SECTION 133419 - METAL BUILDING SYSTEMS

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section Includes:

Structural-steel framing.

Metal roof panels.

Metal wall panels.

Foamed-insulation-core metal wall panels.

Metal soffit panels.

Thermal insulation.

Personnel doors and frames.

Horizontal sliding doors.

Windows.

Translucent panels.

Accessories.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface.

Section 083323 "Overhead Coiling Doors" for coiling vehicular doors in metal building systems.

Section 083613 "Sectional Doors" for sectional vehicular doors in metal building systems.

* + - 1. DEFINITIONS
         1. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.
      2. COORDINATION
         1. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 – Cast-in-Place Concrete.
         2. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
      3. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + - * 1. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

Review methods and procedures related to metal building systems including, but not limited to, the following:

Condition of foundations and other preparatory work performed by other trades.

Structural load limitations.

Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.

Coordinate first subparagraph below with "Source Quality Control" and "Field Quality Control" articles in this Section. Insert requirements to suit Project.

Required tests, inspections, and certifications.

Unfavorable weather and forecasted weather conditions and impact on construction schedule.

Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.

Structural limitations of purlins and rafters during and after roofing.

Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

Temporary protection requirements for metal roof panel assembly during and after installation.

Roof observation and repair after metal roof panel installation.

Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

Compliance with requirements for support conditions, including alignment between and attachment to structural members.

Structural limitations of girts and columns during and after wall panel installation.

Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.

Temporary protection requirements for metal wall panel assembly during and after installation.

Wall observation and repair after metal wall panel installation.

* + - 1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of metal building system component.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

Metal roof panels.

Metal wall panels.

Foamed-insulation-core metal panels.

Metal soffit panels.

Thermal insulation and vapor-retarder facings.

Personnel doors and frames.

Windows.

Translucent roof panels.

Roof ventilators.

Louvers.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for whole structure or individual components (structural steel framing, steel roof panels, steel wall panels) within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.

Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

Show provisions for attaching [**mezzanines**] [**roof curbs**] [**service walkways**] [**platforms**] [**and**] [**pipe racks**].

Metal [**Roof**] [**and**] [**Wall**] Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

Metal building manufacturers' layout drawings often do not include the items in first subparagraph below. Retain if Contractor must insert this information.

Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.

Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.

Show translucent panels.

Retain "Accessory Drawings" Subparagraph below for large-scale details if product data from manufacturer are inadequate. Retain specific scale if required.

Accessory Drawings: Include details of the following items, at a scale of not less than [**1-1/2 inches per 12 inches**] <**Insert scale**>:

Flashing and trim.

Gutters.

Downspouts.

Service walkways.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

* + - * 1. Samples for Initial Selection: For units with factory-applied finishes.
        2. Samples for Verification: For the following products:

Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.

Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.

Vapor-Retarder Facings: Nominal 6-inch- square Samples.

Windows: Full-size, nominal 12-inch- long frame Samples showing typical profile.

Accessories: Nominal 12-inch- long Samples for each type of accessory.

* + - * 1. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.

Retain "Door Hardware Schedule" and "Keying Schedule" subparagraphs below if hardware and keying are specified in this Section.

Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.

Keying Schedule: Detail State's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For metal building systems.

Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer, licensed in the State of New York, responsible for their preparation.

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Submittal in "Letter of Design Certification" Paragraph below is the manufacturer's responsibility according to the MBMA's "Metal Building Systems Manual." It is useful in ensuring compliance with requirements and in comparing competitive quotes from several manufacturers.

* + - * 1. Letter of Design Certification: Signed and sealed by a qualified Professional Engineer, licensed in the State of New York. Include the following:

Name and location of Project.

Order number.

Name of manufacturer.

Name of Contractor.

Building dimensions including width, length, height, and roof slope.

Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.

Governing building code and year of edition.

Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).

Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

Building-Use Category: Indicate category of building use and its effect on load importance factors.

Retain "Erector Certificates" Paragraph below if retaining "Erector Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Erector Certificates: For qualified erector, from manufacturer.

Retain "Material Test Reports" Paragraph below for material test reports that are Contractor's responsibility.

* + - * 1. Material Test Reports: For each of the following products:

Structural steel including chemical and physical properties.

Bolts, nuts, and washers including mechanical properties and chemical analysis.

Tension-control, high-strength, bolt-nut-washer assemblies.

Shop primers.

Nonshrink grout.

* + - * 1. Source quality-control reports.

Retain "Field Quality-Control Reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field Quality-Control Reports.

Retain "Surveys" Paragraph below if survey is required or if not provided by Director’s Representative. If retaining, include "Land Surveyor Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
        2. Sample Warranties: For special warranties.
      1. CLOSEOUT SUBMITTALS

Retain option in "Maintenance Data" Paragraph below if door hardware is specified in this Section.

* + - * 1. Maintenance Data: For metal panel finishes[**and door hardware**] to include in maintenance manuals.
      1. QUALITY ASSURANCE
         1. Manufacturer Qualifications: A qualified manufacturer.

Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."

Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in the State of New York.

* + - * 1. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to the following:

AWS D1.1, "Structural Welding Code - Steel."

AWS D1.3, "Structural Welding Code - Sheet Steel."

* + - * 1. Land Surveyor Qualifications: A professional Land Surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
        2. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

Retain first subparagraph below for large-scale mockup. Indicate portion of wall represented by mockup on Drawings or draw mockup as separate element.

Build mockup of typical wall area as shown on Drawings.

Retain first subparagraph below for limited mockups.

Build mockups for typical wall metal panel including accessories.

Size: [**48 inches long by 48 inches**] <**Insert dimensions**>.

Retain subparagraph below if mockups are not only for establishing appearance factors.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Director’s Representative specifically approves such deviations in writing.

* + - 1. DELIVERY, STORAGE, AND HANDLING
         1. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
         2. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
         3. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain paragraph below for foam-plastic insulation.

* + - * 1. Protect foam-plastic insulation as follows:

Do not expose to sunlight, except to extent necessary for period of installation and concealment.

Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

* + - 1. FIELD CONDITIONS
         1. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
      2. WARRANTY
         1. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

Color fading more than 5 Hunter units when tested according to ASTM D2244.

Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Verify available warranties and warranty periods.

Finish Warranty Period: [**25**] [**20**] [**10**] <**Insert number**> years from date of Substantial Completion.

* + - * 1. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

Verify available warranties and warranty periods.

Warranty Period: [**20**] <**Insert number**> years from date of Substantial Completion.

Insert requirements for extra materials such as metal roof and wall panels, trim, and accessories if required. Verify with Director’s Representative because these materials can present storage difficulties.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

* + - 1. MANUFACTURERS
         1. Approved equivalent.

Retaining "Source Limitations" Paragraph below may limit the number of manufacturers who can bid on Projects; metal building system manufacturers frequently obtain secondary components and accessories from other manufacturers.

* + - * 1. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.
      1. SYSTEM DESCRIPTION

Retain this article if a description of the building is required. Delete if information is adequately shown on Drawings.

* + - * 1. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
        2. Primary-Frame Type:

Retain one or more subparagraphs below or revise to suit Project. Coordinate with design information indicated on Drawings.

Rigid Clear Span: Solid-member, structural-framing system without interior columns.

Rigid Modular: Solid-member, structural-framing system with interior columns.

Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.

Truss-Frame Modular: Truss-member, structural-framing system with interior columns.

Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.

Retain one of two "End-Wall Framing" Paragraphs below. Load-bearing end walls (columns and rafters) in first paragraph are generally more economical than frames. Second paragraph allows future expansion of building without replacing end frame.

* + - * 1. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of [**primary frame, capable of supporting one-half of a bay design load, and end-wall columns**] [**load-bearing end-wall and corner columns and rafters**].
        2. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

Retain one of three options in "Secondary-Frame Type" Paragraph below. Girts are attached to primary framing in one of three relationships: flush framed, with the exterior face of the girt at the exterior face of the column; partially inset framed, with the girt partially extending past the exterior face of the column; and exterior framed (bypass), with the girt attached to the exterior flange of column. See the Evaluations for diagram illustrating three relationships.

* + - * 1. Secondary-Frame Type: Manufacturer's standard purlins and joists and [**flush-framed**] [**partially inset-framed**] [**exterior-framed (bypass)**] girts.

Manufacturers can custom design metal buildings to almost any eave height to suit Project. Dimensions in "Eave Height" Paragraph below are common.

* + - * 1. Eave Height: [**16 feet**] [**20 feet**] [**24 feet**] [**28 feet**] [**Manufacturer's standard height, as indicated by nominal height on Drawings**] <**Insert dimension**>.

Manufacturers can custom design metal buildings to almost any bay spacing to suit Project. Dimensions in "Bay Spacing" Paragraph below are common. Allowing manufacturers to determine most efficient bay spacing usually results in lowest cost but may limit design flexibility. Consistent bay spacing is not necessary.

* + - * 1. Bay Spacing: [**20 feet**] [**25 feet**] [**30 feet**] [**As determined by manufacturer**] [**As indicated on Drawings**] <**Insert dimension**>.

Manufacturers can custom design metal buildings to almost any roof slope to suit Project. Slopes in "Roof Slope" Paragraph below are common.

* + - * 1. Roof Slope: [**1/4 inch per 12 inches**] [**1/2 inch per 12 inches**] [**1 inch per 12 inches**] [**4 inches per 12 inches**] [**Manufacturer's standard for frame type required**] <**Insert slope**>.

Many types of roof panels are available from manufacturers. Options in "Roof System" Paragraph below match panels listed in Part 2 but are examples only. Revise if roof system uses other metal panels.

* + - * 1. Roof System: Manufacturer's standard [**standing-seam, vertical-rib,**] [**standing-seam, trapezoidal-rib,**] [**lap-seam, tapered-rib**] [**foamed-insulation-core**] metal roof panels.

Liner Panels: Tapered rib.

Many types of wall panels are available from manufacturers. Options in "Exterior Wall System" Paragraph below match panels listed in Part 2 but are examples only. Revise if wall system uses other metal panels.

* + - * 1. Exterior Wall System: Manufacturer's standard [**exposed-fastener, tapered-rib,**] [**exposed-fastener, reverse-rib,**] [**concealed-fastener, flush-profile,**] [**foamed-insulation-core**] metal wall panels.

Liner Panels: [**Tapered rib**] [**Flush profile**].

Insert other requirements to suit Project (e.g., brick or stone masonry for custom-designed exterior elevations).

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a Professional Engineer, licensed in the State of New York, to design metal building system.

Retain "Structural Performance" Paragraph below or indicate structural-performance requirements on Drawings.

* + - * 1. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

If retaining option in "Design Loads" Subparagraph below, indicate minimum live, dead, snow, collateral, seismic, wind, and uplift loads and load combinations on Drawings as applicable.

Design Loads: [**As indicated on Drawings**] <**Insert applicable code requirement**>.

Retain one of two "Deflection and Drift Limits" subparagraphs below, if required.

Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."

Deflection and Drift Limits: No greater than the following:

Deflections in first four subparagraphs below are examples only. Masonry walls may require deflection limits of 1/600 or 1/720. Verify limits with authorities having jurisdiction; manufacturers' standards are typically less stringent.

Purlins and Rafters: Vertical deflection of [**1/150**] [**1/240**] [**1/360**] <**Insert limit**> of the span.

Girts: Horizontal deflection of [**1/120**] [**1/180**] [**1/240**] <**Insert limit**> of the span.

Metal Roof Panels: Vertical deflection of [**1/150**] [**1/240**] [**1/360**] <**Insert limit**> of the span.

Metal Wall Panels: Horizontal deflection of [**1/180**] [**1/240**] <**Insert limit**> of the span.

Retain first subparagraph below with one or more of four subparagraphs above.

Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

Options in "Lateral Drift" Subparagraph below are examples only.

Lateral Drift: Maximum of [**1/60**] [**1/100**] [**1/200**] [**1/400**] <**Insert limit**> of the building height.

Retain "Seismic Performance" Paragraph below for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.
        2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Differential values in "Temperature Change" Subparagraph below (for aluminum in particular) are suitable for most of the United States; revise to suit Project.

Temperature Change: [**120 deg F, ambient; 180 deg F, material surfaces**] <**Insert temperature change**>.

Retain "Fire-Resistance Ratings" Paragraph below if fire-resistance-rated assemblies are included in Project. Indicate rating, testing agency, and testing agency's design designation on Drawings.

* + - * 1. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.

Retain "Fire Propagation Characteristics" Subparagraph below if required for wall assemblies containing foam-plastic insulation or foamed-insulation-core panels. Tested products are not available from all manufacturers.

* + - * 1. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.

Retain "Fire-Rated Door Assemblies" Paragraph below if fire-rated door assemblies are included in Project.

* + - * 1. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

Retain "Oversize Fire-Rated Door Assemblies" Subparagraph below if required by authorities having jurisdiction.

Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

* + - * 1. Structural Performance for Metal Roof[**and Wall**] Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

Wind Loads: As indicated on Drawings.

ASTM E1680 in "Air Filtration for Metal Roof Panels" Paragraph below has replaced ASTM E283 for testing metal roof panels; retain option to allow products to be tested according to ASTM E283.

* + - * 1. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680[**or ASTM E283**] at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 25-mph wind and is ASTM E1680 default. Products tested to value in second option below, equivalent to a 50-mph wind, are widely available. Revise to suit Project.

Test-Pressure Difference: [**1.57 lbf/sq. ft.**] [**6.24 lbf/sq. ft.**].

* + - * 1. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 25-mph wind and is ASTM E283 default. Products tested to value in second option below, equivalent to a 50-mph wind, are widely available.

Test-Pressure Difference: [**1.57 lbf/sq. ft.**] [**6.24 lbf/sq. ft.**].

ASTM E1646 in "Water Penetration for Metal Roof Panels" Paragraph below has replaced ASTM E331 for testing metal roof panels; retain option to allow products to be tested according to ASTM E331.

* + - * 1. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646[**or ASTM E331**] at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 34-mph wind and is ASTM E1646 default. Products tested to value in second option below, equivalent to a 50-mph wind, are widely available. Revise to suit Project.

Test-Pressure Difference: [**2.86 lbf/sq. ft.**] [**6.24 lbf/sq. ft.**].

ASTM E331 in "Water Penetration for Metal Wall Panels" Paragraph below indicates that "water contained within drainage flashings, gutters, and sills is not considered failure."

* + - * 1. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 34-mph wind and is ASTM E331 default. Products tested to value in second option below, equivalent to a 50-mph wind, are widely available.

Test-Pressure Difference: [**2.86 lbf/sq. ft.**] [**6.24 lbf/sq. ft.**].

Retain "Wind-Uplift Resistance" Paragraph below if UL-class roof is required. Verify that product is listed in UL's "Roofing Materials & Systems Directory." UL listings include requirements for the entire assembly and not solely the metal roof panels.

* + - * 1. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

The higher the value in the options in "Uplift Rating" Subparagraph below, the greater the uplift resistance.

Uplift Rating: [**UL 30**] [**UL 60**] [**UL 90**].

* + - * 1. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

Retain one option in "Fire/Windstorm Classification" Subparagraph below based on windstorm classification of Project; the higher the value in the option, the greater the uplift resistance. FM Global Loss Prevention Data Sheet 1-28 multiplies the actual field-of-roof uplift pressure by a factor of 2 to obtain the factored pressure, the number that establishes the minimum FM Global approval rating. Verify availability of roofing systems that meet these classifications. Other options for classifications increase in increments of 15 (e.g., Class 1A-135, Class 1A-150, Class 1A-165, and higher). "Class 1A" signifies complying with ASTM E108, Class A fire performance for FM Global-approved, Class 1 panel roofs.

Fire/Windstorm Classification: Class 1A-[**60**] [**75**] [**90**] [**105**] [**120**] <**Insert number**>.

Retain one option in "Hail Resistance" Subparagraph below. For areas that experience three or more hailstorms annually, FM Global recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

Hail Resistance: [**MH**] [**SH**].

Retain "Energy Star Listing" Paragraph below for roofs that must comply with the DOE's ENERGY STAR requirements. The DOE's ENERGY STAR "Roof Products Qualified Product List" is available in PDF at www.energystar.gov.

* + - * 1. Energy Star Listing: Roof panels that are listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for [**low**] [**steep**]-slope roof products.

Retain "Energy Performance" Paragraph below as example for roofs that must comply with local "cool-roof" energy legislation; verify requirements with authorities having jurisdiction. Example and options below are for low-slope roofs that must comply with prescriptive approach of CCR Title 24 (California Building Standards Code). A list of coating products tested according to CRRC-1, along with their test values, is available in PDF at www.coolroofs.org.

* + - * 1. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

Three-year, aged, solar reflectance of not less than [**0.55**] <**Insert value**> and emissivity of not less than [**0.75**] <**Insert value**>.

Three-year, aged, Solar Reflectance Index of not less than [**64**] <**Insert value**> when calculated according to ASTM E1980.

ASHRAE/IESNA 90.1, 2010 edition, includes maximum U-factors for opaque elements of overall assemblies and minimum R-values for insulation of metal buildings, depending on the climate where Project is located.

* + - * 1. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:

Roof:

U-Factor: <**Insert value**>.

R-Value: <**Insert value**>.

Walls:

U-Factor: <**Insert value**>.

R-Value: <**Insert value**>.

* + - 1. STRUCTURAL-STEEL FRAMING

Review this article for compliance with design concept and revise to suit Project. Consult manufacturers for standard framing details.

* + - * 1. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
        2. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
        3. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
        4. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

Retain first subparagraph below if allowed.

Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Director’s Representative.

Retain one of first five "Frames" subparagraphs below.

Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

Frames in "Long-Bay Frames" Subparagraph below are used where bay spacing exceeds 30 feet. Steel joist rafters are typically used with long-bay frames.

Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

Retain "Frame Configuration" Subparagraph below if Drawings do not adequately indicate requirements.

Frame Configuration: [**Single gable**] [**One-directional, sloped**] [**Lean-to, with high side connected to and supported by another structure**] [**Multiple gable**] [**Load-bearing wall**] [**Multistory**].

Exterior Column: [**Uniform depth**] [**Tapered**].

Rafter: [**Uniform depth**] [**Tapered**].

Retain "End-Wall Framing" Paragraph below if required or delete if using half-load primary frames.

* + - * 1. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

Retain "End-Wall and Corner Columns" Subparagraph below and delete "End-Wall Rafters" Subparagraph below if using full-load frames.

End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.

End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

* + - * 1. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

Retain one of two "Purlins" subparagraphs below.

Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.

Retain depths in "Depth" Subparagraph below if manufacturer does not determine depths. Insert manufacturer's proprietary size if required.

Depth: [**As indicated on Drawings**] [**As needed to comply with system performance requirements**] <**Insert dimension**>.

Purlins: Steel joists of depths indicated on Drawings.

Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.

Retain depths in "Depth" Subparagraph below if manufacturer does not determine depths. Insert manufacturer's proprietary size if required.

Depth: [**As indicated on Drawings**] [**As required to comply with system performance requirements**] <**Insert dimension**>.

Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.

Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch- diameter, cold-formed structural tubing to stiffen primary-frame flanges.

Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.

Revise "Base or Sill Angles" Subparagraph below if channel shape is required instead of base angles.

Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.

Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.

Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.

Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

* + - * 1. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.

Retain one of four options in "Type" Subparagraph below. First option is a continuation of roof at eave; second is a continuation of roof over end wall; third is attached at sidewall or end wall, at or below eave.

Type: [**Straight-beam, eave type**] [**Purlin-extension type**] [**Tapered-beam, below-eave type**] [**As indicated**].

* + - * 1. Bracing: Provide adjustable wind bracing [**using any method**] as follows:

Retain one of six subparagraphs below, or retain more than one if type of bracing is manufacturer's option.

Rods: ASTM A36; ASTM A572, Grade 50; or ASTM A529, Grade 50; minimum 1/2-inch- diameter steel; threaded full length or threaded a minimum of 6 inches at each end.

Cable: ASTM A475, minimum 1/4-inch- diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.

Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.

Anchor rods in "Anchor Rods" Paragraph below are not supplied by metal building system manufacturers.

* + - * 1. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

Retain and revise "Materials" Paragraph below to suit Project.

* + - * 1. Materials:

W-Shapes: ASTM A992; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.

Channels, Angles, M-Shapes, and S-Shapes: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.

Plate and Bar: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.

Generally, retain "Steel Pipe" and "Cold-Formed Hollow Structural Sections" subparagraphs below only for interior columns.

Steel Pipe: ASTM A53, Type E or S, Grade B.

Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.

Structural-Steel Sheet: Hot-rolled, ASTM A1011, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.

Metallic-Coated Steel Sheet: ASTM A653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.

Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.

Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.

Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, SS, Grade 50 or 80; with Class AZ50 coating.

Retain "Joist Girders" Subparagraph below if required for primary framing.

Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.

Retain "Steel Joists" Subparagraph below if required for rafters or purlins.

Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.

Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.

Finish: [**Plain**] [**Hot-dip zinc coating, ASTM F2329, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

High-Strength Bolts, Nuts, and Washers: ASTM F3125,Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

Finish: [**Plain**] [**Hot-dip zinc coating, ASTM F2329, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

Retain option in "High-Strength Bolts, Nuts, and Washers" Subparagraph below if applicable. Indicate locations if using bolts below for some connections and ASTM F3125, Grade A325 bolts in "High-Strength Bolts, Nuts, and Washers" Subparagraph above for others.

High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A490, Type 1, heavy-hex steel structural bolts[**or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends**]; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.

Retain "Tension-Control, High-Strength Bolt-Nut-Washer Assemblies" Subparagraph below if required. Tension-control (twist-off) bolt assemblies correspond to strength of ASTM F3125, Grade A325 bolts.

Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, [**heavy-hex**] [**round**] head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1 hardened carbon-steel washers.

Finish: [**Plain**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**] [**Mechanically deposited zinc coating, ASTM B695, Class 50, baked-epoxy coated**].

Retain appropriate materials in "Unheaded Anchor Rods" Subparagraph below or revise if other materials are required. AISC uses the generic term "anchor rods" to include unheaded rods and headed bolts. Plate washers are used with oversized baseplate holes to resist nut pull-through and to transfer shear from baseplate to anchor rod.

Unheaded Anchor Rods: [**ASTM F1554, Grade 36**] [**ASTM A572, Grade 50**] [**ASTM A36**] [**ASTM A307, Grade A**].

Configuration: Straight.

Nuts: ASTM A563 [**heavy-**]hex carbon steel.

Plate Washers: ASTM A36 carbon steel.

Washers: ASTM F436 hardened carbon steel.

Finish: [**Plain**] [**Hot-dip zinc coating, ASTM F2329, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

Retain appropriate materials in "Headed Anchor Rods" Subparagraph below or revise if other materials are required. AISC uses the generic term "anchor rods" to include unheaded rods and headed bolts. Plate washers are used with oversized baseplate holes to resist nut pull-through and to transfer shear from baseplate to anchor rod.

Headed Anchor Rods: [**ASTM F1554, Grade 36**] [**ASTM A307, Grade A**].

Configuration: Straight.

Nuts: ASTM A563 [**heavy-**]hex carbon steel.

Plate Washers: ASTM A36 carbon steel.

Washers: ASTM F436 hardened carbon steel.

Finish: [**Plain**] [**Hot-dip zinc coating, ASTM F2329, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

Threaded Rods: [**ASTM A193**] [**ASTM A572, Grade 50**] [**ASTM A36**] [**ASTM A307, Grade A**].

Nuts: ASTM A563 [**heavy-**]hex carbon steel.

Washers: [**ASTM F436 hardened**] [**ASTM A36**] carbon steel.

Finish: [**Plain**] [**Hot-dip zinc coating, ASTM F2329, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

* + - * 1. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

Clean and prepare in accordance with SSPC-SP2.

Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

If required, insert requirements for crane runway beams, supports, and bracing; mezzanine framing and decking; and floor framing for multistory applications.

* + - 1. METAL ROOF PANELS

Profile requirements in this article are often better described graphically than verbally. If profiles are indicated on Drawings, delete profile descriptions and retain types of metals and metal thicknesses.

This article includes examples of standard metal roof panels offered by manufacturers. Revise or add other types of panels as required, or delete panels in this Section and specify in Section 074113.16 "Standing-Seam Metal Roof Panels". or retain "Standing-Seam, Vertical-Rib, Metal Roof Panels," "Standing-Seam, Trapezoidal-Rib, Metal Roof Panels" or "Exposed-Fastener, Tapered-Rib, Metal Roof Panels," Paragraph below or revise to suit Project.

* + - * 1. Standing-Seam, Vertical-Rib, Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gages, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Clips: [**One-piece fixed**] [**Two-piece floating**] to accommodate thermal movement.

Joint Type: [**Panels snapped together**] [**Mechanically seamed**].

Panel Coverage: [**16 inches**] <**Insert dimension**>.

Panel Height: [**2 inches**] <**Insert dimension**>.

* + - * 1. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels <**Insert drawing designation**>: Formed with raised trapezoidal ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Clips: [**One-piece fixed**] [**Two-piece floating**] to accommodate thermal movement.

Joint Type: [**Panels snapped together**] [**Mechanically seamed**].

Panel Coverage: [**24 inches**] <**Insert dimension**>.

Panel Height: [**3 inches**] <**Insert dimension**>.

Uplift Rating: [**UL 30**] [**UL 60**] [**UL 90**].

* + - * 1. Exposed Fastener, Tapered-Rib, Metal Roof Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**6 inches**] [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**0.75 inch**] [**1.125 inches**] [**1.188 inches**] [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

Retain "Exposed-Fastener, Tapered-Rib, Metal Liner Panels" Paragraph below if field-installed insulation is required and insulation must be concealed.

* + - * 1. Exposed-Fastener, Tapered-Rib, Metal Liner Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**6 inches**] [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Finishes:

Exposed Coil-Coated Finish:

Retain "Two-Coat Fluoropolymer," "Three-Coat Fluoropolymer," or "Siliconized Polyester" Subparagraph below, or add other finishes to suit Project.

Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

Finish in "Concealed Finish" Subparagraph below is frequently used as a factory finish for interior surfaces.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

* + - 1. METAL WALL PANELS

Profile requirements in this article are often better described graphically than verbally. If profiles are indicated on Drawings, delete profile descriptions and retain types of metals and metal thicknesses.

This article includes examples of standard metal wall panels offered by manufacturers. Revise or add other types of panels as required, or delete panels in this Section and specify in Section 074213.13 "Formed Metal Wall Panels."

Retain "Exposed-Fastener, Tapered-Rib, Metal Wall Panels," "Exposed-Fastener, Reverse-Rib, Metal Wall Panels" or "Concealed-Fastener, Flush-Profile, Metal Wall Panels" Paragraph below or revise to suit Project.

* + - * 1. Exposed-Fastener, Tapered-Rib, Metal Wall Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**6 inches**] [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**0.75 inch**] [**1.125 inches**] [**1.188 inches**] [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Exposed-Fastener, Reverse-Rib, Metal Wall Panels <**Insert drawing designation**>: Formed with recessed, trapezoidal major valleys and [**intermediate stiffening valleys symmetrically spaced**] [**flat pan**] between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**1.125 inches**] [**1.188 inches**] [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Concealed-Fastener, Flush-Profile, Metal Wall Panels <**Insert drawing designation**>: Formed with vertical panel edges and [**a single wide recess, centered between panel edges**] [**flush surface**]; with flush joint between panels; with 1-inch- wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 24 and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Panel Coverage: [**16 inches**] <**Insert dimension**>.

Panel Height: [**3 inches**] <**Insert dimension**>.

Retain "Tapered-Rib, Metal Liner Panels" or "Flush-Profile, Metal Liner Panels" Paragraph below if insulated system is required and insulation must be concealed.

* + - * 1. Tapered-Rib, Metal Liner Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Siliconized polyester**] [**Acrylic enamel**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**6 inches**] [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Flush-Profile, Metal Liner Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with flush joint between panels; designed for interior side of metal wall panel assemblies and installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 24 and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Siliconized polyester**] [**Polyester**] [**Acrylic enamel**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Retain "Sound Absorption" Subparagraph below if required.

Sound Absorption: NRC not less than [0.65] [0.85] [1.00] <Insert value> when tested according to ASTM C423.

Panel Coverage: [**12 inches**] <**Insert dimension**>.

Panel Height: [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Finishes:

Exposed Coil-Coated Finish:

Retain "Two-Coat Fluoropolymer," "Three-Coat Fluoropolymer," or "Siliconized Polyester" Subparagraph below, or add other finishes to suit Project.

Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

Finish in "Concealed Finish" Subparagraph below is frequently used as a factory finish for interior surfaces.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

* + - 1. FOAMED-INSULATION-CORE METAL WALL PANELS

Profile requirements in this article are often better described graphically than verbally. If profiles are indicated on Drawings, delete profile descriptions and retain types of metals, metal thicknesses and insulation cores.

This article includes examples of standard foamed-insulation-core metal wall panels offered by manufacturers. Revise or add other types of panels as required, or delete panels in this Section and specify in Section 074213.19 "Insulated Metal Wall Panels." Products in this article are factory assembled.

* + - * 1. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels <**Insert drawing designation**>: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

Panel Thermal-Resistance Value (R-Value): <**Insert R-value**>.

Metal thickness options in "Facing Material" Subparagraph below correspond to obsolete 26, 24 and 22 gage, respectively.

Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Surface: [**Smooth, flat**] [**Striated**] [**Shallow ribs**] [**Shallow V grooves**].

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Panel Coverage: [**36 inches**] [**42 inches**] <**Insert dimension**> nominal.

Panel Thickness: [**2 inches**] [**2.5 inches**] [**3 inches**] [**4 inches**] [**5 inches**] [**6 inches**] <**Insert dimension**>.

Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

Closed-Cell Content: 90 percent when tested according to ASTM D6226.

Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.

Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.

Shear Strength: 26 psi when tested according to ASTM C273.

Fire-Test-Response Characteristics: Class A according to ASTM E108.

Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

* + - * 1. Finishes:

Exposed Coil-Coated Finish:

Retain "Two-Coat Fluoropolymer," "Three-Coat Fluoropolymer," or "Siliconized Polyester" Subparagraph, or add other finishes to suit Project.

Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

Finish in "Concealed Finish" Subparagraph below is frequently used as a factory finish for interior surfaces.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

* + - 1. METAL SOFFIT PANELS

Profile requirements in this article are often better described graphically than verbally. If profiles are indicated on Drawings, delete profile descriptions and retain types of metals and metal thicknesses.

This article includes examples of standard soffit panels offered by metal building system manufacturers. Revise or add other types of panels as required, or delete panels in this Section and specify in Section 074293 "Soffit Panels."

* + - * 1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.
        2. Metal Soffit Panels: Match profile and material of metal [**roof**] [**wall**] panels.

Finish: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated on Drawings**].

Retain "Metal Soffit Panels" Paragraph above or one or both paragraphs below. Retain remainder of this article if not retaining paragraph above and if metal soffit panels are not required to match metal roof or wall panels.

* + - * 1. Exposed-Fastener, Tapered-Rib-Profile, Metal Soffit Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Major-Rib Spacing: [**6 inches**] [**12 inches**] <**Insert dimension**> o.c.

Panel Coverage: [**36 inches**] <**Insert dimension**>.

Panel Height: [**0.75 inch**] [**1.125 inches**] [**1.188 inches**] [**1.25 inches**] [**1.5 inches**] <**Insert dimension**>.

* + - * 1. Concealed-Fastener, Flush-Profile, Metal Soffit Panels <**Insert drawing designation**>: Formed with vertical panel edges and [**a single wide recess, centered between panel edges**] [**flush surface**]; with flush joint between panels; with 1-inch- wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps.

Metal thickness options in "Material" Subparagraph below correspond to obsolete 24 and 22 gage, respectively.

Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.024-inch**] [**0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.

Exterior Finish: [**Fluoropolymer**] [**Siliconized polyester**].

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

Panel Coverage: [**12 inches**] [**16 inches**] <**Insert dimension**>.

Panel Height: [**1 inch**] [**1.5 inches**] <**Insert dimension**>.

* + - 1. THERMAL INSULATION

Retain one of first four paragraphs below. Many metal building system manufacturers do not provide insulation as part of their metal building package; verify availability. Even for those that do, the specifier may elect instead to specify insulation in Section 072100 "Thermal Insulation." Verify type of insulation needed to obtain a fire-resistance rating if required.

Metal building insulation in "Faced Metal Building Insulation" and "Unfaced Metal Building Insulation" paragraphs include most common types used for metal building systems, especially if they are to be exposed on the interior.

* + - * 1. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
        2. Unfaced Metal Building Insulation: ASTM C991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
        3. Mineral-Fiber-Blanket Insulation: ASTM C665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.

Retain "Nonreflective Faced," "Reflective Faced," or "Unfaced" Subparagraph below.

Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).

Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).

Unfaced: Type I (blankets without membrane covering), passing ASTM E136 for combustion characteristics.

Board insulation in "Faced, Polyisocyanurate Board Insulation" Paragraph below is typically installed between girts or purlins and exterior panels.

* + - * 1. Faced, Polyisocyanurate Board Insulation: ASTM C1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.

Retain "Retainer Strips" Paragraph below with insulation that is to be left exposed to the interior. Retainer strips hold insulation in place between supports.

* + - * 1. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

Vapor-retarder facing in "Vapor-Retarder Facing" Paragraph below for blanket insulation is often provided separately and may be laminated to insulation before arriving at Project site, or it may be installed concurrently with insulation. NAIMA recommends that metal building insulation have a vapor-retarder facing with a permeance not greater than 0.10 perm. Facing selection may also be affected by light reflectivity and cold-weather workability.

* + - * 1. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96, Desiccant Method.

Retain one of four "Composition" subparagraphs below or delete all and insert manufacturer's proprietary product.

Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.

Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.

Composition: White [**polypropylene**] [**vinyl**] film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.

Material in "Composition" Subparagraph below is one of the most expensive facings but offers very high puncture resistance.

Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.

* + - * 1. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
      1. PERSONNEL DOORS AND FRAMES

Retain first "Swinging Personnel Doors and Frames" Paragraph below and delete remainder of this article if personnel doors are specified in that Section.

* + - * 1. Swinging Personnel Doors and Frames: As specified in Section 081113 "Hollow Metal Doors and Frames."

Retain "Swinging Personnel Doors and Frames" Paragraph below if personnel doors are specified in this Section.

* + - * 1. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.

Steel face thickness in "Steel Doors" Subparagraph below corresponds to 20-gage and is typical for steel building system manufacturers.

Steel Doors: 1-3/4 inches thick; fabricated from metallic-coated steel face sheets, 0.036-inch nominal uncoated steel thickness, of [**seamed**] [**seamless**], hollow-metal construction; with 0.060-inch nominal uncoated steel thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.

Design: [**Flush panel**] [**As indicated on Drawings**] <**Insert design**>.

Retain one of three "Core" subparagraphs below.

Core: Kraft honeycomb with U-factor rating of at least 0.47 Btu/sq. ft. x h x deg F.

Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F.

Core: Polyurethane foam with U-factor rating of at least 0.07 Btu/sq. ft. x h x deg F.

Retain "Glazing Frames" and "Glazing" subparagraphs below if doors have glazed panel.

Glazing Frames: Steel frames to receive field-installed glass.

Glazing: As specified in Section 088000 "Glazing."

Thickness in "Steel Frames" Subparagraph below corresponds to 16-gage and is typical for steel building system manufacturers.

Steel Frames: Fabricate 2-inch- wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness.

Type: [**Knocked down for field assembly**] [**Factory welded**].

Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.

Hardware below is minimum usually provided by manufacturers. Revise to suit Project or delete hardware in this Section and specify with other door hardware in Section 087100 "Door Hardware". Establish hardware sets if required.

Hardware:

Provide hardware for each door leaf, as follows:

Hinges: BHMA A156.1. Three [**plain**] [**antifriction**]-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches, with nonremovable pin.

Standard lockset in "Lockset" Subparagraph below is usually cylindrical type.

Lockset: BHMA A156.2. [**Key-in-lever cylindrical**] [**Mortise, with lever handle**] type.

Retain "Exit Device" Subparagraph below if required.

Exit Device: BHMA A156.3. Touch- or push-bar type.

Threshold: BHMA A156.21. Extruded aluminum.

Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.

Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.

Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.

Provide each pair of double doors with the following hardware in addition to that specified for each leaf:

Astragal: Removable type.

Surface Bolts: Top and bottom of inactive door.

Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A123.

Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

* + - * 1. Materials:

Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B, suitable for exposed applications.

Hot-Rolled Steel Sheet: ASTM A1011, CS, Type B; free of scale, pitting, or surface defects; pickled and oiled.

Metallic-Coated Steel Sheet: ASTM A653, CS, Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.

* + - * 1. Finishes for Personnel Doors and Frames:

Retain "Prime Finish" or "Factory-Applied Paint Finish" Subparagraph below.

Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.

Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.

Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Director’s Representative’s sample**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color and gloss**>.

* + - 1. HORIZONTAL SLIDING DOORS
         1. Horizontal-Sliding Doors: Manufacturer's standard horizontal-sliding door assembly including structural frame, door panels, brackets, guides, tracks, hardware, and installation accessories.

Door Frames: Channels and zees; metallic-coated steel sheet or structural-steel shapes, 0.060-inch nominal uncoated steel thickness.

Door Panels: Same material and finish as metal wall panels.

Hardware: Manufacturer's standard metallic-coated steel track, bottom guides, lock angles for side closure, and brackets. Support each door leaf by two four-wheel trolleys. Provide metallic-coated steel handle for each leaf, and slide bolt or padlock hasp. Flash top of track with metallic-coated steel sheet hood.

Overhead coiling doors and sectional overhead doors are not provided by metal building system manufacturers. Specify these doors in Section 083323 "Overhead Coiling Doors" and Section 083613 "Sectional Doors."

* + - 1. WINDOWS

Retain first "Aluminum Windows" Paragraph below and delete remainder of article if aluminum windows are specified in that Section.

* + - * 1. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."

Retain "Aluminum Windows" Paragraph below if deleting "Aluminum Windows" Paragraph above and aluminum windows are required for Project.

* + - * 1. Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:

Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 and as follows:

Retain one or more types of units in "Horizontal-Sliding Units," "Single-Hung Units," or "Fixed Units" Subparagraph below. Revise performance class and grade to suit Project.

Horizontal-Sliding Units: [**HS-LC25**] [**HS-CW30**] <**Insert designation**>.

Single-Hung Units: [**H-LC25**] [**H-CW30**] <**Insert designation**>.

Fixed Units: [**FW-LC25**] [**FW-CW30**] [**FW-AW40**] <**Insert designation**>.

Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.

Retain "Thermally Improved Construction" Subparagraph below if required to minimize condensation in cold climates.

Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

Retain "Mullions" Subparagraph below if required.

Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.

Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.

Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.

Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:

Retain applicable hardware types from list below.

Cam-action sweep sash lock and keeper at meeting rails.

Spring-loaded, snap-type lock at jambs.

Pole-operated, cam-action locking device on meeting rail where rail is more than 72 inches above floor.

Lift handles for single-hung units.

Nylon sash rollers for horizontal-sliding units.

Steel or bronze operating arms.

Retain "Sliding-Type Weather Stripping" and "Insect Screens" subparagraphs below for horizontal-sliding and single-hung units.

Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.

Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, and as follows:

Retain one of three subparagraphs below.

Aluminum Wire Fabric: 18-by-18, 18-by-16, or 18-by-14 mesh of 0.013-inch- diameter, coated aluminum wire; complying with FS RR-W-365, Type VII.

Glass-Fiber Mesh Fabric: 18-by-16 or 18-by-14 mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656.

Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.

If needed, insert requirements for steel windows. Aluminum windows are most common with manufacturers.

Retain one of two "Glazing" paragraphs below.

* + - * 1. Glazing: Comply with requirements specified in Section 088000 "Glazing."
        2. Glazing:

Retain one or more types of glass from first six subparagraphs below. Materials are standard with metal building system manufacturers. If retaining more than one, indicate location of each on Drawings.

Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), 3 mm thick.

Heat-Treated Float Glass: ASTM C1048, Type I, Quality-Q3, Class I (clear), Condition A, 3 mm thick.

Tinted Float Glass: ASTM C1036, Type I, Quality-Q3, Class 2, 3 mm thick.

Tint Color: [**Blue**] [**Blue-green**] [**Bronze**] [**Green**] [**Gray**] [**Manufacturer's standard color**] <**Insert color**>.

Patterned Glass: ASTM C1036, Type II, Quality-Q6, Class 1 (clear), Form 3, Pattern P3 (random), 3 mm thick.

Insulating-Glass Units: Factory-assembled units consisting of sealed lites of 2.5-mm-thick clear float glass separated by a dehydrated interspace, qualified according to ASTM E2190.

Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

Retain first subparagraph below if required.

Provide safety glazing labeling.

Glazing Stops: Screw-applied or snap-on glazing stops coordinated with Section 088000 "Glazing" and with glazing system indicated. Match material and finish of window frames.

Retain "Factory-Glazed Fabrication" Subparagraph below unless preglazing is impractical. Occasionally, anchorage system will not permit preglazing.

Factory-Glazed Fabrication: Glaze window units in the factory to greatest extent possible and practical for applications indicated. Comply with requirements in Section 088000 "Glazing."

* + - * 1. Finish:

Retain "Mill finish" or "Baked-Enamel Finish, Organic Coating" Subparagraph below or revise to suit Project.

Mill finish.

Baked-Enamel Finish, Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil, medium gloss.

Metal building system manufacturers' standard color for baked-enamel finish is bronze.

Color: [**As indicated by manufacturer's designations**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color**>.

* + - 1. TRANSLUCENT PANELS

Retain "Uninsulated Translucent Panels" or "Insulated Translucent Panels" Paragraph below if included in Project. "Limited flammability" is not a fire-hazard classification but indicates material is less flammable than general-purpose material.

* + - * 1. Uninsulated Translucent Panels: Glass-fiber-reinforced polyester, translucent plastic; complying with ASTM D3841, [**Type CC2 (general purpose)**] [**Type CC1 (limited flammability)**], Grade 1 (weather resistant); smooth finish on both sides. Match profile of adjacent metal panels.

Verify, with manufacturers, panel weights in "Roof Panel Weight" and "Wall Panel Weight" subparagraphs below.

Roof Panel Weight: Not less than 8 oz./sq. ft.

Wall Panel Weight: Not less than 6 oz./sq. ft.

Light Transmittance: Not less than [**55**] <**Insert number**> percent according to ASTM D1494.

Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.

Color: [**White**] <**Insert color**>.

* + - * 1. Insulated Translucent Panels: Fabricate insulating units of two sheets of glass-fiber-reinforced polyester, translucent plastic separated by an air space; complying with ASTM D3841, Type CC1 (limited flammability), Grade 1 (weather resistant); smooth finish on both sides. Match profile of adjacent metal panels.

Verify, with manufacturers, panel weights in "Exterior Panel Weight" and "Interior Panel Weight" subparagraphs below.

Exterior Panel Weight: Not less than [**8 oz./sq. ft.**] [**6 oz./sq. ft.**].

Interior Panel Weight: Not less than [**8 oz./sq. ft.**] [**6 oz./sq. ft.**] [**4 oz./sq. ft.**].

Light Transmittance: Not less than [**42**] <**Insert number**> percent according to ASTM D1494.

Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.

Color: [**White**] <**Insert color**>.

* + - * 1. Mastic for Translucent Panels: Nonstaining, saturated vinyl polymer as recommended by translucent panel manufacturer for sealing laps.
        2. Performance:

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: [**25**] <**Insert value**> or less.

Smoke-Developed Index: [**450**] <**Insert value**> or less.

* + - 1. ACCESSORIES

This article includes metal building system manufacturers' standard accessories. Retain accessories required to suit Project. If more stringent requirements are needed for some accessories, revise descriptions.

* + - * 1. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

* + - * 1. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.

Retain "Clips" and "Cleats" subparagraphs below only with standing-seam metal roof panels.

Clips: Manufacturer's standard, formed from [**steel**] [**stainless-steel**] sheet, designed to withstand negative-load requirements.

Cleats: Manufacturer's standard, mechanically seamed cleats formed from [**steel**] [**stainless-steel sheet or nylon-coated aluminum**] sheet.

Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Retain "Thermal Spacer Blocks" Subparagraph below if thermal bridging is a concern.

Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

* + - * 1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.

Retain "Backing Plates" Subparagraph below if required; some manufacturers do not provide backing plates for wall panels.

Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

* + - * 1. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

Retain second option in "Opening Trim" Subparagraph below if head and jambs of doors are subject to excessive impact. Painted subframing is often more durable. Metal thickness options correspond to obsolete 26 and 22 gage, respectively.

Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] [**0.030-inch**] nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

* + - * 1. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

Gutter Supports: Fabricated from same material and finish as gutters.

Strainers: Bronze, copper, or aluminum wire ball type at outlets.

* + - * 1. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.

Mounting Straps: Fabricated from same material and finish as gutters.

Service walkways are not available from all manufacturers.

* + - * 1. Service Walkways: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness, steel plank grating; with slip-resistant pattern; [**18-inch**] [**24-inch**] [**36-inch**] overall width. Support walkways on framing system anchored to metal roof panels without penetrating panels; with predrilled holes and clamps or hooks for anchoring.
        2. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.

Retain "Circular-Revolving Type" or "Continuous or Sectional-Ridge Type" Subparagraph below.

Circular-Revolving Type: Minimum [**20-inch-**] <**Insert dimension**> diameter throat opening; zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness, with coil coating; finished to match metal roof panels; with matching base and rain cap.

Type: [**Directional**] [**Stationary**] revolving.

Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; or aluminum, 1/2-inch- square mesh, 0.063-inch wire.

Retain "Dampers" Subparagraph below if required.

Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches of floor.

Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.

Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.

Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.

Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; or aluminum, 1/2-inch- square mesh, 0.063-inch wire.

Retain "Dampers" Subparagraph below if required.

Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.

Throat Size: [**9 inches**] [**or**] [**12 inches**], [**as standard with manufacturer, and as required to comply with ventilation requirements**].

Retain "Louvers" Paragraph below if louvers are required and specified in this Section, if not, delete louvers in this Section and specify in Section 089116 "Operable Wall Louvers". Manufacturers' standard sizes are typically 3 by 3 feet, 3 by 4 feet, and 4 by 4 feet. Verify availability with manufacturers.

* + - * 1. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.036-inch nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

Retain one of two "Blades" subparagraphs below. If retaining both, indicate location of each on Drawings.

Blades: Fixed.

Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.

Free Area: Not less than [**7.0 sq. ft.**] <**Insert dimension**> for 48-inch- wide by 48-inch- high louver.

Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.

In "Mounting" Subparagraph below, interior mounting is for interior face of fixed louvers; exterior mounting is for exterior or interior face of adjustable louvers.

Mounting: [**Interior**] [**Exterior**] face of louvers.

Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.

Retain "Roof Curbs" Paragraph below if roof curbs are required and are specified in this Section; if not, delete and specify roof curbs in Section 077200 "Roof Accessories." Not all manufacturers provide roof curbs; verify availability.

* + - * 1. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.

Retain "Insulation" Subparagraph below if required.

Insulation: 1-inch- thick, rigid type.

Pipe flashing in "Pipe Flashing" Paragraph below is not designed for high-temperature applications.

* + - * 1. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
        2. Materials:

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

Retain one of two "Fasteners for Metal Roof Panels" subparagraphs below. Stainless-steel fasteners in second subparagraph provide additional corrosion resistance.

Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.

Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.

Retain one of two "Fasteners for Metal Wall Panels" subparagraphs below. Stainless-steel fasteners in second subparagraph provide additional corrosion resistance. Retain washers if required; washers are usually omitted from wall panels.

Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws[**, with EPDM sealing washers bearing on weather side of metal panels**].

Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head[**, with EPDM sealing washers bearing on weather side of metal panels**].

Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

Blind Fasteners: High-strength aluminum or stainless-steel rivets.

Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

Metal Panel Sealants:

Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.

Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

* + - 1. FABRICATION
         1. General: Design components and field connections required for erection to permit easy assembly.

Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

* + - * 1. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
        2. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

Make shop connections by welding or by using high-strength bolts.

Join flanges to webs of built-up members by a continuous, submerged arc-welding process.

Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.

Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.

Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

* + - * 1. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

Make shop connections by welding or by using non-high-strength bolts.

Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

* + - * 1. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

* + - 1. SOURCE QUALITY CONTROL

The 2012 International Building Code requires that special inspections of structural steel be performed in accordance with the quality assurance and inspection requirements of AISC 360 for steel frame construction.

Insert additional special inspections for wind- and seismic-resistance requirements.

* + - * 1. Special Inspection: Director’s Representative will engage a qualified special inspector to perform source quality control inspections and to submit reports.

Retain "Accredited Manufacturers" Subparagraph below if authorities having jurisdiction approve shop fabrication work without special inspections by an IAS-AC472-accredited manufacturer. Not all manufacturers are accredited according to IAS AC472 and not all authorities having jurisdictions may accept IAS AC472 accreditation. If retaining, also retain "Manufacturer Qualifications" Paragraph in "Quality Assurance" Article.

Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
          2. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

Engage Land Surveyor to perform surveying.

* + - * 1. Proceed with erection only after unsatisfactory conditions have been corrected.
      1. PREPARATION
         1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
         2. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.
      2. ERECTION OF STRUCTURAL FRAMING
         1. Erect metal building system according to manufacturer's written instructions and drawings.
         2. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
         3. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

Insert leveling plates in "Base and Bearing Plates" Paragraph below if required.

* + - * 1. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

Set plates for structural members on wedges, shims, or setting nuts as required.

Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

* + - * 1. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Level and plumb individual members of structure.

Review subparagraph below with Structural Engineer and revise to suit Project. Delete if not required.

Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

* + - * 1. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

See RCSC for definitions of "snug tightened" and "pretensioned" in "Joint Type" Subparagraph below.

Joint Type: Snug tightened or pretensioned as required by manufacturer.

* + - * 1. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

Provide rake or gable purlins with tight-fitting closure channels and fasciae.

Locate and space wall girts to suit openings such as doors and windows.

Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

Retain "Steel Joists ( and Joist Girders)" Paragraph below if steel joist purlins or joist girders are required; otherwise, delete.

* + - * 1. Steel Joists[**and Joist Girders**]: Install joists[**, girders,**] and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

Before installation, splice joists delivered to Project site in more than one piece.

Space, adjust, and align joists accurately in location before permanently fastening.

Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

Retain one of three "Joist Installation" subparagraphs below.

Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.

Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

Joist Installation: Weld joist seats to supporting steel framework.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

* + - * 1. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

Tighten rod and cable bracing to avoid sag.

Locate interior end-bay bracing only where indicated.

* + - * 1. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
        2. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
      1. METAL PANEL INSTALLATION, GENERAL
         1. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

Retain "On-Site Fabrication" Paragraph below to permit use of on-site, portable roll-forming equipment.

* + - * 1. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
        2. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

* + - * 1. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

Install metal panels perpendicular to structural supports unless otherwise indicated.

Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.

Locate and space fastenings in uniform vertical and horizontal alignment.

Locate metal panel splices over structural supports with end laps in alignment.

Lap metal flashing over metal panels to allow moisture to run over and off the material.

* + - * 1. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

* + - * 1. Metal Protection: 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 metal roof panel manufacturer.
        2. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

Retain subparagraph below if joint-sealant work is part of this Section.

Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

* + - 1. METAL ROOF PANEL INSTALLATION
         1. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

Install ridge[**and hip**] caps as metal roof panel work proceeds.

Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

* + - * 1. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

Install clips to supports with self-drilling or self-tapping fasteners.

Install pressure plates at locations indicated in manufacturer's written installation instructions.

Retain "Snap Joint" or "Seamed Joint" Subparagraph below; coordinate with products selected in Part 2.

Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.

Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.

Provide metal closures at [**peaks**] [**rake edges**] [**rake walls**] [**and**] each side of ridge[**and hip**] caps.

* + - * 1. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.

Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.

Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.

Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.

At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

* + - * 1. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

Generally, retain "Metal Roof Panel Installation Tolerances" Paragraph below only for highly finished metal roof panel assemblies.

* + - * 1. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
      1. METAL WALL PANEL INSTALLATION
         1. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.

Shim or otherwise plumb substrates receiving metal wall panels.

When two rows of metal panels are required, lap panels 4 inches minimum.

When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.

Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.

Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.

Install screw fasteners in predrilled holes.

Install flashing and trim as metal wall panel work proceeds.

Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.

Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.

Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

* + - * 1. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
        2. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.

Install clips to supports with self-tapping fasteners.

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 as weather seal.

Retain "Installation Tolerances" Paragraph below only for highly finished metal wall panel assemblies.

* + - * 1. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
      1. TRANSLUCENT PANEL INSTALLATION
         1. Translucent Panels: Attach translucent panels to structural framing with fasteners according to manufacturer's written instructions. Install panels perpendicular to supports unless otherwise indicated. Anchor translucent panels securely in place, with provisions for thermal and structural movement.

Provide end laps of not less than 6 inches and side laps of not less than 1-1/2-inch corrugations for metal roof panels.

Provide end laps of not less than 4 inches and side laps of not less than 1-1/2-inch corrugations for metal wall panels.

Align horizontal laps with adjacent metal panels.

Seal intermediate end laps and side laps of translucent panels with translucent mastic.

* + - 1. METAL SOFFIT PANEL INSTALLATION
         1. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
         2. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.
      2. THERMAL INSULATION INSTALLATION

Retain this article if insulation is required; delete if using only factory-assembled, insulated metal panels.

* + - * 1. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

Retain first two subparagraphs below if units are furnished with vapor-retarder faces.

Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.

Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.

Retain one of two subparagraphs below. First is for insulation with factory-installed facings; second is for field-installed facings.

Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

* + - * 1. Blanket Roof Insulation: Comply with the following installation method:

Retain one of first four subparagraphs below.

Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.

"Between-Purlin Installation" Subparagraph below accommodates thicker insulation with no compression at purlins; however, thermal bridging occurs through metal roof panels in direct contact with structure.

Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

Thermal spacer blocks in first two subparagraphs below can retard heat transfer at purlins. Blocks are typically used with standing-seam systems attached to structural members by clips instead of lap-seam systems attached by screw fasteners.

"Over-Purlin-with-Spacer-Block Installation" Subparagraph below accommodates thicker insulation with compression occurring at structure.

Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.

Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

"Two-Layers-between-Purlin-with-Spacer-Block Installation" Subparagraph below accommodates thicker insulation with no compression.

Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

Retain "Blanket Wall Insulation" or "Board Wall Insulation" Paragraph below for walls.

* + - * 1. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.

Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

* + - * 1. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.

Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

* + - 1. DOOR AND FRAME INSTALLATION

Retain door types in this article that are specified in Part 2.

* + - * 1. General: 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.
        2. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

Between Doors and Frames at Jambs and Head: 1/8 inch.

Between Edges of Pairs of Doors: 1/8 inch.

At Door Sills with Threshold: 3/8 inch.

At Door Sills without Threshold: 3/4 inch.

Retain subparagraph below if required.

At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

* + - * 1. Sliding Service Doors: Bolt support angles to opening head members through factory-punched holes. Bolt door tracks to support angles at maximum 24 inches o.c. Set doors and operating equipment with necessary hardware, jamb and head mold stops, continuous hood flashing, anchors, inserts, hangers, and equipment supports.

Retain "Field Glazing" Paragraph below if doors are not preglazed.

* + - * 1. Field Glazing: Comply with installation requirements in Section 088000 "Glazing."
        2. Door Hardware:

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."

Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

* + - 1. WINDOW INSTALLATION

Retain this article if window installation is specified in this Section.

* + - * 1. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.

* + - * 1. Set sill members in bed of sealant or with gaskets, for weathertight construction.
        2. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
        3. Mount screens directly to frames with tapped screw clips.
      1. ACCESSORY INSTALLATION
         1. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

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.

Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

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.

* + - * 1. 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.

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.

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).

* + - * 1. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave 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.
        2. 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 o.c. in between.

Retain one of two subparagraphs below.

Provide elbows at base of downspouts to direct water away from building.

Tie downspouts to underground drainage system indicated.

* + - * 1. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
        2. Continuous Roof 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 roof panels.

Retain "Louvers" Paragraph below if louvers are not specified in Section 089116 "Operable Wall Louvers".

* + - * 1. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

* + - * 1. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
        2. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
      1. FIELD QUALITY CONTROL

Retain "Special Inspections" Paragraph below if required. Even if special inspection of shop fabrication is not required for approved fabricators, a special inspection may still be required for verification of field-bolted connections.

Insert additional special inspections for wind- and seismic-resistance requirements.

* + - * 1. Special Inspections: Director’s Representative will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Product will be considered defective if it does not pass tests and inspections.
        2. Prepare test and inspection reports.
      1. ADJUSTING
         1. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

Retain "Door Hardware" Paragraph below if door hardware is specified in this Section and not in Section 087100 "Door Hardware".

* + - * 1. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

Retain "Windows" Paragraph below if windows are not fixed or if they are not specified.

* + - * 1. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.

Delete "Adjustable Louvers" option in paragraph below if louvers are specified in Section 089116 "Operable Wall Louvers".

* + - * 1. [**Roof Ventilators**] [**and**] [**Adjustable Louvers**]: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.

Retain subparagraph below for adjustable louvers.

Adjust louver blades to be weathertight when in closed position.

* + - 1. CLEANING AND PROTECTION

Retain first paragraph below if galvanized items are required.

* + - * 1. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
        2. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

Retain one of two "Touchup Painting" paragraphs below.

* + - * 1. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing[**, bearing plates,**] and accessories.

Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."

Apply a compatible primer of same type as shop primer used on adjacent surfaces.

* + - * 1. Touchup Painting: Cleaning and touchup painting are specified in Section 099114 "Exterior Painting" and Section 099123 "Interior Painting."
        2. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

* + - * 1. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.

Immediately before final inspection, remove protective wrappings from doors and frames.

* + - * 1. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

Retain "Louvers" Paragraph below if louvers are not specified in Section 089116 "Operable Wall Louvers".

* + - * 1. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Director’s Representative, remove damaged units and replace with new units.

Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 133419