



## **SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Vibration isolators.
  - 2. Duct silencers.
  - 3. Ductwork lagging.

#### **1.2 REFERENCES**

- A. Air Movement and Control Association International, Inc. (AMCA).
- B. American National Standards Institute (ANSI):
  - 1. ANSI S1.4 - Sound Level Meters.
  - 2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
  - 3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
  - 4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
- C. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
  - 1. ANSI/AHRI 575 - Method of Measuring Machinery Sound Within An Equipment Space.
- D. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
  - 1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
  - 2. ASHRAE Handbook - HVAC Applications.
- E. ASTM International:
  - 1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - 2. ASTM E477 - Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
  - 3. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
- F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
  - 1. ANSI/SMACNA - HVAC Duct Construction Standards - Metal and Flexible.



- G. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
  - 1. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

### **1.3 SUBMITTALS**

- A. Shop Drawings: Indicate equipment bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, material, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- B. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

### **1.4 PERFORMANCE**

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHDP, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings.
- B. All anchor bolts and tie-ins to structure shall be designed per the Airport Structural Design Standards.

## **PART 2 - PRODUCTS**

### **2.1 VIBRATION ISOLATORS**

- A. Manufacturers:
  - 1. **Amber/Booth Company, Inc.**
  - 2. **Mason Industries.**
  - 3. **M.W. Sausse & Company (Vibrex).**
- B. Open Spring Isolators:
  - 1. Spring Isolators:
    - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    - b. Code: Color code springs for load carrying capacity.
  - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
  - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.



4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- C. Restrained Spring Isolators:
1. Spring Isolators:
    - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    - b. Code: Color code springs for load carrying capacity.
  2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
  3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
  4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
  5. Restraint: Furnish mounting frame and limit stops.
- D. Closed Spring Isolators:
1. Spring Isolators:
    - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    - b. Code: Color code springs for load carrying capacity.
  2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
  3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
  4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- E. Restrained Closed Spring Isolators:
1. Spring Isolators:
    - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    - b. Code: Color code springs for load carrying capacity.
  2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
  3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
  4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.



- F. Spring Hanger:
  - 1. Spring Isolators:
    - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
    - b. Code: Color code springs for load carrying capacity.
  - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
  - 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators rubber hanger with threaded insert.
  - 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- G. Neoprene Pad Isolators:
  - 1. Rubber or neoprene-waffle pads.
    - a. 30 durometer.
    - b. Minimum 1/2 inch thick.
    - c. Maximum loading 40 psi.
    - d. Height of ribs: not to exceed 0.7 times width.
  - 2. Configuration: Single layer. 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.
- H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.
- I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- J. Seismic Snubbers:
  - 1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
  - 2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
  - 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
  - 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

## 2.2 DUCT SILENCERS

- A. Manufacturers:
  - 1. **Noise Control, Inc.**
  - 2. **McGill Airflow LLC.**
  - 3. **Semco.**
- B. Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction.



### **2.3 DUCTWORK LAGGING**

- A. Acoustic Insulation: 2 inch thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.
- B. Covering: Sheet lead, vinyl, or gypsum board with surface weight minimum 4 lb/sq ft.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify equipment, ductwork and piping is installed before work in this section is started.

### **3.2 EXISTING WORK**

- A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.
- B. Extend existing piping and ductwork installations using materials and methods compatible with existing electrical installations.

### **3.3 INSTALLATION**

- A. Support duct silencers independent of ductwork.
- B. Lag ductwork by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.
- C. Install isolation for motor driven equipment.
- D. Adjust equipment level.
- E. Install spring hangers without binding.
- F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

### **3.4 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION**

- A. Equipment Restraints:
  - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.



3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
4. All equipment whether isolated or not, shall be bolted to structure to allow for minimum 1/2 G of acceleration.
5. All structurally suspended overhead equipment isolated or non-isolated shall be four point independently braced within Type III seismic restraining system.
6. Where base anchoring is insufficient to resist seismic forces, supplementary restraining such as seismic restraint system Type III shall be used above systems center of gravity to suitably resist "G" force levels. Vertically mounted tanks may require this additional restraint.

B. Piping Restraints:

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.
3. Install Seismic Restraining System Type III: Taut for overhead suspended non-isolated equipment, piping and slack with 1/2 inch cable deflection for isolated systems.
4. Seismically restrain all piping with Type III restraining system in accordance with guideline as outlined below.
5. Install vibration isolation at all piping connected to rotating equipment and within 50 feet of each piece of equipment such as air handling units, fan coil units and computer room AC units, condensing units, exhaust fans and make-up air units.

C. 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 LAWA if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed 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.
7. Provide ICC-ESR reports, LA-Research Reports (LARR numbers) for all applicable products and anchorages.



END OF SECTION 23 05 48