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**METAL BUILDING SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section covers materials, labor and equipment required to complete the pre-engineered metal building shown and specified.

**1.2 MANUFACTURERS QUALIFICATIONS**

- A. Approval by Contracting Officer is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
- B. Manufacturer regularly and presently manufactures pre-engineered metal buildings as specified as one of its principal products.
- C. Installer has technical qualifications, experience, trained personnel and facilities to install specified items. Approval will not be given, however, where experience record is one of unsatisfactory performance.
- D. Manufacturer's product submitted has been in satisfactory and efficient operation on three installations similar and equivalent to this project for three years. Submit list of installations.

**1.3 DESIGN CRITERIA**

- A. Design metal buildings to resist the dead load, the live load, and the combination of these loads as set forth in Metal Building Manufacturers Association (MBMA) "Recommended Design Practices Manual":
  - 1. Roof Live Load: 20 pounds per square foot) applied on horizontal projection of roof structure.
  - 2. Wind Load: Exposure "B" - 90 MPH.
  - 3. Seismic loading as required by International Building Code.
  - 4. Auxiliary loads consisting of collateral - 10 pounds per square foot.
- B. Deflection Limits (Live and Wind Loads Only):
  - 1. Roof Framing: L/270.
  - 2. Roof Panels: L/180.
  - 3. Walls Panels: L/180., where L = Span length.
- C. Metal Building components shall be capable of supporting design loads without permanent deformation, loss of watertightness, or disengagement of any part of installation.
- D. Maximum "R" Value: Total "R" value through wall panel, roof panels, and insulation shall not be less than R=7-0 and shall take infiltration and stud effect at joints into account.

E. Structural steel sections shall be designed in accordance with AISC, "Specification for Structural Steel Buildings". Light gage cold formed structural members shall be designed in accordance with latest edition of AISI, "Specifications for the Design of Light Gage Cold Formed Steel Structural Members". Welding shall comply with AWS Standard No. D1.1.

F. Metal Building Description:

1. Size 20'-0" x 40'-0".
2. Eave height 12'-8" clear to underside of primary frame roof structure. 12'-0" clear, top of concrete slab to underside of primary frame of roof structure, low side.
3. Single Roof slope 1 in 12.
4. Doors as shown on plan, minimum 7'-0" high.

Note: Metal Building can be in the quick ship category by the manufacture if requirements and specification are complied with.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Samples: Wall and roof panels, 600 mm (24-inch) wide by 300 mm (12 inch) high sections, with factory finish in specified colors. Fasteners for panels
- C. Certificates:
  1. Stating that the zinc coating on steel panels is the specified thickness.
  2. Stating that the thermal values of the roof and wall panels with insulation meet the specified requirements.
  3. Indicating manufacturers and installers meet qualifications specified.
  4. Certificate test reports confirming compliance's with specified bullet resistive rating.
- D. Manufacturer's Literature and Data:
  - Metal Panels
  - Insulation
  - Sealing materials
  - Steel doors, door frames and hardware interlocking thresholds
  - Windows

E. Shop Drawings: Shop drawings, erection drawings and erection manuals showing complete erection layouts, installation instructions, and details of connections. Details and layouts shall show the steel framing location, lengths, and markings of panels and other component parts to correspond with sequence and procedure for erection. Shop drawings shall show connections with adjoining work.

F. Structural Design Analysis:

1. Furnish complete structural design analysis for all structural components of the prefabricated metal buildings.
2. Provide manufacturer load tables indicating the selected panel material, configuration and thickness meets the design requirements for the spans shown.

#### **1.5 STORAGE AND PROTECTION**

Materials stored on site before erection shall be stacked and covered with suitable weather tight covering. Store metal panels so that any accumulated water will drain off. Panels shall not be stored in contact with materials that cause staining. Materials having defects or damages that effect appearance, serviceability or use will be rejected.

#### **1.6 WARRANTY**

Prefabricated metal building shall be warranty against defects in materials and workmanship, and that after erection completed work shall be weather tight and shall be subject to the terms of the "Warranty of Construction" Article in FAR clause 52.246-21, except that the warranty period shall be two years.

#### **1.7 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A36/A36M-05.....Carbon Structural Steel.

A242/A242M-04(E2005)....High-Strength Low-Alloy Structural Steel.

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron-alloy-Coated (Galvannealed) by the Hot-Dip Process

A1008/A1008M(REV A-07)..Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy

A1011/A1011M-07.....Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy

- B209/209M-07.....Aluminum and Aluminum-Alloy Sheet and Plate  
C553-02.....Specifications for Mineral Fiber Blanket  
Thermal Insulation for Commercial and  
Insulation for Commercial and Industrial  
Applications  
D522 REV A-93(R2001)....Standard Test Methods for Mandrel Bend Test of  
Attached Organic Coatings  
D2244-07.....Standard Practice for Calculation of Color  
Tolerances and Color Differences from  
Instrumentally Measured Color Coordinates  
D2794-93(R2004).....Standard Test Method for Resistance of Organic  
Coatings to the Effects of Rapid Deformation
- C. Metal Building Manufacturers Association (MBMA):  
1. Recommended Guide Specifications for Pre-Engineered Metal Buildings.  
2. Recommended Design Practices Manual.
- D. American Institute of Steel Construction (AISC): Document No. 360-05.  
Specifications for Structural Steel Buildings; Allowable Stress Design  
and Plastic Design (1989).
- E. American Welding Society (AWS):  
D1.1/D1.1M-06.....Structural Welding Code.
- F. American Iron and Steel Institute (AISI):  
Light Gage Cold Formed Design Manual.
- G. Uniform Building Code, Latest Edition.
- H. Underwriters Laboratories, Inc. (UL):  
752-06.....Bullet-Resisting Equipment. (

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Steel Framing and Structural Steel Members: ASTM A36 or A242, except  
uncoated steel for light gage members shall conform to ASTM A1008 or  
A1011.
- B. Panels:  
1. Sheet Steel, galvanized light gage steel of specified thickness  
shall conform to ASTM A653/A653M with G40 zinc coating each face.  
2. Aluminum: Sheet aluminum shall conform to ASTM B209, alloy 3004.
- C. Joint Sealant: Sealant shall be heat-resisting compound having low  
shrinkage factor; unaffected by water; with flash-point in excess of

400°C (750 degrees F). Sealant shall not migrate oil up to 120° (250 degrees F) nor exude oil under pressure. It shall not skin, sag, nor weep in panel joints under vibration up to temperature of 65°C (150 degrees F), nor become brittle at temperature down to -1°C (30 degree F).

- D. Sealing Tape: Manufacturer's standard in color to match metal building panels.
- E. Weatherstrips: Door manufacturer's standard approved products; closed cell neoprene or extruded vinyl.
- F. Thresholds: Aluminum, interlocking type.
- G. Semirigid Insulation: Mineral fiberboard, ASTM C553, Type 2, faced with a vapor barrier having a perm rating of not more than 0.5.

## **2.2 FABRICATION**

- A. General: Coordinate fabrication and erection of work with related work of other trades. Provide cutouts and supplemental reinforcement as required to accommodate materials and work specified in other sections of the specifications.
- B. Protection of Dissimilar Metals: Dissimilar materials which are not compatible with adjoining materials when exposed to moisture shall be separated by means of coatings, gaskets, or other effective means.
- C. Steel Framework Fabrication:
  - 1. Steel framing required for pre-engineered metal building shall be coordinated with structural steel shown on drawings. Columns and related components shall be shop fabricated complete, with connection holes for attachment of primary and secondary framing members and bracing.
  - 2. Framing, purlins, girts, struts and miscellaneous steel members required for attachment of pre-engineered metal building panels to building structure shall be roll formed members complying with ASTM A1008. Design, size, space and install members to meet job and loading conditions. Members shall have factory-punched holes and shall be furnished complete with angle clips and fastenings required for attaching to structure.
  - 3. Bolted connections shall use either ribbed or high-tensile steel bolts as appropriate for each connection.
  - 4. Welding shall be in accordance with AWS Standard. Operators shall be qualified as prescribed by American Welding Society. Certification shall be furnished upon request of Resident Engineer.

- D. Wall Panels: Wall panels shall consist of an insulating core enclosed between two metal face sheets. Steel face sheets shall be 24 gauge thick. Design exterior face sheets of panels with grade of steel and configuration of cross section capable of withstanding specified design load conditions without exceeding specified stress and deflection limitations, with same support configuration as that in proposed building. Seal joints between panels with joint sealant as specified. Insulation for panels cores shall be mineral insulation of a type standard with panel manufacturer and shall be noncombustible as defined by NFPA No. 220. Fasten panels to adjoining panels and to steel framework by method recommended by panel manufacturer and approved before work is started.
- E. Roof Panels: Roofing panels shall be 24 gauge thick. Design roof panels with grade of steel or aluminum and configuration of cross section capable of withstanding design load conditions without exceeding specified stress and deflection limitations, with same support configuration as that in proposed building. Sheets shall be applied with a minimum sidelap of not less than one full configuration. Exposed insulation for installation on inside face of roof panels shall be semirigid insulation.
- F. Flashing, Trim And Closures: Same material, gage and finish as adjacent wall and roof panels. Fastenings shall be as specified for wall and roof panels. Form or mold closure strips to match configuration of the roofing or siding. Install closures wherever necessary to insure weather tight construction.
- G. Louvers: Fabricate wall louvers of same material, gage and finish as face sheets for wall panels. Design louver assembly to prevent infiltration of water into building. Provide insect screens and wire guards on wall louvers except omit insect screens on louvers connected to exhaust ducts.
- H. Doors and Frames: Doors and frames shall be complete with weatherstrips as specified. Doors, frames and related items shall be cut, reinforced, drilled, and tapped at the factory for the specified hardware.
1. Doors: Steel, full flush type hollow metal, minimum thickness of face sheets 1.2 mm (0.0478 inch). Equip doors with interlocking aluminum thresholds and weatherstrips at heads, jambs and meeting stiles.

2. Door Frames: Steel, not less than 1.5 mm (0.0598 inch) thick.  
Metal surfaces of doors and frames shall be filled, ground smooth, cleaned and prepared to receive prime coat of paint.
3. Provide all finish hardware including panic bars.

### **2.3 FACTORY FINISH AND PAINTING**

- A. Wall and roof panels, including related components, accessories and fastenings, shall have approved factory finish as follows:
  1. Finish on the weather face of wall and roof panels, and related components shall be a prime coat of epoxy primer with a finish coat of Polyvinylidene Fluoride baked on coating thickness of (0.8-1.3 mils) with the following performance characteristics.
    - a. Salt Spray Test: ASTM B 117, minimum 500 hours. Undercutting of the paint film from the score line shall not exceed 2 mm (1/16 inch).
    - b. Accelerated Weathering Test: ASTM G 153, Method 2, Type D apparatus minimum 2000 hours or Type EH apparatus minimum 500 hours, no checking, blistering or loss of adhesion; color change less than 5 NBS units by ASTM D 2244 and chalking less than No. 8 rating by ASTM D 4214.
    - c. Flexibility: ASTM D 522, Method A, 3 mm 1/8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.
    - d. Adhesion: ASTM D 3359, Method B, for laboratory test and film thickness less than 0.01 mm 5 mil and Method A for site tests. There shall be no film removed by tape applied to 11 parallel cuts spaced 3 mm 1/8 inch apart plus 11 similar cuts at right angles.
    - e. Impact: ASTM D 2794, no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mm mils, expressed in m-kg inch-pounds.
  2. Finish on exposed face of liner panel shall be off white baked enamel suitable as a finished surface or as a base for field painting.
- B. Steel framing members shall be given one coat of shop paint.
- C. Doors, frames, and other similar components shall be bonderized and given one prime coat of baked-on shop paint, then factory applied finish coat.

- D. Windows and louvers shall be factory finished to match adjacent wall panels.
- E. Field paint all exterior exposed fastenings to match adjacent panels.
- F. Abraded surfaces shall be wire-brushed and touched up with the same materials as the shop prime or finish coat of paint.
- G. For color of finish coat, see Section 09 06 00, SCHEDULE FOR FINISHES.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION**

- A. Bolt settings and other dimensions shall be held to a tolerance of plus or minus 3 mm (1/8-inch). Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise shown or specified.
  - 1. Set accurately bases or sill members to obtain uniform bearing and maintain established floor line elevation. Anchors and anchor bolts for securing members to concrete curb or structural steel sub-frame shall be of black steel, set accurately to templates and of proper size to adequately resist applicable design loads at the base.
- B. Wall Panels: Panels shall be applied with configurations running in a vertical position. Supply panels in single lengths from base to eave with no horizontal joints, except at the junction of door units, louver panels, and similar openings. End laps for panels shall be not less than 100 mm (four inches). Walls shall be closed at base and eave, and around doors, frames, louvers, and other similar openings by flashings and/or formed closures to assure adequate weathertightness. Flashing or stops will not be required where weather-closed or approved self-flashing panels are used.
- C. Roof Panels: Roof panels shall be applied with configurations running in direction of roof slope. Supply panels with no transverse joints except at junctions for roof openings and at roof ridge. Lay side laps away from prevailing winds, and seal side laps and end-laps of roof with roof joint sealant. Roof shall be flashed and/or sealed at ridge, at eaves and rakes at projections through roof, and elsewhere as necessary to make roof weather tight. Flashing and/or caulking shall be accomplished in a manner that will assure complete weather-tightness and method to be used shall be subject to approval by Resident



Engineer. Minimum end-laps for roofing and ridge caps for pre-engineered and factory-punched laps shall be 150 mm (six inches); other minimum end-laps shall be not less than 300 mm (12 inches).

1. Install insulation on interior face of roof sheets or panels as shown on approved shop drawings. Secure materials permanently in place and free of inordinate deflection. Finished work shall be neat, clean, uniform in appearance, and free of noticeable variations in color and texture.

D. Fasteners for Securing Roof and Wall Panels: Fastening method, size and spacing shall be as recommended by metal building manufacturer and as approved by Resident Engineer. Fasteners shall be non-corrosive and of design that will produce a weathertight connection. Clearly show fasteners and fastening method on shop and erection drawings. Field paint exterior exposed fastenings to match adjacent panels as specified in paragraph, FACTORY FINISH AND PAINTING.

E. Door Frame Installation: Set frames plumb and align and brace securely until permanent anchors are set. Build in wall anchors or secure to adjoining construction as indicated or specified. Where frames require overhead bracing, securely anchor to structure above.

F. Weatherproofing: Joints between exterior pre-engineered metal building components and other adjacent components and materials, except flashing of metal wall panels and intersecting built-up roofs shall be designed for and shall receive sealing tapes, gaskets, sealant materials, metal flashing and other methods of sealing as required to provide weathertight joints. Joint sealing shall be installed under this section and shall be guaranteed as specified. Color of sealing materials shall match adjacent metal building components.

### **3.2 WARNING SIGN**

- A. Mount on each entrance of the switchgear room, approximately 1500mm (five feet) above the grade or floor, a clearly lettered warning sign for warning personnel. Warning sign shall be "ELECTRICAL ROOM WITH HIGH VOLTAGE". The sign shall be attached with rust proof metal screws.

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