READ THIS FIRST

Notice to the Design Engineer, please refer to the Port of Seattle, Facilities and Infrastructure standards for reference before editing this specification.

This Project Spec Document may need additional modifications to suit your project. It is recommended that you proofread each section, paying attention to any “Notes” boxes such as this one--you should remove these “Notes” sections as you go. Also, do a search for all bracket characters “ [ ] “ as they are used to show you areas containing options or project specific details (you can use Microsoft Word’s Find feature {Ctrl-F} to jump to an open bracket “ [ “ character quickly). Again, these bracket characters should be removed.

It is important that every paragraph be numbered to allow for easy referencing. If you use the document’s built in styles and formatting your outline should be fine (turn on the formatting toolbar by going to View > Toolbars > Formatting). Most paragraphs will use the style “Numbered Material” and can be promoted (Shift) or demoted (Shift-Tab).

You should not have to manually enter extra spaces, carriage returns or outline characters such as A, B, C, or 1.01, 1.02; the formatting will do this for you. The entire document is 11 pt. Arial. If you paste items in, you may need to reapply the “Numbered Material” format.

1. GENERAL
   1. SUMMARY OF WORK
      1. The extent and location of “Hangers and Supports for Electrical Systems” Work is shown in the Contract Documents. This Section includes the following:
         1. Hangers and supports for electrical equipment and systems.
         2. Construction requirements for concrete bases.
      2. Definitions
         1. EMT: Electrical metallic tubing.
         2. IMC: Intermediate metal conduit.
         3. RMC: Rigid metal conduit.
   2. GOVERNING CODES, STANDARDS, AND REFERENCES

List reference standards that are included within the text of this section. Edit the following as required for Project conditions.

* + 1. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
       1. ASTM (American Society for Testing and Materials)
          1. ASTM A36/A36M – Carbon Structural Steel
          2. ASTM A780 – Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
          3. ASTM A1011/A1011M – Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
          4. ASTM F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
       2. AWS (American Welding Society)
          1. AWS D1.1/D1.1M – Structural Welding Code – Steel
       3. MSS (Manufacturers Standardization Society of the Valve and Fittings Industry)
          1. MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation
       4. MFMA (Metal Framing Manufacturers Association)
          1. MFMA-4 Metal Framing Standards Publication
       5. NECA (National Electrical Contractors Association)
          1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction
          2. NECA 101 – Standard for Installing Steel Conduits (Rigid, IMC, EMT)
       6. NFPA (National Fire Protection Association)
          1. NFPA 70 (National Fire Protection Association) – National Electrical Code
       7. OSHA (Occupational Safety & Health Administration)
          1. OSHA 29 CFR 1910.7 – Occupational Safety and Health Standards – Definition and requirements for a nationally recognized testing laboratory
       8. SSPC (The Society for Protective Coatings)
          1. SSPC-PA 1 – Shop, Field, and Maintenance Painting of Steel
  1. SUBMITTALS
     1. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturer’s technical literature, standard details, project specifications, and installation instructions for all products.
     2. Submittals shall include the following:
        1. Product Data: For the following:
           1. Steel slotted support systems.
           2. Nonmetallic slotted support systems.
        2. Shop Drawings: Signed and sealed by a qualified Professional Engineer registered in the State of Washington. Show fabrication and installation details and include calculations for the following:
           1. Trapeze hangers. Include Product Data for components.
           2. Steel slotted channel systems. Include Product Data for components.
           3. Nonmetallic slotted channel systems. Include Product Data for components.
           4. Equipment supports.
        3. Field quality-control reports.
  2. QUALITY ASSURANCE
     1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authority having jurisdiction.
     2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
     3. Comply with NFPA 70.
  3. COORDINATION
     1. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together in Division 3 Concrete.
     2. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
  4. PERFORMANCE REQUIREMENTS
     1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
     2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
     3. Lateral Restraint Loading:
        1. See Section 26 05 48 Seismic Controls for Electrical and Communications work.

1. PRODUCTS

A. If only one product is acceptable (single or sole source product), obtain an approved Competition Waiver and submit to the CPO Construction, Contract Administrator. The language shall read as: “Manufacturer Name, Product # XXXXX, No Equal.” Refer to CPO-6 Competition Waiver Policy for more information.

B. If a Competition Waiver is not approved or more than one product is acceptable, this section must list a minimum of 2 products plus the language “Or Approved Equal,” along with salient characteristics. Refer to CPO Construction’s Salient Characteristics Guidelines for more information.

* 1. SUPPORT ANCHORAGE, AND ATTACHMENT COMPONENTS
     1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1. Cooper B-Line, Inc.
        2. ERICO International Corporation.
        3. Thomas & Betts Corporation.
        4. Unistrut; Atkore International.
        5. G-Strut; Gregory Industries.
        6. Or Approved Equal.
     2. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
        1. 1-5/8 inch x 1-5/8 inch cross section.
        2. Formed from 0.1046 inch thick steel.
        3. Slots at maximum of 2 inches on center in webs, and flange edges turned toward web.
        4. Materials: ASTM A1011/A1011M, Grade 33
        5. Finish: Baked, rust inhibiting, acrylic enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

Engineer to pick between two paragraphs below, or specify conditions for use of metallic and nonmetallic coatings.

* + - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
      2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
      3. Channel Dimensions: Selected for applicable load criteria.
    1. Nonmetallic Slotted Support Systems: Structural grade, factory formed, glass-fiber-resin channels and angels with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
       1. Fittings and Accessories: Products of channel and angles manufacturer, designed for use with those items and of the same materials.
       2. Rated Strength: selected to suit applicable load criteria.
    2. Raceway and Cable Supports: As described in NECA 1 and NECA 101. All raceway and cable supports for both interior and exterior applications shall be galvanized.
    3. Conduit Support Devices: Galvanized steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
    4. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
    5. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
    6. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
       1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
       2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
          1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Cooper B-Line, Inc.

Empire Tool and Manufacturing Co., Inc.

Hilti, Inc.

ITW Ramset/Red Head; Illinois Tool Works, Inc.

MKT Fastening, LLC.

Or Approved Equal

* + - 1. Clip type conduit fasteners are NOT allowed. All fasteners and clamps for conduit raceway support shall use mechanical bolted type hardware.
      2. Concrete Inserts: Steel or malleable-iron, slotted support system units; complying with MFMA-4 or MSS SP-58.
      3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
      4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125 Gr. A325.
      5. Toggle Bolts: All-steel springhead type.
      6. Hanger Rods: Threaded galvanized steel.
  1. FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES
     1. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
     2. Materials: All raceway, box and cable supports shall be galvanized steel.

1. EXECUTION
   1. GENERAL
      1. Coordinate concrete bases with building structural system
   2. APPLICATION
      1. Locations:
         1. Indoor Dry Locations: Steel, zinc plated materials.
         2. Outdoors and Damp Locations: Galvanized steel products.
         3. Corrosive Locations: Stainless Steel.
      2. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
      3. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
      4. Multiple Raceways or Cables: Install trapeze-type supports fabricated with 3/8 in rod minimum and 1-5/8 inch square preformed steel slotted channel support system, sized so conduit capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
         1. Secure raceways and cables to these supports with two-bolt conduit clamps approved for application by an agency acceptable to the authority having jurisdiction.
      5. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future loads within specified loading limits.
   3. SUPPORT INSTALLATION
      1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
      2. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified by applicable Engineer of Record.
      3. Raceways shall not be supported from ducts, pipes or other systems foreign to the electrical installation. The entire electrical installation shall be kept independent from any other trade.
      4. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
         1. Raceways shall be supported with heavy-duty on-hole pressed steel straps on interior surfaces.
         2. Support pendent mounted raceways on 3/8 inch rod with pear shaped hanger or trapeze type hanger with 3/8 inch rod minimum and 1-5/8 inch square pre-formed channel and pipe clamps.
         3. Parallel surface mounted raceways shall be supported from 1-5/8 inch pre-formed channel and pipe clamps.
         4. Multiple conduit runs shall be grouped and neatly racked on trapeze hangers with spare room for minimum (2) ¾ inch future conduits.
         5. Refer to Section 26 05 48 - Seismic Controls for Electrical and Communication Work.
      5. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Determination shall be weight of supported components plus 200 lb.
      6. Equipment and Hanger Restraints:
         1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
      7. Install cables so they do not bend across edges of adjacent equipment or building structure.
      8. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
         1. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
         2. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
         3. Attachment to New Concrete: Bolt to channel type concrete inserts or use expansion anchors.
         4. Attachments to Existing Concrete: Use expansion anchors.
         5. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
         6. To Metal Stud Structures: Fasten with sheet metal screw or bolted fasteners.
         7. To Structural Walls or Slabs: Fasten with steel expansion shells and bolts. Provide flush concrete insert for multiple raceway support system.
         8. Structural Steel: Bolt to heavy duty beam clamps on flanges of beams and columns, or on upper truss chords or bar joists.
         9. Architectural Walls or Masonry Walls: Fasten with toggle bolts or molly screws.
         10. Provide flush concrete insert for multiple raceway support system.
         11. Attachments to Wood Structural Members: Install bolts through members.
         12. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
      9. Drilled-in Anchors:
         1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the Structural Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
         2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
         3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
         4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
         5. Set anchors to manufacturer's recommended torque using a torque wrench.
         6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.
   4. INSTALLATION OF FABRICATED METAL SUPPORTS
      1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
      2. Field Welding: Comply with AWS D1.1/D1.1M.
   5. CONCRETE BASES
      1. Construct concrete bases of dimensions indicated. Concrete bases must not be less than [4”] larger in both directions than supported unit to insure anchors will be a minimum of 10 bolt diameters from edge of the base.
      2. Use [3000-psi], 28-day compressive-strength concrete.
      3. Anchor equipment to concrete base.
         1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
         2. Install anchor bolts to elevations required for proper attachment to supported equipment.
         3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   6. ADJUSTING
      1. Adjust restraints to permit free movement of equipment within normal mode of operation.
   7. PAINTING
      1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
         1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
      2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.
2. MEASUREMENT AND PAYMENT
   1. GENERAL
      1. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to, and included in the payments made for the applicable bid items in the [Schedule of Unit Prices] [Lump Sum price bid for the Project].

End of Section

Revision History:

03/11/2015 New Specification Section

01/12/2025 Revised 1.02 Governing Codes; 1.06.C Lateral Restraint Loading; 2.01.H.6 Through Bolts