

May 28, 2025

AECC

Fitzhugh Generation LM6000
Ozark, Arkansas
Section 133419
Metal Building Systems

PROJECT NUMBER:

0253136

PROJECT CONTACT:

SEAN BUFFINGTON

EMAIL:

SEAN.BUFFINGTON@POWERENG.COMPHONE:

816-898-9538



*Section 133419
Metal Building Systems*

PREPARED FOR: AECC
PREPARED BY:

REVISION HISTORY				
DATE	REVISED BY	CHECKED BY	APPROVED BY	REVISION
03/05/2025	M. Johnson	J. Heaney	S. Buffington	A – Issued for Review
05/28/25	S. Thibodeau	J. Heaney	S. Buffington	B – Issued for Review

TABLE OF CONTENTS

PART 1 - GENERAL	1
1.1 SUMMARY	1
1.2 BUILDING CONFIGURATION	4
1.3 DESIGN LOADS.....	5
1.4 DESIGN REQUIREMENTS	6
1.5 SUBMITTALS	7
1.6 QUALITY ASSURANCE	8
1.7 QUALIFICATIONS	9
1.8 DELIVERY, STORAGE, AND HANDLING.....	9
1.9 WARRANTY	10
1.10 EXTRA MATERIALS	10
PART 2 - PRODUCTS	10
2.1 PRE-ENGINEERED BUILDINGS	10
2.2 FRAMING MATERIALS	10
2.3 WALL AND ROOF SYSTEM MATERIALS.....	12
2.4 GUTTERS AND DOWNSPOUTS MATERIALS	14
2.5 DOORS AND WINDOWS MATERIALS	14
2.6 FINISHES	16
2.7 HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS (HVAC)	17
2.8 FIRE PROTECTION AND DETECTION SYSTEMS.....	21
2.9 ELECTRICAL REQUIREMENTS	25
PART 3 - EXECUTION	28
3.1 EXAMINATION	28
3.2 INSTALLATION – GENERAL	28
3.3 INSTALLATION – FRAMING	29
3.4 INSTALLATION – WALL AND ROOF PANEL.....	29
3.5 INSTALLATION – GUTTER AND DOWNSPOUT.....	35
3.6 INSTALLATION – OTHER	36
3.7 DISSIMILAR MATERIALS	37
3.8 FIELD PAINTING	37

APPENDIX A – WATER TREATMENT BUILDING LAYOUT DRAWINGS

SECTION 133419
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes design, procurement, and installation of pre-engineered, structural steel building and associated building systems. Furnish pre-engineered metal building having length, width, eave height, and roof pitch indicated. The work shall include:
1. Exterior walls covered with field-assembled wall panels attached to framing members using exposed fasteners and fiberglass insulation.
 2. Roof system with standing-seam roofing and fiberglass insulation.
 3. Interior walls and partitions.
 4. Framing around doors, louvers, HVAC equipment, and penetrations.
 5. Eave gutters and downspouts.
 6. Exterior trim, coping, flashing, counterflashing.
 7. Exterior overhead doors with motorized operator.
 8. Exterior and interior personnel doors.
 9. Exterior louvers.
 10. Ventilation openings and fans.
 11. HVAC and associated controls and ductwork
 12. Interior fire detection and alarm systems.
 13. Interior fire suppression systems (Option Price).
 14. Potable water service.
 15. Aboveground sanitary drain piping.
 16. Lighting, controls and electrical systems.
 17. Floor mounted 10 ton bridge crane (Option Price).
- B. Project Description: The building will be installed outdoors at a power generation site near Ozark, Arkansas. Refer to "DESIGN LOADS" of this specification for site design requirements. The intent of this specification is to facilitate procurement of a design-build contractor to design, procure and install complete building system to house owner provided Balance of Plant (BOP) equipment necessary for operation of nearby power generation facility. Schedule is of paramount importance. The preference is for the Contractor to bid the entirety of this scope of services, however contractors may take exception, where deemed necessary, to shorten schedule. Foundation design needs to progress as soon as possible, so bids should provide foundation interface information such as not to exceed column loading, wall extents and foundation interface, and anchor bolt information sufficient for design of foundation. Bid pricing may provide clarification related to taking exception or provides option pricing for scope.
- C. Items provided and installed by Owner or others are as follows:
1. Site preparation design and installation.
 2. Building foundation design and installation, including foundation embedded piping/electrical
 3. Service/instrument air.
 4. Owner procured BOP Equipment:

- a. Multi-Media Filter Skids.
- b. Future Greensand Filter Skid.
- c. RO Skids.
- d. EDI Skids.
- e. RO CIP Skid.
- f. Temporary Water Treatment Backup System.

D. REFERENCE STANDARDS

1. American Institute of Steel Construction:
 - a. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - b. AISC S335 – Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.
 - c. AISC Specification for Structural Joints Using ASTM F3125 Grade A325 or A490 Bolts.
 - d. AISC Quality Certification Program.
2. American Iron and Steel Institute:
 - a. AISI Manual – Cold-Formed Steel Design Manual.
3. American Society of Civil Engineers:
 - a. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.
4. ASTM International:
 - a. ASTM A36 – Standard Specification for Carbon Structural Steel.
 - b. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - c. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - f. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - g. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
 - h. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - i. ASTM A606 – Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled with Improved Atmospheric Corrosion Resistance.
 - j. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - k. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

-
- l. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - m. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - n. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - o. ASTM C553 – Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications.
 - p. ASTM C991 – Standard Specification for Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings.
 - q. ASTM C1107/C1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - r. ASTM D522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - s. ASTM D714 – Standard Test Method for Evaluating Degree of Blistering of Paints.
 - t. ASTM D968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
 - u. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 - v. ASTM D1654 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 - w. ASTM D2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - x. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - y. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
 - z. ASTM D3841 – Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels.
 - aa. ASTM D4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 - bb. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - cc. ASTM E96/E96M – Standard Test Methods for Water Vapor Transmission of Materials.
 - dd. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
 - ee. ASTM F3125 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - ff. ASTM G152 – Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
5. American Welding Society:
- a. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - b. AWS D1.1 – Structural Welding Code – Steel.
 - c. AWS D1.2 – Structural Welding Code – Aluminum.
6. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
7. 2018 Franklin County Building Code (IBC 2018).
8. Arkansas Building Code 2021 (IBC 2021) and applicable references for Fire, Plumbing, Energy, etc.

9. Metal Building Manufacturers Association:
 - a. MBMA – Low Rise Building Systems Manual.
10. North American Insulation Manufacturers Association:
 - a. NAIMA 202 – Standard for Flexible Fiberglass Insulation Systems in Metal Buildings.
11. Sheet Metal and Air Conditioning Contractors' National Association:
 - a. SMACNA Architectural Sheet Metal Manual.
12. Steel Window Association:
 - a. SWA – The Specifier's Guide to Steel Windows.
13. Society for Protective Coatings:
 - a. SSPC – Steel Structures Painting Manual.
14. Underwriters Laboratories Inc.:
 - a. UL – Building Materials Directory.
15. U.S. Environmental Protection Agency:
 - a. ENERGY STAR – ENERGY STAR Voluntary Labeling Program.
16. FM Global:
 - a. FM – American Mutual Insurance Company.
 - b. RoofNav – Approved Roofing System Database maintained by FM.

1.2 BUILDING CONFIGURATION

- A. Building shall be single-span, rigid-frame structure with vertical walls and mono-slope roof.
- B. Eave heights shall be measured from the top of the finished floor to intersection of insides of roof and sidewall sheets.
- C. Bay Spacing: As shown in Appendix A.
- D. Primary Framing: Rigid frames of rafter beams and columns, intermediate columns, and wind bracing.
- E. Secondary Framing: Purlins, girts, eave struts, flange bracing, clips, and other items detailed.
- F. Wall System: Preformed metal panels of vertical profile with sub-girt framing anchorage assembly, insulation, and accessory components.

- G. Roof System: Preformed metal panels of with sub-purlin framing/anchorage assembly, insulation, and accessory components.
- H. Roof Slope: As shown in Appendix A.

1.3 DESIGN LOADS

- A. Design loads shall conform to the requirements of the Arkansas Building Code 2021 (Based on International Building Code 2021), hereafter called The Code. Loading criteria as set out by MBMA Low Rise Building System Manual shall apply only where specifically stated by these Specifications.
- B. Dead loads shall consist of the weight of the structural frame and all other materials of the building system, including siding, roofing, and other appurtenances.
- C. Collateral load of 20 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, and ceilings. Roof framing members (purlins) shall be designed to supporting a point load of 1,000 pounds applied to the center of the span.
- D. Roof live loads and snow loads shall be determined in accordance with The Code and ASCE 7-16, but shall not be less than 20 psf. Live load reduction is not permitted.
- E. Roof Snow Load: Roof snow load used to design the structure shall not be reduced.
 - 1. Ground Snow Load = 10 psf.
- F. Wind loads shall be determined in accordance with The Code and ASCE 7 based on the following criteria:
 - 1. Exposure Category = C.
 - 2. Ultimate Wind Speed = 114 mph.
 - 3. Basic Wind Speed = 90 mph.
 - 4. Topographic Factor $K_{zt} = 1.0$.
 - 5. Risk Category = III.
- G. Seismic loads shall be determined in accordance with The Code and ASCE 7 based on the following criteria:
 - 1. Seismic Importance Factor = 1.25.
 - 2. $S_1 = 0.100g$.
 - 3. $S_s = 0.189g$.
 - 4. Site Class = C
 - 5. Seismic Design Category = B.
 - 6. Risk Category = III.
- H. Concentrated loads shall be applied at locations indicated on the Drawings in Appendix A. Unless otherwise noted, assume concentrated loads as dead loads. All building columns shall be designed

to withstand a 20-kip point collateral live load applied at the top of the column in addition to all other design loads.

- I. Design for the load combinations per The Code.
- J. Live loads shall be in accordance with ASCE 7. In addition to these loads, other live loads such as erection or crane loads shall be considered where appropriate.

1.4 DESIGN REQUIREMENTS

A. Structural Member Design:

1. Structural steel members shall be designed in accordance with AISC Code of Standard Practice and AISC S335 or AISC S342L.
2. Structural steel member connections shall be designed in accordance with AISC Code of Standard Practice, AISC Specification for Structural Joints Using ASTM F3125 Grade A325 or A490 Bolts, and AWS D1.1.
3. Structural cold-formed steel framing members and their connections shall be designed in accordance with the AISI Manual.
4. All column bases shall be designed as pinned connections.
5. Unless otherwise specified, the allowable live load deflection of roof framing members shall not exceed 1/180th of the span.
6. The allowable live load deflection of roof framing members supporting suspended ceilings shall not exceed 1/240th of the span.
7. Roof framing members shall have sufficient rigidity to resist ponding.
8. Members having web openings shall be reinforced as required to resist web stresses at the openings.
9. Limit deflections of the steel members above and along the side of overhead door openings to half the maximum allowable movement for proper operation of the doors.

- B. Lateral deflection, or drift, shall be measured at the building roof level and shall be calculated based on a 50-year mean recurrence interval. Maximum lateral deflection shall be $H/200$ or less if required for architectural or mechanical details.

C. Girt and Purlin Design:

1. Design all girts and purlins with lateral bracing. Bracing shall connect to adjacent structural members. Standing-seam roofing shall not be considered adequate bracing.
2. Whenever net wind uplift is present, lateral bracing shall be provided for both flanges.
3. Flange bracing shall be located as indicated and as required by analysis, but, as a minimum, shall be spaced at quarter points of the member's span.

D. Siding and Roofing Design:

1. Design siding panels and roof panels in accordance with AISI Manual, applicable FM Datasheets and UL 580 requirements.
2. Maximum deflection for siding panels and roof panels when under dead load, live load, and wind load combination shall not exceed $L/180$ where L is the distance between supports.

3. Roof panel stiffness shall be such that when loaded under dead load plus live load combination or dead load plus snow load combination, panel deflected slope will not be negative.
4. Deflection limits described above shall be based on panels continuous across two or more supports.
5. In addition to the specified Design Loads, the roof panels shall be designed for a 200-pound concentrated load at mid-span on a (12-inch) wide section of deck.
6. Design shall provide for thermal expansion and contraction.
7. Siding panels and roofing panels shall not be designed as shear walls or shear diaphragms.
8. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1899:
9. Wind Design Requirements:
 - a. The ultimate design wind speed shall not be taken less than 114 mph as measured as a three second gust wind speed.
 - b. The wind design is based on The Code, FM Data Sheets, and ASCE/SEI 7-16.
 - c. Exposure 'C' terrain coefficient.
 - d. Risk Category III.
10. SPRI's Directory of Roof Assemblies Listing: Roof system component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
11. Wind Uplift Load Capacity: UL90 or FM approved Equal Rating
12. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
13. Fire/Windstorm Classification: Class 1A-90.
14. Hail Resistance: Severe Hazard (SH).

E. Gutters and Downspouts:

1. Design in accordance with the requirements of SMACNA Architectural Sheet Metal Manual for storms which should be exceeded only once in five years.
2. Design with adequate provisions for thermal expansion and contraction.
3. Design supports for the anticipated loads.

F. Louvers shall be dual drainable blade stationary type designed to be rain proof and to resist vibration when air is passed.

G. Building HVAC system shall be sized to meet the temperature and humidity requirements in the "HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS (HVAC)" section.

1.5 SUBMITTALS

A. Bid Phase:

1. Submit not to exceed column and bracing reaction loading to all foundation design to proceed.

2. Submit foundation size and wall panel foundation interface to allow detailing of foundations.
3. Submit column anchor bolt size and location information for foundation design and detailing.

B. Product Data:

1. Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.
2. Submit baseplate reaction loads and baseplate layout one week after purchase order.
3. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing as applicable.

C. Erection Drawings:

1. Submit complete erection drawings showing anchor bolt settings, sidewall, endwall, and roof framing, transverse cross sections, covering, and trim details.
2. Submit accessory installation details to clearly indicate proper assembly of building components.
3. Show vertical elevations from bottom of column base plates.
4. Indicate standard designations, configurations, sizes, spacings, and locations of girts and purlins, including bridging and connections.
5. Provide details of all standard and modified steel connections. Details shall indicate if connections are shop-welded, field-welded, or field-bolted.
6. Indicate welded connections with AWS A2.4 welding symbols.
7. Provide layouts for sheet metal accessories. Layouts shall be drawn at 1/4-inch scale.
8. Provide details of all ventilators, louvers, gutters, downspouts, and other sheet metal accessories at 1-1/2-inch scale showing profiles, methods of joining, and anchorages.
9. Indicate wall and roof system dimensions, panel layout, general construction details, anchorages and methods of anchorage, and installation.
10. Provide manufacturer's installation instructions. Instructions shall indicate preparation requirements, assembly sequence, and erection drawings.
11. Fabrication shall not start until shop drawings have been approved.

D. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in the State of Arkansas, verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.

1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.

1.6 QUALITY ASSURANCE

A. Certificate of design and manufacturing conformance:

1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in the State of Arkansas, verifying that

-
- building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
 3. Certificate shall be on metal building system manufacturer's letterhead.
 4. Refer to Submittals article of this specification section.
- B. Perform work in accordance with AISC Code of Standard Practice and MBMA Low Rise Building Systems Manual.
- C. Manufacturer's steel fabrication shop shall have current certification in accordance with AISC Quality Certification Program, Category MB.
- D. Insulation Installed in Concealed Locations Surface Burning Characteristics:
1. For IBC, surface burning rating is not required for insulation facings installed in Construction Type III, Type IV, and Type V. Facing must be in substantial contact with ceiling, wall, or floor finish.
 2. Batt Insulation: Maximum 25/450 flame-spread/smoke-developed index when tested in accordance with ASTM E84.
- E. Insulation Installed in Exposed Locations Surface Burning Characteristics: 25/450 flame-spread/smoke-developed index when tested in accordance with ASTM E84.
- F. Perform work in accordance with the Franklin County Building Code requirements and The Code.

1.7 QUALIFICATIONS

- A. Manufacturer: A qualified manufacturer shall be listed in FM Approvals' RoofNav for roofing system identical to that used for this Project. Company shall specialize in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Erector: Company specializing in performing work of this Section with minimum five years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the Site in a dry and undamaged condition and stored out of contact with the ground.
- B. Materials other than framing and structural members shall be kept in manufacturer's original, unopened containers and packaging until installation. Materials shall be covered with weather-tight coverings and kept dry.
- C. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.
- D. Materials shall be stored on flat level surface and raised above ground to prevent sagging.

1.9 WARRANTY

- A. Provide a warranty of the metal building system against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 20 years after the date of Substantial Completion.
- B. Provide a warranty of the metal building system against failure of the factory-applied exterior finish on metal roof and wall panels for a period of 20 years after the date of Substantial Completion.
- C. Substantial completion will occur when all items on the Owner's inspection punch list are remedied to the Owner's satisfaction.

1.10 EXTRA MATERIALS

- A. Furnish at least 5 percent excess over required number of nuts, bolts, screws, washers, and other required fasteners for each metal building.
- B. Pack in cartons labeled to identify the contents and store on the site where directed.

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED BUILDINGS

- A. Acceptable Manufacturers:
 - 1. BlueScope Buildings.
 - 2. Varco-Pruden Buildings.
 - 3. Ceco Building Systems.
 - 4. American
 - 5. Nucor
 - 6. Star Buildings
 - 7. Approved equal.
- B. Building Dimensions - As indicated on drawings in Appendix A:
 - 1. Horizontal Dimensions: Measure to inside face of wall sheets.
 - 2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
 - 3. Clear Height Between Finished Floor and Low-Point of Roof Beams: Indicated on the Drawings.
- C. Furnish materials in accordance with the The Code and Franklin County Building Code.

2.2 FRAMING MATERIALS

- A. Primary framing for columns and roof beams shall be welded-up plate sections complete with necessary splice plates for bolted field assembly.

-
- B. Fabricate all built-up members in accordance with MBMA Low Rise Building Systems Manual.
 - C. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.
 - D. Framing having thickness 1/8 inch or more shall conform to ASTM A36, ASTM A572 Grade 50, or ASTM A992.
 - E. Uncoated steel framing having thickness less than 1/8 inch shall conform to ASTM A606, or ASTM A1011 Grade E (42 ksi min.).
 - F. Galvanized steel framing having thickness less than 1/8 inch shall conform to ASTM A653, G 90 coating designation, 0.045 inch minimum thickness.
 - G. Aluminum-zinc coated steel framing having thickness less than 1/8 inch shall conform to ASTM A792, AZ 55 coating designation 0.045 inch minimum thickness.
 - H. Primary framing structural connection shall be high strength bolts conforming to ASTM F3125 Gr A325 or A490 using ASTM A563 nuts. Connections shall be made through factory punched holes.
 - I. Anchor Bolts: ASTM A1554 Grade 36, galvanized. Formed with straight shank, assembled with template for casting into concrete.
 - J. Welding Materials: AWS D1.1; type required for materials being welded.
 - K. Structural pipe shall conform to ASTM A53, ASTM A500, or ASTM A501.
 - L. Holes for bolts shall be made in the shop.
 - M. Secondary Members:
 - 1. Roof purlins, eave struts, sidewall, and end wall girts shall be C- or Z-shaped sections fabricated from 16 gauge (0.0598 inch) minimum thickness cold-formed steel.
 - 2. Flange and sag bracing shall be angles fabricated from 16 gauge (0.0598 inch) minimum thickness, cold-formed steel.
 - 3. Base or sill angles shall be 14 gauge (0.0747 inch) minimum thickness cold-formed galvanized steel sections.
 - 4. Secondary endwall structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14 gauge (0.0747 inch) minimum thickness cold-formed galvanized steel.
 - 5. Wind bracing shall be threaded steel rods.
 - N. Painting of Structural Steel Framing System:
 - 1. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions. Perform subsequent touchup and finish painting, if required to repair damaged prime paint coating.
 - 2. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.

3. Clean primary framing steel in accordance with SSPC-SP2 and factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 15.
4. Minimum Coating Thickness shall be 1.0 mil.
5. Secondary Structural Members shall be Roll-Formed and Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
6. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.

2.3 WALL AND ROOF SYSTEM MATERIALS

- A. Panels shall be pre-finished, field-assembled metal panels with Kynar coated, G90, embossed steel sheets and batt insulation with a minimum 20-year finish warranty. Exterior panel surfaces shall have Kynar coating with a 20-year finish warranty. Provide interior liner panels to cover insulation at base of wall up to 10 feet - 0 inches AFF.
- B. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope or the entire height of any unbroken wall surface.
- C. Panels shall be 24-gauge (0.024 inch) thickness minimum, except panels having design wind uplift pressures or wind suction pressures of 60 psf or greater shall have a minimum thickness of 22 gauge (0.030 inch). Roof Panels:
 1. Provide manufacturer's standard 360-degree "Pittsburgh" double-lock standing seam roof panel designed for mechanical attachment of panels to roof purlins using a concealed clip fastener.
 2. Roof panels shall be 2 feet wide with two major corrugations 2 inches high, 24 inches o.c., between and perpendicular to the major corrugations.
 3. Provide 16-gauge (0.0598 inch) minimum thickness panel clips.
 4. Design in accordance with UL 580 requirement.
- D. Wall Panels:
 1. Wall panels shall have configurations for overlapping adjacent sheets or interlocking ribs for securing adjacent sheets.
 2. Wall panels shall be fastened to framework using exposed or concealed fasteners.
- E. Accessories:
 1. Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be not less than the minimum thickness specified for wall panels or roof panels.
 2. Accessories shall be compatible with the system furnished.
 3. Exposed metal accessories shall be finished to match the covering building finish.
 4. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride pre-molded to match configuration of the adjacent panels and shall not absorb or retain water.
 5. Standing seam clips shall comply with Manufacturer's standard as approved by FM Global.

F. Panel Fasteners:

1. Fasteners for steel wall and roof panels shall be of stainless steel for exterior application and galvanized or cadmium-plated fasteners for interior application.
2. Exposed roof fasteners shall be gasketed or have metal-backed gasketed washers on the exterior side of the covering to waterproof the fastener penetration.
3. Washer material shall be compatible with the covering and have a minimum diameter of 3/8 inch for structural connections.
4. Gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.
5. When wall covering is factory-color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering.
6. Screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.
7. Blind rivets shall be stainless steel with 1/8-inch nominal diameter shank.
8. Rivets shall be threaded-stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.
9. Bolts shall be not less than 1/4-inch diameter, shouldered or plain shank as required, with proper nuts.
10. Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

G. Wall and Roof Insulation Materials:

1. Insulation shall conform to NAIMA 202.
2. Minimum R-value for climate zone 3A: wall insulation shall be R-19 and roof insulation shall be R-13 plus R-13 linear system with R-5 thermal blocks.
3. R-values shall be determined at 24 degrees C (75 degrees F) in accordance with ASTM C518.
4. Insulation shall be a standard product of a manufacturer, factory marked or identified with manufacturer's name or trademark and the R-value. Identification shall be on individual pieces or individual packages.
5. 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 E96. Facing shall be white of reinforced foil with a vinyl finish, except that unreinforced foil with a natural finish may be used in concealed locations. Facings and finishes shall be factory applied.
6. Blanket insulation shall conform to ASTM C553 [ASTM C991].

H. Insulation Retainers:

1. Retainers shall be of type, size, and design necessary to adequately hold the insulation and to provide a neat appearance.
2. Metallic retaining members shall be non-ferrous or have a non-ferrous coating.
3. Non-metallic 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.

I. Sealants:

1. Sealants shall be an elastomeric type containing no oil or asphalt.

2. Exposed sealants shall cure to a rubber-like consistency. Concealed sealants may be the non-hardening type.
- J. Gaskets and insulating compounds shall be non-absorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non-running after drying.

2.4 GUTTERS AND DOWNSPOUTS MATERIALS

- A. Gutters and downspouts shall be fabricated from zinc-coated steel or aluminum-zinc alloy coated steel and shall have the same manufacturer's standard factory finish as roof and wall covering.
- B. Minimum uncoated thickness of materials shall be 0.018 inch for steel and 0.032 inch for aluminum.
- C. Provide all accessories necessary for the complete installation of gutters and downspouts. Accessories shall include gutter straps, downspout elbows, and precast concrete splashblocks. and downspout straps and fasteners. All accessories shall be fabricated from materials compatible with the gutters and downspouts.

2.5 DOORS AND FRAMES

- A. Swinging personnel doors and frames shall be standard with metal building system manufacturer, prepared and reinforced at strike and at hinges to receive factory and field applied hardware according to BHMA A156 Series unless otherwise noted and furnished as specified.
- B. Personnel doors shall be provided where noted on drawings included in Appendix A and shall comply with the following requirements:
 1. Personnel doors shall be extra heavy duty, seamless design with glazed lights. All doors shall be galvanized with minimum thermal transmittance of U-0.70.
 2. Contractor shall provide necessary hardware, framing, trim, and fasteners for personnel door installation.
 3. Fire-Rated Door Assemblies: Personnel door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated on plans, based on testing at positive pressure according to NFPA 252 or UL 10C.
 4. Framed openings for doors and door accessories shall be designed and manufactured to resist the same loads as the enclosure.
 5. Hollow metal (HM) doors shall be provided to the dimensions shown on drawings. Doors shall be 1-3/4-inch-thick flush construction type of not less than 18-gauge galvanized steel reinforced by lamination to a small cell honeycomb core enclosed by a continuous steel perimeter channel. Doors shall be factory painted with one coat of baked on primer. The primer shall be Manufacturer's standard.
 6. Doorframes shall be double ribbed fabricated from a minimum of 16-gauge galvanized steel. Doorframes shall be the Manufacturer's standard frame and be completely compatible with the enclosure wall in or with which they are installed. Doorframes, if self-framing, shall be designed to structurally replace the wall section they replace. Frames shall be factory painted with one coat of baked on primer. The primer shall be Manufacturer's standard.

7. Exterior door and frame finish paint color to compliment exterior façade and approved by Client.
 8. Interior door and frame finish paint color to be approved by Client.
 9. Doors shall be equipped with the following and be the Manufacturer's standard where possible:
 - a. Hardware and accessories to be Grade 1 Heavy Duty.
 - b. Standard weight full mortise stainless steel ball bearing hinges.
 - c. Mortise lockset with lever handle type.
 - d. Cylindrical lock. Lock cylinders shall be capable of replacement by the Owner with keyed cylinders. Three sets of keys shall be supplied, and all delivered to with doors. Locks shall meet any additional requirements as specified by the Owner.
 - e. Extruded aluminum removable threshold shaped to provide positive weather seal.
 - f. Door closures rated for commercial or industrial applications.
 - g. Panic bars shall be installed on all exit doors.
 - h. Electronic Strikes at door frames with card reader access as noted on drawings.
 - i. Silencers, gaskets or weather stripping as appropriate.
 - j. Vision glazing as noted on drawings.
 - k. Insulated to meet wall insulation criteria.
- C. Double doors shall be provided where noted on drawings included in Appendix A and shall comply with the following requirements:
1. Contractor shall provide double doors for equipment installation.
 2. Double door openings shall be 6'(W)x7'(H) with 2' tall removable mullion and transom panel above doors.
 3. Contractor shall provide necessary hardware, framing, trim, and fasteners required for the installation of double doors.
- D. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
- E. Exit devices and auxiliary items on exterior personnel doors shall meet ANSI/BHMA A156.3 and shall be equipped with reinforced cross bars. The exit device shall be operated by a lockable lever from the exterior side.
- F. Rolling steel (overhead) doors shall be provided where noted on drawings included in Appendix A and shall comply with the following requirements:
1. Overhead doors shall be insulated, motor-operated rolling steel doors with 24-gauge slats, IECC weather stripping, and reversing sensors. Provide interior operator. Doors shall have a thermal resistance of not less than R-1.45.
 2. Contractor shall provide rollup doors for equipment installation.
 3. Contractor shall provide necessary hardware, framing, trim, and fasteners required for the installation of overhead doors.
 4. Panel doors shall not be considered an acceptable substitution.
 5. Contractor shall provide electrical controls, cabling, etc. if required.
 6. Overhead door openings shall be 12'x16'.

2.6 FINISHES

- A. Wall and roof panels and their accessories shall have a factory-applied polyvinylidene fluoride (Kynar) finish on the exposed side.
- B. The exterior finish shall consist of a baked-on fluoro-polymer enamel topcoat with an appropriate prime coat. Color to be standard manufacturer color selected by Owner.
- C. The exterior coating shall be a nominal 1-mil thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.7-mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thick.
- D. The interior color finish shall consist of 0.2-mil thick prime coat. The exterior color finish shall meet the test requirements specified.
- E. Salt Spray Test:
 - 1. A sample of the sheets shall withstand a salt spray test for a minimum of 1,000 hours in accordance with ASTM B117, including the scribe requirement in the test.
 - 2. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters, as determined by ASTM D714 and a rating of 6, (1/8 inch) 10, no edge creep failure at scribe, as determined by ASTM D1654.
- F. Formability Test: When subjected to testing in accordance with ASTM D522, the coating film shall show no evidence of fracturing to the naked eye.
- G. Accelerated Weathering, Chalking Resistance, and Color Change:
 - 1. A sample of the sheets shall withstand a weathering test a minimum of 1,000 hours in accordance with ASTM G152, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity.
 - 2. The coating shall withstand the weather test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal.
 - 3. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D3359, Test Method B, shall be considered as an area indicating loss of adhesion.
 - 4. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D4214 test procedures.
- H. Humidity Test: When subjected to a humidity cabinet in accordance with ASTM D2247 for 1,000 hours, a scored panel shall show no signs of blistering, cracking, creepage, or corrosion.
- I. Impact Resistance:
 - 1. Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D2794 equal to 1.5 times metal thickness in millimeters (mils) expressed in Newton-meters (inch-pounds) with no loss of adhesions.

- J. Abrasion Resistant Test:
1. When subjected to the falling sand test in accordance with ASTM D968, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal.
 2. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.
- K. Pollution Resistance: Coating shall show no visual effects where immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D1308.

2.7 CRANE SYSTEMS (OPTION PRICE)

A. General:

1. Contractor shall procure and install free standing overhead bridge crane system.
2. Hoist, trolley, and crane system shall be provided with a minimum capacity of 10 tons.
3. Trolley may be manually operated. Hoist system shall be wire rope type system with electronic motor. Cable festoon system shall be provided to manage cable during system operation.
4. Bridge Crane system shall be L.K. Goodwin Model Number 1003020-1 with 30 foot by 20 foot plan dimensions and 15 foot lift height, or approval equal.

2.8 HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS (HVAC)

A. General:

1. The Contractor shall be responsible for the complete design of the HVAC systems, which shall be in accordance with the guidelines published by the American Society of Heating and Refrigeration Engineers (ASHRAE) and other relevant standards and local jurisdictions. Minimum filtration efficiency of 30% / MERV 7 required.
2. HVAC systems shall meet requirements of NFPA 90A, standard for installation of air conditioning and ventilation systems.
3. The Contractor shall be responsible for the supply of all Facility, Equipment and materials, installation, testing and commissioning of all HVAC systems to provide fully functional and efficient systems.
4. The HVAC system serving the Office/Break Area, Toilet Rooms, and Utility Room shall be a heat pump air handling unit with exhaust fans serving the toilet rooms and utility room. The Water Treatment/Maintenance Area shall be heated with electric unit heaters and cooled/ventilated with exhaust fans and filtered wall intake louvers.
5. All ductwork and support hangers shall be galvanized metal. The duct system shall include fire dampers. Insulation, flexible connectors, and other products shall meet NFPA 90A. Fire dampers shall meet NFPA 90A and UL 555. No products used in the duct construction shall exceed the maximum rating of 25 for flame spread and the rating of 50 for smoke developed and fuel contributed. The duct system shall include appropriate design to include a seismic restraining of mechanical equipment.
6. Externally mounted HVAC Facility and Equipment shall not exceed the required noise levels as defined by the owner.
7. The HVAC systems shall be designed and installed to provide an environment within the buildings suitable for continuous equipment operations. These HVAC systems shall be

designed to maintain proper levels of temperature, air movement, air removal, and fresh air supply.

8. Subcontractor shall possess the appropriate qualifications for the design, preparation of layout drawings, installation, inspection, testing, balancing, maintenance and servicing of Heating, Ventilating, and Air Conditioning (HVAC) systems.

B. System Design:

1. The heating and cooling required for each space shall be calculated in accordance with the methodology described in the ASHRAE Fundamentals Handbook chapter for Nonresidential Heating and Cooling Load Calculation Procedures and the Site Design Conditions. Contractor shall submit calculations for each space. Heated and ventilated spaces shall assume a minimum one air change/hour of infiltration air during winter months.
2. The design of the HVAC systems shall be based on the site ambient conditions and the interior requirements as specified. Subcontractor shall perform calculations for sizing the HVAC equipment. The sensible loads for the equipment the Buyer will be installing in the building for the respective HVAC zones are tabulated in this section. Air velocities in ducts, louvers, and grills shall be sufficiently low so to maintain acceptable noise levels in areas where personnel are normally located as defined later in this section.
3. HVAC systems for air-conditioned spaces shall be designed for operation based on the 0.4% climatic conditions for cooling and the 99.6% climatic conditions for heating.

Winter ambient design:	17.9 °F DB
Summer ambient design:	100.0 °F DB / 75.9 °F WB
4. HVAC systems for spaces where heating and ventilating systems are specified shall be based on the 1% climatic conditions for cooling and the 99% climatic conditions for heating.

Winter ambient design:	22.3 °F DB
Summer ambient design:	96.9 °F DB / 76.3 °F WB
5. Total fresh air shall be calculated according to ASHRAE Standard 62.1.
6. All HVAC equipment shall be certified to ASHRAE standards.
7. HVAC equipment shall be selected to have at least 25% capacity margin above the heat rejection or heating value calculated at 110°F and 0°F respectively and concurrent worst-case wet bulb per ASHRAE.
8. The temperature design requirements for the building spaces are below:

Area	Indoor Temperature	Indoor Humidity Range
Utility Room	70 °F-75 °F	N/A
Restrooms	70 °F-75 °F	N/A
Office Area/Break Area	70 °F-75 °F	40%-60%
Maintenance Bay/Crane Bay	60 °F-85 °F	N/A

9. Buyer will provide estimated equipment heat loads for all process components contained within the building for contractor use. Contractor to indicate with proposal the assumed size of DX units and ventilating equipment used for the bid proposal.

C. Components:

1. The HVAC system serving the Office/Break Area, Restrooms, and Utility Room shall be a Constant Air Volume (CAV) type packaged heat pump unit with no redundant units required. Airflows shall be balanced to provide the rooms with the necessary airflows to meet setpoint conditions. Temperature control shall be based on Office/Break Area conditions.
 - a. The packaged heat pump system components shall include:
 - 1) DX heat pump unit with supply fan, heating/cooling coil, auxiliary electric heating coil, pre-filter, mixing box, economizer, access sections, return air fan (if required), outside air damper, return air damper, and relief air damper (if required).
 - 2) Sheet metal ductwork, ductwork hangers, and supplemental steel.
 - 3) All air distribution fittings and accessories
 - 4) Thermal insulation and acoustical lining for ductwork systems.
 - 5) HVAC control systems including all switches, thermostats, control panels, controllers, disconnects and all other accessories and devices required for complete and operating systems.
 - 6) Duct mounted smoke and heat detectors.
 - 7) Contacts for unit shutdown from duct smoke detectors and control for alarm on the fire protection system control panel
 - 8) All required condensate drain piping for the air conditioning systems.
2. The HVAC system serving the Water Treatment/Maintenance Area shall consist of horizontal discharge electric unit heaters and roof mounted exhaust fans with wall mounted louvers and motorized dampers.
 - a. Unit heater system components shall include:
 - 1) 2-stage electric heating coil.
 - 2) Terminal panel.
 - 3) Single speed spark proof fan and motor.
 - 4) 24V transformer (if required).
 - b. Exhaust fan system components shall include:
 - 1) Wall mounted axial exhaust fan.
 - 2) 45° weather hood.
 - 3) Wall housing.
 - 4) Disconnect switch.
 - 5) Motorized insulated damper.
 - c. Louver:
 - 1) Fixed, drainable, aluminum louver.
 - 2) Insulated damper with spring return motorized actuator.
 - 3) Birdscreen.
 - 4) Filter rack.

-
3. Acoustical Design of HVAC Systems:
 - a. Grilles, registers, and diffusers shall be selected with a noise criterion value of less than or equal to NC35 for occupied areas.
 - b. Grilles, registers, and diffusers shall be selected with a noise criterion value of less than or equal to NC45 for general plant areas.
 4. Ductwork:
 - a. Building chases, shafts, tunnels, and mechanical rooms shall not be used as supply or return air plenums.
 - b. Ductwork supports shall be designed in accordance with SMACNA duct construction standards.
 - c. Ductwork shall be designed using radius elbows without turning vanes whenever possible.
 - d. Manual balancing dampers shall be located at each major branch takeoff and at run outs to diffusers and grilles of supply, return, and exhaust.
 - e. An access door shall be provided in ducts adjacent to each fire damper, smoke damper, and smoke detector. The opening shall be large enough to permit maintenance and resetting of the device.
 5. Outdoor Air Intakes:
 - a. All louvers in external walls shall be double bank configuration, constructed of aluminum; finished to required color and fitted with rear mounted noise attenuators.
 - b. Louvered intake's sills shall not be less than 28 inches from any outdoor roof surface or ground level.
 - c. Intakes shall be located not less than fifteen feet from the discharge of any exhaust duct relief or fan.
 - d. Intakes shall not be located in areas where products of combustion from vehicles may enter the building.
 - e. All intake hoods, louvers, penthouses, and ducts shall have bird screens across the full opening.
 6. HVAC Insulation:
 - a. Ductwork, casing, piping, and equipment with surface temperatures below the ambient dew point temperature shall be insulated.
- D. Controls:
1. The heating, ventilating, and air conditioning systems shall be controlled by a building automation system (BAS) or by locally mounted controls.
 2. The heating, ventilating, and air conditioning system controls shall meet the applicable requirements of ASHRAE 90.1, and ASHRAE 135 (BACnet).
 3. HVAC system control systems shall include indoor HMI thermostat or controller which will allow control and monitoring of the control panel mounted on the outdoor unitary unit.
 4. HVAC system shall include all necessary duct mounted smoke and heat sensors, HVAC shut down on alarm actuation, Ventilation Exhauster shutdown on alarm actuation, etc.

2.9 FIRE PROTECTION AND DETECTION SYSTEMS

A. General:

1. Contractor shall be responsible for the complete design, fabrication, and installation of the fire detection and protection systems within the building.
2. The design of the fire protection and alarm system and the Equipment contained therein shall be in accordance with the latest codes and standards published by the National Fire Protection Association (NFPA), Factory Mutual, all local, State, and Federal requirements, and with the requirements of this Specification.
3. Generally, in the design of the buildings, materials shall be fire resistant and structures shall be protected against fire in accordance with the appropriate regulations and codes, including local codes and regulations. The layout of Equipment shall be spaced in accordance with these codes and standards. Piping and cabling are to be segregated and protected from physical damage. Fire brigade access and escape routes and fire barriers are to be arranged to mitigate against the spread of flame.
4. Portable fire extinguishers shall be located throughout the building. In the electrical rooms or any other areas where sensitive electronics or computers reside, CO₂ type fire extinguishers shall be provided. Dry type chemical type portable fire extinguishers shall not be used in these areas. Maximum distance of travel to a fire extinguisher shall be 75 feet – 0 inches.

B. Fire Protection (Option Price):

1. All areas of the building shall be protected by a wet-pipe sprinkler system.
2. The piping up to the various water control valves shall be continuously charged with high-pressure water.
3. The use of butterfly control and isolation valves is prohibited. All control and isolation valves greater than two (2) inches (NPS) in size shall be of the gate valve type. Valves two (2) inches (NPS) and smaller shall be of the globe valve type.
4. Fire protection system components shall be FM Approved.

C. Fire Detection:

1. The main fire alarm system shall be of the addressable type.
2. The main fire alarm system shall be an integrated fire detection, audible and visible notification appliance signaling, and auxiliary function control system. The required fire alarm system components may share control equipment, or be able to operate as stand-alone sub-systems, but shall, in any case, be fully compatible and arranged to function together as a single system. All component sub-systems shall be capable of simultaneous, continuous full load operation without degradation of the overall system performance.
3. The fire detection component of the overall fire alarm system shall utilize point-addressable technology providing a discrete system "address" for each individual initiating device.
4. The overall fire alarm system shall utilize distributed signal processing, power supplies, and audible and visible notification appliance signaling components provided by the Contractor to provide automatic degrade mode operation in the event of fire alarm control panel failure, central processing unit failure, or communications failure between the central processing unit and one or more fire alarm control panels.
5. The fire alarm system shall monitor and annunciate three distinct types of signals:

- a. Fire alarms, including signals initiated by manual fire alarm stations, smoke detectors (confirmed signals only), heat detectors, and water flow switches. Fire alarms shall be audibly and visually annunciated at the central control room and shall initiate automatic audible and visible notification appliance signaling, remote signaling, and auxiliary control functions as specified.
 - b. Supervisory signals, including signals initiated by isolation valve and sprinkler valve supervisory switches, supervisory pressure switches, common trouble contacts of monitored sub-systems, manual control switches for auxiliary functions, and status annunciation contacts for devices controlled by the fire alarm system as auxiliary functions. Supervisory signals shall be audibly and visually annunciated at the central control room. Supervisory signals shall not initiate automatic audible and visible notification appliance signaling or auxiliary control functions.
 - c. Trouble conditions, including signals initiated by the system in response to fault conditions detected in supervised circuits and/or components. Trouble conditions shall be audibly and visually annunciated at the central control room. They shall not initiate automatic audible and visible notification appliance signaling or auxiliary control functions.
6. Fire alarm control equipment shall be FM Approved and UL listed to Standard 864 for fire and Standard 1076 for security.
 7. The complete fire alarm system, including all panels and peripheral devices, shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

8. Circuit Design:

a. General:

- 1) All wiring required for proper system operation, except as specifically allowed herein, shall be electrically supervised for opens and shorts to ground. Wiring faults on supervised circuits shall initiate trouble conditions.
- 2) All signal line circuit (SLC) and initiating device circuit (IDC) shall be NFPA 72 "Class A" circuits, originating and terminating at the associated control equipment, and shall be capable of full operation over any single open or single ground fault.
- 3) All notification appliance (NAC) signaling circuits (interconnection pathways) shall be NFPA 72 "Class B" circuits, originating and terminating at the associated control equipment, and shall be capable of full operation over any single open or single ground fault.
- 4) Any single open or single ground condition on any non-addressable initiating device circuit or non-addressable auxiliary function circuit, such as the circuits between addressable monitor/control modules and their associated monitored/controlled device(s), shall cause a trouble signal on their associated addressable circuit.
- 5) All AC power connections, all standby battery, and all uninterruptible power supply (UPS) connections shall be electrically supervised such that disconnection of any fire alarm system (primary or backup) power supply shall cause a trouble signal.

b. Power Supplies:

- 1) The panels shall operate at 24 VDC. Batteries and battery charger shall be provided with each panel, sized to accommodate each panel's load, with a 120V AC single-phase power input.
- 2) All 120V AC power input, 24 V DC batteries, and battery chargers shall be electrically supervised to alarm at the central control panel.
- 3) Standby battery capacity, including uninterruptible power supplies as required, shall be sufficient to maintain the entire system in a non-alarm condition for 90 hours, followed by 10 minutes in full load alarm condition (all fire alarm initiating devices in alarm, and all audible and visible notification appliance signals, annunciators, and auxiliary functions activated simultaneously), on battery power only.

c. EMI/RF Protection:

- 1) All fire alarm control and releasing equipment, devices, and wiring shall be protected against electro-magnetic/radio frequency interference or induced voltages caused by AC power circuits, electrical transformers, motors or switchgear, electronic equipment, fluorescent lighting fixtures, hand held portable radios, cellular phones, or other devices.

d. Intrinsic Safety Barriers:

- 1) All circuits/wiring that are connected to devices and/or equipment in hazardous classified locations shall be in accordance with NFPA 70 and NFPA 72, and the fire alarm equipment manufacture wiring requirements.

D. Potable Water and Sanitary Drain System:

1. Potable water will be provided aboveground within 5 feet of the north wall exterior by others.
2. The potable water for the handwash sink, lavatory, water closet, water cooler, and janitor sink will be provided from the potable water system.
3. An electric tank style water heater shall be provided to serve hot water to plumbing fixtures requiring hot water with the exception of emergency shower/eyewash stations.
4. Hot water system shall be provided with the following components:
 - a. Electric water heater equipped with controls, heating elements, and safety devices
 - b. Expansion tank
 - c. Hot water distribution piping
 - d. Recirculating pump and piping as required by energy code
 - e. Hot water supply thermostatic mixing valve
5. Hot water heater shall be set at temperature to prevent the growth of Legionella.
6. All plumbing work shall be in accordance with all federal, state, and local codes and requirements.
7. Aboveground potable piping shall be ASTM B88 Type L copper tubing.
8. The pressure at any fixture under no-flow conditions shall be limited to no more than 80 psig.
9. The minimum drain piping flow velocity is 2 feet/second.
10. Emergency Shower/Eyewash station (ESEW) shall be provided within 55ft. of hazardous materials. The ESEW shall comply with ANSI Z358.1.
11. The ESEW(s) shall be provided with a local instantaneous electric water heater

E. Plumbing Fixtures:

Manufacturers and models listed may be substituted with different manufacturers and models given they meet requirements by code and listed specifications.

1. Water Closet (WC-1)
 - a. Water Closet shall be floor mounted, white vitreous china, ADA compliant, elongated flushometer bowl 1.1-1.6 gpf, flushometer valve type. Provide with flushometer valve and white open front elongated toilet seat.
 - b. Bowl: American Standard Madera 3465001.020
 - c. Seat: American Standard 5901100.020
2. Lavatory (LAV-1)
 - a. Lavatory shall be wall hung with white vitreous china bowl, ADA compliant. Provide with lead free faucet with 0.5 gpm aerator, drain grid.
 - b. Basin: American Standard Decorum 9024.004EC

- c. Faucet: American Standard 1340.227
- 3. Electric Water Cooler (EWC-1)
 - a. Electric Water Cooler shall be wall mounted ADA compliant, stainless steel finish, 115V/60Hz power supply, refrigerated cooling system, with filter.
 - b. Elkay LVRCGRN8
- 4. Sink (SK-1)
 - a. Service Sink shall be two compartment with stainless steel bowls and legs, backsplash. Provide with wall mount style chrome-plated brass faucet with wristblade handles, swingable spout, 1.5 gpm aerator.
 - b. Sink Compartment: Elkay 14-2C16X20-0X
 - c. Faucet: Elkay LK940AT10T4H
- 5. Mop Sink (MS-1)
 - a. Mop sink shall be floor mounted, white, 24"x24" basin, with stainless steel strainer. Provide with wall mounted, chrome finish service sink faucet with 12 gpm aerator
 - b. Basin: MUSTEE 63M
 - c. Faucet: Chicago Faucets 897-RCF

F. Process Drain System:

- 1. Under slab process drain systems and aboveground drains from equipment supplied by others will be installed by others.

G. Sanitary Drain System:

- 1. Under slab sanitary drain piping will be installed by others.

2.10 ELECTRICAL REQUIREMENTS

- A. Contractor shall provide a complete building electrical system. All electrical installations in the building shall be in accordance with the latest edition of the National Electric Code.

B. General Requirements:

1. Contractor shall furnish and install all components necessary to provide a complete and functional electrical system. As a minimum, the following electrical equipment shall be provided inside the building.
 - a. Dry-type 480V/120-208V, 45kVA, 3-phase transformer – Qty: Three (3)
 - b. Lighting Panel 120/208V, 3-phase, 4 wire, 24-pole to supply the AC power needs within this building – Qty: Three (3)
 - c. 120VAC, 20A, 2-pole, 3-wire grounding type duplex receptacles. – Qty – Twenty-one (21) (estimate)
 - d. 480V, 3-phase, 60A welding receptacle – Qty: One (1)

C. Dry-type transformers:

1. Dry-type transformers shall have a 220°C insulation system for a 150°C temperature rise. Four (4) 2 1/2 percent full capacity taps, two above and two below normal voltage, shall be provided on the high-voltage (primary) windings. Dry-type transformers shall be in accordance with NEMA ST-20. Enclosures for dry-type transformers shall be NEMA Type 12 for indoor locations and NEMA Type 3R for outdoor locations.

D. Lighting Panels:

1. Power distribution panel boards shall be in accordance with NEMA PB1 and UL 67.
2. Panel boards shall be dead front, complete with buses and circuit breakers, and enclosed in metal cabinets or boxes.

E. Indoor Lighting, Switches, and Receptacles:

1. Lighting inside the building shall be provided with LED fixtures and provide lighting levels as follows.
 - a. General lighting Process Area and Maintenance Bay: 20 footcandles at floor.
 - b. Office/Break Area & Toilet Rooms: 70 footcandles at counter.
 - c. Utility Room: 30 footcandles at floor.
2. Indoor lighting shall be controlled by three-way switches, 15A, 120V located by each door.
3. Lighted emergency exit signs shall be provided by means of wall-mounted self-contained, continuously charged, battery-powered lighting units.
4. Battery-pack egress lighting shall be rated for at least 90 minutes. All battery-pack fixtures shall be connected ahead of switches.
5. Battery-pack egress lighting and exit signs shall be provided as required by local governing codes.
6. Lighting fixtures from the top shall be located within roof structure to maintain adequate equipment removal clearances.
7. All lighting shall be LED type fixtures.
8. All fixtures shall be completely wired in accordance with NFPA 70 with a minimum No. 14 AWG fixture wire. All fixtures shall bear the Underwriters Laboratories label.
9. Twenty-one (21) 120VAC, 20amps, 2-pole, 3-wire grounding type duplex receptacles as shown on Appendix A drawing. All receptacles shall be equipped with GFI suitable for personal protection.

-
10. One (1) 480V, 3-phase, 60A welding receptacle with integral disconnect switches shall be provided as shown on Appendix A drawing.
- F. Exterior Lighting:
1. Building exterior lighting shall be provided with photocell sensors to turn lights on and off. Mount LED light fixtures above every exterior door to provide a minimum lighting level of 1 footcandle at the ground.
- G. Lighting Wire:
1. Wire for lighting branch circuits shall be single copper conductor stranded No. 8, No. 10, or No. 12 AWG, 600 volt, NFPA 70 type XHHW-2 with moisture and heat resistant cross-linked synthetic polymer insulation. The insulation shall be rated for 90°C copper temperature.
 2. Lighting fixture wire and high temperature wire shall be single copper conductor, stranded No. 14 AWG minimum size, alloy coated, 600 volt, NFPA 70 type SF-2 silicone rubber insulated. The insulation shall be rated for 200°C copper temperature, with glass cloth braid, black for phase conductors, white for neutral, and shall bear Underwriters Laboratories label of approval UL 62.
 3. Metal-clad (Type MC) cable is not an acceptable type of cable and shall not be used for any lighting circuits.
- H. Grounding:
1. Grounding system shall be designed per requirements of NFPA 70 and IEEE 142.
 2. Sizes of grounding conductors shall be based on NFPA 70.
 3. Distribution panels at 480V or less shall be solidly connected to the grounding system by means of one grounding cable.
 4. MCC grounding busbar shall be connected to the main grounding busbar of the building.
 5. Main grounding busbars shall be installed inside the building for common grounding of electrical equipment inside of the building. These grounding busbars shall be connected to the plant main grounding network.
- I. Lightning Protection:
1. Lightning protection system, if required, shall be designed per requirements of NFPA 780 standard.
 2. All lightning protection materials, devices, and down conductor sizes shall comply with NFPA 780.
- J. Conduit:
1. Above grade conduits, unless specified otherwise, will be RGS in accordance with UL1242 and ANSI C70.6. Below grade or under slab conduit may be PVC. EMT may be used in the office areas but not in the process areas. PVC conduit may be used under slab or direct buried. Conduit sizes shall be determined in accordance with NFPA 70. Minimum conduit size shall be 3/4-inch nominal diameter except for lighting fixture stems which may be 1/2-inch nominal diameter.

-
- K. Hoist/Crane Power:
1. Option Price for powering floor mounted bridge crane's electric hoist.
 2. Manufacturer's standard power cables to be provided, including operators pendant.
 3. Contractor shall provide above grade conduit to power crane/hoist system in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing Site conditions and concrete foundation surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify the foundation is capable of structural support or attachment of new work being applied or attached.
- C. Verify that utility services are available with correct characteristics and in correct locations.
- D. Ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work indicated diagrammatically on Drawings.
- F. Coordination meetings with personnel and Subcontractors to ensure coordination of work.
- G. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion.
- H. After Owner's occupancy of premises, coordinate access to Site for correction of defective work and work not complying with Contract Documents, to minimize disruption of Owner's activities.

3.2 INSTALLATION – GENERAL

- A. Erect building in accordance with the approved erection instructions and drawings and with applicable provisions of AISC Code of Standard Practice and MBMA Manual.
- B. The completed building shall be free of excessive noise from wind-induced vibrations under the ordinary weather conditions to be encountered at the location where the building is erected and meet all specified design requirements.
- C. All exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials.
- D. All exposed surfaces that have been thermally cut shall be finished smooth within a tolerance of 1/8 inch.
- E. Welding of steel shall conform to AWS D1.1. Welding of aluminum shall conform to AWS D1.2.

3.3 INSTALLATION – FRAMING

- A. Install cementitious grout under base plates and sill members to obtain sound uniform bearing. Moist cure grout for at least seven days.
- B. Members shall be accurately spaced to assure proper fitting of wall and roof panels.
- C. Fasten work securely as erection progresses to resist the dead loads, wind loads, and erection stresses.
- D. High-strength bolting shall conform to AISC Specification for Structural Joints using ASTM F3125 Grade A325 or Grade A490 bolts.
- E. Furnish temporary bracing as needed to assure stability of the structure during erection. Building permanent bracing shall not be assumed adequate during erection.
- F. Installation tolerances for framing members shall be 1/4 inch from level and 1/8 inch from plumb.
- G. Do not field cut or alter structural members without approval of the metal building manufacturer.
- H. Framing members fabricated or modified on site shall be saw or abrasive cut.
- I. All additional bolt holes required for field erection shall be field drilled.
- J. On-site flame cutting of framing members, with the exception of small access holes in structural beam or column webs, shall not be permitted.
- K. Improperly located bolt holes in structural members or other bolting misalignments caused by improper fabrication shall be repaired in accordance with AISC Code of Standard Practice.
- L. After erection, prime welds, abrasions, and surfaces not shop-primed or galvanized.

3.4 INSTALLATION – WALL AND ROOF PANEL

- A. Roof components and wall panel components shall be installed such that all parts fit together properly. Care shall be taken in placing gaskets or providing other specified means for prevention of moisture penetration and the separation of dissimilar metal surfaces. Partially completed construction shall be sufficiently secure at the end of each workday to prevent panels from blowing off the structure.
- B. Wall panels shall be installed with the longitudinal configurations in the vertical position.
- C. Roof panels shall be installed with the longitudinal configurations in the direction of the roof slope.
- D. Accessories shall be fastened into framing members, except as otherwise approved.
- E. Provide closure strips as required to provide weather-tight construction.

- F. Pre-drilled holes that are mislocated shall be plugged with an oversize screw fastener and gasketed washer. Any panel having more than two of such holes or with such holes in critical locations shall not be used.
- G. When cutting pre-finished sheets, remove all shavings from finish surfaces and touch up the cut edge with a repair compound similar to the shop finish.
- H. Remove all stained, discolored, or damaged panels from the site.
- I. Install sealant and gaskets to prevent weather penetration with approved non-hardening brand of mastic sealing compound.
- J. Installation tolerance for all panels shall be 1/8 inch from true position.
- K. Panel Lap Requirements:
 - 1. Panel end laps shall be made over framing members with fasteners into framing members approximately 2 inches from the end of the overlapping sheet.
 - 2. Panel side laps shall be laid away from the prevailing winds.
 - 3. All panel side laps and end laps and joints at accessories shall be sealed with an approved non-hardening brand of mastic sealing compound.
- L. Spacing of fasteners shall present an orderly appearance. Unless otherwise approved, spacing shall not exceed 8 inches on center at panel end laps, 12 inches on center at connection of panels to intermediate supports, 12 inches on center at roof panel side laps, and 18 inches on center at wall panel side laps.
- M. Side lap distances, end lap distances, joint sealing, and spacing and fastening of fasteners shall be in accordance with the manufacturer's standard practice insofar as the maximum spacings specified are not exceeded and provided such standard practice will result in a structure which will be free from water leaks and meet design requirements. Fasteners shall be installed in straight lines within a tolerance of 1/2 inch in the length of a bay.
- N. Fasteners shall be driven normal to the surface and to a uniform depth to properly seat the gasketed washers.
 - 1. Perform fastener-pullout tests according to roof system manufacturer's written instructions:
 - a. Submit test result within 24 hours of performing tests.
 - b. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- O. Install roofing system according to roofing system manufacturer's written instructions, FM Approval's RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29. Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
- P. Roof and wall Panels shall be placed in continuous overlapping sheets unless standing seam roof is utilized. Where end laps are required, there shall be a minimum of six (6) inches and occur at purlins. Side laps shall overlap a minimum of one major rib. Side laps and end laps shall be weather sealed with an approved non-hardening band of mastic sealing compound. Fasteners shall

be applied in the procedures and locations shown on the Manufacturer's erection drawings and details; fasteners shall be self-tapping. All panels, girts, and purlins shall be pre-drilled by the Contractor.

- Q. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- R. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
1. Submit test result within 24 hours of performing tests.
 2. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- S. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- T. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- U. Install roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition.
- V. Coordinate installation and transition of roofing system component serving as an air barrier.
- W. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches (610 mm) in adjacent rows.
1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 2. Tightly butt substrate boards together.
 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.
 6. Loosely lay substrate board over roof deck.
- X. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- Y. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

Z. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

-
- 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- AA. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
1. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
 2. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 3. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 4. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 5. Trim insulation so that water flow is unrestricted.
 6. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 7. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- BB. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
- CC. Install slip sheet over cover board and immediately beneath roof membrane.
- DD. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- EE. Unroll roof membrane and allow to relax before installing.
- FF. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- GG. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- HH. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- II. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer and install fabric-backed roof membrane.
- JJ. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- KK. Apply roof membrane with side laps shingled with slope of roof deck where possible.

-
- LL. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- MM. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- NN. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- OO. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- PP. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- QQ. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- RR. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- SS. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop.
 - b. Between points of access such as ladders and equipment or drains/scuppers that may require maintenance or cleaning.
 - c. Around equipment or drains/scuppers that require maintenance or cleaning.
 - d. As required by roof membrane manufacturer's warranty requirements.
 2. Provide 6-inch (76-mm) clearance between adjoining pads.
 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- TT. Miscellaneous Supports: Install sub framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
- UU. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.

2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

VV. Laminated-Insulation-Core Metal Wall Panels:

1. **Wrapped-Edge Panels:** Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

WW. **Accessory Installation:** Install accessories with positive anchorage to enclosure and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

XX. **Flashing and Trim:** Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

3.5 INSTALLATION – GUTTER AND DOWNSPOUT

- A. Gutters and downspouts shall be rigidly attached to the building.
- B. Spacing of cleats for gutters shall be 16 inches maximum. Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eaves with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- C. Supports for downspouts shall be spaced according to manufacturer's recommendation.
- D. Slope gutters a minimum of 1/8 inch per foot.
- E. **Downspouts:** Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center.
 1. Tie downspouts to underground drainage system indicated or supply splash pads or blocks under each downspout.

3.6 INSTALLATION – OTHER

- A. Install insulation in accordance with manufacturer's instructions. Final appearance of installed insulation shall be free of unsightly sags and wrinkles.
- B. Install blanket insulation over the purlins and secure tightly against the metal roof panels. Seal facing on blanket insulation with a compatible tape to provide a vapor-tight installation.
- C. Doors, Windows, and Louvers:
 - 1. Anchor securely to the supporting construction.
 - 2. . Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
 - 3. Seal joints at doors and windows in accordance with manufacturer's recommendations to provide weather-tight construction.
 - 4. Door Hardware:
 - a. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - b. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - c. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - d. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified by manufacturer and industry standards."
- D. Install accessories with positive anchorage to enclosure and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- F. Continuous Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal wall panels.
- G. Pipe Flashing: Form flashing around pipe penetration and metal panels. Fasten and seal to panel as recommended by manufacturer.

3.7 DISSIMILAR MATERIALS

- A. Where aluminum surfaces come in contact with ferrous metal or other incompatible materials, keep aluminum surfaces from direct contact by applications to the other materials by one of the following methods:
1. One coat of zinc chromate primer complying with the performance, but not necessarily with the composition requirements of Federal Specification FS TT-P-645, followed by two coats of aluminum paint, SSPC Paint 101.
 2. One coat of high-build bituminous paint SSPC Paint 12, applied to a thickness of 1/16 inch over one coat of zinc chromate primer.
 3. Mylar tape or neoprene spacer as recommended by manufacturer.
 4. Apply rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

3.8 FIELD PAINTING

- A. If shop-coated surfaces become abraded or corroded, wire brush surfaces and touch up with the same material used for the shop coat.
- B. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows shall be painted with two coats of an approved exterior enamel.
- C. Factory color-finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

END OF SECTION