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**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Restrained elastomeric isolation mounts.
  - 2. Restrained spring isolators.
  - 3. Housed spring mounts.
  - 4. Spring hangers with vertical-limit stops.
  - 5. Thrust limits.
  - 6. Pipe riser resilient supports.
  - 7. Resilient pipe guides.
  - 8. Seismic snubbers.
  - 9. Restraining cables.

**1.03 DEFINITIONS**

- A.  $A_v$ : Effective peak velocity related acceleration coefficient.
- A. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "R" number to each seismic restraint it tests. The number describes a specific device applied as tested.

**1.04 SUBMITTALS**

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 4. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch (13-mm) deflection in x, y, and z planes.
- C. Welding certificates.

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- D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

**1.05 QUALITY ASSURANCE**

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or 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. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

**1.06 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

**1.07 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 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 manufacturers specified.

**2.02 VIBRATION ISOLATORS**

- A. Available Manufacturers:
- B. Manufacturers:
  - 1. Ace Mounting Co., Inc.
  - 2. Amber/Booth Company, Inc.
  - 3. B-Line Systems, Inc.
  - 4. California Dynamics Corp.
  - 5. Isolation Technology, Inc.
  - 6. Kinetics Noise Control, Inc.
  - 7. Mason Industries, Inc.
  - 8. Vibration Eliminator Co., Inc.
  - 9. Vibration Isolation Co., Inc.
  - 10. Vibration Mountings & Controls/Korfund.
- C. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
  - 1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  - 2. Neoprene: Shock-absorbing materials compounded according to, the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
  - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- E. Housed Spring Mount: Housed spring isolator with integral seismic snubbers.
  - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.

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2. Base: Factory drilled for bolting to structure.
  3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel before contacting a resilient collar.
- F. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.
- H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
- I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

**2.03 SEISMIC-RESTRAINT DEVICES**

- A. Available Manufacturers:
- B. Manufacturers:

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1. Amber/Booth Company, Inc.
  2. B-Line Systems, Inc.
  3. California Dynamics Corp.
  4. Kinetics Noise Control, Inc.
  5. Loos & Co., Inc.; Cableware Technology Division.
  6. Mason Industries, Inc.
  7. TOLCO Incorporated.
  8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
  9. Vibration Eliminator Co., Inc.
  10. Vibration Isolation Co., Inc.
  11. Vibration Mountings & Controls/Korfund.
- C. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 60, plus or minus 5, with a flat washer face.
- D. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 60, plus or minus 5.
- E. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
- F. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

**2.04 FACTORY FINISHES**

- A. 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 electrogalvanized. Hot-dip galvanize metal components for exterior use.
  3. Baked enamel 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**

**3.01 EXAMINATION**

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

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- 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.

**3.02 INSTALLATION**

- A. Install roof equipment supports and roof penetrations as specified in Division 7 Section "Roof Accessories."
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- F. Install resilient bolt isolation washers on equipment anchor bolts.

**3.03 FIELD QUALITY CONTROL**

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
  - 1. Isolator seismic-restraint clearance.
  - 2. Isolator deflection.
  - 3. Snubber minimum clearances.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**3.04 ADJUSTING**

- A. Adjust isolators after piping systems have been filled and 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. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop.
- D. Adjust snubbers according to manufacturer's written recommendations.
- E. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

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- F. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

**3.05 CLEANING**

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

**3.06 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 1 Section "Closeout Procedures, Demonstration and Training."

**\*\* END OF SECTION \*\***