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Product Guide Specification

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format, including *MasterFormat, SectionFormat,* and *PageFormat,* as described in *The CSI Construction Specifications Practice Guide.*

This section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all "Specifier Notes" after editing this section.

Section numbers and titles are from *MasterFormat 2011 Update.*

SECTION 13 34 19

METAL BUILDING SYSTEMS

Specifier Notes: This section covers the Butler Manufacturing metal building system. Consult Butler Manufacturing for assistance in editing this section for the specific application.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal Building System:

Specifier Notes: Edit the following list as required for the project. List only significant generic types of systems and products. Do not include accessories or detail list of materials.

1. Structural steel framing system.
2. Metal roof system.
3. Metal wall system.
4. Roof and wall insulation systems.

1.2 RELATED REQUIREMENTS

Specifier Notes: Limit the following list to sections with specific information that the reader might expect to find in this section, but is specified elsewhere. Include section number and title for each section.

A. Section _____ – _____.

B. Section _____ – _____.

1.3 REFERENCE STANDARDS

Specifier Notes: List standards referenced in this section, complete with designations and titles. Delete standards not included in the edited section.

A. American Institute of Steel Construction (AISC):
   1. AISC Specification for Structural Steel Buildings.
   2. AISC Serviceability Design Considerations for Low-Rise Buildings.

B. American Iron and Steel Institute (AISI):
   1. AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. 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.

D. Association for Iron & Steel Technology (AISE):
   1. AISE 13 – Specifications for Design and Construction of Mill Buildings.

E. 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 B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
   5. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   6. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
   7. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
   8. ASTM D 523 – Standard Test Method for Specular Gloss.
   9. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
11. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
12. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
13. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
14. ASTM D 3361 – Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
15. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
16. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
18. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
19. ASTM G 87 – Standard Practice for Conducting Moist SO2 Tests.

F. CAN/CSA:
1. A660 – Certification of Manufacturers of Steel Building Systems.
2. S16 – Design of Steel Structures.
3. S136 – North American Specification for the Design of Cold Formed Structural Steel Members.
4. W47.1 – Certification of Companies for Fusion Welding of Steel.
5. W55.3 – Certification of Companies for Resistance Welding of Steel and Aluminum.
6. W59 – Welded Steel Construction (Metal Arc Welding).

G. Canadian Institute of Steel Construction (CISC):
1. CISC – Handbook of Steel Construction.
2. CISC/CPMA - 1-73a A Quick Drying One-Coat Paint for use on Structural Steel.
3. CISC/CPMA – 2-75 A Quick Drying Primer for use on Structural Steel.

H. Canadian Sheet Steel Building Institute (CSSBI):
1. C1 – Certificate of Design and Manufacturing Conformance with NBCC.
2. S8 – Quality and Performance Specification for Pre-Finished Sheet Steel for Building Products.

I. Federal Specifications (FS):
1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards
2. SSPC-SP2 – Hand Tool Cleaning.

J. 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.

K. Metal Building Manufacturers Association (MBMA):

1. MBMA Metal Building Systems Manual.

L. North American Insulation Manufacturers Association (NAIMA):
1. NAIMA 202 – Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.

M. The Society for Protective Coatings (SSPC):
1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
2. SSPC-SP2 – Hand Tool Cleaning.

N. Underwriters Laboratories (UL):
1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.
2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

O. US Army Corps of Engineers (COE):
1. COE Unified Facilities Guide Specification Section 07 61 13.

Specifier Notes: Edit preinstallation meetings as necessary. Delete if not required.

1.4 PREINSTALLATION MEETINGS

A. Convene pre-installation meeting 2 weeks before start of installation of metal building system.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer's representative.

C. Review materials, installation, protection, and coordination with other work.

1.5 SUBMITTALS

Specifier Notes: Edit submittal requirements as necessary. Delete submittals not required.

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

C. 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.

Specifier Notes: Fill in name of Province/Territory where the project is located.

D. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in _____ 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.

Specifier Notes: Specify **one or more** of the following **three** sentences. For Factory Mutual identify the proper classification.

E. Submit certification verifying that the metal roof system has been tested and approved by Underwriter's Laboratory as Class 90.

F. Submit certification verifying that the metal roof system has been tested and approved by Factory Mutual as Class _____.

G. Submit certification verifying that the metal standing seam roof system has been tested in accordance with ASTM E 1592 test protocols.

H. 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.
   1. Certification shall state date on which authorization was granted.

I. 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.

J. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

Specifier Notes: For more information about the CSA A660 Certification program refer to the CSA or CSSBI websites.

A. Manufacturer's Qualifications:
   1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
   2. Accredited based on the requirements of CSA A660 Certification.

B. Installer's Qualifications:
   1. Installer regularly engaged, for past 5 years, in installation of metal building systems of similar type to that specified.
   2. Employ persons trained for installation of metal building systems.

C. Certificate of design and manufacturing conformance:

Specifier Notes: Fill in name of Province/Territory where project is located.

   1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in _____ 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. Certificate shall be on metal building system manufacturer's letterhead.
   4. Refer to Submittals article of this specification section.

D. 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).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. 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. Protect materials and finish during storage, handling, and installation to prevent damage.

1.8 WARRANTY

Specifier Notes: Specify any one of the **three** paragraphs below for generic structural standing-seam roof systems. Specify the **third** paragraph when specifying through-fastened roof systems.

A. Metal building system manufacturer shall provide a written weathertightness warranty for a maximum of 25 years against leaks in standing seam 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 $0.70 USD per square foot of roof area.

B. Metal building system manufacturer shall provide a written weathertightness warranty for a maximum of 20 years against leaks in standing 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 $0.50 USD per square foot of roof area.

C. Metal building system manufacturer shall provide a written weathertightness 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 USD per square foot of roof area

D. Metal building system manufacturer shall provide a written warranty for 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.

E. Metal building system manufacturer shall provide a paint film written warranty for 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 25 years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than 5 color difference units in accordance with ASTM D 2244.

F. 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.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Metal Building System Manufacturer: Butler Buildings (Canada), Unit #21 – 3070 Mainway Drive, Burlington, ON L7M 3X1 Phone 905-332-7786. Website www.butlermfg.com.

2.2 BUILDING DESCRIPTION

A. 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 Beams: Indicated on the Drawings.

B. Primary Structural Members:
   1. Primary Framing System: Butler Manufacturing framing system as specified in this specification section.
   2. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
   3. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
   4. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
   5. Exterior Columns: Welded-up "H" sections or cold-formed “C” sections.
   6. Interior Columns: “H” sections or tube columns.
   7. Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
   8. Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.

C. Secondary Structural Members:
   1. Secondary Framing System: Butler Manufacturing framing system as specified in this specification section.
   2. a, C/Z Purlins and Girts: Acrylic-coated G30 galvanized finish.
      b. Truss Purlins: Acrylic-coated G30 galvanized finish.

D. Metal Roof System: Butler Manufacturing metal roof system as specified in this specification section.

E. Metal Wall System: Butler Manufacturing metal wall system as specified in this specification section.

F. Where metal panels are required to be painted, use coating system as specified in this specification section.

2.3 DESIGN LOADS

Specifier Notes: Fill in information required for the project.

A. 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:
      a. Governing Building Code: _____. (NBCC, or applicable Provincial Code).
      b. Year/Version: _____.
      c. Occupancy Category: _____.

B. Roof Live Load:
   1. Roof live loads are loads produced during the life of the structure by moveable objects. Wind, snow, seismic or dead loads are not live loads. Minimum Roof Live Loads are applied based on a load of 21 psf (1 Kpa).

C. Roof Snow Load:
   1. The roof snow load used for designing the structure may not be reduced and shall be the product of the following criteria defined in the NBCC Division B Section 4.1.6:

      Snow Importance Factor (Is): _____
      Ground Snow (Ss 1/50): _____
      Basic Snow load Factor (Cb): _____
      Wind Exposure Factor (Cw): _____
      Slope Factor (Cs): _____
      Shape Factor (Ca): _____
      Rain Component (Sr); _____

      Roof Snow Load (S) = Is*[Ss*(Cb*Cw*Cs*Ca) + Sr] = _____ Kpa.

D. Wind Load:

   1. The wind load used for designing the structure shall be the product of the following criteria defined in the NBCC Division B Section 4.1.7:

      Wind Importance Factor (Iw): _____
      Reference Velocity Pressure (q 1/50): _____
      Wind Exposure Factor (Ce): _____
      Wind Gust Factor (Cg): _____
      Wind Pressure Coefficient (Cp): _____
      Wind Importance Factor (I_w): _____

      Building Wind Load (p) = Iw*q*Ce*Cg*Cp = _____ Kpa.

   2. Wind Pressure Coefficients and the design pressures shall be applied per the governing code.

E. Seismic Load:
1. The seismic load used for designing the structure shall be based on the following criteria defined in the NBCC Division B Section 4.1.8:

Spectral acceleration for Sa (0.2) _____ %g
Spectral acceleration for Sa(0.5): _____ %g
Spectral acceleration for Sa(1.0): _____ %g
Spectral acceleration for Sa(2.0): _____ %g
Site Classification (for Seismic Site Response): _____
Seismic Importance Factor (Ie): _____

2. Seismic loads shall be applied in accordance with the governing code.

F. Dead Load:

1. Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

G. 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. Architect will provide the metal building system manufacturer with the magnitude and approximate location of concentrated loads greater than 50 pounds before design of the building starts.

H. Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.

I. Crane Loads:
1. Crane loads shall be a function of the Service Class as defined by the governing code and Crane Manufacturers Association of America (CMAA) and the rated tonnage (A- Standby or Infrequent service, B- Light service, C- Moderate service, D- Heavy Service, E- Severe Service, F- Continuous Severe Service).
2. Cranes in Service Class E or F shall be in accordance with AISE 13.
   a. Service Class of Crane: _____.
   b. Deflection Criterion for Crane: _____.
3. Crane loads will be obtained from the crane manufacturer and supplied by the Architect to the metal building system manufacturer at the time of bid.
4. Building structure shall be designed for the crane loads in accordance with the governing code.
5. Multiple cranes in the same bay or aisle shall be designed in accordance with the governing code.
6. If the governing code does not address multiple crane design practices, MBMA Metal Building Systems Manual shall be used.

J. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

2.4 DEFLECTIONS

Specifier Notes: Fill in information required for the project.

A. Structural Members:
   1. Maximum deflection of main framing members shall not exceed 1/_____ of their respective spans.
   2. Maximum deflection due to snow load in roof panels and purlins shall not exceed 1/_____ of their respective spans.
   3. Maximum deflection due to wind load in wall panels and girts shall not exceed 1/_____ of their respective spans.

B. Lateral deflections, or drift, at the roof level of the structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall not exceed H/_____.

C. Calculations for deflections shall be done using only the bare frame method.
   1. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.
   2. Drift shall be in accordance with CSA – S16 Appendix “C”, or AISC Serviceability Design Considerations for Low-Rise Buildings.
   3. Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.
   4. When maximum deflections are specified, calculations shall be included in the design data.

2.5 STRUCTURAL STEEL FRAMING SYSTEM

A. 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:
      a. Structural line to structural line.
      b. Same as nominal; i.e. number of bays times length of bays.
      c. Structural Line: Defined as inside face of wall sheets.
   3. Actual Building Width:
      a. Structural line to structural line.
      b. Nominal building width.

Specifier Notes: Specify minimum roof slope of 1/4 inch in 12 inches for standing-seam roofs. Specify minimum roof slope of 1/2 inch in 12 inches for through-fastened roofs.

   4. Minimum Roof Slope: _____ inch in 12 inches.

Specifier Notes: Specify maximum roof slope of 1 inch in 12 inches for open-web secondary structural members.

5. Maximum Roof Slope: _____ inch in 12 inches.
6. Components and Parts of Structural System:
   a. Indicated on the Drawings or the Specifications.
   b. Clearly marked.
   c. Erection Drawings: Supply for identification and assembly of parts.
   d. Drawings: Carry stamp of a registered professional engineer.
7. Foundations:
   a. 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.
   b. Reactions for Proper Design of Foundations: Supplied by metal building system manufacturer.
   c. Anchor Bolts:
      1) Anchor Bolt Diameter: Indicated on anchor bolt layout drawings furnished by metal building system manufacturer.
      2) Anchor Bolts: Supplied by Contractor, not metal building system manufacturer.
      3) Anchor Bolts on Moment-Resisting Column Bases: Nuts above and below base plates.

B. Structural Steel Design:
   1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with CSA - S16 Design of Steel Structures.
   2. Cold-Formed Steel Structural Members: Design in accordance with CSA S136 - 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).

C. Primary Framing:
   1. Rigid Frames:
      a. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
         1) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.
         2) 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.
      b. Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
   2. Endwall Structural Members: Cold-formed channel members designed in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with CSA - S16 Design of Steel Structures.
      a. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.

1) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
2) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
3) 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.

b. Intermediate Frames: Substituted for end-wall roof beams, when specified.
1) Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.

D. Secondary Structural Members:
1. Purlins:

Specifier Notes: Specify Paragraph a. Purlins for traditional roll-formed secondary structural members with 10-foot to 40-foot bays. Specify Paragraph b. Truss Purlins for open-web secondary structural members with 20-foot to 60-foot bays.

a. Purlins:
1) "Z"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
2) 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" sections.

b. Truss Purlins:
1) Cold-formed trusses, factory assembled.
2) 30 inches, 34 inches or 40 inches deep.

c. Outer Flange of Purlins: Factory-punched holes for panel connections.
d. Attach purlins to main frames and endwalls using 1/2-inch-diameter bolts.
e. Brace purlins spaced at intervals indicated on erection drawings furnished by metal building system manufacturer.
f. Concentrated Loads: Hung at purlin panel points.

2. Eave Members:
a. Eave Struts: Factory punched 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.

3. Girts:
a. "Z" or “C”-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
b. 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" or “C” sections.
c. Outer Flange of Girts: Factory-punched holes for panel connections.

4. Bracing:
a. Locate bracing as indicated on the Drawings.
b. Diagonal Bracing:
1) Hot-rolled rods of sizes indicated on the Drawings.
2) Attach to columns and roof beams as indicated on the Drawings.

c. Optional fixed-base wind posts or pinned-base portal frames may be substituted for wall rod bracing on buildings as required.
d. Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.

E. Welding:
   1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: CSA W59 – Welded Steel Structures and AWS D1.3 - Structural Welding Code – Sheet Steel.
   2. Welding inspection, other than visual inspection as defined by CSA W59, shall be identified and negotiated before bidding.
   3. Certification of Welder Qualification: Supply when requested.

F. Painting of Structural Steel Framing System:
   1. General:
      a. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
      b. Perform subsequent finish painting, if required, in field as specified in the painting section.
      c. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
      d. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
   2. Primary Frames:
      a. Clean steel in accordance with SSPC-SP2.
      b. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements CAN/CSA 1-73a or 2-75.
      c. Minimum Coating Thickness: 1.0 mil.
   3. Secondary Structural Members – Roll-Formed:
      a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
      b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.
   4. Truss Purlins:
      a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
      b. Acrylic-coated G30 galvanized steel: Equal or exceed performance requirements of SSPC Paint-15.

Specifier Notes: Specify Butler Manufacturing "MR-24®", "CMR-24®", "VSR™ II", or "Butlerib® II" metal roof system. Delete metal roof systems not specified.

2.6 METAL ROOF SYSTEM

A. Metal Roof System: Butler Manufacturing "MR-24®" roof system.

B. Roof System Design:
   1. Design roof panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Design roof paneling system for a minimum roof slope of 1/4 inch in 12 inches.
   3. Design roof paneling system to support design live, snow, and wind loads.
   4. 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.

C. Roof System Performance Testing:

1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
4. FM Global (Factory Mutual):
    a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
    b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
    c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
3. Variable Width Panels:
    a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
    b. Minimum Length: 15 feet.
    c. Supply maximum possible panel lengths.

Specifier Notes: Specify **one** of the following **three** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraphs not specified.

4. Panel Material and Finish:
    a. 24-gauge steel coated both sides with layer of acrylic-coated Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc) applied by continuous hot-dip method.
    b. Minimum 0.55-ounce coated weight per square foot as determined by triple-spot test, ASTM A 792.
    c. Apply clear acrylic film for additional protection.
5. Panel Material and Finish:
    a. 24-gauge galvanized steel, G90 coating, ASTM A 653, G90.
    b. Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
        1) Not to peel, crack, or chip.
        2) Chalking: Not to exceed ASTM D 4214, #8 rating.
        3) Fading: Not more than 5 color-difference units, ASTM D 2244.
6. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.
7. Use panels of maximum possible lengths to minimize end laps.
8. Extend eave panels beyond structural line of sidewalls.

9. Factory punch panels at panel end to match factory-punched holes in eave structural member.
10. Panel End Splices: Factory punched and factory notched.
11. 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.
12. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
13. Self-Drilling Fasteners: Not permitted.
14. Ridge Assembly:
    a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
    b. Factory punch parts for correct field assembly.
    c. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
    d. Do not expose attachment fasteners on weather side.
    e. Use lock seam plug to seal lock seam portion of panel.
    f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.

E. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
    a. Stainless Steel Tabs: Factory centered on roof clip when installed to ensure full movement in either direction.
    b. Maximum Force of 8 Pounds: Required to initiate tab movement.
    c. 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 100-degree F temperature difference between interior structural framework of building and of roof panels.

F. 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 panel clips to structural members with "Scrubolt™" fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched holes in structural members.
    a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
3. Exposed fasteners penetrating metal roof membrane at the following locations do not exceed the frequency listed:
    a. Basic Panel System: 0 per square foot.
    b. High Eave Trim, No Parapet: 2 per linear foot.
    c. Exterior Eave Gutter: 2 per linear foot.
    d. Panel Splices: 2 per linear foot.
    e. Gable Trim: 0 per linear foot.
    f. High Eave with Parapet: 0 per linear foot.
    g. Ridge: 0 per linear foot.
    h. Low Eave Structural: 1.5 per linear foot.

G. Accessories:
1. Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.

2. Exterior Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: “Butler-Cote™ 500 FP” finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” 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.
    a. Parts: Compatible and not cause corrosive condition.
    b. Copper and Lead Materials: Do not use with Galvalume panels.

H. Energy Conservation:
1. Insulate purlins (optional) to eliminate "thermal short circuits" between purlins and roof panels.
2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and roof panels by use of thermal block at each purlin location.

2.7 METAL ROOF SYSTEM

A. Metal Roof System: Butler Manufacturing “CMR-24®” roof system.

B. Roof System Design:
1. Design roof panels and liner panels in accordance with CSA S136 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.

C. Roof System Performance Testing:
1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
4. FM Global (Factory Mutual):
    a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
    b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
    c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
3. Variable Width Panels:

a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
b. Minimum Length: 15 feet.
c. Supply maximum possible panel lengths.

Specifier Notes: Specify **one** of the following **three** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraphs not specified.

4. Panel Material and Finish:
   a. 24-gauge steel coated both sides with layer of Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc) applied by continuous hot-dip method.
   b. Minimum 0.55-ounce coated weight per square foot as determined by triple-spot test, ASTM A 792.
5. Panel Material and Finish:
   a. 24-gauge galvanized steel, G90 coating; ASTM A 653, G90.
   b. Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
      1) Not to peel, crack, or chip.
      2) Chalking: Not to exceed ASTM D 4214, #8 rating.
      3) Fading: Not more than 5 color-difference units, ASTM D 2244.
6. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.
7. Use panels of maximum possible lengths to minimize end laps.
8. Extend eave panels beyond structural line of sidewalls.
9. Factory punch panels at panel end to match factory-punched holes in eave structural member.
10. Panel End Splices: Factory punched and factory notched.
11. 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.
12. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
13. Self-Drilling Fasteners: Not permitted in weathering membrane of roof system.
14. Ridge Assembly:
    a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
    b. Factory punch parts for correct field assembly.
    c. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
    d. Do not expose attachment fasteners on weather side.
    e. Use lock seam plug to seal lock seam portion of panel.
    f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.

E. Insulation Board:

1. Rigid “Thermax” Metal Building Board glass-fiber-reinforced, polyisocyanurate foam plastic core.
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 - Metal Building Board.

Specifier Notes: Specify **one** of the following **two** paragraphs for Vapor Retarder.

F. Vapor Retarder:
1. PSK Light Duty (WMP-VR) 0.0015-inch minimum thickness, UV-stabilized, white polypropylene, laminated to 11-pound Kraft paper / metalized polyester and reinforced with glass fiber and polyester scrim.
2. Perm Rating: 0.09.

G. 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 glass fiber and polyester scrim.
2. Perm Rating: 0.02.

H. Interior Liner Panels:
1. Form panels from 0.0149 - inch minimum total coated thickness coated steel with minimum yield strength of 80,000 psi.

Specifier Notes: Specifier Notes: Specify Unpainted Liner Panels or Painted Panel Finish.

2. Unpainted Liner Panels: Galvalume aluminum-zinc alloy coated steel, AZ55 in accordance with ASTM A 792.
3. Painted Panel Finish:
   a. Exposed Side: 0.15-mil min primer and 0.70-mil minimum interior white polyester paint.
   b. Unexposed Side: 0.1-mil minimum primer and 0.40 minimum polyester backer
   c. Panel Dimensions: Nominal 36 inches wide with corrugations 1/2 inches high, 3 inches on center.
4. Factory cut panels to lengths required.

I. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
   a. Stainless Steel Tabs: Factory centered on roof clip to ensure full movement in either direction.
   b. Maximum Force of 8 Pounds: Required to initiate tab movement.
   c. 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 100-degree F temperature difference between interior structural framework of building and of roof panels.

3. .

J. Provision for Expansion and Contraction:
   1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
      a. Stainless Steel Tabs: Factory centered on roof clip to ensure full movement in either direction.
      b. Maximum Force of 8 Pounds: Required to initiate tab movement.
      c. 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 100-degree F temperature difference between interior structural framework of building and of roof panels.

K. 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 "Scrubolt™" fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched or field-drilled holes in structural members.
      a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
   3. Fasteners penetrating metal membrane at the following locations do not exceed the frequency listed:
      a. Basic Panel System: 0 per square foot.
      b. High Eave Trim, No Parapet: 2 per linear foot.
      c. Exterior Eave Gutter: 2 per linear foot.
      d. Panel Splices: 2 per linear foot.
      e. Gable Trim: 0 per linear foot.
      f. High Eave with Parapet: 0 per linear foot.
      g. Ridge: 0 per linear foot.
      h. Low Eave Structural: 1.5 per linear foot.

L. 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: "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" 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.
      a. Parts: Compatible and not cause corrosive condition.
      b. Copper and Lead Materials: Do not use with Galvalume or optional aluminum-coated panels.

M. Thermal Performance:
   1. Determine thermal performance in accordance with ASTM C 1363 and test U-factors for composite roof section.
   2. "Thermax" Insulation Thicknesses: Maximum 4 inches.

N. Physical Properties:

Specifier Notes: Specify **one** of the following **two** paragraphs for Vapor Retarder.

1. WMP-VR Vapor Retarder:
   a. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.09.
   b. Minimum Workability Temperature: 40 degrees F.
2. WMP-50 Vapor Retarder:
   a. For conditions of high interior humidity, UV-stabilized, white polypropylene film.
   b. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.02.
   c. Minimum Workability Temperature: 20 degrees F.
3. Vapor Retarder UL Fire Hazard Classification Ratings, UL 723:
   a. WMP-VR Vapor Retarder:
      1) Flame Spread: 10.
      2) Smoke Development: 10.
   b. WMP-50 Vapor Retarder:
      1) Flame Spread: 5.
      2) Smoke Development: 30.
4. Insulation Board Facing:
   a. Water Vapor Permeance (perm) Rating, ASTM E 96: 0.03.

Specifier Notes: Refer to DOW Corporation Architect's Thermax Insulation Board Reference Manual for specific information on building code approvals.

5. "Thermax" Metal Building Board Insulation:
   a. Class I Factory Mutual Approval and UL Fire Hazard Classification Ratings, UL 723:
      1) Flame Spread: 25 or less.

2.8 METAL ROOF SYSTEM

A. Metal Roof System: Butler Manufacturing "VSR™ II" roof system.

B. Roof System Design:
1. Design roof panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Design roof paneling system and attachments to support design live, snow, and wind loads.

C. Roof System Performance Testing:
1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
4. FM Global (Factory Mutual):
   a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.

b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
1. Factory roll-formed, 16 inches wide, with 2 major corrugations, 2 inches high, 16 inches on center, and with minor longitudinal striations in the flat of the panel.
2. Due to steel mill tolerances, slight waviness known as “oil canning” may appear in erected panels.

Specifier Notes: Specify **one** of the following **three** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraphs not specified.

3. Panel Material and Finish:
a. 24-gauge steel coated both sides with layer of Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc) applied by continuous hot-dip method.
b. Minimum 0.55-ounce coated weight per square foot as determined by triple-spot test, ASTM A 792.
4. Panel Material and Finish:
a. 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
b. Paint with exterior colors of “Butler-Cote™ 500 FP” finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating.
c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
1) Not to peel, crack, or chip.
2) Chalking: Not to exceed ASTM D 4214, #8 rating.
3) Fading: Not more than 5 color-difference units, ASTM D 2244.
5. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.

E. Insulation:
1. Faced Blanket Insulation in Specified Thickness: Use with option of using thermal blocks to eliminate "thermal short circuits”.

F. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion and Contraction Movement of Roof Panels: Clips with movable tab.
a. Tabs: Factory centered on roof clip to ensure full movement in either direction.
2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and roof panels.

G. Fasteners:
1. Make connections of roof panel clips to structural members with self-drilling fasteners.
a. Self-drilling fasteners attach concealed clips to secondary structural members.

2. Make roof panel side laps with field-formed lock seam, formed by a machine seaming device.

H. Accessories:
1. Accessories (i.e., ventilators, skylights, eave and gable trim, gutters, jacks, and curbs): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

I. Energy Conservation:
1. Insulate roof panel support structural members to eliminate "thermal short circuits" between structural members and roof panels.
2. Eliminate heat loss (thermal short circuit) caused by compression of insulation between structural members and roof panels by use of thermal block at each structural support location.

2.9 METAL ROOF SYSTEM

A. Metal Roof System: Butler Manufacturing "Butlerib® II" roof system.

B. Roof System Design:
1. Design roof panels in accordance with CSA - S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Design roof panels to support a 200-pound load distributed evenly over a 2-foot square area centered between purlins, without exceeding a panel deflection-to-span ratio of 1/180 in a 2-span condition.
3. Design roof paneling system for a minimum roof slope of 1/2 inch in 12 inches.
4. Design roof paneling system to support design live, snow, and wind loads.

C. Roof System Performance Testing:
1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
3. FM Global (Factory Mutual):
   a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
   b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
   c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
1. General:
   a. Factory roll-formed to provide width coverage of 3 feet.
   b. Four major corrugations spaced 12 inches on center.

c. Each Major Corrugation: 1-1/2 inches high, 2-7/8 inches wide, tapering 1-9/32 inches wide at top, with no intermediate minor corrugations.
d. In Panel Flat: Two additional minor corrugations, 1 inch wide, 1/8 inch high, spaced 4 inches on center, between major corrugations.

2. Roof Panel Side Laps:
   a. Overlap 1 major corrugation.
   b. One of the Outboard Corrugations: Formed as overlapping corrugation.
   c. Other Outboard Corrugation: Formed as underneath corrugation.
      1) Full corrugation to provide bearing support to side lap.
      2) Formed with continuous-length sealant groove.
3. Roof Panel End Laps:
   a. 6 inches.
   b. Supply maximum possible panel lengths, up to 38'-9", to minimize panel end laps.

Specifier Notes: Optional unpunched panels are available, but not recommended, for a panel on the same slope running continuously more than 80 feet. Consult Butler Manufacturing for additional information.

c. Factory punch roof panel end laps (top panel with a round hole and bottom panel with a slotted hole) to provide for expansion and contraction and panel alignment.
d. Design end laps to occur over and be fastened to secondary structural members.

4. Ridge Panels:
   a. One-piece, factory formed to match roof slope.
   b. Ridge Panel Cross Section: Match roof panels.
   c. Ridge Panel Splices: Occur over first purlin on either side of building center.
5. Eave Panels: Extend beyond building structural line.
6. Factory punch roof panels at panel ends to match factory-punched or field-drilled holes in structural members to ensure proper alignment.

Specifier Notes: The following sentence is optional, but required for the optional 10-year weathertightness warranty. Consult Butler Manufacturing for additional information.

a. Upper End of Eave and Splice Panels: 3/4-inch-long slots to provide for expansion and contraction of panels.

Specifier Notes: Specify **one** of the following **three** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraphs not specified.

7. Panel Material and Finish:
   a. 26-gauge or 24-gauge steel coated both sides with layer of Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc) applied by continuous hot-dip method.
   b. Minimum 0.55-ounce coated weight per square foot as determined by triple-spot test, ASTM A 792.
8. Panel Material and Finish:

a. 26-gauge or 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
b. Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
   1) Not to peel, crack, or chip.
   2) Chalking: Not to exceed ASTM D 4214, #8 rating.
   3) Fading: Not more than 5 color-difference units, ASTM D 2244.

9. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.

E. Provision for Expansion and Contraction:
1. Optional Factory-Punched Roof Panels: 5/16-inch by 3/4-inch-slotted holes at upper end and 5/16-inch-diameter holes at lower end.
2. Slotted Holes: Permit thermal movement of panels without detrimental effect on roof panels.

Specifier Notes: Warranty Requirement: To qualify for the material Extended Life Endorsement (25 years for Galvalume or "Butler-Cote™ 500 FP" finish system) the fasteners shall be "Lock-Rivet™" fasteners, stainless steel "Scrubolt™" fasteners, or stainless steel self-drilling screws. Either factory punched or unpunched roof panels shall be ordered. To qualify for a 10-year Weathertightness Endorsement, the roof panels shall be Galvalume or "Butler-Cote™ 500 FP" finish system and the Extended Life Endorsement shall be ordered. The roof panels and roof structural systems shall be factory punched and the panel-to-panel connection fasteners shall be "Lock-Rivet™" fasteners. Panel-to-structural connection fasteners shall be stainless steel "Scrubolt™" fasteners or "Lock-Rivet™" fasteners.

F. Fasteners:
1. Fastener Locations and Quantities: Indicated on erection drawings furnished by metal building system manufacturer.

Specifier Notes: Specify **one** of the following **five** Panel-to-Structural Connections paragraphs. Delete Panel-to-Structural Connections paragraphs not specified.

2. Panel-to-Structural Connections: Case-hardened, electrogalvanized carbon steel, yellow-chromate finish "Scrubolt™" fasteners, 3/8-inch hex head, with 3/4-inch OD galvanized-steel-backed EPDM washers.
3. Panel-to-Structural Connections: Type 410 stainless steel "Scrubolt™" fasteners, 3/8-inch hex head, with 3/4-inch OD aluminum-backed EPDM washers.
4. Panel-to-Structural Connections: 1/4-14 by 1-1/4-inch galvanized steel, 3/8-inch hex-head self-drilling fasteners, with 3/4-inch OD galvanized-steel-backed EPDM washers.
5. Panel-to-Structural Connections: 1/4-14 by 1-1/4-inch stainless steel, 3/8-inch hex-head self-drilling fasteners, with 3/4-inch OD aluminum-backed EPDM washers.
6. Panel-to-Structural Connections: Self-clinching aluminum "Lock-Rivet™" fasteners, with 3/4-inch diameter low-profile-head EPDM washers.

Specifier Notes: Specify **one** of the following **three** Panel-to-Panel Connections paragraphs. Delete Panel-to-Panel Connections paragraphs not specified.

7. Panel-to-Panel Connections: #14-14 by 7/8-inch galvanized steel 3/8-inch hex-head mini-point self-drilling screws, with 5/8-inch OD metal-backed EPDM washers.
8. Panel-to-Panel Connections: #14-14 by 7/8-inch stainless steel 3/8-inch hex-head mini-point self-drilling screws, with 5/8-inch OD aluminum-backed EPDM washers.
9. Panel-to-Panel Connections: Self-clinching aluminum "Lock-Rivet™" fasteners, with 3/4-inch diameter low-profile-head EPDM washers.

G. Accessories:
1. Accessories (i.e., ventilators, skylights, eave and gable trim, gutters, jacks, and curbs): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

Specifier Notes: Specify Butler Manufacturing™ Butlerib® II", "Shadowall™", "Fluted StylWall® II", "Flat StylWall® II", "Thermawall™ Fluted", "Thermawall™ Fine Line", "Thermawall™ Flat", or "TextureWall™" metal wall system. Delete metal wall systems not specified.

2.10 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Butlerib® II" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. Roll-formed panels, 3 feet wide with 4 major corrugations, 1-1/2 inches high, 12 inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.
2. One piece from base to building eave.
3. Upper End of Panels: Fabricate with mitered cut to match corrugations of "Butlerib® II" roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.
4. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.

Specifier Notes: Specify **one** of the following **two** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraph not specified.

5. Panel Material and Finish:

a. 26-gauge or 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
b. Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
   1) Not to peel, crack, or chip.
   2) Chalking: Not to exceed ASTM D 4214, #8 rating.
   3) Fading: Not more than 5 color-difference units, ASTM D 2244.

6. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.

D. Fasteners:
1. Wall Panel-to-Structural Connections: Torx-head "Scrubolt™" fasteners.
2. Wall Panel-to-Panel Connections: Torx-head self-drilling screws.
3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
4. Exposed Fasteners: Factory painted to match wall color.

E. Accessories:
1. Accessories (i.e., doors, windows, louvers): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.11 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Shadowall™" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. Roll-formed panels, 3 feet wide with 4 major corrugations, 1-7/16 inches high, 12 inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.
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. Upper End of Panels: Fabricate with mitered cut to match corrugations of "Butlerib® II" roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.
6. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.

Specifier Notes: Specify **one** of the following **two** Panel Material and Finish paragraphs. Delete Panel Material and Finish paragraph not specified.

7. Panel Material and Finish:

a. 26-gauge or 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
b. Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
   1) Not to peel, crack, or chip.
   2) Chalking: Not to exceed ASTM D 4214, #8 rating.
   3) Fading: Not more than 5 color-difference units, ASTM D 2244.

8. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.

D. Fasteners:
1. Wall Panel-to-Structural Connections: Torx-head "Scrubolt™" or Torx-head self-drilling screws.
2. Wall Panel-to-Panel Connections: Torx-head self-drilling screws.
3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
4. Exposed Fasteners: Factory painted to match wall color.

E. Accessories:
1. Accessories (i.e., doors, windows, louvers): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

F. Energy Conservation:
1. Insulate secondary structurals (optional) to eliminate "thermal short circuits" between structurals and wall panels.
2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and wall panels by use of thermal block at each structural location.

2.12 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Fluted StylWall® II" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. 16 inches wide with interlocking joints.
2. Roll-form panels with alternating 4-inch by 7/16-inch box corrugations with hidden joint concealing fasteners between panels.
3. Roll-form panels to provide hidden joint concealing fasteners between panels.
4. One piece from base to top of wall with a maximum length of 40'-0".
5. Both Ends of Each Panel: Square cut and unpunched.

6. Panel Material and Finish:
    a. 24-gauge galvanized steel, ASTM A 653, G90.
    b. Embossed finish.
    c. Panel Exterior: Pre-finished with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    d. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
        1) Not to peel, crack, or chip.
        2) Chalking: Not to exceed ASTM D 4214, #8 rating.
        3) Fading: Not more than 5 color-difference units, ASTM D 2244.

D. Insulation:

Specifier Notes: The wall panel system may incorporate a variety of insulation options, including batt insulation, blanket insulation, or rigid insulation board. Consult Butler Manufacturing™ for more information.

1. When Used as Fascia Panels: Insulation not required.
2. Total Insulation Thickness Greater Than 4 Inches: Field notch insulation at structural members to prevent outward bowing of wall panel face.

E. Fasteners:
1. Base, Top, and Girt Connections: Self-drilling sheet metal screws.
2. Reinforcement Clip: Use in conjunction with self-drilling sheet metal screws at wall panel to structural connections.
    a. Not required with fascia panels.
3. Panel-to-Panel Fasteners: Not required.
    a. Make connections from outside, hidden in panel joint, eliminating exposed fasteners.

F. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

G. Energy Conservation:
1. Insulate secondary structurals (optional) to eliminate "thermal short circuits" between structurals and wall panels.
2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and wall panels by use of thermal block at each structural location.

2.13 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Flat StylWall® II" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
   1. 16 inches wide with interlocking joints.
   2. Roll-form panels to provide flat panel with hidden joint concealing fasteners between panels.
      a. Flat of Panel: Laminated to “Thermax” insulation board to provide rigidity, maintain flatness, and improve thermal performance.
   3. One piece from base to top of wall with a maximum length of 40'-0".
   4. Both Ends of Each Panel: Square cut and unpunched.
   5. Panel Material and Finish:
      a. 26-gauge galvanized steel, ASTM A 653, G90.
      b. Due to steel mill tolerances, slight waviness known as "oil canning" may appear in erected panels.
      c. Embossed finish.
      d. Panel Exterior: Pre-finished with “Butler-Cote™ 500 FP” finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating.
      e. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
         1) Not to peel, crack, or chip.
         2) Chalking: Not to exceed ASTM D 4214, #8 rating.
         3) Fading: Not more than 5 color-difference units, ASTM D 2244.

D. Insulation Board:

Specifier Notes: The flat wall panels with rigid Thermax insulation board can provide the insurance and code approvals when the inside surface of the panel is covered by an insurance and/or code-approved material (such as blanket insulation, additional Thermax, gypsum board, etc.).

   1. Flat Panel Insulation Board: Nominal 1-inch rigid “Thermax” glass-fiber-reinforced polyisocyanurate foam plastic core, covered with aluminum facing on both sides.
      a. Mill finish aluminum exposed.

E. Insulation:

Specifier Notes: The wall panel system may incorporate a variety of insulation options, including batt insulation, blanket insulation, or rigid insulation board. Consult Butler Manufacturing™ for more information.

   1. When Used as Fascia Panels: Insulation not required.
   2. Total Insulation Thickness Greater Than 4 Inches: Field notch insulation at structural members to prevent outward bowing of wall panel face.
   3. Tested U-Value of Flat Wall Panels Without Other Insulation: 0.29 (equivalent to 1 inch of fiberglass insulation).

Specifier Notes: Refer to DOW Corporation Architect's Thermax Insulation Board Reference Manual for specific information on building code approvals.

4. Insulation Board: Class I Factory Mutual Approval and US Fire Hazard Classification (UL 723) with the following ratings:
   a. Flame Spread: 25 or less.
   b. Smoke Developed: Less than 145.

F. Fasteners:
1. Base, Top, and Girt Connections: Self-drilling sheet metal screws.
2. Reinforcement Clip: Use in conjunction with self-drilling sheet metal screws at wall panel to structural connections.
   a. Not required with fascia panels.
3. Panel-to-Panel Fasteners: Not required.
   a. Make connections from outside, hidden in panel joint, eliminating exposed fasteners.

G. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

H. Energy Conservation:
1. Insulate secondary structurals (optional) to eliminate "thermal short circuits" between structurals and wall panels.
2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and wall panels by use of thermal block at each structural location.

2.14 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Thermawall™ Fluted" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. Steel-faced, shop-assembled, factory-foamed, insulated panel units.
2. Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.

Specifier Notes: Specify wall panel nominal thickness.

3. Nominal Thickness: [2 inches] [2-1/2 inches] [3 inches] [4 inches].
4. One piece from base to top of wall.
5. Maximum Panel Length: 40 feet.
6. Exterior Face:
   a. Nominal Width: 42 inches.

b. Architectural Corrugations: 3/8 inch deep on nominal 8-l/2-inch centers.
c. Finish: Non-directional embossed finish.

7. Interior Face: Roll-formed from pre-painted steel with 1/16-inch-deep corrugations on 6-inch centers.

D. Panel Material and Finish:
1. Corrugated Exterior-Faced Panels: 26-gauge, AZ50 aluminum-zinc coated steel.
2. Interior Face: 26-gauge, AZ50 aluminum-zinc coated steel.
3. Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
4. Exterior Panel Finish: Pre-finished with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in metal building system manufacturer's standard colors.
5. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
a. Not to peel, crack, or chip.
b. Chalking: Not to exceed ASTM D 4214, #8 rating.
c. Fading: Not more than 5 color-difference units, ASTM D 2244.
6. Interior Panel Finish: Paint with USDA-approved interior white polyester paint.

E. Panel Physical Properties:
1. R-Value : Based on actual test results from ASTM C 518 of panel core material.
a. 2-Inch-Thick Panels: 14.16
b. 2-1/2-Inch-Thick Panels: 19.38
c. 3-Inch-Thick Panels: 23.58
d. 4-Inch-Thick Panels: 30.86
2. Insulated Panels: Carry the following listings:
a. Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
b. Guide NYWR, Insulated Wall Construction Subject 1040.
c. Surface Burning Characteristics: Panel core (6-inch unfaced) tested in accordance with ASTM E 84.
1) Flame Spread: 25.
2) Smoke Developed: 450.
d. 1-Hour or 2-Hour Fire-Resistance Ratings: Achieve by incorporating 2 or 4 layers of 5/8-inch Type X gypsum wallboard on interior side of insulated panels.
1) Rated-Wall Assembly: UL listing U652.

F. Fasteners:
1. Base, Top, and Girt Connections and Panel Joint Clip Attachments: #14 self-drilling screws.
a. Install additional "Lockrivet" fasteners, if necessary due to wind load.
2. Panel-to-Panel Fasteners: Not required.
a. Connections: Hidden, eliminating exposed fasteners.

G. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.15 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Thermawall™ Fine Line" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
   1. Steel-faced, shop-assembled, factory-foamed, insulated panel units.
   2. Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.

Specifier Notes: Specify wall panel nominal thickness.

   3. Nominal Thickness: [2 inches] [2-1/2 inches] [3 inches] [4 inches].
   4. One piece from base to top of wall.
   5. Maximum Panel Length: 40 feet.
   6. Exterior Face:
      a. Nominal Width: 42 inches.
      b. Architectural Ribs: 1/16 inch deep on nominal 6-inch centers.
      c. Finish: Non-directional embossed finish.
   7. Interior Face: Roll-formed from pre-painted steel with 1/16-inch-deep corrugations on 6-inch centers.

D. Panel Material and Finish:
   1. Corrugated Exterior-Faced Panels: 26-gauge, AZ50 aluminum-zinc coated steel.
   2. Interior Face: 26-gauge, AZ50 aluminum-zinc coated steel.
   3. Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
   4. Exterior Panel Finish: Pre-finished with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in metal building system manufacturer's standard colors.
   5. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
      a. Not to peel, crack, or chip.
      b. Chalking: Not to exceed ASTM D 4214, #8 rating.
      c. Fading: Not more than 5 color-difference units, ASTM D 2244.
   6. Interior Panel Finish: Paint with USDA-approved interior white polyester paint.

E. Panel Physical Properties:
   1. R-Value : Based on actual test results from ASTM C 518 of panel core material.
      a. 2-Inch-Thick Panels: 14.16
      b. 2-1/2-Inch-Thick Panels: 19.38
      c. 3-Inch-Thick Panels: 23.58
      d. 4-Inch-Thick Panels: 30.86
   2. Insulated Panels: Carry the following listings:
      a. Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
      b. Guide NYWR, Insulated Wall Construction Subject 1040.

c. Surface Burning Characteristics: Panel core (6-inch unfaced) tested in accordance with ASTM E 84.
   1) Flame Spread: 25.
   2) Smoke Developed: 450.
d. 1-Hour or 2-Hour Fire-Resistance Ratings: Achieve by incorporating 2 or 4 layers of 5/8-inch Type X gypsum wallboard on interior side of insulated panels.
   1) Rated-Wall Assembly: UL listing U652.

F. Fasteners:
1. Base, Top, and Girt Connections and Panel Joint Clip Attachments: #14 self-drilling screws.
   a. Install additional "Lockrivet" fasteners, if necessary due to wind load.
2. Panel-to-Panel Fasteners: Not required.
   a. Connections: Hidden, eliminating exposed fasteners.

G. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.16 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Thermawall™ Flat" wall system.

B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. Steel-faced, shop-assembled, factory-foamed, insulated panel units.
2. Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.

Specifier Notes: Specify wall panel nominal thickness.

3. Nominal Thickness: [2 inches] [2-1/2 inches] [3 inches] [4 inches].
4. One piece from base to top of wall.
5. Maximum Panel Length: 40 feet.
6. Exterior Face:
   a. Nominal Width: 36 inches.
   b. Roll-formed, flat surface from galvanized steel.
   c. Finish: Non-directional embossed finish.
7. Interior Face: Roll-formed from pre-painted steel with 1/16-inch-deep corrugations on 6-inch centers.

D. Panel Material and Finish:
1. Corrugated Exterior-Faced Panels: 22-gauge, AZ50 aluminum-zinc coated steel.
2. Interior Face: 26-gauge, AZ50 aluminum-zinc coated steel.

3. Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
4. Exterior Panel Finish: Pre-finished with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in metal building system manufacturer's standard colors.
5. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
   a. Not to peel, crack, or chip.
   b. Chalking: Not to exceed ASTM D 4214, #8 rating.
   c. Fading: Not more than 5 color-difference units, ASTM D 2244.
6. Interior Panel Finish: Paint with USDA-approved interior white polyester paint.

E. Panel Physical Properties:
1. R-Value : Based on actual test results from ASTM C 518 of panel core material.
   a. 2-Inch-Thick Panels: 14.16
   b. 2-1/2-Inch-Thick Panels: 19.38
   c. 3-Inch-Thick Panels: 23.58
   d. 4-Inch-Thick Panels: 30.86
2. Insulated Panels: Carry the following listings:
   a. Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
   b. Guide NYWR, Insulated Wall Construction Subject 1040.
   c. Surface Burning Characteristics: Panel core (6-inch unfaced) tested in accordance with ASTM E 84.
      1) Flame Spread: 25.
      2) Smoke Developed: 450.
   d. 1-Hour or 2-Hour Fire-Resistance Ratings: Achieve by incorporating 2 or 4 layers of 5/8-inch Type X gypsum wallboard on interior side of insulated panels.
      1) Rated-Wall Assembly: UL listing U652.

F. Fasteners:
1. Base, Top, and Girt Connections and Panel Joint Clip Attachments: #14 self-drilling screws.
   a. Install additional "Lockrivet" fasteners, if necessary due to wind load.
2. Panel-to-Panel Fasteners: Not required.
   a. Connections: Hidden, eliminating exposed fasteners.

G. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.17 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "TextureWall™" wall system.

B. Wall System Design: Design wall panels in accordance with CSA - S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
1. Steel-faced, shop-assembled, factory-foamed, insulated panel units.
2. Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.

Specifier Notes: Specify wall panel nominal thickness.

3. Nominal Thickness: [2 inches] [2-1/2 inches] [3 inches] [4 inches].
4. One piece from base to top of wall.
5. Maximum Panel Length: 40 feet.
6. Exterior Face:
   a. Nominal Width: 36 inches.
   b. Roll-formed, flat surface from 24-gauge, Galvalume-coated steel.
   c. Finish: Non-directional embossed finish, factory cleaned, pretreated, and coated with baked-on finish compatible for "Texture-Cote" finish system adhesion.
7. Interior Face: Roll-formed from pre-painted steel with 1/16-inch-deep corrugations on 6-inch centers.

D. Panel Material and Finish:
1. Flat Exterior Face: 24-gauge, AZ50 aluminum-zinc coated steel.
2. Interior Face: 26-gauge, AZ50 aluminum-zinc coated steel.
3. Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
4. Exterior Finish: "Texture-Cote" finish system applied to substrate and factory cured.
   a. Warranty: 10-year warranty on material and application.
   b. Resistance to cracking, checking, and loss of adhesion.
   c. Resistance to chalk and color fade.
   d. Resistance to dry heat.
   e. Does not support growth of mold or mildew.
   f. Report Test Results of the Following Laboratory Testing:
      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) Flexibility, ASTM D 522.
      4) Resistance to accelerated weathering in Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
      5) Abrasion resistance, ASTM D 968.
      6) Flame Spread, ASTM E 84: Not to exceed 15.
      7) Smoke Development, ASTM E 84: Less than 10.
5. Base Angle and Trim: Extruded plain anodized aluminum with optional trim cap to match wall color.
6. Windows: Thermally broken, aluminum extrusions with bronze anodized finish.
7. Horizontal Panel Joint Trim: Extruded aluminum factory painted to match panel exterior face color.
8. Interior Finish: Paint with USDA-approved interior white polyester paint.

E. Panel Physical Properties:
1. R-Value : Based on actual test results from ASTM C 518 of panel core material.
   a. 2-Inch-Thick Panels: 14.16

b. 2-1/2-Inch-Thick Panels: 19.38
c. 3-Inch-Thick Panels: 23.58
d. 4-Inch-Thick Panels: 30.86

2. Insulated Panels: Carry the following listings:
   a. Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
   b. Guide NYWR, Insulated Wall Construction Subject 1040.
   c. Surface Burning Characteristics: Panel core (6-inch unfaced) tested in accordance with ASTM E 84.
      1) Flame Spread: 25.
      2) Smoke Developed: 450.
   d. 1-Hour or 2-Hour Fire-Resistance Ratings: Achieve by incorporating 2 or 4 layers of 5/8-inch Type X gypsum wallboard on interior side of insulated panels.
      1) Rated-Wall Assembly: UL listing U652.

F. Fasteners:
1. Base, Top, and Girt Connections and Panel Joint Clip Attachments: #14 self-drilling screws.
   a. Install additional “Lockrivet” fasteners, if necessary due to wind load.
2. Panel-to-Panel Fasteners: Not required.
   a. Connections: Hidden, eliminating exposed exterior fasteners.

G. Accessories:
1. Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.18 INSULATION

A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, “Certified R” metal building insulation.
1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.

B. Back-Fill Insulation: Owens-Corning Fiberglas unfaced “Pink Metal Building Insulation Plus”.

Specifier Notes: Specify **one** of the following **two** paragraphs. Fill in information.

C. Roof Insulation:
1. Nominal Thickness: _____ inches.
2. Certified R-Value: _____.

D. Roof Assembly U-Factor: _____ Btu/hr/sq ft/deg F.

Specifier Notes: Specify **one** of the following **two** paragraphs. Fill in information.

E. Wall Insulation:
1. Nominal Thickness: _____ inches.

2. Certified R-Value: _____.

F. Wall Assembly U-Factor: _____ Btu/hr/sq ft/deg F.

Specifier Notes: Specify **one** of the following **10** Roof and Wall Insulation Facing paragraphs. Delete Roof and Wall Insulation Facing paragraphs not specified.

G. Roof and Wall Insulation Facing: R-3035 HD (FSK-HD) (Silver).
   1. 0.0003-inch-thick, aluminum foil laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim, in unpainted (AluminumAdhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket
   2. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Facing Perm Rating: 0.02.

H. Roof and Wall Insulation Facing: PSK Light Duty (WMP-VR).
   1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to 11-pound Kraft paper, reinforced with glass-fiber scrim, in white.
   2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.09.

I. Roof and Wall Insulation Facing: PSK Standard Duty (WMP-10).
   1. 0.0015-inch-thick, UV-stabilized, white metalized polypropylene laminated to 14-pound Kraft paper, reinforced with glass-fiber scrim.
   2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

J. Roof and Wall Insulation Facing: PSK Heavy Duty (WMP-30).
   1. 0.0005-inch-thick, UV-stabilized, white metalized polypropylene laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim.
   2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

K. Roof and Wall Insulation Facing: WMP-VR-R.
   1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to metalized polyester film, reinforced with glass-fiber scrim.
   2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:

a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

L. Roof and Wall Insulation Facing: WMP-50.
1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 30-pound Kraft paper/metalized polyester, reinforced with glass-fiber and polyester scrim.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

M. Roof and Wall Insulation Facing: WMP-F (PSF) (White).
1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 0.0003-inch-thick aluminum foil, reinforced with glass-fiber scrim, in white.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

N. Roof and Wall Insulation Facing: WCF-50.
1. 0.0003-inch-thick, UV-stabilized, white-coated, aluminum foil laminated to 30-pound Kraft paper, reinforced with glass-fiber and polyester scrim, and metalized polyester film.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

O. Roof and Wall Insulation Facing: “Arenashield”.
1. 0.0003-inch-thick, aluminum foil laminated to glass-fiber scrim reinforcement.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

P. Roof and Wall Insulation Facing: “Gymguard”.
1. 0.0015-inch-thick, white metalized polypropylene film, reinforced with glass-fiber scrim.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

Specifier Notes: Specify **one** of the following **two** Insulation Support Systems. Delete Insulation Support System not specified.

2.19 INSULATION SUPPORT SYSTEM

A. Insulation Support System: Butler Manufacturing™ "Sky-Web®" insulation support system.

B. Description:
1. 1,000 denier polyester yarn interwoven on nominal 1/2-inch-square grid coated with fire-retardant, UV-stabilized, PVC-based binder.
2. Polypropylene tape bindings on all 4 edges.
   a. Two Edges that Attach to Building Eave Members: Reinforce with 1/4-inch-diameter polypropylene rope.
3. Furnish in building bay lengths by building widths.
   a. Cover 1 bay of building length.
   b. Extend eave-to-eave across building.

C. Physical Properties:
1. Tensile Strength (pounds/yarn):
   a. Machine Direction: 15 pounds.
   b. Cross Direction: 15 pounds.
2. Ends per Inch:
   a. Machine Direction: 2.5.
   b. Cross Direction: 2.0.
3. Weight: 0.28 to 0.32 ounces per sq ft

D. Fasteners and Attachment Hardware:
1. Connections to Eave Members: Steel strapping and self-drilling screws.
2. Mesh-to-Insulation Support System Edge Connections: Plastic cable ties.

E. Fire-Hazard Classification:
1. UL Fire-Hazard Classification Ratings, UL 723:
   a. Flame Spread: 15.
   b. Smoke Developed: 400.

2.20 INSULATION SUPPORT SYSTEM

A. Insulation Support System: Butler Manufacturing™ "Sky-Web® II" insulation support system.

B. Description:
1. Compatible with roof system.
2. Limit to "over-the-purlin" type insulation systems.
3. Knotted Mesh:
   a. Grid: Nominal 2-3/4 inches by 2-3/4 inches.
   b. Material: Twisted twine of DuPont nylon Type 6-6 fiber.
   c. Mesh Covering Interior Bays: 21-pound twine.
      1) Five-Foot Strip Along Edge: #30 twine, with edge color coded for identification.
4. Double selvage along the 2 edges in machine direction.

5. Furnish up to 60 feet wide by building width.
    a. Cover 1 or 2 bays of building length
    b. Extend eave-to-eave across building.

C. Physical Properties:
1. Minimum Tensile Strength:
    a. #21 Twine: 205 pounds.
    b. #30 Twine: 265 pounds.
2. Runnage:
    a. #21 Twine: 960 feet per pound.
    b. #30 Twine: 605 feet per pound.
3. Cord Used to Make Mesh-to-Mesh Edge Connections: #36 DuPont nylon Type 6-6 white braided twine.
    a. Minimum Tensile Strength: 360 pounds.
    b. Runnage: 533 feet per pound.
4. Mesh Weight: 0.012 pounds per sq ft.

D. Fasteners and Attachment Hardware:
1. Connections to Eave and Gable Members:
    a. 1/8-inch-diameter wire clips looped through 20-gauge steel V-straps.
    b. Steel V-Straps: Fasten to framing with self-drilling screws.
2. Mesh-to-Mesh Edge Connections:
    a. Lace #36 nylon cord through edges of pieces of mesh being connected.
    b. Edge Connections: Plastic cable ties.

E. Fire-Hazard Classification:
1. UL Fire-Hazard Classification Ratings, UL 723:
    a. Flame Spread: 3 or less.
    b. Smoke Developed: Less than 10.

2.21 ROOF INSULATION SYSTEM

A. Roof Insulation System: Butler Manufacturing™ "ThermaLiner™" roof insulation system.

B. System Components:

Specifier Notes: Edit the following sentence for the metal roof system specified in PART 2 of this specification section.

1. Metal Roof System: Butler Manufacturing™ ["MR-24®"] ["VSR™ II"] ["Butlerib® II"] metal roof system.
2. Sub-Structural System:
    a. 3-inch nominal zee-shaped members (nominal 0.060-inch-thick, acrylic-coated, galvanized steel), factory punched for specific roof system being installed.
    b. Support Brackets:
        1) 3-inch, 5-inch, or 8-inch height support zee and provide space for various thicknesses of insulation.

2) Install with self-drilling fasteners through interior liner panel and into building structure.

c. Attach zees to support brackets with self-drilling fasteners.

3. Mod 36 Interior Liner Panels:
   a. Form from 0.0149 - inch minimum total coated thickness coated steel with minimum yield strength of 80,000 psi.
   b. Nominal 36-inch-wide panel with corrugations ½ inch high, 3 inches on center.
   c. Factory cut to required length.

Specifier Notes: Specify **one** of the following **two** sentences.

   d. Unpainted Liner Panels: Galvalume aluminum-zinc alloy coated steel, AZ55 in accordance with ASTM A 792
   e. Painted Liner Panels:
      1) Exposed Side: 0.15-mil min primer and 0.70-mil minimum interior white polyester paint.
      2) Unexposed Side: 0.1-mil minimum primer and 0.40 minimum polyester backer

4. Vapor Retarder:

Specifier Notes: Specify **one** of the following **three** paragraphs.

   a. Liner Panel, Sidelaps, and Endlaps: Seal with “Panlastic” sealant to prevent vapor transmission between sheets.
      1) Foam Closure: Use at terminating ends of liner panels to seal corrugations of panels.
   b. 0.0032-inch minimum thick vinyl facing rolled out over top of liner panels.
      1) Perm Rating: 1.0.
   c. Facing material of vinyl film and metalized substrate laminated to glass fiber scrim reinforcement (VRP) rolled out over top of liner panels.
      1) Perm Rating: 0.02.

5. Insulation:
   a. Unfaced Insulation: NAIMA 202.
   b. Top Layer of Blanket Insulation: 3-inch-thick insulation installed between roof panels and 3-inch zee.
      1) Furnish insulation in rolls of 3-foot, 4-foot, 5-foot, or 6-foot width.
   c. Bottom Layer of Blanket Insulation: Furnish in rolls of 3-foot, 4-foot, 5-foot, or 6-foot width or 5-foot by 5-foot batts.
      1) Thickness of Bottom Layer: Vary dependent on overall thermal performance of system desired. Refer to the following chart.

Specifier Notes: The following sentence is only for use with the “MR-24®”, “VSR™ II” or BR-II metal roof systems and is optional.

   d. Zee Member: Insulated using 3/4-inch-nominal-thick extruded polystyrene foam insulation block along each zee location to minimize “thermal short circuit” between zee and roof panels.

Insulation / U-Factor Chart

System Description	System Height	Roof System	Insulated/ Uninsulated Purlin	Lower Layer(s)	Upper Layer	Total R-value	U-factor	Effective R-value = 1/U
TL 6 MR	6”	MR-24	Uninsulated	R-11 (3.5")	R-11 (3.5")	22	0.051	19.5
TL 7 MR	7-1/4”	MR-24	Insulated	R-13 (4")	R-11 (3.5")	24	0.046	21.7
TL 8 MR	8”	MR-24	Uninsulated	R-19 (6")	R-11 (3.5")	30	0.039	25.8
TL 9 MR	9-1/4”	MR-24	Insulated	R-19 (6")	R-11 (3.5")	30	0.033	30.3
TL 11 MR	11”	MR-24	Uninsulated	R-16 + R11 (5"+3.5")	R-11 (3.5")	38	0.028	35.2
TL12 MR	12-1/4”	MR-24	Insulated	R-19 + R-11 (6"+3.5")	R-11 (3.5")	41	0.026	38.7
TL VSR 6	6”	VSR II	Uninsulated	R-11 (3.5")	R-11 (3.5")	22	0.052	19.2
TL VSR 7	7-1/4”	VSR II	Insulated	R-13 (4")	R-11 (3.5")	24	0.047	21.2
TL VSR 8	8”	VSR II	Uninsulated	R-16 (5")	R-11 (3.5")	27	0.040	25.0
TL VSR 9	9-1/4”	VSR II	Insulated	R-19 (6")	R-11 (3.5")	30	0.036	27.8
TL VSR 11	11”	VSR II	Uninsulated	R-13 + R13 (4"+4")	R-11 (3.5")	37	0.029	34.5
TL VSR 12	12-1/4”	VSR II	Insulated	R-19 + R-11 (6"+3.5")	R-11 (3.5")	41	0.027	37.0
TL 6 BR	6”	Butlerib II	NA	R-11 (3.5")	R-11 (3.5")	22	0.052	19.2
TL 8 BR	8”	Butlerib II	NA	R-16 (5")	R-11 (3.5")	27	0.041	24.1
TL 11 BR	11”	Butlerib II	NA	R-13 + R-13 (4"+4")	R-11 (3.5")	37	0.029	34.5

FEA Model U-Factor: These values are based upon a calculated U-factor using Finite Element Analysis, which reflect in-place performance. This FEA method has been calibrated by thermal tests and is the currently accepted method for determining accurate thermal performance expectations. R-value = 1/U-factor.

Insulation R-Value: These values were calculated using typical published R-values of insulation. This method does NOT take into account compression of insulation and other possible thermal loss areas of installation.

C. Fasteners:
   1. Sub-structurals and Liner Panels: Install with self-drilling screws for attachment
   2. Roof Attachment Fasteners: As specified under Roof System in this specification section.

D. Provision for Expansion and Contraction:
   1. Provision for Thermal Expansion and Contraction Movement: Accomplish in roof system.
   2. As specified under Roof System in this specification section.

E. Performance Testing: As specified under Roof System in this specification section.

2.22 ROOF INSULATION SYSTEM

A. Roof Insulation System: Butler Manufacturing™ “TBS™” roof insulation system.

B. System Components:
   1. Metal Roof System: Butler Manufacturing™ “MR-24®” metal roof system.

2. Roof Panel Supports:
    a. Pre-assembled 5-inch high 'insulation bridge' members, with.
        1) 4-foot long by 2-1/2" wide bridge channel to support flat of roof panels
        2) 5-inch high zee clips fastened to bridge channel at 1'o.c.
            a) factory punched 'tubulated holes' provide for roof clip attachment
            b) provide space for various thicknesses of insulation
        3) Attach insulation bridges to roof purlins with scrubolt™ fasteners.

3. Insulation:
    a. Faced Bottom Layer of Blanket Insulation
        1) Insulation facing

Specifier Notes: Specify **one** of the following **10** Roof and Wall Insulation Facing paragraphs. Delete Roof and Wall Insulation Facing paragraphs not specified.

C. Roof and Wall Insulation Facing: R-3035 HD (FSK-HD) (Silver).
    1. 0.0003-inch-thick, aluminum foil laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim, in unpainted (Aluminum Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket
    2. Assembly of Insulation Blanket and Facing:
        a. Flame Spread Rating: Less than 25.
        b. UL Label: Submit as specified in Submittals article of this section.
        c. Facing Perm Rating: 0.02.

D. Roof and Wall Insulation Facing: PSK Light Duty (WMP-VR).
    1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to 11-pound Kraft paper, reinforced with glass-fiber scrim, in white.
    2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
    3. Assembly of Insulation Blanket and Facing:
        a. Flame Spread Rating: Less than 25.
        b. UL Label: Submit as specified in Submittals article of this section.
        c. Perm Rating: 0.09.

E. Roof and Wall Insulation Facing: PSK Standard Duty (WMP-10).
    1. 0.0015-inch-thick, UV-stabilized, white metalized polypropylene laminated to 14-pound Kraft paper, reinforced with glass-fiber scrim.
    2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
    3. Assembly of Insulation Blanket and Facing:
        a. Flame Spread Rating: Less than 25.
        b. UL Label: Submit as specified in Submittals article of this section.
        c. Perm Rating: 0.02.

F. Roof and Wall Insulation Facing: PSK Heavy Duty (WMP-30).
    1. 0.0005-inch-thick, UV-stabilized, white metalized polypropylene laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim.
    2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
    3. Assembly of Insulation Blanket and Facing:

a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

G. Roof and Wall Insulation Facing: WMP-VR-R.
1. 0.0015-inch-thick, UV-stabilized, white polypropylene laminated to metalized polyester film, reinforced with glass-fiber scrim.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

H. Roof and Wall Insulation Facing: WMP-50.
1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 30-pound Kraft paper/metalized polyester, reinforced with glass-fiber and polyester scrim.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

I. Roof and Wall Insulation Facing: WMP-F (PSF) (White).
1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 0.0003-inch-thick aluminum foil, reinforced with glass-fiber scrim, in white.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

J. Roof and Wall Insulation Facing: WCF-50.
1. 0.0003-inch-thick, UV-stabilized, white-coated, aluminum foil laminated to 30-pound Kraft paper, reinforced with glass-fiber and polyester scrim, and metalized polyester film.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

K. Roof and Wall Insulation Facing: “Arenashield”.
1. 0.0003-inch-thick, aluminum foil laminated to glass-fiber scrim reinforcement.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
a. Flame Spread Rating: Less than 25.
b. UL Label: Submit as specified in Submittals article of this section.
c. Perm Rating: 0.02.

L. Roof and Wall Insulation Facing: “Gymguard”.

1. 0.0015-inch-thick, white metalized polypropylene film, reinforced with glass-fiber scrim.
2. Adhere facing to Owens-Corning Fiberglas “Certified R”, NAIMA 202, fiberglass blanket.
3. Assembly of Insulation Blanket and Facing:
    a. Flame Spread Rating: Less than 25.
    b. UL Label: Submit as specified in Submittals article of this section.
    c. Perm Rating: 0.02.

        2) Furnish insulation in rolls of 4-foot width.
        3) Thickness of Bottom Layer: Vary dependent on overall thermal performance of system desired. Refer to the following chart.
    d. Unfaced Top Layer of Blanket Insulation: NAIMA 202.
        1) Furnish insulation in rolls of 2-foot width.
        2) Thickness of Top Layer: Vary dependent on overall thermal performance of system desired. Refer to the following chart.

Insulation / U-Factor Chart

MR-24 Thermal Spacer Block	Faced Lower Layer(s)	Unfaced Upper Layer	U-factor	Effective R-value = 1/U
Required	R-16	R-19	0.035	28.5
Required	R-19	R-25	0.030	33.2
Required	R-19	R-30	0.029	34.4

U-Factor: These values were determined through certified guarded Hot Box testing. R-value = 1/U-factor.

Insulation R-Value: These values were suppliers’ published R-values of actual insulation materials used in hot box testing.

M. Fasteners:
1. Roof Supports (Insulation Bridges): Install with scrubolt™ fasteners for attachment
2. Roof Attachment Fasteners: As specified under Roof System in this specification section.

N. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion and Contraction Movement: Accomplish in roof system.
2. As specified under Roof System in this specification section.

O. Performance Testing: As specified under Roof System in this specification section.

Specifier Notes: Specify "Butler-Cote™ 500 FP" finish system or "Texture-Cote" metal coating system. Delete metal coating system not specified.

2.23 METAL COATING SYSTEM

A. Metal Coating System: Butler Manufacturing™ "Butler-Cote™ 500 FP" finish system a factory-applied, exterior metal coating system

B. Substrate Preparation:
   1. G90 Hot-Dipped Galvanized Steel or AZ50 Galvalume: Factory-controlled chemical-conversion treatment.

C. Coating:
   1. Material: A full-strength, 70 percent, "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) color coating.
   2. After steel preparation, coat exterior exposed surface with primer and PVDF
      a. Nominal Total Dry Film Thickness: 1.0 mil.
   3. Interior Exposed Surfaces: Coat with polyester color coat.
   4. Apply coatings to entire material dimensions of steel sheets before forming of panels.

D. 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:
      a. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
      b. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
      c. Reverse impact resistance, ASTM D 2794.
      d. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
      e. Resistance to dry heat.
      f. Abrasion resistance, ASTM D 968.
      g. Chemical/acid/pollution resistance, ASTM D 1308 and G 87.
      h. Maintain gloss of finish evenly over entire surface, ASTM D 523

2.24 METAL COATING SYSTEM

A. Metal Coating System: Butler Manufacturing™ "Texture-Cote" factory-applied, exterior metal coating system.

B. Substrate Preparation:
   1. Galvanized Steel: Factory cleaned, pretreated, and coated with baked-on finish compatible for "Texture-Cote" adhesion.

C. Coating:
   1. "Texture-Cote" Finish:
      a. Factory apply to substrate and cure.

b. Warranty: 10-year warranty on material and application.

D. Physical Characteristics of Exterior Coating:
1. Resistance to cracking, checking, and loss of adhesion.
2. Resistance to chalk and color fade.
3. Does not support growth of mold or mildew.
4. Measure by the following laboratory weather-simulating tests to obtain test results justifying metal building system manufacturer's 10-year warranty:
a. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
b. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
c. Flexibility, ASTM D 522.
d. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
e. Resistance to dry heat.
f. Abrasion resistance, ASTM D 968.
g. Flame Spread, ASTM E 84: Not exceed 15.
h. Smoke Developed, ASTM E 84: Less than 10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive metal building system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 ERECTION – STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer’s erection drawings.

B. Field Modifications:
1. Require approval of metal building system manufacturer.
2. Responsibility of building erector.
3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 INSTALLATION – METAL ROOF SYSTEM

Specifier Notes: Specify metal roof system installation for the metal roof system specified in PART 2 of this specification section.

A. Metal Roof System Installation: Butler Manufacturing™ "MR-24®" roof system.
   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 panel clips by matching hole in clip with factory-punched holes in secondary structural members.
   4. 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.
   5. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.
      a. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.
      b. Factory apply side lap sealant.
   6. Panel End Laps: Minimum of 6 inches, sealed with sealant (weather sealing compound), and fastened together by clamping plates.
      a. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
      b. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
      c. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.
   7. Minimum Blanket Insulation Thickness: 2 inches.

B. Metal Roof System Installation: Butler Manufacturing™ "CMR-24®" roof system.
   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-inch 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.
      a. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.
      b. Factory apply side lap sealant.

10. Panel End Laps: Minimum of 6 inches, sealed with “Butler Panlastic” sealant, and fastened together by clamping plates.
    a. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
    b. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
    c. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.

C. Metal Roof System Installation: Butler Manufacturing™ “VSR™ II” roof system.
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. Attach roof panels to supporting structural members with seamed-in-clip device.
    a. Install clip at panel major corrugation.
4. Design roof panel side laps to be interlocking seams with return leg on lower edge of female rib.
    a. Factory apply side lap sealant.
5. Roof Panel End Laps:
    a. Minimum of 6 inches.
    b. Seal with field-applied sealant.
    c. Swage 1 panel end to ensure nestible, watertight end laps.
    d. Install backing plate directly over, but not fastened to, structural support members.
    e. Self-Drilling Fasteners: Do not use to make panel end splices.

D. Metal Roof System Installation: Butler Manufacturing™ Butlerib® II roof system.
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. Factory cut-to-length roof panels in accordance with erection drawings furnished by metal building system manufacturer.
4. Position and align roof panels to hold 3-foot module throughout building length.
    a. Position and align optional factory-punched roof panels by matching factory-punched holes in panels with factory-punched holes in roof structural members.
5. Install side laps with minimum of 1 full corrugation.
6. End Laps:
    a. Minimum of 6 inches.
    b. Fasten together over and to structural members.
7. Panel Side and End Laps: Seal with “Panlastic” sealant to prevent entry of capillary moisture.

3.4 INSTALLATION – METAL WALL SYSTEM

Specifier Notes: Specify metal wall system installation for the metal wall system specified in PART 2 of this specification section.

A. Metal Wall System Installation: Butler Manufacturing™ “Butlerib® II” wall system.

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 1 full corrugation.

Specifier Notes: Specify **one** of the following **two** sentences.

6. Seal wall panels at base with metal trim.
7. Seal wall panels at base with metal trim and foam or rubber closures.
8. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:
   a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in standard color of metal building system manufacturer.
   b. Windows: Factory paint aluminum extrusions (thermally broken).
9. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

B. Metal Wall System Installation: Butler Manufacturing™ "Shadowall™" wall system.
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 1 full corrugation.

Specifier Notes: Specify **one** of the following **two** sentences.

6. Seal wall panels at base with metal trim.
7. Seal wall panels at base with metal trim and foam or rubber closures.
8. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:
   a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Paint with exterior colors of "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in standard color of metal building system manufacturer.
   b. Windows: Factory paint aluminum extrusions (thermally broken).
9. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

C. Metal Wall System Installation: Butler Manufacturing™ "StylWall® II" wall system.
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. Seal wall panels with molded-foam closure block that fits panel configuration at top and bottom of wall panels.
5. Exterior Trim: Match exterior color and embossing of wall panel system, except the following:
    a. Gutters, Downspouts, Eave Trim, Gable Trim, and Base Trim: Galvanized steel factory painted with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    b. Windows: Factory paint aluminum extrusions (thermally broken).
    c. Interior Trim: Painted.
    d. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

D. Metal Wall System Installation: Butler Manufacturing™ "Thermawall™" wall system.
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 for wall panel installation is plumb, level, and aligned as indicated on erection drawings of metal building system manufacturer.
    a. Variation of Intermediate Girts Within Tolerance: Outward direction.
4. Seal wall panels with concealed, factory-applied butyl sealant at side laps and between building structural members and panel interior face at ends of panels.
5. Exterior Trim: Smooth finish and match exterior color of wall panel system, except the following:
    a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Galvanized steel factory painted with "Butler-Cote™ 500 FP" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
    b. Base Angle and Trim: Extruded plain anodized aluminum with optional trim cap to match wall color.
    c. Windows: Aluminum extrusions (thermally broken) with bronze anodized finish.
    d. Horizontal Panel Joint Trim: Extruded aluminum factory painted to match panel exterior face color.
    e. Interior Trim: Painted.
    f. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

E. Metal Wall System Installation: Butler Manufacturing™ "TextureWall™" wall system.
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 for wall panel installation is plumb, level, and aligned as indicated on erection drawings of metal building system manufacturer.
    a. Variation of Intermediate Girts Within Tolerance: Outward direction.
4. Seal wall panels with concealed, factory-applied butyl sealant at side laps and between building structural members and panel interior face at ends of panels.
5. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.5 INSTALLATION – INSULATION

Specifier Notes: Specify insulation installation for the insulation specified in PART 2 of this specification section.

A. Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

3.6 INSTALLATION – INSULATION SUPPORT SYSTEM

Specifier Notes: Specify insulation support system installation for the insulation support system specified in PART 2 of this specification section.

A. Insulation Support System Installation: Butler Manufacturing™ "Sky-Web®" insulation support system.
   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.

B. Insulation Support System Installation: Butler Manufacturing™ "Sky-Web® II" insulation support system.
   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 fiberglass blanket insulation to maintain designed insulation value of roof system.

3.7 INSTALLATION – ROOF INSULATION SYSTEM

A. Roof Insulation System Installation: Butler Manufacturing™ "ThermaLiner™" roof insulation system.
   1. Install roof insulation system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

Specifier Notes: Edit the following sentence for the type of structural system.

   2. Install roof insulation system on Butler Manufacturing™ ["Widespan™"] ["Landmark™"] structural system.

3.8 PROTECTION

A. 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