SECTION 13 3419

METAL BUILDING SYSTEMS

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LANL MASTER SPECIFICATION SECTION

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| --- |
| New in this revision: Updated for compliance with earthquake loads in ESM Ch. 5 Sect. II R11 (i.e., new accelerations for SDC D and new SDC C and its accelerations) |

This Section/template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The template must also be edited to delete specification requirements for processes, items, or designs that are not included in the project, add specification requirements not provided herein as well as delete specifier’s notes such as these.  Additional tailoring requirements are contained in ESM [Chapter 1](http://engstandards.lanl.gov/ESM_Chapters.shtml#esm1) Section Z10 Att. F, Specifications.

To seek a variance from template requirements that are applicable, contact the Engineering Standards Manual [Structural](http://engstandards.lanl.gov/POCs.shtml#struc) and/or [Architectural](http://engstandards.lanl.gov/POCs.shtml#arch)POCs. Also please contact the POCs with suggestions for improvement as well.

When assembling a specification package, include applicable Sections from all Divisions, especially those in Division 1, General requirements.

This template was developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

This Section specifies basic metal building systems, including structural framing, metal roofing, siding, and soffit panels. While other components of the building envelope such as insulation, personnel doors, overhead sectional and coiling doors, sliding doors, windows, accessories, and MEP systems are typically available from metal building system manufacturers, these are specified in other ESM standard specification sections. Also, this Section does not specify footings, foundations, slabs, or interior finished spaces, nor does it specify other types of metal structures such as portable buildings, booths, small utility or storage buildings, or greenhouses.

Structural design of RC II and RC IV buildings must comply with the IBC subject to amendments to it by LANL ESM. The IBC places the following seismic requirements on structural steel structures in Seismic Design Category D and C (i.e., LANL):

SDC = D: Design and detailing shall be in accordance with AISC 341, except as permitted by ASCE 7, Table 15.4-1 (i.e., some of the Non-building Structures Similar to Buildings).

SDC = C: Design and detailing shall be in accordance with AISC 341 unless R < 3 and the seismic force-resisting system is other than a cantilever column system.

NOTE: Although the IBC (and LANL ESM) permits the use of cold-formed steel structures, this construction type is not included in this template)

While IBC-compliant seismic design is included herein, the EOR is responsible for ensuring that any/all requirements/provisions are specifically addressed during his/her review of the Project Record Documents submittals. Refer to IBC Ch. 22 and LANL Master Spec Sections 05 1000 and 05 3000 for details on seismic-related requirements.

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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:
			1. Structural steel framing.
			2. Metal roof panels.
			3. Metal wall panels.
			4. [Foamed-insulation-core metal wall panels.]
			5. [Translucent panels.]
			6. [Metal Soffit panels.]
			7. [Roof ventilators.]
			8. [Louvers.]
	3. REFERENCES

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List reference standards included within the edited text of this section and for Project conditions.

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* + 1. American Architectural Manufacturers Association
1. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
	* 1. American Institute of Steel Construction
			1. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges
			2. AISC 341 – Seismic Provisions for Structural Steel Buildings
			3. AISC 360 – Specification for Structural Steel Buildings
		2. American Iron and Steel Institute
			1. AISI S100 – North American Specification for the Design of Cold-Formed Steel Structural Members.
		3. ASTM International
			1. ASTM A36 – Standard Specification for Carbon Structural Steel
			2. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
			3. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
			4. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting for High- Temperature or High Pressure Service and Other Special Purpose Applications
			5. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs and Threaded Rods, 60,000 PSI Tensile Strength
			6. ASTM A475 – Standard Specification for Zinc-Coated Steel Wire Strand
			7. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
			8. ASTM A529 – Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
			9. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts
			10. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
			11. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
			12. ASTM A755 – Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products
			13. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
			14. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
			15. ASTM A992 – Standard Specification for Steel for Structural Shapes
			16. ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
			17. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength, Low-Alloy and High-Strength Low Alloy with Improved Formability, and Ultra-High Strength
			18. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
			19. ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
			20. ASTM C273 – Standard Test Method for Shear Properties of Sandwich Core Materials
			21. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
			22. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
			23. ASTM C920 -Standard Specification for Elastomeric Joint Sealants
			24. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
			25. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
			26. ASTM D1494 – Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels
			27. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics
			28. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.
			29. ASTM D2244 – Standard Test Method for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
			30. ASTM D3841 – Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels
			31. ASTM D4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
			32. ASTM D6226 – Standard Test Method for Open-Cell Content of Rigid Cellular Plastics
			33. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
			34. ASTM E108 – Standard Test Methods for Fire Tests of Roof Coverings
			35. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
			36. ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
			37. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
			38. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
			39. ASTM E1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
			40. ASTM E1646 – Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
			41. ASTM E1680 – Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems
			42. ASTM E1980 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
			43. ASTM F436 – Standard Specification for Hardened Steel Washers
			44. ASTM F844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
			45. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
			46. ASTM F2329 – Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
			47. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
		4. American Welding Society
			1. AWS D1.8 – Structural Welding Code – Seismic Supplement
		5. Cool Roof Rating Council
			1. CRRC-1 – CRRC Product Rating Program
		6. FM Global
			1. FM 4471 – Approval Standard, Class I Panel Roofs
		7. International Accreditation Service
			1. IAS AC472 –Metal Building Systems Inspection Accreditation
		8. International Code Council
			1. IBC – International Building Code
		9. Metal Building Manufacturers Association
			1. MBMA – Metal Building System Manual (MBSM)
		10. National Fire Protection Association
			1. NFPA 285 – Method of Test for the Evaluation of Fire Propagation Characteristics of Exterior, Non-load-Bearing Wall Assemblies Containing Combustible Components
		11. Research Council on Structural Connections
			1. RCSC SPEC – Specification for Structural Joints Using ASTM F3125 Bolts
		12. Steel Joist Institute
			1. SJI STD SPEC – Standard Specifications and Load Tables for Steel Joists and Joist Girders
		13. Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA) – Architectural Sheet Metal Manual
		14. The Society for Protective Coatings
			1. SSPC SP-2 – Surface Preparation Specification No. 2: Hand Tool Cleaning
			2. SSPC SP-3 – Surface Preparation Specification No. 3: Power Tool Cleaning
		15. Underwriters Laboratories Inc.
			1. UL 580 – Tests for Uplift Resistance of Roof Assemblies
		16. U.S. Department of Energy
			1. DOE ENERGY STAR Roof Products Qualified Product List. (undated).
	1. DEFINITIONS
		1. Terminology Standard: See MBMA MBSM for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

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* Manufacturer is responsible for the design and fabrication of the building.
* Erector is responsible for the construction/installation of the building.
* General Contractor is responsible for construction of the overall Project involving the building.

In the context of this Section, the term “Subcontractor” is used in lieu of General Contractor.
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* 1. COORDINATION
		1. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt/ -rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 3000 "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.
	2. Pre-Installation MeetingS

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1. Pre-Installation Conference: Conduct conference at [Project site] [\_\_\_\_\_\_\_\_] a minimum of [one] [\_\_\_\_\_\_\_] week prior to commencing work of this Section, and attended by <Insert List>.
	1. Review methods and procedures related to metal building systems including, but not limited to, the following:
		1. Condition of foundations and other preparatory work performed by other trades.
		2. Structural load limitations.
		3. Construction schedule. Verify availability of materials and erector’s personnel, equipment, and facilities needed to make progress and avoid delays.

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* + 1. Required tests, inspections, and certifications.
		2. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
	1. Review methods and procedures related to metal roof panel assemblies including, but not limited to the following:
		1. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
		2. Structural limitations of purlins and rafters during and after roofing.
		3. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
		4. Temporary protection requirements for metal roof panel assembly during and after installation.
		5. Roof observation and repair after metal roof panel installation.
	2. Review methods and procedures related to metal wall panel assemblies including, but not limited to the following:
		1. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
		2. Structural limitations of girts and columns during and after wall panel installation.
		3. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
		4. Temporary protection requirements for metal wall panel assembly during and after installation.
		5. Wall observation and repair after metal wall panel installation.

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Edit submittals to include only those absolutely necessary to assure requirements and features that are important for the specific project will be met.

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* 1. ACTION SUBMITTALS
1. [Product Data: For each type of metal building system component.
	1. Include construction details, material descriptions, dimensions of individual components and profiles, and finished for the following:
		1. Metal roof panels.
		2. Metal wall panels.
		3. Foamed-insulation-core metal panels.
		4. Metal soffit panels.
		5. Translucent roof panels.
		6. Roof ventilators.
		7. Louvers].
2. [Shop/Erection Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
	1. 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.
	2. 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
		1. Show provisions for attaching [mezzanines] [roof curbs] [service walkways] [platforms] [and] [pipe racks].
	3. 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 wall panels only].

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* + 1. Show roof-mounted items (specified elsewhere) including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
		2. Show wall-mounted items (specified elsewhere) including doors, windows, louvers, and lighting fixtures.
		3. Show translucent panels.

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* 1. Accessory Drawings: Include details of the following items (as specified elsewhere), at a scale of not less than [1-1/2 inches per 12 inches (1:8)] [\_\_\_\_\_\_\_\_\_].
		1. Flashing and Trim
		2. Gutters
		3. Downspouts
		4. Roof ventilators
		5. Louvers
		6. Service walkways]
1. [Samples

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* 1. Samples for Initial Selection: For units with factory-applied color finish.
	2. Samples for Verification: For each type of exposed finish required, prepared on samples of sizes indicated thusly:
		1. Metal Panels: Nominal 12 inches long x actual panel width. Include fasteners, closures, and other exposed panel accessories.
		2. Translucent Panels: Nominal 12 inches long x actual panel width.
		3. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
		4. Accessories: Nominal 12-inch-long samples for each type of accessory.]

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The Design Submittal D.1 (below) is the manufacturer's responsibility according to the MBMA MBSM. It is useful in ensuring compliance with requirements and in comparing competitive quotes from several manufacturers.

The submittal D.2 (below) is labelled “Delegated Design” in the commercial template used to create this section. In speaking with that template’s author about this option (i.e., for the construction Subcontractor being responsible for design; hence, delegated design), the author wasn’t sure when such should/could be used (since other submittals related to the metal building system will likely be provided/prepared by the manufacturer and those aren’t “delegated”). The author didn’t see any issues arising out of the approach used herein (i.e., merely requiring design calcs to be submitted as a “normal/non-delegated” submittal).

The submittal D.3 (below), unlike the 1st two, wasn’t included in the generic template modelled, rather it comes from the MBMA Performance Guide Spec.

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1. [Design Submittals
	1. Letter of Design Certification: Signed and sealed by a professional engineer who is legally qualified to practice in New Mexico. Include the following:
		1. Name and location of Project.
		2. Order Number.
		3. Name of Manufacturer.
		4. Name of Subcontractor.
		5. Building dimensions including width, length, height, and roof slope.
		6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
		7. Governing version of IBC.
		8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, Seismic Design Category D, and auxiliary loads (cranes).
		9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing version of IBC.
		10. Building Risk Category: Indicate IBC Risk Category, along with rationale behind/reason for this, and its effect on load importance factors.
	2. Structural-design calculations for the metal building system. Include analysis data indicating compliance with performance requirements signed and sealed by the professional engineer who is responsible for the preparation of the calculation and is legally qualified to practice in New Mexico.
	3. Anchor rod placement plan, column reactions [and] [\_\_\_\_\_\_] in advance of shop/erection drawings.]
	4. INFORMATIONAL SUBMITTALS

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Retain "Qualification Data" Paragraph with qualification requirements in Section 01 4000, *Quality Requirements*, and as supplemented in “Quality Assurance” Article.
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* + 1. [Qualification Data: For [erector] [manufacturer] [land surveyor].]

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

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* + 1. [Material Test Reports:
			1. Structural steel including chemical and physical properties.
			2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
			3. Tension-control, high-strength, bolt-nut-washer assemblies.
			4. Shop primers.
			5. Non-shrink grout.]
		2. [Source quality-control reports.]
		3. [Manufacturer’s Installation Instructions: Indicate preparation requirements, assembly sequence [and] [\_\_\_\_\_\_\_\_\_].]

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

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Include only sustainable design submittals that are appropriate for the project’s sustainable design goals, if any.

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* 1. SUSTAINABLE DESIGN SUBMITTALS
		1. [Manufacturer’s Certificate: Certify products meet or exceed specified sustainable design requirements.
			1. Sustainable Sites Certificates:
				1. Certify roofing materials solar reflectance index.
			2. Materials Resources Certificates:
				1. Certify recycled material content for recycled content products.
				2. Certify source for local and regional materials and distance from Project site.
			3. Indoor Air Quality Certificates:
				1. Certify volatile organic compound content for each interior finish and coating not specified elsewhere.]

[Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

* + - 1. Provide cost data for the following products:

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. [Products with recycled material content.]
2. [Local and regional products.]
3. [ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ].]
	1. CLOSEOUT SUBMITTALS

[Maintenance Data: for metal panel finishes to include in maintenance manuals.]

* + 1. [Warranties: Normal and special warranties.]
		2. [Section 01 7839 *Project Record Documents*: Record actual locations of concealed components and utilities.]
	1. QUALITY CONTROL

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There is a difference between quality control (QC) and quality assurance (QA) that applies herein:

* QC is what is contained in this Section, and is the responsibility of the Subcontractor, the metal building manufacturer, and whoever erects the metal building.
* QA (required by IBC Ch, 17) is contained in the EOR’s Statement of Special Inspections (SSI), and its execution is the responsibility of LANL. The SSI template is found in ESM Ch. 16, Sect. IBC-IP, Attach. B.

The SSI need not include fab-shop inspections if the manufacturer is an LBO-approved fabricator**\***, and if the seismic force-resisting system (SFRS) is an ordinary moment frame (ref. MBMA Spring-2012 Tech Bulletin, *IBC Special Inspection Requirements - Approved Fabricators are Exempted!*).

**\***Manufacturers that have IAS AC472 accreditation are much more likely to be approved than those that don’t.

If the SFRS is an intermediate or special moment frame then nondestructive testing (NDT) of the CJP groove welds in material > 5/16” will be required (regardless of whether or not manufacturer is AC472 accredited or LBO-approved).

Whether or not fab-shop inspections and/or NDT of welds are included in the SSI, if erection of the building requires field-bolted connections then the special inspections required by AISC 360 for such must be included in the SSI. Finally, any/all applicable special inspections required by AISC 341 for field work/erection also must be included unless AISC 341 isn't applicable per the portion of the author note on pp. 1 pertaining to SDC C.

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* + 1. Manufacturer Qualifications
			1. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in New Mexico.
		2. 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 the manufacturer.
		3. Quality Control Inspector (QCI) Qualifications: The qualifications of the QCI engaged by the erector shall comply with the applicable provisions in Section 01 4000, *Quality Requirements*, and AISC 360 Chapter N, paragraph N4.1.

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Retain subparagraph below if Project includes a SFRS unless AISC 341 isn't applicable per the portion of the author note on pp. 1 pertaining to SDC C.

AISC 360 and 341 define NDT as being a QA responsibility; however, the scope paragraphs in the respective QA and QC chapters (i.e., N1 and J1) allow for the LBO to have it performed by an LBO-approved fabricator. This allowance is not exercised herein for the following reasons:

* 1. The NDT-related qualifications in ‘360’ would have to be added herein (as a new paragraph),
	2. The NDT-related qualifications in ‘341’ would have to be added to subparagraph below,
	3. The subsequent Source QC paragraph (in PART 2) would have to include project-specific NDT requirements (e.g., the applicable NDT method(s), the extent of testing, distinguishing between “seismic and non-seismic” for the methods and extent, etc.), and
	4. Welds completed by the erector aren’t included in the allowance (so they must be “QA-ed”, which would “blur the lines” between QA and QC in this Section).

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* + 1. SFRS QCI Qualifications: In addition to QCI Qualifications (stated above), the qualifications of the QCI engaged by the erector of the SFRS shall comply with the following:
			- 1. Visual welding inspection shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2.

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Retain appropriate subparagraph(s) under paragraph below if shop and/or field welding is required.

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1. Welding Qualifications and Control:
	* 1. Shop.
2. Refer to Section 01 4444 *Offsite Welding and Joining Requirements*.
	* 1. Field.
3. Refer to Section 01 4455 *Onsite Welding and Joining Requirements.*

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Retain subparagraph below if SFRS consists of intermediate or special moment frames consisting of material > 5/16” thick that requires welding unless AISC 341 isn't applicable per the portion of the author note on pp. 1 pertaining to SDC C..

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* + 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

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If LANL is providing land survey, delete the following paragraph.

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1. Land Surveyor Qualifications: A professional land surveyor who practices in New Mexico and who is experienced in providing surveying services of the kind indicated.
	* 1. [Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and 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.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. [Build mockup of typical wall area as shown on Drawings.]

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Retain first subparagraph below for limited-scale mockups.
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* + - 1. [Build mockups for typical wall metal panel including accessories.
				1. Size: [48 inches] [\_\_\_\_\_\_] long x [48 inches] [\_\_\_\_\_\_] wide.]

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Retain subparagraph below if mockups are not only for establishing appearance factors.
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* + - 1. [Approval of mockups does not constitute approval of deviations from the Subcontract Documents contained in mockups unless LANL STR 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.
		4. Protect foam-plastic insulation as follows:
			1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
			2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
			3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.
	2. 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.
	3. warranty

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This Article contains extended warranties that increase construction costs and Owner-enforcement responsibilities. Specify warranties with caution.
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* + 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.
			1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
				1. Color fading more than 5 Hunter units when tested according to ASTM D2244.
				2. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
				3. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2. A 20-year period is common for fluoropolymer finish; 25- and 30-year periods are available from some manufacturers. A 10-year period is usually available for siliconized polyester.
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* + - 1. [Finish Warranty Period: [25] [20] [10] [\_\_] years from date of Substantial Completion.]]
		1. [Special Weather-tightness 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.

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Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Warranty Period: [20] [10] [5] [\_\_] years from date of Substantial Completion.]
1. PRODUCTS
	1. MANUFACTURERS

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In this article, list manufacturers acceptable for this Project. Each of the “defaults” indicated below are MBMA members and accredited by IAS under its Metal Building Inspection Program (i.e., AC472). This would ideally be the case for any other manufacturer added; however, because this is a fairly newly available accreditation, it was not made mandatory at this time.

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* + 1. Manufacturers List:
			1. [Butler Manufacturing, a Division of Blue Scope Buildings North America, Inc.] Model [\_\_\_\_\_\_\_\_\_\_].
			2. [Ceco Building Systems, a subsidiary of NCI Building Systems.] Model [\_\_\_\_\_\_\_\_\_\_].
			3. [Star Building Systems, a subsidiary of NCI Building Systems.] Model [\_\_\_\_\_\_\_\_\_\_].
			4. [Whirlwind Steel Buildings, Inc.] Model [\_\_\_\_\_\_\_\_\_\_].
			5. [\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_] Model [\_\_\_\_\_\_\_\_\_\_].
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

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

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Retain one or more subparagraphs below or revise to suit Project. Coordinate with design information indicated on Drawings.
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* + - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
			2. Rigid Modular: Solid-member, structural-framing system with interior columns.

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Include the following paragraph when Drawings do not indicate bay spacing.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
			2. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
			3. Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.

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Retain one of two "End-Wall Framing" Paragraphs below. Load-bearing end walls (i.e., those with 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.

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Retain 1 of 3 options in "Secondary-Frame Type" Paragraph below. Girts are attached to primary framing in 1 of 3 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 document accompanying the template used to develop this one for the diagram illustrating the 3 relationships.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

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Manufacturers can custom design metal buildings to almost any eave height to suit Project. Dimensions in 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].

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Manufacturers can custom design metal buildings to almost any bay spacing to suit Project. Dimensions in 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.
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* + 1. Bay Spacing: [20 feet] [25 feet] [30 feet] [As determined by manufacturer] [Asindicated on Drawings] [Insert dimension].

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Manufacturers can custom design metal buildings to almost any roof slope to suit Project. Slopes in Paragraph below are common.
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* + 1. Roof Slope: [1/4 inch per 12 inches (1:48)] [1/2 inch per 12 inches (1:24)] [1 inchper 12 inches (1:12)] [4 inches per 12 inches (1:3)] [Manufacturer's standard forframe type required] [Insert slope].

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

A standing-seam (S-S) roof system is one in which the longitudinal (side) joints between the roof panels are arranged in a vertical position above the roof line. The roof panel system is secured to the roof substructure by means of concealed hold down clips attached with screws to the substructure, except that through fasteners may be used at limited locations where simple lap joints occur, such as at ends of panels and at roof penetrations. Given this, unless the hold-down clips are specially designed and tested, S-S panels can’t be relied on for bracing of purlins or for diaphragm action.

A through-fastened (referred to herein as “Lap-Seam” or “Exposed-Fastener”) roof system is one in which the roof panels are attached directly to the roof substructure with fasteners which penetrate through the roof sheets and into the substructure. This is more economical than S-S; however, it doesn’t look as good, and it tends to be less weather-resistant (particularly over time).

Per MBMA MBSM, “Horizontal diaphragm systems in metal buildings might consist of either the metal cladding of the roof itself or horizontal bracing systems beneath the roof alone. Examples of horizontal bracing systems used include rods, angles, cables, or other structural members and are often tension-only bracing.” The preceding also needs to be kept in mind when editing paragraph 2.4.E (Structural Steel Framing, Bracing).
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* + 1. Roof System: Manufacturer's standard [standing-seam, vertical-rib,] [standing-seam, trapezoidal-rib,] [lap-seam, tapered-rib] [foamed-insulation-core] metal roof panels.
			1. Liner Panels: [Tapered rib] [Flush profile].

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Many types of wall panels are available from manufacturers. Options in 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.
			1. Liner Panels: [Tapered rib] [Flush profile].

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Insert other requirements to suit Project (e.g., brick or stone masonry for custom-designed exterior elevations, etc.).
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* + 1. Sustainability Characteristics

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Edit sustainable design requirements to suit content of this section and Project sustainable design requirements, if any.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Steel
				1. Post-Consumer Content: 16 percent (Basic Oxygen Furnace (BOF), 67 percent (Electric Arc Furnace (EAF)).
				2. Total Recovered Materials: 25-30 percent (BOF), 100 percent (EAF).
			2. Aluminum
				1. Post-Consumer Content: 25-95 percent
				2. Total Recovered Materials: 20-95 percent.
			3. Metallic-Coated Steel Sheet: Provide steel sheet with average recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
			4. Rubber
				1. Post-Consumer Content: 12-100 percent
				2. Total Recovered Materials: 100 percent
			5. Plastic or Plastic/Rubber Composite
				1. Post-Consumer Content: 100 percent.
				2. Total Recovered Materials Content: 100 percent.
	1. PERFORMANCE REQUIREMENTS

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

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* + 1. Structural Performance: Metal building systems shall withstand the effects of the following loads within limits and under conditions indicated according to procedures in MBMA MBSM.

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Edit subparagraph below based on whether or not design loads (i.e., minimum live, dead, snow, collateral, seismic, and wind) and load combinations are included herein (vs. on Drawings).

The loads and load combinations indicated shall be based on a) the IBC Risk Category assigned to Project/building and b) LANL ESM Ch. 5 Sect. II.

Ensure that Seismic Design Category D is indicated (i.e., along with the loads and load combinations).

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1. Design Loads: [As indicated on Drawings] [Insert applicable loads and load combinations].

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Retain one of two "Deflection and Drift Limits" subparagraphs below. If the 1st subparagraph is retained then, in order to comply with IBC Sect. 1604, the fact that LANL is SDC D must be known/ stipulated (ref. 1604.3 and its reference to ASCE 7 12.12.1).

With regard to 1st subparagraph and wind loads, what’s indicated in IBC Table 1604.3 (i.e., footnote f) is based on a “10-yr event (from ASCE 7 App, C and its Commentary),” which will likely suffice for typical buildings. However, for drift-sensitive buildings, since a 50- or 100-yr event is more appropriate, footnote f needs to be edited herein.

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* + - 1. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits stipulated in IBC Section 1604. The drift limits applicable to earthquake loading shall be determined based on Seismic Design Category D.
			2. Deflection and Drift Limits: No greater than the following:
				1. Purlins and Rafters: Vertical deflection of [Insert limit in terms of a fraction; 1/x] of the span.
				2. Girts: Horizontal deflection of [Insert limit in terms of a fraction; 1/x] of the span.
				3. Metal Roof Panels: Vertical deflection of [Insert limit in terms of a fraction; 1/x] of the span.
				4. Metal Wall Panels: Horizontal deflection of [Insert limit in terms of a fraction; 1/x] of the span.
				5. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

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Retain subparagraph below with 1 or more of 4 subparagraphs above.

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* + - * 1. Lateral Drift: Maximum of [Insert limit in terms of a fraction; 1/x] of the building height.

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Delete paragraph below if seismic-performance requirements are indicated on Drawings.

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* + 1. Seismic Performance: Metal building system shall be designed, fabricated and erected in accordance with the seismic provisions in IBC Section 2205 that apply to Seismic Design Category D.
		2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, over-stressing 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.

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Differential temperature values in subparagraph below (for aluminum in particular) are suitable for most of the U.S.; revise to suit Project.

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* + - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces [Insert temperature change].

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

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* + 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.
			1. Indicate design designations from UL’s “Fire Resistance Directory” or from the listings of another qualified testing agency.

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

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

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* Standing-Seam Metal Panel Roof Systems (MPRS): ASTM E1592 or FM 4474.
* Through-Fastened MPRS: ASTM E1592, UL 580, or FM 4474.

All 3 of these tests appear in 1 or more of the remaining Paragraphs in this Article (although FM 4474 compliance is “buried/hidden” in FM 4471). With regard to ASTM E1592, per MBMA and AISI, AISI S906 can be used to interpret the results of E1592 testing (i.e., “convert” results into LRFD and/or ASD capacities).” And Project-specific “input (i.e., demand/loading criteria)” isn’t needed since E1592 simply consists of incremental loading to failure.
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* + 1. Structural Performance for Metal Roof [and Wall] Panels: The capacity/strength of metal panel systems shall be based on testing in accordance with ASTM E1592.

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ASTM E1680 in Paragraph below has replaced ASTM E283 for testing metal roof panels; retain option to allow products to be tested according to ASTM E283.

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

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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 1st option in subparagraph below is equivalent to a 25-mph wind and is ASTM E283 default. Products tested to value in 2nd option below, equivalent to a 50-mph wind, are widely available.
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* + - 1. Test-Pressure Difference: [1.57 lbf/sq. ft.] [6.24 lbf/sq. ft.].

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* + 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:

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* + - 1. Test-Pressure Difference: [2.86 lbf/sq. ft.] [6.24 lbf/sq. ft.].

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ASTM E331 in Paragraph below indicates that "water contained within drainage flashings, gutters, and sills is not considered failure."

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Value in 1st option in subparagraph below is equivalent to a 34-mph wind and is ASTM E331 default. Products tested to value in 2nd option below, equivalent to a 50-mph wind, are widely available.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

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Per IBC Ch. 15, UL 580 is a permissible testing alternative for structural lap-seam metal panel roof systems; however, any roof system/assembly that requires a UL rating can be tested.

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

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

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

The 1-90 minimum uplift rating is per ESM Chapter 4 Architectural, Section B – Shell, Roofing subsection; it typically exceeds local roof uplift forces and is an industry standard for commercial roof systems.

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* + - 1. Uplift Rating: FM Class 1-90.
		1. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM 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.

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Retain 1 option in 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-105, Class 1A-135, and higher). Class 1A signifies complying with ASTM E108, Class A fire performance for FM Global-approved, Class 1 panel roofs.

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* + - 1. Fire/Windstorm Classification: Minimum Class 1A-90.
			2. Hail Resistance: SH.
		1. Solar Reflectance: Provide roof panels with Solar Reflectance Index not less than [78] [29] when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.

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Retain 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.

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* + 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.

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Retain Paragraph below as example for roofs that must comply with local "cool-roof" energy legislation; verify requirements with LANL STR. 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](file:///%5C%5Cdcstorage.lanl.gov%5Ces-do%5Cce-prog%20office%5CEngineering%20Standards%5C3.%20Master%20Specs%5CDiv_13%5C13%203419%20Metal%20Buildings%5Cwww.coolroofs.org).

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* + 1. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
			1. Three-year, aged, solar reflectance of not less than [0.55] [Insert value] and emissivity of not less than [0.75] [Insert value].
			2. Three-year, aged, Solar Reflectance Index of not less than [64] [Insertvalue] when calculated according to ASTM E1980.

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ASHRAE/IESNA 90.1 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.

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* + 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:
			1. Roof:
				1. U-Factor: [Insert value].
				2. R-Value: [Insert value].
			2. Wall:
				1. U-Factor: [Insert value].
				2. R-Value: [Insert value].
	1. STRUCTURAL STEEL FRAMING

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

With regard to the option in the 1st Paragraph below (i.e., AISC 341), refer to the author note at the outset of this template.

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* + 1. Structural Steel: Comply with AISC 360 [and AISC 341].
		2. Bolted Connections: Comply with RCSC Spec.
		3. Cold-Formed Steel: Comply with AISI S100 for design requirements and capacities.
		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 lateral-force bracing.
			1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Retain 1st subparagraph below if allowed.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer’s standard, as approved by LANL STR.

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Retain 1 of the first 5 subparagraphs below. “Rigid = Moment,” and “Clear = Single;” thus, for example, a rigid clear-span frame is a single-span moment frame, etc.
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* + - 1. [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.]
			2. [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.]
			3. [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.]
			4. [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.]

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* + - 1. [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.]

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Frame Configuration: [Single gable] [One-directional sloped] [Lean to, with high side connected to and supported by another structure] [Multiple gable] [Load-bearing-wall type] [Multistory].
			2. Exterior Column Type: [Uniform depth] [Tapered].
			3. Rafter Type: [Uniform depth] [Tapered].

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Retain 1st subparagraph below and delete 2nd one if using full-load frames.
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* + - 1. 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.
			2. 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, pre-painted with coil-coating, to comply with the following:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Retain 1 of 2 “Purlins” subparagraph below.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. Depth: [As indicated on Drawings] [As needed to comply with system performance requirements] [Insert dimension].
			1. Purlins: Steel joists of depths indicated.
			2. 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.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. Depth: [As indicated] [As required to comply with system performance requirements] [\_\_\_\_\_\_].
			1. 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.
			2. Flange Bracing: Minimum 2 x 2 x 1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.
			3. Sag Bracing: Minimum 1 x 1 x 1/8-inch structural-steel angles.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Revise 1st subparagraph below if C-shape is required instead of base angles.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Base or Sill Angles: Manufacturer's standard base angle, minimum 3 x 2-inch, fabricated from zinc-coated (galvanized) steel sheet.
			2. Purlin and Girt Clips: Manufacturer’s standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
			3. 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.
			4. 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 1 of 4 options in subparagraph below. 1st option is a continuation of roof at eave; 2nd is a continuation of roof over end wall; 3rd is attached at sidewall or end wall, at or below eave.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Type: [Straight-beam, eave type] [Purlin-extension type] [Tapered-beam, below-eave type] [As indicated].
		1. Lateral-Force Bracing: Lateral forces/horizontal loads not resisted by main-frame action shall be resisted by bracing in the sidewall, endwall, and in the roof. Such bracing shall consist of one or more of the following:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Retain one of the 6 subparagraphs below, or retain more than one if type of bracing is manufacturer’s option.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Rods: ASTM A36, ASTM A572, Grade 50; or ASTM A529, Grade 50; minimum ½-inch-diameter steel, threaded full length or threaded a minimum of 6 inches at each end.
			2. Cable: ASTM A475, minimum ¼-inch-diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded-end anchors.
			3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
			4. 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.
			5. 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.
			6. Diaphragm Action of Metal Panels: Design metal building to resist lateral forces through diaphragm action of metal panels.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain and revise Paragraph below to suit Project.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. Materials:
			1. W-Shapes: ASTM A992; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
			2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A 529, Grade 50 or 55.
			3. Plate and Bar: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.

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Generally, retain 1st 2 subparagraphs below only for interior columns.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Steel Pipe: ASTM A53, Type E or S, Grade B.
			2. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
			3. 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.
			4. Metallic-Coated Steel Sheet: ASTM A653, Structural Steel (SS), Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
			5. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755.
				1. 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.
				2. Aluminum-Zinc Alloy-Coated Steel Sheet; ASTM A792, SS, Grade 50 or 80; with Class AZ50 coating.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain subparagraph below if joist girders are required for primary framing.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Joist Girders: Manufactured according to SJI STD SPEC; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for primary framing.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1st subparagraph below if joists are required for rafters or purlins.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Steel Joists: Manufactured according to SJI STD SPEC; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for secondary framing.
			2. 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.
				1. Finish: [Plain] [Hot-dip zinc coating, ASTM F2329, Class C] [Mechanically-deposited zinc coating, ASTM B695, Class 50].
			3. Structural Bolts, Nuts, and Washers: ASTM F3125, Type 1, heavy-hex steel structural bolts; ASTM A563 heavy-hex carbon steel nuts; and ASTM F436 hardened carbon-steel washers.
				1. Finish: [Plain] [Hot-dip zinc coating, ASTM F2329, Class C] [Mechanically-deposited zinc coating, ASTM B695, Class 50].

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain option in subparagraph below if applicable. Indicate locations if using bolts below for some connections and ASTM F3125 bolts in subparagraph above for others.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain subparagraph below if required. Tension-control (twist-off) bolt assemblies correspond to strength of ASTM F3125 bolts.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Type 1, heavy-hex-head steel structural bolts with spline ends.
				1. 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 the two Anchor-Rod subparagraphs 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.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Unheaded Anchor Rods: [ASTM F1554, Grade 36]; [ASTM A572, Grade 50] [ASTM A36] [ASTM A307, Grade A].
				1. Configuration: Straight.
				2. Nuts: ASTM A563 heavy-hex carbon steel.
				3. Plate Washers: ASTM A36 carbon steel.
				4. Washers: ASTM F436 hardened carbon steel.
				5. Finish: [Plain] [Hot-dip zinc coating, ASTM F2329, Class C] [Mechanically-deposited zinc coating, ASTM B695, Class 50].
			2. Headed Anchor Rods: [ASTM F1554, Grade 36] [or ASTM A307, Grade A].
				1. Configuration: Straight.
				2. Nuts: ASTM A563 heavy-hex carbon steel.
				3. Plate Washers: ASTM A36 carbon steel.
				4. Washers: ASTM F 436 hardened carbon steel.
				5. Finish; [Plain] [Hot-dip zinc coating, ASTM F2329, Class C] [Mechanically-deposited zinc coating, ASTM B695, Class 50].
			3. Threaded Rods: [ASTM A36] [ASTM A193] [ASTM A572, Grade 50].
				1. Nuts: ASTM A563 [heavy-] hex carbon steel.
				2. Washers: [ASTM F436 hardened] [ASTM A36] carbon steel.
				3. 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.
			1. Clean and prepare in accordance with SSPC-SP2.
			2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
				1. 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

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This Article includes examples of standard metal roof panels offered by manufacturers. Revise or add other types of panels as required.

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 thickness.

Retain 1 of the 3 panel-type-callouts 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 subparagraph below correspond to obsolete 26, 24, and 22 gages, respectively.

The 1-90 minimum uplift rating in “6” below is per ESM Chapter 4 Architectural, Section B – Shell, Roofing subsection.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
		1. Exterior Finish: [Two-coat Fluoropolymer] [Three-coat Fluoropolymer] [Siliconized polyester].
		2. Color: [As indicated by manufacturer's designations] [As selected by EOR from manufacturer's full range] [\_\_\_\_\_\_\_]
			1. Clips: [One-piece fixed] [Two-piece floating] to accommodate thermal movement.
			2. Joint Type: [Panels snapped together] [Mechanically seamed].
			3. Panel Coverage: [16 inches] [Insert dimension].
			4. Panel Height: [2 inches] [Insert dimension].
			5. Uplift Rating: Minimum FM Class 1-90.
		3. 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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

The 1-90 minimum uplift rating in “6” below is per ESM Chapter 4 Architectural, Section B – Shell, Roofing subsection.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Two-coat Fluoropolymer] [Three-coat Fluoropolymer] [Siliconized polyester]
				2. Color: [As indicated by manufacturer's designations] [As selected by EOR from manufacturer's full range] [Insert color].
			2. Clips: [One-piece fixed] [Two-piece floating] to accommodate thermal movement.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain one of first two subparagraphs below.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Joint Type: [Panels snapped together] [Mechanically seamed].
			2. Panel Coverage: [24 inches] [Insert dimension].
			3. Panel Height: [3 inches] [Insert dimension].
			4. Uplift Rating: Minimum FM Class 1-90.
		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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.

The 1-90 minimum uplift rating in “5” below is per ESM Chapter 4 Architectural, Section B – Shell, Roofing subsection.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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 A 755.
				1. Exterior Finish: [Two-coat Fluoropolymer] [Three-coat Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Major-Rib Spacing: [6 inches] [12 inches] Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. Panel Height: [0.75 inches] [1.125 inches] [1.188 inches] [1.25 inches] [1.5 inches] [Insert dimension]
			5. Uplift Rating: Minimum FM Class 1-90.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 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 subparagraphs below correspond to obsolete 26, 24, and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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 A 755.
				1. Exterior Finish: [Two-coat Fluoropolymer] [Three-coat Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color]
			2. Major-Rib Spacing: [6 inches] [12 inches] [Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. Panel Height: [1.25 inches] [1.5 inches] [Insert dimension].
		1. Finishes:
			1. Exposed Coil-Coated Finish:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1 of the 3 subparagraphs below or add other finish to suit Project.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. 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.
				2. 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.
				3. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Finish in subparagraph below is frequently used as a factory finish for interior surfaces.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

This article includes examples of standard metal wall panels offered by manufacturers. Revise or add other types of panels as required.

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.

Retain 1 of the 1st 3 paragraphs 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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Two-coat Fluoropolymer] [Three-coat Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Major-Rib Spacing: [6 inches] [12 inches] [Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. 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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Major-Rib Spacing: [12 inches] [Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. 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 subparagraph below correspond to obsolete 24 and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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.
				1. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color]
			2. Panel coverage: [16 inches] [Insert dimension].
			3. Panel Height: [3 inches] [Insert dimension].

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1 of next 2 Paragraphs 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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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.
				1. Exterior Finish: [Siliconized polyester] [Acrylic enamel].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Major-Rib Spacing: [6 inches] [12 inches] [Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. 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 1st subparagraph below correspond to obsolete 24 and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Siliconized polyester] [Polyester] [Acrylic enamel].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1st subparagraph below if required.
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* + - 1. Sound Absorption: NRC not less than [0.65] [0.85] [1.00] [Insert value] when tested according to ASTM C423.
			2. Panel Coverage: [12 inches] [Insert dimension].
			3. Panel Height: [1.5 inches] [Insert dimension].
		1. Finishes:
			1. Exposed Coil-Coated Finish:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1 of next 3 subparagraphs below, or add other finishes to suit Project.

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* + - * 1. 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.
				2. 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.
				3. 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 subparagraph below is frequently used as a factory finish for interior surfaces.
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* + - 1. 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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* This Article includes examples of’ standard foamed-insulation-core metal wall panels offered by manufacturers. Revise or add other types of panels as required.

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.
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* + 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
			1. Panel Thermal- Resistance Value (R-Value): [Insert R value].

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Metal thickness options in subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.
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* + - 1. 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. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Surface: [Smooth, flat] [Striated] [Shallow ribs] [Shallow V grooves].
				2. Exterior Finish: [Two-coat fluoropolymer] [Three-coat fluoropolymer] [Siliconized polyester].
				3. Color: [As indicated by manufacturer's designations] [As selected by EOR from manufacturer's full range] [Insert color].
			2. Panel Coverage: [36 inches] [42 inches] [Insert dimension] nominal.
			3. Panel Thickness: [2 inches] [2.5 inches] [3 inches] [4 inches] [5 inches] [6 inches] [Insert dimension].
			4. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type.
				1. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
				2. Density: 2.0 to 2.6 lb/cu.ft. when tested according to ASTM D1622.
				3. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
				4. Shear Strength: 26 psi when tested according to ASTM C273.
				5. Fire-Test-Response Characteristics: Class A according to ASTM E108.
				6. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.
		1. Finishes:
			1. Exposed Coil-Coated Finish:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Retain 1 of next 3 subparagraphs below.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. 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 manufacturer’s written instructions.
				2. 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 manufacturer’s written instructions.
				3. 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 subparagraph below is frequently used as a factory finish for interior surfaces.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. 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. TRANSLUCENT PANELS

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1 of 1st 2 Paragraphs below. “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 1st two subparagraphs below.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Roof Panel Weight: Not less than 8 oz./sq.ft.
			2. Wall Panel Weight: Not less than 6 oz./sq.ft.
			3. Light Transmittance: Not less than [55] [Insert number] percent according to ASTM D1494.
			4. Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.
			5. 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 1st two subparagraphs below.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Exterior Panel Weight: Not less than [8 oz./sq.ft.] [6 oz./sq.ft.]
			2. Interior Panel Weight: Not less than [8 oz./sq.ft.] [6 oz./sq.ft.] [4 oz./sq.ft.]
			3. Light Transmittance: Not less than [42] [Insert number] percent according to ASTM D1494.
			4. Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.
			5. Color: [White] [Insert color].
		1. Mastic for Translucent Panels: Non-staining, saturated vinyl polymer as recommended by translucent panel manufacturer for sealing laps.
		2. Performance:
			1. 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.
				1. Flame-Spread Index: 25 or less.
				2. Smoke-Developed Index: 450 or less.
	1. METAL SOFFIT PANELS

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* This Article includes examples of standard soffit panels offered by metal building system manufacturers. Revise or add other types of panels as required.

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.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Retain Paragraph above or 1 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 subparagraph below correspond to obsolete 26, 24, and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Two-coat Fluoropolymer] {Three-coat fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Major-Rib Spacing: [6 inches] [12 inches] [Insert dimension] o.c.
			3. Panel Coverage: [36 inches] [Insert dimension].
			4. 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 subparagraph below correspond to obsolete 24 and 22 gage, respectively.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch] [0.030-inch] nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A755.
				1. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
				2. Color: [As indicated by manufacturer’s designations] [As selected by EOR from manufacturer’s full range] [Insert color].
			2. Panel Coverage: [12 inches] [16 inches] [Insert dimension].
			3. Panel Height: [1 inch] [1.5 inches] [Insert dimension].
	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.
	1. 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.
2. 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.
	1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. Clips: Manufacturer’s standard, formed from [steel] [stainless-steel] sheet, designed to withstand negative-load (uplift) requirements.
	2. Cleats: Manufacturer’s standard, mechanically seamed cleats formed from [steel] [stainless-steel sheet or nylon-coated aluminum] sheet.
	3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
	4. 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 pre-molded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain subparagraph below if thermal bridging is a concern.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. 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.
	1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
	2. 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, pre-painted with coil coating; finished to match adjacent metal panels.
	1. 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.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch] [0.030-inch] nominal uncoated steel thickness, pre-painted 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, pre-painted 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.”
	1. Gutter Supports: Fabricated from same material and finish as gutters.
	2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
2. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, pre-painted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
	1. Mounting Straps: Fabricated from same material and finish as gutters.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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.

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* 1. 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.
		1. Type: [Directional] [Stationary] revolving.
		2. Bird Screening: Galvanized steel, ½-inch square mesh, 0.041-inch wire; or aluminum, ½-inch-square mesh, 0.063-inch wire.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches of floor.
		2. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
		3. 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.
	1. 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, pre-painted 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.
		1. Bird Screening: Galvanized steel, ½-inch-square mesh, 0.041-inch wire; or aluminum, ½- inch-square mesh, 0.063-inch wire.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain subparagraph below if dampers required.
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. 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.
		2. Throat Size: [9 inches] [or] [12 inches], [as standard with manufacturer, and as required to comply with ventilation requirements].

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain Paragraph below if louvers are required. 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.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* 1. Blades: Fixed.
	2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
	3. Free Area: Not less than [7.0 sq. ft.] [Insert dimension] for 48-inch-wide by 48-inch-high louver.
	4. Bird Screening: Galvanized steel, ½-inch-square mesh, 0.041-inch wire; with re-wireable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* In subparagraph below, interior mounting is for interior face of fixed louvers; exterior mounting is for exterior or interior face of adjustable louvers.
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* + 1. Mounting: [Interior] [Exterior] face of louvers.
	1. Vertical Mullions: Provide mullions at spacing recommended by manufacturer, or 72 inches o.c., whichever is less.

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1. Pipe Flashing: Pre-molded, EPDM pipe collar with flexible aluminum ring bonded to base.
2. Materials:
	1. 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 1 of next 2 subparagraphs below. Stainless-steel fasteners in 2nd subparagraph provide additional corrosion resistance. Retain washers if required; washers are usually omitted from wall panels.
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* + 1. 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].
		2. 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].
		3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
		4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
	1. 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.
	2. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
	3. Metal Panel Sealants:
		1. Sealant Type: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape of manufacturer’s standard size.
		2. 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.
	4. FABRICATION
1. General: Design components and field connections required for erection to permit easy assembly.
	1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
	2. 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.
2. Tolerances: Comply with MBMA’s "Metal Building Systems Manual" for fabrication and erection tolerances.
3. 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.
	1. Make shop connections by welding or by using high-strength bolts.
	2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
	3. 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.
	4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
	5. Shop Priming: Prepare surfaces for shop priming according to SSPC SP-2. Shop prime primary framing with specified primer after fabrication.
4. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming to 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.
	1. Make shop connections by welding or by using non-high-strength bolts.
	2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC SP-2. Shop prime uncoated secondary framing with specified primer after fabrication.
5. 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.
	1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.
	2. SOURCE QUALITY CONTROL

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The content of this Article is based on non-use of Seismic Force-Resisting System consisting of intermediate or special moment frames that have material to be welded > 5/16”.
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1. Fabricator is responsible for the performance of the inspections and tests required by the fabricator’s quality control procedures, and for the submission of related reports.
2. Reports shall indicate whether or not fabrication of structural steel members and connections between them are in accordance with MBMA MBSM and, as applicable, ASIC 360 and AISC 341.
3. Products not fabricated in accordance with the aforementioned documents, as applicable, will be considered defective.
4. 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.
			1. Engage land surveyor to perform surveying.
		3. Proceed with erection only after unsatisfactory conditions have been corrected.
	2. 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.
	3. 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 360 and, as applicable, AISC 341. Maintain structural stability of frame during erection.

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* + 1. Base and Bearing Plates: Clean concrete- ad masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
			1. Set plates for structural members on wedges, shims, or setting nuts as required.
			2. 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.
			3. 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.
		2. 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.
			1. Level and plumb individual members of structure.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Revise subparagraph below to suit Project. Delete if not required.
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* + - 1. 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 rods. 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.
			1. Make field connections using high-strength bolts installed according to RCSC SPEC for bolt type and joint type specified.

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* + - * 1. Joint Type: Snug tightened, pre-tensioned, or slip-critical 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.
			1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
			2. Locate and space wall girts to suit openings such as doors and windows.
			3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

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* + 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 STD SPEC, joist manufacturer’s written instructions, and requirements in this Section.
			1. Before installation, splice joists delivered to Project site in more than one piece.
			2. Space, adjust, and align joists accurately in location before permanently fastening.
			3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Retain 1 of next 3 subparagraphs.
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* + - 1. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
			2. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC SPEC for high-strength structural bold installation and tightening requirements.
			3. Joist Installation: Weld joist seats to supporting steel framework.
			4. 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:
			1. Tighten rod and cable bracing to avoid sag.
			2. Locate interior end-bay bracing only where indicated.
		2. 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.
		3. Erection Tolerances: Maintain erection tolerances of structural framing within those permitted by 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 Paragraph below to permit use of on-site, portable roll-forming equipment.
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* + 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.
			1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
		3. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
			1. 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.
				1. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
			2. Install metal panels perpendicular to structural supports unless otherwise indicated.
			3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
			4. Locate and space fastenings in uniform vertical and horizontal alignment.
			5. Locate metal panel splices over structural supports with end laps in alignment.
			6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
		4. Lap-Seam Metal Wall 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.
			1. 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.
		5. 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.
		6. 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.
			1. 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.

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* + - 1. [Prepare joints and apply sealants to comply with requirements per Section 07 9200, *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.
			1. Install ridge [and hip] caps as metal roof panel work proceeds.
			2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
		2. 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.
			1. Install clips to supports with self-drilling or self-tapping fasteners.
			2. Install pressure plates at locations indicated in manufacturer’s written installation instructions.

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* + - 1. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
			2. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
			3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
			4. Provide metal closures at [peaks] [rake edges] [rake walls] [and] each side of ridge [and hip] caps.
		1. Exposed Fastener 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.
			1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
			2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
			3. 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.
			4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
		2. 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.

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Generally retain paragraph below only for highly finished metal roof panel assemblies.

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* + 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 as indicated 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.
			1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
			2. Shim or otherwise plumb substrates receiving metal wall panels.
			3. When two rows of metal panels are required, lap panels 4 inches minimum.
			4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
			5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
			6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
			7. Install screw fasteners in predrilled holes.
			8. Install flashing and trim as metal wall panel work proceeds.
			9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
			10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling of self-tapping screws.
			11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
		2. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
		3. 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.
			1. Install clips to supports with self-tapping fasteners.
			2. 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.

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* + 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.
			1. 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.
			2. 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.
			3. Align horizontal laps with adjacent metal panels.
			4. Seal intermediate end laps and side laps of translucent panels with translucent mastic.
	2. METAL SOFFIT PANEL INSTALLATION
		1. Provide metal soffit panels of 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.
	3. THERMAL INSULATION INSTALLATION

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Retain this Article if insulation is required; delete if using only factory-assembled, insulated metal panels. Other insulation options are found in specification section 07 2100 *Thermal Insulation.*

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

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* + - 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
			2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.

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* + - 1. 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.
			2. 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:

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* + - 1. 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.

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

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* + - 1. 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 cross bands below insulation.

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Thermal spacer blocks in next 2 subparagraphs 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.

1st subparagraph below accommodates thicker insulation with compression occurring at structure.

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* + - 1. 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.
				1. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

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Subparagraph below accommodates thicker insulation with no compression.

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* + - 1. 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 cross bands below insulation.
				1. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
			2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

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Retain 1 of 2 Paragraphs below for walls.

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* + 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.
			1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
			2. 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.
		2. 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.
			1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
	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.
			1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seams covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
			2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
			3. Where dissimilar metals contact surfaces 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.
		2. Flashing and Trim: Comply with performance requirements, manufacturer’s written installation instructions, and SMACNA’s “Architectural Sheet Metal Manual.” Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
			1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
			2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
		3. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach to eave with 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.
		4. 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.
			1. Apply bituminous paint on surfaces in contact with cementitious materials.

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* + - 1. Provide elbows at base of downspouts to direct water away from building.
				1. Install splash [pans] [pads] [\_\_\_\_\_\_\_\_] under each downspout.
			2. 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.
		3. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
			1. 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.
			2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
			3. 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 contact with concrete, masonry, or dissimilar metals.
			4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 9200*, Joint Sealants* for sealants applied during louver installation.
		4. Roof Curbs: Install curbs at locations indicated. Install flashing around bases where they meet metal roof panels.
		5. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
	1. FIELD QUALITY CONTROL
		1. Erector’s QCI: Perform the field tests and inspections required by the erector’s quality control (QC) procedures.
			1. Provide QCI with access to places where structural-steel Work is being erected to perform tests and inspections.
		2. The QCI shall inspect the following as a minimum, as applicable:
			1. Field welding, high-strength bolting, and details in accordance with AISC 360 Section N5, except paragraph N5.5.
			2. Steel deck and headed steel stud anchor placement and attachment in accordance with AISC 360 Section N6.
			3. Field-cut surfaces in accordance with AISC 360 Section M2.2.
			4. Tolerances for field erection in accordance with AISC 303 paragraph 7.13.

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* 1. [SEISMIC FORCE-RESISTING SYSTEM FIELD QC
		1. Inspection tasks and documentation for QC for the SFRS shall be as provided in the tables in AISC 341 Sections J6 – J9. NDT of welded joints (paragraph J6.2) is excluded.]
	2. ADJUSTING

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Doors are specified in Section 08 1100, *Wood Doors* and/or 08 1400, *Metal Doors and Frames* and/or 08 3323, *Overhead Coiling Doors*.

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* + 1. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

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* + 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.

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 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.]
		2. [[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.
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* + - 1. [Adjust louver blades to be weathertight when in closed position.]
	1. CLEANING AND PROTECTION

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Retain next Paragraph below if galvanized items are required.

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* + 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.

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Retain 1 of next 2 paragraphs.

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* + 1. Touchup Painting: After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing [, bearing plates,] and accessories.
			1. Clean and prepare surfaces by SSPC SP 2 or SP 3.
			2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
		2. Touchup Painting: Cleaning and touchup painting are specified in Section 09 9100*, Painting*.
		3. 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.
			1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
		4. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
			1. Immediately before final inspection, remove protective wrappings from doors and frames.
		5. [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.]
		6. [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.
			1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by EOR, remove damaged units and replace with new units.
				1. 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

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Do not delete the following reference information:

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification Section 13 3419 Rev. 6, dated April 30, 2021.