SECTION 07 41 13 – Metal Roof Panels

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes: Prefinished, prefabricated structural standing seam roof system with continuous interlocking field formed seams, clips, and fasteners.

B. Related Requirements:
   1. Section 05 10 00: Structural Metal Framing/Metal Deck
   2. Section 05 40 00: Cold-Formed Metal Framing.
   3. Section 05 50 00: Metal Fabrications.
   4. Section 06 10 00: Rough Carpentry
   5. Section 07 22 00: Roof Insulation
   6. Section 07 27 15: Air Barrier and Vapor Retarder
   7. Section 07 62 00: Sheet Metal Flashing and Trim
   8. Section 07 71 00: Sheet Metal Roof Accessories/Roof Specialties
   9. Section 07 92 00: Joint Sealants.

1.3 REFERENCES

A. Reference Standards:

   1. ASCE 7-22: Minimum Design Loads for Buildings and Other Structures.
   2. ASTM A653/A924: Steel Sheet, Zinc Coated (Galvanized) Class G90 by the Hot Dip Process (Prepainted G-90 is generally available in the Pacific Northwest as a standard).
   3. ASTM A792: Steel Sheet, Aluminum/Zinc (Galvanized), AZ-50 (painted), AZ-55 (unpainted) by the Hot Dip Process. (Prepainted AZ-50 is generally available in California and the Southwest as a standard).
   4. ASTM A755/A7565-18: Specification for Steel Sheet, Metallic Coted by the Hot-Dip Process for Exterior Exposed Building Products.
   5. ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
   6. ASTM E1680: Rate of Air Leakage Through Exterior Metal Roof Panel Systems
   7. ASTM E283: Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   8. ASTM E1592: Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
   9. ASTM E1646: Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
   10. ASTM E331: Water Penetration Through Exterior Windows, Skylights, Doors, and Curtain Walls.
   11. ASTM E2140: Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.

12. CRRC-1 Method #1: Measuring Solar Reflectance of a Flat, Opaque, and Heterogeneous Surface Using a Portable Solar Reflectometer.
13. SMACNA Architectural Sheet Metal Manual.
14. UL 580: Standard for Tests for Uplift Resistance of Roof Assemblies. UL-90 Wind Uplift Rating.
15. UL-790: Standard for Fire Resistance and Roof Covering Materials.
16. FM Global: Class 4471- Flame Spread, Hail Damage, Foot Traffic, and Wind Uplift Resistance.
17. ICC Evaluation Report- ESR-5046- TMP Metal Roofing Panels
18. UL Evaluation Report- UL ER25913-01
19. US Environmental Protection Agency: Energy Star Reflective Roof Products
20. US Green Building Council (USGBC): Leadership in Energy and Environmental Design (LEED).
21. Environmental Product Declaration/Health Product Declaration.
22. National Coil Coaters Association (NCCA)
23. NRCA- The NRCA Roofing and Waterproofing Manual
24. AAMA Paint Standards: 620, 2603, 2604, 2605 (Aluminum Substrate) and 621-96 (Steel Substrate)
25. NAAMM- National Association of Architectural Metal Manufacturers

1.4 SUBMITTALS FOR INFORMATION

A. Product Data.

B. Design and Test Reports: Provide the following certified test reports from an independent testing laboratory:

1. Independent laboratory testing report, stamped by a licensed engineer, for system design load and seam integrity.
2. Professional engineer's documentation that roofing system incorporated sufficient allowance for stress and movement.
3. A letter signed by an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in the tests and supporting data.
4. Manufacturer's verifications that the panels are factory roll formed (or formed by portable equipment approved through UL's Follow-Up Service when panel lengths exceed 62 feet).
5. ASTM E1592: Test results must clearly demonstrate compliance with the following requirements:
   a) The ultimate test failure load shall be reduced by the safety factor specified in article 1.9 to determine the allowable working load for the panel system.
   b) The proposed system has been tested to ensure that the allowable working load of the panel system meets or exceeds the specified negative wind uplift pressures listed in article 1.9 of this specification for all roof zones.
   c) The test results are applicable for the thickness, width, and profile specified. Results are not applicable for systems that are thinner or wider than the system which was tested. If the tested material was not the specialty material specified herein (for instance, the tested material was G-90 steel), then the test results shall be reduced by the ratio of the yield strength (Fy) or the specified material to the tested material.
   d) The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in article 3.3 C for all roof areas. Clip spacing shall not be

increased for any roof zone from that which is specified.

e) Capacities for gauge, span, or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside the test range is not acceptable.

C. Provide copies of the panel manufacturer's current evaluation reports. The report must include pertinent information regarding weather resistance, fire classification, structural capabilities, wind uplift resistance, impact resistance, live loads, underlayment, load tables, and attachment details:
   1. ICC Evaluation Report- ESR-5046- TMP Metal Roofing Panels
   2. UL Evaluation Report- UL ER25913-01

Failure to provide current ICC report for review will be cause for immediate rejection. Panel system must be listed in such report or will be rejected.

D. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

E. Fire resistance classification – Class A roof covering as determined by UL 790.

F. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-22, for Components and Cladding. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article.

G. Shop Drawings:
   1. Indicate thickness and dimensions of parts, fastenings and anchoring methods, details and locations of joints, transitions and other provisions necessary for thermal expansion and contraction.
   2. Indicate locations of field and factory-applied sealant.

H. Samples:
   1. Submit two samples, 12 inches long by full panel width, showing proposed metal thickness and seam profile.
   2. Submit standard color samples of metal for Architect's selection.

I. Manufacturer Qualifications: Add manufacturer's signed letter supporting both financial capability and at least 5 projects of comparable size with architect and contractor contact information.

J. Installer Qualifications: Submit list of five completed projects, with names and contact information for architects and contractors. Submit signed letter from Manufacturer demonstrating completion of manufacturer's certified installation class.

K. Test Reports: Indicate compliance of products with project requirements.

L. LEED Submittals:
   1. LEED Credit SS 7.2 – Heat Island Effect – Roof: Product data indicating Solar Reflectance Index (SRI) of roof panels.
   2. LEED Credit MR 4 – Recycled Content: Product data indicating percentage by weight of post-consumer and post-industrial recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

M. Warranty Documentation: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer, installing contractor, and the Owner.

N. Any material submitted as equal to the specified material must be accompanied by a report reviewed by a professional engineer licensed in the state in which the installation takes place.This report shall show that the submitted equal product(s) meets the Design and Performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance. The owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

O. Insurance Documentation: Provide current Certificate of Insurance showing a min. of $2,000,000 liability coverage per occurrence.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Ten years' experience, minimum, in the factory fabrication of metal panels. (Ten years' experience, minimum, in the field fabrication of metal panels)
   2. Manufacturer shall carry $2,000,000 liability insurance, minimum, for metal panel system.

B. Installer Qualifications:
   1. Three years' experience, minimum, in the successful application of metal roof or wall panels.
   2. Five satisfactory projects with metal panel work of similar product(s), scope and complexity to Work of this Project.
   3. Installer must be approved by manufacturer, in writing, prior to bid. Approval document must be included with project bid.

C. Testing Agency Qualifications: Agency compliant with ISO/IEC Standard 17025, or an accredited independent agency recognized by the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement or ANSI.

D. Source Limitations: Obtain all components of roof system (including underlayment) from a single manufacturer, including roll goods materials if required. Secondary products that are required shall be recommended and approved in writing by the roofing system manufacturer.

E. Engage the manufacturer's field representative to conduct required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections (2__, 3__, weekly) inspections required and a final inspection before the close of the project.

F. Alternate Manufacturers: The following manufacturer criteria must be submitted. Alternate systems will not be considered for approval unless each of these items has been submitted for review at least 15 (20) business days prior to bid opening:
   1. Submit each item listed in article 1.4 (A through E) for evaluation of the proposed system
   2. Tests shall have been made for identical systems within the ranges of specified performance criteria.

3. Empirical calculations for roof performance shall only be acceptable for positive loads with web crippling evaluation.
4. A list of a minimum of five (5) jobs where the proposed alternate material was used under similar conditions. The reference list shall include date of project, size of project, project address, and telephone number of architect/owner contact.
5. A written statement from a corporate officer of the manufacturing company stating that he or she has reviewed the specifications and confirms that the proposed system meets or exceeds all performance requirements listed as well as meets the panel size, gauge, weight, clip design, sealant design, uplift pressures and height of the vertical seam.
6. Proof that the manufacturer has been in business for a minimum number of years equal to the warranty period required for this project.

G. Mock-Ups:
1. Visual Mock-Up: Construct mock-up (refer to dimensions or drawings) as required to show at least two pattern repeats, and in same orientation, and tie-ins to other roofing or siding products.

1.6 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities.

C. Objectives of conference to include:
1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
2. Tour representative areas of roofing substrates (decks); inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
4. Review roofing system requirements (drawings, specifications and other contract documents).
5. Review required submittals both completed and yet to be completed.
6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
7. Review required inspection, testing, certifying and material usage accounting procedures.
8. Review weather and forecasted weather conditions and procedures for coping with un favorable conditions, including possibility of temporary roofing (if not mandatory requirement).
9. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish a copy of records to each party attending. If substantial

disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
10. Review notification procedures for inclement weather or non-working days.

D. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

E. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Engineer of Record.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
1. Keep panels and accessory items dry.
2. Protect against damage and discoloration.
3. Handle panels with non-marring slings.
4. Support panels to prevent permanent deformation.
5. Store panels above ground, with one end elevated for drainage.
6. Protect panels against standing water and condensation between adjacent surfaces.
7. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and keep sheets separate for air-drying.
8. Painted panels may (depending on material or coating) be shipped with protective plastic sheeting or a strippable film coating between panels. Remove strippable film coating prior to installation. Do not allow strippable film coating to remain on panels in extreme heat, cold, or direct sunlight or other UV source.
9. Do not allow panels to contact treated lumber.
10. Adequately cover/protect metal panels and flashing with tarpaulins, scrim sheeting, or similar protection during transit to prevent dirt and debris from coming in contact with the exposed finished surfaces of finished goods.
11. Protect packaged panels, flashing, and accessories from UV sources, dirt or sand, and precipitation until they are used.

B. Installer's responsibilities:
1. Stack pre-finished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.
2. Unload panels with equipment that will adequately support the panels to prevent damage. Verify equipment is sufficient to lift the weight of panels while still in crating. Certified riggers may be required.
3. Protect moisture-sensitive and water-based materials from the weather.
4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.8 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage and protection requirements for roofing system.
1. Protection:

a) Protect completed roofing from subsequent construction operations. Comply with Manufacturer's recommendations.
b) Do not overload roof with stored materials.
c) Roof-mounted equipment shall not be fastened directly to, or mounted on, the standing seam metal roofing system.

B. Ascertain that work of other trades penetrating the roof/siding substrate is made watertight and approved prior to installation of new metal roofing/siding panel system.

1.9 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Expansion and Contraction.
1. The completed metal roofing system and flashing shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
2. The design temperature differential shall be not less than [120] °F and based on historical high and low temperatures in the area of the installation.
3. Interface between panel and clip shall provide for adequate thermal movement in each direction along the longitudinal direction. Floating (2 pc. Including a base and top) clips are required when panel lengths are over 30 ft. long and mechanically seamed). Snap Lock clips allow thermal movement, but must elevate the panel above the fastener heads to avoid frictional failure.
4. Location of metal roofing rigid connector ("PIN" point) shall be at roof ridge unless otherwise approved by the Project Architect and TMP. (Contact TMP representative for other options and drag loading calculations).

B. Uniform Wind Uplift Load Capacity

1. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing given in engineered calculations per wind zones. (Remove the following project specific criteria if the information is included in the project's structural drawings)
a) Design Code:_____
b) Panel Safety Factor:_____
c) Importance Class____Building with an Importance Factor of _____.
d) Wind Speed:_____mph.
e) Ultimate Pullout Value:_____ pounds per each of the two fasteners holding the panel anchor to the roof decking or framing system.
f) Exposure Category:_____
g) Design Roof Height:_____feet
h) Minimum Building Width:_____feet.
i) Roof Pitch:_____inches per foot.
j) Roof Area Design Uplift Pressure: Zone 1 - Field_____psf.
Zone 2 – Eaves_____psf
Zone 3 – Corners_____ psf.
2. Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above. In order to comply with the building code, panel system must be tested to withstand these listed pressures at clip spacing no farther apart than those listed in clip attachment schedule.

1.10 WARRANTY

A. Manufacturer's Finish Warranty: Manufacturer's standard (20, 30, 35, 40, or inquire for other options)-year performance
warranty, stating the following:
   1. Architectural fluorocarbon finish: Polyvinylidene Fluoride (PVDF- Kynar 500® or Duranar®).
      a) Will be free of fading or color change in excess of 5 Hunter delta-E units as determined by ASTM D2244-02.
      b) Will not chalk in excess of numerical rating of 8 when measured in accordance with standard procedures specified in ASTM D4214-98 method D659.
      c) Will not peel, crack, chip, or delaminate.

B. Installer's Warranty: Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, covering repairs required to maintain roof panels watertight and weatherproof with normal usage for two years following Project Substantial Completion date.
   1. Furnish written warranty, signed by installer.

C. Weathertight Performance Warranty: Manufacturer's standard warranty in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight within specified warranty period. Contact TMP representative for Weathertightness Warranty options.

PART 2 – PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Products: Provide the following:
Taylor Metal Products'; (MS-200™ or MS-200™ Curved)
ICC Evaluation Report- ESR-5046- TMP Metal Roofing Panels
Or--UL Evaluation Report- UL ER25913-01

B. Substitution Limitations: (Substitutions will not be considered), (Substitutions will be considered in accordance with Section 01 25 00 "Substitution Procedures".)

C. Performance Criteria
   1. Wind Uplift: Class 90 per UL 580 (As required by ASCE 7), (Insert- governing code), (Insert required load).
      a) Panel system shall be ASTM E1592 tested under the supervision of an ANSI or ISO/IEC accredited laboratory and the laboratory shall issue the test report.
      b) Deflection Limits: Withstand wind loads with deflections no greater than (1/180 or_____) of the span.
   2. FM Rating: (Class 1-75- 60" oc open purlin attachment), Class 1-120- 24" oc open purlin or 22 ga. solid deck attachment).
   3. Air Infiltration: Tested in accordance with (ASTM E1680- Roof Applications) and/or (ASTM E283- Siding Applications).
      a) 0.01 cfm per square foot of joint at static test pressure differential of 25.00 psf.

4. Water Infiltration Under Static Pressure: Tested with side lap sealant (ASTM E1646- Roof Applications) and/or (ASTM E331- Siding Applications).
   a) No leakage through panel joints at 40.00 psf.

Taylor Metal Products has tested MS-200™ panels for water penetration using ASTM E2140. This standard is a stringent evaluation for metal roof panels. Most manufacturers only test for water infiltration using ASTM E1646.

5. Water Penetration: No leakage in the panel system after 6 hours when tested according to ASTM E2140 at a static water pressure head of 6.00 inches.
6. Thermal Movements: Accommodate thermal movement without buckling, joint opening, overstressing components, failure of connections, or other detrimental effects, through the following temperature changes:
   a) 120 degrees F, ambient.
   b) 180 degrees F, material surface.

D. Sustainability Characteristics:

Taylor Metal Products panels, in their standard sheet steel, contain approximately 25.5 percent post-consumer recycled content and 6.8 percent pre-consumer recycled content, for a total 28.9 percent recycled content as calculated for this LEED 5.0 credit. Higher percentages are available if specified.

1. Recycled Content: (28.9), (50), or (75) percent post-consumer recycled content (calculated according to LEED Credit MR 5).
2. Energy Performance:
   a) Provide Energy Star® qualified product for slope indicated in Drawings.
   b) Solar reflective index (SRI): Not less than (29)<*Insert requirement*> per ASTM E1980.
   c) Reflectance and Emissivity:
      i. Solar Reflectance: Not less than (0.25)<*Insert requirement*> per ASTM test methods C1549 or E1918, or CRRC-1 Method #1.
      ii. Thermal Emissivity: Not less than (0.75)<*Insert requirement*> per ASTM C1371.
3. Shipping Distance: Provide panels manufactured at the following factory: (if locally manufactured materials are a project requirement, select factory closer to Project site)
   a) Salem, Oregon 97301
   b) Auburn, Washington 98001
   c) Sacramento, California 95834
   d) Riverside, California 92509
   e) Spokane, Washington 99202
4. Environmental Product Declaration: (EPD- Riverside, CA.-#7fdc28ba-4ª91-4221-a906-0d4f6d7007a8 and Salem, OR.- #F73eab7a-e72c-4c53-9602-3e6c14444ef8) and Health Product Declaration. Manufacturer documentation verification required.

If project is subject to Federal Buy American or BABA provisions, retain paragraph below. Taylor Metal Products comply with this requirement.

E. Manufacturing Characteristics: Provide panels complying with provisions of Buy American Act 41 U.S. C 10a - 10d or Build America Buy America (BABA).

2.2 PANELS

A. Products: MS-200™ (or MS-200™ Curved- Suitable for slopes of 1/2" in 12" or greater. Very restricted conditions may allow a lesser slope. Consult a TMP representative for slope design restrictions).
   1. Manufacturer
      a) Taylor Metal Products: 4566 Ridge Drive NE, Salem OR: 800-574-1388: www.Taylormetal.com

B. Panels: Basis of Design- 2" MS-200™ (or Curved MS-200™) Mechanical Seam Metal Roof Panel:
   1. Material: Steel
      a) 24 Gauge (or 22 ga. Select gauge according to TMP's performance tables, required span, and applicable loads. 24 and 22 ga. are standard): minimum thickness of .0236" (.0285"). Grade 50 minimum yield and 65 tensile strengths (lesser grades are not allowed).
   2. Thickness and yield strength as required for performance indicated: ASTM A653: Steel Sheet, Zinc Coated (Galvanized) Class G90 (or aluminum-zinc alloy coating conforming to ASTM A792, Class AZ50) by the Hot Dip Process. For projects with multiple profiles of varied combinations of profiles, rib patterns and finishes, show on drawings.
   3. Panel Width and Pattern: 18" (As scheduled. 12", 14", 16" options. Consult with TMP representative regarding appropriate width for project requirements). With (Choose smooth, accent ribs, or striated—striated panels are the most resistant to distortion or "oil canning") pattern.
   4. Panel Seam Height: 2".
   5. Panel Finish: Choose one or more of the following exterior finishes.
      a) Polyvinylidene Fluoride (PVDF), full 70 percent (Kynar 500® or Duranar®) consisting of a baked-on nominal 0.25 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 5 to 30 when tested in accordance with ASTM D523 at 60 degrees and 85 degrees (matte - low gloss).
      b) Marine Guard™ (Marine or Corrosive environments) consisting of a high-build, corrosion resistant primer, finish coat, and clear top coat (minimums apply).
      c) Color: Choose from full range of manufacturer's standard colors, metallics, and custom colors (Custom colors are available on orders of 3,000 lineal feet or more. Consult TMP representative for other requirements).
      d) ZINCALUME® Plus/Galvalume® Plus protective coating for unpainted aluminum-zinc alloy coating.
      e) Panel Color: (As scheduled), (As selected from manufacturer's full range), <*insert color*>.
   6. ICC Evaluation Report- ESR-5046- TMP Metal Roofing Panels
   7. UL Evaluation Report- UL ER25913-01

Factory Injected Seam Sealant is not available in the MS-200 Curved panel (field apply sealant)

   8. Seam Sealant: Factory (field) applied, high-grade non-skinning sealant within the confines of panel and concealed clip's female leg, designed to seal against adjacent male panel leg.

2.3 FRAMING AND SUBSTRATES

A. Secondary Framing: See Section 05 40 00 "Cold-Formed Metal Framing".

B. Sheathing: See Section 06 16 00 "Sheathing".
   1. Roofing Underlayment: (As per Metal Roof Manufacturer's recommendation)**. TMP SAM-HT**™--or--**BLUE ARMOR-HT**™ self-adhered ice and water shield vapor barrier is required for projects requiring a manufacturer's weathertightness warranty.
   2. Synthetic Roofing Felt: (<*insert requirements*>).
   3. Self-Adhering Membrane (SAM) Underlayment: (<*insert requirements*>).
      ASTM E108- Class A Fire Resistant Options (metal roofing):
      a) Sheet Thickness: 80 mils, minimum.
      b) Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
      c) Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
      d) Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method (Method A).
      e) Functional Temperature Range: Minus 45 degrees F to 250 degrees
      f) Products:
         i. Owens Corning Corporation; Titanium® FR: www.owenscorning.com/en-us/#sle. CCRR-1024- (E108-RFU-19682- 05, 06, 10, and 11)
         ii. Polyglass; Polystick® XFR: www.polyglass.us (UL- TGFU.R1457)
         iii. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 CLIPS AND FASTENERS

A. Clips: Provide clip designed to allow panels to thermally expand and contract. Clip shall incorporate a self-centering feature to allow (.5, 1, ___) inch of movement in both directions along panel length. Clip type shall be selected to meet positive and negative pressures as specified.
   1. Sealant: Factory-installed sealant to provide continuity of seal at clip locations.

B. Bearing Plate: (Consult TMP representative regarding thickness and size- 22, 20, 18 ga. 4" x 6" G-90 galvanized minimum)

C. Fasteners: As recommended by manufacturer for performance indicated (size, length, clip fasteners, trim fasteners). Weather coated per project environment, conditions and substrate.

2.5 INSULATION

A. Rigid Insulation: (See section 07 22 00 "Roof and Deck Insulation")<*Insert requirements*>
   1. Thermal Spacer Blocks: As recommended by roofing manufacturer.

B. Fiberglass Insulation: (See section 07 21 00 "Thermal Insulation")<*Insert requirements*>

C. Acoustic Insulation: (See section 09 81 00 "Acoustic Insulation")<*Insert requirements*>

2.6 ACCESSORIES

A. Trims and Flashings: Material, metal thickness, and finish to match panels. Profiles indicated in drawings.

1. Provide manufacturer's standard accessories and other items essential to completeness of standing seam roof installation.

B. Panel Penetration Flashings: As recommended by panel manufacturer; designed to provide sufficient movement to prevent creation of points of fixity at penetrations.

C. Sealant for Field Application: (high grade curing or non-curing butyl, Polyether, Silicone, and curing urethane sealant as recommended by panel manufacturer. Do not use sealant containing asphalt). (See section "07 92 00" Joint Sealants.)

2.7 FABRICATION

A. Fabrication, General:
D. Unless otherwise shown on the drawings or specified herein, fabricate panels in continuous lengths and fabricate flashings and accessories in longest practical lengths.
E. Panel materials shall be factory correctively leveled.

B. Panels:
1. Provide panels in full length from ridge to eave up to 150 ft. Transverse seams are not allowed. (consult with TMP rep. for longer lengths or options to break up the plane of the roof).
2. Roof panels shall have flush horizontal and vertical surfaces to facilitate sealing at terminations. Panel configurations which create voids and requiring supplemental closure devices shall not be considered acceptable (foam closures).
3. Engineer panels to use concealed anchors that permit expansion and contraction away from the point of fixity ("PIN" point).

C. Seams:
1. Panel seams shall interlock entire length of seam.
2. Design standing seam to lock up and resist joint disengagement during design wind uplift conditions as calculated according to local building codes.
3. Provide pre-installed sealant within confines of panel's female leg to aid in resistance of leaks and provide panel-to-panel seal while allowing expansion and contraction movement.
4. Seams shall be continuously locked or crimped together by mechanical means during installation. Seaming tools shall be sourced from manufacturer's recommended vendor.
5. Mechanically Seamed Joint Option: 90 deg._____180 deg._____(*insert requirement based on roof slope, structural, and wind uplift requirements)*

D. Fabrication Tolerances:
1. Flat metal surfaces will display waviness commonly referred to as "oil canning". This is caused by steel mill tolerances and is a characteristic, not a defect, of panels manufactured from light gauge metal. Panel materials are factory correctively leveled to minimize the occurrence of "oil canning". As such, "oil canning" will not be accepted as cause for rejection.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: With Installer present.
   1. Examine conditions and substrates on which metal panels are to be installed. Structural support or substrate shall be flat and plumb to avoid panel stresses and distortion.
   2. Prior to starting work, correct defects.

B. Field Measurements:
   1. Coordinate field measurements and fabrication schedule with construction progress.
   2. Field measure prior to fabrication. Show recorded dimensions on shop drawings, including locations of shop-fabricated openings.
   3. If field measurements differ from drawing dimensions, notify Architect prior to fabrication.

C. (Framing) (Substrate) Tolerances: Deviations from flat plane shall not exceed the following.
   1. 1/4 inch in 20 feet.
   2. 1/2 inch across building elevation.
   3. 1/8 inch in 5 feet.

3.2 PREPARATION

A. (Secondary Framing) (Substrate and Underlayment): Install according to approved shop drawings and metal panel manufacturer's recommendations.

3.3 INSTALLATION

A. Panels and Trim: Comply with manufacturer's instructions for assembly, installation and erection for weathertight installation.
   1. Install according to approved shop drawings.
   2. Install panels in accordance with manufacturer’s instructions and recommendations. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer’s recommendations for design wind load criteria.
   3. Form seams with manufacturer-approved motorized seaming tool; completely engage panel, clip, and factory-applied sealant in seam.
   4. Comply with methods and recommendations of SMACNA Architectural Sheet Metal Manual for flashing configurations required.
   5. Discrepancies between job site conditions and shop drawings shall be brought to the attention of the Architect for resolution.
   6. Cutting and Fitting:
      a) Cut panels neat, square, and true with shearing action cutters. Torch or power saw cutting is prohibited.
      b) Openings 6 inches and larger: Shop fabricate and reinforce to maintain original load capacity.
      c) Openings less than 6 inches: Field cutting is acceptable.
   7. Dissimilar Metals or Materials:
      a) Where panel or trim may come in contact with dissimilar metals or treated lumber, fabricate transition to facilitate drainage and minimize possibility of galvanic action. Galvanic action can cause panels and trim to fail prematurely.
      b) At points of contact with dissimilar metal or treated lumber, coat panel and trim with protective paint or separate materials with a weatherproof underlayment.
      c) Direct contact or run-off from CCA, ACQ, CA, or other treated lumber (outdoor wood) or fire retardant impregnated or treated wood shakes or siding can cause panels and trim to fail prematurely. Avoid contact with these materials.

B. Accessories: Install trims, flashings, and roofing specialties according to Drawings and manufacturer's recommended details.

C. Sealant Installation: Apply according to approved shop drawings and SMACNA Architectural Sheet Metal Manual recommendations.
   1. Provide airtight and waterproof installation.

D. Installation Tolerances: (Match dimensional tolerances of framing or substrate.)
   1. Flatness: <*Insert requirement*.>

3.4 CLEANING

A. Repairs:
   1. Touch up paint is not required for panels with scratches that do not expose base metal.
   2. PVDF (air dryable) touch up paint pens are recommended for minor scratches showing the substrate. Use minimal paint to fill scratch.
   3. Panels or flashings with finish damage exposing metal or with substrate damage shall be replaced.

B. Cleaning and Waste Management: (See Division 01 Section "Construction Waste Management and Disposal" for recycling requirements.)
   1. At completion of each day's work and at work completion, sweep panels, flashings, and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate.
   2. Clean exposed surfaces of work promptly after completion of installation.

3.5 PROTECTION

A. Protect Work as required to ensure that roofing will be without damage at Final Completion.

END OF SECTION