

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Seismic restraints for electrical equipment and systems.

1.2 COMPONENT CERTIFICATION

- A. Provide seismic certification in accordance with ASCE 7-05 paragraph 13.2 for each electrical component with importance factor of 1.5.
 - 1. Certification shall include project specific design documentation provided by a registered structural engineer or
 - 2. Manufacturers certification that the component is seismically qualified by
 - a. Testing
 - b. Analysis
 - c. Experience data

1.3 ATTACHMENT CERTIFICATION

- A. Provide seismic certification in accordance with ASCE 7-05 paragraph 13.2 for attachment and support to structure for each electrical component with importance factor of 1.5.
 - 1. Certification shall include project specific design documentation provided by a registered structural engineer or
 - 2. Manufacturers certification that the component is seismically qualified by
 - a. Testing
 - b. Analysis
 - c. Experience data

1.4 SPECIAL INSPECTION

- A. Coordinate with the Owner's Testing Agency to provide periodic special inspection during the construction in accordance with IBC 1707.1.3, 1707.8 and 1705.3 for of anchorage of electrical equipment used for emergency power system.

1.5 SUBMITTALS

- A. Provide submittal information in accordance with Division 1 - General Requirements and Section 26 05 00 - Common Work Results For Electrical and requirements described in this section.
- B. Product Data for Non-Seismic Support: Illustrate and indicate style, material, fastening provision, and finish for each type and size of electrical support component used.
- C. Shop Drawings for Non Seismic Support:
 - 1. Fabricated Supports: Representations of field-fabricated supports.

- D. Component Seismic Certification. Provide certification documentation as described above.
- E. Attachment Seismic Certification. Provide certification documentation as described above.
- F. Product Data for Seismic Restraint: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - 2. Annotate to indicate application of each product submitted and compliance with requirements.
- G. Seismic Restraint Design Analysis
 - 1. All seismic restraint analysis shall be performed by a structural engineer registered in the State of Washington.
 - 2. Provide design analysis to support selection and arrangement of seismic restraints. Include calculations of combined tensile, compressive, and shear loads.
 - 3. Evaluation Documentation: Supporting documentation by an agency acceptable to authorities having jurisdiction showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- H. Shop Drawings for Seismic Restraint: Submit shop drawings indicating routing of single raceways, trapeze systems and cable trays requiring bracing. Indicate on the shop drawing the type and location of bracing to be used. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a registered structural engineer in the State of Washington.
- I. Seismic Restraint Details. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
- J. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- K. Qualification Data: For professional engineer.
- L. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in IBC unless requirements in this Section are more stringent.
- B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

1.7 PROJECT CONDITIONS

- A. Seismic Design Category: **D**

B. Assigned Seismic Use Group: **IV**.

C. Importance Factor for non-structural seismic per the following table:

Element	Importance Factor	Reason
Emergency System Building Power Distribution - panels, switchboards, switchgear, transformers	1.5	Life Safety
Normal Building Power Distribution - switchboards, switchgear, transformers	1.5	Continued Operation
Normal Building Power Distribution - panels	1.0	
Normal Branch power distribution -raceway greater than 2 1/2 inches	1.5	Continued Operation
Normal Branch power distribution - raceway 2 1/2 inches or less	Exempt	
Emergency Branch power distribution -raceway greater than 2 1/2 inches	1.5	Life Safety
Emergency Branch power distribution - raceway 2 1/2 inches or less	Exempt	
Lighting Interior - served from Life safety or Critical branch	1.5	Life Safety
Lighting Interior - served from normal branch	1.0	
Lighting Control	1.0	
Nurse/Patient Communication Systems	1.5	Life Safety
Transient Voltage Surge Suppression (TVSS) System	1.0	
Grounding systems	1.0	
Isolated Power System	1.5	Continued Operation
Fire Alarm System	1.5	Life Safety
Smoke Damper Power and Control	1.5	Life Safety
Public Address	1.0	
Elapsed Time Clocks	1.0	
Clock System	1.0	
Communication Infrastructure - Cable trays, racks, IDF/MDF equipment	1.5	Continued Operation
Communication raceway greater than 2 ½ inches and Fiber Optic risers	1.5	Continued Operation
Communication raceway less than 2 1/2 inches or less	1.0	
Voice/Data Cabling	1.0	
Access Control System	1.0	
Television Distribution System	1.0	
CCTV Video Surveillance System	1.0	
Television Distribution Raceway System	1.0	
Distributed Antenna System (Radio Redistribution System)	1.5	Continued Operation
Outside Plant Infrastructure	NA (Below grade)	
Wireless Local Area Network (WLAN)	1.0	
Patient Care Monitor System Raceways	1.0	

1.8 COMPONENTS EXEMPT FROM SEISMIC REQUIREMENTS

- A. In accordance with ASCE 7-05 paragraphs 13.1.4, 13.6.1 and 13.6.5.5.6 the following electrical items are exempt from seismic requirements:
1. Electrical components when the importance factor is 1.0
 2. Electrical components weighing less than 20 lbs if flexibly mounted.
 3. Electrical components weighing less than 5 lbs/foot if flexibly mounted.
 4. Electrical components weighing less than 400 lbs. and mounted less than 4 feet above the floor if flexibly mounted.
 5. Pendant light fixtures if free to rotate and swing without hitting other components and if sufficiently supported (1.4 times operating weight).
 6. Conduits 2-1/2" and smaller with importance factor of 1.5
 7. Conduits, bus duct or cable tray mounted from trapeze assembly with importance factor of 1.5 where weight is 10 lbs/foot or less.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
1. Manufacturers:
 - a. Cooper B-Line; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Allied Support Systems; Power-Strut Unit.
 - d. GS Metals Corp.
 - e. Michigan Hanger Co., Inc.; O-Strut Div.
 - f. National Pipe Hanger Corp.
 - g. Thomas & Betts Corporation.
 - h. Unistrut; Tyco International, Ltd.
 - i. Wesanco, Inc.
 2. Finishes:
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
 3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- B. Raceway and Cable Supports: As described in NECA 1.
- 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. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. 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.
 - a. Manufacturers:
 - 1) Hilti, Inc.
 - 2) ITW Construction Products.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co. Inc.
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.
 - a. Manufacturers:
 - 1) Cooper B-Line; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc
 - 3) Hilti, Inc.
 - 4) ITW Construction Products.
 - 5) MKT Fastening, LLC.
 - 6) Powers Fasteners.
3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 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, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 SEISMIC-RESTRAINT COMPONENTS

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Strength in tension, compression, shear, and pullout force of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
 1. Manufacture: International Seismic Application Technology (ISAT) (877) 999-4728.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
 1. Manufacturers:
 - a. Amber/Booth Company, Inc.
 - b. International Seismic Application Technology (ISAT)
 - c. Loos & Co., Inc.
 - d. Mason Industries, Inc.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

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 Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
 2. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

- D. 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 or use expansion anchor fasteners.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 5. To Light Steel: Sheet metal screws.
 6. 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 meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 5 Section "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 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

- A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- B. 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.
- C. Restraint Cables: Provide slack within maximums recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing: Test pullout resistance of seismic anchorage devices.
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 5. Test to 90 percent of rated proof load of device.
 6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Record test results in tabular form and submit to Owner's Representative.

END OF SECTION