SECTION 260548

VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Division 26 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

C. All equipment shall be Factory Mutual approved.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: B
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III

a. Component Importance Factor: 1.25
b. Component Response Modification Factor: Per ASCE 7-05 Table 13.6-1.
c. Component Amplification Factor: Per ASCE 7-05 Table 13.6-1.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.187g.
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.049g.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by [an evaluation service member of ICC-ES
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

    a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. 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.
    c. Preapproval and Evaluation Documentation: By [an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: Proof of Professional Engineering license in State of New York

F. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing

laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the New York City Building Code unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer licensed in the State of New York.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Base Mounts

1. Neoprene Pad Isolators (abbreviation on schedules - NP):

a. Static deflection of 0.125" (3mm).
b. Rubber or neoprene-waffle pads.

1) Durometer to achieve static deflection as specified.
2) Minimum 1/2 in. (13 mm) thick.
3) Maximum loading 40 psi (275 kPa).
4) Height of ribs: not to exceed 0.7 times width.

c. Configuration: 1/2 in. (13 mm) thick waffle pads bonded each side of 1/4 in. (6 mm) thick steel plate.
d. Provide grommetted bolt when anchoring.
e. Provide neoprene material with anti-ozone and anti-oxidant additives.
f. Provide EPDM or equal elastomeric elements in place of neoprene on all vibration isolators installed outdoors.

g. Basis of design: Mason type WM or approved equal.

2. Neoprene Mount (abbreviation on schedules - NM):

    1) Molded one-piece assemblies with skid resistant base plates and mounting holes.
    2) Double deflection type with static deflection range from 0.3 to 0.5 in..
    3) Coat metal surfaces with neoprene to prevent corrosion.
    4) Provide friction pad.
    5) Basis of design: Mason type ND or approved equal.

    b. Provide neoprene material with anti-ozone and anti-oxidant additives.
    c. Provide EPDM or equal elastomeric elements in place of neoprene on all vibration isolators installed outdoors.

3. Restrained Neoprene Mount (abbreviation on schedules - RNM):

    a. Molded rubber designed for 0.2 in. (5 mm) deflection with all direction seismic restraint.
    b. Basis of design: Mason type BR or approved equal.

4. Open Free-Standing Spring Isolators (abbreviation in schedules - FS):

    a. Static deflection range from 1.0 to 5.0 in. nominal.
    b. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    c. Springs:

        1) Code: Color code springs for load carrying capacity.
        2) Minimum horizontal stiffness equal to 100 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
        3) Free standing and laterally stable spring isolators (single or multiple steel springs) without any housing and complete with 1/4 in. neoprene acoustical pads between the base plate and the support.
        4) Spring diameter shall be no less than 0.8 of the compressed height of the spring at design load.
        5) Minimum Additional Travel: 50 percent of the required deflection at rated load.
        6) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

    d. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-in.- (6 mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
    e. Spring Mounts: Furnish with leveling devices, minimum 0.25 in. (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.
    f. Sound Pads: Size for minimum deflection of 0.05 in. (1.2 mm); meet requirements for neoprene pad isolators.
    g. Provide all mountings with leveling bolts, rigidly bolted to the equipment.
    h. Provide height saving mounting brackets where applicable, height adjustment bolts.
    i. Basis of design: Mason type SLF, SLFH or approved equal.

5. Restrained Spring Isolators (abbreviation on schedules - RS):

    a. Static deflection range from 1.0 to 5.0 in. nominal.

b. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
c. Springs:

1) Code: Color code springs for load carrying capacity.
2) Minimum horizontal stiffness equal to 100 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3) Spring isolators (single or multiple steel springs) complete with 1/4 in. neoprene acoustical pads between the base plate and the support.
4) Spring diameter shall be no less than 0.8 of the compressed height of the spring at design load.
5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6) Minimum Additional Travel: 50 percent of the required deflection at rated load.
7) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

d. Spring Mounts: Furnish with leveling devices, minimum 0.25 in. (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.
e. Sound Pads: Size for minimum deflection of 0.05 in. (1.2 mm); meet requirements for neoprene pad isolators.
f. Restraint: Furnish mounting frame and limit stops. A minimum 1/2 in. clearance shall be maintained around the restraint bolts, housings, and springs so as not to interfere with the spring action.
g. Basis of design: Mason type SLR or approved equal.

C. Hangers:

1. Neoprene Hanger (abbreviation on schedules - NH).

a. Molded neoprene units in a steel hanger frame.
b. Double deflection types with static deflection range from 0.3 to 0.5 in..
c. Designed to preclude contact of hanger rods with frame (30 degrees misalignment). Insert neoprene bushing where rod passes through housing.
d. Bases of design: Mason HD.

2. Spring Hanger (abbreviation on schedules - SH)

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
b. Springs: Freestanding, laterally stable steel spring with a neoprene element in series. Color code springs for load carrying capacity.
c. Housings: Incorporate rubber hanger with threaded insert.
d. Misalignment: Capable of 20 degree hanger rod misalignment.
e. Provide neoprene material with anti-ozone and anti-oxidant additives.
f. Provide EPDM or equal elastomeric elements in place of neoprene on all vibration isolators installed outdoors.
g. Basis of design: Mason type PC30N or 30N or approved equal.

3. Spring Hanger with Vertical Limit Stop (abbreviation on schedules - SHL)

a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

b. Springs: Freestanding, laterally stable steel spring with a neoprene element in series. Color code springs for load carrying capacity.
c. Housings: Incorporate rubber hanger with threaded insert.
d. Misalignment: Capable of 20 degree hanger rod misalignment.
e. Provide neoprene material with anti-ozone and anti-oxidant additives.
f. Provide EPDM or equal elastomeric elements in place of neoprene on all vibration isolators installed outdoors.
g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
h. Basis of design: Mason type PC30NS or approved equal.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

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.

3.3 VIBRATION ISOLATION AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 in..
3. Install seismic-restraint devices using methods approved by OSHPD providing required submittals for component.

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. 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.

D. 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 pre-stressed 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.

E. Transformer Installation

1. Inside the building, floor mounted transformers larger than 50 kVA shall be installed on Type RS Restrained Spring Isolators, and suspended transformers larger than 50 kVA shall be suspended on SH Spring Hangers. Below is a schedule of transformer vibration isolator requirements for various VA capacities that indicate isolator type and deflections by mounting arrangement.

Transformer Isolation Requirements			
Size	**Mounting**	**Isolator Type**	**Minimum Static Deflection (in)**
< 500 VA	Any	NP or RNM	
500 VA – 50 kVA	Floor	NM or RNM	3/8
500 VA – 50 kVA	Suspended from Ceiling	NH	3/8

500 VA – 50 kVA	Wall	NH	3/8
≥ 50 kVA	Floor	FS or RS	1
≥ 50 kVA	Suspended from Ceiling	SH	1

2. All wiring connections to a transformer on Type SM or Type SH isolators shall be made with a minimum 3-ft long flexible conduit in a slack U-shape or loop, provided that the total bend is 360 degrees.
3. Wiring connections to a transformer supported on Type NM, NH or RNM isolators shall be made with a minimum 3-ft flexible conduit in a slack U-shape or as approved by Acoustics Consultant. Transformers shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators, but shall be supported on or suspended from building structure.

F. Engine Driven Generators

1. Engine Driven Generators should adhere to the requirements and associated notes in ASHRAE 2007 Chapter 47: Sound and Vibration Control – Table 42 “Selection Guide for Vibration Isolation”.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect'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 Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION