SECTION 260529

SUPPORTING DEVICES

## PART 1 GENERAL

### 1.1 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

### 1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Instructions to Bidders and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 26 Sections apply to this section:

1. Section 260000 - Basic Electrical Requirements.
2. Section 260001 - Basic Electrical Materials and Methods.

### 1.3 SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

B. This Section includes secure support from or to the building structure for seismic support of electrical items by means of vibration isolators and restraining devices.

C. Related Sections: The following Sections contains requirements that relate to this Section:

1. Division 5 Section "Metal Fabrications" for requirements for miscellaneous metal items involved in supports and fastenings.
2. Division 7 Section "Joint Sealers" for requirements for fire stopping at sleeves through walls and floors that are fire barriers.

### 1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

C. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

D. Shop drawings indicating details of fabricated products and materials showing compliance with these specifications.

E. Engineered Design consisting of details and engineering analysis for supports for the following items:

F. Vibration Isolation: An itemized list showing the items of equipment to be isolated, the isolator type and model selected, isolator loading and deflection and isolation displacement and calculations.

G. Restraining Devices: Submit seismic calculations for restraints for all switchboards, transformers, motor control centers, etc., and freestanding equipment.

1.5 QUALITY CONTROL

A. Electrical Component Standard: Component and installation shall comply with NFPA 70 -National Electrical Code.

B. Electrical components shall be listed and labeled by UL, ETL, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

C. Office of Statewide Planning and Development (OSHPD) R-number anchorage pre-approval list, 12/29/89 printing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following, or equivalent manufacturer as approved by the Professional:

1. Slotted Metal Angle and U-Channel Systems:

   a. Allied Tube & Conduit
   b. American Electric (Superstrut)
   c. B-Line Systems, Inc.
   d. Cinch Clamp Co., Inc.
   e. GS Metals Corp.
   f. Haydon Corp.
   g. Kin-Line, Inc.
   h. Unistrut Diversified Products

2. Conduit Sealing Bushings:

   a. Bridgeport Fittings, Inc.
   b. Cooper Industries, Inc.
   c. Elliott Electric Mfg. Corp.
   d. GS Metals Corp.
   e. Killark Electric Mfg. Co.
   f. Madison Equipment Co.
   g. L.E. Mason Co.
   h. O-Z/Gedney
   i. Producto Electric Corp.
   j. Raco, Inc.
   k. Red Seal Electric Corp.
   l. Spring City Electrical Mfg. Co.
   m. Thomas & Betts Corp.

3. Vibration Isolators

   a. California Dynamics Company
   b. Mason Industries

## 2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

## 2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: All steel springhead type.
3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 12-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 6 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

## 2.4 VIBRATION ISOLATORS

A. General: Provide vibration isolators with either known un-deflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

1. Provide isolators that operate in the linear portion of their load versus deflection curve. Furnish load versus deflection curves from the manufacturer that are linear, over a deflection range 50% above the design deflection.

B. Vibration Isolator Types

1. General Properties

a. All vibration isolators shall have either undeflected heights, or calibration markings, so that, after adjustment when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

b. All isolators shall operate in the linear portion of their load versus deflection curve. Furnish load versus deflection curves from manufacturer; curves must be linear over a deflection range of not less than 50% above the design deflection.
c. The ratio of lateral to vertical stiffness shall be not less than 0.9, nor greater than 1.5.
d. The theoretical vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than (+/-) 10%.
e. Wave motion through the isolator shall be reduced to the following extent: Isolation above the primary vertical system resonance frequency shall follow the theoretically predicted isolation curve for single degree of freedom systems with 10 db to 50 db at all frequencies above the 150 Hz.
f. All neoprene mountings shall have a shore hardness of 40-65 after minimum aging of 30 days, or corresponding open-aging.

C. Isolator Description

1. Type MS shall be spring type, without housings or snubbers, equipped with leveling bolts and with two layers of ribbed or waffled neoprene pads, separated by a 1/16" galvanized steel plate under the base plate. Neoprene sleeves and washer shall be installed at all anchor bolts.
2. Type HS shall be suspension hangers having a steel frame and spring element, in series with a neoprene pad, cut or washer. The isolator shall be designed so that hanger rod may be misaligned 15 degrees in any direction relative to the vertical, without contacting hanger box frame.
3. Type MN shall be neoprene isolator support type unit having a minimum static deflection of 1/4".
4. Type HN shall be a suspension hanger type employing a neoprene isolator unit having a minimum static deflection of 1/4".

D. Equipment Frames

1. Mounting frames and brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.
2. The mounting frames shall consist of welded, wide flange or channel structural steel, with welder brackets to accept the isolators. The section depth of any frame member shall be not less than 1/10th of the length of the longest frame member, and not less than 1/10th of the greatest span between support points. All frame members shall have the same depth.

2.5 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

2.6 SHEET METAL: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

A. 3-inch and smaller: 20-gauge.

B. 4-inch to 6-inch: 16-gauge.

C. Over 6-inch: 14-gauge.

1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
2. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.
3. Restraining Devices

D. Materials

1. Restraints shall consist of 2" by 1/4" flat iron bars with resilient pads to provide vertical and lateral restraining during seismic shock.
2. Each restraint shall consist of two pieces of lat iron bars bolted together with two 3/8" bolts and serrated washers. The holes in the bars shall be slotted vertically to permit adjustment for required clearance.
3. Refer to contract drawings for additional requirements.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install supporting devices to fasten electric components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.
2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.
7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

F. In open overhead spaces, cast boxes threaded to raceways shall be supported separately support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

G. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed fire stopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Section "Joint Sealers."

H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

    1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
    2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
    3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

J. Vibration Isolators:

    1. Install dry type transformer as recommended by manufacturer.

K. Restraining Devices: Bolt restraints to floor with 1/2" lag type bolts and anchors. Install restrains after equipment has been set on isolators and after the isolators have been adjusted for required deflection.

TABLE I: SPACING FOR RACEWAY SUPPORTS

| Raceway Size (Inches) | in Run | No.of Conductors | Location | Maximum Spacing of Supports (Feet) RMS&IMC* | EMT | RNC |
|---|---|---|---|---|---|---|
| HORIZONTAL RUNS | | | | | | |
| 1/2, 3/4 | 1 or 2 | | Flat ceiling or wall. | 5 | 5 | 3 |
| 1/2, 3/4 | 1 or 2 | | Where it difficult to provide support except at intervals fixed by the building construction. | | | |
| 1/2, 3/4 | 3 or more | | Any location. | 7 | 7 | -- |
| 1/2 - 1 | 3 or more | | Any location. | 7 | 7 | -- |
| 1 & larger | 1 or 2 | | Flat ceiling or wall. | 6 | 6 | -- |
| 1 & larger | 1 or 2 | | Where it is difficult to provide supports except as intervals fixed by the building construction. | 10 | 10 | -- |
| 1 & larger | 3 or more | | Any location. | 10 | 10 | -- |
| Any | -- | | Concealed. | 10 | 10 | -- |
| VERTICAL RUNS | | | | | | |
| 1/2, 3/4 | -- | | Exposed. | 7 | 7 | -- |
| 1, 1-1/4 | -- | | Exposed. | 8 | 8 | -- |
| 1-1/2 and larger | -- | | Exposed. | 10 | 10 | -- |
| Up to 2 | -- | | Shaftway. | 14 | 10 | -- |
| 2-1/2 | -- | | Shaftway. | 16 | 10 | -- |
| 3 & larger | -- | | Shaftway. | 20 | 10 | -- |
| Any | -- | | Concealed. | 10 | 10 | -- |

Maximum spacing for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

| | | |
|---|---|---|
| Abbreviations | EMT | Electrical metallic tubing. |
| | IMC | Intermediate metallic conduit. |
| | RMC | Rigid metallic conduit. |
| | RNC | Rigid nonmetallic conduit. |

END OF SECTION 260529