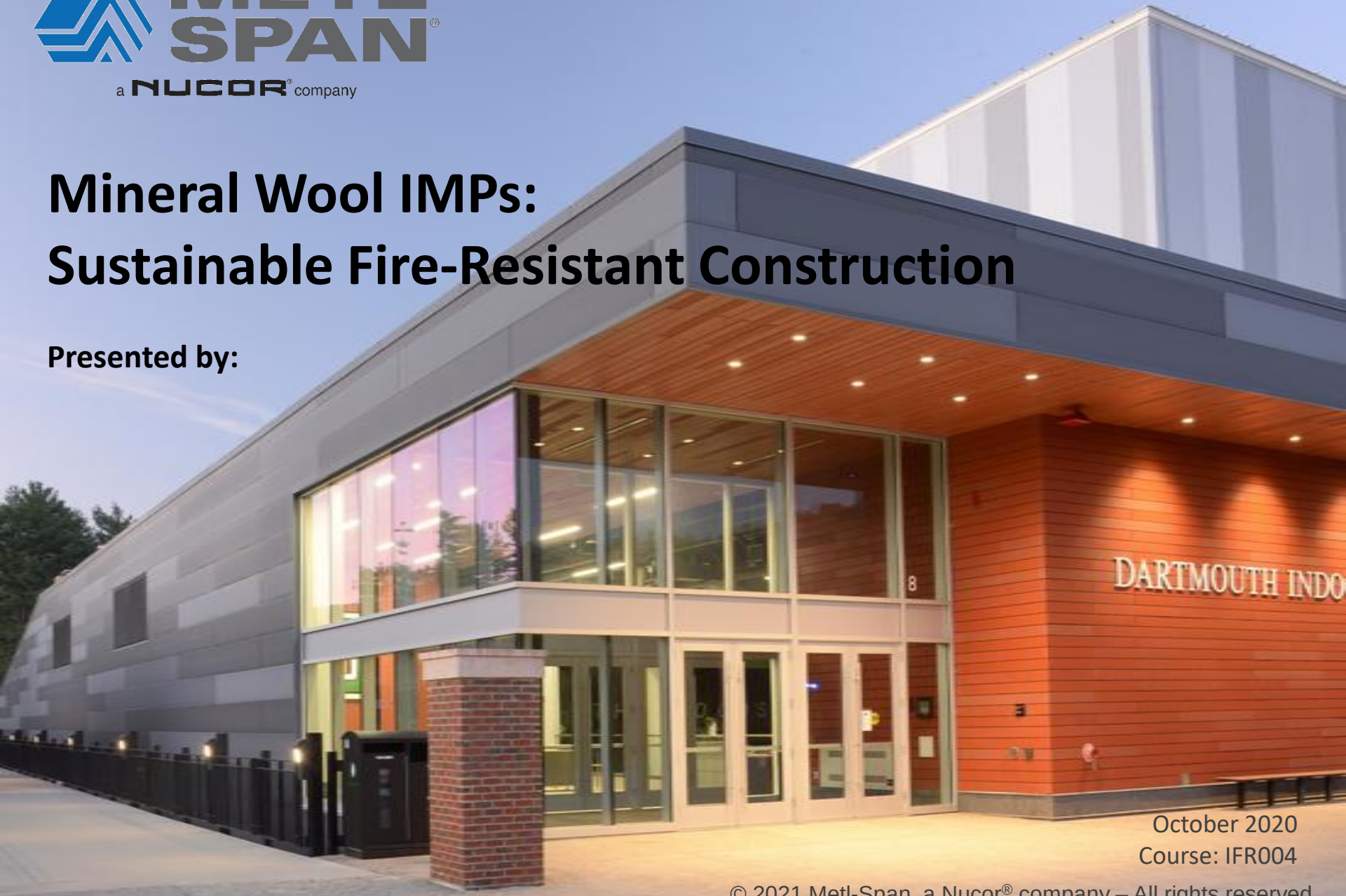
Mineral Wool IMPs: Sustainable Fire-Resistant Construction

Presented by:



October 2020
Course: IFR004

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

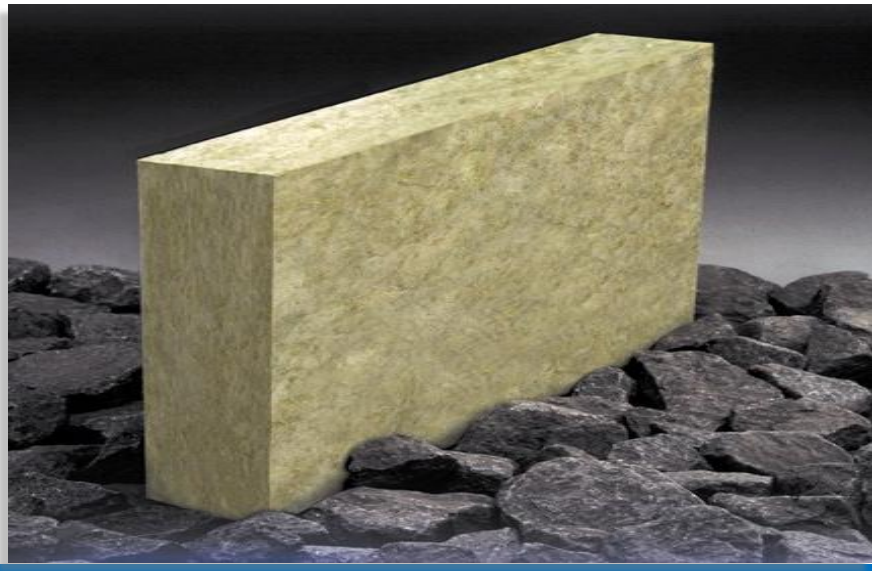
Course Number: IFR004 Learning Units: 1 LU/HSW/SD Hour

Learning Objectives

- ✓ Understand the characteristics that best describe insulated metal panels (IMPs) with mineral wool cores
- ✓ Understand the design options for mineral wool core IMPs
- ✓ Remember the top six advantages to using mineral wool IMPs
- ✓ Understand how IMPs provide all necessary air, water, vapor and thermal control layers through a single component
- ✓ Be able to understand the installation considerations of mineral wool IMPs
- ✓ Comprehend the basics of fire testing and standards
- ✓ Be able to differentiate between the various IBC code chapters that deal with building types, occupancy and fire safety requirements
- ✓ Visualize the differences between fire walls and fire barriers, as well as interior vs. exterior wall applications
- ✓ Analyze the environmental performance associated with mineral wool IMPs

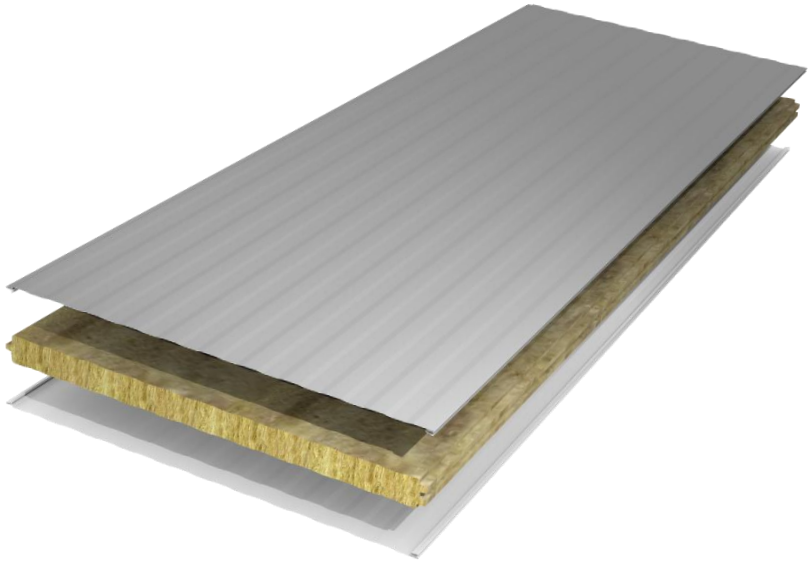
What is Mineral Wool?

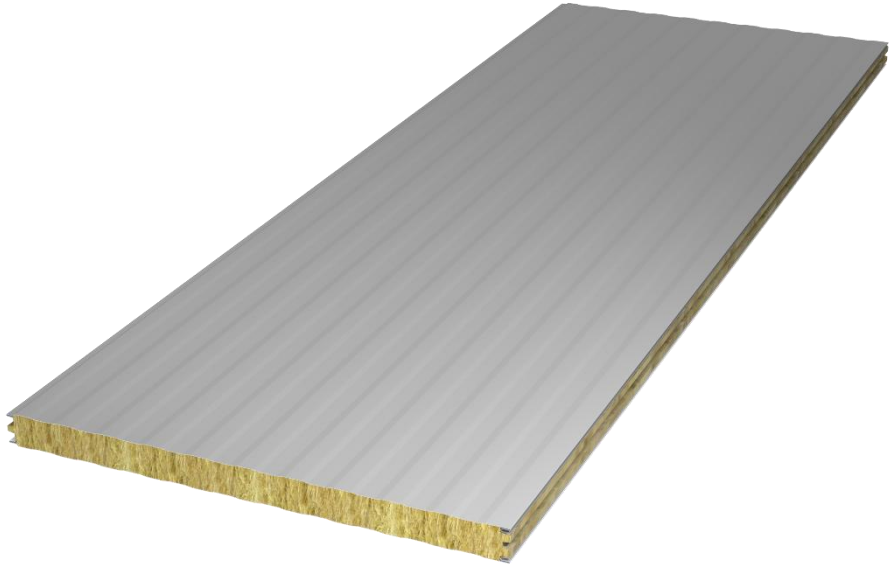
- Produced from basalt rock & blast furnace slag
- Spun-blown, variety of forms such as batt, board, blanket and pipe insulation
- Binders (resins and oils) added for rigidity, less dust and water repellency
- Variety of names: stone wool, slag wool, mineral fiber, Rockwool®



What are Insulated Metal Panels w/Mineral Wool Cores?

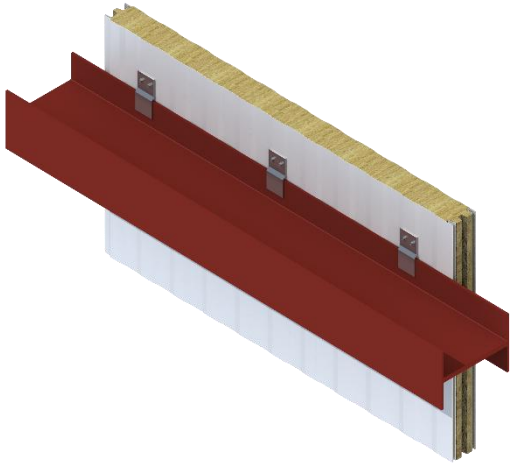
- High density mineral wool boards bonded to two sheets of pre-painted metal with polyurethane adhesive
- Single component provides exterior finish, interior finish and ALL building envelope control layers
- Non-combustible cladding
- VOC and CFC free

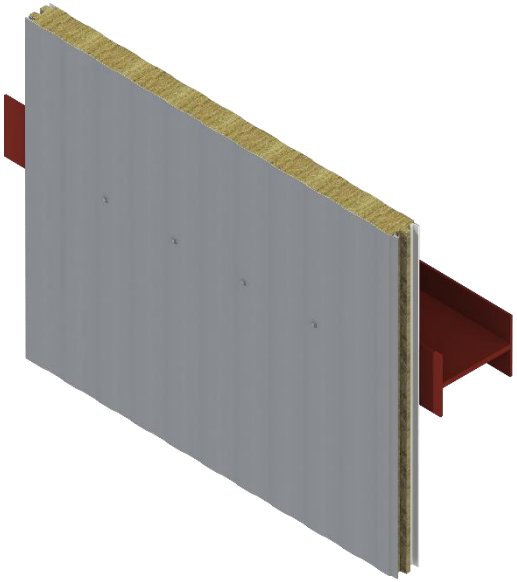


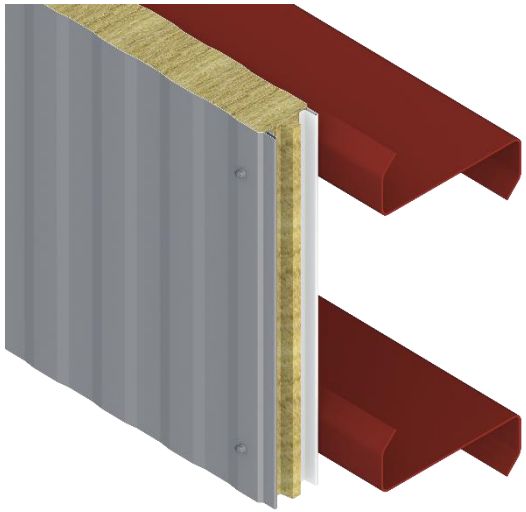


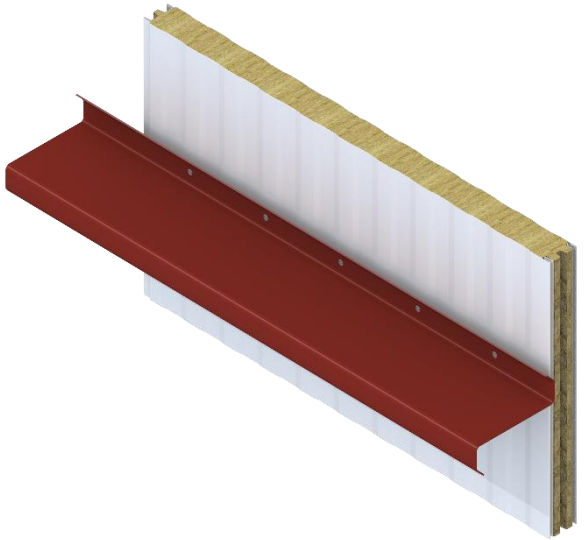
Mineral Wool Insulated Metal Panels

- Panel facings: shallow profile ribbing, stucco embossed
- Side joints: double tongue and groove with integral spline
- Insulation value: ≈ R 3.61 per inch
- Module width: 42”
- Thickness: 4” – 8”
- Lengths: 8’ – 40’
- Weights: 4.5 – 7.5 lbs./sf
- Face fastened (exposed) or back fastened (concealed)







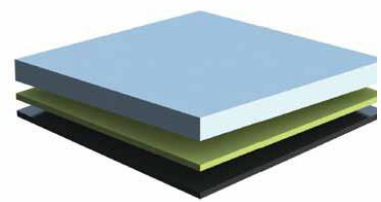


Mineral Wool Insulated Metal Panels – Integral Spline

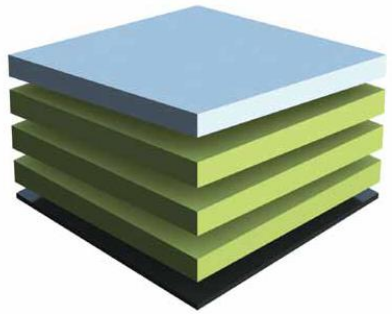
- Integral spline improves fire performance at joint, reduces installation vs. field installed spline
- Integral spline improves thermal performance
- Joint sealant not required for fire performance, only for weather seals

Design Options - Finishes and Coatings

- Prefinished on BOTH exterior and interior faces
- Essentially maintenance free
- Resists UV degradation, corrosion, acid rain, chemicals, pollutants
- Finish warranties of 20+ years
- Smooth, embossed and stucco finish options



Standard 1.0 mil.

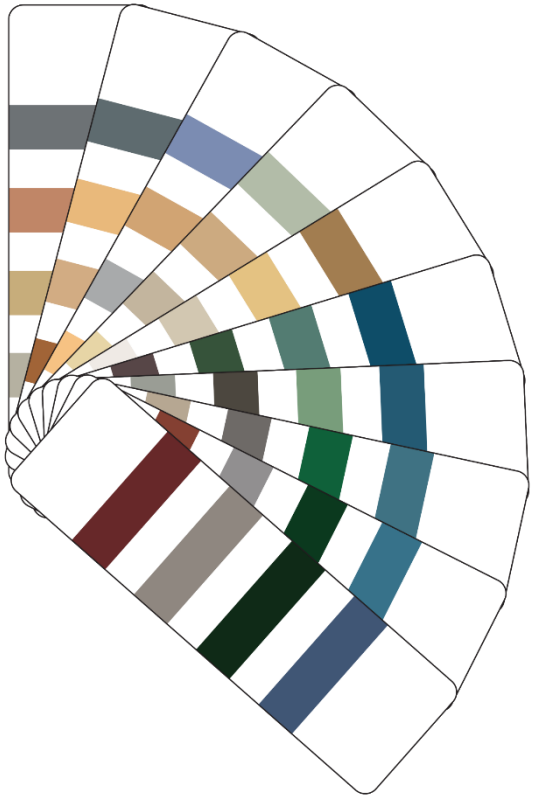


High build 3.2 mil.

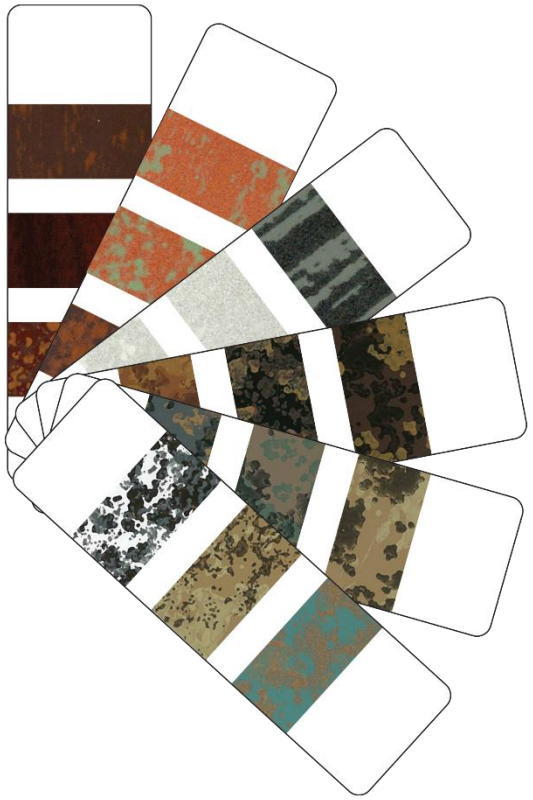
Standard embossing

Heavy embossing

Design Options - Finishes and Coatings



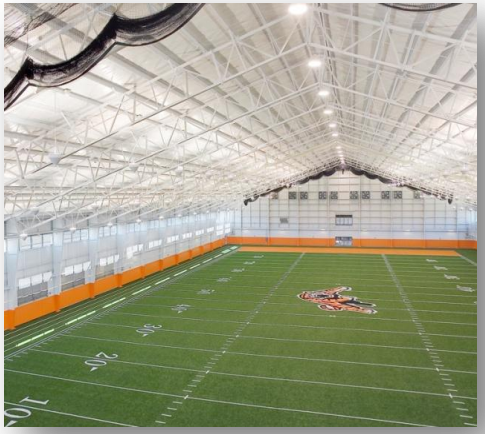
- Solids
- Micas
- Metallics
- Color shifting



- Weathered metals
- Patinas
- Variegated stone

Mineral Wool Insulated Metal Panels – Applications

- Property lines (one, two or three hour rated)
- Stairwells
- Demising walls (partitions – office/warehouse/manufacturing)
- Elevator shafts
- Parking garages
- Walls/ceilings



Top 6 Reasons to Use Mineral Wool IMPs

1. Fire resistance
2. Thermal resistance
3. Sound attenuation
4. Vapor permeability
5. Non-hygroscopic
6. Dimensional stability

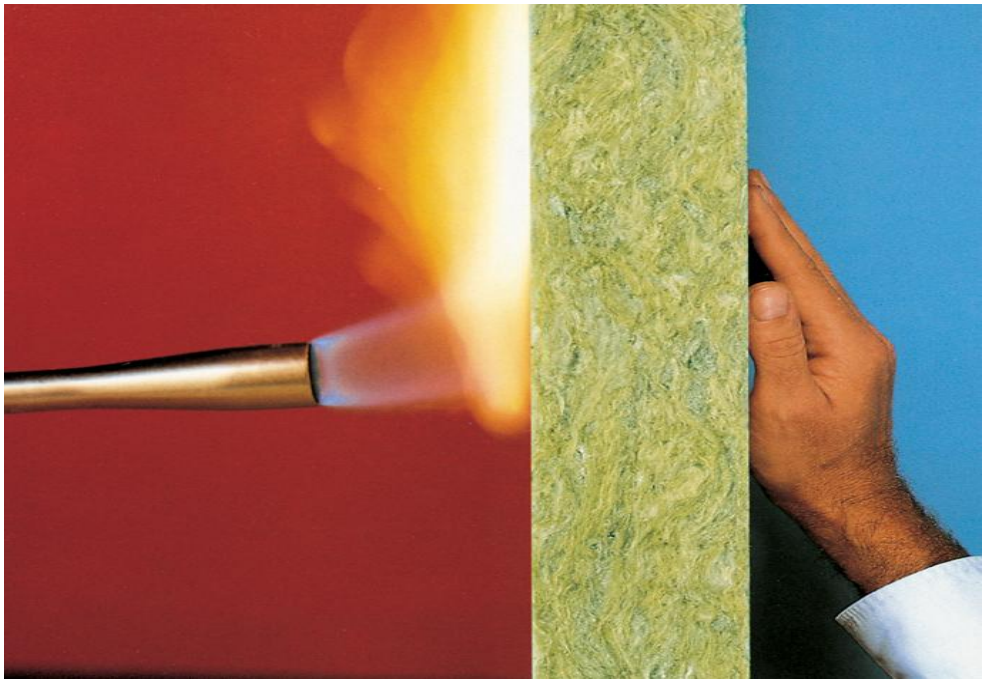
Top 6 Reasons to Use Mineral Wool IMPs:

#1 Fire Resistance

Flame Spread: 0

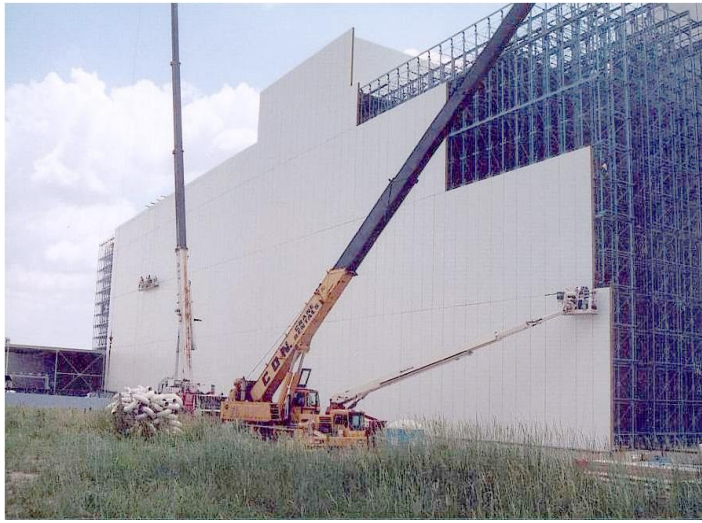
Smoke Development: 0

Non-combustible, melting point ≈ 2150^{o}F

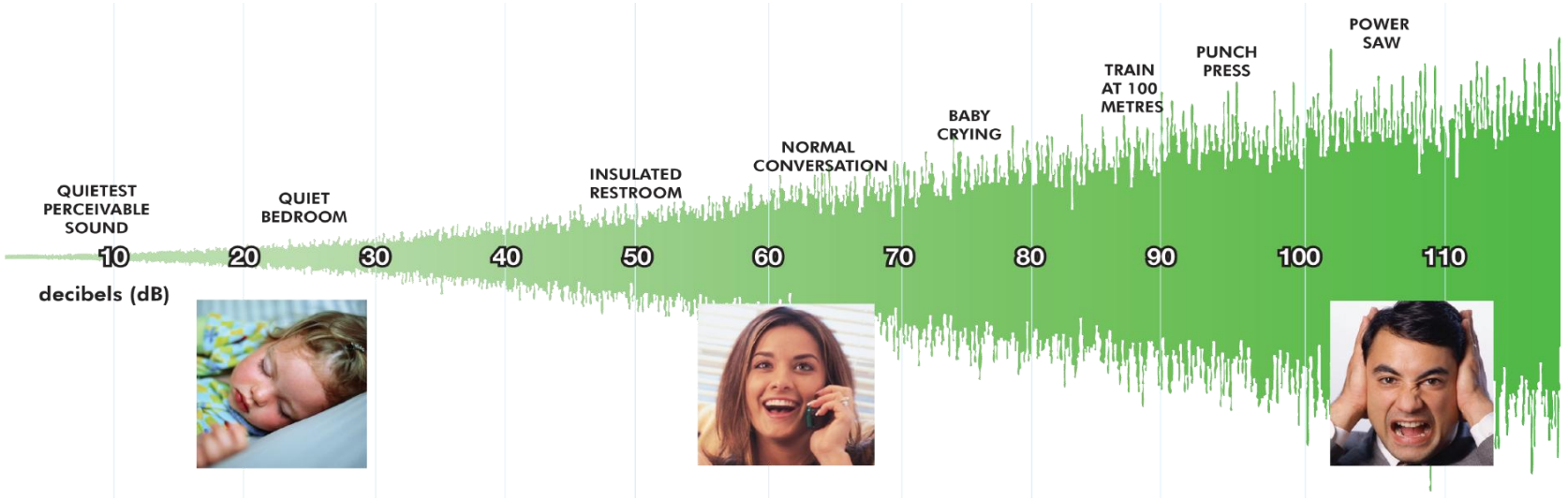


Top 6 Reasons to Use Mineral Wool IMPs: #2 Thermal Performance

- Higher R value than fiberglass batts (R 3.61 vs. 3.17)
- IMPs with mineral wool is a form of continuous insulation due to integral spline
- Protection from outside elements
- Cavity insulation not required
- Heating and cooling costs reduced
- Improved thermal comfort for building occupants



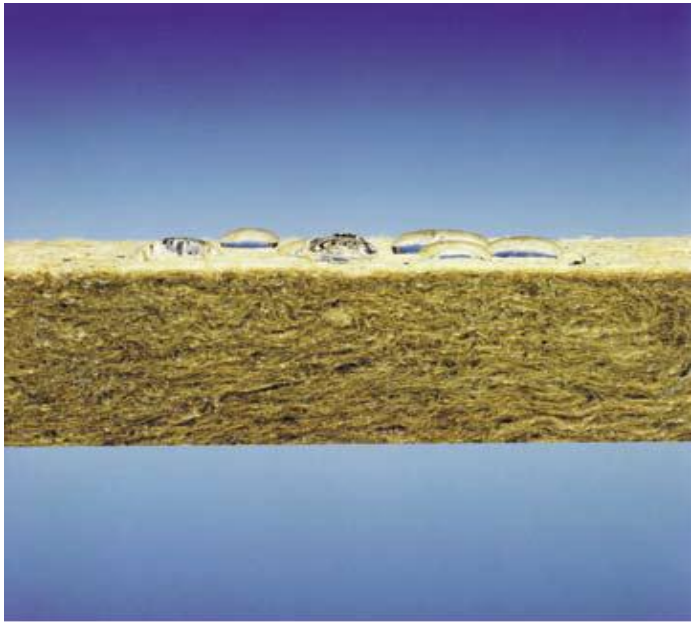
Top 6 Reasons to Use Mineral Wool IMPs: #3 Sound Attenuation



- Mineral wool IMPs sound transmission class (STC) rating of ≈ 32
- Mineral wool density and mass provides higher STC rating vs. other types of rigid insulation

Top 6 Reasons to Use Mineral Wool IMPs: #4 Permeability

- Mineral fiber is permeable – dries out from evaporation
- “Breathable insulation” will not trap vapor
- Does not support mold or fungus growth
- Maximizes drying potential
- Great for mixed climates

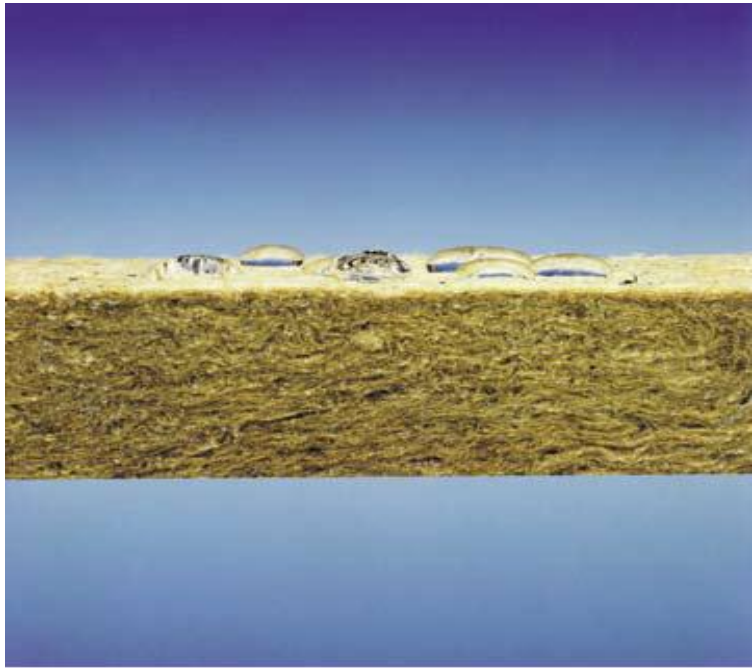


Top 6 Reasons to Use Mineral Wool IMPs: #5 Dimensional Stability

- Ideal high temperature insulation
- ASTM C356 Linear Shrinkage: 0.01%@ 350°F
- Provides excellent core stability for IMPs

Top 6 Reasons to Use Mineral Wool IMPs: #6 Non-Hygroscopic

- Mineral fiber is non-hygroscopic
- ASTM C1104 Moisture Sorption
- Suitable for rainscreen barrier walls
- Ideal for retrofit cavity fill between IMPs and existing walls



IMPs and Building Control Layers

IMPs and Building Control Layers – Water

Barrier Walls

Single line of defense:

- Lacks redundancy

Insulated Metal Panels

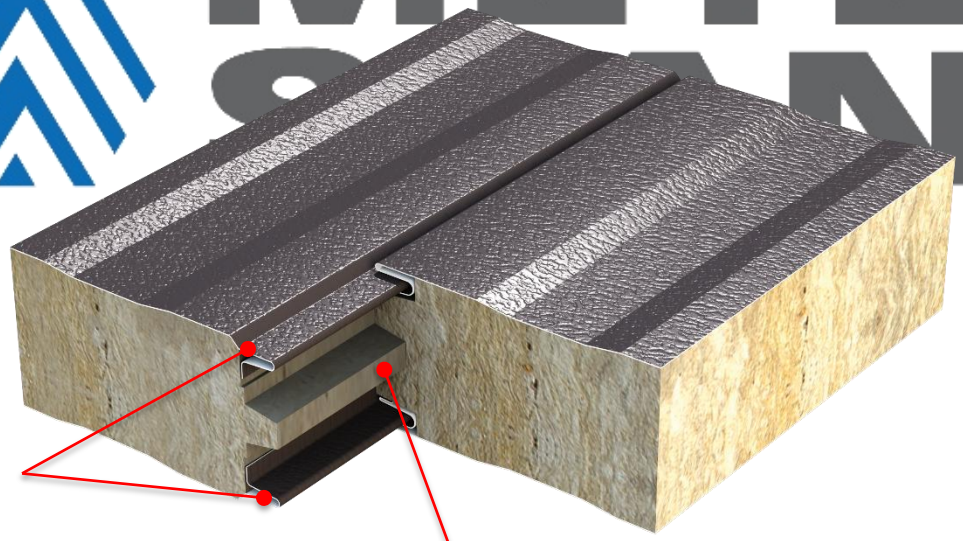
Double barrier wall technology:

- Outer water shedding layer
- Sealed exterior joint
- Sealed interior joint provides redundancy

IMPs and Building Control Layers - Thermal

Insulated Metal Panels Minimize Thermal Bridging

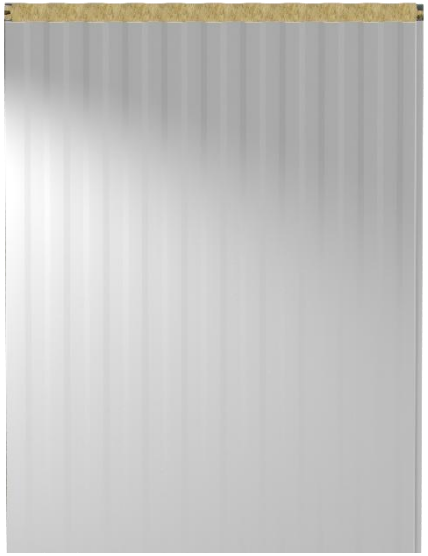
- Panel faces are separated
- Spline ensures continuous insulation at edges
- Through fastening and/or back fastening minimizes thermal bridging
- R values up to ≈ 29 (8” panel)



IMPs and Building Control Layers - AIR

- Protects against air infiltration
- Serves “double duty” as vapor barrier
- Does not require redundant assemblies

Insulated Metal Panel



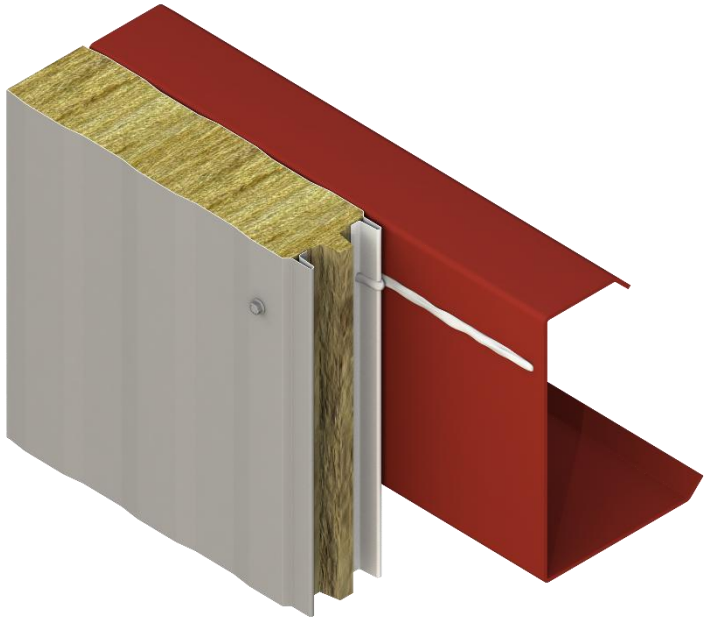
Replaces need for wraps and fluid applied assemblies

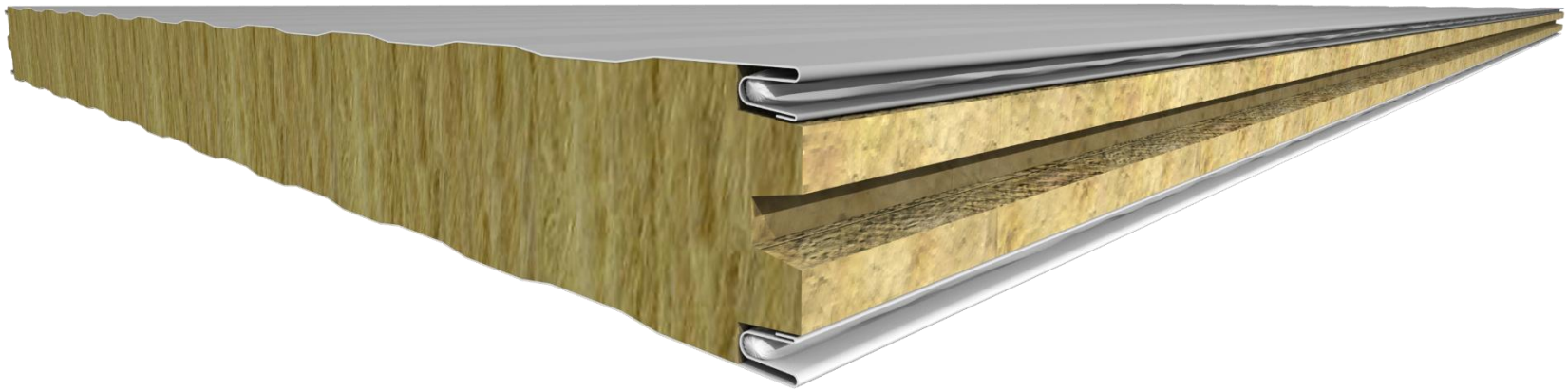
Wraps

Fluid Applied

IMPs and Building Control Layers - Vapor

IMPs provide an integral vapor barrier – panels sealed to structure and flashings

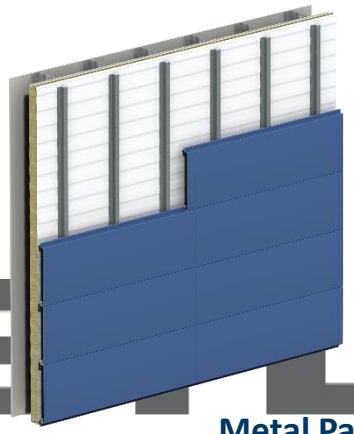


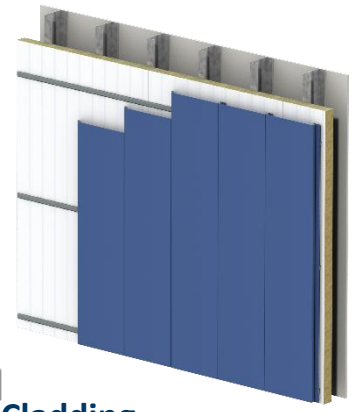


Building Control Layers – Non-Combustible IMP Barrier Walls

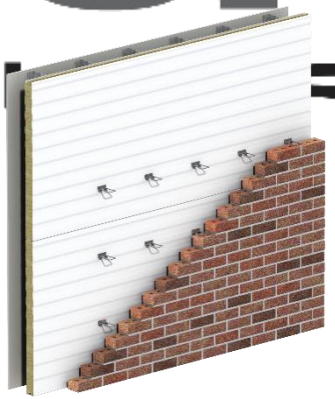
New technology for rainscreen barrier walls

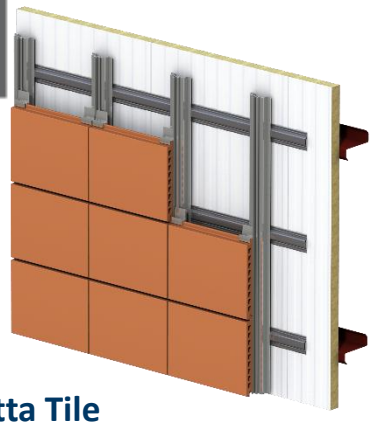
- Metal panel cladding over **IMPs**
  - Minimum continuous 3/8” air gap
- Terracotta tile over **IMPs**
  - Minimum continuous 3/8” air gap
- Brick veneer over **IMPs**
  - 1” air gap





Metal Panel Cladding





Terracotta Tile

Brick Veneer

Installation Considerations

Installation Considerations

- One step installation vs. gypsum sheathing and stud assemblies
- Interior partitions can be moved and re-used
- Sealants not required for interior use
- Fast installation due to single component wall assembly
- Panels provide all four control layers for exterior walls (air, water, vapor and thermal)

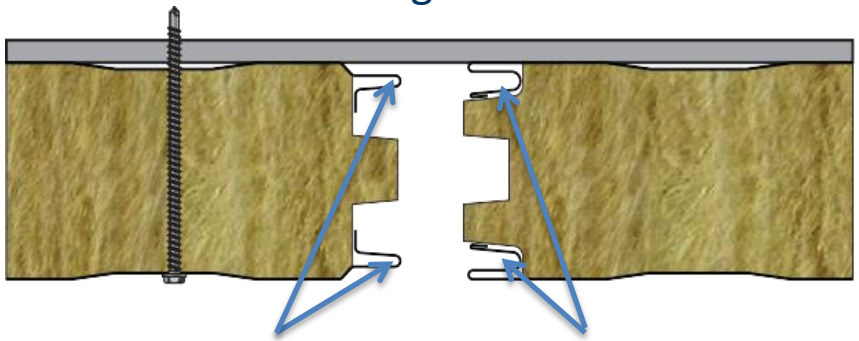
Installation Considerations – Exterior Walls

Vertical panels require *horizontal* supports

- Pre-engineered building girts
- Tube steel, hot-rolled girts and open web joists

Installation Considerations – Exterior Walls - Vertical

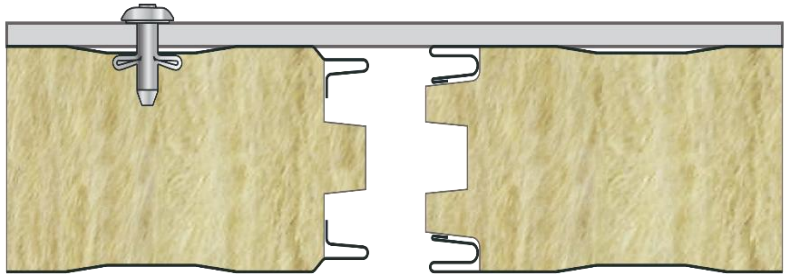
Through fastened



Male legs on right edge

Female pockets on left edge

Back fastened



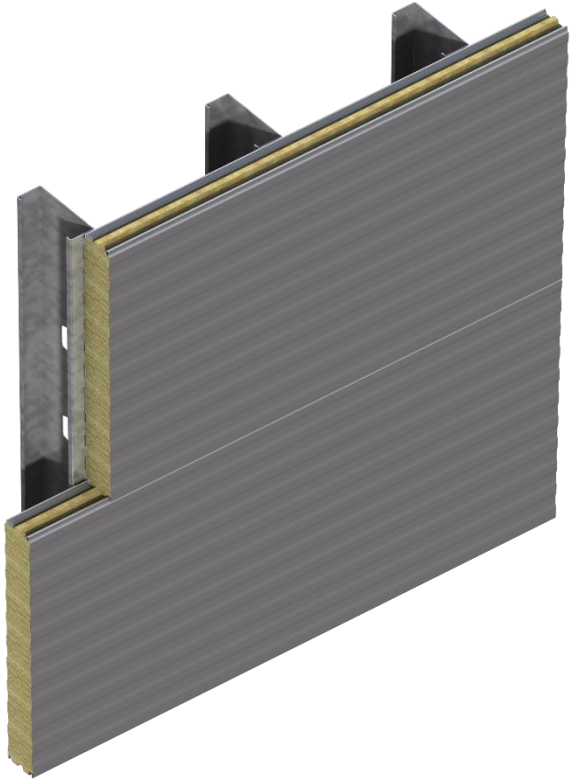
- Panels typically installed ***left to right***:
  - male legs on right edge
  - female pockets on left edge
- Panels *may* be installed **right to left** by rotating panels

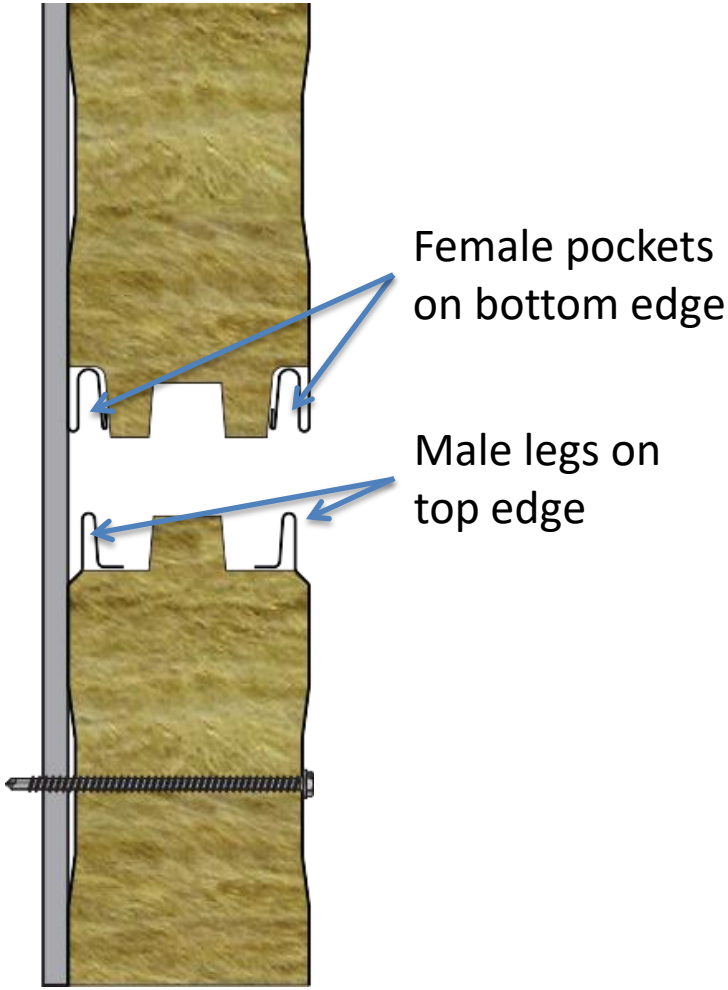
Installation Considerations – Exterior Walls - Horizontal

Horizontal panels require *vertical* supports

- Vertical steel studs
- Vertical hat channels over horizontal wall girts or tube steel
- Vertical I beams (or 3 plate built-up)

Installation Considerations – Exterior Walls





- Panels installed **bottom up**:
  - male legs are on top edge of panel
  - female pockets are on bottom edge of panel
- Through-fastened
- Back fastened option

Installation

IMPs can be installed in nearly all types of weather:

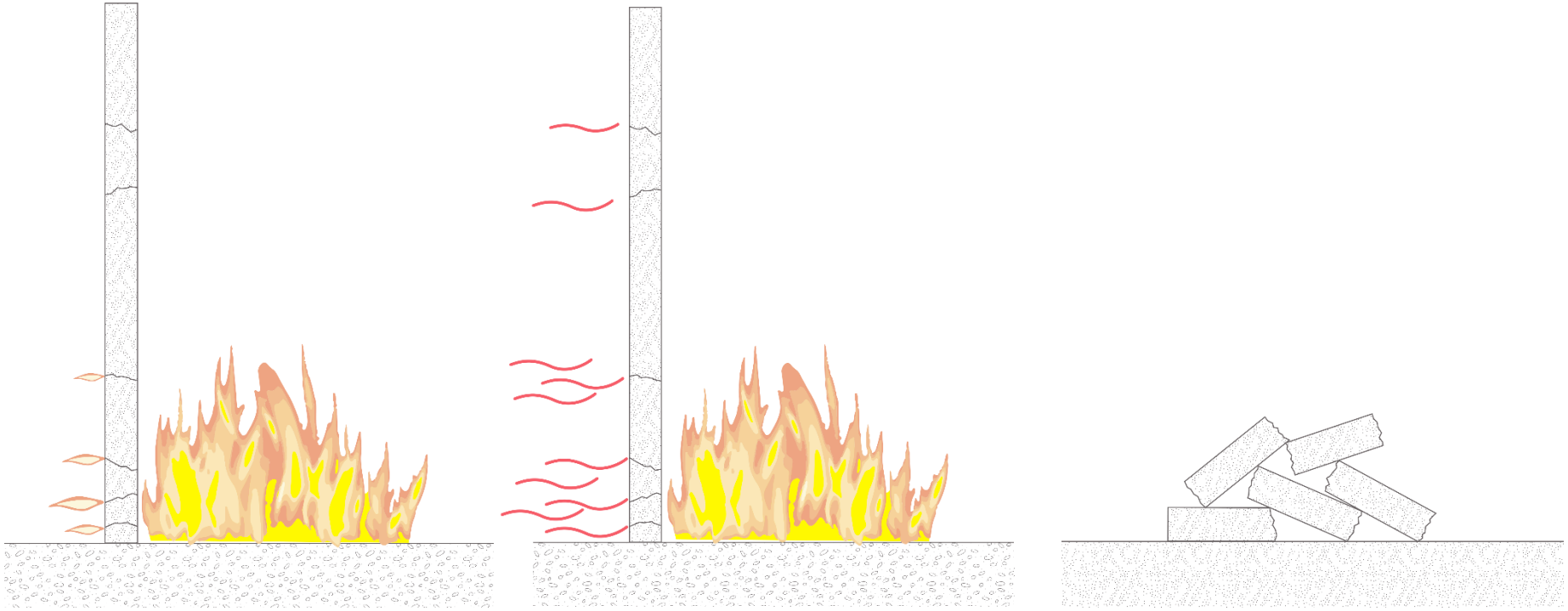
- ***Rain*** – panels impervious to moisture
- ***Cold*** – no affect on panels (keep sealants in warming bin)
- ***Snow*** – no affect on panels
- ***Wind*** – can shut down installation due to safety concerns

Pneumatic panel lifting equipment

Testing Requirements

Testing Requirements

- Prevent passage of flame or hot gasses
- Prevent transmission of excessive heat
- Must not burn through or collapse (wall or ceiling)



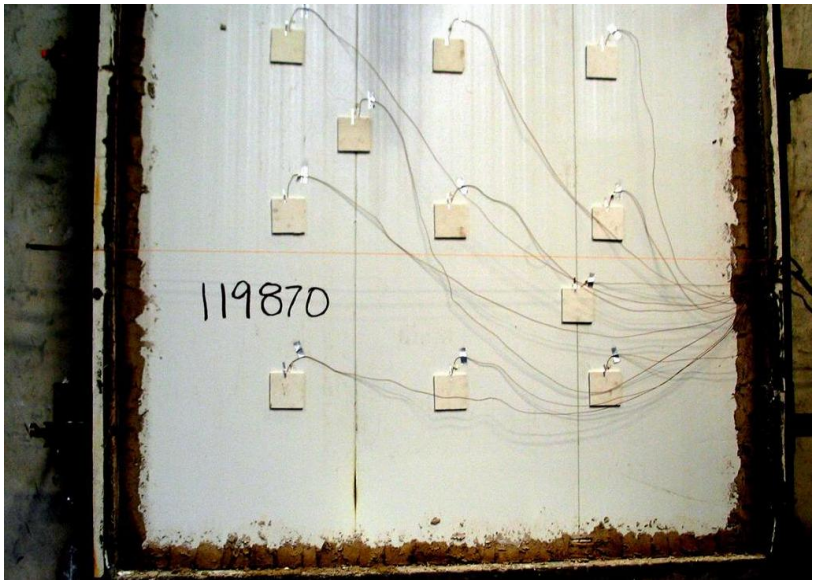
Testing – Laboratory Chamber - BEFORE

Vertical furnace

Thermocouple Placement

Testing – Laboratory Chamber – During and After

Wall Test – Hot Side

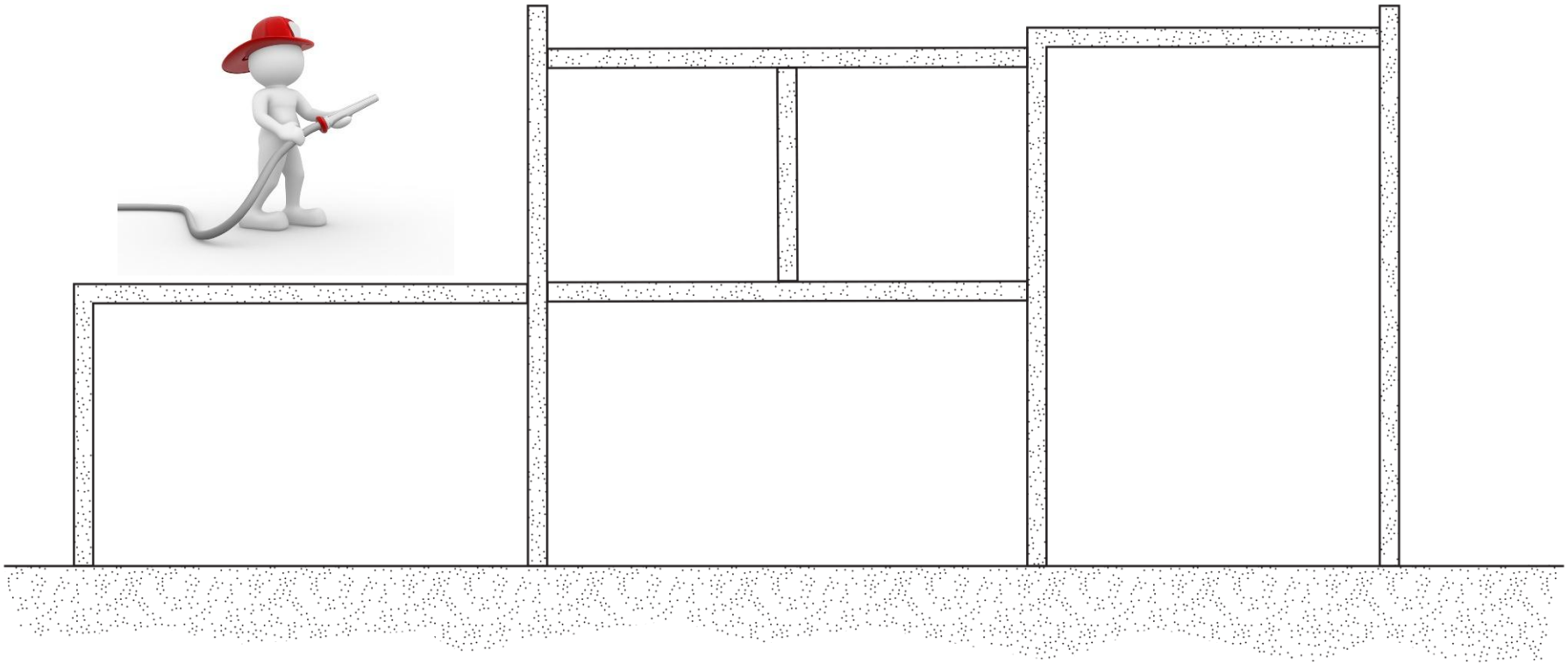


Wall Test – Cold Side

Code Requirements and Approvals

Code Requirements and Approvals - Fire Resistance

- Provide secure barriers to prevent spread
- Provide refuge and safe egress for occupants
- Prevent collapse of walls and ceilings
- Provide firefighting access



Code Requirements and Approvals - Resistance Ratings

- **Ratings expressed in hours** – apply to floor-ceilings, roof-ceilings, beams, columns, walls, partitions
- **Ratings determined by testing** for the amount of time to contain the fire, and the wall's ability to perform structurally
- **Mineral wool IMPs** tested in accordance with *ANSI/UL 263 (ASTM E119 and NFPA 251 or UBC 7-1),* "Fire Tests of Building Construction and Materials"
- **Mineral wool IMPs achieve 1-, 2- & 3- hour fire resistance ratings for non-load bearing walls**

Code Requirements and Approvals

Requirements based on IBC code version adopted for use at the project's location

- Varies by state or city

Code determines where/when fire resistive construction is required

- Specifies where fire resistant construction is required
- Specifies resistance rating required
- Architect determines materials used to accomplish requirement

Authority having jurisdiction (AHJ) interprets and enforces code requirements

- Fire Marshall
- Code official
- Sometimes review outsourced to another locality/entity

Code Requirements and Approvals – IBC Chapters 3-5

Chapter 3 Use and Occupancy Classification

- Determines proper classification required for safety based on:
  - Use of building (churches, hospitals, prisons, retail, manufacturing, housing, agriculture, aviation etc.)
  - Number of occupants
  - Flammable or toxic materials in use or stored

Chapter 4 Special Detailed Requirements Based on Use and Occupancy

Chapter 5 General Building Heights and Areas

- Determines maximum allowable areas and heights based on classifications
- Specifies fire separation/protection areas and ratings

Code Requirements and Approvals – IBC Chapter 6

Chapter 6 Types of Construction

Five categories, ≈ descending order from *most* to *least* fire resistant

- **Types I and II** (non-combustible construction *required*)
- **Types III, IV and V** (combustible construction *permitted*)

Sub-divided as follows:

- **Non-combustible (protected): Types IA, IB and IIA**
  - Structures are non-combustible AND fire protected
- **Non-combustible (unprotected): Type IIB**
  - Structures are non-combustible but not fire protected
- **Combustible (protected): Types IIIA, IV and VA**
- **Combustible (unprotected): Types IIIB and VB**

- **Types III, IV and V** are considered *combustible*, but certainly okay to use *non-combustible* construction

Code Requirements and Approvals – IBC Chapter 7

Chapter 7 Fire and Smoke Protection Features

- Establishes test procedures needed for code compliance
- Provides *specifics* on construction methods and materials allowed
- Identifies structural components that must be addressed in fire resistive construction:
  - Columns, beams, trusses (roof joists) and spandrels attached to columns
  - Floor or roofing assemblies connected to columns
  - Bracing members that stabilize primary framing

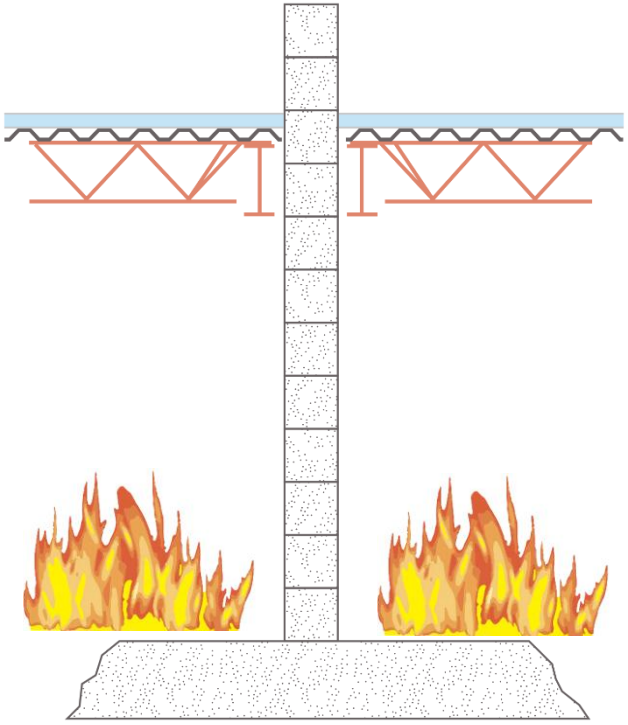
Code Requirements and Approvals – Protecting Framing

- Responsibility of structural designer
- Steel loses strength at high temperatures
- Fire protection insulates framing from heat of fire
- Fire protection of framing may influence wall and ceiling design
- Spray applied or “box-outs”

Construction Assemblies

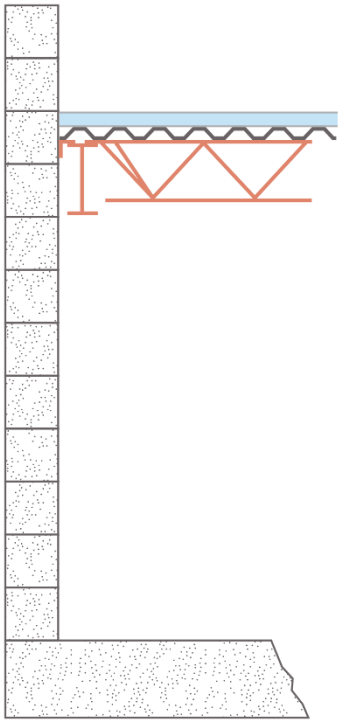
Construction Assemblies: Fire Walls

- Complete separation of occupancy groups
- Exterior walls on lot lines
- Self-supporting during fire
- Vertical continuity (floor to/through roof)



Occupancy separation

- Fire walls are rated for fire exposure from ***both*** sides of wall
- IBC 2015 Chapter 7, Section 706

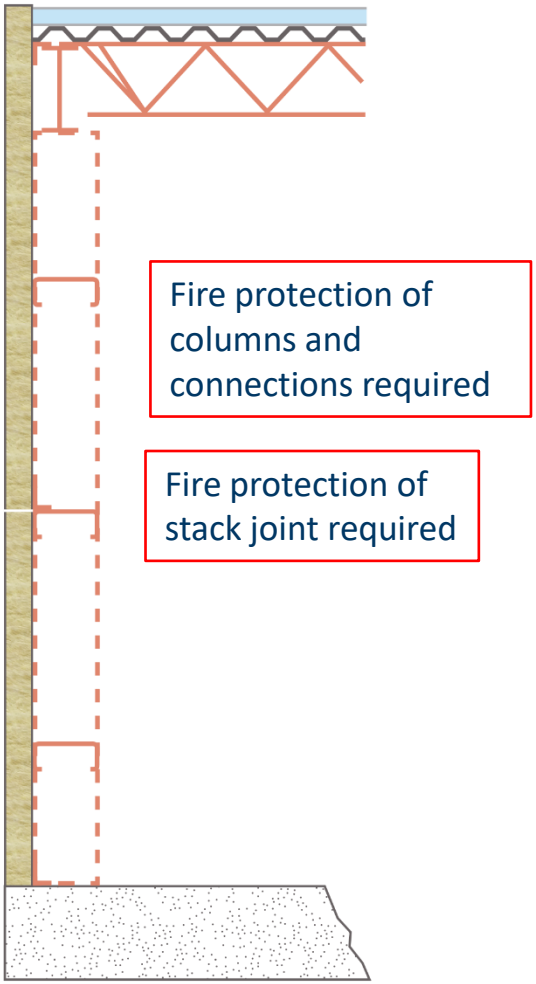


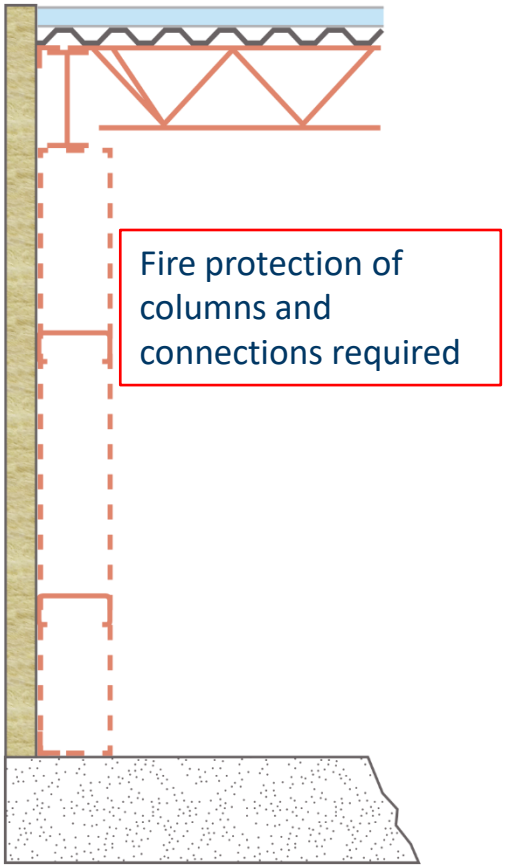
Lot line

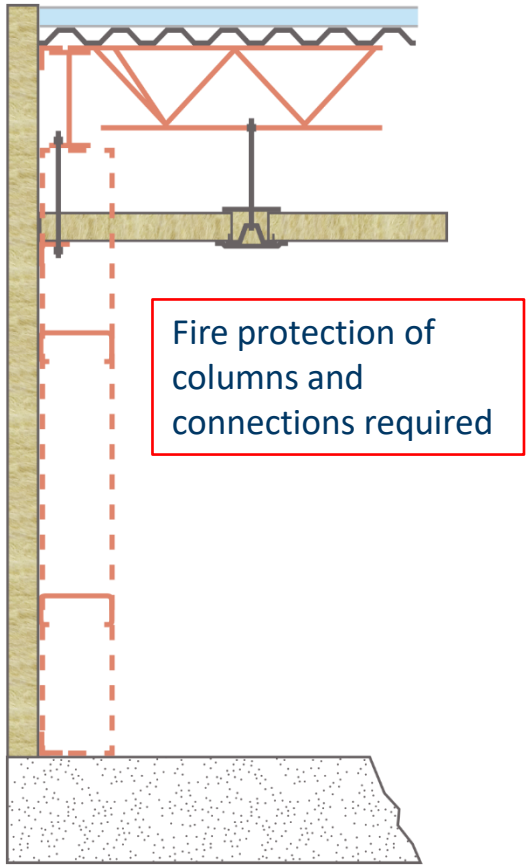
Subject to state/local codes

Construction Assemblies: Fire Rated Exterior Walls – MW IMPs

- IBC 2015 Chapter 7, Section 704





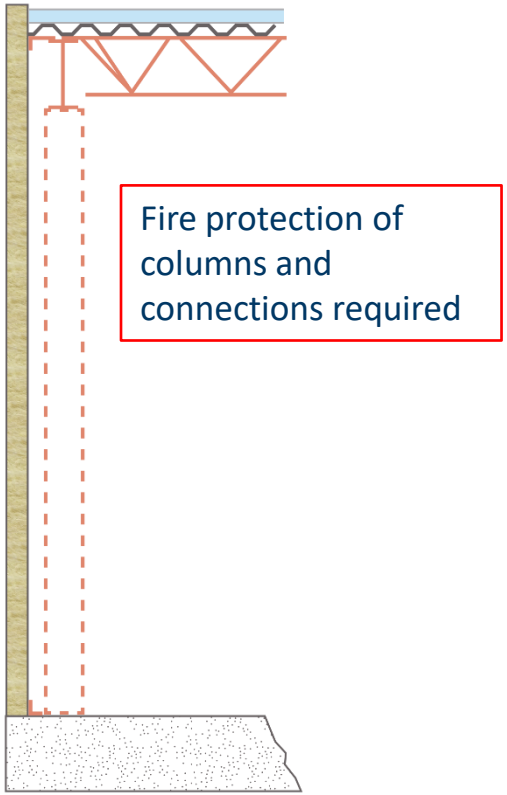


Subject to state/local codes

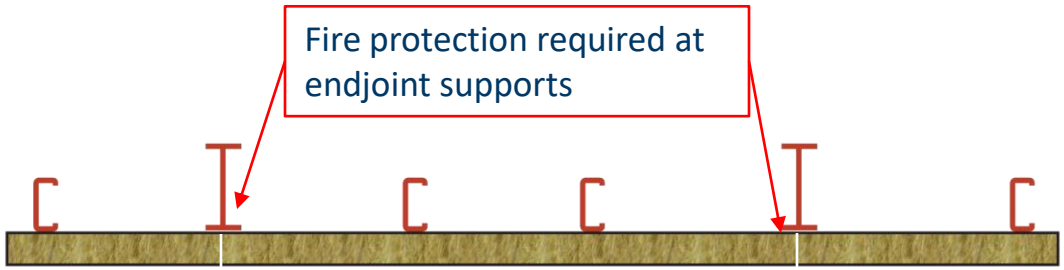
Construction Assemblies: Fire Rated Exterior Walls – MW IMPs

Fire protection required for:

- Structural members that support the fire wall construction
- Vertical columns that support *horizontal* panels
- IBC 2015 Chapter 7, Section 705



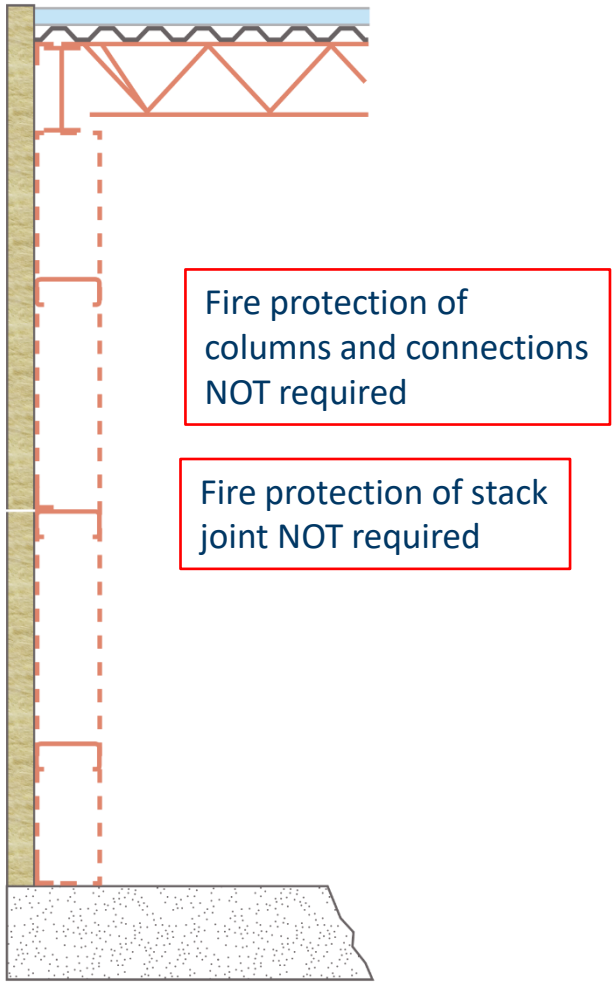
Vertical wall panels

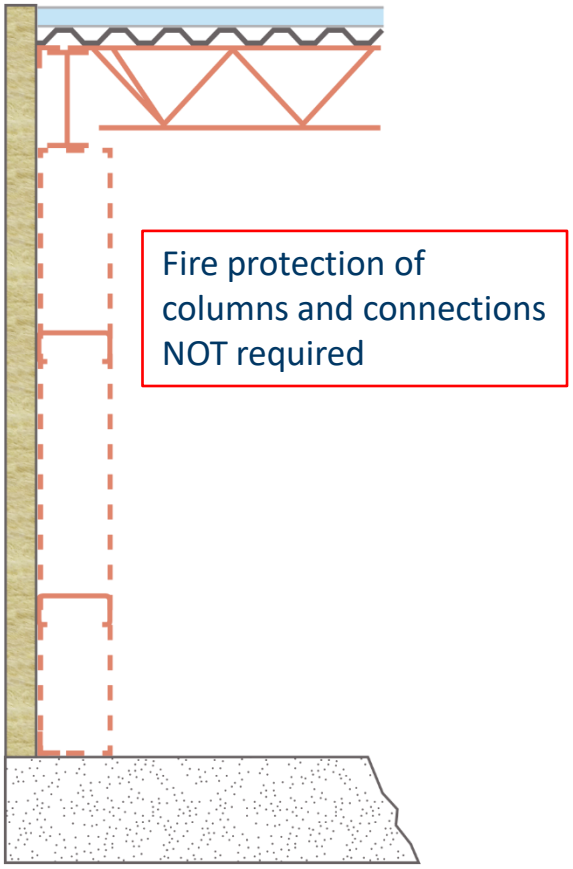


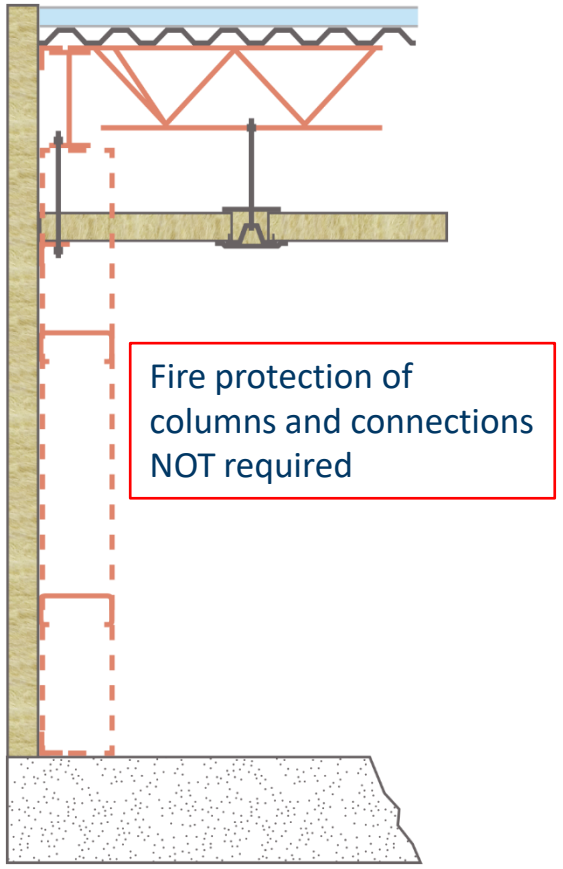
Horizontal wall panels

Subject to state/local codes

Construction Assemblies: Non-Combustible Exterior Walls



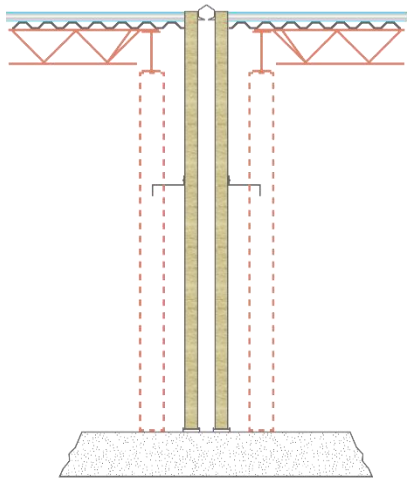


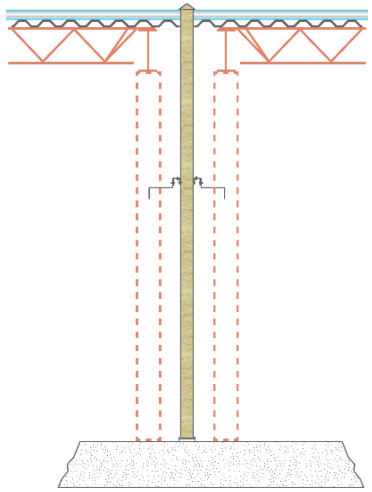


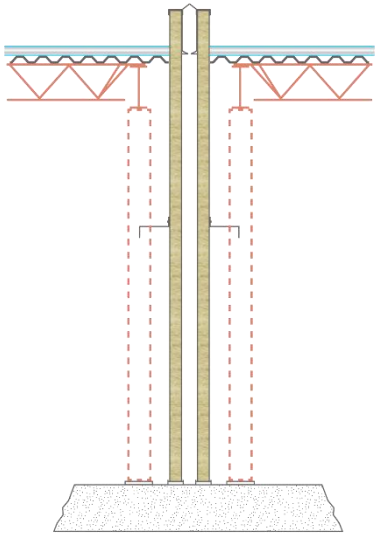
Subject to state/local codes

Construction Assemblies: Interior Fire Walls – MW IMPs

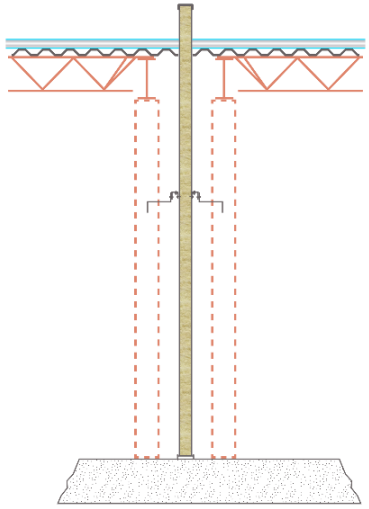
- **Structural stability** – wall must remain in place
- **Vertical continuity** - wall must extend from floor to
  - 30" above roof (parapet)
  - Underside of roof deck
- **Horizontal continuity** - wall must extend from exterior wall to exterior wall w/18” extension
  - Extension not required if wall is ≥ 1 hour rated or non-combustible







Double walls



Single wall – break away clips

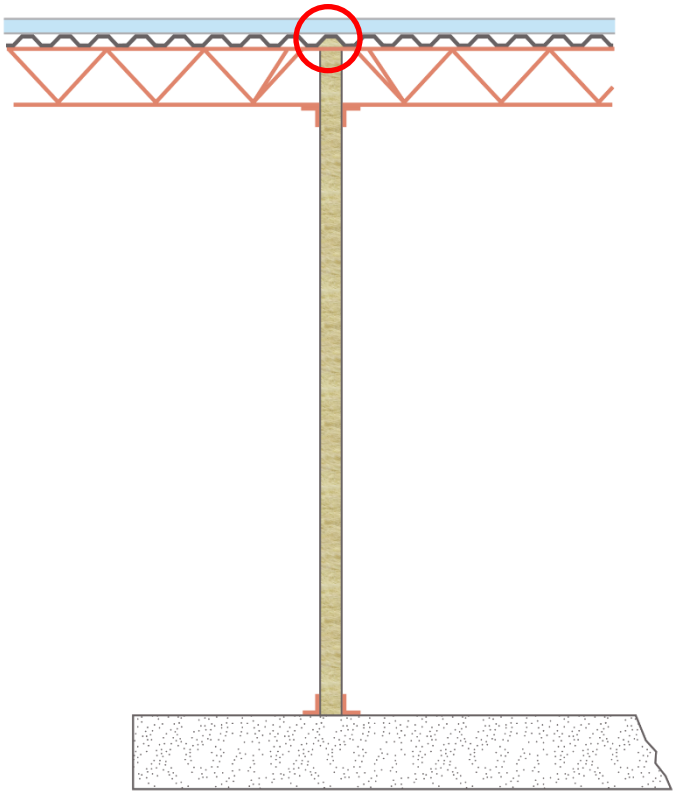
Subject to state/local codes

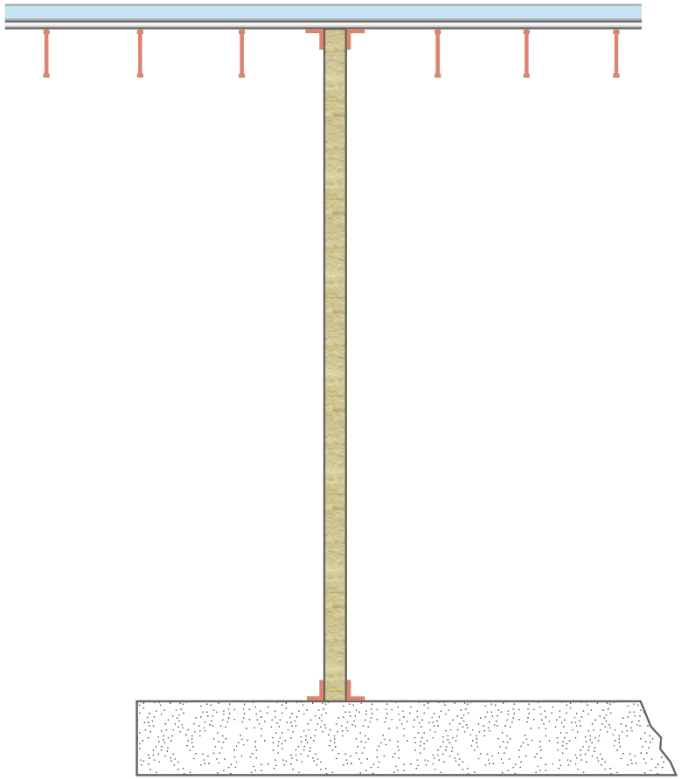
Construction Assemblies: Interior Partitions – MW IMPs

Fire partitions used to separate:

- Dwelling units
- Sleeping units
- Tenants in covered malls
- Some corridor walls

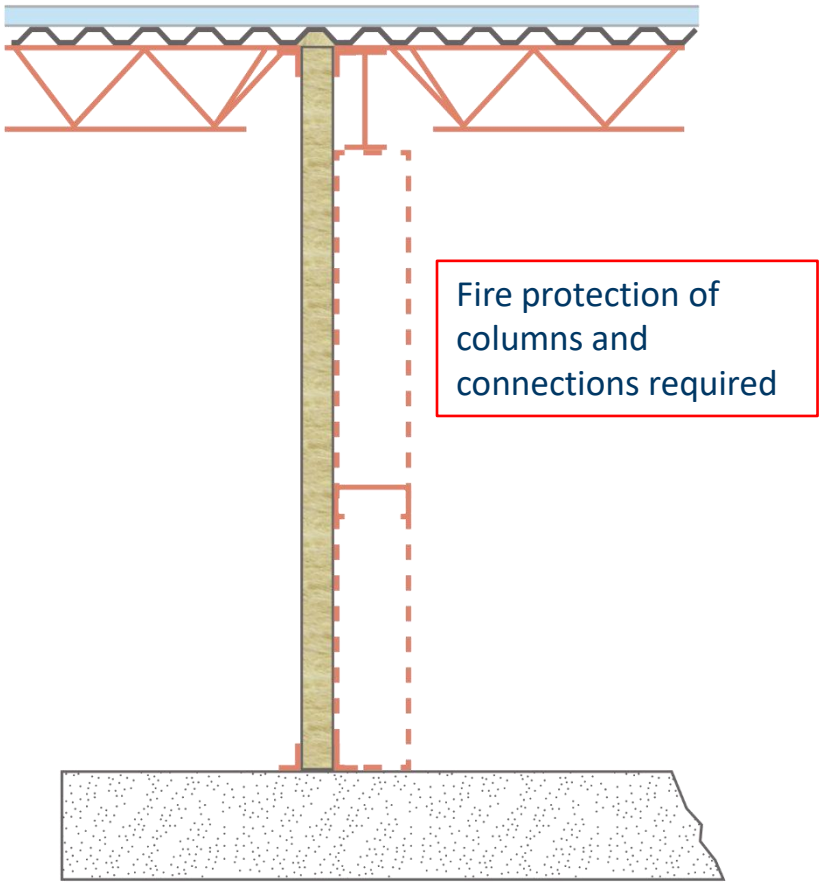
- IBC Chapter 7, Section 708

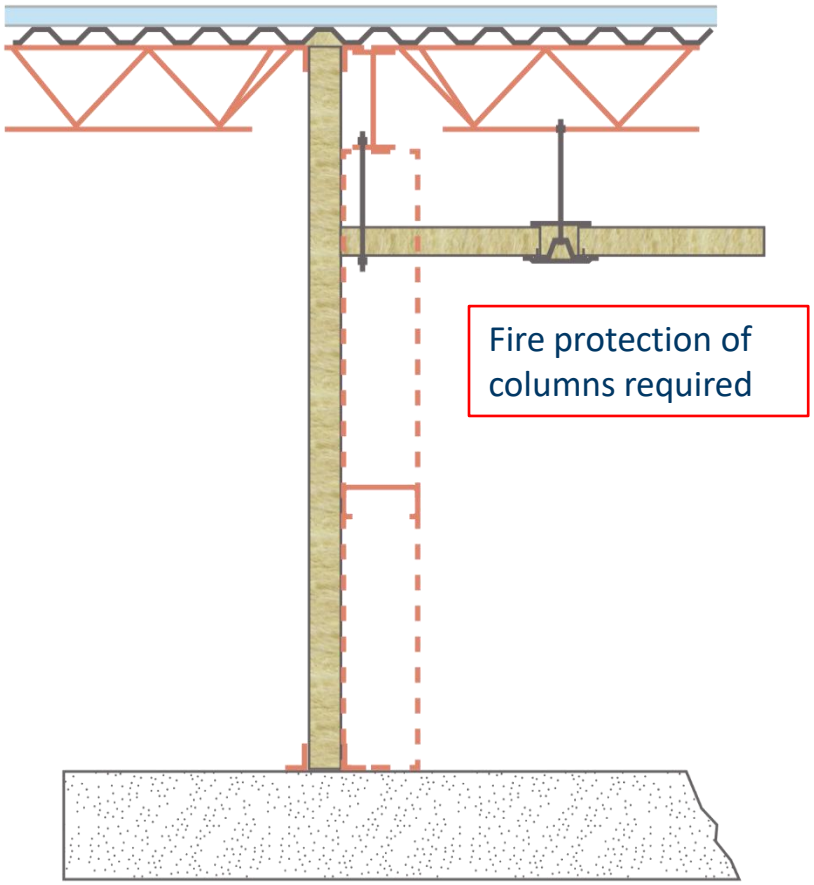




Subject to state/local codes

Construction Assemblies: Interior Partitions w/Framing – MW IMPs

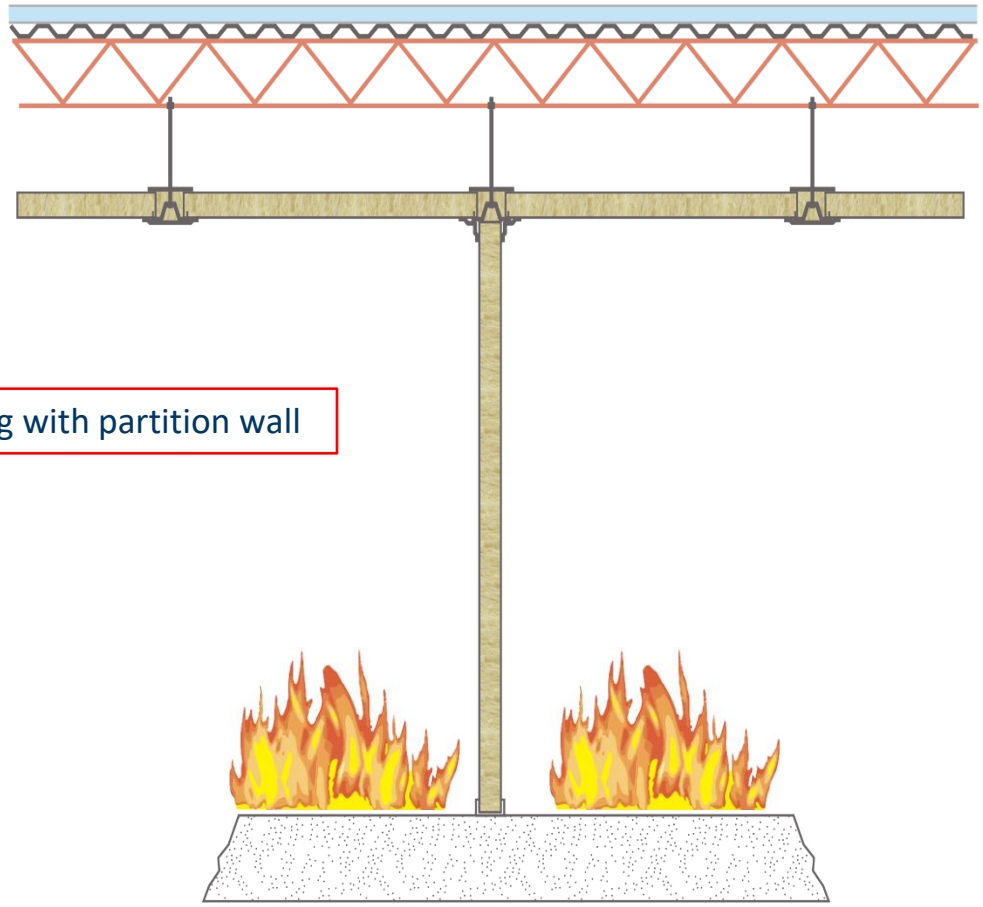




Subject to state/local codes

Construction Assemblies: Fire Partitions w/Rated Ceiling – MW IMPs

- Must be rated from *both* sides
- Vertical continuity – wall must extend from floor to underside of roof/ceiling/upper floor
- Rated ceiling protects roof structure



Suspended rated ceiling with partition wall

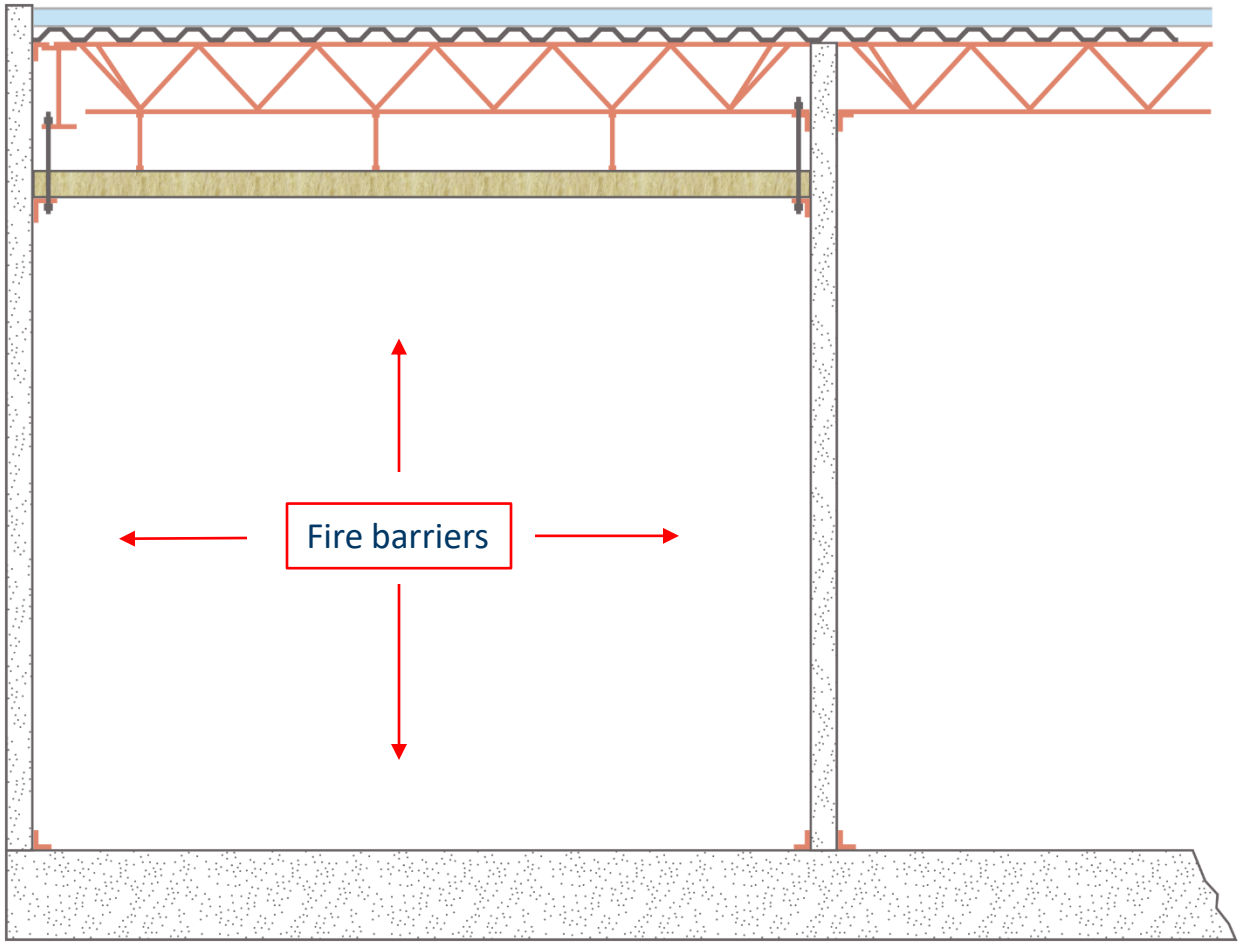
Subject to state/local codes

Construction Assemblies: Fire Barriers – MW IMP Ceiling

Fire barriers used for:

- Shafts
- Exit enclosures
- Exit passageways
- Separation of fire areas
- Incidental use
- Mixed occupancies

- IBC Chapter 7, Section 707



Subject to state/local codes

Construction Assemblies: Interior Walls/Partitions

Construction Assemblies: Ceilings

WH (Intertek) Design No. FC 200
Fire Resistance Rating for Ceiling

- 6" thick (minimum) = 1-1/2 hour rating
- Rated for fire exposure on *underside*

Construction Assemblies: Penetrations

Penetrations and how to properly seal them are included in the UL Firestop XHEZ Approval Listings (http://database.ul.com).

Sustainability and Transparency

Sustainability and Transparency

Mineral Wool Insulated Metal Panels

- Average recycled content of facings ≈ 25-35% (mainly post-consumer)
- Average recycled content of core ≈ 75% (mainly pre-consumer)
- Long life cycle ≈ 60 years
- Steel 100% recyclable at end of use
- Core can be safely disposed, or ground and used as brick additives

Sustainability and Transparency

- Environmental Product Declarations (Type III)
  - Life Cycle Analysis of product's environmental impact
  - Assists Owners/Designers to make informed product decisions
- Health Product Declarations
  - Evaluates product chemistry, potential health risks
- IMPs offer substantial contributions towards various environmental rating systems
  - USGBC LEED® Green Building Rating System
  - Green Globes
  - Living Building Challenge

Summary

Mineral Wool IMPs provide outstanding value in a single component

- ✓ *Fire performance (code compliant)*
- ✓ *Thermal performance*
- ✓ *Environmental Control layers (water, air, vapor and thermal)*
- ✓ *Sound attenuation*
- ✓ *Design flexibility*
- ✓ *Competitive initial cost*
- ✓ *Longevity (up to 60 years)*
- ✓ *Fast installation*
- ✓ *Low maintenance (periodic washdowns only)*
- ✓ *Structural performance (long spans, handles wind, snow and seismic loads)*
- ✓ *Environmentally sustainable*

METL SPAN®

a NUCOR® company