Fire Resistant Wall & Ceiling Construction

TECHNICAL DIGEST

METL SPAN®

PIONEERING INSULATED METAL PANEL TECHNOLOGY

PIONEERING INSULATED METAL PANEL TECHNOLOGY

METL SPAN®

CONTENTS

INTRODUCTION

Building fires are a significant threat to human life, property and commerce. In the US alone there are over a million building fires each year causing thousands of deaths, injuries, and more than $11 billion in direct property damage (more than typically caused by hurricanes, floods, tornadoes or earthquakes).

It is important to note that the majority of these fires are residential fires while the incidence of non-residential fires has progressively declined. Currently there are an estimated 98,500 non-residential fires each year causing more than $2.5 billion direct property damage. The decline in non-residential fires validates the continuing improvements in commercial fire resistant materials & construction, and more effective fire safety regulation.

An example of the improvements in fire resistant materials and construction is the evolution of the mineral fiber insulated metal panels. These factory assembled composite panels have become an important performance and cost-effective solution for fire resistant wall and ceiling construction.

The purpose of this technical digest is to provide a general understanding of fire resistant construction, its regulation and effective application relative to a building's walls and ceilings. The information in this digest is primarily focused on non-residential construction for typical steel framed, commercial and industrial buildings.

This digest answers the basic questions of: what is fire resistant construction, where and why is it required, who determines and regulates its requirements, and what are the common fire resistant wall and ceiling constructions. This digest also explains the real world benefits of the advanced designed mineral fiber insulated metal panel system for fire resistant construction.

Note: Fire loss based on NFPA data (2011).
Hurricane and tornado/hail loss based on Stanford University RMS data.
Flood loss based on NOAA data (5 yr. avg.), Earthquake loss based on FEMA data.

WHAT IS THE PURPOSE OF FIRE RESISTANT CONSTRUCTION?

Provide Separation – Fire resistant walls and ceilings are specified as separation barriers to prevent the spread of a fire into other areas of a building or into other buildings.

This function may be referenced as “compartmentation” or “fire containment”.

Provide Safe Egress – Fire resistant walls and ceilings are specified to enclose refuge areas and exit corridors for safe escape of personnel from a building in which there is a fire.

Prevent Collapse – Fire resistant walls or ceilings are specified to minimize personnel injury or property damage resulting from collapse of the walls or ceiling when subjected to a fire.

Provide Firefighting Access – Fire resistant walls or ceilings are specified to provide safe access for fire fighting personnel and equipment to fight a fire within the building.

WHAT IS FIRE RESISTANT CONSTRUCTION?

To qualify as “Fire Resistant Construction”, a building’s walls and ceilings must do the following when exposed to a fire:

Prevent passage of flame or hot gases – The wall or ceiling construction must be a barrier which blocks a fire’s flame and hot gases from passing through the construction so it cannot ignite material or injure inhabitants in the space on the other side.

Prevent transmission of excessive heat – The wall or ceiling construction must be a thermal insulator which reduces the transmission of a fire’s heat through the construction to the extent that it cannot ignite material or injure inhabitants in the space on the other side.

Must not burn through or collapse – The wall or ceiling construction must remain in place and continue to block the passage of flame and hot gases and continue to reduce heat transfer during the duration of the fire.

Must not collapse during fire fighting – The wall or ceiling construction must continue to block the passage of flame and hot gases and not collapse while being subjected to the pressure and thermal shock of the firefighter’s water hose stream.

WHO DETERMINES FIRE RESISTANT CONSTRUCTION REQUIREMENTS?

Building Code or Fire Safety Code – In most cases, the states (and some cities or local areas) require that buildings within their jurisdiction are regulated by a specific building code and/or fire safety code.

Prior to 1997, most state and local building codes were based on various versions of model codes such as UBC, BOCA and SBC. In 1997, the model codes were combined into the International Building Code (IBC). Most jurisdictions now base their specific building codes on versions of the IBC.

The information in this guide is generally based upon the 2012 version of the IBC (which may be referenced herein by "IBC" or "the code").

Caution: The information in this guide may be in variance with a specific building code or fire safety code and does not attempt to present all of the clarifications and exceptions contained within specific codes.

Governing Authority – The approval and regulation of fire resistant construction is the responsibility of the governing state or community's building code enforcement office or fire marshal's office. Any proposed fire resistant construction must be approved by the governing code official or fire marshal.

It is most critical to seek early approval of a project's fire resistant construction so varying interpretations of the code can be resolved in the design phase, and to seize opportunities of project specific variance from the code for economic or other interests of the community.

HOW IS THE PERFORMANCE OF FIRE RESISTANT CONSTRUCTION MEASURED?

The Model Fire – The National Bureau of Standards conducted full scale fire tests in 1917 & 1918 to develop a measurable model of the typical fire that occurs in a building. From these tests, the fire load concept and temperature/time curve were derived.

The model fire is based upon the burning effects of a standardized representation of common combustible materials.

Fire Load Concept – The duration of the typical fire is proportional to the mass of combustible material per unit of floor area. The intensity of the fire is equal to the potential heat value of the combustible material (7000 to 8000 BTU per lb.).

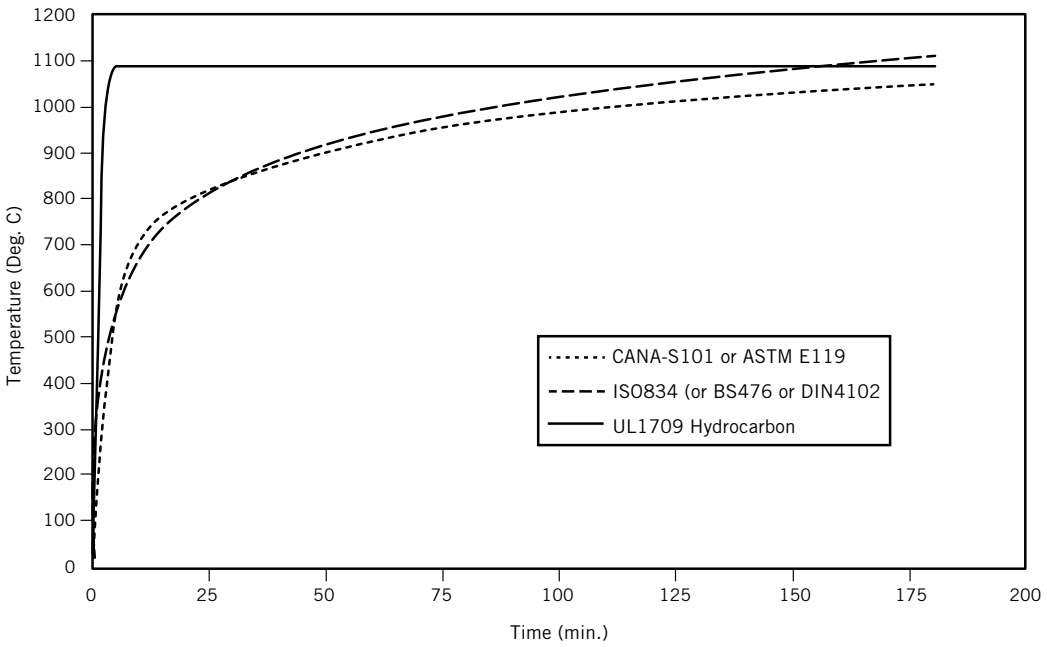
Based upon the model fire, 10 lb. of the combustible material per sq. ft. of floor area will produce a fire of 1 hour duration, 20 lb. will produce a fire of 2 hour duration and 30 lb. will produce a fire of 3 hour duration.

HOW IS THE PERFORMANCE OF FIRE RESISTANT CONSTRUCTION MEASURED? (cont.)

Time/Temperature Curve – During a typical fire in a building, the heat produced by the fire rises rapidly during the first few minutes after the fire started, and then continues to rise at a slower constant rate until the combustible materials are consumed.

Based upon the model fire, the duration and intensity of the model fire is plotted as a time/temperature/time, such as shown in the chart below.

Time/Temperature Curves



ASTM E119 – In 1933, based on the fire load concept and temperature/time curve of the model fire, the American Society of Testing Materials (ASTM) issued the ASTM E119 test standard titled "Fire Tests of Building Construction and Materials".

This is a full scale test that measures the duration of a construction's resistance to the model fire, and measures the heat transfer through the construction. It also evaluates the construction's resistance to the pressure and thermal shock of fire fighting hose streams.

Note: Test standards designated as UL 263, NFPA 251 and UBC standard 7-1 are recognized as being equivalent to ASTM E119.

For Canada, the equivalent test standard is CAN/ULC S101 which is similar to ASTM E119 and uses the same time/temperature curve.

UL1709 is a similar test, but with a faster rise time/temperature curve for testing exposure to fast burning flammable liquid fires.

HOW IS THE PERFORMANCE OF FIRE RESISTANT CONSTRUCTION MEASURED? (cont.)

Hourly Rating – To meet the requirements of the IBC building code, fire resistant wall and ceiling constructions must be tested in accordance with the ASTM E119 test standard.

Within the ASTM E119 test standard, the fire resistance capability of the tested construction or material is rated in terms of hourly duration. This means the construction or material is rated to resist the conditions of the typical (model) fire for a specified (1 hour, 1½ hour, 2 hour or 3 hour) duration of time.

According to the building's use and other factors, the building code or fire safety code specifies the building's construction elements (structural, wall, roof and floor systems) in terms of their required hourly fire resistance rating.

In the US and Canada, ASTM E119 and CAN/ULC S101 tests are conducted, rated and certified by independent laboratories, such as Underwriter's Laboratories. (UL mark) and Intertek Testing Services (Warnock Hersey mark).

Alternate Methods of Hourly Rating – The building code may also allow approval of fire resistant construction based upon pre-qualified (prescriptive) designs which are defined by the code or by qualified engineering analysis. Either method must be based upon the fire exposure and acceptance criteria specified in ASTM E119.

HOW DOES THE BUILDING CODE SPECIFY FIRE RESISTANT CONSTRUCTION?

A primary objective of the building code is to specify and regulate the fire protection requirements of the building, its occupants and neighboring buildings and properties.

The code's strategy is to first classify the building in accordance with its fire hazard potential. And then specify the required fire resistance rating for the building's elements (structural framing, wall, roof, ceiling and floor assemblies) in accordance with the fire hazard classifications and related factors.

The building's fire hazard potential is determined by:

1. The type of the activities in the building.
2. The type and density of occupants within the building.
3. The type and density of combustible materials contained within the building.
4. The building's size (height and area).

Following are the primary factors in classifying the building's fire hazard potential and the fire resistance requirements of its construction.

HOW DOES THE BUILDING CODE SPECIFY FIRE RESISTANT CONSTRUCTION? (cont.)

Use & Occupancy – IBC Chapter 3 classifies the building in accordance with the fire hazard potential of the building's intended use and occupancy. The classifications are designated into ten groups with sub-groups. For example:

Groups A1 thru A5 - Assembly (theaters, restaurants, churches, etc.)
Group B - Business (offices, service transactions, records storage, etc.)

Occupancy Separation – IBC Chapter 5 specifies physical separation of different occupancies and incidental use areas within the building in accordance with the fire hazard potential of the respective occupancies and use.

Height and Area – Larger buildings have greater potential of property damage, occupant injury and fire fighting difficulty. IBC Table 503 specifies the size limits of the building (height and floor area) in accordance with the fire hazard potential of the building's use & occupancy group and types of construction.

Types of Construction – IBC Table 503 categorizes the building's required type of construction as Types I through Type V in accordance with the building use and occupancy group. These construction types are then sub-categorized as A or B in accordance with the building height and area limitations.

Separation Distance – The potential of a fire spreading between adjacent buildings or properties is reduced when there is sufficient space (fire separation distance) between the building's exterior wall and the adjacent buildings or properties.

IBC chapter 2 defines "fire separation distance" and specifies the factors in determining the separation distance.

Required Fire Resistance Ratings – The building's construction elements (structural framing, walls, floors, roof & ceilings) may require an hourly fire resistance rating as specified by the code.

IBC Table 601 specifies the required fire resistance ratings for the building's construction elements in accordance with the building's type of construction.

IBC Table 602 specifies the required fire resistance rating for non-load bearing exterior walls in accordance with the building's type of construction, occupancy group and separation distance.

Note: The code may reference types of construction and construction elements as non-combustible and combustible.

Sprinkler Systems – For areas with greater fire hazard potential, the code may specify that automatic sprinklers are required (reference IBC section 903). Where the code does not require sprinklers, the application of sprinklers generally reduces the hourly fire resistance requirements of the building's elements.

HOW DOES THE BUILDING CODE SPECIFY FIRE RESISTANT CONSTRUCTION? (cont.)

Means of Egress – IBC Chapter 10 specifies the quantity, location and size of exit enclosures and corridors in accordance with the fire hazard potential of the building's use, the nature and density of its occupants and the building size.

Construction Requirements for Building Elements – IBC Chapter 7 specifies the fire resistance construction requirements for the building elements, such as exterior walls, interior walls, fire walls, ceilings and structural members. Included are the requirements for specific conditions such as elevator and stairway shafts, exits and corridors, etc.

Opening Protection – IBC section 715 specifies the fire resistance requirements of doors and windows (glazing) in accordance with specific conditions.

Doors are fire resistance rated in accordance with UL 10B or UL 10C (or NFPA 252) standards. Windows are fire resistance rate rated in accordance with UL 9 (or NFPA 257) standards.

Penetration Fire Stops – IBC section 714 specifies that penetrations of pipes, conduits and ducts through fire resistant walls must be protected by a penetration fire stop system with a fire resistance rating equal to the rating of the wall.

The fire stop systems are rated in accordance with the ASTM E814 (ANSI/UL 1479) standard.

BASIC REQUIREMENTS FOR FIRE RESISTANT WALLS & CEILINGS

IBC Chapter 7 specifies the design requirements for the fire resistant building elements. Following are examples of basic requirements for exterior walls, interior walls, fire walls, ceilings and structural framing:

Caution: The design requirements specified in Chapter 7 are very detailed with many exceptions and cross references which must be studied carefully for specific wall and ceiling applications. The following are examples only and are not intended to present the full scope of design requirements.

EXTERIOR WALLS (IBC Section 705)

Fire Resistance Function – Exterior walls function as fire barriers for the following:

1. Prevent fire in the building from spreading to adjoining buildings or property.
2. Prevent exterior fires from spreading into the building.
3. Prevent fire in the building from spreading through exterior wall openings to the upper stories on a multi-story building.

BASIC REQUIREMENTS FOR FIRE RESISTANT WALLS & CEILINGS (cont.)

Fire Resistant Rating - The exterior walls must meet the minimum ASTM E119 hourly fire resistance rating specified by the code for the specific building conditions.

Exception: For exterior walls with a separation distance of 20′ or greater, the heat transmission limitations of ASTM E119 do not apply. With separation distance less than 20′, the heat transmission limitations may not apply for exterior walls with certain conditions of opening exposure and protection.

Fire Exposure - The exterior walls must be fire resistance rated for exposure to fire from both sides of the wall.

Exception: When the separation distance on the exterior side of the wall is greater than 10′, the fire resistance rating may be required only for the interior side of the wall.

Vertical Continuity - The exterior walls must extend continuously from the floor to above the roof as a parapet. The function of the parapet is to prevent a fire from spreading from the building's roof to adjacent buildings or property. The minimum height of the parapet is 30″ (or higher for certain roof slope and opening protection conditions).

Exception: The parapet is not required for certain building conditions, such as, less than 1000 sq. ft. per floor area, certain separation distances, or the roof assembly meeting certain conditions of fire protection.

When a parapet is not required, the wall must extend from the floor to the underside of the roof decking or sheathing.

Opening Limitations - The code specifies the percentage area of openings allowed in exterior walls in accordance with separation distance, sprinkler protection and the degree of opening protection.

Flame barriers may be required between vertical spaced opening in accordance with specific building conditions.

Structural Stability - When exposed to fire, the wall must have sufficient structural stability that it will remain in place during the duration of time indicated by the required fire resistance rating.

INTERIOR WALLS (IBC Sections 707 & 708)

Fire Resistance Function - The code designates fire resistant interior walls as fire partitions or fire barriers to prevent fire from spreading between areas within the building.

Fire partitions are specified for separating tenants, dwellings units and sleeping areas, and for enclosing, corridors and elevator lobbies.

BASIC REQUIREMENTS FOR FIRE RESISTANT WALLS & CEILINGS (cont.)

Fire barriers are specified for separating fire areas, mixed occupancies, exits, stairway shafts, incidental use areas and hazardous material areas, etc. Fire barriers typically have greater fire protection requirements than fire partitions.

Fire Resistant Rating - The interior walls must meet the minimum ASTM E119 hourly fire resistance rating specified by the code for the specific building conditions.

Vertical Continuity - Fire barriers and fire partitions must extend continuously from the floor to the underside of the roof (or floor) decking.

Exception: Fire partitions may extend to the underside of a fire rated ceiling.

Opening Limitations - Openings in fire partitions must be fire protected with the fire resistance rating specified by the code for the building conditions.

For openings in fire barriers, the code specifies the maximum width of the openings and specifies the total percentage of opening width allowed per wall length in accordance with sprinkler protection and the degree of opening protection.

Structural Stability - When exposed to fire, the wall must have sufficient structural stability that it will not collapse during the duration of time indicated by the required fire resistance rating.

FIRE WALLS (IBC Section 706)

Fire Resistance Function - A fire wall is a common wall between two buildings which prevents the spread of fire from one building to the other. Fire walls serve the following functions:

To divide a building into separate areas of different allowable area and construction type relative to fire resistance rating requirements. The separated areas on either side of the firewall are treated by the code as separate buildings with individual fire resistance requirements.

To function as a party wall between two buildings of separate ownership. The party wall is located on the lot line between the two buildings and provides joint service to both buildings.

Fire Resistant Rating - Fire walls must meet the minimum ASTM E119 hourly fire resistance rating specified by the code for the building or area with the greater fire resistance requirements.

Fire Exposure - The wall's fire resistance rating must be for exposure to fire from both sides of the wall.

BASIC REQUIREMENTS FOR FIRE RESISTANT WALLS & CEILINGS (cont.)

Structural Stability - When exposed to fire, the fire wall must have sufficient structural stability that it will not collapse during the duration of time indicated by the required fire resistance rating, even if the fire causes a collapse of the structural framing on either side of the wall.

To meet this requirement, the wall must be a totally self supporting single wall which is isolated from the effects of structural framing collapse on either side, or must be a double wall with each wall independently supported by (or supporting) its respective structural framing.

Vertical Continuity - The fire wall must extend continuously from the floor to above the roof as a parapet. The function of the parapet is to prevent a fire from spreading to the roof of the adjacent building.

Exception: The parapet is not required for certain building conditions, such as, roof assembly meeting certain conditions of fire protection.

When a parapet is not required, the wall must extend from the floor to the underside of the roof decking or sheathing.

Horizontal Continuity - The fire wall has to be continuous from exterior wall to exterior wall, and extend 18″ beyond the exterior walls. The function of the extension is to prevent a fire from spreading from the exterior wall surface of one building to the exterior wall surface of the other building.

Exception: the 18″ extension is not required for certain building conditions, such as, the exterior wall has at least a 1 hr. fire resistance rating, or has a non-combustible exterior sheathing or finish. Only the areas of the exterior wall extending 4′ from either side of the fire wall have to meet this requirement.

Opening Limitations - For openings in fire walls, the code specifies the maximum width of the openings and specifies the total % of opening width allowed per wall length in accordance with sprinkler protection and the degree of opening protection.

Exception: Openings are not permitted in party walls.

CEILINGS (IBC Section 711)

Fire Resistant Function - The fire resistance function of the ceiling is to provide a fire resistant cover to the underside of a floor or roof assembly, or to prevent the spread of fire between areas where the separating walls do not extend to the roof or floor above.

Fire Resistant Rating - The code specifies the required minimum ASTM E119 hourly fire resistance of ceilings to be equal to the specified fire resistant rating of the roof or floor assembly, or equal to the specified fire resistance rating for separation of areas.

Horizontal Continuity - Fire resistant ceilings must extend continuously from exterior wall to exterior wall, or from wall to wall of the specified enclosed area.

BASIC FIRE PROTECTION OF STRUCTURAL STEEL FRAMING

Although fire protection of the structural framing members is normally the responsibility of the structural designer rather than the wall and ceiling designer, this section provides a basic description of the fire protection requirements for the structural framing protection.

Note: For a more in-depth understanding of fire protection for structural steel framing, reference the Fire Resistance chapter of the Steel Design Guide published by AISC (American Society of Steel Construction).

Description of Structural Framing - The code specifies the following members (which carry gravity loads) as primary structural framing:

1. Columns
2. Horizontal members (such as beams, trusses and spandrels) which are directly connected to the columns.
3. Members of floor and roof assemblies directly connected to the columns.
4. Bracing members that stabilize the primary framing.

The code specifies the following as secondary framing:

1. Structural members not having direct connections to the columns.
2. Members of floor and roof assemblies not connected directly to the columns.
3. Bracing members not part of the primary framing.

Purpose of Structural Fire Protection - Although steel is non-combustible, it loses strength at higher temperatures. For example at 1300° F steel loses 80% of its bending strength. The purpose of structural fire protection is to insulate the structural members from the heat of a fire.

Fire Resistance Requirements - Fire Resistance Rating - the code specifies the minimum ASTM E119 fire resistance rating required for structural framing in accordance with the building's construction type.

Column Protection - When the primary framing requires a fire resistance rating, the code specifies the columns must be fully encased with fire protection for their entire length. If the column passes through a fire resistance rated ceiling, the column protection must still extend through the ceiling cavity to the top of the column.

The column's fire protection must include protection of the column's connections to other structural members.

Horizontal Member Protection - When the primary framing requires a fire resistance rating and the horizontal member supports a bearing wall or supports multi-story construction (more than two floors, more than one floor and a roof, or non-bearing walls more than two stories high) the member must be fully encased with fire protection for its full length.

BASIC FIRE PROTECTION OF STRUCTURAL STEEL FRAMING (cont.)

Exception: Horizontal structural members may be fire protected by encasement only on the exposed sides if the fire resistance rating of the assembly is confirmed by testing.

Secondary Member Protection - When the secondary members require a fire resistance rating, the members may be protected by encasement only on the exposed sides or by a fire resistance rated ceiling.

Both methods of protection may be used on a framing member passing through different areas of construction.

20′ Floor to Roof Height - Except for certain occupancy groups, fire protection of the roof structural members, roof framing and roof decking is not required when the entire roof and roof framing assembly is more than 20′ above the immediate functional floor below.

Wall & Ceiling Support Members - IBC Chapter 7 specifies the fire resistance requirements for the support members of the exterior walls, interior walls, fire walls and ceilings.

In general, the wall and ceiling support members must continue to support the wall during the duration of time indicated by the fire resistance rating as specified by the code for the respective wall or ceiling assembly. This requires that the structural members supporting the wall must a fire resistance rating equal to the rating required for the wall.

Exception: When the exterior wall has a separation distance of 30′ or greater, the wall's structural support member require only the fire resistance rating specified for secondary members per IBC table 601.

Note: The requirement that the wall must remain in place even if the structure collapses only applies to fire walls.

WHO SELECTS THE DESIGN FOR FIRE RESISTANT CONSTRUCTION?

The building code specifies where fire resistant construction is required, what fire resistance rating is required and what the construction requirements are.

But the code does not specify the specific construction design. The selection of the construction materials and the construction design (such as solid masonry vs. stud wall vs. insulated panel, etc.) is left to the discretion of the building's owner and designer.

FIRE RESISTANT WALL & CEILING DESIGN CONSIDERATIONS

The following are important considerations when determining which fire resistant materials and designs are most suitable for the building:

Fire Resistant Rating - Regardless of what fire resistant wall design and materials are used, the construction must have the hourly fire resistance rating specified in the governing building code. And the fire resistance rating must have been established in accordance with the ASTM E119 standard.

Prescriptive Designs - Most building codes provide a list of "prescriptive" fire resistant wall designs. These are typically older field assembled masonry and stud wall designs using generic materials and have been pre-approved for an hourly fire resistance rating.

Some of the prescriptive masonry and stud wall designs extend back to the 1930's, when the ASTM E119 standard originated. Many of the dry wall designs extend back to the 1950's when gypsum board became commonly used for commercial buildings.

In Chapter 7 of the IBC 2012 building code, the prescriptive wall designs are listed on tables, such as various masonry and dry wall constructions.

Certified Designs - Newer designs and designs using proprietary materials are certified and listed by the testing agency which tested and rated the design in accordance with the ASTM E119 standard.

Certified designs such as those that are tested and certified for fire resistance by Underwriter's Laboratories or Intertek Testing Services, are listed and described on the respective testing/certification agency's certifications directory websites.

Common Fire Resistant Materials - Following is a comparison of the common non-combustible materials used in fire resistant construction:

Steel - Being non-combustible, high strength, and economical, steel is commonly used for fire resistant structural framing, stud wall framing and ceiling framing.

Steel is also used as non-combustible exterior and interior facings or cladding for fire resistant walls and ceiling constructions.

Note: Because steel weakens when subjected to high temperatures, steel framing members may require covering with a non-combustible insulating material to reduce heat transmission from the fire to the steel member.

FIRE RESISTANT WALL & CEILING DESIGN CONSIDERATIONS (cont.)

Masonry - Masonry is a general term for construction using materials such as such rock, clay bricks & tiles and concrete. Concrete may be in the form of solid or hollow blocks, pre-cast panels or cast-in-place.

Walls may be masonry only, such a concrete block or cast concrete, or combined with other materials, such as brick or tile veneer backed by stud framing with a non-combustible gypsum board interior covering and mineral fiber insulation.

Masonry is typically specified for fire resistant wall construction because of its non-combustibility, durability and aesthetics. Compared to other construction materials, masonry is typically heavy, expensive and labor intensive requiring specialized trades and weather constraints.

Gypsum - Gypsum is non-combustible and when subjected to the heat of a fire, gypsum releases water which has a cooling effect on heat transmission.

Gypsum board and gypsum plaster are commonly used as interior covering for fire resistant wall and ceiling construction. Gypsum is also used as a covering over steel framing members to insulate the member from the heat of a fire.

Because gypsum board has a relatively weak span strength, it requires close spaced support, such as a stud wall framing with 16″ or 24″ stud spacing.

Gypsum board has limited impact resistance and water resistance, causing it to be unsuitable for areas with direct abuse and moisture exposure. Gypsum board is economical, but its installation requires specialized trades and protection from weather.

Mineral Fiber - Being non-combustible and fibrous, mineral fiber is the commonly used insulating material to reduce heat transmission through stud wall cavities and concrete block cavities.

Mineral fiber is also used to insulate steel framing from the heat of a fire, and is the commonly used fire stop material for joints and penetrations etc.

Mineral fiber consists of naturally non-combustible rock and steel mill slag, which are melted together and spun into fibers. Mineral fiber is also referenced as “rock wool” and “mineral wool”.

Mineral fiber is light weight, economical and can be used in the form of loose fill, batts, boards, and mixed in plasters.

Note: Technically, fiberglass and ceramic fiber are also mineral fibers, but the IBC code, uses the term “mineral fiber” to reference fibrous rock and slag.

FIRE RESISTANT WALL & CEILING DESIGN CONSIDERATIONS (cont.)

Fiberglass insulation has a lower melting point and is typically limited to constructions of only 1 hour fire resistance. Ceramic fiber insulation has a higher melting point, but its higher cost typically limits its use to special applications.

Mineral Fiber Insulated Metal Panels - These panels consist of non-combustible steel facings (exterior and interior) and a non-combustible mineral fiber insulating core which are factory assembled into a self-contained unit.

Being structurally capable of significant spans because of its composite construction, and being complete with exterior and interior facings and insulation, the panels are most often used as the total wall or ceiling construction, without the need of stud framing and additional insulation and coverings.

Installation of the panels does not require specialized trades. Being considered as structural panels, the panels can often be installed by the same contractors who erect the structural framing. The mineral fiber insulated metal panel provides an effective solution for fast and economical construction of fire-resistance rated walls and ceilings.

THE METL-SPAN® FIRE RESISTIVE PANEL SYSTEM

The panel is available under the Metl-Span brand as the ThermalSafe® Fire Resistant Insulated Panel. For more information visit metlspan.com.

ADVANTAGES OF MINERAL FIBER INSULATED PANELS SYSTEM

This section defines the specific advantages of using mineral fiber insulated metal panels for fire resistant wall and ceiling construction.

The following information is based upon the broader range of capabilities of the Metl-Span designed fire resistant insulated metal panels. For purposes of this digest, the panels will be reference as the “Metl-Span panel” or the “panel”.

Universal Use - The Metl-Span panel can be used for most fire resistance rated non-load bearing wall applications, such as exterior walls, interior walls (fire partitions & fire barriers) and can be used for fire resistance rated ceilings.

The panel is available with 1 hour, 2 hour & 3 hour fire resistance ratings for walls and 1 ½ hour for ceilings to meet the building code’s hourly fire resistance requirements for walls and ceilings.

ADVANTAGES OF MINERAL FIBER INSULATED PANELS SYSTEM (cont.)

The wall panels are available in any length up to 40′, and may be stacked for greater heights. The wall panels may be applied vertically or horizontally. The ceiling panels are available as 12′ max. length within its integral suspended ceiling system.

Single Source/Single Trade - Field assembled constructions often require multiple material sources and multiple and specialized construction trades. The fire resistive insulated panels are delivered as complete factory assembled wall and ceiling units from a single source and require only one trade for installation.

Factory Assured Quality - The performance of field assembled construction is dependent upon the quality and condition of the materials, the quality of the installers and the field conditions.

The Metl-Span® panels are manufactured in a controlled environment on a specifically designed automated production line with specifically trained technicians and controlled materials. This ensures the consistent and predictable quality and performance of the wall and ceiling panels.

Technical Support - To further ensure the proper application and installation of the Metl-Span panels, the most comprehensive system of technical support is provided, which includes: published design and performance data, guide specifications, per job load/span and thermal stress analysis, installation guide, per job installation drawings and readily accessible technical and field services professionals.

Pre-Qualified Performance - Because the components are individually fire resistance rated, field assembled constructions often require determining and qualifying the overall fire resistance performance ratings on a per job basis.

Because of its unitized construction with standardized materials, the Metl-Span panels have been tested and rated for fire resistance as complete wall and ceiling constructions. This provides a pre-qualified performance verification of the total wall or ceiling construction with performance certifications listed by the testing/certifications agencies.

Wall Framing Requirements - Most wall designs require structural framing to support the wall materials and resist lateral loads (such as wind.). Even load bearing masonry walls often require structural framing to resist lateral forces. Wall designs using covering materials such as masonry veneer and gypsum board typically require close spaced stud framing to support the materials and resist lateral forces.

The Metl-Span panel's composite construction allows the wall panels to span as much as 20′ between framing members, depending upon the project's lateral load & thermal stress conditions and the panel's configuration (panel thickness and facing options).

ADVANTAGES OF MINERAL FIBER INSULATED PANELS SYSTEM (cont.)

Because the Metl-Span® panel requires fewer support framing members than most other constructions, the framing material and installation costs, and intrusion of framing members into the interior space is typically less than other constructions.

Ceiling System - Metl-Span fire resistant ceiling panels are integrated into a fire resistance rated suspended ceiling system consisting of tee channels and hanger rods supporting the ceiling panels. The panels can span as much as 12′ between the supporting tee channels.

Connections - The ends of the Metl-Span wall panels are connected to the supporting framing members simply with thru-panel screws. This means the panel installation can be performed from the exterior without interior scaffolding and without specialized tools.

Where thru-panel screws are not desirable or suitable, other connection options are available.

Ceiling panels are connected to the tee channels and perimeter support members simply with screws through the support member flange into the ceiling panel's bottom face.

Thermal Efficiency - Field assembled designs typically require the application of additional insulating materials and thicker stud cavities etc. to achieve usable thermal efficiency.

Wall and ceiling constructions using Metl-Span panels provide an efficient thermal resistance of 14.5 to 29 "R" (depending upon panel thickness) without need of additional insulation material.

Weather Tightness - Field assembled wall designs often require additional sheathing and vapor barriers to prevent infiltration of water and water vapor into the wall construction and into the building interior.

Water and vapor cannot infiltrate through the non-permeable steel faces of the Metl-Span panel. Adjacent panels are joined by a precision fitting tongue and groove joining of the steel facings which is made non-permeable by the silicone sealant encapsulated within the joint where it is protected from UV and weathering erosion.

Special Uses – The Metl-Span panels may be used for applications subject to sanitary requirements, abuse and wash-downs etc. where other fire resistant constructions would not be suitable.

The Metl-Span's surfaces are durable, non-permeable, washable and do not have pockets or crevices that can harbor insects, mold or other contaminates. The panels are available with USDA compliant factory painted faces.

ADVANTAGES OF MINERAL FIBER INSULATED PANELS SYSTEM (cont.)

Aesthetics - Non-combustible materials used for fire resistant wall constructions are often not aesthetically compatible with adjacent non-fire resistant walls.

The facings of the Metl-Span® panels have a mild stucco embossed texture and are factory painted with a broad range of available colors. This provides the panels with an attractive appearance that is suitable for most commercial and industrial buildings and many community buildings.

Reusable Construction - As facilities grow and functions change, it is often desirable to relocate the walls. Unlike other constructions, the Metl-Span panels may be relocated by simply disconnecting the panels from the support framing at the existing location, and re-connecting the panels to the support framing at the new location.

By reusing the panels, there is no additional cost for disposal of the existing materials and no additional cost for new materials except fasteners and sealants.

Opening Protection - Fire resistant hollow metal door and window framing designs have been developed specifically for the Metl-Span panel and are fire resistance certified in the name of the panel system. This means the appropriate fire resistance rated doors and windows can be readily selected with the panel manufacturer's assurance that they are most suitable and fire resistance rated for application in the Metl-Span walls.

Penetration Fire Stops - Penetration fire stop systems have been developed specifically for the Metl-Span panel system and are fire resistance certified in the name of the panel system. This means the appropriate penetration fire stop system can be readily selected with the panel manufacturer's assurance that it is most suitable and fire resistance rated for application in the Metl-Span wall.

These penetration fire stop systems cover a very broad range of metal and plastic pipe types and sizes, with and without insulation, as well as sheet metal ducts, all of which are optimized for installation through Metl-Span wall panels.

Note: Currently, the fire stop and door & window systems for the Metl-Span panel are the only fire resistance rated penetration fire stop and fire resistance rated door/window systems specifically certified for use with insulated metal panels in the US and Canada. Accordingly, UL has assigned listing categories specifically for these systems.

FIRE RESISTANCE CERTIFICATIONS

Following are the fire resistance certifications for the Metl-Span® ThermalSafe® Fire Resistant Panels. The design requirements for these certifications may be found on the product certifications directory of the respective testing/certifications agency.

Intertek (Warnock Hersey) Designs MSN/WA 60-1, 120-1 & 180-1
Tested and certified per ASTM E119 & CAN/ULC S101

- Wall panel - 4″ thick (min) - 1 hour fire resistance rating
- Wall panel - 6″ thick (min) - 2 hour fire resistance rating
- Wall panel - 8″ thick (min) - 3 hour fire resistance rating

Intertek (Warnock Hersey) Design MSN/CA 90-1
Tested and certified per ASTM E119 & CAN/ULC S101

- Ceiling panel - 6″ thick - 1-½ hour fire resistance rating

UL Design U050
Tested and certified per UL 263 (ASTM E119)

- Wall panel - 4″ thick (min) - 1 hour fire resistance rating
- Wall panel - 7″ thick (min) - 2 hour fire resistance rating
- Wall panel - 8″ thick (min) - 3 hour fire resistance rating

ULC (Canada) Design W021
Tested and certified per CAN/ULC S101

- Wall panel - 4″ thick (min) - 1 hour fire resistance rating
- Wall panel - 7″ thick (min) - 2 hour fire resistance rating
- Wall panel - 8″ thick (min) - 3 hour fire resistance rating

UL Designs SP-2-001 & WA-2-001 (US & Canada approved)
Tested and certified per UL 10B, UL 10C, CAN4-S104 & CAN4-S106

- Door & window designs - 1 hour fire resistance rating (for 1 hr rated wall)
- Door & window designs - 1-½ hr fire resistance rating (for 2 hr rated wall)

UL Designs W-N-1001 thru W-N-7001 (US & Canada approved)
Tested and certified per UL 1479 (ASTM E814)

- Penetration fire stop designs - for 1 hour & 2 hour fire resistance rated wall (reference the following page for the specific designs)

Factory Mutual FM4880
Class 1 fire rating of interior walls and ceiling panels

PENETRATION FIRE STOP DESIGNS

Following are the penetration fire stop systems specifically designed use with for the Metl-Span® ThermalSafe® Fire Resistant Panels. The fire resistance design requirements and details for these fire stop systems are available on the UL product certifications directory (refer to specific UL design listed below).

Penetrant	Max. Size	Insulation	Fire Stop System	"F" Rating	T" Rating	UL Design	UL File No.
Steel pipe Iron pipe Steel conduit Copper pipe Copper tube	18" dia. 18" dia. 6" dia. 6" dia. 6" dia.	None	Cover Plate	1 hr. & 2 hr.	0 hr. & ¼ hr.	W-N-1001	XHEZ.W-N-1001 XHEZ7.W-N-1001*
			Intumescent Caulk	1 hr. & 2 hr.	0 hr. & ¼ hr.	W-N-1002	XHEZ.W-N-1002 XHEZ7.W-N-1002*
Steel pipe Iron pipe Steel conduit Copper pipe Copper tube	18" dia. 18" dia. 6" dia. 6" dia. 6" dia.	2" Fiberglass Discontinuous	Cover Plate	1 hr. & 2 hr.	1 hr. & 2 hr.	W-N-5003	XHEZ.W-N-5003 XHEZ7.W-N-5003*
			Intumescent Caulk	1 hr. & 2 hr.	1 hr. & 2 hr.	W-N-5005	XHEZ.W-N-5005 XHEZ7.W-N-5005*
		2" Fiberglass Continuous	Intumescent Wrap Collar	1 hr. & 2 hr.	1 hr. & 2 hr.	W-N-5001	XHEZ.W-N-5001 XHEZ7.W-N-5001*
		1" Armaflex Continuous	Intumescent Wrap Collar	1 hr. & 2 hr.	0 hr. & ¾ hr.	W-N-5004	XHEZ.W-N-5004 XHEZ7.W-N-5004*
PVS pipe CPVC pipe ABS pipe FRPP pipe	6" dia. 6" dia. 6" dia. 4" dia.	None	Intumescent Wrap Collar	1 hr. & 2 hr.	1 hr. & 2 hr.	W-N-2001	XHEZ.W-N-2001 XHEZ7.W-N-2001*
PVC pipe CPVC pipe	6" dia. 6" dia.	1" Fiberglass Continuous	Intumescent Wrap Collar	1 hr. & 2 hr.	1 hr. & 2 hr.	W-N-5002	XHEZ.W-N-5002 XHEZ7.W-N-5002*
Steel Duct	23½" x 23½" 23½" dia.	None	Retaining Angles & Intumescent Caulk	1 hr. & 2 hr.	0 hr. & 0 hr.	W-N-7001	XHEZ.W-N-7001 XHEZ7.W-N-7001*

Notes:

1. Reference the UL Fire Resistance Directory for each system's assembly details and materials.
2. *For Canada Certifications reference UL file number category XHEZ7.
3. The "T" and "R" ratings are for 4″ & 7″ thick wall panels, respectively.
4. Continuous insulation extends through the wall opening. Discontinuous insulation does not extend through the wall opening, but terminates against the wall face on both sides.

CONSIDERATIONS FOR FIRE PROTECTION OF SUPPORT FRAMING

For vertical oriented Metl-Span® fire resistant panels, the horizontal framing members supporting the top and bottom ends of the panels must be fire protected to continue supporting the panel during the duration of the fire. The intermediate horizontal support members which only support the panel against lateral loads do not require fire protection.

For horizontal oriented panels, the vertical framing members supporting each end of the panel must be fire protected to continue supporting the panel during the duration of the fire. The Intermediate vertical support members which only support the panel against lateral loads do not require fire protection.

Exception: Horizontal support members at the base of the panels which are supported by the foundation or floor construction do not require fire protection.

For Metl-Span ceiling systems, the fire protection of the suspended ceiling tee channels and hanger rod system is integrated into the ceiling assembly. Fire protection of the perimeter support framing will be required.

GENERAL DETAILS

Panel Details – The first two details in this section describe the Metl-Span panel and show the general assembly for vertical and horizontal wall applications.

Wall/Ceiling Sections – The following wall sections details show typical applications of the Metl-Span panels for fire resistant exterior walls, interior walls and ceilings.

The wall sections show a generic post and beam structural framing with open web roof joists. However, the Metl-Span panel may be used just as readily with any other type framing that provides connection members at each end of the panel and at intermediate locations when required for lateral loads (such as wind loads).

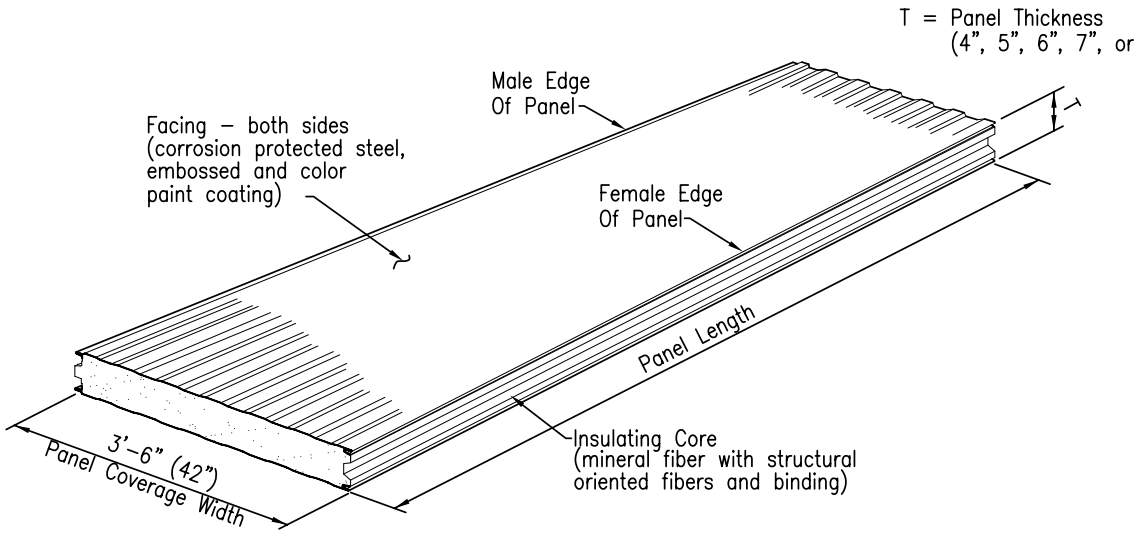
For specific connection and flashing details and options, reference the fire resistant panel architectural details and installation guide available from Metl-Span.

Fire Door & Window Options - The last detail shows the size and configuration options for the hollow metal door & window systems which are fire resistance rated for use with the Metl-Span fire resistant panels. For specific door/window material and hardware options, reference UL designs SP-2-001 & WA-2-001. For installation details reference the hollow metal door/window system technical digest available from Metl-Span.

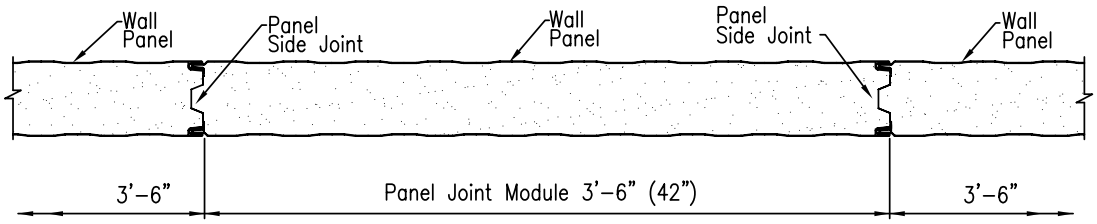
INDEX FOR DRAWING DETAILS

Panel Description

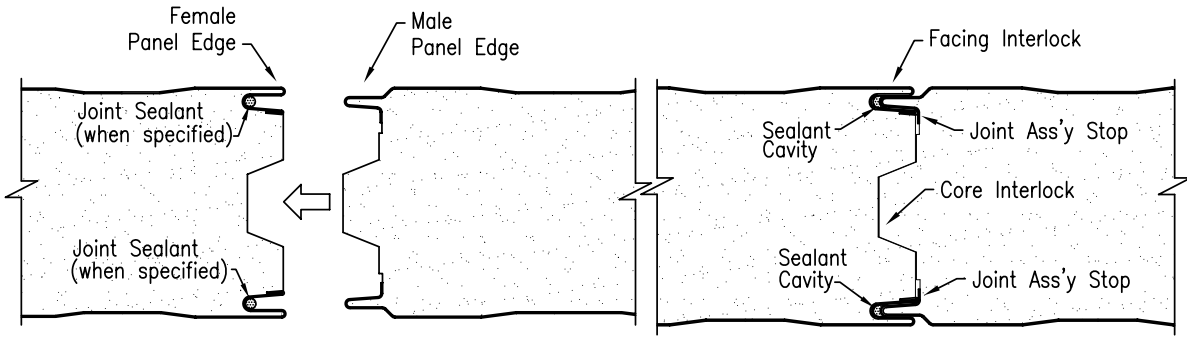
MSS098.900



THERMALSAFE PANEL



PANEL ASSEMBLY SECTION



PANEL EDGES BEFORE ASSEMBLY

PANEL JOINT AFTER ASSEMBLY

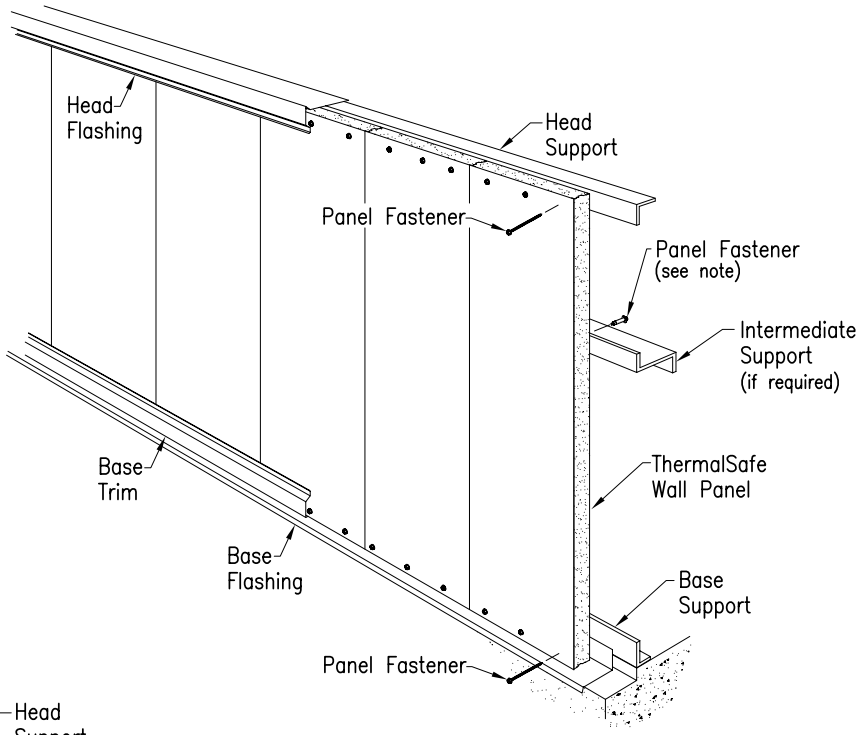
Basic Wall Assembly & Panel Orientation

MSS098.901

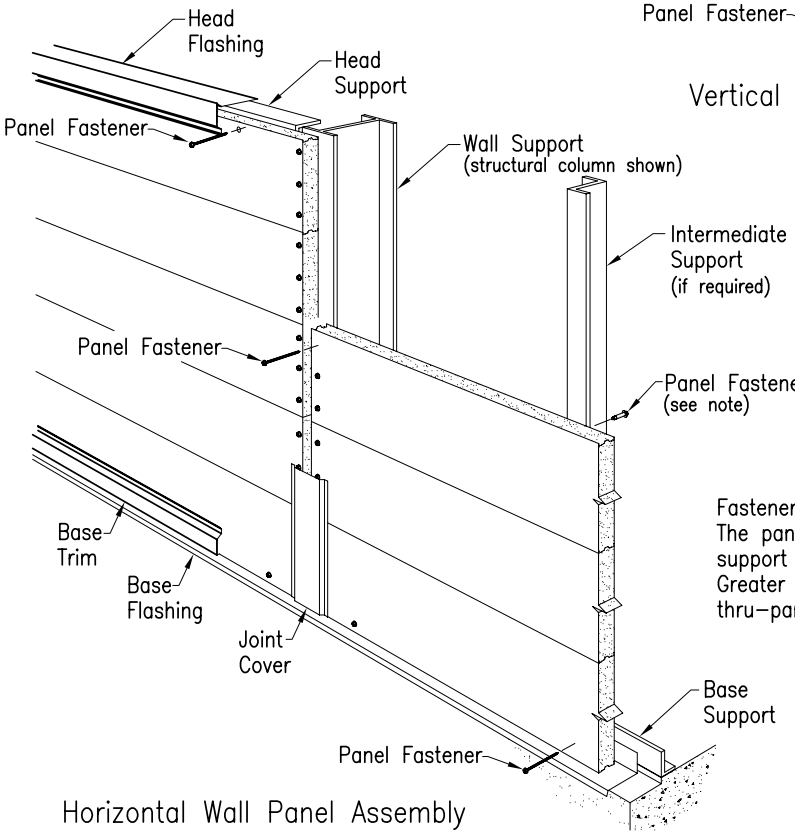
Panel Support:
For vertical panels, the primary support is provided by horizontal framing members at the top & bottom ends of the panel.

For horizontal panels, the primary support is provided by vertical framing members at each end of the panel.

Intermediate support framing may be required to resist lateral loads (such as wind loads).



Vertical Wall Panel Assembly

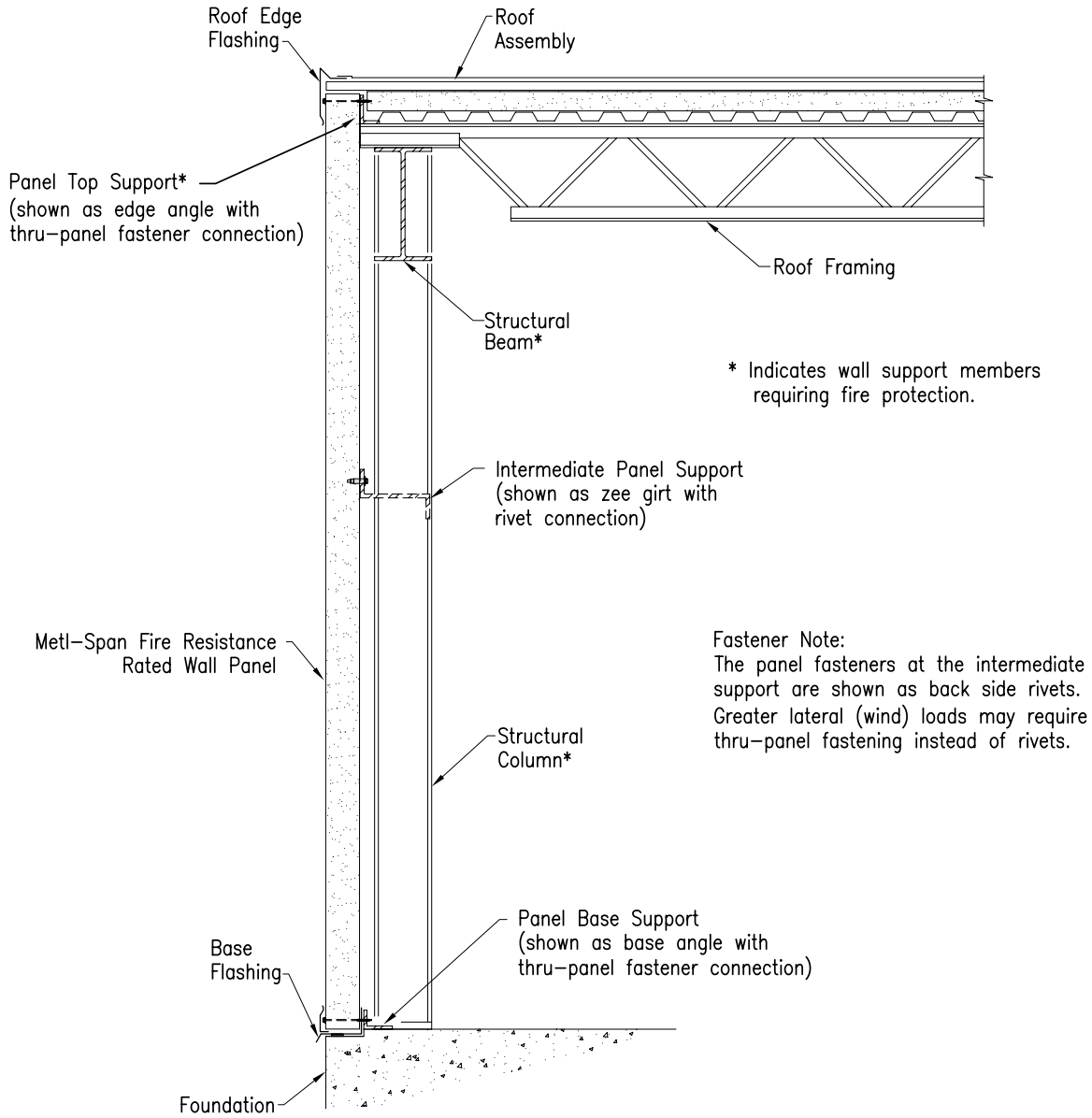


Horizontal Wall Panel Assembly

Fastener Note:
The panel fasteners at the intermediate support are shown as back side rivets. Greater lateral loads may require thru–panel fasteners instead of rivets.

Exterior Wall – Vertical Panel

MSS098.801.2

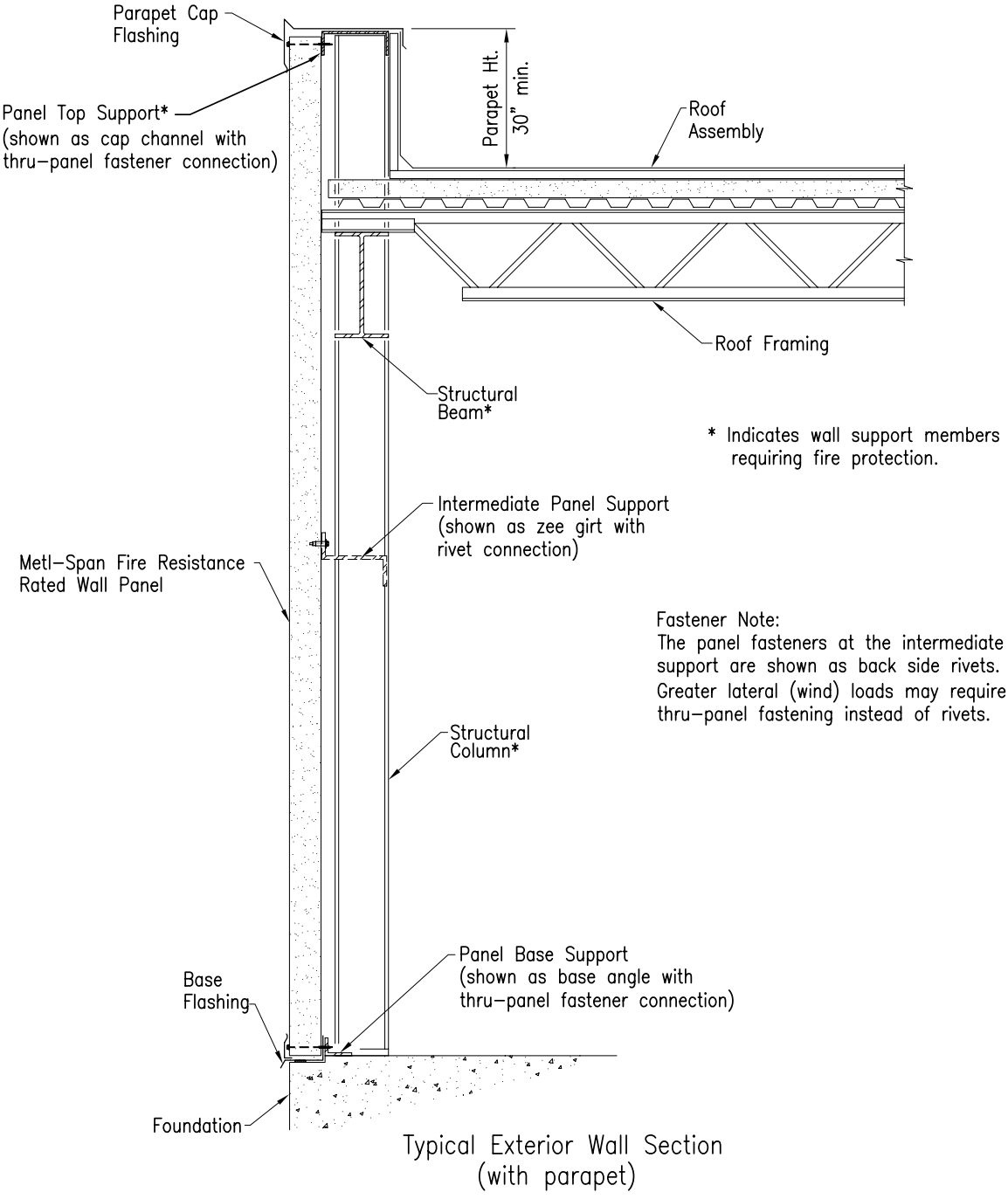


Typical Exterior Wall Section

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Exterior Wall With Parapet – Vertical Panel

MSS098.802.2

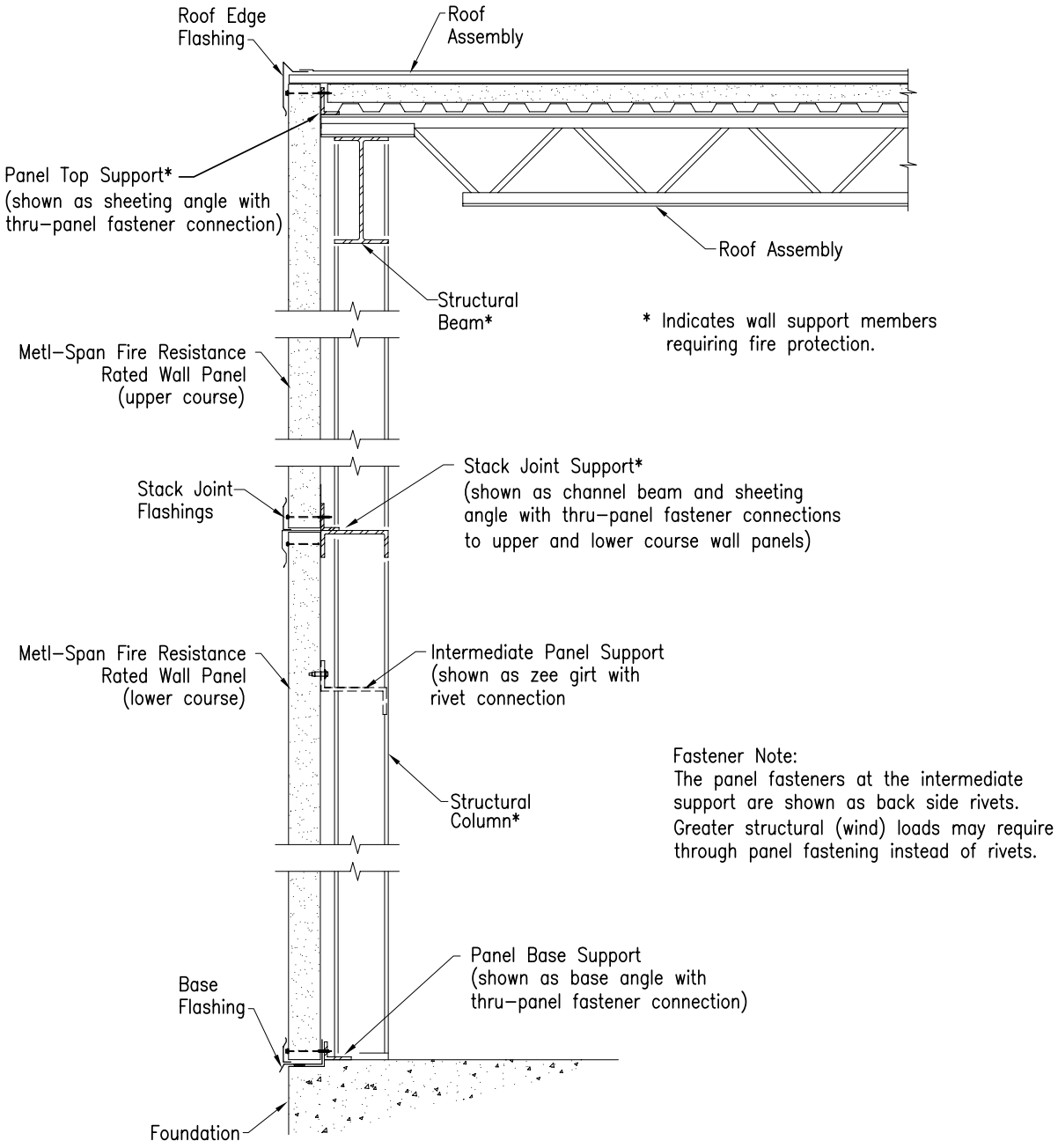


Typical Exterior Wall Section
(with parapet)

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Exterior Wall With Stack Joint – Vertical Panel

MSS098.803.2

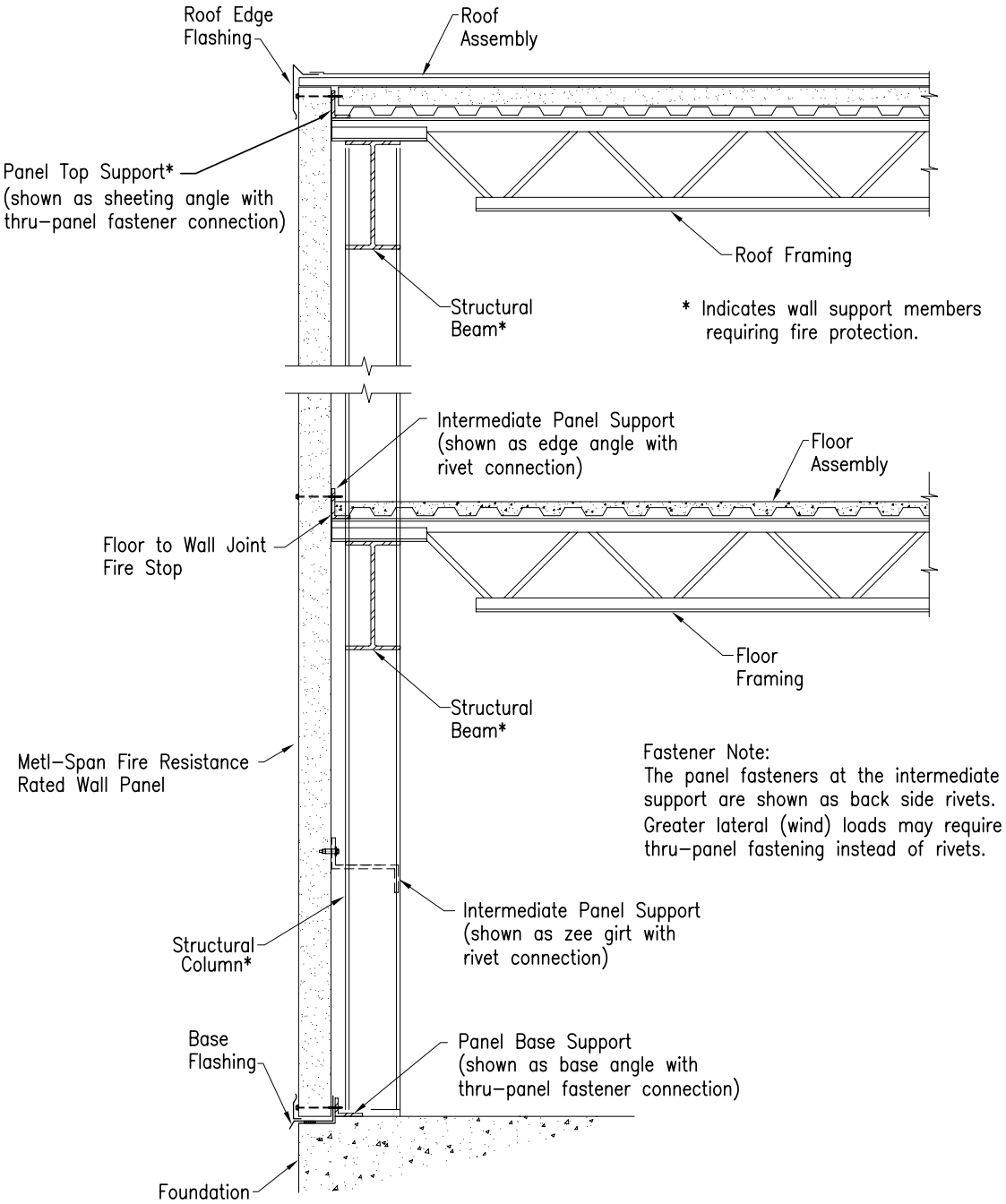


Typical Exterior Wall Section
(with stack joint)

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Multi–Story Exterior Wall – Vertical Panel

MSS098.804.2

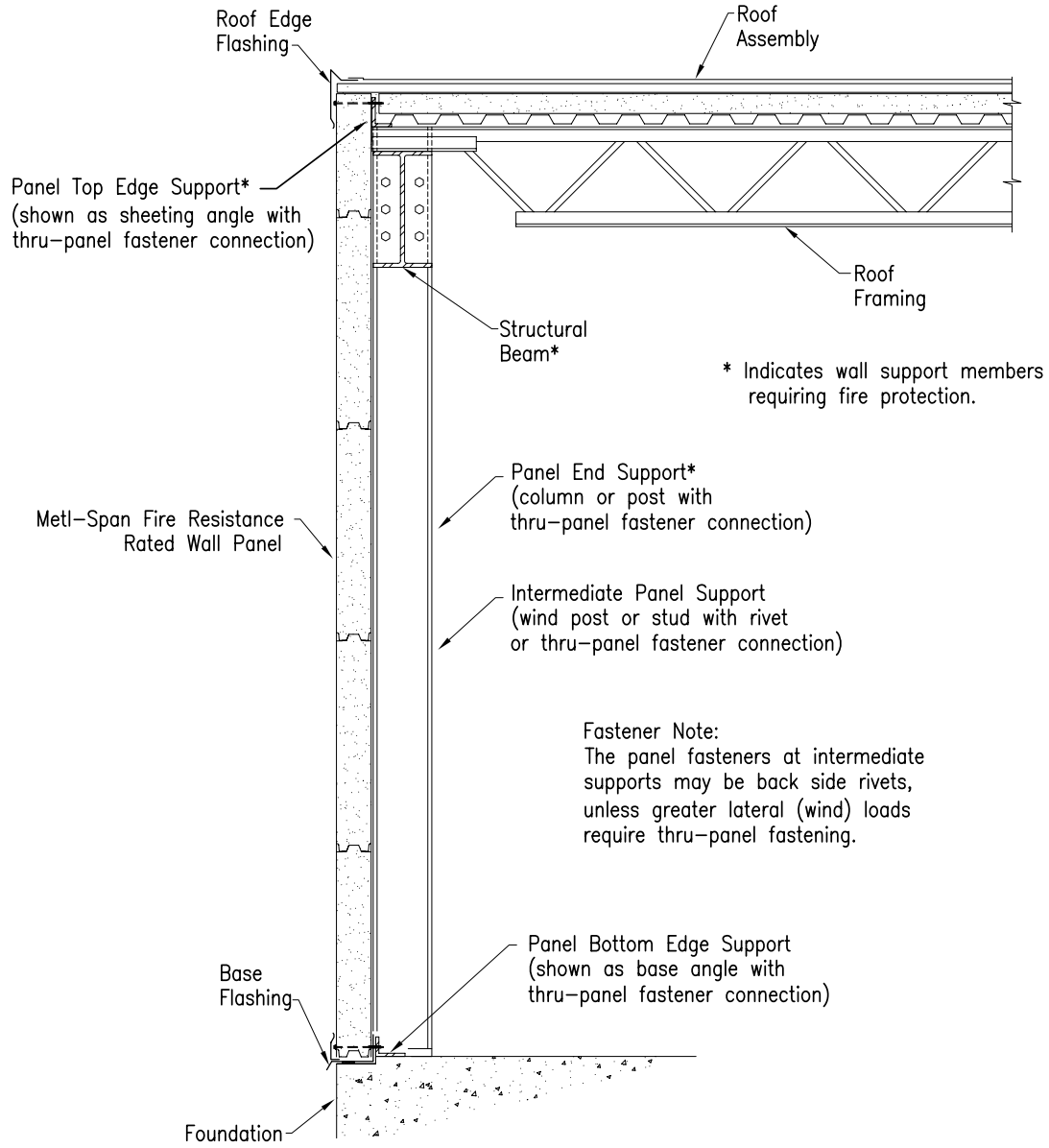


Typical Exterior Wall Section
(multi story)

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Exterior Wall – Horizontal Panel

MSS098.805.2

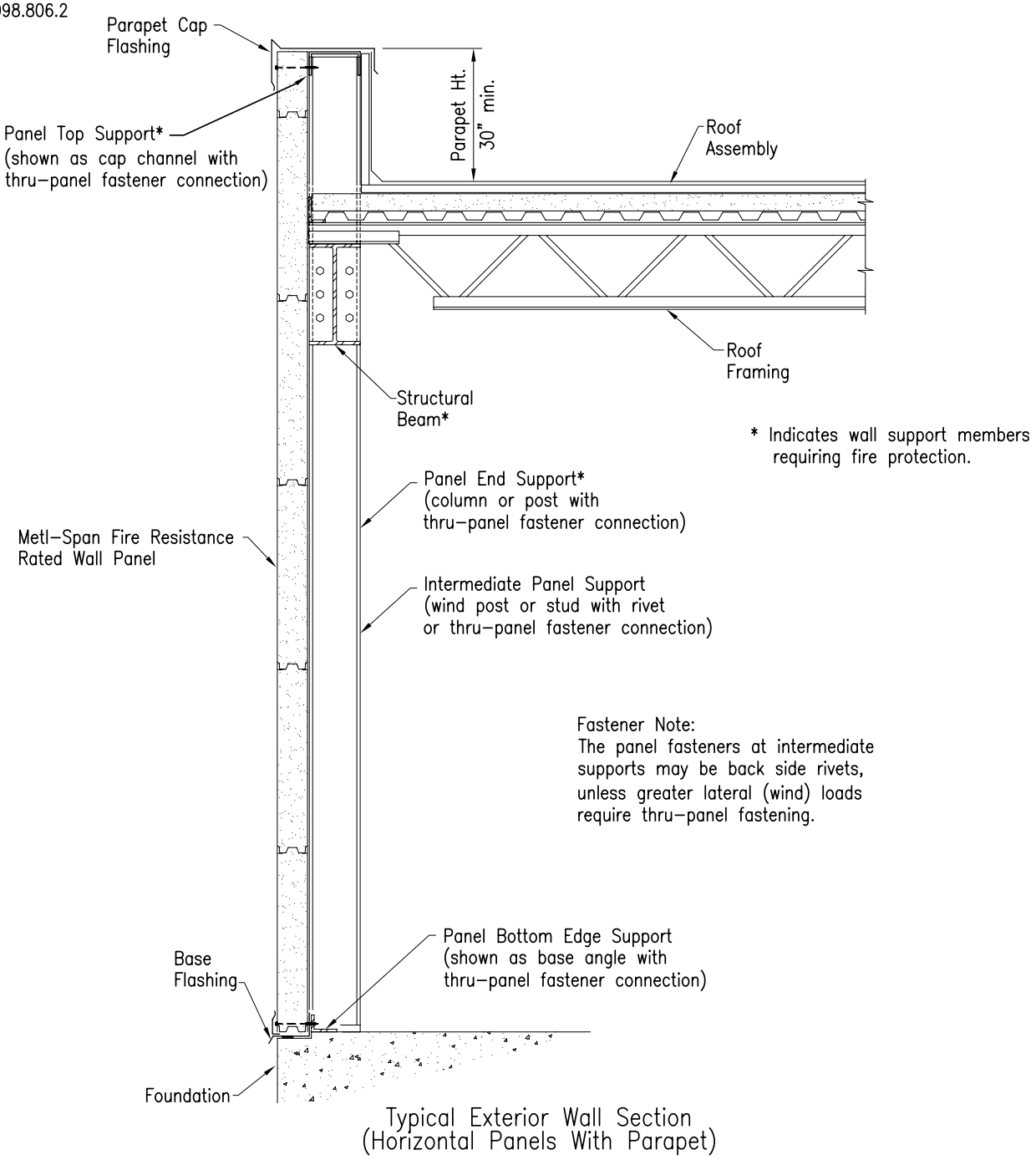


Typical Exterior Wall Section
(Horizontal Wall Panel)

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Exterior Wall – Horizontal Panel With Parapet

MSS098.806.2

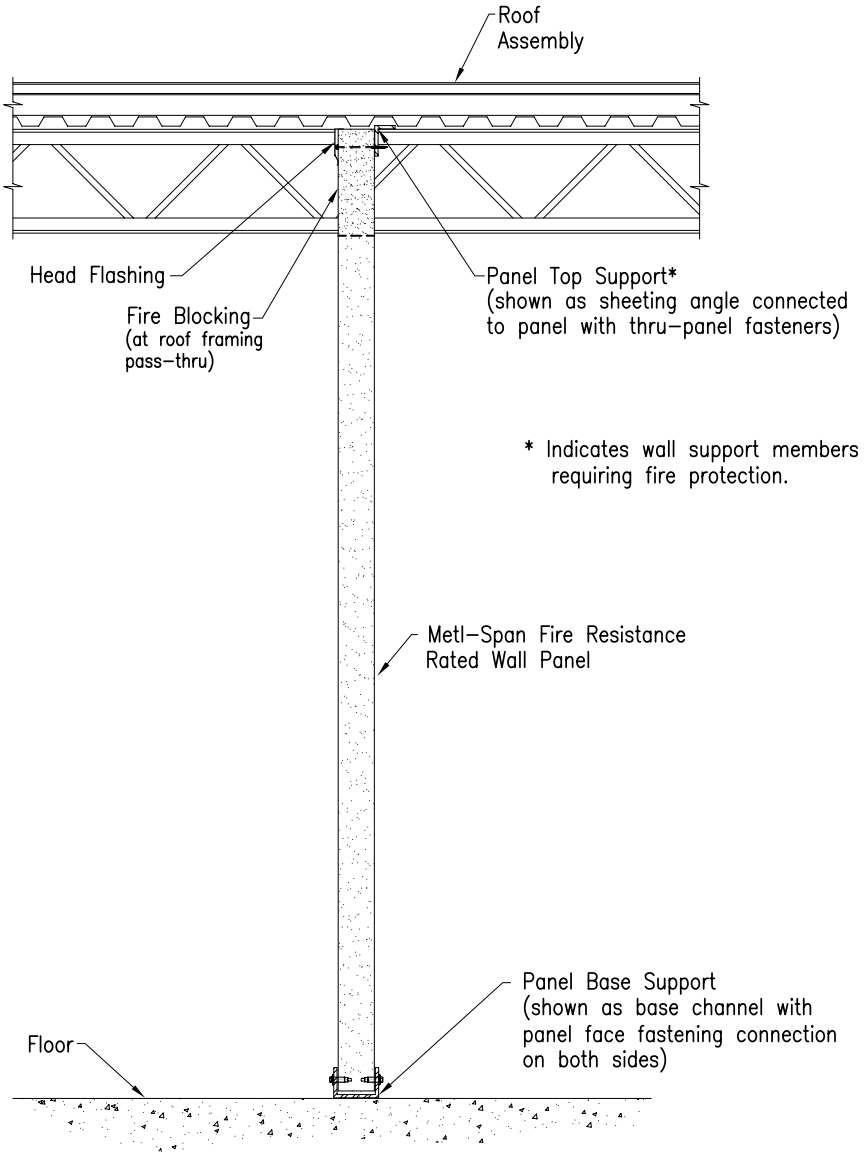


Typical Exterior Wall Section
(Horizontal Panels With Parapet)

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Interior Wall

MSS098.807.1

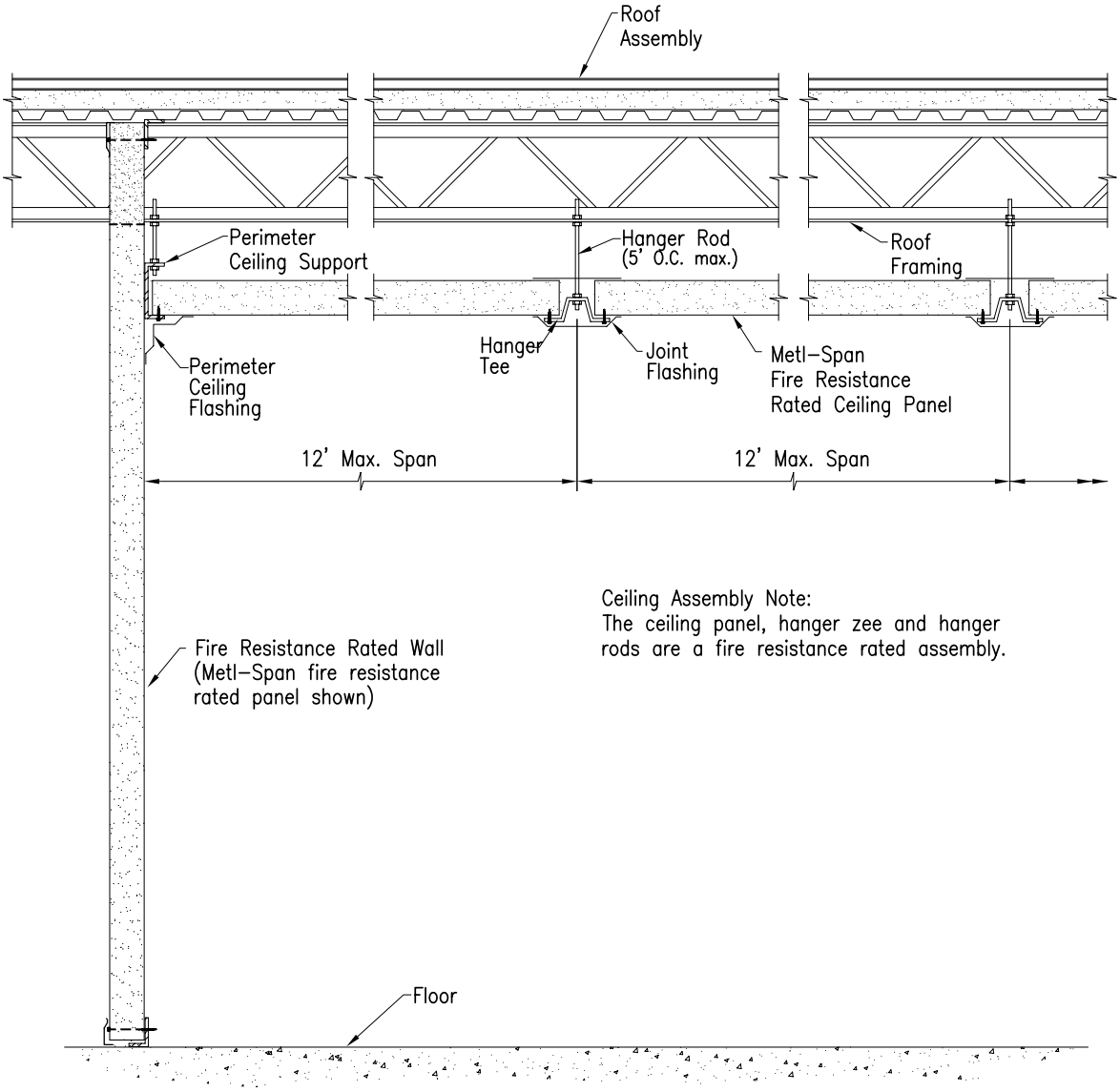


Typical Interior Wall Section

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Ceiling Assembly

MSS098.808.1

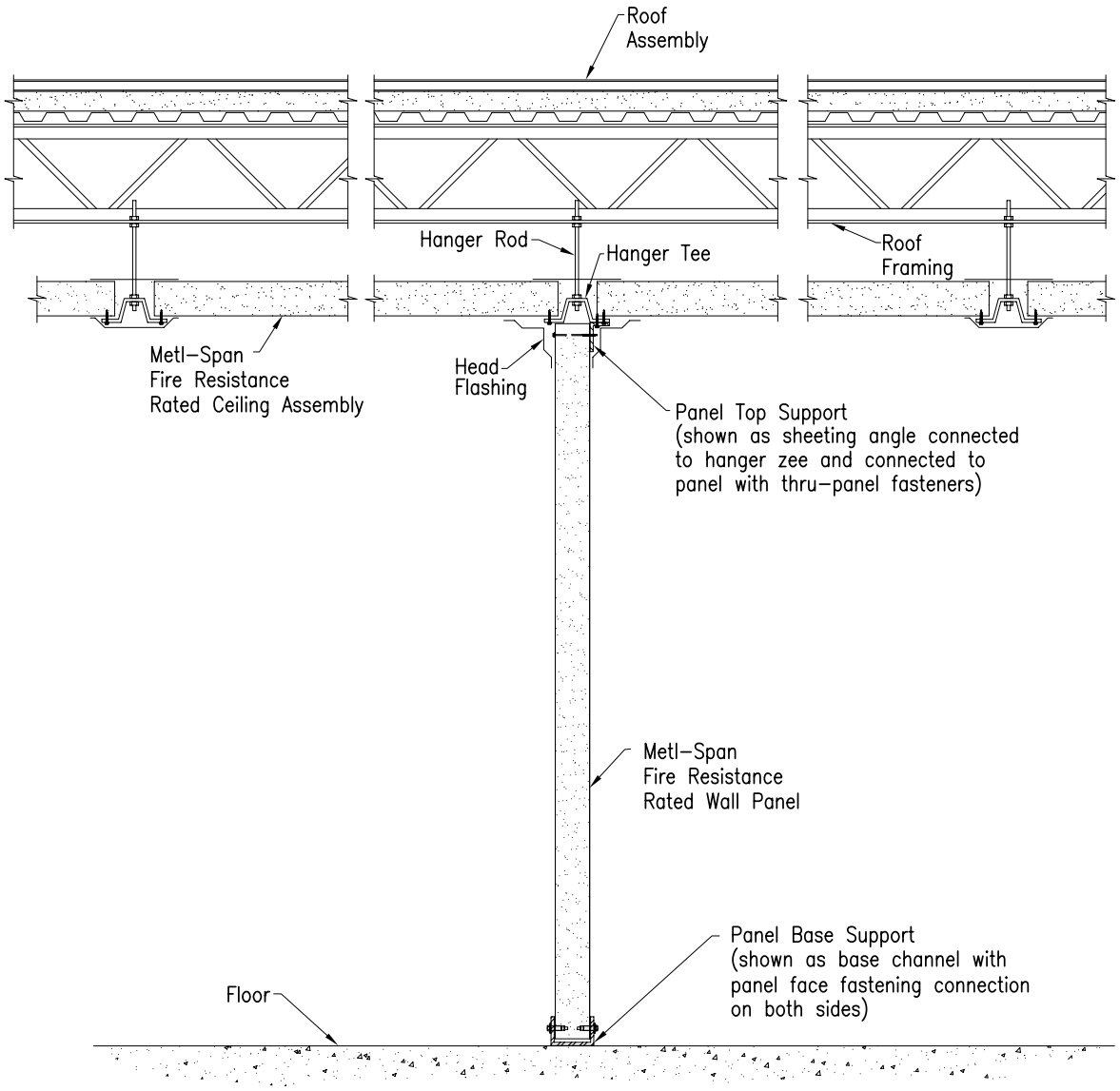


Typical Ceiling Section

This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Interior Wall Below Ceiling

MSS098.809.2



Typical Interior Wall Section
(Below Ceiling)

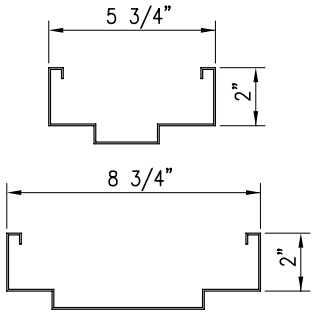
This typical detail is based upon requirements of the 2012 International Building Code. Specific fire protection requirements may vary in accordance to the project's governing building code or fire safety code.

Fire Rated Door & Window Variations

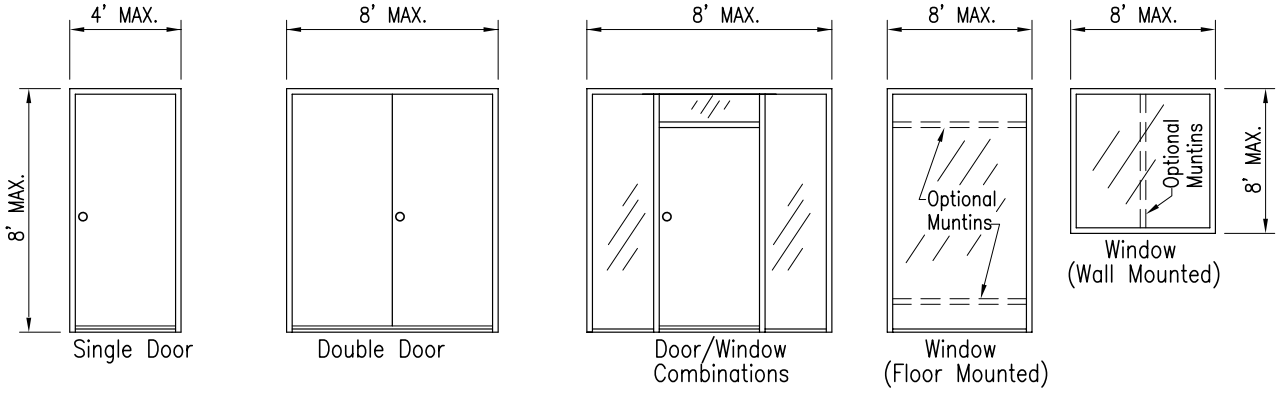
MSS098.902

Frame Schedule		
Frame Depth	5 3/4"	8 3/4"
Wall Thickness	4"	7"
Fire Rating*	1 Hr. Max.	1 1/2 Hr. Max.

*Fire Rating available only with ThermalSafe or EcoFicient fire resistant wall panels.

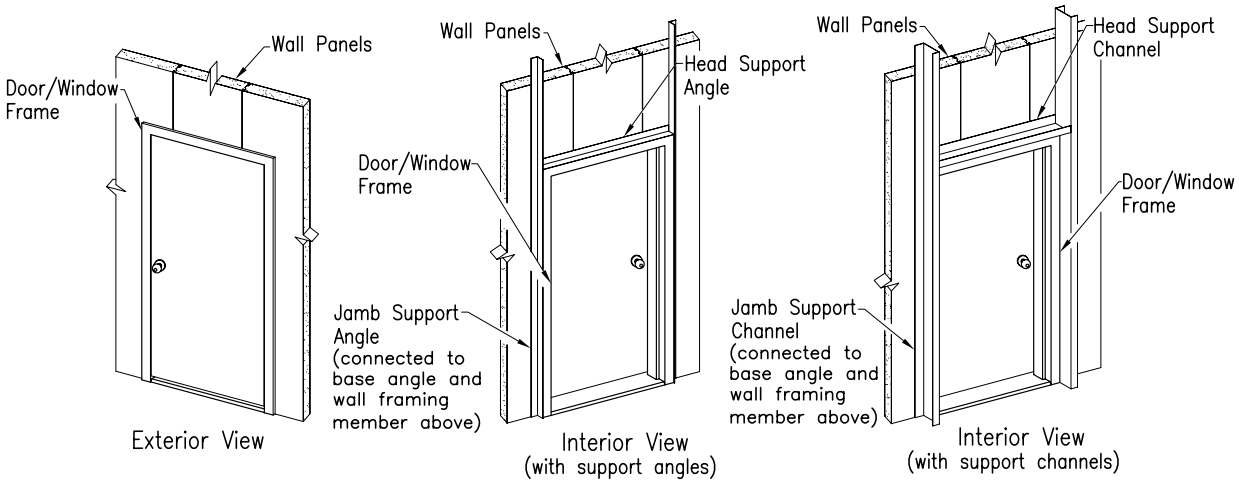


Frame Sections



Typical Door/Window Assembly Variations

(doors may be outswing or inswing, windows may be exterior or interior glazed, reference UL designs SP–2–001 & WA–2–001 for hardware options)

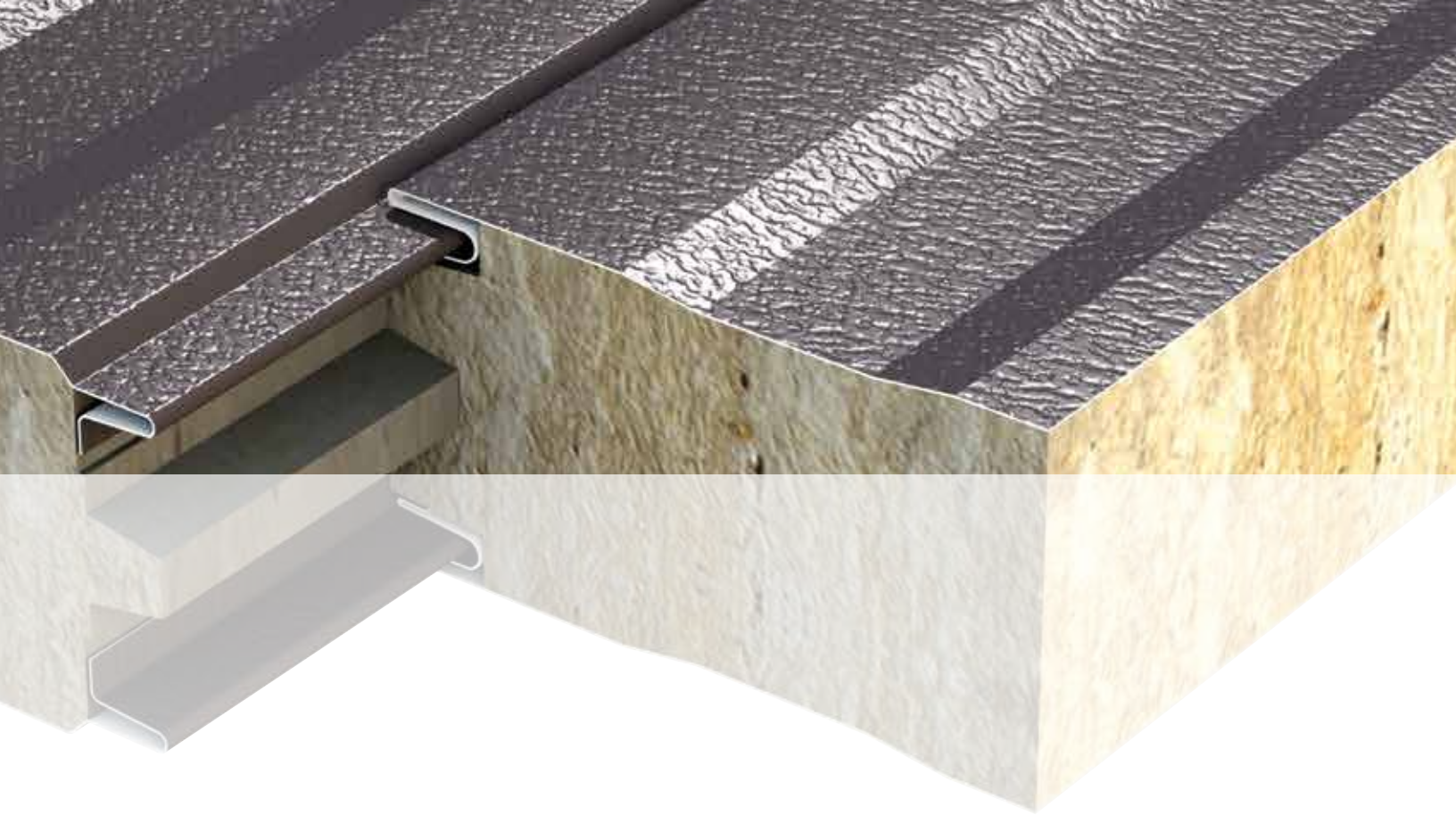


Typical Frame Assemblies

(door assemblies shown, windows similar)

Notes:

PIONEERING INSULATED METAL PANEL TECHNOLOGY



METL SPAN®

PIONEERING INSULATED
METAL PANEL TECHNOLOGY

1720 Lakepointe Drive, Suite #101
Lewisville, Texas 75057
Toll-free: 877.585.9969
Tel: 972.221.6656
Fax: 972.420.9382
Web: metlspan.com