PIP ARS13120
Pre-Engineered Metal Buildings Specification
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

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1. **Scope**

This Practice provides requirements for design, materials, fabrication, and erection of pre-engineered metal buildings, including exterior doors, windows, louvers and ventilators. This Practice does not include buildings to be designed for blast loads.

2. **References**

Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, unless otherwise noted. Short titles are used herein where appropriate.

### 2.1 Process Industry Practices (PIP)

- PIP ARS08111 - *Standard Steel Doors and Frames Supplier Specification*
- PIP ARS08112 - *Standard Steel Doors, Frames and Related Hardware Installation Specification*
- PIP ARS08710 - *Standard Steel Door Hardware Supplier Specification*
- PIP CVC01017 - *Plant Site Data Sheet*
- PIP CVC01018 - *Project Data Sheet*
- PIP STC01015 - *Structural Design Criteria*

### 2.2 Industry Codes and Standards

References shown below are U.S. standards. For buildings to be erected outside of the United States, where appropriate national or local standards are available, they shall be substituted for the standards shown below as approved by purchaser. If there is no appropriate national or local standard, the U.S. standard shall be followed.

- Air Movement and Control Association International (AMCA)
  - AMCA 500-L - *Laboratory Methods for Testing Louvers for Rating*
- American Architectural Manufacturers Association (AAMA)
  - AAMA 701/702 - *Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals*
- American Institute of Steel Construction (AISC)
  - ANSI/AISC 303 - *Code of Standard Practice for Steel Buildings and Bridges*
  - ANSI/AISC 360 - *Specification for Structural Steel Buildings*
  - AISC 326 - *Detailing for Steel Construction*
- American Iron and Steel Institute (AISI)
  - AISI S100 - *North American Specification for the Design of Cold-Formed Steel Structural Members*
• American Society of Civil Engineers (ASCE) / Structural Engineering Institute (SEI)
  – ASCE/SEI 7-10 - Minimum Design Loads for Buildings and Other Structures
  – ASCE/SEI 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures

• American Society of Mechanical Engineers (ASME)
  – ASME B30.2 - Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
  – ASME B30.11 - Monorails and Underhung Cranes

• American Welding Society (AWS)
  – AWS D1.1/D1.1M - Structural Welding Code-Steel
  – AWS D1.3/D1.3M - Structural Welding Code-Sheet Steel

• Association for Iron and Steel Technology (AIST)

• ASTM International (ASTM)
  – ASTM A36/A36M - Standard Specification for Carbon Structural Steel
  – ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  – ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength
  – ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  – ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
  – ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric)
  – ASTM A572/A572M - Standard Specification for High-Strength Low- Alloy Columbium-Vanadium Structural Steel
  – ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  – ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
- ASTM A992/A992M - Standard Specification for Structural Steel Shapes
- ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
- ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- ASTM C1036 - Standard Specification for Flat Glass
- ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications
- ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- ASTM D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
- ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
- ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series
- ASTM F1136/1136M - Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
– ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength


– ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

• Glass Association of North America (GANA)
  – GANA Glazing Manual

• International Accreditation Service (IAS)
  – IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems

• International Code Council
  – International Building Code (IBC)

• Metal Building Manufacturers Association (MBMA)
  – Metal Building Systems Manual (including supplements)
  – Metal Roofing Systems Design Manual

• National Fire Protection Association (NFPA)

• Research Council on Structural Connections (RCSC)
  – Specification for Structural Joints Using High-Strength Bolts

• Society for Protective Coatings (SSPC)
  – SSPC V1 - Good Painting Practice: Painting Manual Volume 1
  – SSPC SP 1 - Solvent Cleaning
  – SSPC SP 3 - Power Tool Cleaning
  – SSPC SP 7 - Brush-Off Blast Cleaning

• Steel Joist Institute (SJI)
  – Standard Specifications and Load and Weight Tables for Steel Joists and Joist Girders

2.3 Government Regulations

• U.S. Department of Justice (DOJ) - Americans with Disabilities Act (ADA)
  – ADA Standards for Accessible Design
  – Guidance on the ADA Standards for Accessible Design

• U.S. Department of Labor (DOL) - U.S. Occupational Safety and Health Administration (OSHA)
  – 29 CFR Part 1910 - Occupational Safety and Health Standards
  – 29 CFR Part 1926 - Safety and Health Regulations for Construction
3. Definitions

*contract documents:* Any and all documents, including codes, studies, design drawings/documents, specifications, sketches, practices, and data sheets, that purchaser or engineer of record has transmitted or otherwise communicated, either by incorporation or reference, and made part of the legal contract agreement or purchase order between purchaser and supplier.

*engineer of record:* Purchaser’s authorized representative with overall authority and responsibility for engineering design, quality, and performance of civil works, structures, foundations, materials, and appurtenances described in contract documents. Engineer of record is licensed as defined by laws of the locality in which the work is to be constructed, and is qualified to practice in the specialty discipline required for the work described in contract documents.

*inspector:* Party responsible for verifying quality of all materials, installations, and workmanship furnished by manufacturer/supplier. Inspector is qualified by training and experience and holds certifications or documentation of their qualifications. Unless otherwise specified in contract documents, inspector is an independent party retained by purchaser.

*manufacturer:* Party who produces and warrants performance of materials provided in accordance with contract documents. Materials are manufactured in a controlled process using standard codes, specifications, tests and possibly include shop drawings to assist in proper application, installation and/or use. The term manufacturer applies also to manufacturer’s subcontractor(s) and/or vendor(s).

*owner:* Party who has authority through ownership, lease, or other legal agreement over site wherein building will be used.

*professional engineer:* An engineer, other than engineer of record licensed as defined by laws of the locality in which building is to be constructed, and qualified to practice in the specialty discipline required for the work described in contract documents.

*purchaser:* Party who awards contract to supplier. Purchaser may be owner or owner’s authorized agent.

*supplier:* Party responsible for providing building in accordance with contract documents.

4. Requirements

4.1 Quality Assurance

4.1.1 Metal building manufacturer and manufacturer's professional engineer shall have a minimum of 5 years experience in successful design and fabrication of pre-engineered metal buildings of size and complexity specified in contract documents.

4.1.2 Construction superintendent shall have a minimum of 5 years experience in erection of pre-engineered metal buildings and at least two years of experience in erection of pre-engineered metal building of size and complexity specified in contract documents. Construction superintendent shall have proven experience erecting the specific brand of metal building that is provided.

4.1.3 Metal building manufacturer shall be a Metal Building Manufacturers Association (MBMA) member and have an Accredited Metal Building Inspection Program in accordance with IAS AC472.
4.1.4 Manufacturer shall be responsible for quality control of all materials and workmanship.

4.1.5 Purchaser or inspector shall have right to inspect all materials and workmanship and shall have unrestricted access to fabrication shops and work sites at all times during which the work is being performed.

4.1.6 Inspections or approvals from purchaser shall in no way relieve manufacturer or supplier from any obligations to perform work in accordance with contract documents.

4.1.7 Purchaser may reject improper, inferior, defective, or unsuitable materials and workmanship.

4.1.8 All rejected materials and workmanship shall be replaced as directed by purchaser.

4.2 Submittals

4.2.1 Anchor Locations and Reactions

4.2.1.1 Within time period prescribed in contract documents, a drawing shall be submitted to purchaser that provides diameter, projection, and location of all required anchors and unfactored reactions at each point influencing foundation design for each design load (e.g., dead, live, snow, wind, seismic, crane, etc.).

4.2.1.2 For use in determining anchor bolt diameter, anchor bolt material shall be assumed to be ASTM F1554 Grade 36, unless otherwise specified in contract documents.

4.2.2 Structural Design Calculations

4.2.2.1 Within time period prescribed in contract documents, one copy of manufacturer’s design calculations for building shall be submitted to purchaser for review.

4.2.2.2 Design calculations shall be sealed by manufacturer’s professional engineer.

4.2.2.3 Design calculations shall include all necessary calculations to demonstrate that strength and serviceability requirements of this Specification have been met. Include the following:

   a. Summary of criteria, codes, design loads, and load combinations used for building design including criteria listed in IBC Section 1603 where not shown in PIP data sheets

   b. Deflection and drift calculations

   c. Crane/Hoist supporting members

   d. Foundation reactions

4.2.3 Fabrication and Erection Drawings for Review and Approval

4.2.3.1 Before start of fabrication, complete and checked fabrication and erection drawings shall be submitted to purchaser for review and approval. Fabrication shall not proceed until written approval is obtained.
4.2.3.2 Drawings shall comply with *IBC* Section 1603, Construction Documents, and shall be sealed by manufacturer’s professional engineer.

### 4.2.4 Product Data

4.2.4.1 Product information, specifications, and installation instructions for building components and accessories shall be submitted with fabrication and erection drawings that are submitted for review and approval.

4.2.4.2 Accessory component drawings shall show locations and elevations for personnel doors, overhead doors, windows, ventilator, louvers, gutters, downspouts, and any other accessories. Include door and hardware schedules.

4.2.4.3 Specifications, data sheets, and wiring diagrams for motor-operated doors detailing power, signal, and control systems shall be submitted with clear differentiation between field-installed and factory-installed wiring.

### 4.2.5 Material Samples

Unless otherwise required by contract documents, one of each of the following samples shall be submitted to purchaser for approval before fabrication. Fabrication shall not proceed without purchaser’s written approval.

4.2.5.1 12 inches (300 mm) by actual width samples of roofing, siding, liner, translucent and soffit panels with required finishes, including specified style and texture

4.2.5.2 Fasteners (including standing seam roof clips) for application of roofing, siding, and soffit panels

4.2.5.3 A minimum 12-inch by 12-inch (300-mm by 300-mm) sample of side lap seams both sides of typical roofing and siding panels, including any sealants, fasteners, clips and closures

4.2.5.4 Color chips for color selections by purchaser

### 4.2.6 Maintenance Manual

Before mechanical completion, an electronic copy (such as a PDF) and two identical three-ring binder manuals shall be submitted that include the following:

4.2.6.1 Outer jacket labeled to read: “Maintenance Manual” - Name of Project, Completed (date: )

4.2.6.2 Table of contents

4.2.6.3 List of prime and subcontractors with key personnel, addresses, and phone numbers

4.2.6.4 Letters of guarantee and warranties

4.2.6.5 Warning labels for posting by owner at roof access

4.2.6.6 Maintenance instructions

4.2.6.7 Any other relevant information
4.2.7 Final Fabrication and Erection Drawings Record

4.2.7.1 Before delivery, final checked and sealed fabrication drawings and erection drawings shall be submitted in both hard copy and electronic formats.

4.2.7.2 All drawings shall identify materials of construction by type of material, ASTM specification, thickness, etc., as applicable.

4.2.8 Mill Certification

Mill certification for structural bolts, structural steel, wall and roof covering shall be submitted to purchaser upon delivery of materials.

4.2.9 Warranty

4.2.9.1 Furnish ten (10) year manufacturer warranty for pre-engineered building systems and components (including weathertightness).

4.2.9.2 Special Warranty on Metal Panel Finishes: Manufacturer’s standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within 20 years from date of substantial completion.

4.2.9.3 Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer’s standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within 10 years from date of substantial completion.

4.3 Government Regulations

4.3.1 Buildings to be erected in the United States:

4.3.1.1 Buildings erected in the United States shall be in accordance with federal standards and instructions of OSHA and state and local codes, including any additional requirements by state or local agencies that have jurisdiction where the building is to be constructed. If required by owner or state or local agencies, buildings shall also be in accordance with NFPA 101 standards and instructions.

4.3.1.2 If applicable, building and all components shall be designed and constructed in accordance with ADA Standards for Accessible Design and Guidance on the ADA Standards for Accessible Design.

4.3.1.3 Building energy codes and standards of federal, state, and municipal agencies that have jurisdiction where metal building is to be erected shall apply.

4.3.2 Buildings to be erected outside of the United States:

For buildings to be erected outside of the United States, supplier shall determine if specific regulations and other country, regional, or local safety, energy, or disability requirements apply for application of this Practice.

4.4 Design

4.4.1 Structural Design and Performance

4.4.1.1 Building shall be designed in accordance with requirements specified herein and requirements of contract documents.
4.4.1.2 Building shall be designed by, or under the responsible charge of a professional engineer.

4.4.1.3 Building system shall be designed in accordance with PIP STC01015, PIP CVC01017, and PIP CVC01018.

4.4.1.4 The entire building envelope shall be designed for the full design wind load. This includes roofing, siding, doors, roll-up doors, and windows. If building is partially enclosed (such as a warehouse type building with large roll-up doors), this condition shall be considered in wind design.

4.4.1.5 Design criteria shall be in accordance with the *MBMA Metal Building Systems Manual*. If there are conflicts between the *MBMA Metal Building Systems Manual* and PIP Practices, PIP Practices have precedence. Collateral or auxiliary loads defined in contract documents shall be included with other design loads.

4.4.1.6 Deflections and Drift Limits

   a. Maximum deflections of primary and secondary structural members shall comply with the *MBMA Metal Building Systems Manual*.

   b. Deflections for members supporting cranes shall be in accordance with PIP STC01015.

   c. Maximum wind drift shall be in accordance with PIP STC01015.

4.4.1.7 Structural steel design shall be in accordance with ANSI/AISC 360.

4.4.1.8 Cold-formed steel design shall be in accordance with AISI S100.

4.4.1.9 Roofing, siding, and other accessories shall be designed in accordance with the *MBMA Metal Building Systems Manual* and the *MBMA Metal Roofing Systems Design Manual*. Roof panels and their supports shall be capable of supporting a 300 pound (135 kg) concentrated load.

4.4.1.10 Cranes and Monorails

   a. Crane supports (including building frame) shall be designed in accordance with PIP STC01015, ASME B30.2, and ASME B30.11. Crane loads shall be a function of the Service Class as defined by the Crane Manufacturers Association of America (CMAA) and rated tonnage. Unless otherwise specified, CMMA Class A cranes shall be assumed. If crane class is higher than Class A, building and supports shall be designed for fatigue in accordance with Appendix 3 of ANSI/AISC 360.

   b. Cranes in Service Class E or F: Crane runway systems including supporting building / structure shall be designed in accordance with AIST TR-13. Fabrication tolerances shall be in accordance with ANSI/AISC 303 and MBMA Metal Building Systems Manual, as applicable.

   c. Rated capacities for cranes/monorails shall be clearly labeled on the system.

4.4.1.11 All field connections shall be bolted, and all shop connections shall be either bolted or welded.
4.4.1.12 Bolted Connections
   a. Design, detailing, and fabrication of bolted connections shall be in accordance with ANSI/AISC 360 and ANSI/AISC 303. Connection detailing shall be in accordance with AISC 326.
   b. Connections using ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1 or ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1 shall be in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.

4.4.1.13 Welded Connections
   Design and detailing of welded connections shall be in accordance with ANSI/AISC 360, ANSI/AISC 303, AWS D1.1/D1.1M, and AWS D1.3/D1.3M. Design and detailing of welded connections for cranes, monorails and supporting members shall be in accordance with AWS D14.1/D14.1M.

4.4.1.14 Structural Steel Detailing
   Structural steel detailing shall be performed in accordance with AISC 326.

4.5 Products and Materials
4.5.1 General
   4.5.1.1 Products and materials shall be provided as specified herein, in accordance with contract documents, and as required for design of building.
   4.5.1.2 Substitutions shall not be permitted without prior written approval of purchaser.

4.5.2 Structural
   4.5.2.1 Hot-rolled structural shapes, plates, and bars (including built-up members) shall be in accordance with any of the following material specifications:
      a. ASTM A36/A36M
      b. ASTM A529/A529M
      c. ASTM A572/A572M, Grade 50
      d. ASTM A992/A992M
   4.5.2.2 Cold-formed structural shapes shall be in accordance with any of the following material specifications:
      a. ASTM A1011/A1011M, Grade 55 (380), Class 1 or 2
      b. ASTM A1008/A1008M, Grade 55 (380), Class 1 or 2
      c. ASTM A653/A653M, Grade 50 (340), Class 1 (galvanized)
   4.5.2.3 Pipe shall be ASTM A53/A53M, Types E or S, Grade B, or ASTM A106/A106M, Grade B.
   4.5.2.4 Structural tube shall be ASTM A500/A500M, Grade C, unless otherwise specified in contract documents.
4.5.2.5 High-strength bolt assemblies shall be provided as follows:
   a. Bolt - ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1 or ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, as specified in contract documents.
   b. Washer - ASTM F436/F436M
   c. Direct tension indicator (DTI) washer (if specified in contract documents) - ASTM F959/F959M
   d. Heavy hex nut - ASTM A563, Grade DH (ASTM A563M, Class 10S)

4.5.2.6 Standard bolt assemblies shall be provided as follows:
   a. Bolt - ASTM A307, Grade A heavy hex
   b. Washer - ASTM F436/F436M
   c. Heavy hex nut - ASTM A563, Grade A

4.5.2.7 Crane Rails shall be provided as follows:
   a. Rails less than 104 lb/yard (51.6 kg/m) - ASTM A1
   b. Rails 104 to 175 lb/yard (51.6 to 86.8 kg/m) - ASTM A759

4.5.2.8 Steel joists shall be in accordance with SJI Standard Specifications and Load and Weight Tables for Steel Joists and Joist Girders.

4.5.2.9 Welding of Structural Shapes - Comply with AWS D1.1/D1.1M, Section 3.3 (including Table 3.1) with an electrode strength of 58 ksi (400 MPa) minimum yield strength and 70 ksi (490 MPa) minimum tensile strength (e.g., use E70XX for SMAW, F7XX-EXXX for SAW, ER70S-X for GMAW, and E7XT-X for FCAW).

4.5.2.10 Welding of sheet steel shall be performed in accordance with AWS D1.3/D1.3M, Section 1.4 (including Table 1.1).

4.5.2.11 Welding of connections for cranes, monorails and supporting members shall be in accordance with AWS D14.1/D14.1M.

4.5.3 Roofing and Siding

4.5.3.1 Steel sheets shall be in accordance with any of the following material specifications:
   a. ASTM A1011/A1011M - Grade 50 or 55 (340 or 380)
   b. ASTM A1008/A1008M - Grade 50 (340), Class 1, 2, or higher
   c. ASTM A792/A792M SS, Gr 50 or 80 (340 or 550) – AZ55 (AZM165)

4.5.3.2 Steel coating shall be in accordance with any of the following:
   a. Zinc coating - ASTM A653/A653M Coating Designation G90 (Z275)
   b. Aluminum-zinc alloy coating - ASTM A792/A792M Coating Designation AZ55 (AZM165)
c. Prime/painted - In accordance with SSPC V1. This coating shall be applied over zinc or aluminum-zinc alloy coating, specified in Section 4.5.3.2 a or b.

d. Polyvinylidene fluoride (PVDF) shall be factory applied on all sides of all panels if specified in contract documents.

4.5.3.3 Trim

Flashing, trim, caps, and closure pieces shall be of the same material, finish, and color as adjacent material. Profile shall suit the system provided.

4.5.3.4 Insulation

a. Insulation shall be rigid, semi-rigid, ASTM C665, batt or roll, with vapor retardant facing and shall have a thickness or R-rating as required in contract documents.

b. UL flame spread classification shall be 25 or less. Smoke development classification shall be 450 or less.

4.5.3.5 Fasteners

a. Wall and roofing through-fasteners shall be manufacturer’s standard self-drilling stainless steel screws with bonded sealing washer.

b. Clips for standing seam panels shall be manufacturer’s standard sliding design to permit unrestrained expansion and contraction movement of panels, complete with manufacturer’s fasteners at each clip. A minimum of two fasteners shall be provided for each clip.

c. Exposed fasteners for eave, end lap, ridge cover, trim, and flashing shall be manufacturer’s standard self-drilling stainless steel screws with bonded sealing washer.

d. All exposed fastener heads shall be factory colored to match color of panels.

4.5.3.6 Sealant

a. Factory-applied roof panel sealant shall be non-shrinking, non-drying, butyl-based sealant specifically formulated for factory application in standing seams and to permit roof panel assembly at temperatures from -10°F to +140°F (-23°C to +60°C) or manufacturer’s standard type if approved by purchaser.

b. Field-applied roof panel sealant shall be a purchaser approved, non-shrinking, non-drying, butyl-based sealant specifically formulated for roof application at temperatures from 20°F to 120°F (-7°C to 49°C) or manufacturer’s standard type if approved by purchaser. At exposed sealant locations, use polyurethane sealant.

c. Sealant color shall be clear or match color of adjacent material.

4.5.3.7 Insulated Panels

Insulated panels may be provided as an alternative if approved by engineer of record.
4.5.4 Accessories

4.5.4.1 Personnel doors shall be in accordance with PIP ARS08111.

4.5.4.2 Door hardware shall be in accordance with PIP ARS08710.

4.5.4.3 Overhead Roll-up Doors

a. Complete overhead roll-up door assemblies including door curtain, guides, counterbalance, hardware, operators, and installation accessories shall be provided as specified herein.

b. Doors and frames shall be designed for wind loading in accordance with Section 4.4.1.

c. Overhead doors shall be manufacturer’s standard construction, industrial type, fabricated of 0.034 inch (0.864 mm) minimum uncoated thickness galvanized steel or aluminum-zinc alloy coated steel. All hardware and accessories necessary for complete installation of door including galvanized steel track, brackets, lifting handles, torsion-spring mechanism, ball bearing rollers, cylinder locks, and weather stripping shall be furnished. Windlocks shall be provided on roll-up doors in hurricane prone areas (basic wind speed in accordance with ASCE/SEI 7-10 or ASCE/SEI 7-16 as applicable exceeds 120 mph (54 m/s)) and special wind zone areas.

d. Doors up to 144 ft² (13.4 m²) shall be manually operated (chain) operated unless otherwise specified in contract documents. Doors greater than 144 ft² (13.4 m²) shall be chain hoist operated.

e. Chain Operation

(1) An operator assembly shall be provided, consisting of an endless alloy steel hand chain, chain pocket wheel and guard, and geared reduction unit with maximum 25-pound (11-kg) pull for door operation.

(2) Chain hoist shall be designed with self-locking mechanism permitting curtain to be stopped at any point in its travel and to remain in that position until movement is reactivated.

(3) Chain with chain holder shall be furnished secured to operator guide.

f. Door Curtain

(1) Interlocking steel slat door curtain with one-piece slats for full length of door width shall be provided.

(2) Door curtain shall be formed from minimum 0.0269 inch (0.70 mm) structural sheet steel.

(3) Where required in contract documents, insulation shall be manufacturer’s standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and
450, respectively, according to ASTM E84. Enclose insulation completely within metal slat faces.

g. Bottom Bar
   (1) Bottom bar shall be provided on door curtain consisting of two 1/8 inch (3 mm) thick angles of the same metal as door curtain slats.
   (2) A flexible rubber, vinyl, or neoprene weather seal and cushion bumper shall also be provided on the bottom bar.

h. Where required in contract documents, vision panels shall be 1/4-inch (6-mm) thick cast thermo-plastic, methyl methacrylate vision panels set in neoprene or vinyl glazing channels shall be provided in the arrangement indicated.

i. Weather Seals
   (1) At exterior doors, 1/8-inch (3-mm) thick continuous rubber or neoprene sheet weather seals on metal pressure bars secured to inside of curtain coil hood shall be provided.
   (2) At doorjambs, 1/8-inch (3-mm) thick continuous strip secured to exterior side of jamb guide shall be provided.

j. Hood
   (1) Coiled curtain and operating mechanism shall be entirely enclosed at opening head to act as a weather seal.
   (2) End brackets, to which the hood is attached, shall be contoured to suit.
   (3) Top and bottom edges shall be rolled and reinforced for stiffness.
   (4) Closed ends shall be provided for surface-mounted hoods and any portion of between-jamb mounting projecting beyond wall face.
   (5) Intermediate support brackets shall be provided to prevent sag.
   (6) Hoods for steel doors shall be fabricated from 0.0209 inch (0.55 mm) minimum zinc-coated steel sheet and phosphate-treated before fabrication.

k. A factory finish shall be provided in accordance with contract documents.

l. Electric Door Operators
   (1) An electric operator assembly of adequate size and capacity shall be furnished.
   (2) Operators shall be furnished with NEMA-rated motor and factory- prewired motor controls, gear reduction unit, solenoid-operated brake, remote control stations, control devices, conduit and wiring from controls to motor and central stations, and accessories required for proper operation.
(3) Electric operator shall be furnished in accordance with purchaser’s area classification in accordance with contract documents.

(4) A hand-operated disconnect or mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation shall be provided. An interlock device to automatically prevent motor from operating if manual operator is engaged shall also be included.

(5) Electric Motors

   a. A high-starting torque, reversible, constant duty, Class A insulated electric motor with overload protection shall be provided.

   b. Motor shall be sized to move door in either direction, from any position, at not less than 0.67 foot (200 mm) nor more than 1 foot (300 mm) per second.

   c. Wiring requirements and current characteristics of motors shall be coordinated with building electrical system.

   d. An open-drip-proof-type motor and controller with NEMA Type 1 enclosure shall be furnished.

(6) Remote Control Station

   a. A NEMA-approved, momentary contact, three-button remote control station with push-button controls labeled “open,” “close,” and “stop” shall be provided.

   b. For interior units, full-guarded, surface-mounted, heavy-duty remote control stations, with general-purpose NEMA Type 1 enclosures shall be provided.

   c. For exterior units, full-guarded, surface-mounted, standard-duty weatherproof-type remote control stations designed for key operation and with NEMA Type 4 enclosures shall be provided.

(7) Automatic Reversing Control

   a. Each door shall be furnished with an electric automatic safety switch, extending the full width of the door bottom, located within a neoprene or rubber astragal mounted to the bottom rail of the door or an “electric eye” system.

   b. The mechanism shall be manufactured so that contact with an obstruction before fully closing will immediately stop downward travel and reverse the travel direction so that the door is returned to the fully opened position.

4.5.4.4 Aluminum Windows

   a. Aluminum windows shall be designed and constructed for integral installation with the building system and comply with
AAMA/WDMA/CSA 101/I.S.2/A440. Unless otherwise required in contract documents, use manufacturer’s standard commercial grade double-pane windows with medium natural anodized finish. The following AAMA/WDMA/CSA 101/I.S.2/A440 standards shall be used:

1. Horizontal sliding units: HS-CW30
2. Single-hung units: H-CW30
3. Fixed sash units: F-CW30

b. Aluminum extruded frame material shall be in accordance with ASTM B221 / ASTM B221M.

c. Frames shall have “thermal-break” construction, i.e., separate frame and sash members exposed on the exterior from metal parts exposed on interior by a continuous gasket or filler of rubber or plastic, locked into construction.

d. Mullions between adjacent windows, fabricated of extruded aluminum matching finish of window units shall be provided.

e. Fasteners made from aluminum, stainless steel, or other material warranted by window manufacturer shall be provided, and shall be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

f. Depending on strength and corrosion-inhibiting requirements, anchors, clips, and window accessories shall be fabricated from aluminum, stainless steel, or hot-dip zinc-coated steel in accordance with ASTM A123/A123M.

g. Compression glazing strips and weather-stripping shall be provided in one of the following:
   1. Molded neoprene gaskets in accordance with ASTM D2000 designation 2BC415 to 3BC620
   2. Molded PVC gaskets in accordance with ASTM D2287
   3. Molded expanded neoprene gaskets in accordance with ASTM C509

h. For sliding weather-stripping, woven pile weather-stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric, with aluminum backing strip shall be provided in accordance with AAMA 701/702.

i. Manufacturer’s standard sealants shall be provided for the joint size or anticipated movement. Sealants shall remain permanently elastic and be non-shrinking and non-migrating.

j. Removable insect screen shall be provided on each operable exterior sash, with finish matching window.

k. To the greatest extent possible, window units shall be glazed at the factory before installation.
l. Unless otherwise required in contract documents, glass shall be provided in accordance with ASTM C1036 for glass type, class, quality, style, kind, and form and recommendations of the GANA Glazing Manual.

m. Windows shall be as shown in contract documents and furnished complete with all accessories including operating and locking hardware, glazing, screened panels, weatherstripping, frames and fasteners for proper installation.

n. Windows shall comply with ASTM E1996 in hurricane prone areas (basic design wind speed in accordance with ASCE/SEI 7-10 or ASCE/SEI 7-16 as applicable exceeds 120 mph (54 m/s)).

4.5.4.5 Wall Louvers

a. Louvers shall be provided in accordance with contract documents and AMCA 500-L. In hurricane prone areas (basic wind speed in accordance with ASCE/SEI 7-10 or ASCE/SEI 7-16 as applicable exceeds 120 mph (54 m/s)), louvers shall be wind-driven rain louver effectiveness “A”. For other areas (basic wind speed 120 mph (54 m/s) or less), louvers shall be wind-driven rain louver effectiveness “B”.

b. Louvers shall be fabricated of aluminum, zinc-coated steel, stainless steel, or aluminum-zinc alloy coated steel. Minimum uncoated thickness of materials shall be 0.048 inch (1.2 mm) for steel and 0.064 inch (1.6 mm) for aluminum and withstand design seismic and wind loads.

c. Blades shall be secured to frames by riveting or welding.

d. Louvers shall be primed and finished to match wall panels.

e. Vertical mullions shall be provided for louvers 4 feet (1200 mm) and wider with one mullion for each 4 feet (1200 mm) of width.

f. Flanges shall be provided on interior face of frames if air intake or exhaust louvers are to be connected to mechanically operated dampers or metal ductwork.

g. Insect screens in rewirable frames shall be provided on exterior face of louvers. Screens shall be secured with clips that facilitate removal for cleaning and rewiring. Screens may be made of aluminum, galvanized steel, or stainless steel.

h. Screen frames shall be fabricated to match louvers.

4.5.4.6 Translucent Panels

a. Wall and roof light-transmitting panels shall be in accordance with manufacturer’s standard conforming to ASTM D3841.

b. Panel deflection shall not exceed L/120 based on wind design load specified in Section 4.4.1.4 and shall not darken based on ASTM D2244. Panels shall be one-piece, flexible, and translucent; and be manufactured from fiberglass-reinforced resins.
c. Roof panels shall be capable of supporting a 300-lb (135-kg) concentrated load without failure.

d. Unless noted otherwise in contract documents, panels shall be uniformly white with a maximum heat transmission of 25% and a minimum light transmission of 55% in accordance with ASTM D1494.

e. In areas where windborne debris protection is required by code, the panels must meet these criteria in accordance with ASTM E1996 and ASTM E1886.

4.5.4.7 Gutters and Downspouts

a. Gutters shall be suspended box sections of a minimum of 0.022 inch (0.56 mm) galvanized steel formed to match configuration of gable trim.

b. Gutters shall be independent of roof seal and shall be attached to eave strut adapter by means of a gutter hanger from same material and finish as gutters.

c. Downspouts shall be located in accordance with contract documents and shall be 0.022 inch (0.56 mm), galvanized factory-colored steel to match siding, in minimum 10 ft (3 m) lengths with formed elbows and offsets.

d. Unless otherwise required in contract documents, a 45-degree elbow shall be provided at base of all downspouts.

e. Downspout straps shall be galvanized steel, 1/16 inch by 1 inch (1.5 mm by 25 mm), and factory-colored to match downspout.

f. Gutters and downspouts shall be sized in accordance with MBMA Metal Building Systems Manual.

g. All accessories for complete installation of gutters and downspouts shall be provided including gutter straps, downspout elbows, downspout straps and metal fasteners compatible with gutter and downspout materials.

4.5.4.8 Ventilators

a. Ridge ventilators shall be provided as required and at locations specified in contract documents.

b. Ridge ventilators shall be fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel. Minimum uncoated thickness of materials shall be 0.022 inch (0.56 mm) for steel and 0.032 inch (0.813 mm) for aluminum.

c. Ridge ventilators shall be provided in standard length sections and braced at mid-length.

d. Ventilators shall be provided in throat sizes and total lengths specified in contract documents.

e. Ventilators shall be furnished complete with side baffles, ventilator assembly, chain or cable operated spring-loaded dampers, hardware,
bird screen, end caps, splice plates, flashing, reinforcing diaphragms, closures, and fasteners.

f. Finish shall match roof panels.

**4.5.4.9 Roof Curbs**

a. Fabricate from a minimum 0.052-inch (1.32-mm) nominal-thickness, metallic coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; capable of withstanding loads of size and height specified in contract documents.

b. Seal all curbs against water penetration and to permit expansion and contraction of roof panels.

c. Curbs wider than 2 ft (600 mm) shall be cricketed on high side.

**4.6 Fabrication**

4.6.1 Hot-rolled and built-up members shall be fabricated in accordance with ANSI/AISC 303 and ANSI/AISC 360.

4.6.2 Cold-formed structural members shall be fabricated in accordance with MBMA Metal Building Systems Manual, “Common Industry Practices.”

4.6.3 Fabrication tolerances for hot-rolled members shall be in accordance with ANSI/AISC 303.

4.6.4 Fabrication tolerances for built-up members and cold-formed structural members shall be in accordance with the MBMA Metal Building Systems Manual, “Common Industry Practices.”

4.6.5 Welding of structural steel shall be in accordance with AWS D1.1/D1.1M.

4.6.6 Welding of sheet steel shall be in accordance with AWS D1.3/D1.3M.

**4.6.7 Bolted Connections**

4.6.7.1 Fabrication of bolted connections shall be in accordance with Section 4.4.1.11.

4.6.7.2 High-strength bolt assemblies in accordance with Section 4.5.2.5 shall be used in all primary structural framing connections. Minimum diameter shall be 3/4 inch (M20).

4.6.7.3 Standard bolt assemblies in accordance with Section 4.5.2.6 may be used in secondary structural framing. Only 5/8 inch (M16) diameter shall be used. Washers may be omitted if manufacturer confirms they are not required for the applicable connection(s).

4.6.7.4 If used, direct tension indicator washers shall be installed in accordance with washer manufacturer’s published specifications.

4.6.7.5 Unless otherwise specified, all structural bolts shall be galvanized or coated with other corrosion protective coating as specified in Section 4.6.11.2.

4.6.7.6 ASTM A563 / ASTM A563M nuts for high-strength bolts shall be provided with Supplementary Requirement S1 for Supplementary Lubricant.
4.6.8 Welded Connections

Fabrication of welded connections shall be in accordance with Section 4.5.2.9 or 4.5.2.10 as applicable.

4.6.9 Primary Structural Framing

4.6.9.1 Primary structural framing includes transverse and lean to frames, rafter, rake, canopy, runway, and platform beams, sidewall, endwall, intermediate, corner, and platform columns, eave struts and wind bracing.

4.6.9.2 Primary structural framing shall be fabricated from hot-rolled structural steel shapes that are built-up factory-welded, I-beam-shaped or open web-type frames consisting of tapered or parallel flange beams and tapered columns. Parallel flange columns may be utilized if column depth is within any required depth limitations.

4.6.9.3 Framing shall be furnished with attachment plates, bearing plates, and splice members, factory-drilled or punched for field-bolted assembly.

4.6.9.4 Endwall columns shall be rolled shapes, built-up factory-welded I-beam- shaped, or cold-formed C sections, fabricated from 14-gage minimum steel. Adequate bracing shall be provided and designed in accordance with PIP STC01015 for both lateral and torsional buckling of endwall columns.

4.6.9.5 Endwall beams shall be rolled C shapes or C-shaped cold-formed sections fabricated from 0.059 inch (1.5 mm) minimum roll-formed steel.

4.6.9.6 Adequate load path shall be provided to transfer horizontal forces acting at the top of endwall columns to the load resisting system such as the roof bracing system.

4.6.9.7 Longitudinal Bracing

Longitudinal bracing may consist of any of the following:

a. Steel rods, furnished with necessary slope (hillside) washers, flat washers, and adjusting nuts at each end.

b. Hot-rolled angles, double angles or other similar suitable structural shapes.

c. Moment Resisting Frames (Portal Frames / Wind Bents)

d. Diaphragm action bracing may be provided in wall panels with following limits and conditions:
   (1) Building shall have only one story and eave height shall not exceed 20 ft (6 m).
   (2) Building width shall not exceed 50 ft (15 m).
   (3) Minimum required panel width and aspect ratio shall be noted on erection drawings for reference in case of future added openings or modifications.
   (4) Required attachment of diaphragm panels to foundation shall be specified or required load transfer shall be noted on anchor bolt
layout drawings for attachments specified by other than manufacturer.

4.6.10 Secondary Structural Framing

4.6.10.1 Secondary structural framing includes purlins, girts, flange braces, gable angles, headers, jambs, and brackets and clips for accessories.

4.6.10.2 Purlins and Girts

a. Purlins and girts shall be C- or Z-shaped sections fabricated from 0.053 inch (1.3 mm) minimum roll-formed steel.

b. C-shaped girts shall be installed toe down.

4.6.11 Factory-Applied Finishes

4.6.11.1 Surface Preparation and Coatings

a. Unless otherwise specified in contract documents, all framing members shall be factory-primed.

b. Surfaces shall be cleaned of loose mill scale, rust, dirt, oil, grease, and other matter that precludes bonding of paint in accordance with SSPC \textit{V1}, surface preparation methods \textit{SSPC SP 1} and \textit{SSPC SP 3} shall apply. \textit{SSPC SP 7} shall apply if specified in contract documents.

c. Unless otherwise required in contract documents, members shall be primed with manufacturer’s standard rust-inhibiting primer.

(1) Coils utilized for cold-formed framing members may be pre-primed at a coil processing facility. Steel surfaces exposed or damaged during fabrication shall be cleaned and primed in fabrication shop with manufacturer’s standard rust-inhibiting primer.

(2) Primers utilized for all building components shall be of a similar color.

d. Unless otherwise required in contract documents, steel roofing, siding and all related trim shall be coil-coated with a two-coat system in accordance with \textit{ASTM A755/A755M}. Top coat shall be silicone polyester or fluoropolymer, as specified in contract documents. Paint dry film thickness shall be 1 mil (0.025 mm) on exterior face of panels and 0.5 mil (0.012 mm) on interior face of panels.

e. Roofing and siding shall be in manufacturer’s standard colors. Trim, gutters, and downspouts shall match in color.

4.6.11.2 Galvanizing / Corrosion Protective Coating

If galvanizing / corrosion protective coating is required by contract documents, the following shall apply:

a. Hot-rolled shapes, built-up members and plates shall be hot-dip galvanized in accordance with \textit{ASTM A123/A123M}.

b. Cold-formed sections shall be galvanized in accordance with \textit{ASTM A653/A653M}, minimum coating designation G90 (Z275).
c.  *ASTM F3125/F3125M*, Grade A325 (Grade A325M) bolts and corresponding nuts and washers shall be galvanized in accordance with *ASTM B695* or *ASTM F2329/F2329M*.

d.  *ASTM A307*, Grade A bolts and corresponding nuts and washers shall be galvanized in accordance with *ASTM B695* or *ASTM F2329/F2329M*.

e.  *ASTM F3125/F3125M*, Grade A490 (Grade A490M) bolts and corresponding nuts and washers shall be coated with zinc/aluminum corrosion protective coating in accordance with *ASTM F1136/F1136M*, Grade 3, unless otherwise specified in contract documents.

f.  All other bolts, nuts and washers shall be mechanically galvanized in accordance with *ASTM B695*.

### 4.6.12 Roofing - Single Sheet Sloped Roof System

4.6.12.1 Roof panels shall be provided precision roll-formed from 0.0209-inch (0.55-mm) minimum sheet steel.

4.6.12.2 Panel edges for standing seam roofing shall be fabricated for a machine-closed, double lock (360 degrees) seam with factory-applied sealant.

4.6.12.3 Panel edges for through-fastened roofing shall be fabricated for side laps of one full major rib.

4.6.12.4 End splices shall be located over a structural member with a minimum 6-inch (150-mm) lap. Panel ends shall be factory-notched for end splicing.

4.6.12.5 Panels shall be the longest length possible, considering handling and installing, to minimize end splices.

4.6.12.6 Perimeter trim, gutters, start/finish panels, ridge panels, and transition flashing shall be provided as required for roofing system and shall be designed to accommodate roof’s expansion and contraction.

4.6.12.7 Closures shall be of the exact profile as the panel to provide a weather-tight seal.

4.6.12.8 Sealants and fasteners shall be provided as required by design to form a weather-tight installation.

### 4.6.13 Siding - Single Sheet Wall System

4.6.13.1 Wall panels shall be provided precision roll-formed from 0.0209-inch (0.55-mm) minimum sheet steel.

4.6.13.2 Panel side laps shall be formed by lapping major ribs at panel edges. Underlapping rib shall have full bearing legs to support side lap.

4.6.13.3 Panel end splices shall be located over a structural member with a minimum 4-inch (100-mm) lap.

4.6.13.4 Panels shall be the longest length possible, considering handling and installing, to minimize end laps.
4.6.13.5 Corner trim, base trim, and transition flashings shall be provided for wall system and shall provide a weather-tight installation.

4.6.13.6 Sealants and fasteners shall be provided to form a weather-tight installation.

4.6.14 Gutters and Downspouts

4.6.14.1 Gutters and downspouts shall be provided in accordance with contract documents.

4.6.14.2 Gutter hangers shall be appropriately spaced to provide adequate support of gutters without excess deflection affecting performance of gutters.

4.6.14.3 Gutter sections shall be provided in the longest continuous sections possible, considering handling and installing.

4.6.14.4 At joints, sections shall be lapped a minimum of 4 inches (100 mm) and sealed with sealant, then fastened with fasteners.

4.6.14.5 Gutter end closures shall be sealed with sealant and fastened with pop rivets.

4.6.14.6 Downspouts shall be attached to a thimble installed in gutter.

4.6.14.7 Downspouts shall be attached to wall panel using straps spaced no more than 10-ft (3-m) center-to-center.

4.6.15 Framed Openings

4.6.15.1 Structural shapes of proper design and size shall be provided to reinforce openings and to carry imposed loads and vibrations, including equipment furnished by others if specified in contract documents.

4.6.15.2 Framed openings shall be securely attached to building structural framing.

4.7 Erection

4.7.1 Erection shall be in accordance with the *MBMA Metal Building Systems Manual*, “Common Industry Practices.”

4.7.2 Material Handling, Delivery, and Storage

4.7.2.1 Prefabricated components, sheets, panels, and other manufactured items, shall be delivered and stored so that they cannot be damaged or deformed.

4.7.2.2 If subjected to water accumulation, materials shall be stored in such a manner so that they can drain freely.

4.7.2.3 Sheets and panels shall not be stored in contact with other materials that might cause staining or corrosion.

4.7.2.4 All damaged material shall be reported to purchaser to determine if replacement is required.

4.7.3 Inspection of Work Area

4.7.3.1 Work area shall be inspected to verify that conditions are satisfactory to begin work. This inspection shall include column-bearing surface, foundation level and elevation, and anchor bolt locations and projections.
4.7.3.2 Purchaser shall be notified in writing of any unsatisfactory conditions.

4.7.4 Structural and Miscellaneous Steel

4.7.4.1 For buildings erected in the United States, erection of structural and miscellaneous steel shall be in accordance with manufacturer’s drawings, contract documents, ANSI/AISC 303, OSHA 29 CFR Part 1910, OSHA 29 CFR Part 1926, and any applicable state or local regulations or codes.

4.7.4.2 For buildings erected outside of the United States, supplier shall determine if specific regulations and other country, regional, or local regulations apply for erection of structural and miscellaneous steel. In the absence of country, regional, and local regulations, U.S. regulations listed in Section 4.7.4.1 apply.

4.7.5 Roofing and Siding

4.7.5.1 General

a. Roofing and siding shall be installed in accordance with this Practice, and contract documents.

b. Ribbed or fluted sheets shall be lapped one full rib corrugation.

c. Panels and associated items shall be joined for neat and weather-tight enclosure.

d. “Panel creep” or application not true to line shall be avoided.

e. Factory finishes shall be protected from damage.

f. Field cutting of exterior panels by torch shall not be permitted.

g. Weather seal shall be provided under ridge cap.

h. Roof panels shall be flashed and sealed at eave and rake with rubber, neoprene, or other closures to exclude weather.

4.7.5.2 Standing Seam Roof Panel System

a. Roof panels shall be fastened to purlins with concealed clips.

b. Clips shall be installed at each support.

c. At end laps of panels, sealant shall be installed between panels.

d. Factory-caulked cleats shall be installed at standing-seam joints. Cleats shall be machine-seamed to panels to provide a weather-tight joint.

4.7.5.3 Through-Fastened Roof Panel System

a. Roof panels shall be fastened to purlins with fasteners at required spacing.

b. Sealant shall be installed continuously at all panel side and end laps.

4.7.5.4 Wall Panel System

a. Elastomeric sealant shall be applied continuously between metal base channel (sill angle) and foundation, and elsewhere as necessary to provide a weather-tight joint.
b. Sealant and backup shall be handled and applied in accordance with sealant manufacturer’s recommendations.

c. Unless otherwise required, bottoms of wall panels shall be aligned and panels shall be fastened with blind rivets, bolts, or self-tapping screws.

d. Flashings and trim around openings and similar elements shall be fastened with self-tapping screws.

e. Window and door frames shall be fastened with machine screws or bolts.

f. If building height requires two rows of panels at gable ends, lap of gable panels shall be aligned over wall panels at eave height.

g. Fasteners shall be installed with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels.

h. Weatherproof escutcheons or flashing shall be provided for pipe, conduit, cable tray, and duct penetrations at exterior walls as required in contract documents.

4.7.6 Accessories

4.7.6.1 Sheet Metal Accessories

a. Gutters, downspouts, ventilator louvers, and other sheet metal accessories shall be installed in a manner that provides positive anchorage to building and weather-tight mounting.

b. Accessories’ operating mechanisms shall be adjusted to provide proper operation.

4.7.6.2 Hollow Metal Doors and Frames

a. Doors, frames, and related hardware shall be installed in accordance with PIP ARS08112.

b. Frames shall be securely anchored to building structure.

c. Hardware shall be adjusted to provide proper operation.

4.7.6.3 Overhead Doors

a. Doors and operating equipment shall be set complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports.

b. Moving hardware shall be adjusted to provide proper operation.

4.7.6.4 Windows

a. Windows shall be anchored securely in place.

b. Perimeter of each unit shall be sealed with elastomeric sealant used for panels.

c. Operating sash and hardware shall be adjusted and lubricated to provide proper operation.
d. Surfaces of window units shall be cleaned.
e. Screens shall be mounted directly to frames with tapped screw clips.

### 4.7.6.5 Field Glazing

a. Channel surfaces shall be cleaned and primed in accordance with sealant manufacturer’s recommended practice.
b. Glass shall be cut to required size for measured opening.
c. Provide a 1/8 inch (3 mm) clearance between glass and measured opening such that glass dimensions are 1/4 inch (6 mm) less than measured opening in each direction.
d. Glass that has significant edge damage or other defects shall not be installed.
e. Broken or damaged glass shall be replaced.
f. Each piece of exterior glass shall be installed to be airtight and watertight through normal weather/temperature cycles and through normal door/window operation.
g. Damaged factory-sealed double-pane windows shall be repaired or replaced as required by window manufacturer.

### 4.7.6.6 Insulation

a. Insulation shall be installed concurrently with installation of roof and wall panels.
b. Blankets shall be installed straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier.
c. Insulation shall be located on inside of roof and wall sheets, extending across flange of purlin or girt members and held taut and snug to panels with retainer clips.
d. Retainer strips shall be installed at each longitudinal joint in such a manner that strips are straight and taut and can hold insulation firmly in place.

4.7.6.7 Translucent panels shall be attached to structural framing and roof and wall panels in a manner that provides a weather-tight installation.

### 4.7.7 Cleaning and Touch-Up

4.7.7.1 All component surfaces shall be cleaned.

4.7.7.2 Abrasions, marks, skips, and other defects to finished surfaces shall be touched up with the same type of finish.