SECTION  – pre-engineered metal structures

1. General
   1. SUMMARY
      1. This Section includes requirements for supply and installation of pre engineered steel building systems consisting of the following:
         1. Structural steel framing system.
         2. Metal roof system.
         3. Metal wall system.
         4. Roof and wall insulation systems.
         5. Metal trim.
      2. Related Requirements:
         1. Section 03 35 00 – Concrete Finishing.
         2. Section 05 50 00 – Metal Fabrications.
         3. Section 06 10 00 – Rough Carpentry.
         4. Section 06 20 00 – Finish Carpentry.
         5. Section 07 92 00 – Joint Sealants.
         6. Section 08 11 13 – Steel Doors and Frames.
         7. Section 08 33 23 – Overhead Coiling Doors.
         8. Section 09 29 00 – Gypsum Board.
         9. Section 09 90 00 – Painting.
         10. Section 10 28 13 – Washroom Accessories.
   2. reference standards
      1. American Institute of Steel Construction (AISC):
         1. AISC Specification for Structural Steel Buildings.
         2. AISC Serviceability Design Considerations for Low-Rise Buildings.
      2. American Iron and Steel Institute (AISI):
         1. AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
      3. American Welding Society (AWS):
         1. AWS D1.1 / D1.1M - Structural Welding Code - Steel.
         2. AWS D1.3 / D1.3M - Structural Welding Code - Sheet Steel.
      4. ASTM International (ASTM):
         1. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
         2. ASTM A 653 / A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
         3. ASTM A 792 / A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
         4. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
         5. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
         6. ASTM D 522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
         7. ASTM D 523 - Standard Test Method for Specular Gloss.
         8. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
         9. ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
         10. ASTM D 2244 - Standard Practice for Calculation of Colour Tolerances and Colour Differences from Instrumentally Measured Colour Coordinates.
         11. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
         12. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
         13. ASTM D 3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
         14. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
         15. ASTM E 96 / E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
         16. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
         17. ASTM G 87 - Standard Practice for Conducting Moist SO2 Tests.
      5. FM Global:
         1. FMRC Standard 4471 - Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance. Roof systems shall be installed to meet the requirements of the assembly tested.
      6. Metal Building Manufacturers Association (MBMA):
         1. MBMA Metal Building Systems Manual.
      7. North American Insulation Manufacturers Association (NAIMA):
         1. NAIMA 202 - Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.
      8. The Association for Materials Protection and Performance (AMPP):
         1. SSPC-Paint 25 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 25 standards.
         2. SSPC-SP2 - Hand Tool Cleaning.
   3. definitions
      1. Cladding: Exposed exterior wall and roof skin of any material type and combination including fasteners and attachments, weather sealants, trim, flashing, fascia, and closures, as applicable.
      2. Steel Building System: Integrated assembly of manufactured steel structural components and cladding components specifically designed by the fabricator to support and transfer loads and provide a complete or partial building shell.
      3. Structural Framing: Steel framework consisting of primary members (rigid frames, beams, girders, trusses, arches, rafters, columns), secondary members (purlins, joists, struts, bracing, tension rods, girts, eave struts, base angle and channel, header, jambs, sills, and other structural items) and all necessary hardware.
   4. PREINSTALLATION MEETINGS
      1. Arrange a preconstruction meeting in accordance with Division 1 requirements to review methods and procedures related to steel building systems including but not limited to, the following:
         1. Review and discuss condition of foundations and other preparatory work performed by other trades.
         2. Review structural load limitations.
         3. Review and finalize construction schedule and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
         4. Review required testing, inspecting, and certifying procedures.
         5. Review weather and forecasted weather conditions and procedures for unfavourable conditions.
      2. Conduct a preconstruction roof assembly meeting to review methods and procedures related to metal roof panel assemblies including but not limited to, the following:
         1. Review purlin conditions for compliance with fabricator's requirements including flatness and attachment to structural members.
         2. Review structural limitations of purlins during and after roofing.
         3. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
         4. Review temporary protection requirements for metal roof panel assembly during and after installation.
         5. Review roof observation and repair procedures after metal roof panel installation.
      3. Conduct a preconstruction wall assembly meeting to review methods and procedures related to metal wall panel assemblies including but not limited to, the following:
         1. Review support conditions for compliance with requirements including alignment between and attachment to structural members.
         2. Review structural limitations of girts and columns during and after wall panel installation.
         3. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
         4. Review temporary protection requirements for metal wall panel assembly during and after installation.
         5. Review wall observation and repair procedures after metal wall panel installation.
      4. Contractor shall hold pre-installation conference two (2) weeks prior to commencing Work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, Subcontractor, Pre-Engineer installers and manufacturer's representative, and cast-in-place concrete manufacturer's representative to discuss the following, but not limited to the following:
         1. Substrate conditions and preparation requirements.
         2. Levelness tolerances.
         3. Wall details and treatments.
      5. Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant.
      6. Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicate required actions and by which party.
      7. Coordinate with building foundations, grade beams and slabs for installation of steel building systems.
   5. SUBMITTALS
      1. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
      2. Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.
      3. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.
      4. Certification: Submit written letter of certification prepared and signed by a Professional Engineer, registered in the Place of the Work, verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
         1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
         2. Submit certification 1 week before bid date on the metal building system manufacturer's letterhead.
      5. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.
      6. Dealer Certification: Submit certification 1 week before bid date that the metal building system supplier or metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished.
      7. Certification shall state date on which authorization was granted.
      8. Installer Certification: Submit certification 1 week before bid date that the metal building system or roof system installer has been regularly engaged in the installation of building systems of the same or equal construction to the system specified.
      9. Warranty Documentation: Submit manufacturer's standard warranty.
   6. quality assurance
      1. Manufacturer's Qualifications:
         1. Manufacturer regularly engaged, for past ten (10) years, in manufacture of metal building systems of similar type to that specified.
         2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC), Chapter 17.
      2. Installer's Qualifications:
         1. Installer regularly engaged, for past five (5) years, in installation of metal building systems of similar type to that specified.
         2. Employ persons trained for installation of metal building systems.
      3. Letter of Certification:
         1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered in the Place of the Work, verifying that building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
         2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
         3. Letter of certification shall be on metal building system manufacturer's letterhead.
      4. Material Testing:
         1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
         2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).
   7. DELIVERY, STORAGE AND HANDLING
      1. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
      2. Deliver components, sheets, panels, and other manufactured items in a manner to prevent damage or deformation, package metal panels for protection during transportation and handling.
      3. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
      4. Storage and Handling Requirements:
         1. Store and handle materials in accordance with manufacturer's instructions.
         2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
         3. Do not store materials directly on ground.
         4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
         5. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
         6. Protect materials and finish during storage, handling, and installation to prevent damage.
   8. WARRANTY
      1. Metal building system manufacturer shall provide a written weather tightness warranty for a maximum of 10 years against leaks in roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
         1. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.
         2. Maximum liability of warranty shall be no less than $0.20 per square foot of roof area.
      2. Metal building system manufacturer shall provide a written warranty for twenty-five (25) years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions.
         1. Warranty shall be signed by metal roof system manufacturer.
      3. Metal building system manufacturer shall provide a paint film written warranty for twenty-five (25) years against cracking, peeling, chalking, and fading of exterior coating on painted roof and wall panels.
         1. Warranty shall be signed by metal building system or roof system manufacturer and state that the coating contains 70 percent "Kynar 500" or "Hylar 5000" resin.
         2. Metal building system manufacturer shall warrant that the coating shall not peel, crack, or chip for 25 years.
         3. For a period of twenty-five (25) years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than five (5) colour difference units in accordance with ASTM D 2244.
      4. Metal Building System Manufacturer's Certification: Metal building system manufacturer shall submit a signed written Certification 1 week before bid date, stating that the metal roof system manufacturer or approved representative will provide warranties and Inspection and Report Service specified in this specification section.
         1. Warranty terms shall be submitted with bid.
2. Products
   1. manufacturer
      1. Compatibility: Verify that pre-engineered building materials/systems are provided by the same manufacturer or are compatible with one another when provided by different manufacturers.
      2. Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the Project; additional manufacturers offering similar products may be incorporated into the Work of this Section provided they meet the performance requirements established by the named products.
      3. Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include but are not limited to, the following:
         1. Butler Manufacturing.
         2. Robertson Building Systems.
      4. Manufacturer Approved Installers:
         1. Butler Manufacturing.
         2. Robertson Building Systems.
         3. Integrated Structures Inc; Attn: Mario Stillitano, T- 416-571-9588.
         4. Armour Steel Buildings Inc; Attn: Pat Bruzzese, T - 905-388-7751.
         5. Northwinds Construction Limited; Attn: Doug Gullett, T -705-792-2492.
         6. MeadowBrook Construction; Attn: Steven Buhagiar, T - 905-670-3052.
   2. BUILDING DESCRIPTION
      1. Building Dimensions: Indicated on the Drawings.
         1. Horizontal Dimensions: Measure to inside face of wall sheets.
         2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
         3. Clear Height Between Finished Floor and Bottom of Roof Steel: Indicated on the Drawings.
      2. Primary Structural Members:
         1. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
         2. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
         3. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
         4. Exterior Columns: Welded-up "H" sections or cold-formed "C" sections.
         5. Interior Columns: "H" sections or tube columns.
         6. Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
         7. Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.
      3. Secondary Structural Members:
         1. Secondary Framing System: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section, and bolt for field assembly.
         2. C/Z Purlins and Girts: Acrylic-coated G30 galvanized finish.
      4. Where metal panels are required to be painted, use coating system as specified in this specification section.
   3. DESIGN LOADS
      1. Design pre-engineered metal buildings capable of withstanding design loads within limits and under design loads indicated in this Section, and as follows:
         1. Dead Loads: Account for weights of materials and construction accessories.
         2. Structural Loads:
            1. Wind Loads: 0.44 kPa 1/50 year occurrence in accordance with the Building Code.
            2. Deflection Normal to Wall Plane: Limited to L/175.
      2. Governing Design Code:
         1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
            1. Governing Building Code: Ontario Building Code.
            2. Year/Version:
            3. Occupancy Category: Group F, Division 3.
      3. Collateral Load:
         1. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
         2. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
         3. Equipment loads of 50 pounds or more shall be indicated on the Drawings and the structure shall be strengthened as required.
      4. Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.
      5. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.
   4. STRUCTURAL STEEL FRAMING SYSTEM
      1. General:
         1. Design of Structural System: Clear or multi-span rigid frame with tapered or straight columns and roof beams, with gable or single-slope roof.
         2. Actual Building Length:
            1. Structural line to structural line.
            2. Same as nominal, i.e., number of bays times length of bays.
            3. Structural Line: Defined as inside face of wall sheets.
         3. Actual Building Width:
            1. Structural line to structural line.
            2. Nominal building width.
         4. Roof Slope: As indicated on Drawing A103.
         5. Components and Parts of Structural System:
            1. Indicated on the Drawings or the Specifications.
            2. Clearly marked.
            3. Erection Drawings: Supply for identification and assembly of parts.
            4. Drawings: Carry stamp of a registered professional engineer.
         6. Foundations:
            1. Foundations, Including Anchor Bolt Embedment Length: Properly designed by qualified engineer, retained by other than metal building system manufacturer, in accordance with specific soil conditions for building site.
            2. Reactions for Proper Design of Foundations: Supplied by metal building system manufacturer.
            3. Anchor Bolts:

Anchor Bolt Diameter: Indicated on anchor bolt layout drawings furnished by metal building system manufacturer.

Anchor Bolts: Supplied by Contractor, not metal building system manufacturer.

Anchor Bolts on Moment-Resisting Column Bases: Nuts above and below base plates.

* + 1. Structural Steel Design:
       1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with AISC Specification for Structural Steel Buildings.
       2. Cold-Formed Steel Structural Members: Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
       3. Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).
    2. Primary Framing:
       1. Rigid Frames:
          1. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.

Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.

Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.

* + - * 1. Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
      1. Endwall Structural Members: Cold-formed channel members designed in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with AISC Specification for Structural Steel Buildings.
         1. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.

Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.

Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.

Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.

* + - * 1. Intermediate Frames: Substituted for end-wall roof beams, when specified.

Factory fabricates necessary endwall posts and holes for connection to intermediate frame used in endwall.

* + 1. Secondary Structural Members:
       1. Purlins:
          1. Purlins:

"Z"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.

7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" sections.

* + - * 1. Outer Flange of Purlins: Factory-punched holes for panel connections.
        2. Attach purlins to main frames and endwalls by 1/2-inch-diameter bolts through end seat of truss purlin.
        3. Brace purlins on top and bottom chords spaced at intervals indicated on erection drawings furnished by metal building system manufacturer.
        4. Concentrated Loads: Hung at purlin panel points.
      1. Eave Members:
         1. Eave Struts: Factory punched 7", 8-1/2", 10", or 11-1/2" deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
      2. Girts:
         1. "Z" or "C"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
         2. 7", 8-1/2", 10", or 11-1/2" deep "Z" or "C" sections.

Outer Flange of Girts: Factory-punched holes for panel connections.

* + - 1. Bracing:
         1. Locate bracing as indicated on the Drawings.
         2. Diagonal Bracing:

Hot-rolled rods of sizes indicated on the Drawings.

Attach to columns and roof beams as indicated on the Drawings.

* + - * 1. Optional fixed-base wind posts or pinned-base portal frames may be substituted for wall rod bracing on buildings as required.
        2. Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.
    1. Welding:
       1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: AWS D1.1 - Structural Welding Code - Steel and AWS D1.3 - Structural Welding Code - Sheet Steel.
       2. Welding inspection, other than visual inspection as defined by AWS D1.1, paragraph 6.9, shall be identified and negotiated before bidding.
       3. Certification of Welder Qualification: Supply when requested.
    2. Painting of Structural Steel Framing System:
       1. General:
          1. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
          2. Perform subsequent finish painting, if required, in field as specified in the painting section.
          3. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
          4. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
       2. Primary Frames:
          1. Clean steel in accordance with SSPC-SP2.
          2. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 25.
          3. Minimum Coating Thickness: 1.0 mil.
       3. Secondary Structural Members - Roll-Formed:
          1. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
          2. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-25.
  1. METAL ROOF SYSTEM
     1. Basis of Design - Metal Roof System: Butler Manufacturing CMR-24 Roof System or Robertson Building Systems Battenlok HS.
     2. Roof System Design:
        1. Design roof panels and liner panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
        2. Design roof paneling system to support design live, snow, and wind loads.
        3. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.
     3. Roof System Performance Testing:
        1. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
        2. FM Global (Factory Mutual):
           1. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
           2. Installation modifications or substitutions can invalidate FM Global approval.
     4. Roof Panels:
        1. Factory roll-formed, standing seam panel.
        2. Panel Material and Finish:
           1. 24-gauge galvanized steel, G90 coating; ASTM A 653, G90.
           2. Paint with exterior colours of manufacturer's standard colour line using fluoropolymer (PVDF) coating.
           3. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.

Not to peel, crack, or chip.

Chalking: Not to exceed ASTM D 4214, #8 rating.

Fading: Not more than 5 colour-difference units, ASTM D 2244.

* + - 1. Use panels of maximum possible lengths to minimize end laps.
      2. Extend eave panels beyond structural line of sidewalls.
      3. Factory punch panels at panel end to match factory-punched holes in eave structural member.
      4. Panel End Splices: Factory punched and factory notched.
      5. Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.
      6. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
      7. Self-Drilling Fasteners: Not permitted in weathering membrane of roof system.
      8. Ridge Assembly:
         1. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
         2. Factory punch parts for correct field assembly.
         3. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
         4. Do not expose attachment fasteners on weather side.
         5. Use lock seam plug to seal lock seam portion of panel.
         6. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.
    1. Insulation Board:
       1. Rigid glass-fiber-reinforced, polyisocyanurate foam plastic core, as recommended by system manufacturer.
       2. Width: 4 feet.
       3. Maintain Class A fire rating.
       4. Approved for use without thermal barrier.
       5. Maximum Thickness: 4 inches.
       6. Covered with embossed aluminum facing both sides.
    2. Vapor Retarder:
       1. WMP-50, 0.0015-inch minimum thickness, UV-stabilized, white polypropylene, laminated to 30-pound Kraft paper / metalized polyester and reinforced with fibreglass and polyester scrim.
       2. Perm Rating: 0.02.
    3. Interior Liner Panels:
       1. Form panels from 0.015" minimum thickness coated steel with minimum yield strength of 80,000 psi.
       2. Painted Panel Finish:
          1. Exposed Side: 0.1-mil primer and 0.4-mil minimum interior white polyester paint.\
       3. Unexposed Side: 0.3-mil minimum non-colour-controlled wash coat.
       4. Panel Dimensions: Nominal 36 inches wide with corrugations 9/16 inches high, 2-9/16 inches on center.
       5. Factory cut panels to lengths required.
    4. Provision for Expansion and Contraction:
       1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
          1. Stainless-Steel Tabs: Factory centered on roof clip to ensure full movement in either direction.
          2. Maximum Force of 8 Pounds: Required to initiate tab movement.
          3. Each Clip: Accommodates a minimum of 1.25-inch movement in either direction.
       2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 38 deg C (100 deg F) temperature difference between interior structural framework of building and of roof panels.
    5. Fasteners:
       1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless-steel tabs, seamed into standing seam side lap.
       2. Fasten insulation board, bearing plates, and panel clips to structural members with fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched or field-drilled holes in structural members.
          1. Fasteners: Metal-backed rubber washer to serve as torque indicator.
    6. Accessories:
       1. Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
       2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: To match roof and wall panel finish - fluoropolymer (PVDF) coating.
       3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
       4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
    7. Thermal Performance:
       1. Determine thermal performance in accordance with ASTM C 1363 and test U-factors for composite roof section.
    8. Physical Properties:
       1. WMP-50 Vapor Retarder:
          1. For conditions of high interior humidity, UV-stabilized, white polypropylene film.
          2. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.02.
          3. Minimum Workability Temperature: 7 deg C (20 deg F).
       2. Metal Building Board Insulation:
          1. Class I Factory Mutual Approval and UL Fire Hazard Classification Ratings, UL 723:
          2. Flame Spread: 25 or less.
  1. METAL WALL SYSTEM
     1. Basis of Design - Exterior Metal Wall System: Butler Manufacturing Shadowall Wall System or Robertson Building Systems A-36 Architectural Panel.
     2. Wall System Design: Design wall panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
        1. Wall Panels:
           1. Roll-formed panels.
           2. One piece from base to building eave.
           3. Each Panel Corrugation: Fastener alignment groove to center fastener within corrugation.
           4. Exposed Panel Side Laps: Hemmed to eliminate raw cut panel edge.
           5. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.
           6. Panel Material and Finish:

Paint with exterior colours from manufacturer's standard product line - fluoropolymer (PVDF) coating.

PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following:

Not to peel, crack, or chip.

Chalking: Not to exceed ASTM D 4214, #8 rating.

Fading: Not more than 5 colour-difference units, ASTM D 2244.

* + - * 1. Panel Material and Finish: Special materials, gauges, or colours as applicable for custom designs.
        2. Insulation Board: As recommended by the system manufacturer. Thickness to maintain a building interior environment temperature range of 15 deg C to 20 deg C.
      1. Fasteners:
         1. Wall Panel-to-Structural Connections: Self-drilling screws.
         2. Wall Panel-to-Panel Connections: Self-drilling screws.
         3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
         4. Exposed Fasteners: Factory painted to match wall colour.
  1. INSULATION SUPPORT SYSTEM
     1. Basis of Design - Insulation Support System: Butler Manufacturing ThermaLiner Insulation Support System or Robertson Building Systems ESP Wall Panel.
     2. Description:
        1. Roll-formed panels, minimum 26 gauge thick.
        2. Compatible with roof system.
     3. Fasteners and Attachment Hardware: As supplied by system manufacturer to provide a complete the assembly.
  2. METAL COATING SYSTEM
     1. Factory-applied, exterior metal coating system.
     2. Substrate Preparation:
        1. G90 Hot-Dipped Galvanized Steel or AZ50 Galvalume: Factory-controlled chemical-conversion treatment.
     3. Coating:
        1. Material: Fluoropolymer (PVDF) colour coating.
        2. After steel preparation, coat exterior exposed surface with primer and "Fluropon."
           1. Nominal Total Dry Film Thickness: 1.0 mil.
        3. Interior Exposed Surfaces: Coat with polyester colour coat.
        4. Apply coatings to entire material dimensions of steel sheets before forming of panels.
     4. Physical Characteristics of Exterior Coating:
        1. Resistance to failure through cracking, checking, peeling, and loss of adhesion.
        2. Measure by the following laboratory weather-simulating tests to obtain test results justifying metal building system manufacturer's 25-year warranty:
           1. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
           2. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
           3. Reverse impact resistance, ASTM D 2794.
           4. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
           5. Resistance to dry heat.
           6. Abrasion resistance, ASTM D 968.
           7. Chemical/acid/pollution resistance, ASTM D 1308, and G 87.
           8. Maintain gloss of finish evenly over entire surface, ASTM D 523.

1. Execution
   1. EXAMINATION
      1. Examine area to receive metal building system.
      2. Notify Consultant of conditions that would adversely affect installation or subsequent use.
      3. Do not begin installation until unacceptable conditions are corrected.
   2. ERECTION - STRUCTURAL STEEL FRAMING SYSTEM
      1. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.
      2. Field Modifications:
         1. Require approval of metal building system manufacturer.
         2. Responsibility of building erector.
      3. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.
   3. INSTALLATION - METAL ROOF SYSTEM
      1. Metal Roof System Installation:
         1. Install roof system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
         2. Install roof system weathertight.
         3. Position and align liner panels and insulation board by installing starting panels against endwall trim clips and sidewall eave structural.
         4. Place liner panels with edges up and corrugations perpendicular to secondary structural members and with end laps over secondary structural members.
         5. Attach liner panels to roof secondary structural members with self-drilling screws in accordance with erection drawings furnished by metal building system manufacturer.
         6. Install vapor retarder over liner panels with 6" minimum side laps and end laps.
         7. Position panel clips and bearing plates by matching hole in clip with factory-punched or field-drilled holes in secondary structural members.
         8. Position and properly align panels by matching factory-punched holes in panel end with factory-punched holes in eave structural member and by aligning panel with panel clip.
         9. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.
            1. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.
            2. Factory applies side lap sealant.
         10. Panel End Laps: Minimum of 6 inches, sealed with manufacturers recommended sealant, and fastened together by clamping plates.
             1. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
             2. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
             3. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.
   4. INSTALLATION - METAL WALL SYSTEM
      1. Metal Wall System Installation:
         1. Install wall system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
         2. Install wall system weathertight.
         3. Verify structural system is plumb before wall panels are attached.
         4. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.
         5. Install side laps with minimum of one (1) full corrugation.
         6. Seal wall panels at base with metal trim and foam or rubber closures.
         7. Exterior Trim: Apply same finish as exterior colour of wall panels.
         8. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.
   5. INSTALLATION - INSULATION
      1. Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   6. INSTALLATION - INSULATION SUPPORT SYSTEM
      1. Insulation Support System Installation:
         1. Install insulation support system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
         2. Verify roof structural system is in place before installation of insulation support system.
         3. Keep insulation support system in place after metal roof system is installed.
         4. Fasten insulation support system to structural framing at perimeter of building.
         5. Make mesh-to-mesh connections above interior frames.
         6. Verify installed system conforms to geometry of fibreglass blanket insulation to maintain designed insulation value of roof system.
   7. INSTALLATION - ROOF INSULATION SYSTEM
      1. Roof Insulation System Installation:
         1. Install roof insulation system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   8. PROTECTION
      1. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION