PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general conditions, Division 26, and Basic Electrical Materials and Methods (Section 2605000) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

C. Related Requirements:
1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 SUMMARY

A. Section Includes:
1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 QUALITY ASSURANCE AND STANDARDS

A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

B. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

C. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

1.4 SUBMITTALS

A. Submit shop drawings per Section 260500.

B. Action Submittals
1. Product Data: For each type of product.
a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
1) Hangers.
2) Steel slotted support systems.
3) Trapeze hangers.

4) Clamps.
5) Brackets.

b. Include rated capacities and furnished specialties and accessories.

2. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
   a. Trapeze hangers. Include product data for components.
   b. Steel slotted-channel systems.
   c. Equipment supports.
   d. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
3. Delegated-Design Submittal: For hangers and supports for electrical systems.
   a. Include design calculations and details of trapeze hangers.
   b. Include design calculations for seismic restraints.

C. Informational Submittals
1. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   a. Suspended ceiling components.
   b. Structural members to which hangers and supports will be attached.
   c. Size and location of initial access modules for acoustical tile.
   d. Items penetrating finished ceiling, including the following:
      1) Lighting fixtures.
      2) Air outlets and inlets.
      3) Speakers.
      4) Sprinklers.
      5) Access panels.
2. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
3. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.25.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper B-Line, Inc.; a division of Cooper Industries.
b. Thomas & Betts Corporation.
c. Unistrut; Tyco International, Ltd.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. 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.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.

1. Spacing not to exceed the following:

Conductor Size (AWG)	Support Spacing (Feet)
1/0 and Smaller	100
2/0 through 4/0	80
250 kcmil through 350 kcmil	60
500 kcmil	50
750 kcmil	40

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following and shall be compatible with all building surfaces and materials:
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.
a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel for outdoor and steel for indoor, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. 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.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways for Electrical Systems" and Section 260534 "Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and GRC as required by the CEC. Minimum rod size shall be 3/8 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Support vertical conduits passing through sleeves with UL approved riser clamps secured to the conduit and resting on the building structure. Support vertical conduits 1¼" and larger a minimum of once and on 15' centers maximum. For vertical conduits smaller than 1¼" provide standoffs on 8' centers maximum. Support conduits adjacent to walls with preformed channels. Support freestanding risers with conduit racks of angle iron or channel iron members, rigidly bolted or welded together and adequately braced. For securing vertical conduits 1" or smaller to metal studs, horizontal ¼" diameter steel pencil rods tied with No. 16 gauge galvanized steel, twisted tie wires, is acceptable.

G. Install rigid steel conduit with threaded couplings. Support conduits 1" and larger on 10' intervals, smaller than 1" on 7' intervals, all sizes within 3' of connection to box, cabinet or fitting.

H. Support electric metallic tubing on maximum spacing of 10' and within 3' of connections to box, cabinet or fitting including couplings.

I. Support flexible metal conduit on 4' intervals, within 1' of outlet box or fitting (except at connections to recessed lighting fixtures) and within 2' of vibrating equipment.

J. Support gutter and wireways at 5' intervals and at changes of direction, in a manner to allow full access.

K. Attach to field poured concrete with preset inserts for conduits 3" and larger and with preset inserts or steel wedge screw anchors for smaller sizes. Shot driven studs are not permitted without written approval from the Architect. Submit size, quantity and approximate weight with request to use shot driven studs. Secure conduit with cast conduit clamps and cadmium plated machine or lag screws.

L. Attach to plaster, dry wall or hollow masonry walls with metal toggle bolts.

M. Attach to solid masonry walls with steel wedge anchors.

N. Do not fasten rigid conduit or tubing to equipment subject to vibration or mounted on shock mounts.

O. Secure conduits 1¼" and smaller to steel deck where permitted by Architect with cast or malleable iron conduit clamps and 1" minimum cadmium plated or galvanized sheet metal screws.

P. Where attaching to steel members, use beam clamp, welded threaded studs or machine screws.

Q. Where not otherwise specified herein, support all sizes of suspended conduit from structure with factory made pipe hangers with split hinged malleable iron or springable steel pipe rings and solid round mild steel rods, ¼" diameter for up to 1¼" conduit, 3/8" diameter up to 2" conduit and ½" diameter for larger conduit. Friction type conduit support hardware and attachments are not acceptable. Where required conduit spacing is more frequent than available structural members, provide intermediate steel support as required.

R. Provide trapeze type hangers where three or more conduits run parallel and clamp conduit to hanger. Provide diagonal seismic bracing for suspended runs of conduits 2" trade size and larger. Use unistrut type channel for trapeze assemblies. Lathing channels are not acceptable.

S. Provide plated or galvanized hangers, threaded, rods, channels and metallic support and fastening material or provide two coats of rust resistant paint, in all damp or corrosive locations (e.g., vehicle maintenance garage, labs).

T. Do not use perforated metal strap or wood as support material.

U. Support conduit to structure above suspended ceilings 3" minimum above ceiling to allow removal of tile. Do not support from T-bars or T-bar hanger wires. Maintain 2" clearance above recessed light fixtures.

V. Above fixed ceiling and in stud walls, tie conduit 1" or smaller to furring, support channels capable of carrying the weight, or studs with No. 16 gauge galvanized wire ties 4' on center, maximum.

W. Attached to precast or prestressed concrete as described under applicable sections of the specifications. Coordinate installation of precast unistrut or inserts where required, or obtain written approval from the Architect of alternate support methods.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. 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. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. 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. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts using mechanical expansion anchors.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight

concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

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.

3.5 PAINTING

A. Touchup: Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION