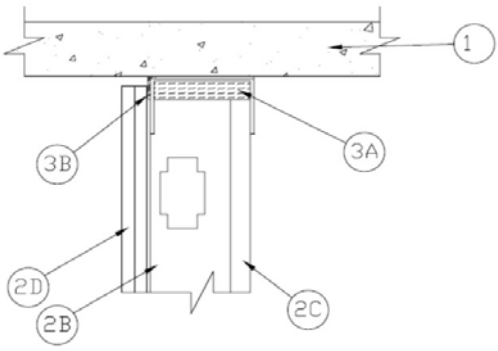
Mechanical top-of-wall Joint Systems







Factory Applied Intumescent on Track

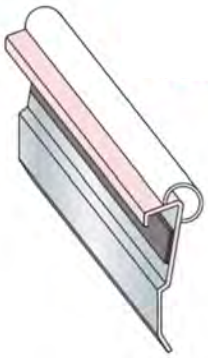




- Slotted or solid
- Gap remains unfilled
- 3A = mineral wool inside top track (shaft wall only)
- 3B = factory applied intumescent on top or side of track
- Intumescent on top visible from side view

Framing devices with intumescent tape

- Post-installed
  - after wall framing, prior to drywall
- Must be installed on both sides

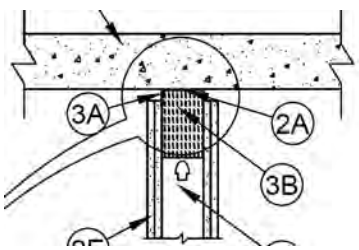




U-shaped firestop gasket

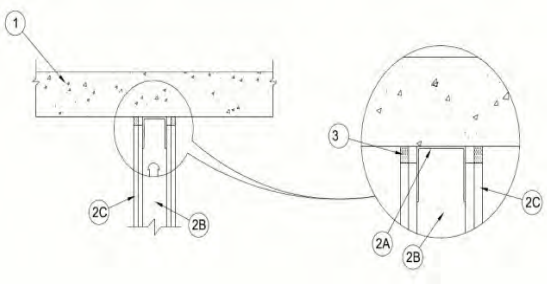
- Installed during ceiling runner installation
- Sides must drape down – cover vertical leg
- Side legs can't be penetrated by screws
- For profiled decks, mineral wool is needed in flutes
- Some systems require mineral wool within track







Compressible Foam Gasket



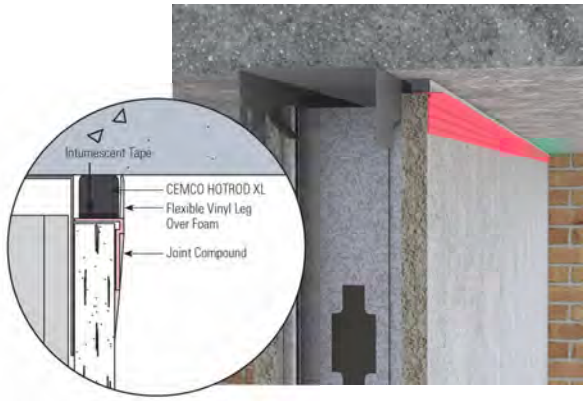




- Only for flat concrete
- 2-hr system may not fill full depth
- Some gasket compression required
- Installed after drywall
- Both sides of wall
- Must verify proper orientation

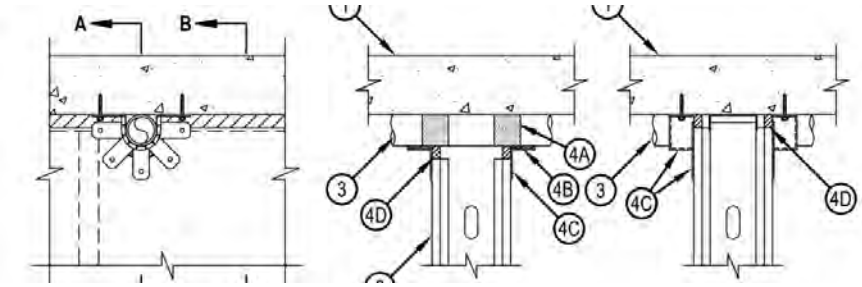
Post-installed preformed joint systems

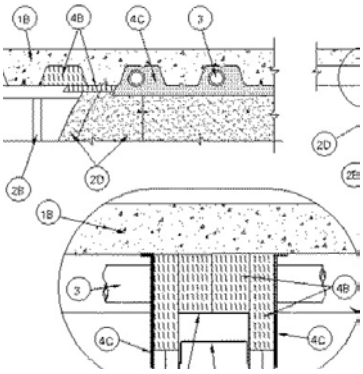


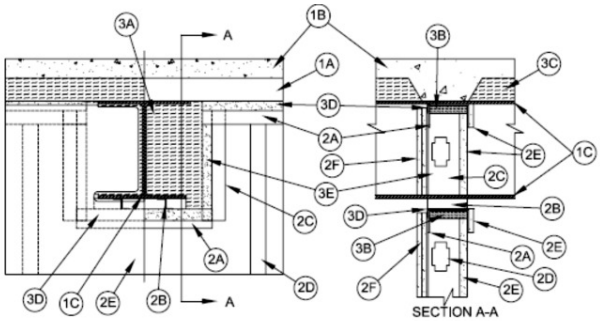


- Specialty firestop tape used over mineral wool instead of spray or sealant
- Foam gasket factory-applied to vinyl trim

Penetrations through joints

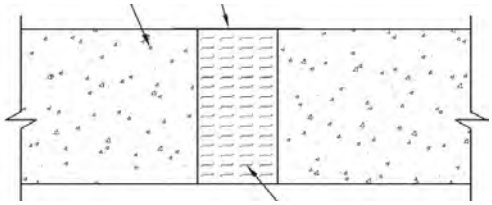




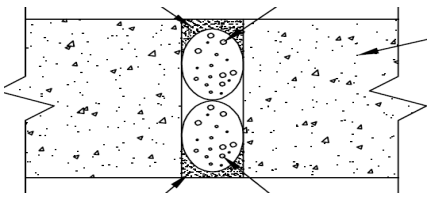


- Some head-of-wall joint systems allow for penetrations
- Beam penetrations are part of some listed joint systems

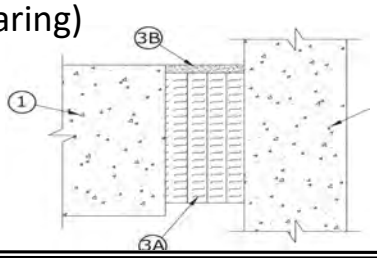
Other Typical Joint Systems



- Floor to Floor (non load bearing)



- Wall to Wall



- Floor to Wall

Fire Resistive Expansion Joint Types

SMALL fire resistive expansion joints (typically less than 4")

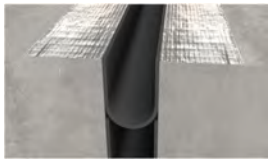
MINERAL WOOL & SEALANT

- Oversized Mineral wool strips held in place through compression.
- Topped with intumescent fire caulk to secure the wool in place and protect from water infiltration
- *Not to be confused with Edge of Slab, Head of Wall or Penetration solutions
- Requires metallic cover to meet code



INTUMESCENT TEXTILES

- Intumescent material and foil scrim sheet goods
- "Draped" into throat of joint and secured in place with aluminum frames
- Requires metallic cover to meet code



Fire Resistive Expansion Joint Types



SMALL fire resistive expansion joints (no mechanical attachments)

HYBRID SYSTEMS

- Utilize combination of intumescent sheet goods, foils and/or insulating ceramic wools
- Held in place through non-invasive outward compression.
- Requires metallic cover to meet code
- Verify butt seams and transitions are addresses specific to the product. Each manufacturer achieves these via alternate means



FIRE RATED OPEN CELL FOAMS

- Open cell foam with fire retardant materials incorporated
- Ribbed facing with colored silicone for water resistance
- Tested n concrete and gypsum walls (*note- gypsum board required in throat of joint- cannot be adhered direct to bare studs)
- No metal cover plate required

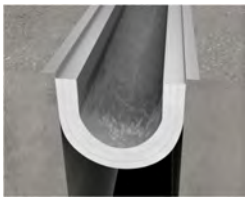


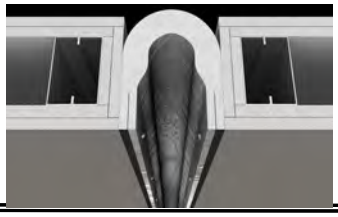
Fire Resistive Expansion Joint Types

LARGE fire resistive expansion joints

TRADITIONAL FIRE BLANKET SYSTEMS (draped assembly)

- high temperature fire-resistive blankets, stainless foil, cycling shields and edge retainers
- Tested in concrete and gypsum walls but are applicable to wide range of substrate conditions
- Requires metallic cover to meet code
- Approved alternative covers for specific conditions such as Chase-walls.
- Verify with installation instructions splices (required by testing), transitions, and directional changes.



Building Code Requirements Fire Resistive Joints



- Section 715.3: **Fire Resistance-rated assembly intersection**
  "Joints installed in or between fire-resistance rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is Installed."

- Exceptions: 9 specific exemptions exist
  e.g. walls permitted to have unprotected openings, floors within malls, etc..

Building Code requirements
Fire Resistive Joints – 715.1 Exceptions

Fire resistive joint systems not required in the following:

Floors

- Within single dwelling unit
- Where joint is protected by shaft enclosure
- Within atriums
- Within malls
- Within parking garages
- Mezzanines

Other locations

- Walls permitted to have unprotected openings
- Roofs where openings are permitted (i.e. almost all roofs)
- Max. 5/8 in wide controls joints if tested as part of assembly in accordance with ASTM E119/UL 263

Building Code Requirements
Fire Resistive Joints

715.2 Installation

Systems and materials must be securely installed according to manufacturer's installation instructions…so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases.

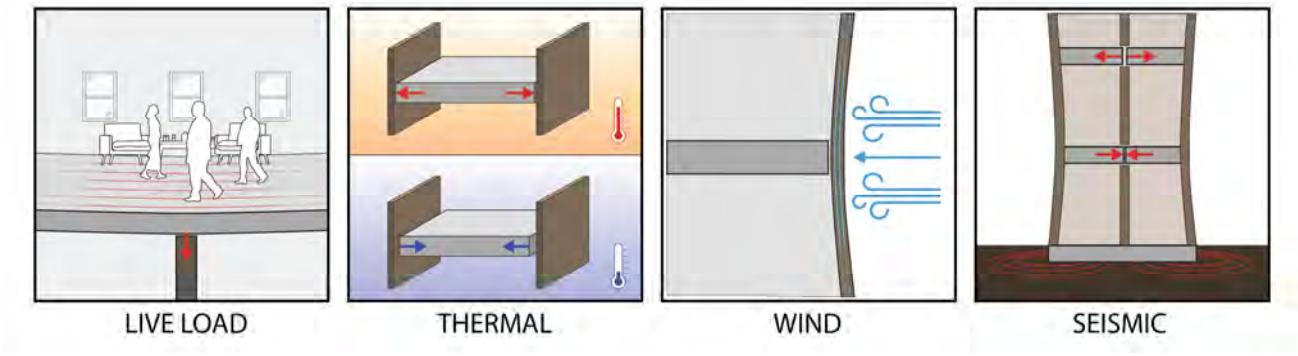
715.3.1 – Fire test criteria

Shall be tested to ASTM E 1966 or UL2079

715.8 - Joints and voids in smoke barriers

…shall be tested in accordance with … UL 2079 for air leakage…
L-rating of the joint system shall not exceed 5 cfm / linear ft of joint

Forces Which Induce Movement



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Fire-rating of joint systems

Listings combine (3) testing methodologies >
Assembly fire rating / Joint fire rating / Movement

- **ASTM E119 / UL 263 Adjacent Building Elements**
  Standard Test Methods for Fire Tests of Building Construction and Materials
- **ASTM E1966 / UL 2079 Fire Test Specific to 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

Intertek and other nationally recognized laboratories use AST and/or UL standards for testing

Establishing movement capabilities:
Cycling of joint prior to fire test per ASTM E1399:



Cycling Requirements

Class Movement	Min. Cycles	Frequency
I	500	1 cycle / min.
II	500	10 cycle / min.
III	100	30 cycle / min.
IV	100	30 cycle/min and
	400	10 cycle / min.

- Cycling conducted prior to fire test
- Joint fire tested at maximum extension
- Listing will report maximum extension and compression
  - Beware systems with compression only – no such real life applications!

Fire resistive joint system inspection and plan review made easy

Step 1:

- Ask for the listed system used for every joint type in/between fire-rated walls or floors

Step 2:

- Verify that the field conditions meet the firestop system exactly

There are over 2,300 third-party listed fire resistive joint systems.
Every system has a very precise set of conditions.

Fire rated Joint System Parameters

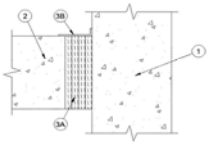
- Nominal Joint Width
- Assembly construction and Rating
- Movement
  - Extension
  - Compression
- Percent (%) Extension / Compression
- Mineral Wool Compression
- Sealant Depth

Compare system and field conditions

1. What type of building assemblies form the joint?
   - Floor/Floor, Floor/Wall, Wall/Wall, Top of Wall/Ceiling
2. What materials are the assemblies constructed from?
   - Concrete, CMU, Gypsum
3. What is the required hourly rating?
   - Assembly rating (1 – 4 hour)
4. What is the nominal width of the joint (inches)?
5. How much movement is required?
   - Must accommodate building movement (% of joint size)
6. Joint firestopping materials
   - Thickness, backing materials, mineral wool compression

System No. FW-D-0001

Assembly Rating - 1 Hr
L Rating at Ambient — Less than 1 CFM/Lin Ft
L Rating at 400 F — Less than 1 CFM/Lin Ft
Nominal Joint Width - 2 In.
Class II Movement Capabilities - 12.5% Compression or Extension



1. **Wall Assembly** — Min 4-1/2 in. thick reinforced lightweight or normal weight (100 - 150 pcf) structural concrete. Wall may also be constructed of any UL Classified **Concrete Blocks***.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. **Floor Assembly** — Min 2-1/2 in. thick reinforced lightweight or normal weight (100 - 150 pcf) structural concrete.

3. **Joint System** — Max separation between edge of floor and face of wall (at time of installation of joint system) is 2 in. The joint system is designed to accommodate a max 12.5 percent compression or extension from it's installed width. The joint system shall consist of the following:

A. **Forming Material*** — Min 4 pcf mineral wool batt insulation installed in joint opening as a permanent form. Pieces of batt cut to min width of 2-1/2 in. and installed edge-first into joint opening, parallel with joint direction, such that batt sections are compressed min 50 percent in thickness and that the compressed batt sections are flush with top surface of the floor. Adjoining lengths of batt to be tightly-butted with butted seams spaced min 24 in. apart along the length of the joint.

ROXUL INC — SAFE Mineral Wool

THERMAFIBER L L C — SAF Mineral Wool

B. **Fill, Void or Cavity Material* - Spray** — Min 1/8 in. wet thickness of fill material applied on top surface of floor to completely cover the mineral wool and overlap a min 1/2 in. onto concrete floor and side of wall.

ABC FIRESTOPPING CO. — SuperDuper Firestop Spray

*Bearing the UL Classification Mark

Field Inspection of Joint Systems

- Identify the type of building assemblies that form the joint (e.g. type, thickness)
- Verify the materials and installation of the joint system
- Are there any special considerations?
  - Conditions that require Engineering Judgments (not within listed system parameters)
  - High movement requirements

What to look for



- Ensure the framing members allow for required movement
- Confirm appropriate backing material is used if required
  - Mineral wool may be used above the track or inside top track
  - Manufacturer and type (eg. Type SAF and SAFE)
  - Nominal density (typically 4pcf if field cut. 6pcf for prefab)
  - Compression and orientation per listing

Joint Inspection Process

- Inspect joint systems during framing inspection
- Contractor to provide you with the listed assembly as shown / approved on the plans
- Confirm all joint systems will accommodate required movement
- For Mechanical Joints observe the ceiling runner for the label located on the side of the runner

Expansion joint details requiring verification

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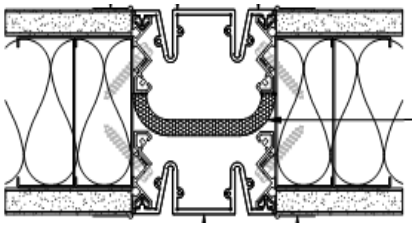
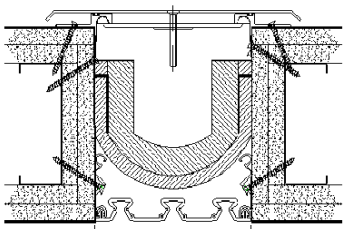
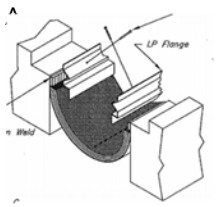
Confirm that construction in full accordance with listing details

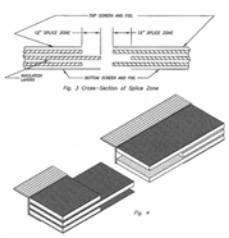


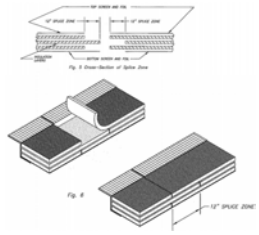


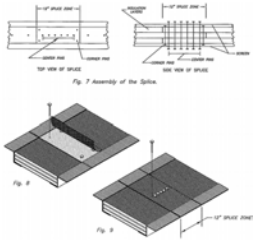
- Some systems tested without gypsum returns in the throat of the joint
- Some require partition to be encapsulated

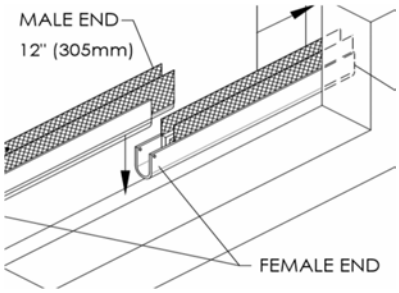
Verify splices conform to listing (tested) details











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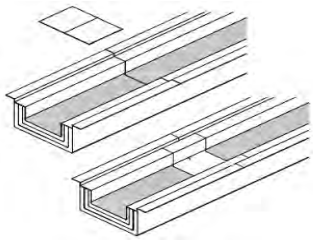

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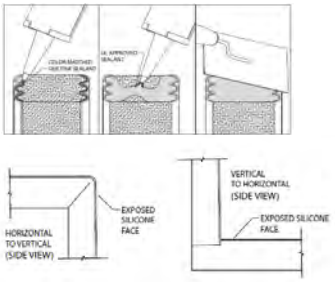

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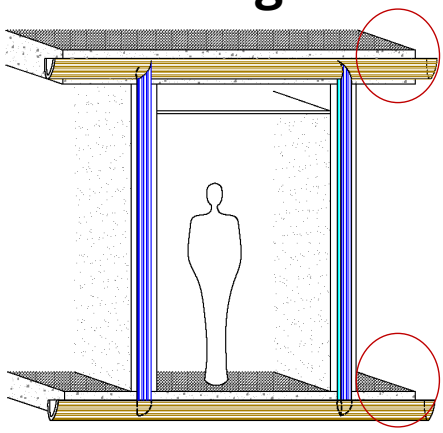
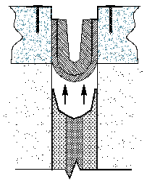
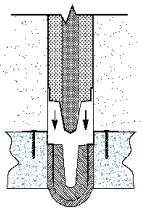
Transitions from horizontal to vertical or directional change: see manufacturer instructions



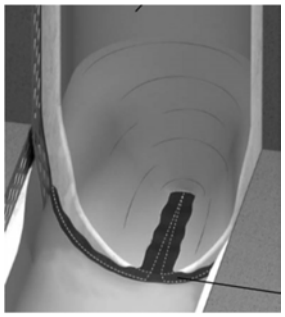
Section through Rated Corridor



Head of Wall/ Underside of Deck above



Nested at Base of Wall



Continuity head-of-wall joints

2021 IBC

- 707.9 Voids at intersections

  The voids created at intersection of fire barrier and non-fire resistance rated roof assembly shall be filled. An approved material or system shall be used to fill the void, shall be securely installed in or on intersection for its entre length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to retard the passage of fire and hot gases.

- Tested system NOT required
- Listed system instead of EJs:
  - Approval should be easier/faster
  - Save time/money

Continuity head-of-wall joints

2024 IBC (revised)

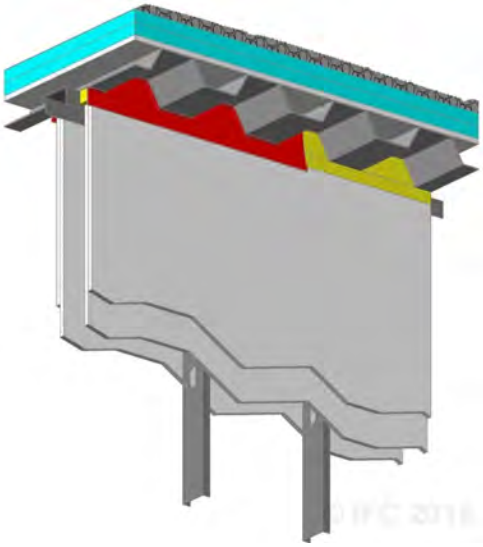
- 715.6 *Fire barrier/nonfire-resistance-rated roof assembly intersections.* Voids created at the intersection of a fire barrier and the underside of a nonfire-resistance-rated roof sheathing, slab or deck above shall be filled by an approved material or system to retard the passage of fire and hot gases, **or** shall be protected by an approved continuity head-of-wall system tested in accordance with ASTM E2837 to provide an F rating/T rating for a time period not less than the required fire-resistance rating of the fire barrier in which it is installed.
- Tested system NOT required, but accepted
- Listed system instead of EJs:
  - Approval should be easier/faster
  - Save time/money

Joint: Rated wall to non-rated floor or roof

- ASTM E2837: Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies
- Applies to joints under a roof, or under a floor
  - 2024 IBC applies only to under a roof
  - 2028 IBC on track to also include under non-rated floors
- UL listing category XHBO
  - Nomenclature, e.g. CJ-D-0001

ASTM E2837 listings

- Many for insulated steel deck roof
- No modifications ever needed to roof or wall
- Typical “stuff and spray” joint systems similar to E1966/UL2079 listings



Joint Systems - Summary

- Provide tested and listed systems that includes joint movement at Plan Review or before field inspection
- Joints must accommodate expected building movement
- Inspect some joint systems during framing inspection