SECTION 13121
PRE-ENGINEERED BUILDINGS

PART 1 GENERAL

1.01 SCOPE

1.1.1 These specifications delineate the design criteria, material quality, and fabrication processes used in metal building systems.

1.1.2 These specifications are intended for use as an outline of the performance requirements for the various materials used within the metal building systems. They are further intended to insure that architects, engineers, builders, and owners understand the basis for design, manufacture, and application of these materials.

1.1.3 Engineering and mechanical properties of materials utilized by the metal building manufacturer in its product line shall be provided or referenced within the engineered shop drawings and specifications, and shall be industry specification standards, where applicable.

1.1.4 These standards, specifications and/or interpretations and recommendations are those of professionally recognized groups and agencies, such as MBMA, AISC, AISI, AWS, ASTM, as the basis in establishing its own design, fabrication and quality criteria, standards, practices, methods, and tolerances. For convenience, certain provisions of a specification and/or recommendation of one of these groups or agencies (i.e. AISC, AISI, etc.) may be referenced, where appropriate, in the manufacturer’s documents. In all cases however, unless stipulated otherwise in the contract documents, industry standard design, fabrication and quality criteria, standards, practices, methods, and tolerances will govern the work.

1.1.5 Due to the possibility of product improvement through product development, and also due to possible changes in material availability, these specifications are subject to change without notice.

1.2 MATERIALS

1.2.1 Standard material furnished for all metal building systems shall include primary and secondary structural framing members, bracing, metal panels for roofing and siding, flashings, fasteners, sealants, accessories, and all other miscellaneous component parts required for a complete building (with the exception of anchor bolts and other embedded items, which are excluded). Insulation and other specific items beyond the scope of standard material shall also be furnished if shown or called for by contract documents.

1.3 DRAWINGS AND CALCULATIONS

1.3.1 The drawings and calculations required as part of 1.3.2 thru 1.3.4 shall be submitted to the Architect in conjunction with the requirements of Section 01300.

1.3.2 The pre-engineered building manufacturer shall provide erection information and drawings as required to assemble all parts, components, and accessories furnished by the manufacturer. Drawings shall include anchor bolt setting plans, roof framing plan, wall framing elevations, cross-sections, etc., and shall also be furnished if shown or called for by contract documents. These drawings shall be signed and sealed by a Florida licensed professional engineer.

1.3.3 Anchor bolt setting plans shall include column reactions for use in designing foundations for the building.

1.3.4 The manufacturer shall furnish design calculations certifying the design for the structural framing and covering panels of the metal building system. These calculations shall be signed and sealed by a Florida licensed professional engineer. The design calculations may be computer-generated or prepared manually and may also include test reports.

1.4 BUILDING NOMENCLATURE

1.4.1 The building width shall be measured from side wall “steel line” to the opposite side wall “steel line.” The building length shall be measured from end wall “steel line” to the opposite end wall “steel line.”

1.4.2 The building eave height shall be measured from finished floor to top of the eave strut. The top of the eave strut is the point of intersection between the side wall “steel line” and the roof “steel line.”

1.4.3 The bay spacing shall be measured as
follows:

A. Interior bays from center-line to center-line of interior frames.

B. End bays from end wall "steel line" to center-line of first interior frame.

1.5 SUPPLIERS

1.5.1 Substitutions: Under provisions of Section 01600.

1.6 MANUFACTURERS

1.6.1 Approved Manufacturers:
2. Metal Building Manufacturer, Inc.
4. Star Building Systems
5. American Steel Buildings, LLC.
6. Butler Manufacturing
7. Southern Structures Company
8. Whirlwind Steel Buildings
9. A&S Building Systems
10. Gulf States Manufacturers
11. Frontier Steel Buildings
12. Mesco Building Solutions
13. Kirby Building Systems, LLC.
14. Nuror Building Systems
15. American Building Company
16. Vulcan Steel Structures, Inc.

1.7 QUALIFICATIONS

1.7.1 Installer: Company specializing in performing the work of this section with minimum 10 years experience.

1.8 REFERENCE STANDARDS

1.8.1 ASIC 360
1.8.2 ASTM A36
1.8.3 ASTM D529
1.8.4 ASTM 572
1.8.5 ASTM A607
1.8.6 ASTM A792

PART 2 DESIGN

2.1 GENERAL

2.1.1 All structural steel mill sections and welded plate members shall be designed in accordance with the applicable sections, relating to design requirements and allowable stresses, of the American Institute of Steel Construction (AISC) “Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design.”

2.1.2 All light-gauge, cold formed, structural members and covering shall be designed in accordance with the applicable sections, relating to design requirements and allowable stresses, of the American Iron and Steel Institute (AISI) “Specification for the Design of Cold Formed Steel Structural Members.”

2.2 DESIGN LOADS

2.2.1 Design load requirements shall be determined by local conditions, applicable codes, building end use. Magnitude of design loads shall be specified by the contract documents. Application of design loads shall be in accordance with the Design Practices sections of the Metal Building Manufacturers Association (MBMA) 1996 “Low Rise Building Systems Manual” unless specified otherwise.

2.2.2 Loads to be considered are defined as follows:

A. Dead Load: The weight of the building system materials.

B. Collateral Loads: The weight of additional permanent materials, other than the building system, such as sprinklers, mechanical and/or electrical systems, partitions, and ceilings.

C. Roof Live Loads: Loads that are produced 1) during maintenance by workers, equipment, and materials, and 2) during the life of the structure by movable objects. Live loads do not include snow, wind, seismic, or collateral loads.

D. Wind Loads: The load caused by wind blowing from any horizontal direction.

E. Auxiliary loads: Dynamic live loads such as those induced by cranes and material handling systems.
F. Floor Live Loads: Those loads induced on a floor system by the use and occupancy of the building.

2.2.3 Unless otherwise specified, load combinations shall be those listed in the Design Practices section of the MBMA 1996 "Low Rise Building Systems Manual."

2.3 UPLIFT RATINGS

2.3.1 For compliance with Underwriters Laboratories standard UL 580 class 90 (UL90) requirements, the following panels, installed in accordance with the manufacturer's standard erection instructions, shall be used.

A. MAP with up to 6 inches of blanket type insulation
B. MVR with up to 6 inches of blanket type insulation
C. CLP with up to 6 inches of blanket type insulation
D. CLP with up to 4 inches of rigid board insulation
E. CRP16 with up to 6 inches of blanket type insulation
F. CRP16 with up to 4-1/4 inches of rigid board insulation
G. CXP with up to 6 inches of blanket type insulation
H. CXP with up to 4 inches of rigid board insulation
I. Composite with up to 4 inches of rigid board insulation

2.4 MATERIAL AND WORKMANSHIP WARRANTIES

2.4.1 Provide manufacturer’s written warranties as follows:

A. The manufacturer shall provide a written warranty for twenty (20) years against cracking, crazing, blistering, peeling, chalking or fading of the coating on painted wall, roof and soffit panels.

B. The manufacturer shall provide a written warranty for twenty (20) years against perforation of metal panels due to corrosion.

C. The manufacturer shall provide a written weather tightness warranty for twenty (20) years against leaks in metal panels.

PART 3 STRUCTURAL FRAMING

3.1 PRIMARY FRAME TYPES

3.1.1 Rigid Frame Clear Span: Primary frames shall be welded rigid frame design, clear span type, with single gable roof and pin base columns. Columns shall be either tapered or straight as specified. Girts shall be by-pass, inset or flush type. Column bases may be fixed if required.

3.1.2 Expandable End Frame - Post and Beam end frame shall be designed with rafter pin connected at corner and end posts with end posts spaced at intervals along the end wall. Corner posts and end posts shall be designed as pinned both ends. Rafters shall be roll formed Cee sections (single or double) or H sections either mill shape or welded-up. Corner posts and end posts shall be roll formed Cee sections (single or double) or “H” shaped, straight sections either mill shape or welded-up depending on loading. Girts shall be Inset type.

3.2 STRUCTURAL FRAMING

3.2.1 All framing members shall be cleaned to remove loose rust and mill scale, and given one shop coat of primer. Primer shall be formulated to equal or exceed performance, under laboratory conditions, requirements of U.S. Federal Specification TTP-636. The primer coat thickness shall be an average of one mil.

3.2.2 Secondary structural framing may be cold-formed using pre-painted coil stock which eliminates the need for a shop coat of primer. In which case base metal shall be thoroughly cleaned then treated with iron phosphate solution to enhance paint adherence before coil is coated with a red oxide polyester paint. Paint dry film thickness shall be 0.5 mil on both sides.

3.2.3 Primary Members

3.2.3.1 Primary structural framing shall refer to the primary frames, expandable and non-expandable end frames, and wind bracing systems.

A. Sheet, plate, strip mill plate, plate coils and flat bar stock used to fabricate welded-up structural members shall conform to one of the following ASTM specifications as appropriate: ASTM A-570, Grade 50; ASTM A-572, Grade 50; ASTM A-529, Grade 50; ASTM A-607, Grade 50.

B. Members fabricated from W shapes (hot-
rolled structural sections) will conform to one of the following ASTM specifications: ASTM A-529, Gr. 50; ASTM A-572, Grade 50 or ASTM A-992, Grade 50.

C. Members fabricated from other hot-rolled structural sections (S shapes, American Standard channels, angles, rods for anchor bolts, and all other miscellaneous structural shapes) shall conform to ASTM A-529, Grade 50 or ASTM A-572, Grade 50.

D. Interior columns of multi-span frames will be fabricated from round pipe column sections which have a minimum yield strength of 42,000 psi and conform to physical specifications of ASTM A-500.

E. Rods used for bracing will conform to the physical specifications of ASTM A-529, Gr. 50.

F. Cables used for bracing shall be zinc coated steel wire (7 strands), extra high strength grade.

G. Members fabricated by cold forming process shall conform to ASTM specification ASTM A-570, Grade 55.

3.2.4 Secondary Members

3.2.3.1 Secondary structural framing shall refer to purlins, girts, eave struts, base members, flange bracing, gable angles, clips and other miscellaneous structural parts.

A. Purlins, girts, eave struts, base members and gable angles shall be cold-formed from steel conforming to ASTM specification A-570, Grade 55.

1. Purlins are roll formed “Z” sections, 8-1/2 inches or 10 inches deep. Each flange of these “Z”s has a stiffening lip formed at 50° to the flange.

2. Girts are either roll formed “Z” sections, 8-1/2 inches or 10 inches deep, or roll formed “C” sections, 10-1/2 inches deep. Each flange of these members has a stiffening lip formed at 50° to the flange on “Z”s and at 90° on “C”s.

3. Eave struts are roll formed “C” sections, 8-1/2 inches deep (roll formed) with 3-1/4 inch wide top and bottom flanges; or brake formed “C” sections 9-5/8 inches deep with 3-1/4 inch wide top flange and 4-1/2 inches wide bottom flange. Flanges are formed at angles other than 90° to the web to accommodate various roof slopes. Each flange has a stiffening lip formed at 90° to the flange.

B. All other miscellaneous secondary members shall have a minimum yield strength of 36,000 psi.

3.2.5 Connections

3.2.5.1 All field connections shall be bolted (unless otherwise noted).

A. All primary bolted connections, as shown on drawings, shall be furnished with high strength bolts conforming to ASTM specification ASTM A-325.

B. All secondary bolted connections, as shown on drawings, will be furnished with machine bolts conforming to ASTM specification ASTM A-307 unless ASTM A-325 bolts are required by design.

3.2.5.2 All shop welding shall be by the submerged arc, gas metal arc, or shielded arc process. Groove joint welds shall develop the full strength of the members connected. Welding shall conform to the applicable requirements of the American Welding Society “Structural Welding Code,” AWS D1.1-98, with ultrasonic test acceptance criteria modified in accordance with AWS D1.1-98 Section 6.8 based on suitability for service criteria. 2.4 General

3.3 GENERAL

3.3.1 Standard covering for roofs or walls shall be a ribbed-type panel having 36 inches net coverage. These panels shall be 26 gauge, galvanized steel.

3.3.2 All Panels shall be precision roll-formed to the required configuration specified under Section 2.6, except for the MIP panel which may be brake-formed.

3.4 PANEL MATERIALS

3.4.1 Galvanize is a corrosion resistant zinc coating applied by a hot dip galvanization process. Galvanized panels shall conform to ASTM specification ASTM A-653, Grade 50 with coating weight G90. Grade 80 may be used as specified under item 2.6.3.

3.4.2 Paint, color coated panels shall have the exterior side finished with an extended life, fluoropolymer coating utilizing Kynar 500® Resin. This coating shall be applied over a galvanized steel substrate. Surfaces shall be properly prepared and primed, then coated and oven-baked to cure. Top coating system shall have a dry film thickness of .75 -.90 mils on the
exterior surface. Specular Gloss at 60° viewing angle shall be 35± 5%. The interior side of these panels shall be protected by a back coat system of .60±.05 mils thickness. Panels shall be coated prior to roll forming.

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3.4.3 Provide samples of various panels in conjunction with Section 01300.

3.4.4 Provide 20 year warranty on roof and wall panels.

3.4.5 Panel Thickness

1. MAP Panels shall be 29 GA
2. MIP Panels shall be 26 GA
3. Roof Panels shall be 26 GA

3.5 PANEL CONFIGURATIONS AND FINISHES

3.5.1 Ribbed Panels shall be as follows:

A. MAP (Architectural Panels) shall have 1-1/2 inch deep major ribs which taper in width from 2 inches to 3-15/16 inches, and are spaced 12 inches on center. Between each major rib are two minor stiffening ribs, plus two small “pencil” ribs. The “leading edge” rib has a bearing leg. Each panel shall provide 36 inches of lateral coverage. Panel finish shall be painted. Color to be selected by the Architect from complete range of manufacturer's available colors.

B. MIP (Interior Panel) shall have 3/4 inch deep major ribs which taper in width from nominally 1 inch to 2 inches and are spaced 6 inches on center. The “leading edge” rib has a bearing leg. Each panel shall provide 36 inches of lateral coverage. Panel finish shall be painted. Color to be selected by the Architect from complete range of manufacturer's available colors.

3.6 FLASHING, TRIM & CLOSURES

3.6.1 Flashing and/or trim shall be furnished at eaves, rake, corners, base, framed openings, and wherever necessary to seal against the weather and provide a finished appearance. Color shall be selected from standard paint colors. Profiles and dimensions of all flashing/trim will be per manufacturer’s standards. Refer to manufacturer’s color charts for paint colors available for trim.

3.6.2 Eave gutters and downspouts may be specified as optional. Gutters are box-shaped with face profile shaped to match rake trim. Downspouts are rectangular-shaped (2-7/8 inches x 4-1/4 inches minimum size) and shall have a 45 degree elbow at the bottom. Colors for eave gutters and downspouts shall be selected from the manufacturer's standard color chart.

3.6.3 Color coated, galvanized steel for flashing, trim, metal closures, gutter and downspouts (29 gauge), and other miscellaneous uses shall be 26 gauge thickness of the same specification as the roof and wall covering material.

3.6.4 Material used for Base Angle/Trim members shall be color coated, 18 gauge, galvanized steel, 36,000 yield strength. Color shall be shall be selected from the manufacturer's standard color chart.

3.6.5 Preformed, closed cell, polyethylene closure strips matching the profile of the panel shall be installed along the eave and at other locations to provide weathertightness.

3.7 FASTENERS

3.7.1 Wall Fasteners shall be self-drilling carbon steel screws with an integral 5/16 inch hex. washer head. Screws for “panel to structural” application shall be #12 diameter with a minimum length of 1-1/4 inches. “Stitch” screws shall be 1/4 inch diameter and 7/8 inch long. Panel to structural screws shall have a sealing washer (PVC or EPDM). Both “standard” and “optional” Wall Fasteners shall have carbon steel heads. Entire fastener (body and head) shall have 0.0005 inch minimum thickness zinc plating plus a polymer coating for long term corrosion resistance. Fastener head shall also be painted to match wall panel and/or trim color.

3.7.2 Roof Fasteners shall be self-drilling carbon steel screws with an integral 5/16 inch
hex. washer head (washer face undercut to encapsulate a sealing washer). Screws for “panel to structural” application shall be #12 diameter with a minimum length of 1-1/4 inches. “Stitch” screws shall be 1/4 inch diameter and 7/8 inch long. Standard Roof Fasteners shall be screws with carbon steel heads and shall have a sealing washer (PVC or EPDM). Entire fastener (body and head) shall have 0.0005 inch minimum thickness zinc plating plus a polymer coating or long term corrosion resistance. When used with color coated material, fastener head shall also be painted to match panel and/or trim color. Optional Roof Fasteners shall be screws with an “Extended Life” head and shall have a sealing washer (EPDM). “Extended Life” heads shall be either a zinc/aluminum/ manganese alloy casting or a 300 series stainless steel cap: (customer’s option). Body (shank) of fastener shall have 0.0005 inch minimum thickness zinc plating. When used with color coated material, fastener head shall be painted to match panel and/or trim color.

3.8 SEALANTS
3.8.1 See section 07900 for sealants.

3.9 PERSONNEL DOORS
3.9.1 Coordinate doors with Door Schedule and Sections 08111, 08112, 08360, and 08361.
3.9.2 Door frame shall be an open “C” section to “wrap-around” the end of girts.
3.9.5 Sheet metal trim shall be furnished with all doors to flash around door frame and provide a finished appearance.

3.10 FIXED GLASS WINDOWS
3.10.1 Coordinate Windows with Window Schedule and Section 08520.
3.10.2 Structural sub-framing, consisting of angle sections (hot-rolled or cold formed), shall be furnished with each window. Sub-framing, consisting of cold formed channel sections shall be provided.

PART 4 EXECUTION

4.1 ERECTION
4.1.1 The erection of the pre-engineered metal building system shall be in accordance with applicable erection drawings, and other erection information furnished by the manufacturer.

4.1.2 Erection shall be performed by a qualified erector using proper tools and equipment. It shall be the responsibility of the erector to comply with all applicable legal and safety requirements. It shall further be the responsibility of the erector to determine and provide any and all temporary bracing, bridging, blocking, shoring, and/or securing of components, etc. as required for stability during the entire erection process.

4.1.3 Erector shall not make any field modifications to any structural member except as authorized and specified by the manufacturer.

4.2 ANCHOR BOLTS
4.2.1 Anchor bolts shall be furnished by the General Contractor and shall be set in strict accordance with the manufacturer’s anchor bolt drawings. Anchor bolts shall be of length and strength to properly resist the governing reactions induced by the design loads and shall be of the diameter shown on the manufacturer’s anchor bolt drawings. All anchor bolts shall be unpainted so as to bond with the concrete in which they are set.

4.3 FOUNDATIONS
4.3.1 The building foundation shall be designed by a Florida licensed professional engineer or registered architect to support the metal building and all other loads required by the occupant’s usage. The manufacturer’s anchor bolt drawings shall show column reactions to be used for designing the building foundation.

4.4 INSTALLATION OF PRIMARY FRAMING
4.4.1 Temporary Supports, such as temporary guys, braces falsework or other elements required for erection shall be determined, furnished and installed by the erector. (Section 7.9.1 AISC Code of Standard Practice, 9th Edition)

4.4.2 Installation of high strength bolts shall conform to ASTM Specification A-325. (NOTE: Tightening of these bolts by the Turn-of-Nut-Method is recommended per “AISC Specifications for Structural Joints”.) If verification of the tightening of high strength bolts is required, it shall be the responsibility of the owner or owner’s representative to do so.
4.5 INSTALLATION OF WALL AND ROOF PANELS

4.5.1 Wall panels shall be continuous from base to eave. If panel lengths exceed manufacturing and shipping limitations, splice shall occur over a wall girt.

4.5.2 Roof panels shall be continuous from eave to ridge. If panel lengths exceed manufacturing and shipping limitations, splice end laps shall be installed per manufacturer’s erection details. Sealant shall be used in all roof panel end laps.

4.5.3 When specified, all ribbed, roof panel side laps shall be sealed with a field applied, continuous ribbon of tape mastic sealant. Eaves shall also be sealed when specified.

4.5.4 Fastener population and pattern for both wall and roof panels shall be as shown on erection details.