

CFR INSULATED METAL ROOF PANEL
ARCHITECTURAL
DESIGN GUIDE



PIONEERING INSULATED METAL PANEL TECHNOLOGY

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INTRODUCTION

The CFR Roof System utilizes the proven thermal and structural performance of Metl-Span foam panel technology, combined with the superior weathertight performance of a standing seam roof, to provide you the most effective roof system available today.

Metl-Span has designed the CFR Roof System to meet today's stringent performance requirements. Metl-Span substantiates this performance by providing complete testing and approval credentials by recognized certification agencies such as: UL, FM, and WH/Intertek for US and Canada (including Miami Dade County and City of L.A.).

To ensure the ultimate performance and long service life of your CFR roof, Metl-Span provides the highest quality materials and the most comprehensive system of factory preparation, self-alignment features and erection aids. No other insulated roof system can provide as much factory assured performance and erection efficiency as the Metl-Span CFR Roof System.

With the CFR Roof System, you are working with the leading edge of roofing technology. This Design Guide provides you the product and application information necessary to understand and use the CFR Roof System.

CUSTOMER RESPONSIBILITIES

The customer is responsible for assuring that the CFR Roof System is suitable for the purpose for which it is to be used and that the roof system's published credentials, application and installation meet all local, state and/or federal building codes and regulations.

The customer is responsible for assuring that the roof system is installed in accordance with good engineering and construction practices and in accordance with the CFR Insulated Metal Roof Panel Installation Guide and the installation drawings.

The customer is responsible for advising the roof owner of the proper maintenance of the CFR Roof System in accordance with good metal roof maintenance practice and the warranty terms. This includes the owner's responsibility to perform regular maintenance, removal of excess snow and ice, frequent clearing of drainage systems and immediate repair of roof damage.

NOTE: Clarification or recommendations concerning the CFR Roof System applications, modifications, repairs, etc., should be directed to Metl-Span's Technical Services Department. Contact the Metl-Span office:

1720 Lakepointe Drive, Suite #101
Lewisville, Texas 75057
TEL: (972) 221-6656
FAX: (972) 436-7028
WEB: metlspan.com

PRODUCT FEATURES

Complete Roof System – To assure the optimum factory controlled performance of the total roof, the CFR Roof System is available as a complete system consisting of the roof panels, roof flashing, perimeter trim and gutter. This includes the necessary attachment clips, closures, sealants and fasteners, as well as factory fabricated end caps, corner caps and peak caps.

Factory Assembled Panels – The roof system is made up of factory assembled panels which are mechanically interlocked together in the field. Each panel is a self-contained unit of roof weather membrane, roof insulation and liner/decking. This provides factory control of the roof's materials, fit-up and performance. This also provides the efficiency and control of a single source and single trade installation for the complete roof system.

Standing Seam Design – The CFR roof panel's exterior face provides the proven weathertightness performance and architectural acceptance of the standing seam design.

Metl-Span Foam Core – Provides the superior thermal efficiency, structural performance, dimensional accuracy and environmental acceptance of the zero ozone depleting polyurethane core.

2" to 6" Panel Thickness Range – Provides the maximum material efficiency for almost any specific thermal performance requirement.

42" Panel Width – With 70% fewer sidelaps than other standing seam roofs, the CFR roof panel provides unequalled material and erection efficiency and significantly reduces side lap leakage exposure. Also available in 30" and 36" widths for special applications and load conditions.

Top Side Erection – For maximum erection efficiency and safety, the panel installation is performed from the top side of the roof. Interior scaffolding is not required.

Factory Cut-Back – For erection efficiency and factory assured fit-up of the eave and endlap assemblies, the panel's foam core and interior face are cut-back and removed in the factory.

Factory Swaging and Notching – For erection efficiency and factory assured fit-up of the critical endlap assembly, the panel is factory swaged and notched. This provides for the necessary clearance and alignment of the lapping panels.

Back-up Plates – For factory assured performance of the endlap, ridge and high eave assemblies, back-up plates are factory installed under the panel's exterior face to provide for uniform compression of the endlap sealant and prevent strip-out of the endlap screws.

Proprietary Fasteners – The fasteners are designed to provide the optimum structural, weathertightness, durability and erectability performance for the specific assemblies.

Proprietary Sealants – The sealants are formulated and designed to provide the optimum weathertightness, durability and erectability performance for the specific assemblies.

Diaphragm Clips – Metl-Span's exclusive "clinch" clip design is available as an option. The specially designed panel clips lock the adjacent roof panels together in a manner that allows the entire roof to act as a diaphragm to resist lateral wind loads. This important feature can minimize expensive and intrusive bracing within the building.

PRODUCT DESCRIPTION

GENERAL

The Metl-Span CFR Roof System consists of factory assembled panels joined together by interlocking side joints and secured to the structure with concealed interlocking clips. Integral components such as panel clips, closures, flashing, perimeter trim, gutter, sealants and fasteners are furnished as required.

ROOF PANEL

Panel Assembly – The panel is a factory assembled composite of a foam core with exterior and interior metal faces. The foam core is continuously foamed in-place and chemically bonded to the metal faces. The panels have male and female edge configurations for side joint assembly. The edge of the exterior face forms a 2" high standing seam. The edge of the interior face forms a tongue and groove joint. The panel edges have a thermal break between the exterior and interior faces.

Panel Width – The panel is available for coverage widths of 30", 36" or 42".

Panel Thickness – The nominal panel thickness is the thickness of the foam core. The panel is available in thicknesses of 2", 2 1/2", 3", 4", 5" or 6".

Panel Length – The maximum fabricated panel length is 53'-0". The maximum shipped panel length may be less due to transportation limitations. The minimum panel length is 9'-6". Shorter panel lengths require off-line cutting and are available per special order.

Exterior Face – The exterior face is a roll-formed pan section with the edges formed into a 2" high standing rib. The tops of the standing ribs are configured for the male and female portions of the interlocking seam.

The pan is configured with a 1/8" deep x 2" wide Mesa pattern.

The exterior face material is 24 gage, ASTM A653 minimum grade 50 steel, or 22 gage, ASTM A653 minimum grade 33 steel, with a G-90 galvanized and/or AZ-50 aluminum/zinc alloy cladding and clear acrylic coating.

Interior Face – The interior face is a roll formed pan section with the edges formed into the male and female portions of a tongue and groove side joint. The pan is configured with a 1/8" deep x 2" wide Mesa pattern.

The interior face material is stucco embossed 26, 24 or 22 gage, ASTM A653 grade 33 steel, with a G-90 galvanized and/or AZ-50 aluminum/zinc alloy cladding and painted finish.

Panel Finish – The standard exterior finish consists of a 0.2 mil primer with a 0.7 mil, full strength 70% PVDF fluoropolymer or siliconized polyester finish coat, available in Metl-Span's standard colors. The standard interior finish is a 0.2 mil primer with a 0.7 mil siliconized polyester finish coat. The standard interior color is a USDA compliant Igloo White. Non-standard finishes and non-standard colors are available per special order.

Foam Core – The core is a foamed-in-place, 92% closed cell, Non-CFC, 2.0lb/cu ft (min.) density, polyurethane foam.

PRODUCT DESCRIPTION (cont.)

PANEL CLIP

The panel clip secures the roof panels to the roof structurals. The clips are located along the panel's male edge, and are designed to mechanically tie the panel's exterior face as well as the interior face to the roof structurals. No intermediate panel attachment fasteners are required.

The clip is a two piece, G-90 Galvanized steel assembly consisting of a 12 gage base and a 20 gage tab.

The base is factory punched with multiple holes to provide for fastening the clip to various types of roof structurals and the base is slotted to provide for easy field insertion into the roof panel's foam core.

DIAPHRAGM CLIPS

For the description of the optional diaphragm clips, refer to the Metl-Span Technical Bulletin, "CFR Insulated Metal Roof Panel Diaphragm Strength."

CLIP FASTENER

The panel clip is secured to the roof structural with fasteners designed for the specific project's design requirements and roof structural materials.

ALTERNATE ATTACHMENTS

Some cold storage applications and other special applications may require alternate roof panel attachments to the roof structurals. Contact Metl-Span's Technical Services Department for specific details.

PANEL SEAM

The seam is of a design which positively interlocks the panel's exterior faces and clips, as they are installed, and resists opening when the roof is subjected to wind uplift pressures.

The seam is designed to enclose and uniformly compress the seam sealant at its optimum thickness.

The seam is closed with a motorized or manual seamer tool, especially designed for the CFR panel, to assure structural integrity of the panel side joint and clip connections as well as proper compression of the sealant.

TONGUE-AND-GROOVE JOINT

The tongue-and-groove joint interlocks the panel's interior faces and provides a cavity for application of the vapor sealant (when required). The tongue-and-groove joint is designed to enclose and uniformly compress the vapor sealant as the panel's side joint assembly is closed.

The tongue-and-groove joint is designed to provide minimum visual distraction to the roof's interior aesthetics.

PRODUCT DESCRIPTION (cont.)

PANEL ENDLAP

The roof panels are provided in the longest length available for the specific project, to minimize the need for panel endlaps.

When endlaps are required, the endlap consists of a 3" overlap of the exterior faces and butt joining of the foam core and interior faces. The end of each panel is supported by the roof structurals. The lapped exterior faces are sealed with a specially designed endlap sealant, and secured with specially designed endlap fasteners and back-up plates.

Panel Cut-back – At the end of the up-slope panel, the interior skin and foam core are cut back and removed in the factory to provide for the overlap of the exterior face.

Swaging – At the end of the down-slope panel, the exterior face is factory swaged to provide clearance for the lapped panels and sealant.

Notching – At the end of the down-slope panel, the standing ribs are factory notched to provide seam clearance and panel end alignment.

Back-up plates – At the end of the down-slope panel, 16 gage steel back-up plates are factory installed under the exterior skin. The back-up plates allow the use of self-drilling screws to secure the lapped panels with minimum liability of fastener strip-out.

Endlap Fasteners – The endlap fasteners are designed to uniformly compress the endlap sealant and to accommodate stress movement of the endlap assembly. The fasteners are self-drilling screws. To ensure uniform compression of the sealant, the fasteners are provided with a 1 1/8" dia., EPDM, sealing washer with a 16 gage, stainless steel backer.

EAVE ASSEMBLY

At the low eave, the roof panel's foam core and interior face is cut back 3" (at the factory) to allow the roof panel's exterior face to be attached and sealed directly to the eave trim (or interior gutter or valley pan).

The eave trim is designed with a double thickness top flange to provide uniform compression of the eave sealant and to resist strip-out of the eave fasteners.

The eave trim is designed with a drip lip to allow use of a basic eave gutter that can be installed and replaced without disturbance of the eave seal.

RIDGE ASSEMBLY

At the ridge or high eave, the roof panel end is closed with the ridge closure. The ridge closure is a formed metal pan with bottom and side flanges designed to compress the flashing sealant between the closure and the roof panel. The closure is secured to the roof panel with self-drilling fasteners and back-up plates. The closure has a top flange which provides an attachment surface for the ridge flashing, high eave trim or transition flashing.

The ridge closure is made of the same material and finish as the roof panel's exterior face.

The back-up plates are 16 gage steel and are factory installed under the roof panel's exterior face.

An interior flashing is provided to close the inside face of the ridge or high eave assembly and to support the filler insulation. The flashing is made of the same material as the roof panel's interior face.

PRODUCT DESCRIPTION (c o n t .)

RAKE ASSEMBLY

At the rake, the roof panel is field cut to the required width. The roof panel edge is closed with the rake closure. The rake closure is a zee section with a bottom flange designed to compress the flashing sealant between the closure and the roof panel. The closure is secured with fasteners that penetrate through the roof panel and into the rake structural. The closure has a top flange which provides an attachment surface for the rake trim or transition flashing.

The rake closure is made of the same material as the roof panel's exterior face.

The rake closure and panel edge are secured with through fasteners that are designed for the specific project's roof panel thickness and rake structural material.

ROOF FLASHING

The roof flashing is made of the same material and finish as the roof panel's exterior face.

The roof flashing is assembled with the flashing sealant and flashing fasteners as specified on the installation drawings for the specific project.

PERIMETER TRIM AND GUTTER

The eave and rake trim and eave gutter are made of 26, 24 or 22 gage, with a G-90 galvanized and/or AZ-50 aluminum/zinc clad steel with painted finish, available in Metl-Span's standard colors. Non-standard finishes and colors are available per special order. The end caps, corner caps and peak caps are factory fabricated.

The trim and gutter are assembled with the flashing caulking and blind rivets and will be attached to the roof assembly with the flashing sealant and flashing fasteners as specified on the installation drawings for the specific project.

SEALANTS

The sealants for the seam, endlap, eave, ridge and rake assemblies are high performance extruded sealants, formulated and profiled to provide the optimum performance for the specific assemblies.

The extruded sealants are provided in rolls with a specially designed backing (release paper).

The backing is of the appropriate width to provide an installation alignment guide for the specific assemblies.

The sealants for the vapor seal applications are high performance gun grade sealants specifically formulated to allow for component movement during the roof erection. The sealant is provided in 10.1 oz. tubes for installation with standard caulking guns.

The sealant for perimeter trim, gutter joints and specific roof flashing joints is a high performance gun grade caulking/sealant specially formulated for optimum performance of the trim and flashing joints.

The sealants are designed for field application at temperatures of +20 to +120 degrees F.

The sealants are designed for service temperatures of -60 to +180 degrees F.

PRODUCT DESCRIPTION (cont.)

FASTENERS

The roof system fasteners are designed to provide the optimum structural and sealing performance of the specific assemblies. The fasteners are made of corrosion resistant alloys or coated to provide long-term service life. The fasteners are of self-drilling or self-tapping design to allow for installation with standard tools and procedures. The fasteners are designed to be installed from the top side of the roof.

PERFORMANCE

ROOF PANELS ALLOWABLE POSITIVE AND CONNECTION LOADS (PSF)

CFR PANEL DIMENSIONS	DESIGN CRITERIA	SUPPORT SPAN (FEET)					
		2.5	3.0	4.0	5.0	6.0	7.0
42" WIDE, 2" THICK	BENDING & SHEAR	141.3	115.8	84.8	66.8	55.1	46.9
	DEFLECTION (L/240)	176.4	143.2	101.2	75.7	58.6	46.4
	CONNECTION	39.8	38.1	34.8	31.5	28.2	24.2
42" WIDE, 2.5" THICK	BENDING & SHEAR	163.2	133.8	97.8	76.8	63.2	53.7
	DEFLECTION (L/240)	204.5	167.0	119.7	91.0	71.6	57.7
	CONNECTION	48.7	46.0	40.6	35.2	29.8	25.6
42" WIDE, 3" THICK	BENDING & SHEAR	182.9	150.1	109.7	86.0	70.7	60.0
	DEFLECTION (L/240)	229.3	188.0	136.0	104.4	83.1	67.8
	CONNECTION	57.6	53.9	46.4	38.9	31.5	27.0
42" WIDE, 4" THICK	BENDING & SHEAR	195.2	160.6	117.7	92.3	75.6	64.0
	DEFLECTION (L/240)	249.6	205.8	150.7	117.2	94.8	78.6
	CONNECTION	75.4	71.1	62.5	53.9	45.4	36.8
42" WIDE, 5" THICK	BENDING & SHEAR	222.1	183.2	134.6	105.7	86.6	73.2
	DEFLECTION (L/240)	283.5	234.4	172.5	135.1	110.0	91.9
	CONNECTION	75.4	71.1	62.5	53.9	45.4	36.8
42" WIDE, 6" THICK	BENDING & SHEAR	246.1	203.4	149.8	117.8	96.6	81.6
	DEFLECTION (L/240)	313.7	259.8	192.0	151.0	123.4	103.6
	CONNECTION	75.4	71.1	62.5	53.9	45.4	36.8

NOTES: 1. Based on CFR-42 panel with 24 Ga. exterior face (min Fy = 50 ksi) and 26 Ga. interior face (min Fy = 33 ksi). 2. Based on attachment with CFR panel clip with (3) 1/4"-14 Self-Drilling Tek 3 screws in min. 14 Ga. steel or (2) 1/4"-14 Self-Drilling Tek 3 screws in min. 12 Ga. steel. In lieu of self-drilling screws, self-tapping screws may be used. 3. Allowable positive load is the lowest value of panel bending strength, shear strength & deflection limit. 4. Allowable suction load is the lowest value of panel bending strength, shear strength, deflection limit and connection strength. 5. Connection loads will increase with interior back fastening. Consult Metl-Span for loads and fastening patterns. 6. The loads based on panel stress and deflection design criteria are derived from ASTM E72 structural testing. The allowable loads are calculated with a factor of safety of 2.5 and 3.0 for bending and shear stresses, respectively, and deflection limitation of L/240. 7. The panel and its connection strength was determined from ASTM E1592 testing, and the allowable loads are calculated with a factor of safety of 2.0. 8. The clip fastener capacity was determined from manufacturer fastener pullout data, and the allowable loads are calculated with a factor of safety of 3.0. 9. The structural capacity of the purlins are not considered and must be examined independently. 10. Reference to multiple spans is based on conditions of 3 or more spans. 11. For SI: 1 foot = 305 mm, 1 psf = 47.9 Pa, 1 inch = 25.4 mm.

WIND UPLIFT RESISTANCE

The CFR roof panel assembly has been tested using panel clip fastening with two screws per clip, and classified for wind uplift resistance by Underwriter's Laboratories Inc., as follows:

- UL 580, Class 90 Rating, Construction Detail No. 499, tested at 7' purlin spacing
- UL 580, Class 90 Rating, Construction Detail No. 500, tested at 5' purlin spacing
- UL 1897, 140 psf Rating, tested at 7' purlin spacing
- UL 1897, 166 psf Rating, tested at 5' purlin spacing

The CFR roof panel assembly has been tested and classified for wind uplift resistance by Factory Mutual Research Corporation, as follows:

- Class No. 4471, Class 1-90 Rating, tested at 5' purlin spacing in the field zone and reduced in the perimeter and corner zones. Minimum 14 gage purlin thickness.

PERFORMANCE

WATER PENETRATION

The CFR roof panel assembly was tested for water penetration in accordance with ASTM E1646 by an independent testing laboratory. The assembly did not leak at 12 psf differential pressure, which is the maximum pressure specified in the ASTM test procedure.

AIR INFILTRATION

The CFR roof panel assembly was tested for air infiltration in accordance with ASTM E1680 by an independent testing laboratory. At 12 psf negative pressure, the air infiltration was measured as 0.002 cfm/sq. ft. of roof area.

THERMAL TRANSMISSION

Metl-Span panels are tested for thermal transmission in accordance with ASTM C518 by an independent testing laboratory. The panels have a K-factor, Btu in/ft² hr. °F @ 75°F (24°C) mean core temperature = 0.140. K-factor, Btu in/ft² hr. °F @ 40°F (4°C) mean core temperature = 0.126.

SURFACE BURNING CHARACTERISTICS

The CFR panels have been evaluated for surface burning characteristics by an independent testing laboratory in accordance with the following standards:

- ASTM E84, class 1 foam core, meets requirements for flame spread 25 and smoke developed 450.
- CAN/ULC-S102, foam core, rated for flame spread 10 and smoke developed 40.
- CAN/ULC-S126, meets requirements for “fire spread under roof/deck assemblies”.

FM CLASS 4880 (UNLIMITED HEIGHT)

When tested in accordance with requirements of the 50' high corner test for unlimited height structures, Metl-Span panels do not support a self-propagating fire which reaches any limits of the 50' corner test structure as evidenced by flaming or material damage of the ceiling of the assembly. The FM approval is applicable to structures of unlimited height.

FM CLASS NO. 4471

The CFR Roof Panel has been approved by Factory Mutual Research Corporation as having met the requirements for Class 1A fire classification and Class SH Hailstorm classification. To qualify, the CFR Roof Panel had to satisfy Factory Mutual evaluation of the following performance criteria:

- Combustibility – from below the roof
- Combustibility – from above the roof
- Wind uplift resistance
- Foot traffic resistance
- Hail resistance
- Water leakage resistance
- Quality Control Program (including factory and field review)

D E S I G N

The CFR Roof System is designed in accordance with the 2007 Edition of the AISI “Specification for the Design of Light Gage, Cold-Formed Steel Structural Members,” and in accordance with sound engineering methods and practices.

W A R R A N T I E S

MATERIAL & WORKMANSHIP

The CFR Roof System components are furnished with Metl-Span’s standard two (2) year limited warranty providing the panels and other components to be free of defects in materials and workmanship.

NO PERFORATION

The CFR Roof Panels, with unpainted Aluminum/Zinc finish, are available with Metl-Span’s twenty (20) year limited warranty providing the panels to be free from rust perforation.

FINISH

The CFR Roof Panels are available with Metl-Span’s twenty (20) year limited warranty providing the panel exterior finishes to be free of checks, cracks, peeling and excessive chalking and color fade.

LIMITATIONS

All Metl-Span warranties are subject to acceptance and approval by Metl-Span’s Customer Service Manager. Metl-Span makes no warranties, expressed or implied, pertaining to the fitness or merchantability of the CFR Roof System, other than as specified in writing under Metl-Span’s published guarantees, which are approved and issued by Metl-Span’s Customer Service Manager for a specific project.

Contact Metl-Span’s Customer Service Department for sample warranties.

R O O F D E S I G N G U I D E L I N E S

GENERAL

The Metl-Span CFR Roof System is intended for industrial, commercial and cold storage applications where thermal efficiency, watertightness, durability and architectural acceptance are of prime importance.

ROOF DESIGN GUIDELINES (c o n t .)

It is the building designer's responsibility to assure that the specified roof materials and roof design are suitable for the intended use. These following design guidelines offer important considerations concerning the proper application (use) of the CFR Roof System.

As with any building design, the roof design factors vary with the circumstances, such as intended use, location and climate. The roof designer must determine the specific factors for the roof being considered.

ROOF CONFIGURATION

Rectangular – As an industrial/commercial roof, the CFR Roof System is designed primarily for single plane, rectangular roof areas. The rectangular shaped roof makes maximum use of the CFR Roof System's factory fabricated roof panels and components.

Although the CFR Roof System can be applied to more complex configurations, serious consideration must be given to the increased material and labor cost and potential erection errors resulting from the complexity of the parts and their installation.

Application of the CFR Roof System to the complex roof configurations listed below must be specifically approved by Metl-Span's Technical Services Department.

Beveled – Trapezoidal configurations such as hips, valleys, beveled eaves and beveled rakes are designed similar to their rectangular counterparts with the exception of the beveled parts. The beveled parts are the roof panels, flashing and closures which require field cutting and field fitting to achieve the required bevel. The supporting structurals require critical field fabrication and alignment to achieve the required bevel while maintaining the correct elevations.

Curved – Curved low eave configurations require field cutting the roof panels to the curved configuration and require specially fabricated, curved eave trim and eave structurals. Curved rake and high eave configurations are extremely difficult because of the requirement to close the curved roof panel edges and ends. Specially fabricated curved rake and ridge closures may be required. Specially fabricated, curved rake and high eave structurals will be required and the alignment and elevation of the supporting structurals will be most critical.

Pitch Transitions – Changes in roof pitch will require a transition step between the differently pitched roof sections. The step must be of sufficient height (6" minimum plus the panel thickness) to provide for the transition flashing and closures. The roof structurals will have to be designed to provide the transition step and support the roof panels' ends above and below the step.

Arched – Because of the CFR Roof Panel's rigidity, the panels are not recommended for application on an arched structure.

ROOF DESIGN GUIDELINES (c o n t .)

ROOF PITCH

Minimum Pitch Factors

The roof pitch is one of the most critical factors in determining a roof's weathertight performance. Generally, steep pitched roofs shed water, snow, and ice, while low pitch roofs may tend to accumulate snow and ice and pond water under some climatic conditions.

Ideally, every roof would have a steep pitch to assure weathertightness, but other considerations such as material efficiency, space efficiency, heating/cooling efficiency and aesthetics may require a lower roof pitch.

For a specific roof, the minimum allowable roof pitch is primarily determined as the amount of pitch necessary to prevent standing water (ponding) on the roof.

The common factors in determining the potential for water ponding are rainfall intensity, wind direction, snow and ice accumulation, roof size, roof drainage design and roof deflection.

Low pitch roofs in heavy snow and ice regions should not be designed with conditions that will accumulate snow or ice, such as valleys, high profile eave gutters and high parapets, etc.

On low slope roofs, roof loads may cause excessive deflection of the supporting structurals resulting in ponding on the roof. This ponding consequently increases the deflection of structurals which may in turn cause additional ponding. Loads supported by the same structurals that support the roof, such as suspended ceilings, lighting, HVAC equipment, sprinklers and cranes may cause excessive roof deflection with resulting ponding.

The CFR Roof System utilizes gasket type joints to provide weathertightness on low pitch applications. These joints, when properly assembled with the sealants in their correct position and condition, are designed to resist momentary flooding, such as caused by heavy rain with wind gusts. Long-term ponding such as caused by roof obstructions, clogged valley and gutter, ice damming and roof deflection must be avoided.

As a general rule for rectangular roofs without specific ponding conditions, the recommended minimum pitch is 1/2:12. For less than 1/2:12 roof pitch, please contact Metl-Span for project qualification. For roofs with field cut conditions such as hips and valleys, the recommended minimum roof pitch is 3:12. In all cases, it is the roof designer's responsibility to assure that the roof pitch is sufficient for the roof's intended use and conditions.

Maximum Pitch Factors

Maximum roof pitch is primarily determined by the effect upon the supporting structure, erection requirements and trim/flash/gutter designs. High pitch roofs, when subjected to gravity roof loads, may develop substantial "in plane" loads and require special bracing.

ROOF DRAINAGE

Drainage Factors

Roof drainage is an important factor in the design of a building. It is affected by building conditions such as roof configuration, roof pitch, roof size and run-off conditions. Roof drainage is affected by environmental conditions such as rainfall intensity, snow and ice occurrence and wind factors.

Roof Profile And Width

The width of the building is limited by the roof drainage system's ability to carry off rain water.

On a single slope roof, the entire roof area drains to the low eave. The absence of a ridge and gutter/downspout system at one eave provides material and erection savings. The high eave is more suitable for parapet or facade treatment.

On a gabled roof, the ridge divides the roof area so each eave handles half the roof drainage. With a gutter/downspout system at each eave, a wider roof area can be drained.

For extremely wide roof areas, multi-gabled roofs will be required. The roof is divided by alternate ridges and valleys with drainage at each eave and at the valleys. The valleys require an interior drain pipe system and provisions to keep the gutter open during ice damming conditions.

Eave Drainage Options

Eave drainage is usually by exterior mounted gutter and downspouts. Where suitable for appearance and ground run-off conditions, gutters are not provided and the run-off occurs at the roof edge.

Interior eave gutters are required when the low eave is at a parapet or wall, or when icing is so severe that the gutter and drain pipes must be heated by the building's interior.

In severe snow and ice regions, the eave gutters may be omitted and the roof edge extended so run-off and icing occurs away from the wall surface.

Effect Of Steep Pitch On Roof Drainage

Steep roof pitch increases the rate of run-off during high intensity rainfalls which can cause gutter and downspout overflow. Steep roof pitch can cause snow and ice slides which can cause damming of the gutter and downspouts as well as gutter damage. Selection of the gutter type (low profile vs. high profile) is an important consideration for steep pitch roofs.

EXPANSION/CONTRACTION

Temperature Differential

The temperature differential between the roof's surfaces and the supporting structural determines the amount of differential expansion/contraction movement the roof system must accommodate. In the case of the CFR Roof Panel, with its superior insulating properties, the roof panel's interior face is nearly the same temperature as the supporting structure.

ROOF DESIGN GUIDELINES (cont.)

In most circumstances, the critical temperature differential occurs between the roof panel's interior and exterior faces. The longitudinal expansion/contraction stress and strain is accommodated by thermal bowing of the panel between its attachments to the roof structurals and is equally divided between the individual spans. The transverse expansion/contraction stress and strain is accommodated by the flexing of the roof panel edges at the side joints.

In determining differential temperature limitations, consideration must be given to panel color, building location (climatic conditions and solar exposure), interior temperatures and support spacing.

Based on input of temperature differentials, support spacing and design loads, Metl-Span can provide job specific panel design analyses which calculate the panel reactions, panel deflections and temperature differential safety margins (based on thermal stress with or without combined load stress). Contact the Metl-Span's Technical Services Department for specific panel design information.

CFR Roof System applications requiring a temperature differential greater than 120 degrees F and roof applications requiring a roof width (dimension from the eave to the ridge or high eave) greater than 120' must be approved by Metl-Span's Technical Services Department.

Expansion Joints

Expansion joints tie separate roof sections together, yet allow each section to expand and contract independently. Expansion joints are required at structural expansion joints and at the transition to different roof types.

For expansion joints running parallel to the eave, a transition step is required between the two roof sections. The step provides for the transition flashing and closures and the differential expansion movement between the roof sections.

For expansion joints running parallel to the rake, a small parapet is required between the two roof sections. The parapet provides for the transition flashing and the differential expansion movement between the roof sections.

GENERAL STRUCTURAL CONSIDERATIONS

ROOF DEAD LOAD – CFR Roof Panel						
PANEL THICKNESS	2"	2 1/2"	3"	4"	5"	6"
WEIGHT	2.48 lbs. per sq.ft.	2.56 lbs. per sq.ft.	2.65 lbs. per sq.ft.	2.82 lbs. per sq.ft.	3.00 lbs. per sq.ft.	3.17 lbs. per sq.ft.

Lateral Stability

Because the CFR Roof Panels attach directly to the roof structurals, the panel attachments may be used to provide lateral stability to the roof structurals. The design of the lateral bracing for the roof structurals is the responsibility of the framing contractor.

The roof structurals must have sufficient lateral stability to support the roof erection loads prior to attachment of the roof panels, or must be temporarily braced to support the erection loads.

ROOF DESIGN GUIDELINES (c o n t .)

In-Plane Deflection

The roof structurals must have sufficient strength and stiffness or be braced to resist any in-plane (outward) deflection caused by the roof load. As the roof pitch increases, other factors being equal, the in-plane load increases.

Panel Attachment Requirements

The roof structurals must provide a 2 1/2" minimum width bearing support to the roof panels. The bearing surfaces must be uniform and level to the nominal roof plane. The maximum deviation from the roof plane is $\pm 1/8$ " in any 5' length and $\pm 1/4$ " in any 20' length.

The roof structurals bearing surface must have sufficient strength and stiffness to resist the load imposed on it by the base of the panel clip and its attachment fasteners.

The panel clip attachment fasteners will be provided by Metl-Span as appropriate for the roof design requirements and the structural member material, size and spacing as specified on the contract.

ROOF PENETRATIONS

Critical Requirements

The proper flashing of roof penetrations is an important factor concerning the roof's water tightness and structural performance. Because the penetration cuts through the panel and is subjected to the full and often concentrated water run-off as well as snow and ice accumulation, the design and installation of the penetration is critical and should be performed only by those experienced in such applications.

Pipe flashings and curbs are not provided by Metl-Span and must be procured from specialty manufacturers who are qualified to provide the appropriate pipe flashings, curbs and hardware (fasteners and sealants) for the metal roof system.

Pipe Flashing

Penetrations for small pipes and ducts may be flashed with standard metal roof pipe flashing. The flashing consists of a flexible boot with a metal backed sealing flange. The flashing must be located in the panel flat and provide a 2" min. space between the panel rib and the flashing to prevent blockage of roof run-off. An interior flashing and filler insulation must be provided to close the penetration and provide continuity of the insulation and vapor seal. When aesthetically acceptable, a standard pipe flashing may be used as the interior flashing.

Curbs

For larger penetrations, a curb is attached to the roof to close the perimeter of the opening. The penetrating object is then counter flashed over the curb. If the penetrating object is to move in relation to the roof, the counter flashing must be designed so it can move freely over the roof curb, thus accommodating the differential movement between the roof and the penetrating object.

ROOF DESIGN GUIDELINES (cont.)

Penetrations, which are wider than the roof panel's standing rib spacing, will require a specially designed roof curb to close the roof panel's ribs. The recommended curb is a metal, factory built assembly consisting of a vertical wall at least 6" tall with a continuous perimeter flange for attachment to the roof panels. The uphill side of the curb is provided with an extended flange and built in cricket to divert and direct the roof run-off around the sides of the curb.

The curb must be provided with the appropriate sealant and fasteners for the secure attachment of the curb to the roof panel. Curb material should be stainless steel or galvanized or aluminum/zinc alloy coated steel to assure compatibility with the roof panel material.

An interior flashing and filler insulation will be required to close the penetration and provide continuity of the insulation and the vapor seal.

Load Bearing Curbs

As a general rule, a minimum 18" x 18" roof curb that is uniformly supported by the roof panel can accept equipment loads such as hatches, skylights, ventilators, fans, etc. up to 200 lbs. The roof structure's capability to support the weight of the curb, plus the load, must be assured by the roof designer.

Larger size curbs distribute loads over a greater roof area. Thus, larger curbs may accept greater loads subject to review and approval by Metl-Span's Technical Services Department.

For heavy equipment loads, the equipment weight must be supported directly by a sub-structure which will transfer the load directly to the roof structurals, the primary structure or to the floor.

Clearances

Curbs must be located at least 4" away from adjacent construction to allow for attachment to the roof panel or supporting structurals and to allow for roof run-off around the sides of the curb.

It is most important that the roof panels and support structurals are at the correct elevation and in-plane to assure that the curb flange will uniformly fit to the roof panel and to eliminate any ponding areas around the curb.

CONDENSATION CONTROL

With any insulated roof system, the proper design and installation of vapor seals and ventilation system are of the utmost importance to prevent condensation and the resulting problems of moisture damage and drippage. Metl-Span recommends the services of a qualified engineer to specify the appropriate vapor control system for the specific building and environmental conditions.

Metl-Span provides a gun grade vapor sealant for application into the roof panel's interior face side joints, end joints and junctions, and to the perimeter structurals and interior flashing.

The roof designer must assure that these vapor seals are appropriate for the specific roof conditions.

ROOF DESIGN GUIDELINES (c o n t .)

CORROSION

The CFR Roof Panels and flashing are made of steel clad with painted G-90 Galvanizing or unpainted aluminum/zinc alloy. These are the strongest, most durable and maintenance free of the practical roof materials.

However, to help ensure longevity, the roof must be designed, installed and maintained so as to prevent the roof's exposure to the following conditions:

1. Exposure to corrosive atmospheres, settlements and run-off such as chemical exhausts and salt spray, etc.
2. Exposure through direct contact or run-off from corrosive materials such as uncured cement, some treated lumbers, acids, caustics, etc.
3. Consistent exposure to moisture such as caused by water or steam exhausts, continuous drainage overflow, long term ponding and moisture-holding materials such as accumulated dirt, leaves, saw dust, fibers, etc.
4. Exposure to wet sub-materials such as caused by roof leakage and improper condensation control.
5. Exposure, through direct contact or run-off, to bare and rusting iron or steel objects and dissimilar metals such as copper pipes.
6. Damage or erosion of the roof material's protective cladding which exposes the material's bare steel.

PANEL CONDITION

Every effort must be made to assure that the CFR Roof materials reach the job site, are stored and installed in such a manner that their premium appearance is preserved.

Oil-Canning

Oil-canning is an inherent quality of light-gauge metals used in the roll-forming process and may not be construed as a product defect and cause for rejection.

Roof panels that are rigidly fixed to the roof structurals, so that thermal bow occurs, may exhibit more pronounced oil-can when subjected to rising temperatures.

Roof Traffic

The roof surface must be protected from damage caused by roof traffic conditions. Except for roof erection and roof and equipment maintenance, no other traffic should be allowed on the roof.

To prevent roof damage caused by necessary roof traffic conditions, Metl-Span recommends the application of a proper roof walkway system. There are several manufactured systems available with bearing features and clamps which will secure the walkways without roof penetrations or bearing damage.

ROOF DESIGN GUIDELINES (c o n t .)

ERECTION

Installation Drawings And Installation Guide

Roof system erection requirements and recommendations are described in the CFR Insulated Metal Roof Panel Installation Guide and Installation Video which are available from Metl-Span.

When provided for in the contract, Metl-Span will provide the installation drawings for the project. The latest installation drawings and the installation guide must be available at the job site. It is the Customer's responsibility to assure that the roof installation contractor is qualified to properly and safely install the CFR Roof System and that he is provided with and comprehends the latest installation drawings and installation guide.

Seamers

The roof seaming equipment is specially designed for the CFR Roof Panel and is available only from Metl-Span. The equipment is furnished on a rental basis to the roof purchaser. The seaming equipment is not delivered with the roof material, but is requisitioned separately based on the actual erection schedule.

Erection Temperature

Roof erection temperatures are important considerations. Temperature extremes must be considered during installation of the roof because of the temperature sensitivity of the sealants and the roof panel.

The recommended installation temperature range is 20° F to 120° F. At colder temperatures, the sealant stiffens, resulting in loss of adhesion and compressibility. At higher temperatures, the sealant becomes too soft for practical handling. Once the roof is installed and in service, the sealant can withstand temperatures of -60° F to 180° F.

The roof panels are subject to thermal bowing due to differential surface temperatures between the exterior and interior faces. Excessive bowing may cause erection difficulty. In such cases, the panels will have to be shaded from the sun or turned over to reduce the surface temperature differential.

ROOF ADDITIONS AND MODIFICATIONS

Any modifications or additions to the CFR Roof System must be reviewed and approved by Metl-Span. Instructions for specific parts placement suggestions, modifications and additions may affect the structural and watertight performance of the roof in ways that may not be readily understood or considered by parties other than Metl-Span.

The customer is responsible for reviewing all modifications or additions for effects on the structure and code compliance.

ARCHITECTURAL DETAILS

GENERAL

The following Architectural Details provide a graphic description of the CFR Roof System and its standard applications. Use these details to assist you in determining the applications required for your specific project.

These standard application details are based on typical and proven industrial/commercial designs, utilizing gasket type sealed assembly to provide more positive watertightness under a broad range of conditions including low pitched roofs. It is the roof designer's responsibility to assure that the specified application detail is appropriate for the roof's intended use.

These details show generic roof structurals and adjacent construction for simplicity of presentation.

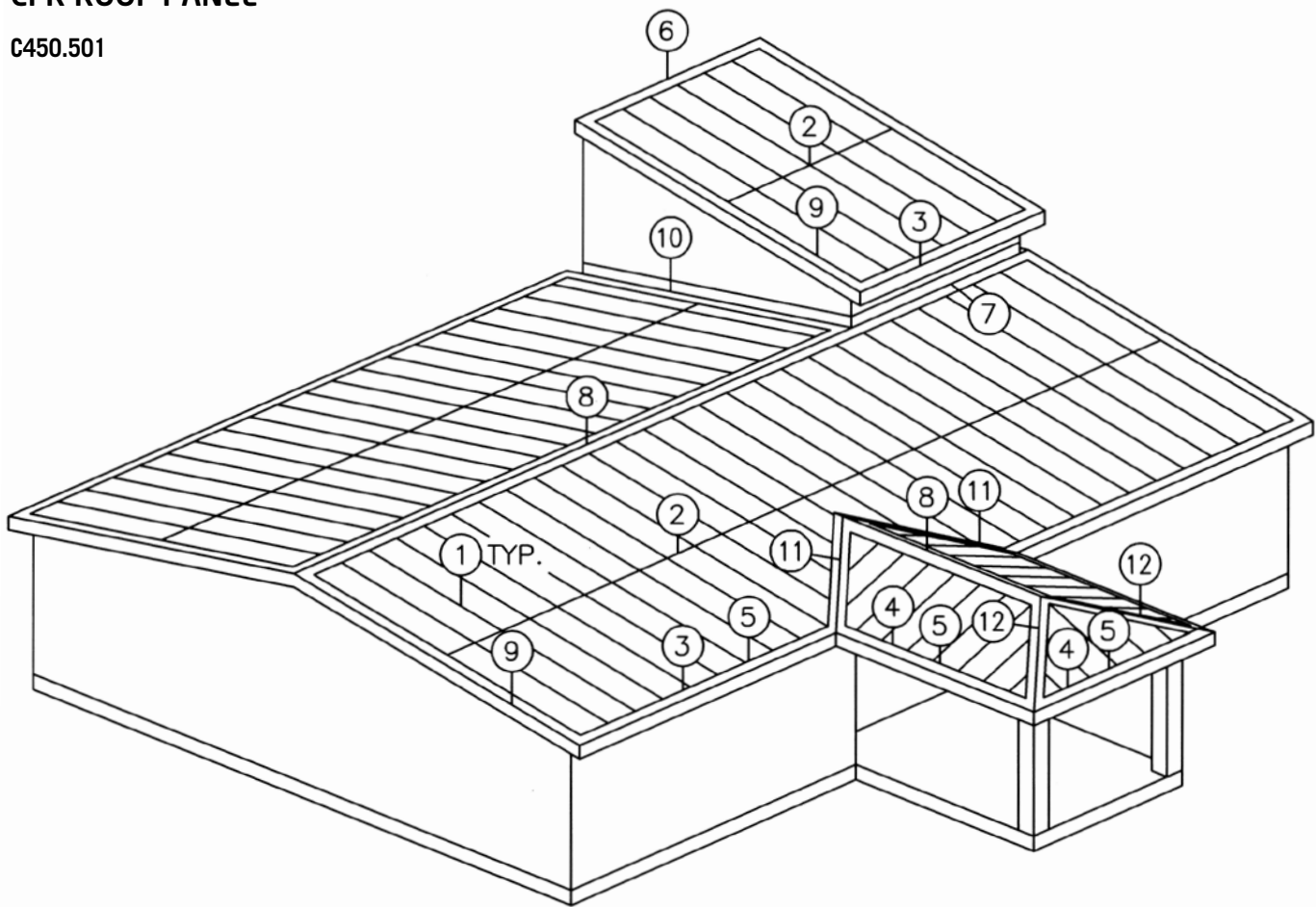
These details may be modified to accommodate minor changes such as clarification of structural members and adjacent construction, trim profile, flashing tie-in to adjacent construction, etc. The basic functions of the details such as fit-up, sealing and attachments, etc., cannot be modified. All applications not in accordance to these details or applications based on modification of the details require approval by Metl-Span's Technical Services Department.

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CFR ROOF PANEL

C450.501

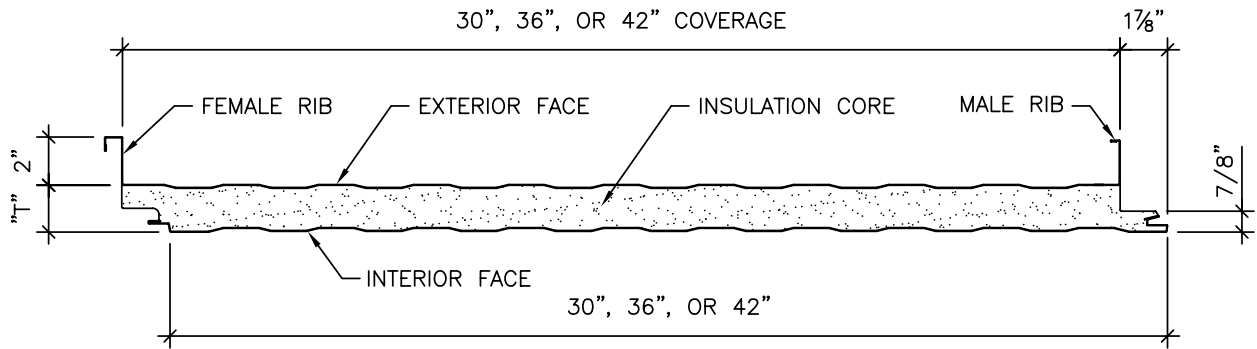


DETAIL LEGEND

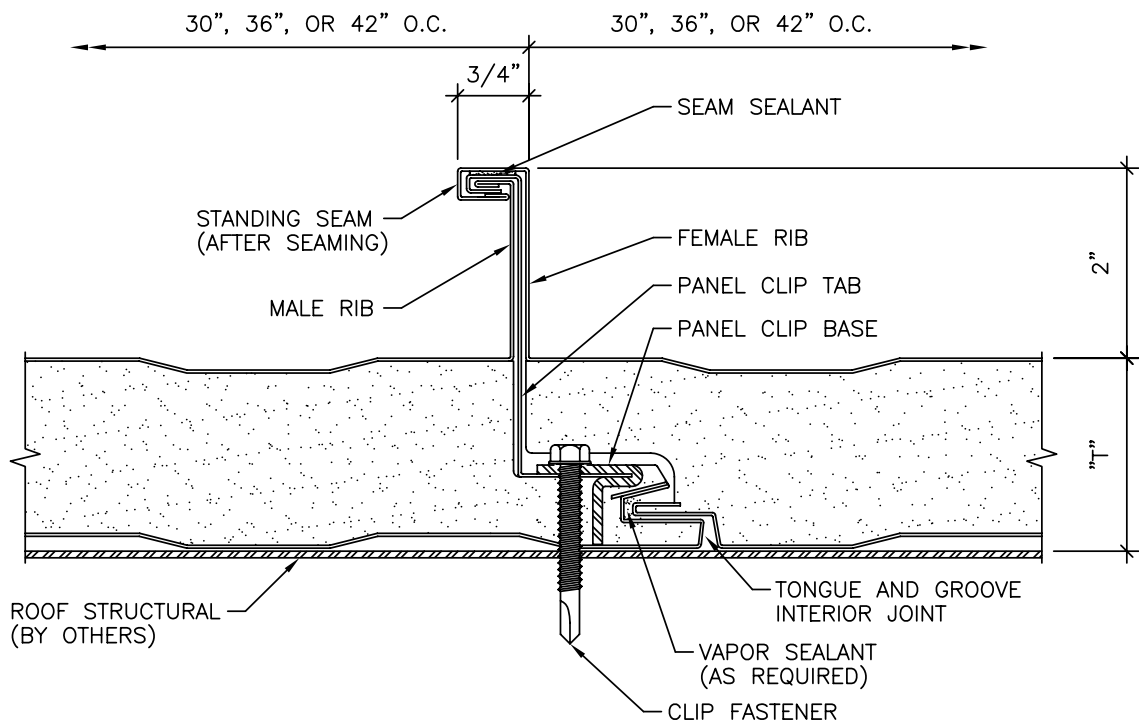
- | | |
|----------------------------|--------------------------------------|
| ①ROOF PANEL SIDELAP | ⑦HIGH SIDE TRANSITION FLASHING |
| ②ROOF PANEL ENDLAP | ⑧RIDGE FLASHING |
| ③EAVE TRIM | ⑨RAKE TRIM |
| ④EAVE TRIM ON CANOPY | ⑩RAKE TRANSITION FLASHING |
| ⑤GUTTER | ⑪VALLEY FLASHING |
| ⑥HIGH SIDE EAVE TRIM | ⑫HIP FLASHING |

CFR ROOF PANEL

C450.502.1



PANEL SECTION

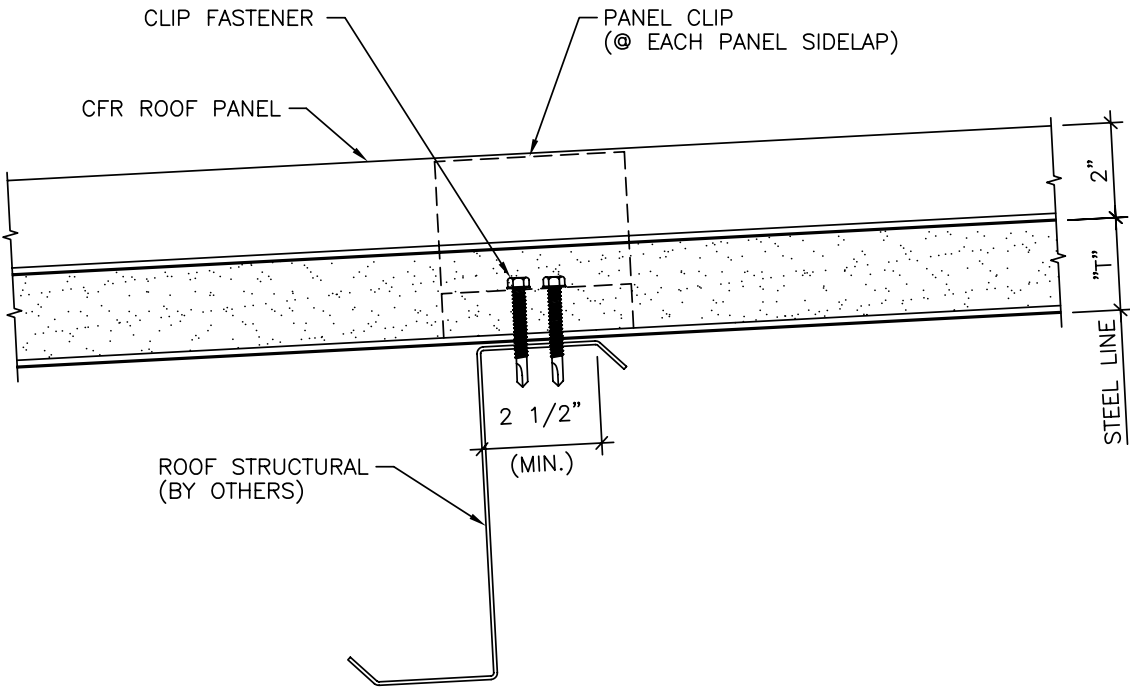


SIDELAP SECTION

"T" = PANEL THICKNESS (2", 2 1/2", 3", 4", 5", OR 6")

CFR ROOF PANEL

C450.503.1

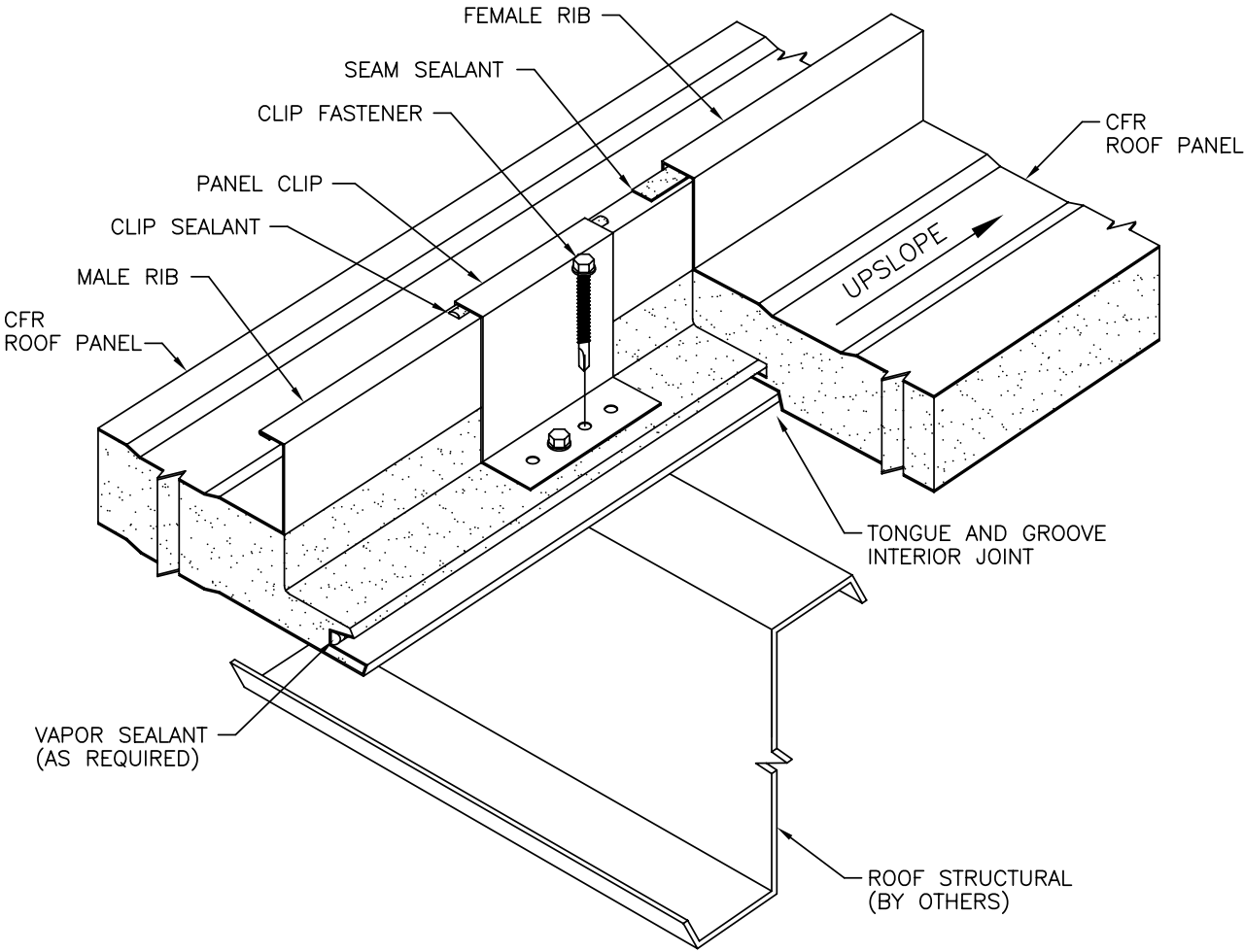


PANEL ATTACHMENT SECTION

"T" = ROOF PANEL THICKNESS

CFR ROOF PANEL

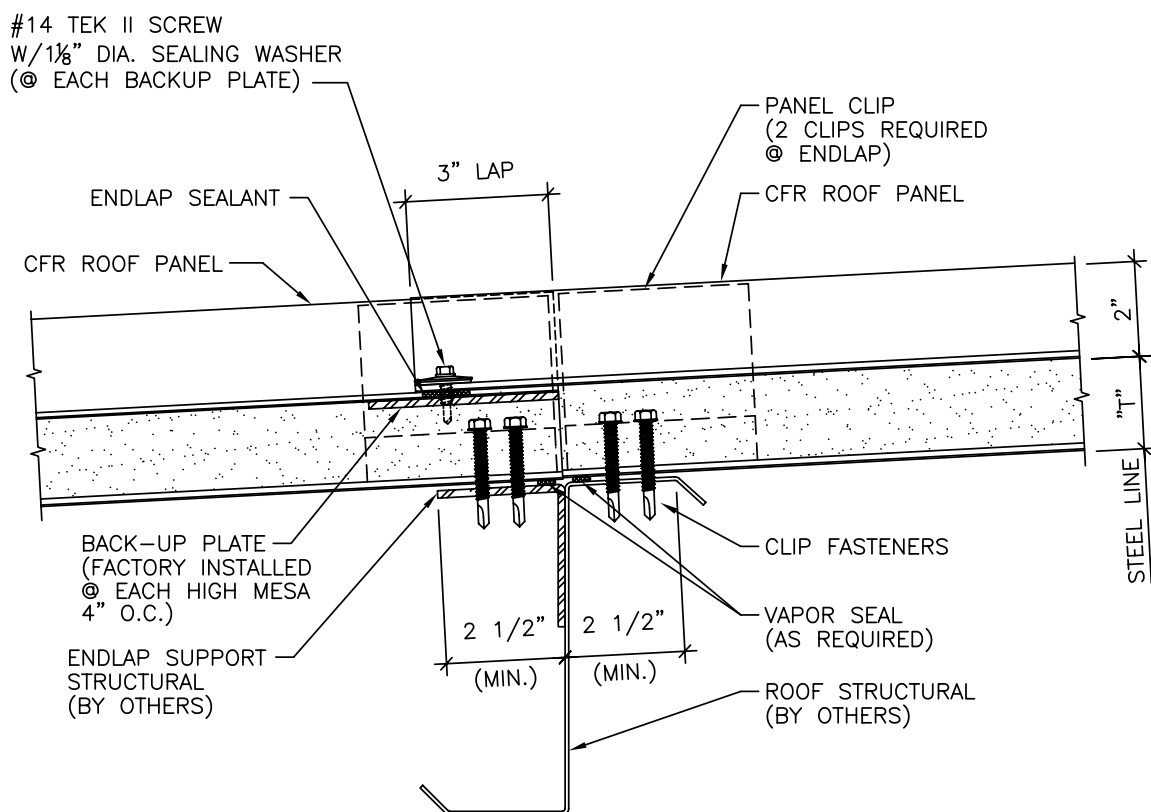
C450.504.1



PANEL ATTACHMENT AND SIDELAP DETAIL

CFR ROOF PANEL

C450.505.1

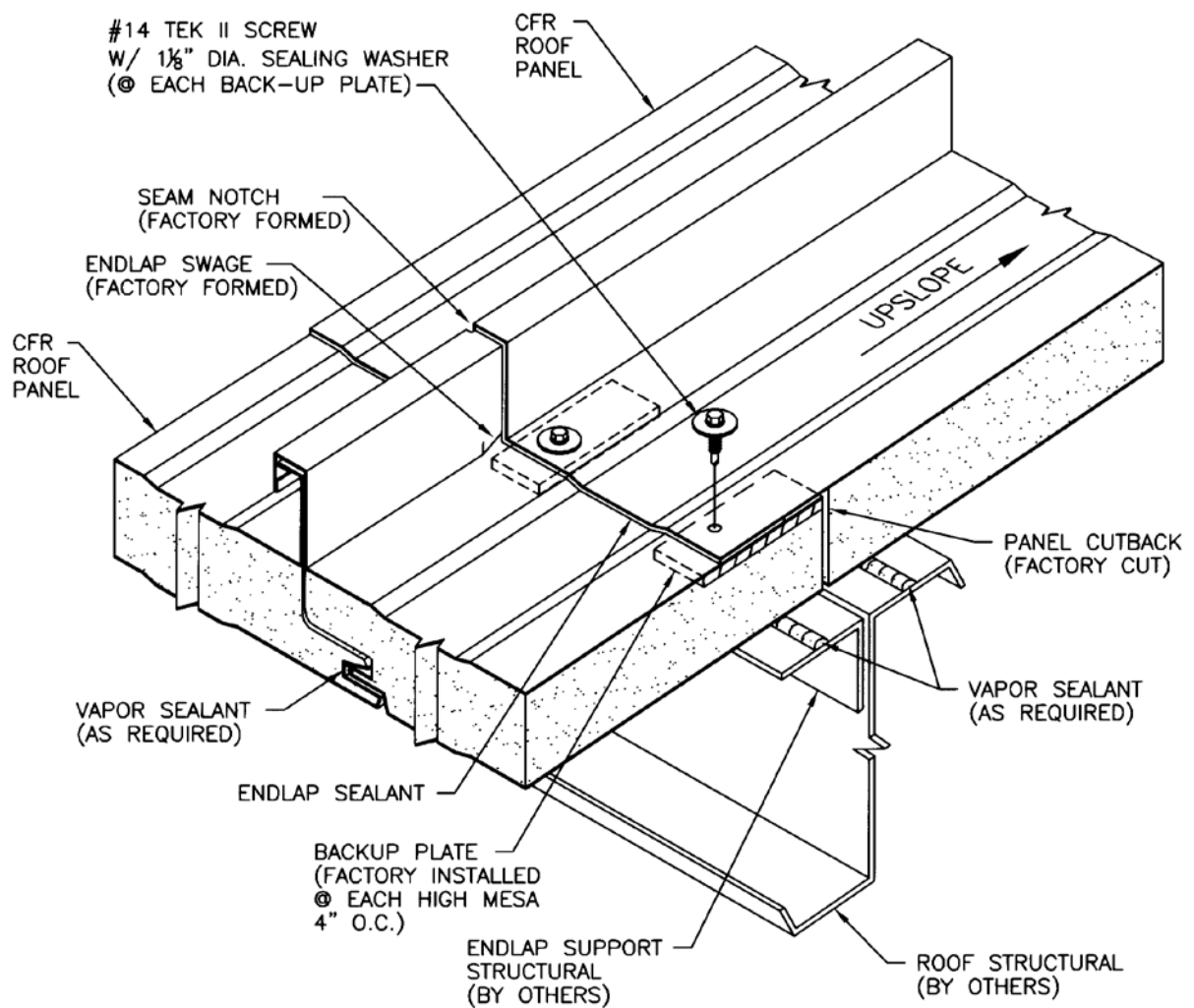


PANEL ENDLAP SECTION

NOTE: "T" = ROOF PANEL THICKNESS

CFR ROOF PANEL

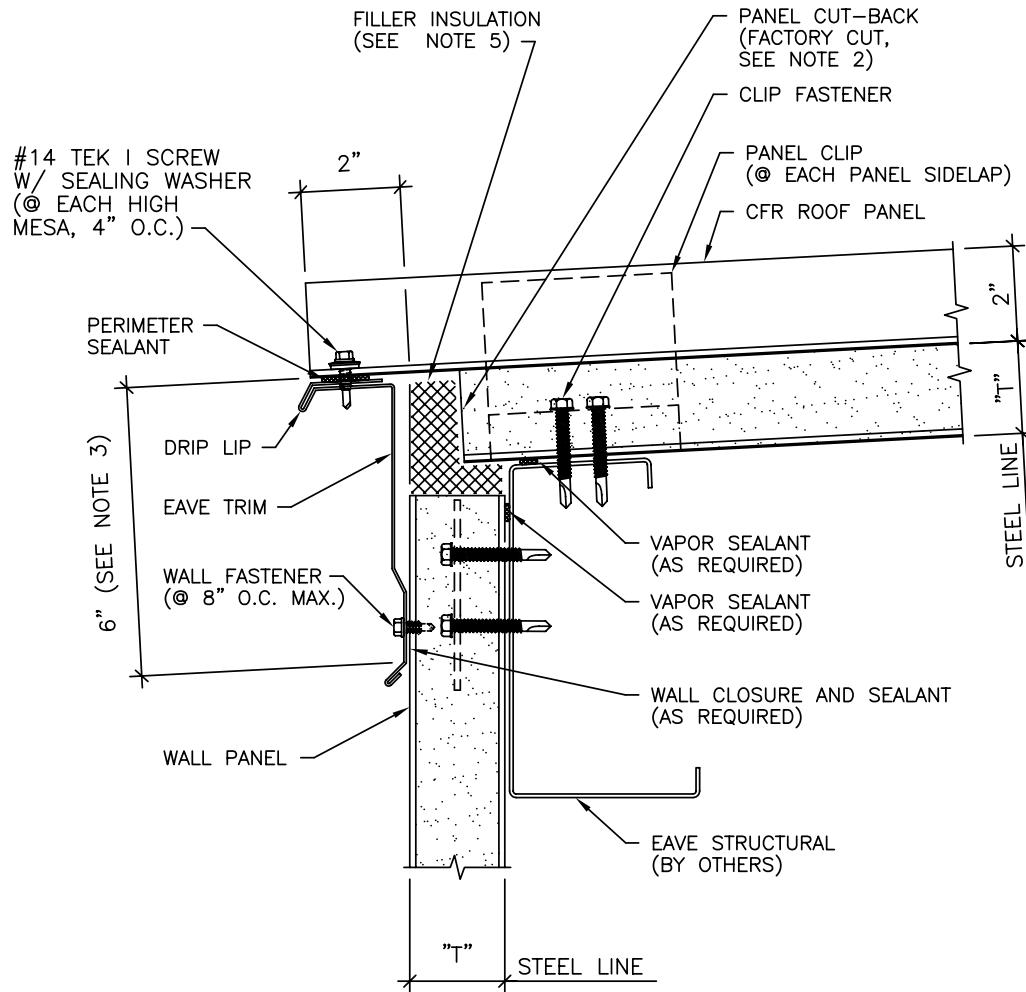
C450.506



PANEL ENDLAP DETAIL

CFR ROOF PANEL

C450.507.2

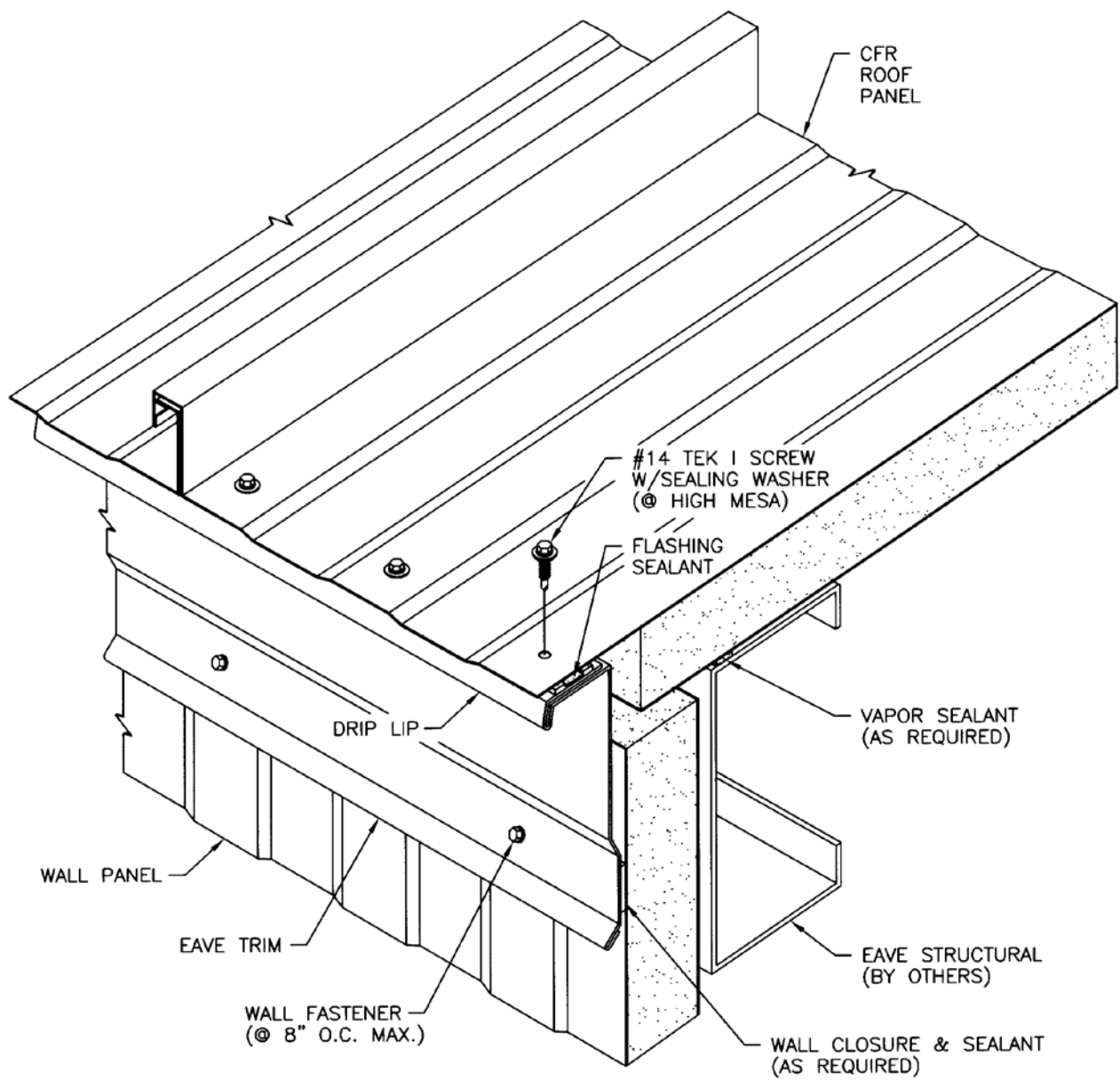


LOW EAVE SECTION

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. STANDARD CUT-BACK IS 3", CONSULT FACTORY FOR AVAILABILITY OF OTHER CUT-BACK DIMENSIONS.
 3. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 4. WALL FASTENERS AND WALL CLOSURES PROVIDED WITH WALL SYSTEM.
 5. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.

CFR ROOF PANEL

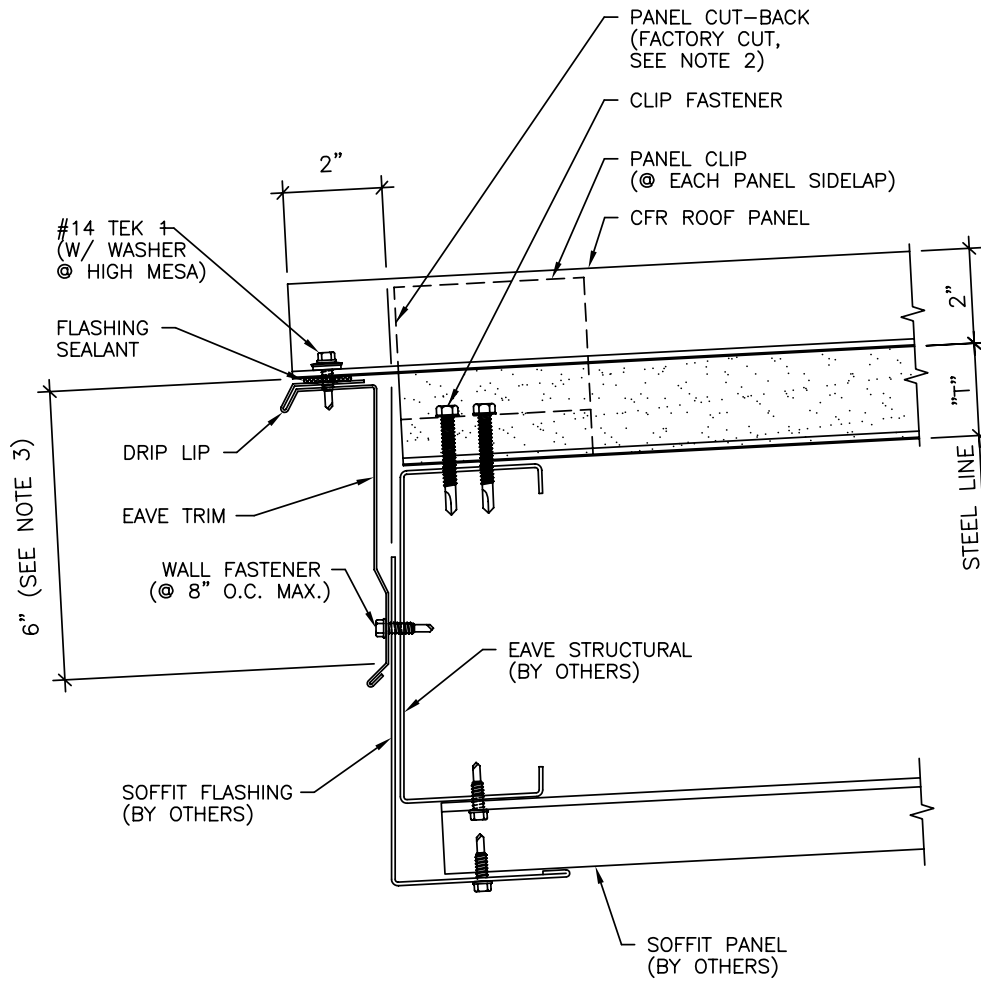
C450.508



LOW EAVE DETAIL

CFR ROOF PANEL

C450.510.2



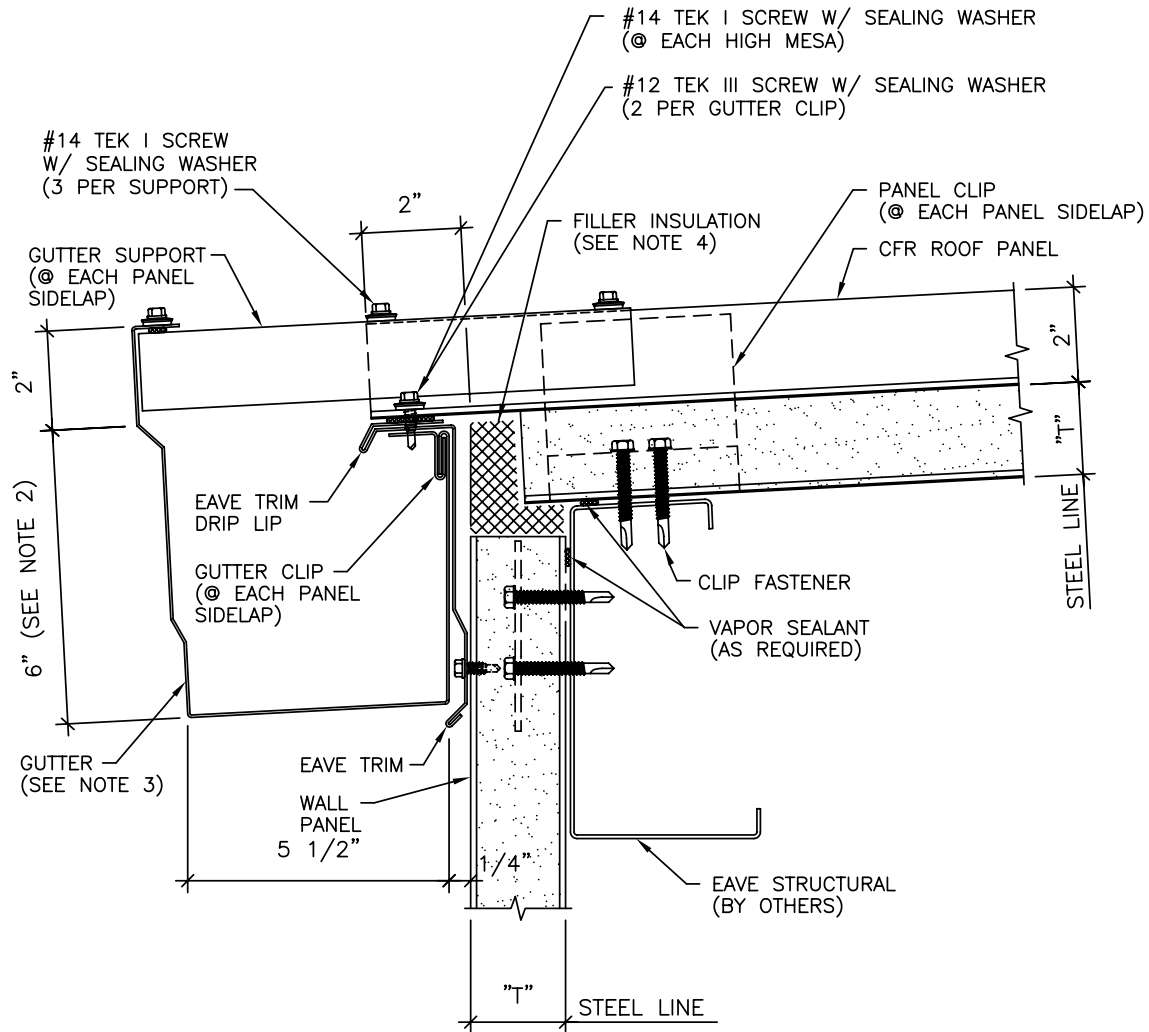
LOW EAVE SECTION

(@ CANOPY)

- NOTES:
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 2. STANDARD CUT-BACK IS 3", CONSULT FACTORY FOR AVAILABILITY OF OTHER CUT-BACK DIMENSIONS.
 3. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.

CFR ROOF PANEL

C450.511.2



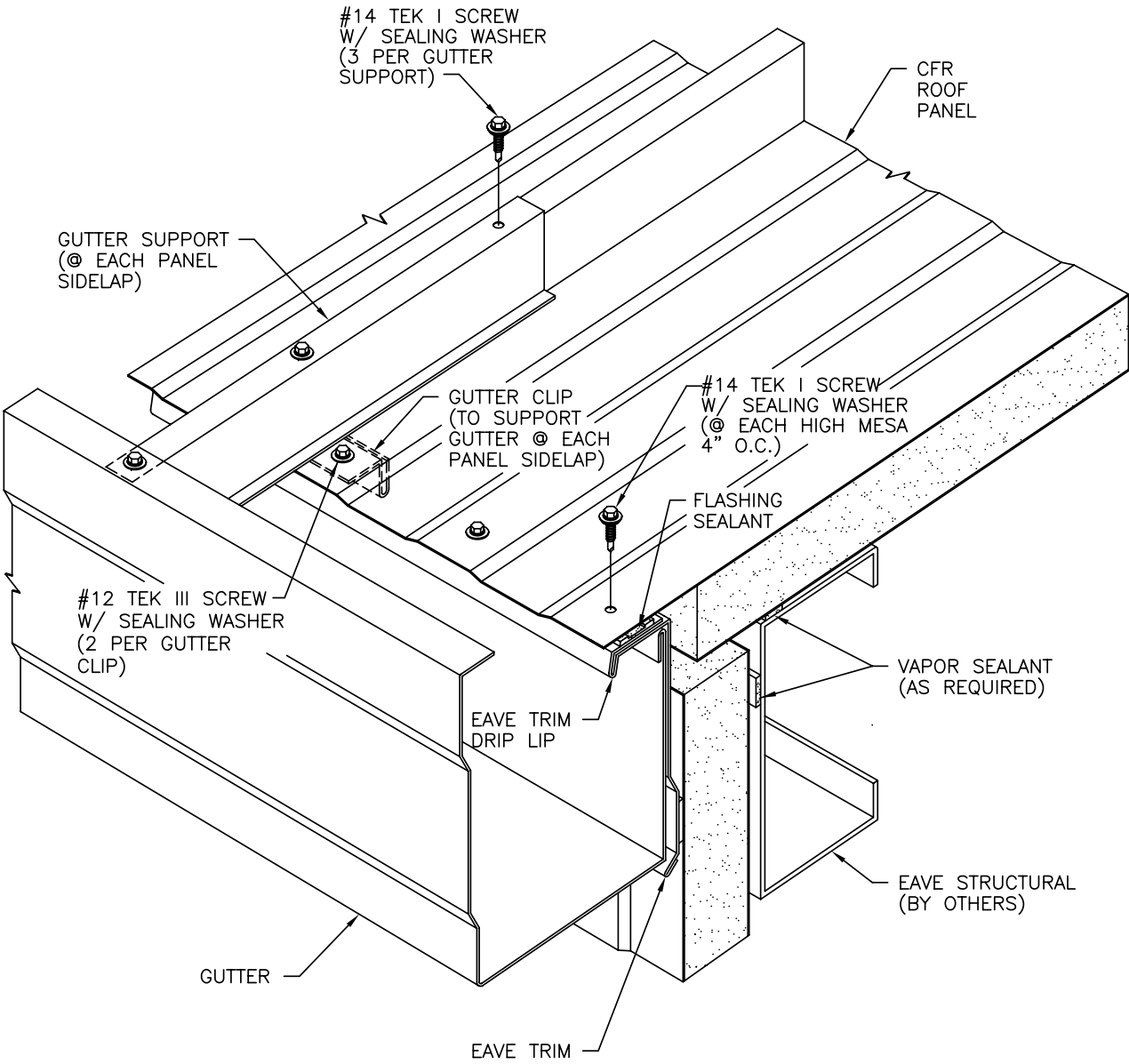
(REFER TO EAVE TRIM SECTION FOR EAVE TRIM DETAILS)

EAVE GUTTER SECTION

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. STANDARD GUTTER SHOWN, CONSULT FACTORY FOR AVAILABILITY OF LARGER CAPACITY GUTTERS.
 4. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 5. EAVE GUTTERS ARE NOT RECOMMENDED FOR APPLICATIONS SUBJECT TO SNOW AND ICE DAMMING OR OTHER CAUSES OF GUTTER OVERFLOW.

CFR ROOF PANEL

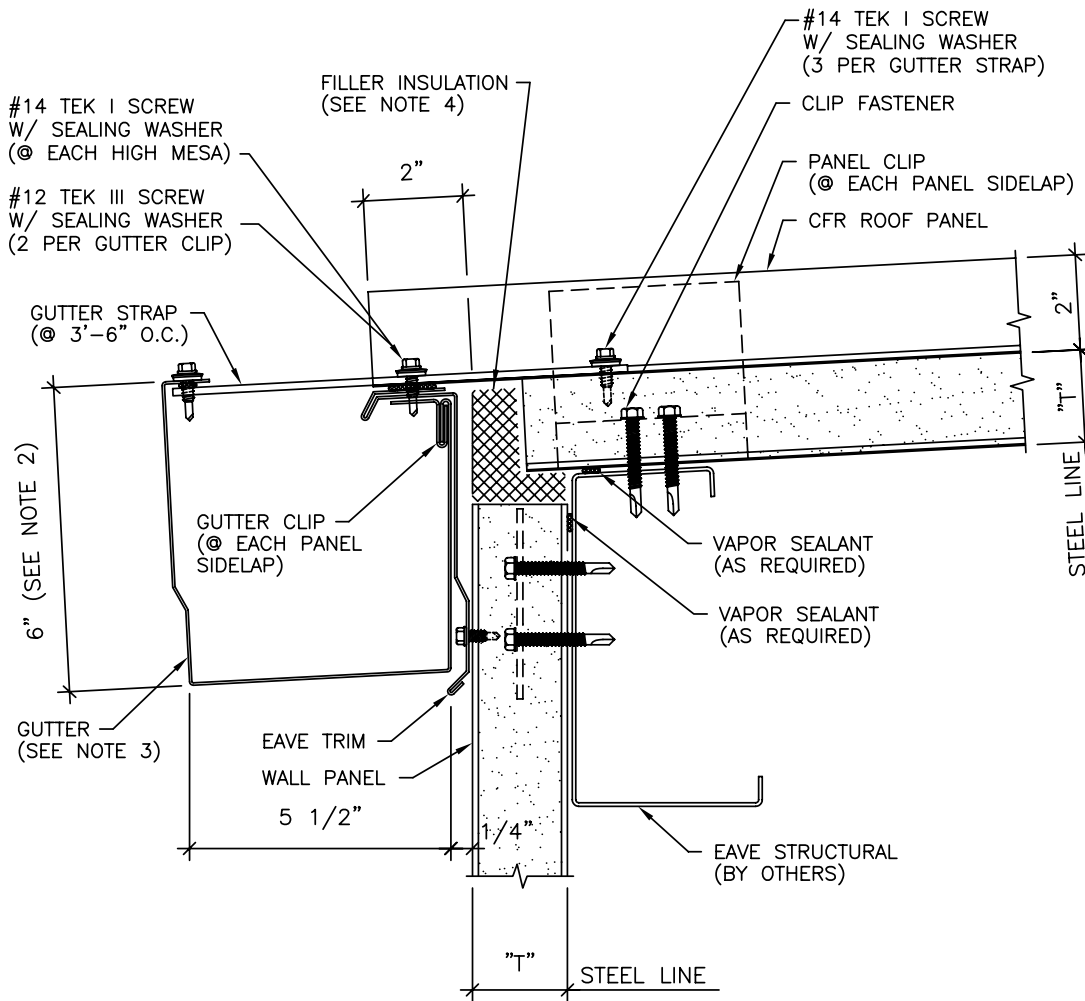
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EAVE GUTTER DETAIL

CFR ROOF PANEL

C450.513.2



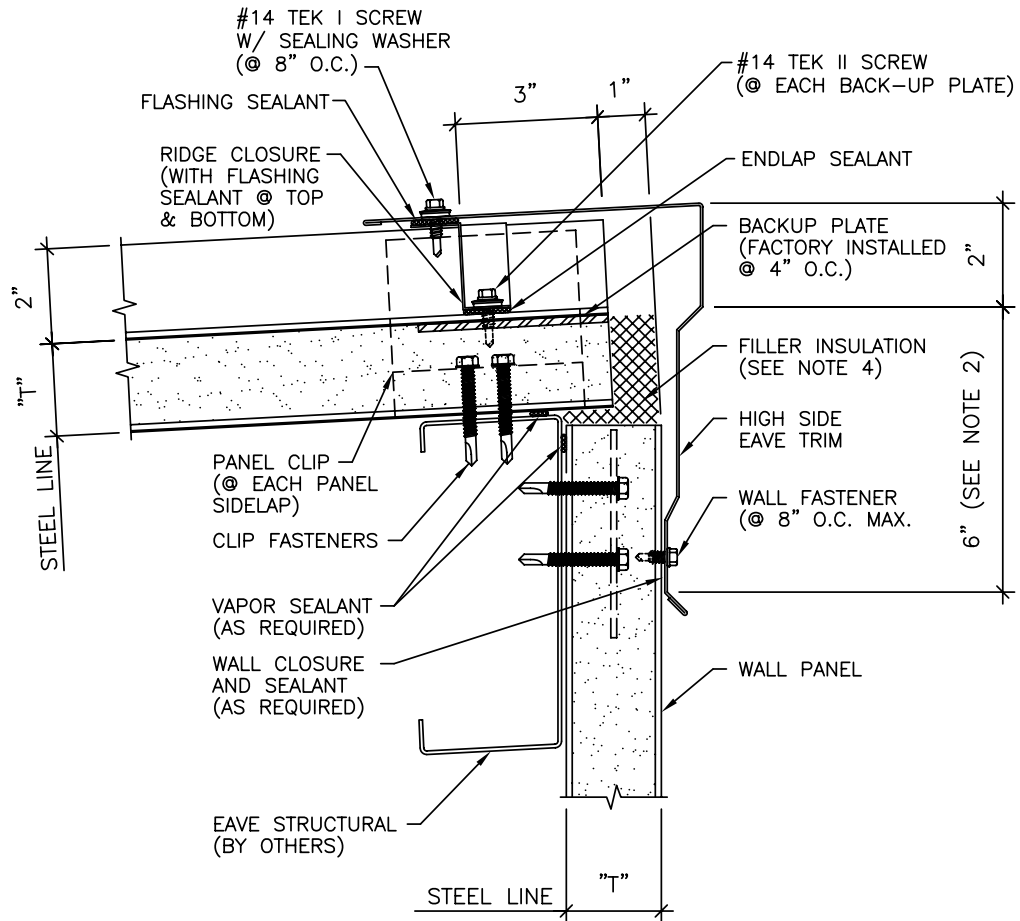
(REFER TO EAVE TRIM SECTION FOR EAVE TRIM DETAILS)

EAVE GUTTER SECTION (LOW PROFILE GUTTER)

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. STANDARD GUTTER SHOWN, CONSULT FACTORY FOR AVAILABILITY OF LARGER CAPACITY GUTTERS.
 4. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 5. EAVE GUTTERS ARE NOT RECOMMENDED FOR APPLICATIONS SUBJECT TO SNOW AND ICE DAMMING OR OTHER CAUSES OF GUTTER OVERFLOW.

CFR ROOF PANEL

C450.514.1

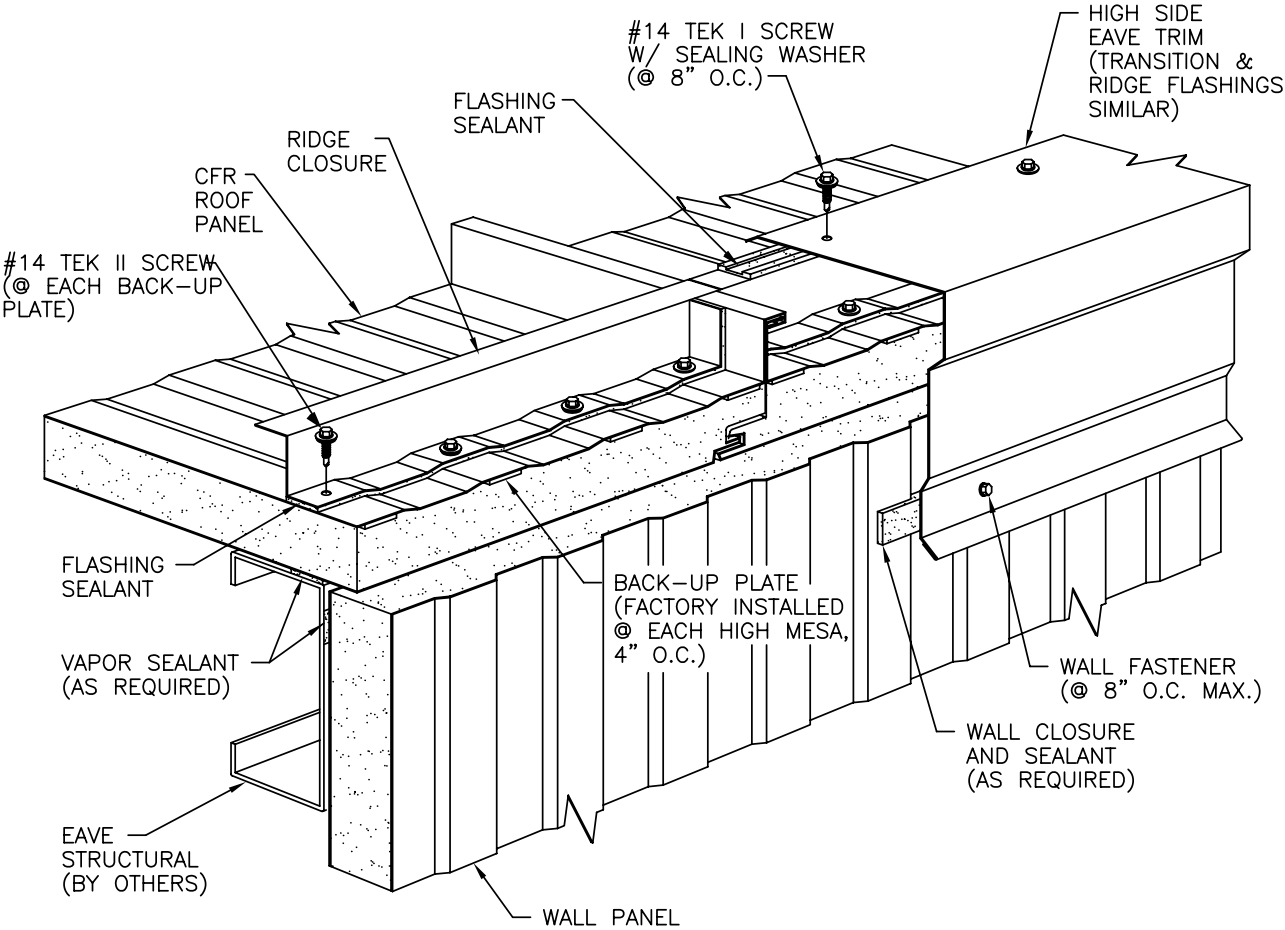


HIGH SIDE EAVE SECTION

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. WALL FASTENER AND WALL CLOSURES ARE PROVIDED WITH WALL SYSTEM.
 4. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.

CFR ROOF PANEL

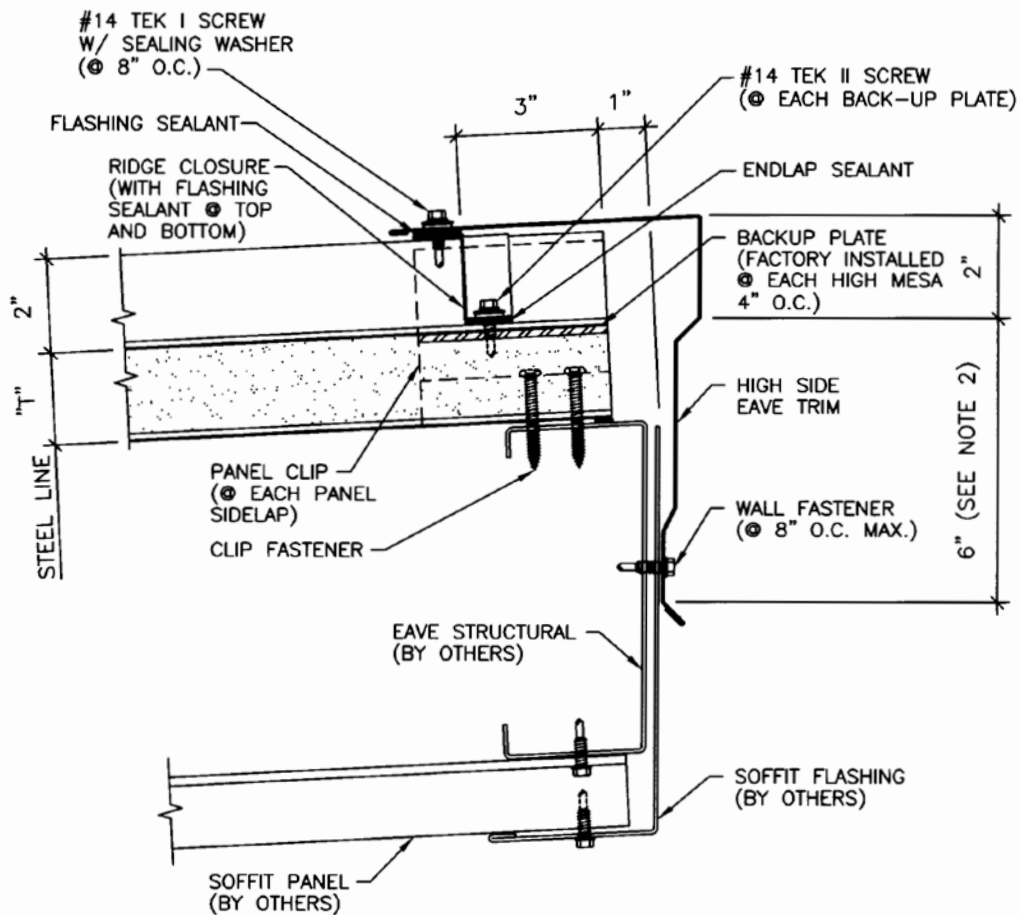
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HIGH SIDE EAVE DETAIL

CFR ROOF PANEL

C450.516

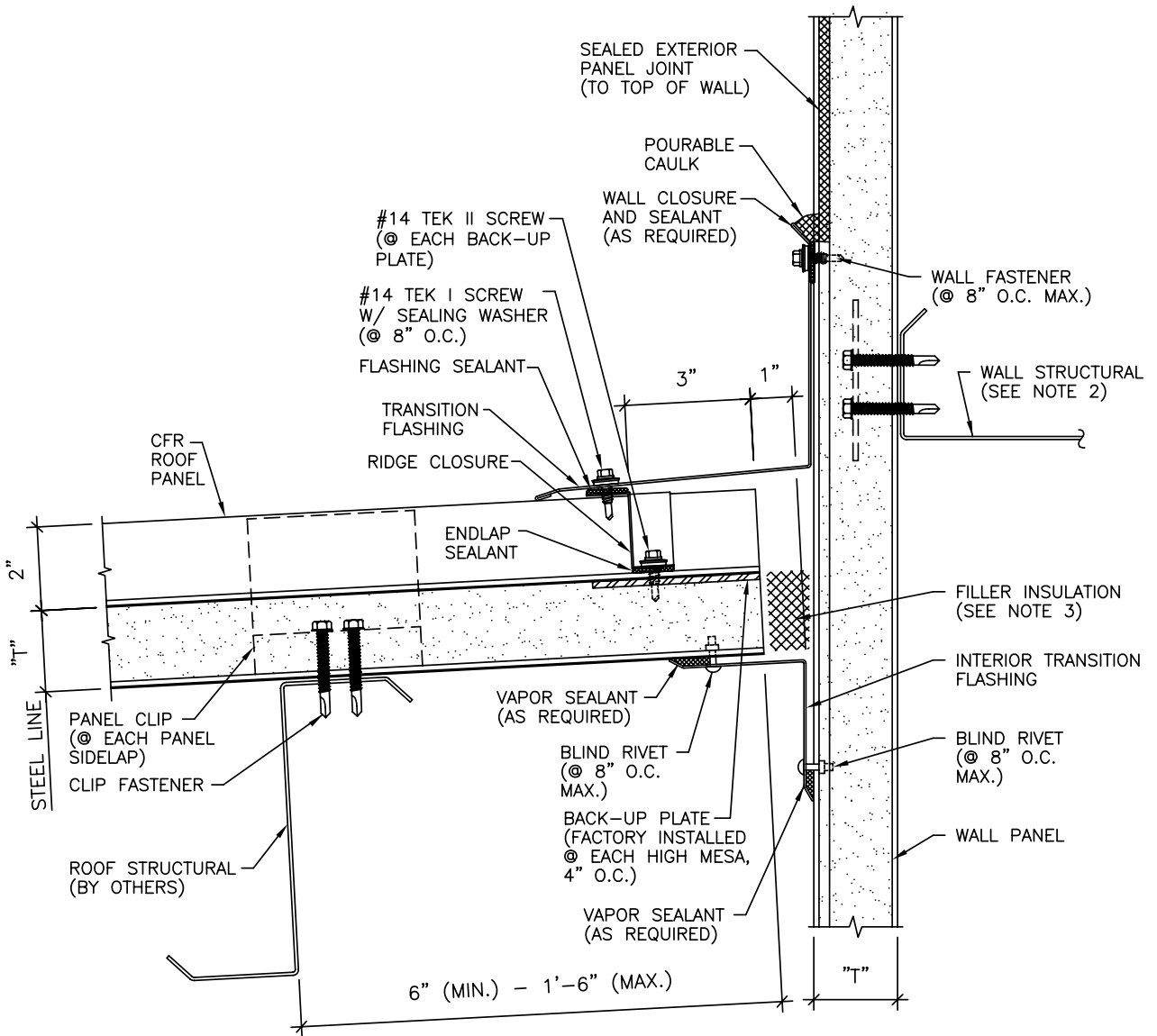


HIGH SIDE EAVE SECTION (⊙ CANOPY)

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.

CFR ROOF PANEL

C450.517.1

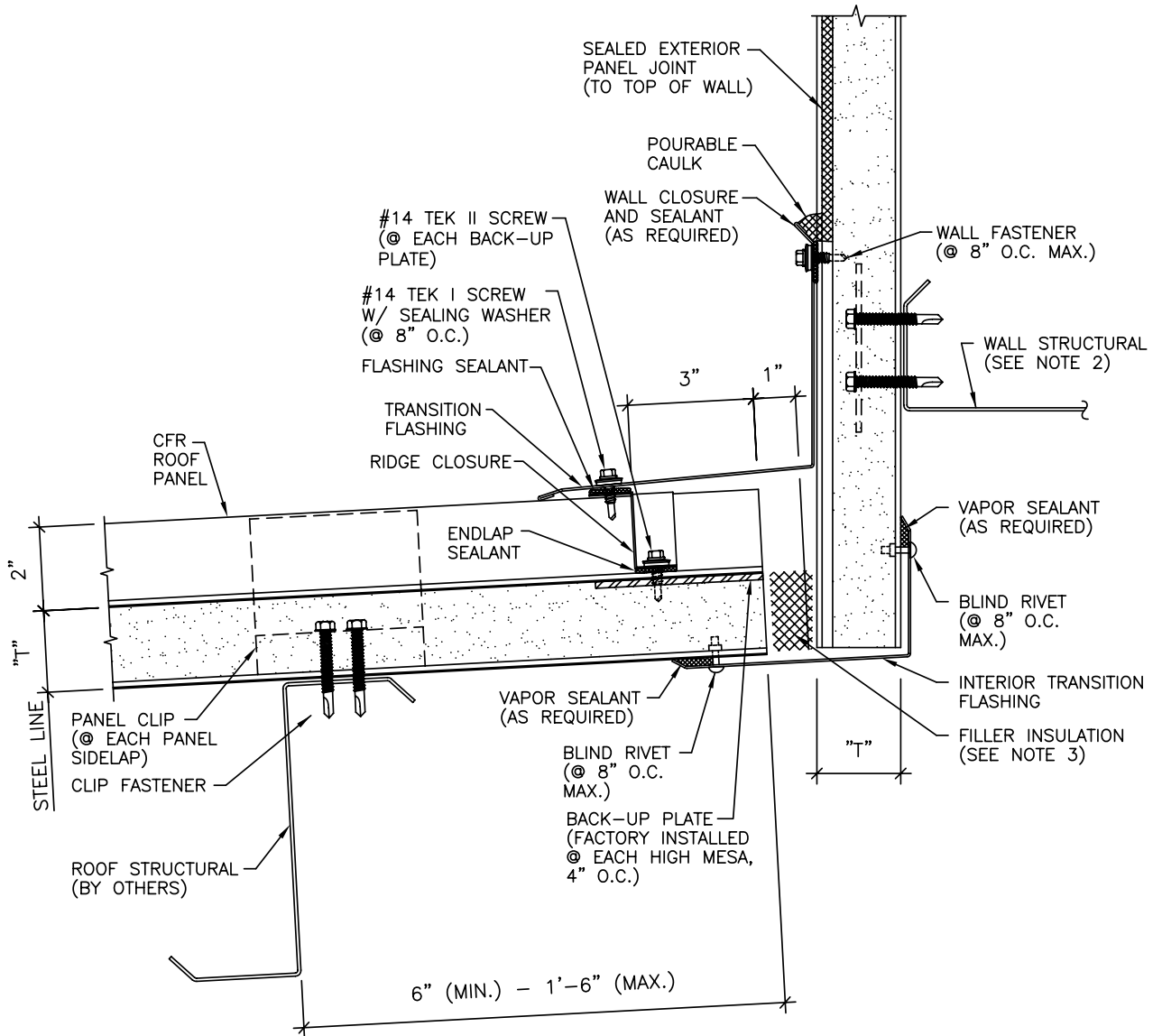


HIGH SIDE TRANSITION SECTION (WALL BELOW)

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. WALL STRUCTURAL BY OTHERS, LOCATED 0 TO 24" ABOVE OR 0 TO 12" BELOW ROOF LINE.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 4. TRANSITION FLASHING IS INSTALLED WITH A PITCH 1/2:12 GREATER THAN THE ROOF PITCH.

CFR ROOF PANEL

C450.518.1

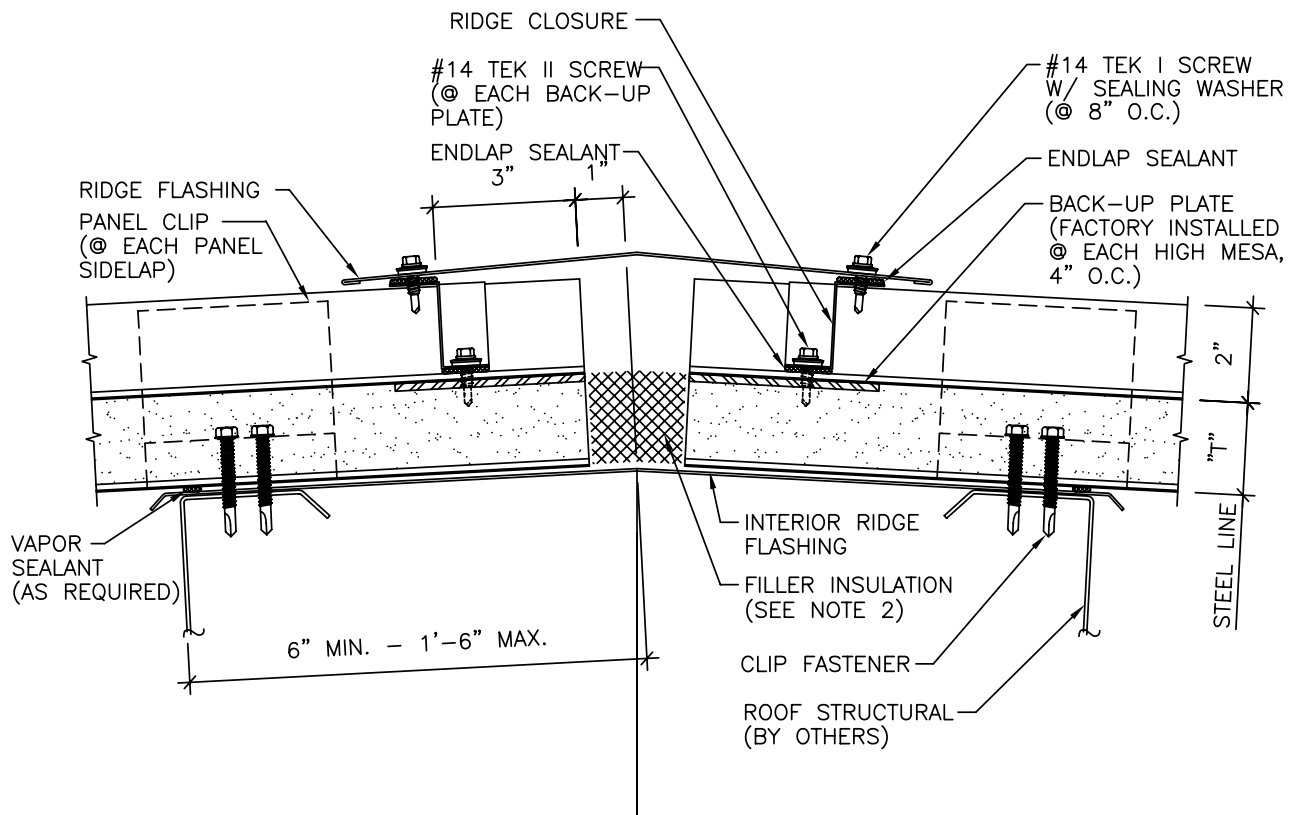


HIGH SIDE TRANSITION SECTION (WALL BELOW)

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 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 4. TRANSITION FLASHING IS INSTALLED WITH A PITCH 1/2:12 GREATER THAN THE ROOF PITCH.

CFR ROOF PANEL

C450.519.1

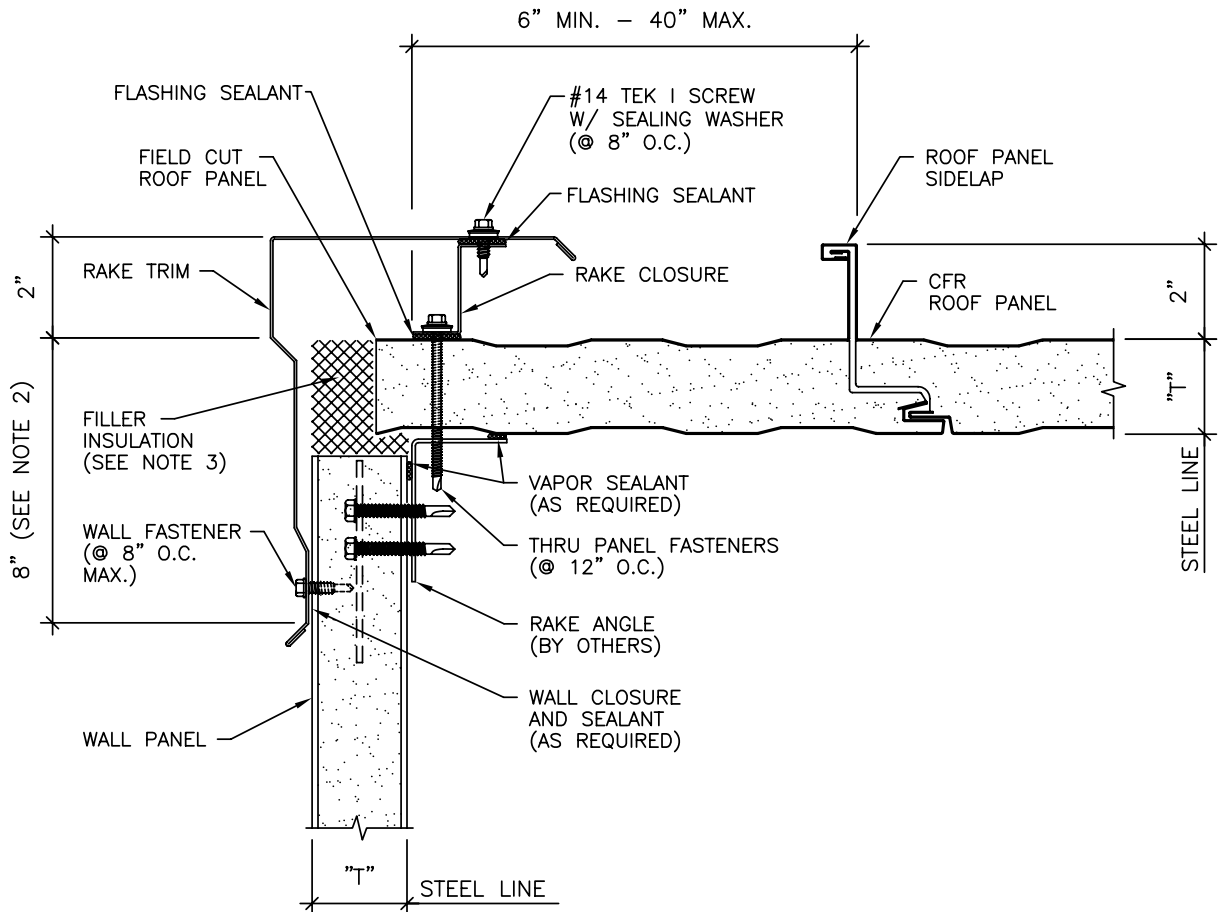


RIDGE SECTION

- NOTES:
1. "T" = ROOF PANEL THICKNESS.
 2. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 3. RIDGE FLASHING IS INSTALLED WITH A PITCH 1/2:12 GREATER THAN THE ROOF PITCH.

CFR ROOF PANEL

C450.520.1

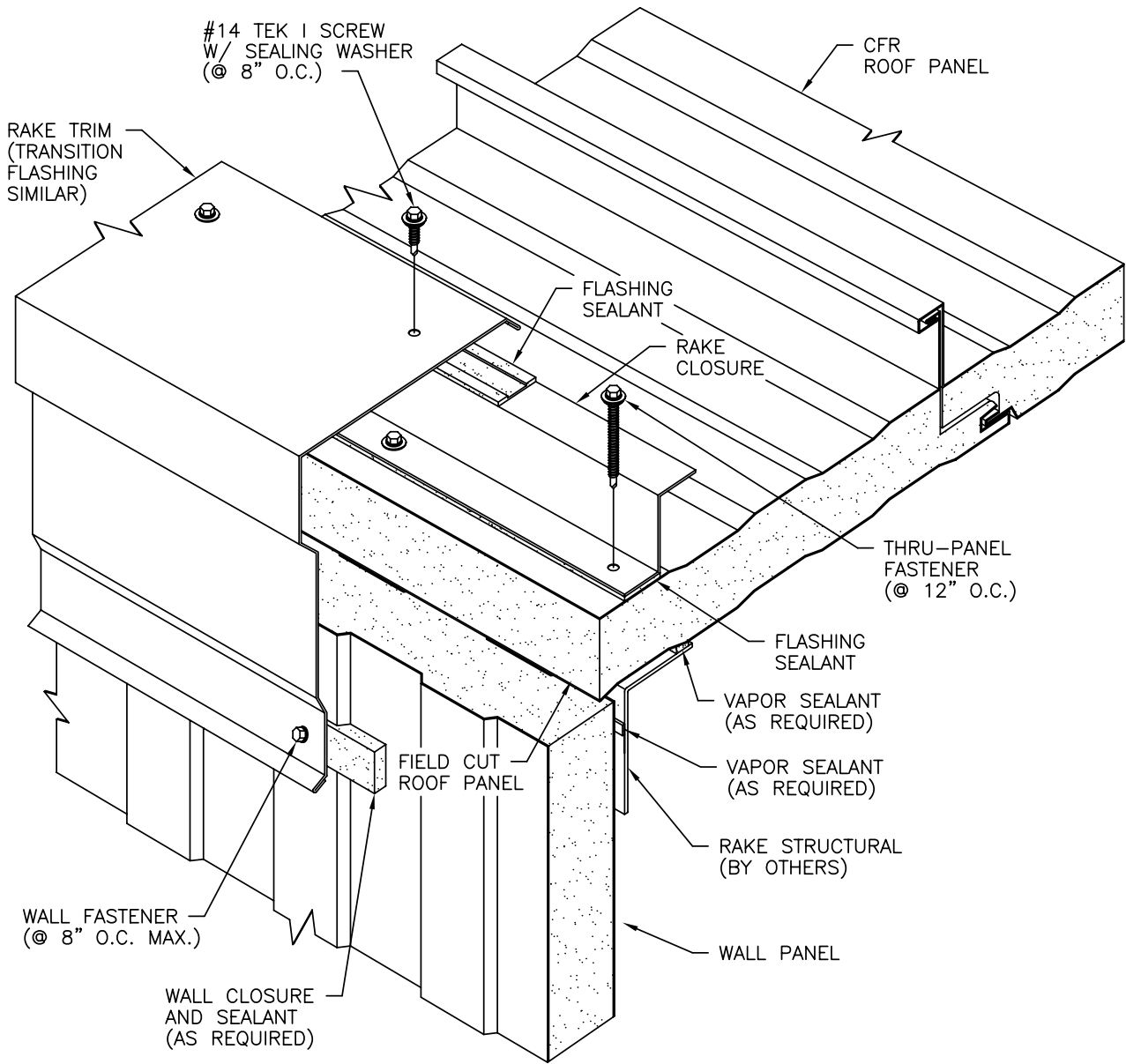


RAKE SECTION

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 4. WALL FASTENERS AND CLOSURES PROVIDED WITH WALL SYSTEM.

CFR ROOF PANEL

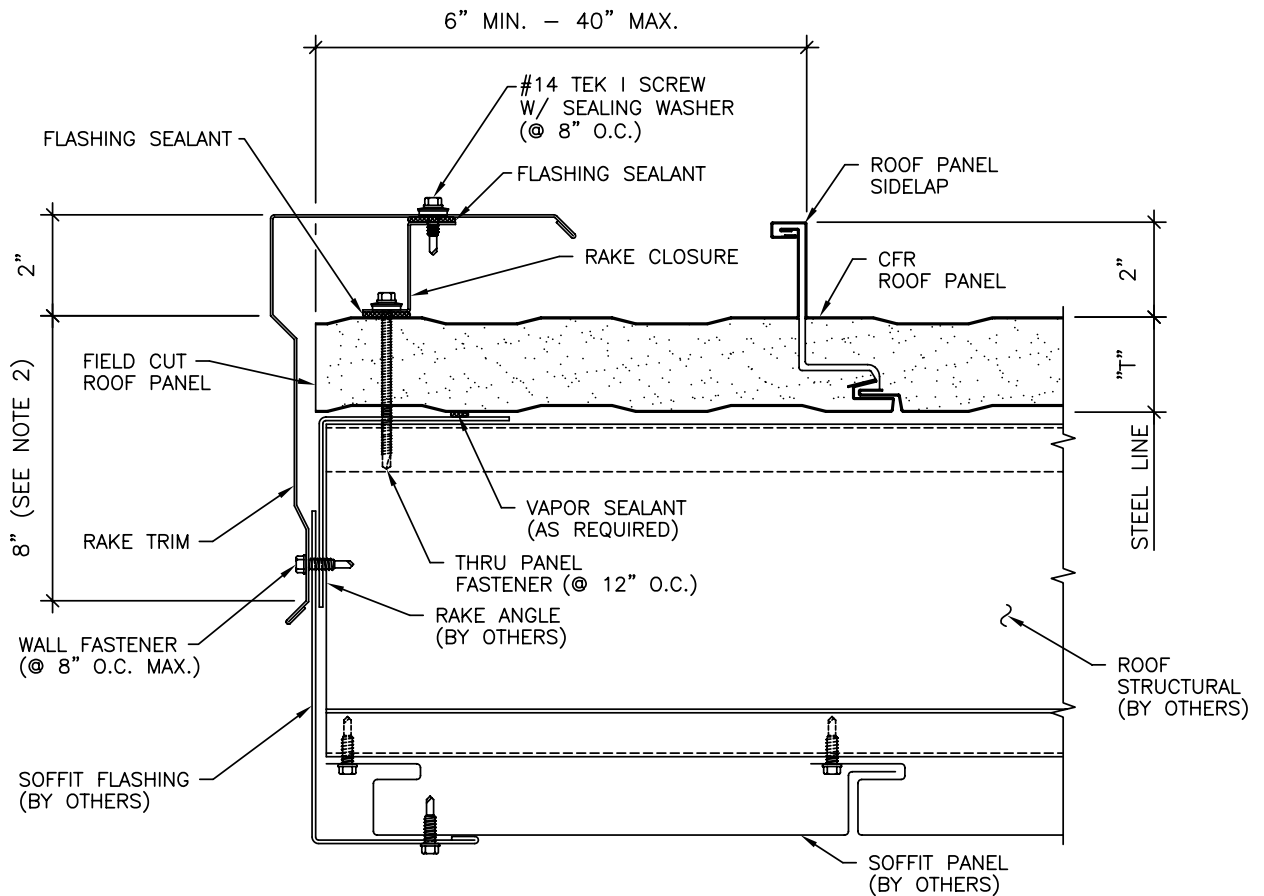
C450.521.1



RAKE DETAIL

CFR ROOF PANEL

C450.523.1

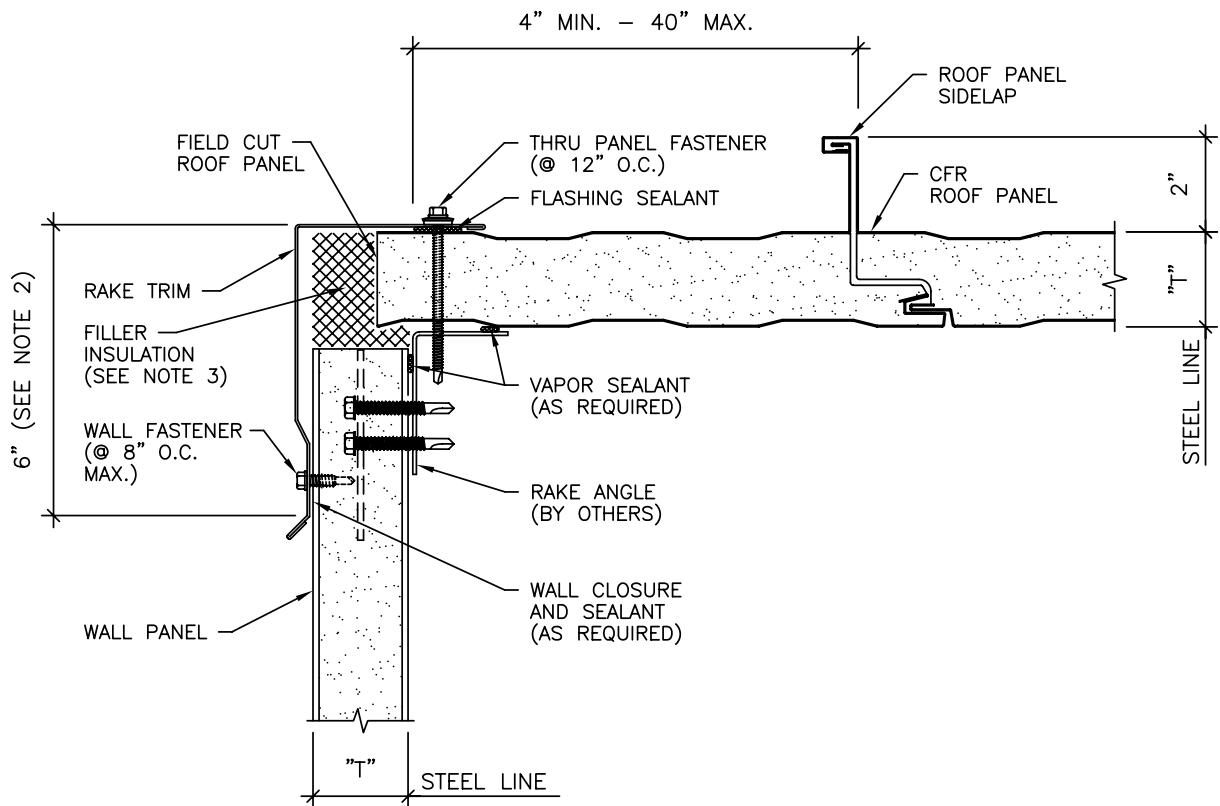


RAKE SECTION (AT CANOPY)

- NOTES: 1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.

CFR ROOF PANEL

C450.522.1

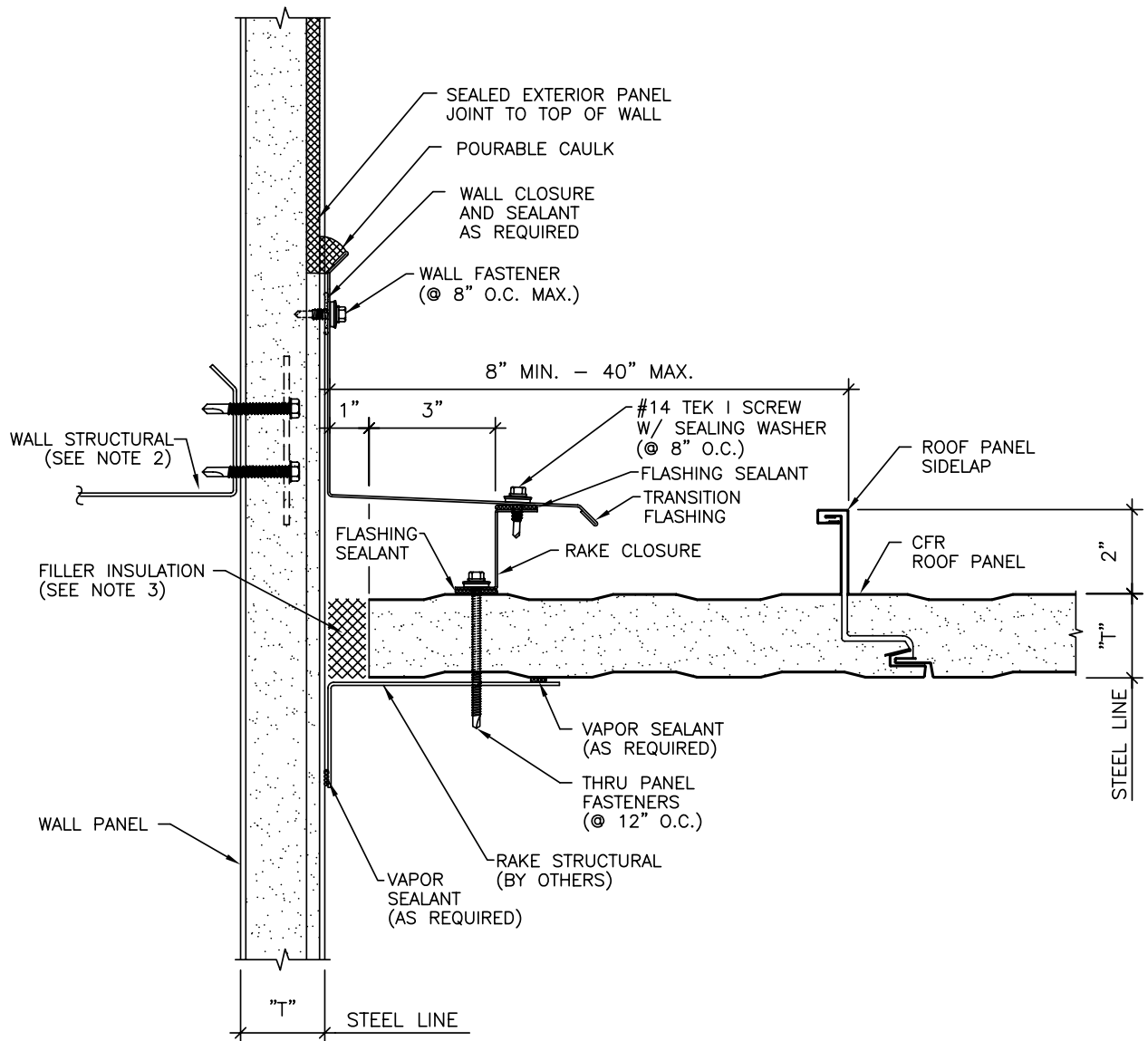


RAKE SECTION (LOW PROFILE RAKE TRIM)

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. DIMENSION SHOWN IS FOR 2" TO 3" THICK ROOF PANEL. ADJUST DIMENSION PROPORTIONALLY FOR OTHER ROOF PANEL THICKNESSES.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 4. WALL FASTENERS AND CLOSURES PROVIDED WITH WALL SYSTEM.
 5. LOW PROFILE RAKE TRIM CANNOT BE USED WITH HIGH PROFILE EAVE GUTTER.

CFR ROOF PANEL

C450.524.1

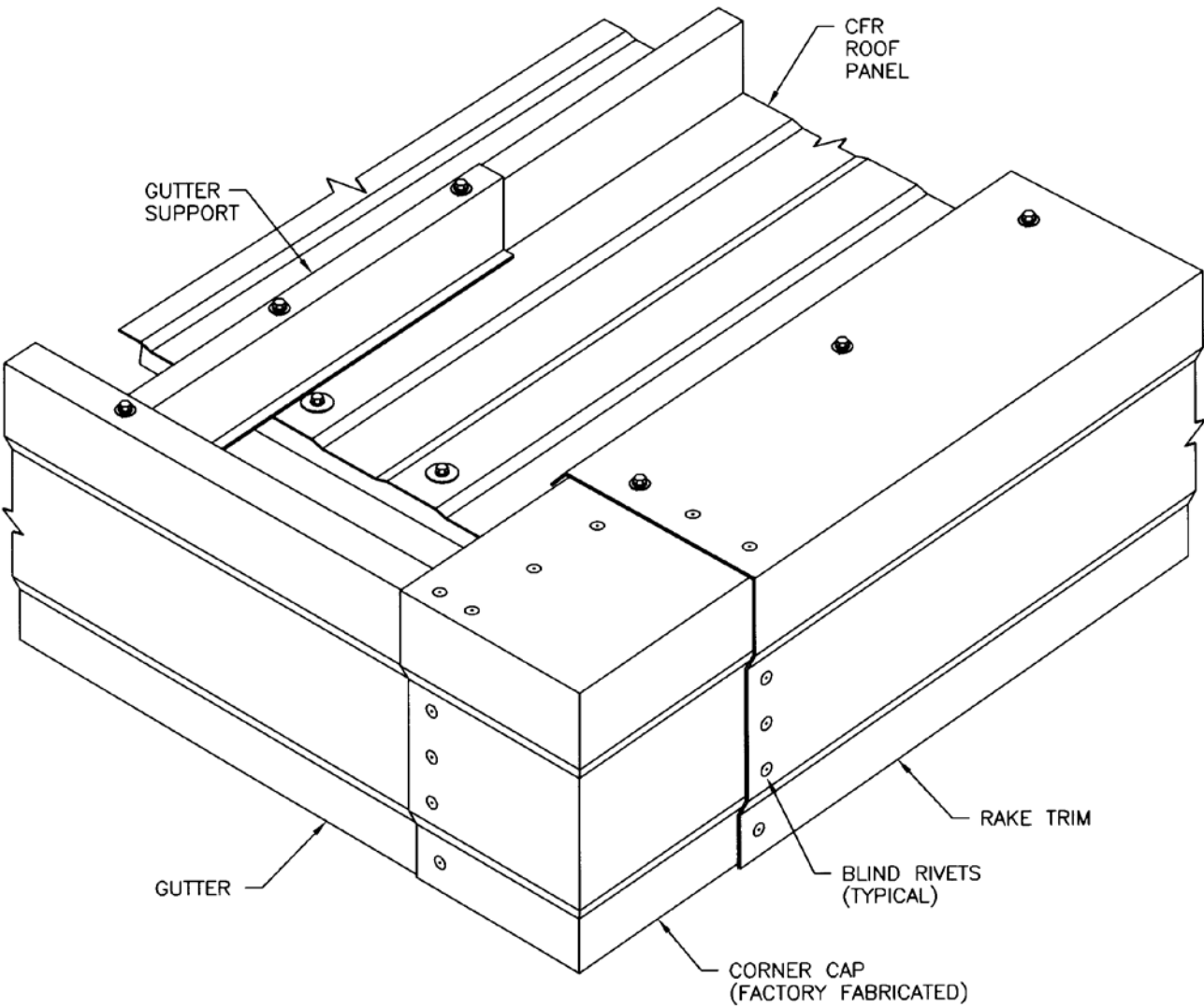


RAKE TRANSITION SECTION

- NOTES:
1. "T" = ROOF AND WALL PANEL THICKNESSES.
 2. WALL STRUCTURAL BY OTHERS, LOCATED 0 TO 24" ABOVE AND 0 TO 12" BELOW ROOF LINE.
 3. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 4. TRANSITION FLASHING IS INSTALLED WITH A PITCH 1/2:12 GREATER THAN THE ROOF PITCH.

CFR ROOF PANEL

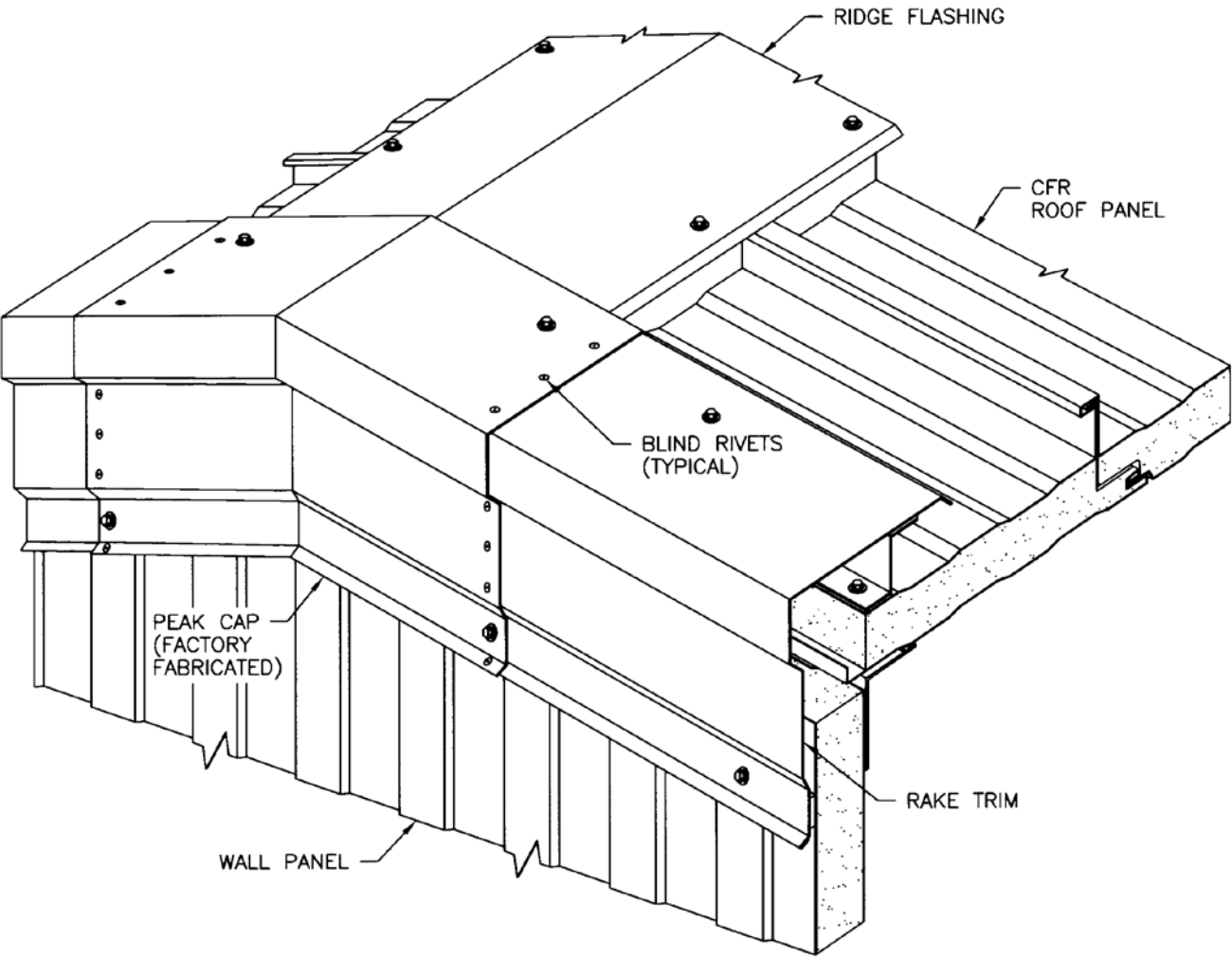
C450.525



CORNER CAP DETAIL

CFR ROOF PANEL

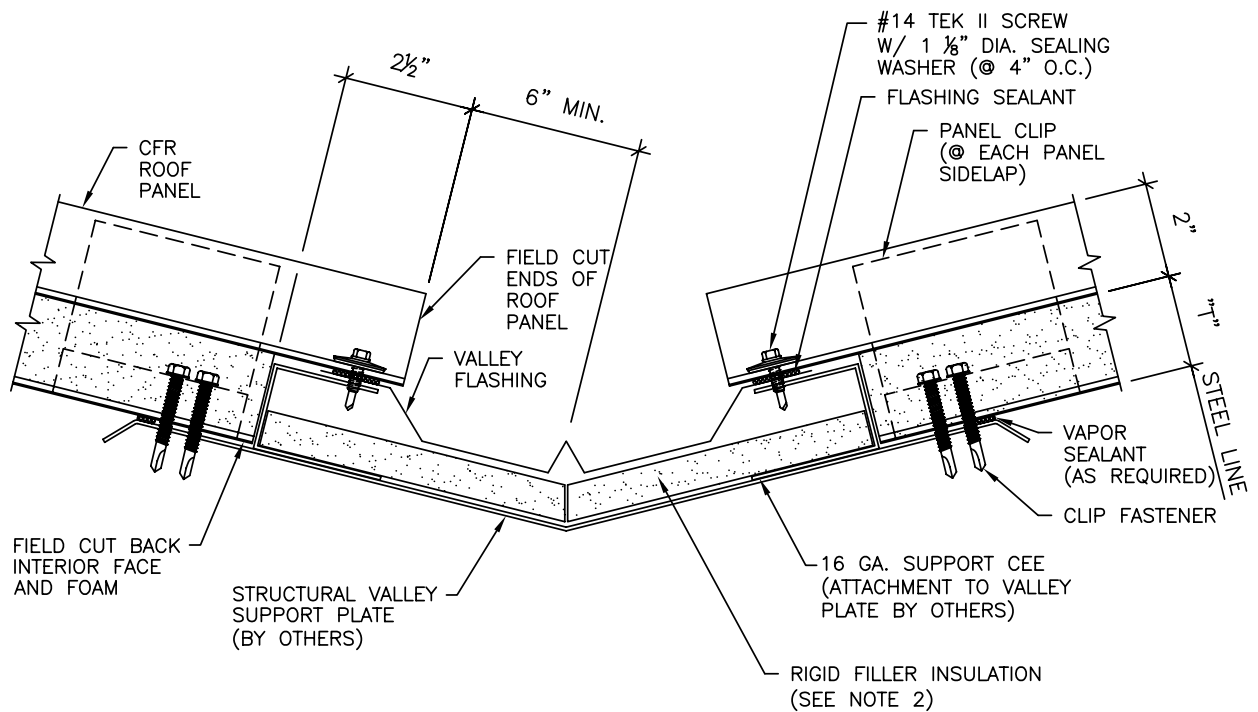
C450.526



PEAK CAP DETAIL

CFR ROOF PANEL

C450.528.1

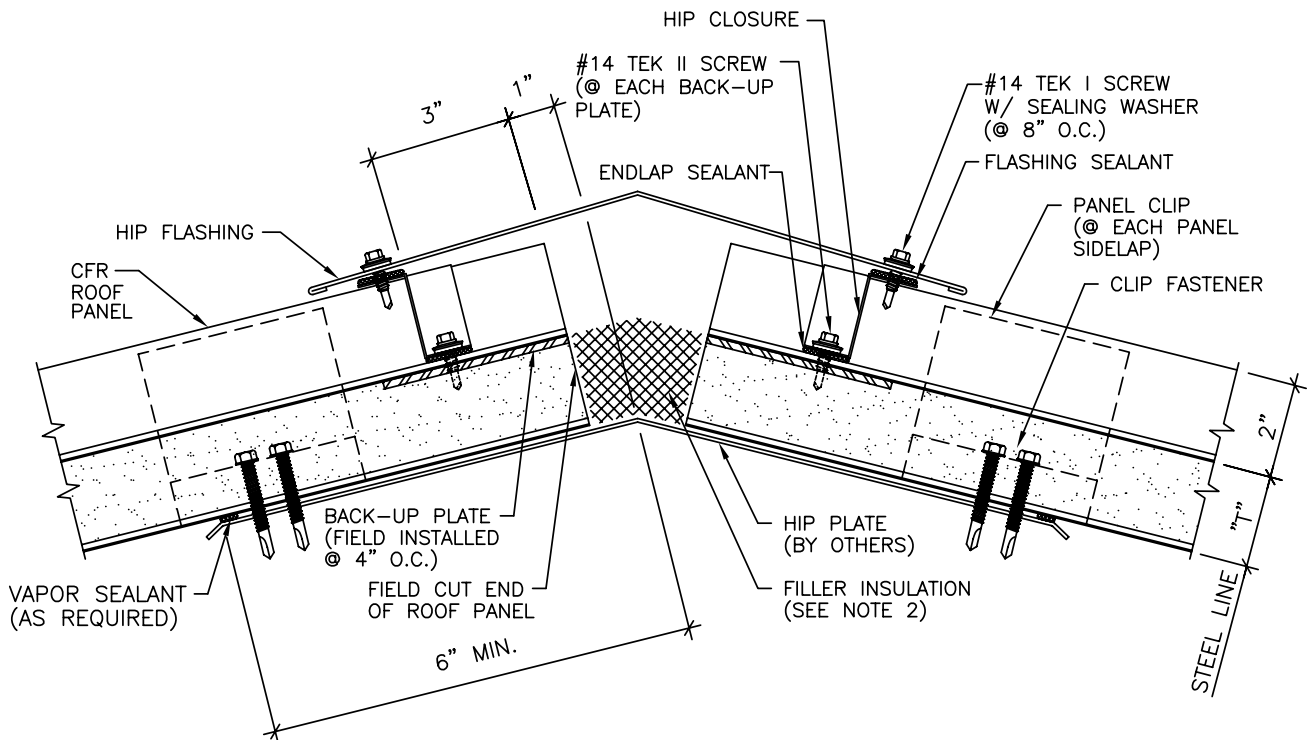


VALLEY SECTION

- NOTES:
1. "T" = ROOF PANEL THICKNESS.
 2. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 3. VALLEY CONDITIONS ARE NOT RECOMMENDED FOR APPLICATIONS WITH ROOF PITCH LESS THAN 3:12.
 4. THE VALLEY PAN WIDTH VARIES WITH THE ROOF'S DRAINAGE REQUIREMENTS.
 5. RECOMMENDED VALLEY PAN IS 16 GA. MIN. STEEL, WELDED WATER-TIGHT AND COATED OR LINED WITH MEMBRANE.

CFR ROOF PANEL

C450.529.1



HIP SECTION

- NOTES:
1. "T" = ROOF PANEL THICKNESS.
 2. FILLER INSULATION MATERIAL AND APPLICATION IS SPECIFIED BY THE ROOFING CONTRACTOR.
 3. HIP FLASHING IS INSTALLED WITH A PITCH $1\frac{1}{2}$:12 GREATER THAN THE ROOF PITCH.
 4. HIP CONDITIONS ARE NOT RECOMMENDED FOR APPLICATIONS WITH ROOF PITCH LESS THAN 3:12.

[illegible]

PIONEERING INSULATED METAL PANEL TECHNOLOGY



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