
USACE / NAVFAC / AFCEA UFGS-13120 (October 2003)

Preparing Activity: NAVFAC Superseding
UFGS-13121N (August 2001)
UFGS-13120A (January 2002)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13120

PREENGINEERED METAL BUILDINGS

10/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Design Requirements
 - 1.2.1.1 Design Analysis
 - 1.2.1.2 Dimensions
 - 1.2.1.3 Framing
 - 1.2.1.4 Foundation Requirements
 - 1.2.2 Performance Requirements
 - 1.2.2.1 Dead Loads
 - 1.2.2.2 Roof Live Loads
 - 1.2.2.3 Roof Snow Loads
 - 1.2.2.4 Wind Loads
 - 1.2.2.5 Impact Loads
 - 1.2.2.6 Seismic Loads
 - 1.2.2.7 Collateral Loads
 - 1.2.2.8 Deflection
 - 1.2.2.9 Provisions for Gutters and Downspouts
 - 1.2.2.10 Provisions for Louvers
 - 1.2.2.11 Ventilators
 - 1.2.2.12 Drift Provisions
 - 1.2.2.13 Cranes
 - 1.2.2.14 Grounding and Lightning Protection
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
 - 1.4.1 Qualifications
 - 1.4.1.1 Manufacturer
 - 1.4.1.2 Installer
 - 1.4.1.3 Manufacturer's Representative
 - 1.4.2 Regulatory Requirements
 - 1.4.2.1 Drawings: Preengineered Building
 - 1.4.2.2 Design Data Building
 - 1.4.3 Coordination Meeting
 - 1.4.4 Instructions

- 1.4.4.1 Instruction Manuals
- 1.4.4.2 Erection
- 1.4.5 Samples
 - 1.4.5.1 Factory color Finish
 - 1.4.5.2 Accessories
 - 1.4.5.3 Roofing and Siding
 - 1.4.5.4 Fasteners
 - 1.4.5.5 Insulation
 - 1.4.5.6 Gaskets and Insulating Compounds
 - 1.4.5.7 Sealant
 - 1.4.5.8 Skylights
 - 1.4.5.9 Wall Liners
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 WARRANTIES
 - 1.6.1 Warranty
 - 1.6.2 Prime Contractor's Weathertightness Warranty
 - 1.6.3 Manufacturer's Material and/or System Weathertightness Warranties

PART 2 PRODUCTS

- 2.1 WALL AND ROOF MATERIALS
 - 2.1.1 Minimum Thickness
 - 2.1.2 Panels
 - 2.1.2.1 Zinc-Coated Steel Sheet
 - 2.1.2.2 Aluminum/Zinc-Coated Steel Sheet
 - 2.1.2.3 Aluminum Sheet
 - 2.1.2.4 Aluminum-coated Steel
 - 2.1.3 Wall Liners
- 2.2 FRAMING AND STRUCTURAL MEMBERS
 - 2.2.1 Steel
 - 2.2.2 Aluminum
 - 2.2.3 Uncoated Steel
 - 2.2.4 Galvanized Steel
 - 2.2.5 Aluminum Sheet
 - 2.2.6 Structural Tube
- 2.3 ACCESSORIES
 - 2.3.1 Caps, Strips, and Plates
 - 2.3.2 Closure Strips
 - 2.3.3 Sealant
 - 2.3.4 Gaskets and Insulating Compounds
 - 2.3.5 Fasteners
 - 2.3.5.1 Screws
 - 2.3.5.2 End-Welded Studs
 - 2.3.5.3 Explosive Actuated Fasteners
 - 2.3.5.4 Blind Rivets
 - 2.3.5.5 Bolts
 - 2.3.6 Gutters
 - 2.3.7 Downspouts
 - 2.3.8 Circular Roof Ventilators
 - 2.3.9 Continuous (Ridge) Roof Ventilators
 - 2.3.10 Louvers
 - 2.3.11 Skylights
 - 2.3.12 Light Transmitting Roof Panels (Insulating)
 - 2.3.13 Light Transmitting Roof Panels (Noninsulating)
 - 2.3.14 Plastic Wall Lights
 - 2.3.15 Insulation
 - 2.3.15.1 Rigid Board Insulation
 - 2.3.15.2 Mineral Fiber

- 2.3.15.3 Blanket Insulation
- 2.3.15.4 Insulation Retainers
- 2.3.16 Vapor Retarder
 - 2.3.16.1 Vapor Retarders as Integral Facing
 - 2.3.16.2 Vapor Retarders Separate from Insulation
- 2.3.17 Doors and Windows
 - 2.3.17.1 Swinging Personnel Doors and Frames
 - 2.3.17.2 Sliding Doors
 - 2.3.17.3 Overhead Doors Rolling Doors
 - 2.3.17.4 Sectional Overhead Doors
 - 2.3.17.5 Vertical Lift Doors
 - 2.3.17.6 [Aluminum Windows] [or] [Steel Windows]
- 2.3.18 Canopies
- 2.3.19 Sealant
- 2.3.20 Gaskets and Insulating Compounds
- 2.4 FINISH
 - 2.4.1 Shop Painting
 - 2.4.2 Factory Color Finish
 - 2.4.3 Testing of Factory Color Finishes
 - 2.4.3.1 Salt Spray Test
 - 2.4.3.2 Accelerated Weathering Test
 - 2.4.3.3 Flexibility
 - 2.4.3.4 Adhesion
 - 2.4.3.5 Impact
 - 2.4.3.6 Humidity Resistance
 - 2.4.3.7 Specular Gloss
 - 2.4.3.8 Abrasion
 - 2.4.3.9 Formability Test
 - 2.4.3.10 Pollution Resistance

PART 3 EXECUTION

- 3.1 INSPECTION
- 3.2 ERECTION
 - 3.2.1 Dissimilar Materials
 - 3.2.2 Rigid Frames, Bases, and Sill Members
 - 3.2.2.1 Field Welding
 - 3.2.2.2 Field Bolting
 - 3.2.3 Wall Construction
 - 3.2.4 Roof Construction
 - 3.2.5 Installation of Gutters and Downspouts
 - 3.2.6 Louvers and Ventilators
 - 3.2.7 Doors and Windows
 - 3.2.8 Minimum Fastener Spacing
 - 3.2.9 Installation of Insulation
 - 3.2.9.1 Roof Insulation
 - 3.2.9.2 Wall Insulation
 - 3.2.10 Vapor Retarder Installation
 - 3.2.10.1 Integral Facing on Blanket Insulation
 - 3.2.10.2 Polyethylene Vapor Retarder
 - 3.2.11 Wall Liner
- 3.3 FIELD PAINTING
- 3.4 FIELD QUALITY CONTROL
- 3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA UFGS-13120 (October 2003)

Preparing Activity: NAVFAC Superseding
UFGS-13121N (August 2001)
UFGS-13120A (January 2002)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION 13120

PREENGINEERED METAL BUILDINGS 10/03

NOTE: This guide specification covers the requirements for preengineered metal buildings.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: Preengineered buildings of the truss frame, dome, arch triodetic and geodesic types are not included and should be specified in other sections.

Section 13121 METAL BUILDING SYSTEMS (MINOR REQUIREMENTS) should be used for small, simple, utilitarian type buildings that do not require the higher level of performance and quality obtained by using this section.

NOTE: The following information shall be shown on the project drawings:

1. Floor and eave height dimensions required.
2. Clear spans, clear heights necessary.
3. Roof slope if important.

4. Type of roof and wall coverings.
5. Approximate locations for downspouts, roof ventilators, louvers, and skylights.
6. Location and required "R" factor of insulation.
7. Color schedule indicating color required for factory-finished surfaces.
8. Collateral loads for special equipment or crane loads, special live loading.
9. Depth of roof and wall coverings, if necessary.
10. Location of liner panels.
11. Minimum roof dead, live, and snow loads. Location for uplift design information.
12. Basic wind speed in kg per hour or miles.
13. Importance factor for wind and seismic computations.
14. Where applicable, state the allowable horizontal drift between the pre-engineered metal building and adjacent or adjoining construction.
15. Designer should specify anchor bolt embedment. Building manufacturer will provide size and layout, but will not provide embedment length. Specify contractor design or designer of record must specify on contract drawings.

NOTE: Metal building systems may be economical solutions for providing a usable structure if this type of system is acceptable to the user. Interior finishing of metal buildings will be held to a minimum, and siting of metal buildings in areas inconsistent with their architectural appearance will be avoided.

In order to fully benefit from the inherent savings in utilizing acceptable components which are standard with the building manufacturers, items such as doors, windows, and ventilators will not be specified by reference to other sections based on the guide specifications for these items, unless the number of buildings required or the performance requirements are such as to make the references to other sections necessary.

Designs of acceptable metal building systems vary widely regarding such features as roof slopes, panel configurations, fastener types and spacings,

covering lapping distances, and joint sealing methods, all of which have a direct bearing on the water tightness of the installation. Grounding for metal building systems is required, in accordance with Section 13100N or 13100A LIGHTNING PROTECTION SYSTEM. In order to avoid placing undue restrictions on acceptable buildings, this guide specification includes only certain minimum requirements for these features and the requirement that the completed building be guaranteed.

This guide specification includes the requirements for the most commonly used materials and components; it is not possible to indicate all possible combinations and selections which may be utilized in adapting this guide specification to a particular project. Therefore, careful editing is necessary to assure that the project is properly and adequately specified.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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

ALUMINUM ASSOCIATION (AA)

AA 30 (1986) Aluminum Structures, Construction Manual Series Section 1

AA 45 (2003) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1999) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD (1995a) AISC Quality Certification Program

AISC Pub No. S303 (2000) Code of Standard Practice for Steel Buildings and Bridges

AISC S329	(1985) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts
AISC S335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 7	(2002) Minimum Design Loads for Buildings and Other Structures
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel
ASTM INTERNATIONAL (ASTM)	
ASTM A 252	(1998; R 2002) Welded and Seamless Steel Pipe Piles
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 463/A 463M	(2002a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 500	(2003) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(2001) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 529/A 529M	(2003) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled
ASTM A 572/A 572M	(2003a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(2003) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(2001) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled

ASTM A 618	(2001) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 755/A 755M	(2001) Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A 792/A 792M	(2002) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 241/B 241M	(2002) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 308/B 308M	(2002) Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 429	(2002) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C 1289	(2002) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 236	(1989; R 1993e1) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 518	(2002e1) Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 553	(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation

ASTM C 991	(2000) Flexible Glass Fiber Insulation for Metal Buildings
ASTM D 1308	(2002) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(2002e1) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3841	(1997; R 2001) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4397	(2002) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 5894	(1996) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2001) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002) Evaluating Degree of Blistering of Paints
ASTM D 828	(1997; R 2002) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
ASTM D 968	(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

ASTM E 96 (2000e1) Water Vapor Transmission of Materials

ASTM G 23 (1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1 (2000) Butts and Hinges

BHMA A156.2 (1996) Bored and Preassembled Locks and Latches

BHMA A156.3 (2001) Exit Devices

BHMA A156.4 (2000) Door Controls - Closers

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 70 (2000) Top Running and Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes, No. 70

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM (2002) Metal Building Systems Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual (2003, 6th Ed) Architectural Sheet Metal Manual

STEEL DECK INSTITUTE (SDI)

SDI DDM02 (1987) Diaphragm Design Manual

STEEL DOOR INSTITUTE (SDI)

SDI A250.8 (2003) Standard Steel Doors and Frames

STEEL WINDOW INSTITUTE (SWI)

SWI SGSW (2002) Architect's Guide to Steel Windows

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

1.2 SYSTEM DESCRIPTION

1.2.1 Design Requirements

1.2.1.1 Design Analysis

NOTE: Metal Building System manufacturers do not

design foundations; foundation investigation and design may be performed by the Contractor. The project design structural engineer must design and detail the foundations based on loads obtained for similar building types with the specified loading. The drawings should contain notes indicating that the foundations are provided for bid purposes only and that actual foundations, using similar details, will be provided by the Contractor.

The design analysis shall be the design of a licensed Professional Engineer experienced in design of this work and shall include complete calculations for the building, its components, and the foundations. Foundations shown on the drawings are based on loads derived from a representative set of similar building types. The Contractor shall obtain the services of a licensed Professional Engineer to verify that the foundations shown are adequate for the building supplied using the criteria in paragraph Foundations. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross-referencing shall be clear. Wind forces on various parts of the structure, both positive and negative pressure, shall be calculated with the controlling pressure summarized. Lateral forces due to seismic loading shall be calculated and tabulated for the various parts and portions of the building. Computer programmed designs shall be accompanied by stress values and a letter of certification, signed by a licensed Professional Engineer, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design. A narrative of the computer program delineating the basic methodology shall be included. Computer program output shall be annotated and supplemented with sketches to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer, who shall function as a point of contact to answer questions during the detail drawing review.

1.2.1.2 Dimensions

Building dimensions shall be as standard with manufacturer, not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of finished floor to intersection of insides of roof and sidewall sheets. The clear height between finished floor and bottom of roof steel shall be as indicated.

1.2.1.3 Framing

NOTE: Modify the paragraph as necessary to describe the type of framing system required. Allow optional roof slopes except where conditions do not permit.

NOTE: Gable roofs will be specified for all buildings, except where single-slope roofs are necessary for small buildings or for building extensions. Structures will be limited to single-span only when interior columns would

adversely affect the use of the building.

Drawings will show roof slope. Drawings will show required width and length dimensions from inside face of wall covering; minimum inside clear dimensions; size, type, and number of windows, doors, louvers, ventilators, and skylight panels; hardware requirements, if not scheduled in the specifications, including requirements for door weather stripping and thresholds; and other information as required to supplement the specifications.

Provide building with vertical walls and [gable] [single-slope] roof. Building shall be [single-span] [single-span or multiple-span] structures with one of the following framing systems: self-framing, column with single-span or continuous trusses, continuous beam frames, column with rigid frame, or rigid frame type, similar to AISC S335, Type I construction. End walls shall be of [rigid frame] [beam and column design]. Roof slope shall be a minimum of 1 to 24 [to a maximum of [____]]. [Roof slope greater than that indicated may be furnished if the required materials are provided and appropriate drawings are submitted and approved.] Design framed openings structurally.

1.2.1.4 Foundation Requirements

NOTE: The following paragraph is intended to be a synopsis of the foundation report, and will be supplemented with additional data as required. Coordinate with paragraph DESIGN ANALYSIS.

When dealing with soil, a larger factor of safety is used. Unlike steel and concrete, which are manufactured, controlled, and tested to meet prescribed standards, soils are natural materials. Therefore it is common practice to apply a factor of safety of at least 3.0 in soil engineering work.

Design foundations for allowable soil bearing pressure and a minimum bottom of footing depth as indicated. Use a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300N CAST-IN-PLACE CONCRETE. The foundation loads are supplied by the building manufacturer.

1.2.2 Performance Requirements

MBMA MBSM, for loading combinations and definitions with the exceptions of wind load and special collateral loads. Design for each material shall be as specified by the Design Authority as listed in MBMA MBSM.

1.2.2.1 Dead Loads

The dead load shall consist of the weight of all permanent construction such as roof, framing, covering members and all other materials of the building system.

1.2.2.2 Roof Live Loads

- a. Uniform Loads: Uniform roof live loads, including maintenance traffic and construction loads, shall be determined and applied in accordance with ASCE 7.
- b. Concentrated Loads: In addition to ASCE 7 roof live loads, a minimum design concentrated load of 1335 N 300 pounds shall be used to simulate a construction load on roof panels. The concentrated load shall be applied at the panel midspan and shall be resisted by a single standing seam metal roof panel, or a 610 mm 24 inches wide corrugated metal panel, assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.2.2.3 Roof Snow Loads

The design roof snow loads, including effects of drifting, shall be determined and applied in accordance with ASCE 7.

1.2.2.4 Wind Loads

Compute and apply wind pressures, ASCE 7. Basic wind speed and multiplying factors are as indicated.

1.2.2.5 Impact Loads

Impact loads due to [monorails] [cranes] [and] [_____] of [_____] magnitude shall be applied as indicated in [MBMA MBSM] [AISC S335].

[1.2.2.6 Seismic Loads

NOTE: Procedures for determining and applying
seismic forces shall be in accordance with NAVFAC TI
809-04, or the Uniform Building Code.

As required for ground motion acceleration indicated.

]1.2.2.7 Collateral Loads

NOTE: Collateral loads include mechanical,
electrical, fire protection system.

[As indicated.]

[Collateral load of [_____] Pa 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. This allowance does not include the weight of hung equipment weighing 25 kg 50 pounds or more. Equipment loads of 25 kg 50 pounds or more shall be shown on the shop (detail) drawings and the structure (frame, purlins, girts) shall be strengthened as required. The Contractor is responsible for providing the building manufacturer the magnitude and approximate location of all concentrated loads greater than 25 kgs 50 pounds before design of the

building commences.]

1.2.2.8 Deflection

NOTE: For buildings with masonry, infill, limit
frame sway 1/600th of building eave height and
consider limiting wall purlin deflection to 1/600th
of span. The designer should also consider weight
handling systems and building finishes when
specifying deflection limits.

- a. Structural Members: The maximum deflection of main framing members shall not exceed 1/240th of their respective spans. The maximum deflection due to live load in roof panels and purlins shall not exceed 1/180th of their respective spans.
- b. Roof Panels: UL 580, Class 90. The design analysis shall establish that the roof when deflected under dead plus live or snow loads, will not result in a negative gradient. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. In addition, the roof decking shall be designed for a 90 kg 200-pound concentrated load at midspan on a 300 mm 12 inch wide section of deck. Panels thinner than 0.8 mm 0.03 inches are not permitted for diaphragms used to resist seismic loads in Seismic Zones 2 through 4.
- c. Wall Panels: The maximum deflection due to wind on wall panels and girts shall be limited to 1/120th of their respective spans except that when interior finishes are used the maximum allowable deflection shall be limited to 1/180th of their respective spans.
- d. Openings: Limit deflections of steel framing above and along the side of rolling door openings to a maximum of 1/2 the allowable movement in the telescoping top roller of the doors to ensure proper operation. Frame all equipment openings over 300 by 300 mm 12 by 12 inches.

1.2.2.9 Provisions for Gutters and Downspouts

Gutters and downspouts shall be designed according to the requirements of SMACNA Arch. Manual for storms which should be exceeded only once in 5 years and with adequate provisions for thermal expansion and contraction. Supports for gutters and downspouts shall be designed for the anticipated loads. Roof drainage system to withstand rainfall intensity of [_____] mm/hour inches per hour, with 5 minute duration.

1.2.2.10 Provisions for Louvers

Louvers shall be [fixed-blade] [adjustable] type designed for a minimum net open area of [_____] square meters, square feet, to be rainproof, and to resist vibration when air is passed at the rate of [_____] cubic meters per second.cubic feet per minute.

1.2.2.11 Ventilators

- a. Circular Ventilators: Circular roof ventilators shall be gravity

[directional] [stationary] [revolving] type, [with] [without] dampers, designed for a minimum capacity of [_____] cubic meters of air per second cubic feet of air per minute for each ventilator, based on a wind velocity of 8 km per hour 5 miles per hour and an exterior-interior temperature differential of 6 degrees C 10 degrees F and without screens in place.

- b. Continuous Ventilators: Continuous roof ventilators shall be ridge mounted gravity type, [with] [without] dampers, designed for a minimum capacity of [_____] cubic meters of air per second cubic feet of air per minute for each 3 m (10 foot) 10 foot section based on a wind velocity of 8 km per hour 5 miles per hour and an exterior-interior temperature differential of 6 degrees C 10 degrees F and without screens in place.

1.2.2.12 Drift Provisions

NOTE: When masonry walls are anchored to the steel framing, the maximum allowable deflection of the wall will be used as a limiting value for the structure drift. Complete masonry design and details must be shown on the drawings. Sections A6 and A15 of MBMA Low Rise Manual should be reviewed when determining drift limitations.

Lateral deflections, or drift, at the roof level of a structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall [conform to MBMA MBSM] [be less than [_____] mm inches].

1.2.2.13 Cranes

NOTE: Delete this paragraph when cranes are not required. To properly specify a crane, the designer must provide complete crane data to the Builder. Crane data sheets commonly supplied by a crane manufacturer do not provide the complete specifications necessary for the design of a crane for a building.

In specifying crane data, it is important that consideration be given to future operations which could increase crane loadings and fatigue. Special drift requirements must be specified on the Contract Documents.

NOTE: Insert appropriate Section number and title in blank below using format per UFC 1-300-02.

The crane loads shall be obtained from the crane manufacturer and shall be applied per MBMA MBSM for the design of the crane runways and supports. The cranes, girders, rails, end trucks, stops, and bumpers shall be

provided by the crane manufacturer as specified in [Section 14630 OVERHEAD ELECTRIC CRANES] [____]. Cranes with a capacity greater than 89 kN 10 tons shall [be supported by a structural system which is separate from the building frames except for lateral support. Flexible connections to the building columns, if used, shall allow the separate crane support system to resist longitudinal crane loads by other means without over stressing the building frame. Likewise, the building frame shall be free to deflect without over stress caused by connections to the more rigid crane support system] [____].

1.2.2.14 Grounding and Lightning Protection

Grounding and lightning protection shall be provided as specified in Section [13100N] [13100A] LIGHTNING PROTECTION SYSTEM.

1.3 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Preengineered Building; G, [_____]

Template for anchorage

Submit as necessary to erect the building and install components.

SD-03 Product Data

Preengineered metal building materials

Submit sufficient data indicating conformance to specified requirements on materials provided under this section.

Instruction Manuals

Erection

Qualifications

SD-04 Samples

Factory color finish

Accessories

Roofing and Siding

Fasteners

Insulation

Gaskets and Insulating Compounds

Sealant

Skylights

Wall Liners

SD-05 Design Data

NOTE: Require calculations only for structural or
load bearing items necessary to check the
manufacturer's submittals for conformance.

Building; G, [_____]

Foundation loads; G, [_____]

anchor bolts; G, [_____]

[Purlins and girts; G, [_____]]

[Bracing; G, [_____]]

SD-06 Test Reports

Factory Color Finish

Insulation

SD-07 Certificates

Preengineered metal building materials

Submit certificates attesting that materials comply with this specification.

SD-10 Operation and Maintenance Data

Preengineered Building, data package 1; G, [_____]

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Qualifications of the manufacturer, the manufacturer's Representative when one is used, and qualifications and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

1.4.1.1 Manufacturer

The manufacturer shall have AISC FCD, category MB certification.

1.4.1.2 Installer

NOTE: Obtain a waiver for this paragraph from the
Contracting Officer.

Erector shall have specialized experience in the erection of metal building systems for a period of at least 3 years.

1.4.1.3 Manufacturer's Representative

NOTE: Remove this paragraph when the manufacturer's
representative is not required.

A representative designated by the building manufacturer, who is familiar with the design of the building supplied and experienced in the erection of metal buildings similar in size to the one required under this contract, shall be present at the job site during construction, from the start of the structural framing erection until completion of the installation of the exterior covering, to assure that the building is erected properly.

1.4.2 Regulatory Requirements

1.4.2.1 Drawings: Preengineered Building

Submit complete design drawings for the preengineered building. Submit drawings for the foundations and anchorage.

1.4.2.2 Design Data Building

Submit design calculations for the entire preengineered building and foundations, prepared and stamped by a professional engineer. Also submit for components requested, and stamp with the seal of a professional engineer. Include sizes and location of anchor bolts.

1.4.3 Coordination Meeting

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing/metal building system manufacturer, the roofing/metal building supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

1.4.4 Instructions

1.4.4.1 Instruction Manuals

Manufacturer's literature for individual building component systems.

1.4.4.2 Erection

Manufacturer's erection instruction and erection drawings describing the preparation requirements, assembly sequence, temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components.

1.4.5 Samples

1.4.5.1 Factory color Finish

Submit one sample of each color indicated for verification that the color matches the colors indicated. Where colors are not indicated, submit not less than four different samples of manufacturer's standard colors for selection by the Contracting Officer.

1.4.5.2 Accessories

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

1.4.5.3 Roofing and Siding

One piece of each type and finish (exterior and interior) to be used, 225 mm 9 inches long, full width. The sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality

control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish.

1.4.5.4 Fasteners

Two samples of each type to be used, with statement regarding intended use.

If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

1.4.5.5 Insulation

One piece of each type to be used, and descriptive data covering installation.

1.4.5.6 Gaskets and Insulating Compounds

Two samples of each type to be used and descriptive data.

1.4.5.7 Sealant

One sample, approximately 0.5 kg, 1 pound, and descriptive data.

1.4.5.8 Skylights

One piece, 225 mm 9 inches long, full width.

1.4.5.9 Wall Liners

One piece, 225 mm 9 inches long, full width.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle manufactured items so that materials remain dry and undamaged. Do not store in contact with materials that might cause staining.

1.6 WARRANTIES

1.6.1 Warranty

The Metal Building System, composed of framing and structural members, roofing and siding, gutters and downspouts, accessories, fasteners, trim, and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer) shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by exposure to the elements and service design loads, leaks and wind uplift damage. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.6.2 Prime Contractor's Weathertightness Warranty

The Metal Building System shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The Metal Building System covered

under this warranty shall include but is not limited to the following: framing and structural members, roofing and siding panels and seams, interior or exterior gutters and downspouts, accessories, fasteners, trim, flashings and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer), connectors, components, and fasteners, and other system components and assemblies installed to provide a weathertight system; and items specified in other sections of these specifications that become part of the metal building system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor is ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached **WARRANTY FOR METAL BUILDING SYSTEMS**, and start upon final acceptance of the facility. The Contractor shall provide a separate bond in an amount equal to the installed total metal building system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building system as outlined above.

1.6.3 Manufacturer's Material and/or System Weathertightness Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties to the Contracting Officer which cover all Metal Building System components:

- a. A manufacturer's 20 year material warranty warranting that the specified aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed securement system including fasteners and coil material.
- b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change colors in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to replacing the defective coated material.

PART 2 PRODUCTS

2.1 WALL AND ROOF MATERIALS

NOTE: Delete materials not in the project. Interior gutters are for use when two rigid frames are erected side by side; such installation is not

normally recommended.

MBMA MBSM except as specified otherwise herein. Design roof and wall panels, accessories, and flashings to be completely weathertight and free of abrasions, loose fasteners, and deformations. Each piece or part of the assembly shall be clearly and legibly marked to correspond with the drawings.

2.1.1.1 Minimum Thickness

NOTE: Choose one of the bracketed groups in the table below. Choose the second bracketed option, beginning "Girders and Columns...", for projects in seismic zones 3 and 4.

As required to conform to design requirements but not less than the following:

Items	Minimum Thickness (Uncoated)
[Steel Structural Members Other Than Roof and Wall Panels	18 Manufacturer's Standard (MFG STD) gage, 1.2 mm
Roof and Wall Panels	
Steel	26 MFG STD gage, 0.5 mm
Aluminum	0.8 mm
Plastic	1.1 mm
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	26 MFG STD gage, 0.5 mm
Aluminum	0.8 mm
Plastic	1.1 mm
Interior Gutters	
Steel	24 MFG STD gage, 0.6 mm
Aluminum	1 mm
Eave Gutters and Downspouts	
Steel	26 MFG STD gage, 0.5 mm
Aluminum	0.8 mm
Roof Ventilators	
Steel	26 MFG STD gage, 0.5 mm
Aluminum	0.8 mm
Louvers	
Steel	18 MFG STD gage, 1.2 mm
Aluminum	1.6 mm]
[Girders and Columns	5 mm
Purlins and Girts	14 Manufacturer's Standard gage (MFG STD)

Items	Minimum Thickness (Uncoated)
Roof Panels	
Steel	22 MFG STD gage
Aluminum	1 mm
Wall Panels	
Steel	24 MFG STD gage
Aluminum	0.8 mm
Bracing	5 mm thick steel members
Column Base Plates	16 mm thick
Column Anchor Bolts	16 mm diameter
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	24 MFG STD gage
Aluminum	0.8 mm
Plastic	1.1 mm
Interior Gutters	
Steel	24 MFG STD gage
Aluminum	1 mm
Eave Gutters and Downspouts	
Steel	24 MFG STD gage
Aluminum	0.8 mm
Louvers	
Steel	18 MFG STD gage
Aluminum	1.6 mm]
Items	Minimum Thickness (Uncoated)
[Steel Structural Members Other Than Roof and Wall Panels	18 Manufacturer's Standard (MFG STD) gage, 0.0478 inch
Roof and Wall Panels	
Steel	26 MFG STD gage, 0.0179 inch
Aluminum	0.032 inch
Plastic	0.045 inch
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	26 MFG STD gage, 0.0179 inch
Aluminum	0.032 inch
Plastic	0.045 inch
Interior Gutters	
Steel	24 MFG STD gage, 0.0239 inch
Aluminum	0.040 inch
Eave Gutters and Downspouts	
Steel	26 MFG STD gage, 0.0179 inch
Aluminum	0.032 inch

Items	Minimum Thickness (Uncoated)
Roof Ventilators	
Steel	26 MFG STD gage, 0.0179 inch
Aluminum	0.032 inch
Louvers	
Steel	18 MFG STD gage, 0.0478 inch
Aluminum	0.064 inch]
[Girders and Columns	3/16 inch
Purlins and Girts	14 Manufacturer's Standard gage (MFG STD)
Roof Panels	
Steel	22 MFG STD gage
Aluminum	0.04 inch
Wall Panels	
Steel	24 MFG STD gage
Aluminum	0.032 inch
Bracing	3/16 inch thick steel members
Column Base Plates	5/8 inch thick
Column Anchor Bolts	5/8 inch diameter
Gable and Eave Trim, Fascia Closure Strips, Rake Flashings, Copings, and Liner Panels	
Steel	24 MFG STD gage
Aluminum	0.032 inch
Plastic	0.045 inch
Interior Gutters	
Steel	24 MFG STD gage
Aluminum	0.040 inch
Eave Gutters and Downspouts	
Steel	24 MFG STD gage
Aluminum	0.032 inch
Louvers	
Steel	18 MFG STD gage
Aluminum	0.064 inch]
2.1.2 Panels	

NOTE: Give options for roof and wall panels unless there are specific material requirements. Do not specify factory-insulated roof panels when skylights are specified since this is, apparently, a proprietary system.

- a. Fabricated of [zinc-coated steel] [aluminum/zinc-coated steel]
[or] [aluminum] [except translucent wall panels indicated].

- b. Preformed.
- c. Factory-insulated to provide weathertight joint upon installation, with:
 - [(1) Inner and outer sheets formed and joined at edges into a tongue-and-groove joining system with vinyl seals, closed cell foam tape, or factory-applied nonskinning butyl sealant] [; or]
 - [(2) Outer sheet designed to overlap adjacent panel a minimum of one configuration.]
- d. If designed as diaphragm, roof decks shall be designed in accordance with SDI DDM02.
- e. For standing seam roofs, Section 07611N STEEL STANDING SEAM ROOFING.

[Depth of the panels shall be as indicated.] [Insulation in the cores of the panels shall be asbestos-free composition and provide an overall "U" value of not more than 0.10 for wall panels [and] [0.05 for roof panels].] [Insulation in factory-insulated panels shall have a flame spread rating of 75 or less and a smoke development factor of 150 or less]. [Panels over 30 feet in length shall be designed for thermal expansion and contraction.]

2.1.2.1 Zinc-Coated Steel Sheet

ASTM A 755/A 755M, Coating Class Z 350 G-90 or ASTM A 653/A 653M, SQ, Grade 33, Coating Class Z 350 G-90.

2.1.2.2 Aluminum/Zinc-Coated Steel Sheet

ASTM A 792/A 792M, AZ 55

2.1.2.3 Aluminum Sheet

Alloy 3004 Alclad conforming to ASTM B 209M ASTM B 209.

2.1.2.4 Aluminum-coated Steel

ASTM A 463/A 463M, Type Z, coating designation T2 ES; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 E5.

2.1.3 Wall Liners

NOTE: Wall liners will be specified when necessary to provide protection to the insulation and will be the minimum height consistent with the use of the building. When full-height liners are required, they should be specified under this paragraph in lieu of using factory insulated panels. Wall liners of plywood, hardboard or other suitable materials may be used when considered to be more appropriate than sheet metal liners and when these materials will meet the fire hazard classifications required for the installation. If alternative liners are used, omit the following paragraph and show the

supplementary supports for the liner on the drawings.

Wall liners shall be 0.6 mm 0.024 inch thick minimum for aluminum or 0.45 mm 0.018 inch thick minimum for steel with the same composition specified for panels or siding, and formed or patterned to prevent waviness and distortion, and shall extend from floor to [a height of not less than [_____] mm feet above the floor.] [the ceiling.] Matching metal trim shall be provided [at base of wall liner,] [at top of wall liner,] [around openings in walls] [and over interior and exterior corners]. Wall liners shall have [the same factory color finish as specified for the exterior face of the wall panels.] [manufacturer's standard finishes.] Colors shall be [selected from manufacturer's standard finishes] [as indicated].

2.2 FRAMING AND STRUCTURAL MEMBERS

2.2.1 Steel

ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M.

2.2.2 Aluminum

ASTM B 221/ASTM B 221 or ASTM B 308/B 308M.

2.2.3 Uncoated Steel

ASTM A 570/A 570M, ASTM A 606, or ASTM A 607.

2.2.4 Galvanized Steel

ASTM A 653/A 653M, G 90 coating designation, 0.045 inch minimum thickness.

2.2.5 Aluminum Sheet

Aluminum sheet shall conform to ASTM B 209, 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221 or ASTM B 308/B 308M. Structural pipe shall conform to ASTM A 53/A 53M, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241/B 241M, or ASTM B 429. Holes for structural connections shall be made in the shop.

2.2.6 Structural Tube

ASTM A 500 or ASTM B 221/ASTM B 221.

2.3 ACCESSORIES

2.3.1 Caps, Strips, and Plates

Form ridge caps, eave and edge strips, fascia strips, miscellaneous flashings, and miscellaneous sheet metal accessories from the same material and gage as the roof panels. Wall plates, base angles or base channels, and other miscellaneous framing members may be standard structural steel shapes, or may be formed from steel not lighter than 1.2 mm 18 gage thick.

2.3.2 Closure Strips

Provide closure strips of closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering. Closure strips shall not absorb or retain water.

2.3.3 Sealant

Provide elastomeric type sealant containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

2.3.4 Gaskets and Insulating Compounds

Provide nonabsorptive gaskets and insulating compounds suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.3.5 Fasteners

NOTE: Fasteners that are not color coated may be limited to 300-series corrosion resisting steel when warranted by atmospheric exposure conditions.

For projects in hurricane areas, self-clinching pull-stem rivets or bolts provide greater resistance to failures from "flutter" and uplift action of high wind forces than sheet-metal screws.

Provide fasteners for [standing seam metal roofs in accordance with Section 07611N STEEL STANDING SEAM ROOFING (SSSR)] [steel wall and roof panels of zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall and roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear strength of not less than 3.3 kN 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 10 mm 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm 1/8 inch thick. When wall covering is factory color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system using concealed clips shall be manufacturer's standard for the system provided.]

2.3.5.1 Screws

Provide self-tapping screws not less than No. 14 diameter and not less than No. 12 diameter if self-drilling/self-tapping type.

2.3.5.2 End-Welded Studs

Provide automatic shouldered type studs with a shank diameter of not less than 5 mm 3/16 inch and cap or nut for holding covering against the shoulder.

2.3.5.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank diameter

of not less than 3.7 mm 0.145 inch with a shank length of not less than 12 mm 1/2 inch for fastening panels to steel and not less than 25 mm one inch for fastening panels to concrete.

2.3.5.4 Blind Rivets

Provide aluminum rivets with 5 mm 3/16 inch nominal diameter shank or stainless steel rivets with 3 mm 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Provide hollow stem rivets with closed ends.

2.3.5.5 Bolts

Provide bolts not less than 6 mm 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.3.6 Gutters

Provide complete with mitered corners, end pieces, and special pieces that may be required. Expansion-type slip joints shall be provided at the center of the runs and at intervals of not more than 9800 mm 32 feet for aluminum and not more than 12 200 mm 40 feet for steel. Provide water tight seal at all other joints. Provide gutters below the slope line of the roof, to allow snow and ice to slide clear. Provide hangers and fastenings from a metal compatible with the gutters. Space hangers not more than 900 mm 36 inches apart.

2.3.7 Downspouts

Provide cross sectional area not less than the size of gutter indicated and complete including elbows and offsets. Provide downspouts in approximately 3000 mm 10 foot lengths; end joints shall telescope not less than 12 mm 1/2 inch, and longitudinal joints shall be locked. Provide gutter outlets with stainless steel wire ball strainers of a standard type. Position downspouts not less than 12 mm 1/2 inch away from walls and fasten to the walls at top, bottom, and at not to exceed 1500 mm 5 foot centers intermediately between with manufacturer's standard type leader straps, or concealed type fasteners. Form straps and fasteners from a metal compatible with the downspouts. [Provide open downspout.]

2.3.8 Circular Roof Ventilators

Provide circular roof ventilators fabricated of aluminum or zinc-coated steel with [manufacturer's standard factory finish, color as indicated] [the same finish specified in paragraph entitled "Finish," color as indicated] [mill finish], furnished with removable [bird] [insect] screens [and] [chain or cable operated dampers]. Provide rigid weathertight ventilators free from vibration upon installation.

2.3.9 Continuous (Ridge) Roof Ventilators

Provide ventilators fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel, of [manufacturer's standard factory finish, color as indicated] [the same finish specified in paragraph entitled "Finish," color as indicated] [mill finish], complete with braces, [chain-operated dampers], and bird screening. Provide ventilators in sections 8 or 10 feet 2400 or 3000 mm long, braced at midlength. Join sections together with splice plates of the same material as the sections. Provide end closures for each section. [Throat size (vent opening) shall

be [_____] mm inches.]

2.3.10 Louvers

NOTE: Delete inapplicable paragraph. Louvers shall
be specified to be provided with the building only
if formed metal louvers of the type standard with
the building manufacturer are acceptable. Check
with the Mechanical Engineer for special
requirements.

[Provide louvers and frames of the sizes, design, and color indicated. Provide [manufacturer's standard factory finish] [the same finish specified in paragraph entitled "Finish"] [mill finish]. Fold or bead blades at the edges, set at an angle to exclude driving rains, and secure to the frames by riveting or welding as standard with manufacturer. Provide mullions for louvers over 1200 mm 4 feet in width; provide not less than one mullion for each 1200 mm 4 foot width. Provide flanges on the interior face of frames where air intakes or exhaust louvers are indicated to be connected with mechanically-operated dampers or metal ductwork. Provide woven wire bird screening, not less than 8.5 by 8.5 mm mesh per square meter 3 by 3 mesh per square inch in rewirable frames, on the [interior] [exterior] of louvers; install screen frames by means of clips to allow easy removal for cleaning and rewiring. The screens and frames shall be of the same type metal as the louvers; screen wire shall be not less than 1.2 mm 0.0475 inch in diameter.] [Specified in Section 15810N DUCTWORK AND DUCTWORK ACCESSORIES. Provide framing and flashings as necessary for installation of louvers.]

2.3.11 Skylights

Skylights shall conform to the requirements of Section 08600 SKYLIGHTS.

2.3.12 Light Transmitting Roof Panels (Insulating)

Standard with the manufacturer of [a nominal size of [_____] by [_____] feet] [size indicated]. The light transmitting roof panels shall consist of an interior and exterior plastic face with a sealed airspace of 25 to 37 mm one to 1 1/2 inches. The exterior plastic face shall be not less than 1.4 mm 0.055 inch thickness and shall have the same configurations as the roofing panels. The interior plastic face shall be not less than 0.9 mm 0.035 inch thickness. Plastic faces shall be fiberglass consisting of polyester synthetic resin reinforced with a fibrous glass mat and rated self-extinguishing by Underwriters Laboratories. The "U" factor of the light transmitting roof panels shall not be more than 0.50.

2.3.13 Light Transmitting Roof Panels (Noninsulating)

ASTM D 3841, Type II, Grade 1, weighing not less than 2.4 kg per square meter 8 ounces per square foot, standard with the manufacturer. Size and color as indicated. Provide light transmitting roof panels of the same configuration as the roof panel.

2.3.14 Plastic Wall Lights

ASTM D 3841, Type II, Grade 1, weighing not less than 2.4 kg per square meter 8 ounces per square foot, standard with the manufacturer. Size and

color as indicated. Provide wall lights of the same configuration as the metal wall panels.

2.3.15 Insulation

NOTE: Heat is transferred through walls and roofs, and is either gained or lost, depending on whether a building is experiencing summer or winter conditions. Along with heat transfer concepts, moisture transfer concepts must be considered. In cold climates moisture migration can create a problem due to condensation. It is important to remember that drawings must show type, extent, and location of insulation. The vapor retarder location is dependent on the climate as noted in paragraph VAPOR RETARDER.

The required R-value for the insulation will be determined and shown at the appropriate details on the drawings. The required R-values for the insulation will never be less than the R-values used in the Energy Budget Analysis. The R-values shown on the drawings should be greater than those used in the design analysis to account for thermal bridges. Provide about a one-third increase (or as local experience has shown, if different) in R-value over what is calculated; that is, if an R-value of 3 is needed in metric (metric units are square meter K/W) (16 in I-P with units of h x square feet x degree F/Btu) use an R-value of 4 (21) in the contract. If an analysis of thermal bridges in the design gives a requirement greater or less than this, it should be used.

Flame spread and smoke development ratings of insulation, to include facing, must comply with the requirements of MIL HDBK 1008C. Exposed insulation will be faced, mineral fiber type, only; cellular plastic insulations will not be exposed.

If prefabricated insulated sandwich panels are used for siding and roofing, delete this paragraph in its entirety.

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. [Blanket insulation shall have a facing as specified in paragraph VAPOR RETARDER]. [Roof] [Roof and wall] insulation [, including facings,] shall have a flame spread not in excess of [_____] and a smoke developed rating not in excess of [_____] when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory. Contractor shall comply with EPA

requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.3.15.1 Rigid Board Insulation

NOTE: Detailed information concerning EPA requirements on recycled/recovered materials is available at the following URL's:
<http://www.epa.gov/cpg/products/> and then click on the appropriate item from the list (building.htm for building insulation, for example).
<http://www.epa.gov/cpg/products.htm> (similar results).
<http://www.epa.gov/cpg/pdf/back.pdf> which opens up EPA530-R-98-003 (dated July, 1998, titled BACKGROUND DOCUMENT FOR PROPOSED CPG III AND DRAFT RMAN III).

Using data from listed locations, fill in blank space for required percentage of recycled or recovered material. This is in accordance with the requirements of 40 CFR 247 and Section 01670 which should be included in all projects.

- a. Polyisocyanurate: Polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of [_____] percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 25 mm 1 inch of insulation used shall be 1.27 mm.7.2 inch.
- b. Polystyrene: Insulation shall conform to ASTM C 578, Type IV.

2.3.15.2 Mineral Fiber

Insulation shall conform to ASTM C 612.

2.3.15.3 Blanket Insulation

Blanket insulation shall conform to [ASTM C 991] [ASTM C 553] 9.6 kg per cubic m 0.6 pound fiber-glass as standard with the metal building manufacturer having a factory-applied facing on one side and a permeance rating of 0.05 or less when tested in accordance with ASTM E 96.

- a. Facing on insulation shall be vinyl-scrim foil [, except that behind liner panels [and [_____]], facing may be 0.05 mm 0.002 inch thick aluminum foil]. Vinyl-scrim foil shall have a tensile strength of not less than 178 N 40 pounds machine direction and 134 N 30 pounds cross machine direction when tested in accordance with ASTM D 828.
- b. The insulation, including facings, shall have a flame spread rating of [75] [_____] or less and a smoke development factor of [150] [_____] or less when tested in accordance with ASTM E 84.
- c. Wall insulation shall have guarded hot box values for "R" of [_____] or more as measured in accordance with ASTM C 236 test method. Roof insulation shall have guarded hot box values for "R"

of [_____] or more as measured in accordance with ASTM C 236.

- d. Provide insulation containing 20 percent or greater recovered material which has been diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, provide the one containing the higher recovered material content.

2.3.15.4 Insulation Retainers

Retainers shall be type, size and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.3.16 Vapor Retarder

NOTE: The term vapor retarder has been selected to describe the membrane used to reduce moisture vapor transmission. The location of the vapor retarder is determined by the climate and the building type.

The vapor retarder goes on the side of the insulation with the greatest vapor pressure during the course of the year; therefore it goes on the outside in a climate predominately warm, and on the inside in a climate predominately cool. The designer should determine the most appropriate application/installation of the vapor retarder based on project circumstances. See TM 5-810-1 for humid climate definition.

Detail the use of insulation on the drawings. Coordinate with Sections 07412, "Non-Structural Metal Roofing" and 07416, "Structural Standing Seam Roofing (SSSR)" vapor retarder requirements.

2.3.16.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of [1.15] [_____] ng per Pa-second-square meter [0.02] [_____] perm or less when tested in accordance with ASTM E 96. Facing shall be [white] [black] reinforced polypropylene kraft laminate (PSK). Facings and finishes shall be factory applied.

2.3.16.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to the requirements of ASTM D 4397. A single ply of 0.25 mm 10 mil polyethylene sheet; or, at the option of the Contractor, a double ply of 0.15 mm 6 mil polyethylene sheet shall be used. A fully compatible polyethylene tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

[2.3.17 Doors and Windows

NOTE: Normally, doors and windows should be specified in separate sections to assure proper coordination with doors, windows, glass, and hardware which are part of the project occurring in other types of construction in the project, and to allow the Contractor to obtain competitive pricing.

If the project involves only small storage type buildings with no other type of building construction, and building manufacturer's standard doors and windows will be satisfactory, the doors, windows, glazing, and hardware, if necessary, may be included in this section.

NOTE: Insert appropriate Section numbers and titles in blankS below using format per UFC 1-300-02.

Doors and windows are specified in [_____] and [_____]. Provide framing members and flashings as necessary for installation of the doors and windows.

2.3.17.1 Swinging Personnel Doors and Frames

SDI A250.8, Grade II, Model 1, 2, 3, or 4, design as indicated, zinc-coated and shop primed, exterior mounting.[Doors shall be glazed with [_____] glass.][Hardware is specified in Section 08710 DOOR HARDWARE.][Hardware shall conform to BHMA A156.1, BHMA A156.2, BHMA A156.3, and BHMA A156.4.] Doors shall be provided with the following hardware:

DOOR NO.	HARDWARE REQUIRED
[_____]	[_____]

2.3.17.2 Sliding Doors

[Hollow metal][Sheet metal] type. [Hollow metal type shall conform to SDI A250.8, Grade II, Model 1, 2, 3, or 4, design as indicated, zinc-coated and shop primed.][Sheet metal type shall consist of steel framework covered with siding of the same type and finish as used for the building.] Provide hardware necessary for the complete installation of sliding doors. Sliding door hardware shall include heavy-duty zinc-coated steel tracks, brackets, end and center stops, not less than two-wheel ball or roller bearing, adjustable type hangers - two per leaf, binders, guides, handles, heavy type cane bolt and socket for one leaf of pairs of doors, padlock eyes or heavy safety hasp, and flashing for outside door tracks. Hardware items shall be approved types, standard with the door manufacturer.

2.3.17.3 Overhead Doors Rolling Doors

NOTE: Insert appropriate Section number and title in blank below using format per UFC 1-300-02.

Overhead rolling doors shall conform to the requirements of [Section 08330 OVERHEAD ROLLING DOORS] [____]. Hardware shall be [as scheduled [herein] [on the drawings]] [as specified in Section 08710 DOOR HARDWARE].

2.3.17.4 Sectional Overhead Doors

Sectional overhead doors shall conform to the requirements of Section 08361 SECTIONAL OVERHEAD DOORS. Hardware shall be [as scheduled [herein] [on the drawings]] [as specified in Section 08710 DOOR HARDWARE].

2.3.17.5 Vertical Lift Doors

Vertical lift doors shall conform to the requirements of Section 08370 VERTICAL LIFT DOORS. Hardware shall be [as scheduled [herein] [on the drawings]] [as specified in Section 08710 DOOR HARDWARE].

2.3.17.6 [Aluminum Windows] [or] [Steel Windows]

NOTE: Choose "a. Aluminum Windows" or "b. Steel Windows" or choose both leaving the Contractor the option. Steel windows are no longer completely American made. Contact the Contract Office for a waiver.

- [[a. Aluminum Windows:] AAMA 101, Type [A-C] [HS-C] [HS-HC] [C-C] [C-HC] [DH-C] [DH-HC] [P-C] [P-HC]. Windows shall be factory glazed with [____] glass. Provide aluminum with [an AA-M10-C22-A31 clear anodized finish in accordance with the requirements of AA 45] [manufacturer's standard factory finish, color as indicated] [the same finish specified in paragraph entitled "Finish," color as indicated]. Ventilating sections shall be provided with insect screens. [Windows shall be provided with thermal barrier features.]]
- [[b. Steel Windows:] SWI SGSW, [commercial projected] [architectural projected] [standard intermediate projected] [standard intermediate casement] type. Provide [manufacturer's standard factory finish, color as indicated] [the same finish specified in paragraph entitled "Finish," color as indicated]. Provide ventilating sections with insect screens. Provide factory glazed windows with [____] glass. [Provide windows with thermal barrier features.]]

]2.3.18 Canopies

Of same materials and finish as the building. Soffit materials shall be [____] [of material indicated].

2.3.19 Sealant

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be [colored to match the applicable building color] [clear] and shall cure to a rubber like consistency.

2.3.20 Gaskets and Insulating Compounds

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.4 FINISH

2.4.1 Shop Painting

Ferrous metal work, except factory-finished work, zinc-coated work, aluminum-coated work, and work specified to be painted herein, shall be (1) cleaned of dirt, rust, scale, loose particles, grease, oil, and other deleterious substances; (2) phosphate treated; and (3) then be given one coat of an approved rust-inhibiting primer paint of the type standard with the metal building manufacturer.

2.4.2 Factory Color Finish

NOTE: Specify a high performance coating by giving chemical name of paint and percentage of resin in the coating. 70 percent resin fluoropolymer is Kynar. Edit listed tests to include appropriate requirements. A 0.02 mm 0.8 mil fluoropolymer clear protection coat is used for special colors or metallic finish. It is part of Pittsburgh Paints Duranar system.

NOTE: Factory color finish will be specified except when the buildings are to be used for temporary purposes or where mill finish aluminum panels provide an acceptable appearance. If factory color finish is not required, document the rationale for the decision in the design analysis and remove this paragraph.

The US Metal Building Industry offers a variety of color finishes to protect the metal panels against chemical corrosion and ultraviolet radiation; to provide long life with minimum maintenance plus acceptable weathering and color retention; and to assure chalk, fade, and mar resistance. Some of the most widely used coatings include, but are not limited to, the following:

- a. Polyvinylidene fluoride (PVF2); a nominal 0.025 mm (1 mil) thick coating modified with a proprietary resin for toughness; it may be used in most environments.
- b. Silicone-modified polyester (SMP); a thermoset coating system composed of polyester resin modified by copolymerization with a functional silicone resin intermediate designed for added protection against chemical corrosion and ultraviolet radiation.

c. Plastisol (PVC); a two-coat system consisting of a polyvinyl-chloride resin dispersed in a plasticizer top-coat over a corrosion-resistant primer; it is a high-performance, thick coating designed for highly aggressive and corrosive environments with excellent resistance to common acids, alkalis, and inorganic compounds.

Most coatings may be ordered extra-thick for buildings in direct contact with salt or chemical laden air or where a premium finish would be justified. The thicker coating provides additional primer and increases the coating's corrosion and abrasion resistance but it requires a special run by the coil coater, at least a 22 degrees C (70 degrees F) environment, and additional delivery time. Appropriate specification requirements must be added if the thick film coatings are to be used.

The high cost of preventing corrosion of galvanized steel panels, together with the fact that cut edges, scratches and penetrations of the panels expose the steel substrate, warrants consideration for the use of solid aluminum which is inherently less susceptible to damaging corrosion.

Exterior wall and roof panels are available in several standard colors. Standard trim colors are usually more limited. Except where interior surfaces receive a factory color coat, the exposed reverse side of the panels normally are provided with an off-white backer coating. Color other than manufacturer's standard colors will be used only when the extra cost is justified.

The choice of coating for the interior face of panels depends on environmental and aesthetic considerations. Where a corrosive atmosphere is anticipated within the structure, the finish should be PVF2 in a thickness appropriate to the environment. For utilitarian facilities with little likelihood of a detrimental atmosphere, a standard backer coat is appropriate. Backer coat is the manufacturer's standard coating (usually polyester based) applied to the back side of the metal panel. This coating is normally a wash coating and is not controlled for consistent color or gloss. Where interior surfaces are concealed behind insulation, liner panels, etc.; provide only a primer coat. These finishes should not be confused with a wash coat which is used primarily to facilitate the coil forming process and which is not closely controlled for color, gloss or film thickness. The designer's rationale for using any special interior finish should be reflected in the design analysis.

Energy considerations must be included in the choice of standard colors for the roof panels. White or light-colored roofing surfaces are much better at

reflecting sunlight than darker surfaces. This keeps roofs 20 to 35 degrees C (35 to 60 degrees F) cooler, which means less heat will be transferred to internal building spaces. Demonstration projects have shown that cooling energy use can be cut by as much as 40 percent when light-colored surfaces are used. Coordinate the use of light-colored roofing material with the user.

Provide exterior and interior exposed surfaces of metal roof and wall panels, [roof ventilators,] [louvers], gutters, downspouts, and metal accessories with a thermal-cured factory finish. Color shall be [selected from manufacturer's standard colors] [as indicated]. Provide an exterior finish top coat of [the building manufacturer's standard paint] [50 percent resin silicone polyester] [70 percent resin fluoropolymer]. Provide standard dry film thickness of [0.02] [0.025] mm [0.8] [1.0] mil for exterior coating exclusive of primer. Provide exterior primer thickness [standard with building manufacturer] [0.005] [0.02] mm [0.2] [0.8] mil. Interior color finish shall consist of [the same coating and dry film thickness as the exterior] [a backer coat with dry film thickness of [0.01] [0.005] mm [0.5] [0.2] mil thick prime coat.] Provide [interior and] exterior color finish meeting the test requirements specified below. Tests shall have been performed on the same factory finish and thickness provided.

2.4.3 Testing of Factory Color Finishes

2.4.3.1 Salt Spray Test

NOTE: The results of the salt spray test will vary depending on the thickness of the coating.

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610 and a rating of 6, over 2.0 to 3.0 mm 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.4.3.2 Accelerated Weathering Test

ASTM G 23, 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.

2.4.3.3 Flexibility

ASTM D 522, Method A, 1/8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.

2.4.3.4 Adhesion

ASTM D 3359, Method B, for laboratory test and film thickness less than 5 mil and Method A for site tests. There shall be no film removed by tape applied to 11 parallel cuts spaced 1/8 inch apart plus 11 similar cuts at

right angles.

2.4.3.5 Impact

ASTM D 2794, no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mils, expressed in inch-pounds.

NOTE: Use 1500 hours for kynar on galvanized steel.
Use 2000 hours for kynar on aluminum.

2.4.3.6 Humidity Resistance

ASTM D 2247, [1000] [_____] hours, no signs of blistering, cracking, creepage or corrosion on score panel.

NOTE: MIL-HDBK-1028/1, "Aircraft Maintenance Facilities," Section 2, paragraph entitled "Surface Treatment," requires this for roof surfaces so located that glare may be an operational hazard. Manufacturers producing prefinished sheets meeting this requirement as a standard item are limited, and the sheets are available only in certain colors. The fade and chalk requirements will not apply with this low gloss. Delete them from "Factory Color Finish."

2.4.3.7 Specular Gloss

NOTE: Few manufacturers regularly produce prefinished panels meeting these low gloss requirements and such sheets are available only in limited colors. Standard 70 percent PVF2 finish, for example, has a medium gloss. Low gloss paint formulations result in reduced weathering properties. Identify individual facilities requiring low gloss finish.

For roof of structures at airfields where glare would be objectionable and may be an operational hazard, the specular gloss value should be limited to 10 or less at an angle of 85 degrees.

ASTM D 523, finished surfaces exposed to the building exterior shall have a specular gloss of 10 measured at an angle of 85 degrees.

[2.4.3.8 Abrasion

ASTM D 968, Method A, falling sand shall not expose substrate when tested in quantities [7.9-10.6] [13.2-15.9] gallons of sand per mil of thickness.]

2.4.3.9 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm 1/8

inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.4.3.10 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

PART 3 EXECUTION

3.1 INSPECTION

Check concrete dimensions, anchor bolt size and placement, and slab elevation with the metal building manufacturer's templates and drawings before setting any steel.

3.2 ERECTION

Erect in accordance with the manufacturer's approved erection instructions and diagrams. Correct defects and errors in the fabrication of building components in a manner approved by the Contracting Officer. If defects or errors in fabrication of components cannot be corrected, remove and provide nondefective components. When installing wall and roof systems, install closure strips, flashing, sealing material, and other accessories in accordance with building manufacturer's instructions to provide a weathertight system, free of abrasions, loose fasteners, and deformations. After erection is complete, repair and coat abraded and damaged, primed or factory-finished surfaces to match adjacent surfaces.

3.2.1 Dissimilar Materials

Prevent direct contact between aluminum surfaces, and ferrous or other incompatible metals, by one of the following methods:

- a. Paint the incompatible metal with a coating of manufacturer's standard heavy-bodied paint.
- b. Paint the incompatible metal with a prime coat of corrosion inhibitive primer followed by one or two coats of aluminum metal-and-masonry paint, or other suitable protective coating, excluding products containing lead and chromium pigmentation.
- c. Provide an approved nonabsorptive gasket.
- d. Apply an approved calking between the aluminum and the incompatible metal.

If drainage from incompatible metal passes over aluminum, paint the incompatible metal by method (a) or (b). Paint aluminum surfaces in contact with concrete or masonry materials by method (a). Paint green or wet wood, or wood treated with incompatible wood preservatives, by method (a) or use two coats of aluminum paint.

3.2.2 Rigid Frames, Bases, and Sill Members

Brace frames as necessary to ensure safety. Set accurately, using a nonshrink grout to obtain uniform bearing on the concrete and to maintain a level base line elevation. Separate leveling plates under column base

plates shall not be used. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses. Supports for electric overhead traveling cranes shall be positioned and aligned in accordance with CMAA 70. Clean surfaces to receive the mortar and thoroughly moisten immediately before placement of mortar. Water cure exposed surfaces of mortar with wet burlap for 7 days.

3.2.2.1 Field Welding

Steel, AWS D1.1/D1.1M. Aluminum, AA 30.

3.2.2.2 Field Bolting

AISC S329. Improper or mislocated bolt holes in structural members or other misfits caused by improper fabrication or erection, shall be repaired in accordance with AISC Pub No. S303. Concrete work is specified in [Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE] [Section 03300N CAST-IN-PLACE CONCRETE]. Anchor bolts shall be accurately set by template while the concrete is in a plastic state.

3.2.3 Wall Construction

Apply panels [in the longest obtainable lengths] [full wall heights from base to eave with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations]. Lay side laps away from the prevailing winds. Seal side and end laps with the joint sealing material recommended by the manufacturer. Flash or seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Flashing will not be required where approved "self-flashing" panels are used. Minimum end laps for all types of panels shall be 64 mm 2 1/2 inches. Minimum side laps for all types of panels shall be one corrugation, one configuration, or an interlocking joint. Install liner panels to [height indicated] [[_____] mm[_____] feet above finished floor].

3.2.4 Roof Construction

**NOTE: If full length roofing panels are desired,
ensure availability in the length required for the
building. Normally, panels are not available for
buildings over 18 m 60 feet in width.**

Apply the roofing panels in [the longest lengths obtainable with end laps occurring only at structural members] [full lengths from ridge [or ridge panel] to eaves] [top eave to bottom eave on shed roofs] with no transverse joints except at the junction of ventilators, curbs, light transmitting roof panels, chimneys, and similar openings. Lay side laps away from the prevailing wind, and seal side and end laps with joint sealing material. Flash and seal the roof at the ridge, at eaves and rakes, at projections through the roof, and elsewhere as necessary. Minimum side lap shall be [one corrugation, configuration, or interlocking rib] [except] [1 1/2 corrugations for standard corrugated sheets]. [End laps shall not be less than 150 mm 6 inches and shall occur only over purlins.]

3.2.5 Installation of Gutters and Downspouts

Gutters and downspouts shall be rigidly attached to the building. Spacing of cleats for gutters shall be 400 mm 16 inches maximum. Spacing of brackets and spacers for gutters shall be 1 m 36 inches maximum. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.2.6 Louvers and Ventilators

Louvers and ventilators shall be rigidly attached to the supporting construction to assure a weather tight installation.

3.2.7 Doors and Windows

Doors and windows, including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors and windows shall be sealed according to manufacturer's recommendations to provide weathertight construction.

3.2.8 Minimum Fastener Spacing

Space fasteners according to manufacturer's instructions, but not to exceed:

- a. 200 mm 8 inches o.c. at end laps of covering,
- b. 300 mm 12 inches o.c. at connection of covering to intermediate supports,
- c. 300 mm 12 inches o.c. side laps of roof coverings, 450 mm 18 inches o.c. at side laps of wall.

3.2.9 Installation of Insulation

NOTE: If factory insulated panels are used for roofing and siding, delete this paragraph in its entirety.

NOTE: These paragraphs are limited to mineral fiber insulations of a 150 mm 6 inch thickness or less. If thicker insulation is required, consult metal building manufacturer for recommendations for installation.

NOTE: Choose the bracketed option only when insulation must be stapled from the interior of the building and concealment of the joints is desired.

3.2.9.1 Roof Insulation

Install over purlins before roof coverings are applied. Hold insulation rigid until secured in place. Insulation facing shall be exposed on the interior side of the building. Fold and staple facing tabs of insulation on

150 mm 6 inch centers, from exterior side of building to completely seal joints. If folding and stapling can only be accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets [, and cover side laps of insulation with metal strips formed for this purpose and paint to match the facing material. Install the strips spanning from purlin to purlin and in accordance with the metal building manufacturer's recommendations].

3.2.9.2 Wall Insulation

Install over girts before wall coverings are applied. Hold insulation rigid until secured in place. Expose facing toward the interior side of the building. Fold and staple facing tabs of insulation on 150 mm 6 inch centers, from exterior side of building, to completely seal joints. If folding and stapling can only be accomplished from the inside, push the tabs neatly up between the edges of adjoining blankets [, and cover side laps of insulation with metal strips formed for this purpose and paint to match the facing material. Install the strips spanning from girt to girt and in accordance with the metal building manufacturer's recommendations].

3.2.10 Vapor Retarder Installation

NOTE: Choose one paragraph and delete the other.

3.2.10.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

3.2.10.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 150 mm.6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

3.2.11 Wall Liner

Wall liner shall be securely fastened into place in accordance with the manufacturer's recommendation and in a manner to present a neat appearance.

3.3 FIELD PAINTING

NOTE: Field painting covers touch-up painting of previously painted surfaces and finish painting of steel doors and steel windows. Additional requirements will be added as necessary to cover finish painting of wood doors and other items requiring a field applied paint finish. When required, field color finish will be specified in accordance with Section 09900, "Painting, General."

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same color and material used for the shop coat. Section 09900 PAINTS AND COATINGS, for painting of shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows.

3.4 FIELD QUALITY CONTROL

At the discretion of the Contracting Officer, sample panels may be taken at random from each delivery or from stockpiles on the site at any time during the construction period, and tests may be made to check the conformance of the materials to the requirements specified in paragraph entitled "Factory Color Finish." Failure of the sample sheets to pass the required tests shall be cause for rejection of all sheets represented by the samples and replacement of the entire shipment.

3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by paragraph 3.2 of FEMA 302, NEHRP RECOMMENDED PROVISIONS FOR SEISMIC REGULATIONS FOR NEW BUILDINGS AND OTHER STRUCTURES.

This paragraph will be applicable to both new buildings designed according to TI 809-04, SEISMIC DESIGN FOR BUILDINGS.

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with Chapter 3 of FEMA 302. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452A SPECIAL INSPECTION FOR SEISMIC RESISTING SYSTEMS.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
PREENGINEERED METAL BUILDINGS

FACILITY
DESCRIPTION: _____

BUILDING
NUMBER: _____

CORPS OF ENGINEERS CONTRACT
NUMBER: _____

CONTRACTOR

CONTRACTOR: _____
ADDRESS: _____

POINT OF
CONTACT: _____

TELEPHONE
NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF
CONTACT: _____

TELEPHONE
NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION
AGENT: _____
ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE
NUMBER: _____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
PREENGINEERED METAL BUILDINGS
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY [_____] FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON [_____] AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
PREENGINEERED METAL BUILDINGS
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, AND GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
PREENGINEERED METAL BUILDINGS
(Exclusions from Coverage Continued)

IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPLACED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT. A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --