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Standard Specification for Metal Canopy Systems[1]

This standard is issued under the fixed designation E2950; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification includes the following:
1.1.1 Structural framing,
1.1.2 Canopy Deck System,
1.1.3 Drainage system,
1.1.4 Fascia panels,
1.1.5 Accessories and trim, and
1.1.6 Canopy concrete foundations and accessories.

1.2 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
A36/A36M Specification for Carbon Structural Steel
A325/A325M Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A500/A500M Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A775/A775M Specification for Epoxy-Coated Steel Reinforcing Bars
A992/A992M Specification for Structural Steel Shapes
A1011/A1011M Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
C1107/C1107M Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
F1554 Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

2.2 *ACI Standard:*[3]
ACI 318 Building Code Requirements for Structural Concrete and Commentary

2.3 *AISC Standard:*[4]
AISC 303 Code of Standard Practice for Steel Buildings and Bridges

2.4 *ASCE Standard:*[5]
ASCE 7 Minimum Design Loads for Buildings and Other Structures

2.5 *AWS Standard:*[6]
AWS D1.1 Structural Welding Codes

2.6 *ICC Standard:*[7]
International Building Code

2.7 *SSPC Standards:*[8]
SSPC-PA1 Paint Application No. 1
SSPC-SP2 Hand Tool Cleaning
SSPC-SP3 Power Tool Cleaning

[1] This specification is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.05 on Building and Infrastructure Protection.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, http://www.concrete.org.

[4] Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 700, Chicago, IL 60601-2001, http://www.aisc.org.

[5] Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, http://www.asce.org.

[6] Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, http://www.aws.org.

[7] Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, http://www.iccsafe.org.

[8] Available from Society for Protective Coatings (SSPC), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, http://www.sspc.org.

2.8 *Federal Standard:*[9]

29 CFR Part 1926 Subpart R Safety and Health Regulations for Construction, Steel Erection

3. General Requirements

3.1 *System Performance Requirements:*

3.1.1 *General*—Provide a complete pre-engineered metal canopy system, manufacturer's standard mutually dependent components, and assemblies that form a pre-engineered overhead canopy system to enhance safety and security. The pre-engineered overhead canopy system shall be capable of withstanding required design loads per the International Building Code (IBC) as adopted or modified by local jurisdictions, thermally induced movement, and exposure to weather without failure. Primary structural frame design to include fixed-base columns capable of transferring moments and forces into foundations and will include roof purlins, main frame beams, and tube columns, plus secondary framing, canopy deck and fascia panels, and accessories complying with requirements indicated, including those in this specification. Provide the design for concrete foundations to be installed by the general contractor.

3.1.2 *Pre-Engineered Metal Canopy System Design:*

3.1.2.1 Column layout, clearance, and fascia profile per project specifications.

3.1.2.2 *Primary Structural Frame*—Design with fixed-base columns capable of transferring moments and forces into foundations. Options include rigid frames and cantilevered column design. Primary framing includes roof purlins, main frame beams, and tube columns. Design loads per applicable building code requirements.

3.1.2.3 Secondary framing per manufacturer's standard details as required per specifications and required design loads.

3.1.2.4 Metal canopy deck system per manufacturer's standard interlocking load-bearing deck panels.

3.1.2.5 Provide primary and secondary drainage per building code requirements.

3.1.2.6 Anchor rod design per ACI 318, Appendix D, latest edition.

3.1.2.7 Concrete foundation designed for fixed-base column loads. Constrained or nonconstrained pier design to resist lateral loads per IBC is considered acceptable. Alternate foundation designs are considered acceptable but may require specialty engineering design. Alternate foundation design shall still be designed to support fixed-base column loads.

3.1.3 *Structural Performance*—Provide pre-engineered metal canopy system capable of withstanding the effects of gravity loads and the following loads. Loads or stress levels, or both, shall meet required specification allowable levels.

3.1.3.1 *Design Loads (Live, Wind, Snow, Rain, and Seismic Load)*—Per IBC, latest edition, and ASCE 7.

3.1.3.2 Load combinations as specified per IBC and ASCE 7. Use of either allowable stress design or strength design is permitted as allowed by appropriate material specifications.

3.1.3.3 *Deflection Limits*—Per IBC deflection criteria. American Institute of Steel Construction (AISC) ponding criteria shall also be met.

3.2 *Submittals:*

3.2.1 *Product Data*—Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal canopy system components:

3.2.1.1 Structural-framing system.

3.2.1.2 Canopy deck panels.

3.2.1.3 Fascia panels.

3.2.1.4 Drainage system.

3.2.2 *Shop Drawings*—For the following overhead canopy system components, include plans, elevations, sections, and details.

3.2.2.1 For installed components indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

3.2.2.2 *Anchor-Rods Plans*—Include location, diameter, and projection of anchor rods required to attach metal canopy to foundation.

3.2.2.3 *Structural-Framing Drawings*—Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross sections. Supply:

(1) Name and location of project;

(2) Name of manufacturer;

(3) Overhead canopy dimensions including width, length, and clear height;

(4) Indicate compliance with AISC standards for hot-rolled steel and American Iron and Steel Institute (AISI) standards for cold-rolled steel, including edition dates of each standard;

(5) Governing building code and year of edition;

(6) Design Loads—Include dead load, roof live load, roof snow load, wind loads/speeds, and exposure and seismic design category.

(7) Building-Use Category—Indicate category of building use and its effect on load importance factors.

3.2.2.4 *Canopy Deck Layout Drawings*—Show layouts of load-bearing deck panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.

3.2.2.5 Concrete footing details.

3.2.3 *Samples for Initial Selection*—Manufacturer's color charts showing the full range of colors available for each type of the following products with factory applied color finishes.

3.2.3.1 Canopy deck panels, and

3.2.3.2 Fascia panels.

3.2.4 *Product Certificates*—Submit product certificates signed by the manufacturer certifying material compliance with specified performance characteristics and criteria and physical requirements.

3.2.5 *Qualification Data*—Firms and persons specified in Supplementary Requirement S1 should demonstrate their capabilities and experience. Include lists of completed projects

[9] Available from the U.S. Government Printing Office, Superintendent of Documents, 732 N. Capital St., NW, Washington DC 20402-0001.

with project names and addresses, names, and addresses of architects and owners and other information specified.

3.2.6 *Warranties*—Special warranties specified in this section.

3.3 *Delivery, Storage, and Handling:*

3.3.1 Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package deck and wall panels to protect them during transportation and handling.

3.3.2 *Handling*—Unload, store, and erect deck and wall panels to prevent bending, warping, twisting, and surface damage.

3.3.3 Stack materials on platforms or pallets covered with tarpaulins or other suitable weather tight and ventilated covering. Store deck and wall panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

3.3.4 Protect components and accessories from corrosion, deformation, damage, and deterioration when stored at the job site. Keep materials free from dirt and foreign matter.

3.4 *Project Conditions:*

3.4.1 *Weather Limitations*—Proceed with installation only when weather conditions permit deck and fascia panel installation to be performed according to manufacturer's written instructions and warranty requirements.

3.4.2 *Field Measurements*—The contractor shall verify locations and elevations of footings relative to finished grade, columns, and other construction contiguous with pre-engineered metal canopies. Verification should be performed by using field measurements as indicated on the drawing before fabrication.

3.4.2.1 *Established Dimensions*—Contractor is responsible to coordinate footer locations and elevations with any interferences with or attachments to abutting structures.

3.5 *Coordination:*

3.5.1 The contractor will install and coordinate size and location of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements shall be as per manufacturer's recommended drawings.

3.5.1.1 *Nonmetallic, Shrinkage-Resistant Grout*—Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with Specification C1107/C1107M, of consistency suitable for application, and with a 30-min working time. Shrinkage-resistant grout to be provided and installed by the general contractor.

3.5.2 *Site Condition*—Shall meet manufacturer's required job site conditions for installation.

3.5.2.1 Anchor rods shall be installed plumb and with minimum exposed thread and embedment per erection drawings. Footings need to be free of debris and anchor bolt threads undamaged.

3.5.2.2 All work surfaces shall be backfilled and level without open holes or piles of backfill.

3.5.3 *Work Area*—A work area shall be required extending 10 ft (3 m) beyond the canopy in all directions to the extent practical. The work area shall be flat, comprised of hard-packed soil, gravel, asphalt, or concrete. The work area shall be free of open excavations, debris, and construction equipment.

3.5.3.1 An additional flat workspace of 25 by 25 ft (7.6 by 7.6 m) or as practical shall be provided adjacent to the canopy for unloading and storing materials.

3.5.3.2 Site to meet Occupational Safety and Health Administration (OSHA) guidelines to allow lift equipment and scaffolding to maneuver the work area.

3.5.3.3 Special Inspections, if required, are the responsibility of the owner to provide and pay for, and the General Contractor to execute as the owner's representative.

3.5.3.4 The general contractor to provide dumpster for debris.

3.6 *Warranty:*

3.6.1 *General Warranty*—Special warranties specified in this specification shall not deprive the owner of other rights. The owner may have, under other provisions of the contract documents, and shall be in addition to, and run concurrent with, other warranties made by the contractor under requirements of the contract documents.

3.6.1.1 *Warranty Period*—One year from date of substantial completion.

3.6.2 *Special Warranty on Panels*—Written warranty executed by the manufacturer agreeing to repair or replace the deck and fascia panels that fail in materials or workmanship within a specified warranty period.

3.6.2.1 *Warranty Period*—One year from date of substantial completion.

3.6.3 *Special Warranty on Deck Panel Finishes*—Written warranty signed by the manufacturer agreeing to repair, finish, or replace metal panels that show evidence of deterioration of factory applied finishes within a specified warranty period. Deterioration of finish includes, but is not limited to, color-fade, chalking, cracking, peeling, and loss of film integrity.

3.6.3.1 *Warranty Period for Deck Panels*—Ten years from date of substantial completion.

4. Products

4.1 *Manufacturers:*

4.1.1 *Available Manufacturers*—Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work shall have ten years experience.

4.2 *Materials:*

4.2.1 *Structural Framing Materials:*

4.2.1.1 *Structural-Steel Shapes*—Specification A992/A992M structural steel shapes 50-ksi (345-kPa) minimum yield strength.

4.2.1.2 *Steel Plate, Bar, or Strip*—Specification A36/A36M 36-ksi (248-kPa) minimum yield strength.

4.2.1.3 *Structural Square HSS Tube Steel*—Specification A500/A500M Grade B 46-ksi (317-kPa) minimum yield strength.

4.2.1.4 *Structural Round HSS Tube Steel*—Specification A500/A500M Grade B 42-ksi (290-kPa) minimum yield strength.

4.2.1.5 *High-Strength Bolt Assemblies*—Specification A325/A325M, Type 1.

(1) Finish—Uncoated.

4.2.1.6 *Anchor Rod Assemblies*—Specification F1554, Grade 36.

(1) Finish—Uncoated.

4.2.2 *Sheet Metal:*

4.2.2.1 *Metallic-Coated Steel Sheet Prepainted with Coil Coating*—Steel sheet metallic coated by the hot dip process and prepainted by the coil-coating process to comply with Specification A775/A775M and the following requirements:

(1) Zinc-Coated (Galvanized) Steel Sheet—Specification A653/A653M, Grade 40, with G60 (Z180) coating designation.

(2) Zinc-Coated (Galvanized Steel Sheet—Specification A1011/A1011M, Grade 50, with G60 coating designation.

4.3 *Fabrication:*

4.3.1 *General*—Design components and field connections required for erection to permit easy assembly and disassembly.

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

4.3.1.2 Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

4.3.2 *Primary Framing*—Shop-fabricate framing components to indicated size and section with base plates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

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

4.3.2.2 Brace compression flange of primary framing by angles connected between frame web and purlin, so flange compressive strength is within allowable limits for any combination of loadings.

4.3.2.3 *Primers*—As selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, and capability to provide a sound foundation for field applied topcoats as follows:

(1) Primer—Manufacturer's standard, lead- and chromate-free, high solids modified alkyd, rust-inhibiting primer.

4.3.2.4 *Shop Priming*—Prepare surfaces for shop priming according to SSPC-SP2. Shop prime primary structural members with specified primer after fabrication as per SSPC-PA1.

4.3.3 *Secondary Framing*—Shop-fabricate framing components to indicated size and section by roll forming or break forming, with base plates, 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.

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

4.4 *Structural Framing*—Canopy structural framing to consist of wide flange roof purlins, HSS tube, or structural "C" or "Z" roof purlins hung from (or stacked above) wide flange main framing beams. Main framing beams to be supported by HSS columns (square, rectangular, or round). Provide bracing as required. All field connections to be designed as bolted connections unless specified otherwise on drawings.

4.5 *Deck Panels:*

4.5.1 Load-bearing smooth or embossed galvanized or galvannealed steel panels as per Specification A653/A653M, 20 gauge by 16 in. (40.6 cm) wide by 3 in. (7.6 cm).

4.5.2 *Roof Panel Accessories*—Provide components required for a complete deck panel assembly including trim, copings, corner units, clips, seam covers, battens, flashings, gutters, sealants, fillers, closure strips, and similar items. Match materials and finishes of deck panels, unless otherwise indicated.

4.5.3 Deck panels shall have a finish side coated with a full coat of polyester paint baked on over a polyester primer. The reverse side shall be protected by a whitewash coat baked on over a polyester primer.

4.5.4 *Deck Panels*—Fasten deck panels to purlins with a clip system that requires no "thru panel" fasteners.

4.5.4.1 "Deck clips" shall be tested and rated to meet the most critical effects of load factors and load combinations.

4.6 *Drainage:*

4.6.1 Smooth or embossed gutter.

4.6.2 *Drainage Accessories*—Provide components required for a complete drainage assembly including flashings, horizontal leads, vertical leads, secondary drainage, sealants, fillers, closure strips, and similar items. Match materials and finishes of roof panels, unless otherwise indicated.

4.7 *Fascia Panels:*

4.7.1 Aluminum composite material (ACM).

4.7.1.1 Per manufacturer's specification.

4.7.2 *Other Materials*—Various custom fascia to meet design requirements such as architectural shingles, exterior insulation and finish system (EIFS), standing seam, or laminated panels. If custom design is a full hip or gable roof over canopy deck, design must include canopy deck access penetration for future canopy maintenance or installation, or both, of future appurtenances.

5. Execution

5.1 *Erection of Structural Steel:*

5.1.1 Erect metal canopy system according to manufacturer's written instructions and erection drawings. Steel erection shall be performed in conformance with OSHA 29 CFR Part 1926, Subpart R.

5.1.2 Do not field cut, drill, or alter structural members without written approval from pre-engineered metal canopy system manufacturer's professional engineer.

5.1.3 Set structural framing in locations and to elevations indicated and according to AISC specifications referenced in 2.3. Maintain structural stability of frame during erection.

5.1.4 *Base Plates and Bearing Plates*—Clean concrete bearing surfaces of bond-reducing materials and roughen surfaces before setting base plates and bearing plates. Clean bottom surface of base plates and bearing plates.

5.1.4.1 Set base plates and bearing plates for structural members on setting nuts.