SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Inertia bases.

B. Vibration isolators.

C. Seismic restraints.

D. Expected sound levels.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract apply to this section.

1.03 SUBMITTALS

A. Product Data: Provide schedule of vibration isolator type with location, load, and deflection on each.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Detail bases and select based on lowest operating speed of equipment. Indicate seismic control measures with load calculations, spacing, location and strut types.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.04 APPLICABLE REQUIREMENTS

A. Expected noise levels in various parts of the building shall conform to noise criteria recommendations set forth in the 2015 ASHRAE Handbook of HVAC Applications, Chapter 48.

B. Equipment shall be selected so that RC(N) levels shall not exceed the following ranges:

Suites	30 to 35
Meeting/Banquet	30 to 35
Service/Support	40 to 45
Corridors	40 to 45

C. An allowance not to exceed 5 dB may be added to the measured sound value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design conditions after occupancy, which may include the addition of sound absorbing materials, such as furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room, and sound pressure level in room.

D. Allowable vibration tolerances for rotating, non-reciprocating equipment shall not exceed a self-excited vibration maximum velocity of 0.20-inch per second RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions, or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.05 APPLICATION

A. Provide vibration isolators for all rotating and reciprocating equipment.

B. Provide spring hangers for all piping within Mechanical Room that is connected to rotating equipment.

C. For equipment which has no sound power ratings scheduled on the drawings, the contractor shall select equipment such that the noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook 2013, Chapter 8, Sound and Vibration.

D. Provide seismic restraints as indicated, and as follows:

1. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force, as determined in accordance with the International Building Code (IBC).

2. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force, as determined in accordance with the IBC.

E. Provide flexible duct connections at all air handling equipment, even if they are provided with internal fan isolation, and at the inlet and discharge of all fans.

F. Provide flexible piping connections at chillers, condensers, cooling towers, air handling units and pumps.

1.06 RELATED DOCUMENTS

A. For seismic requirements by building type, hazard exposure and location, refer to the International Building Code (IBC), latest edition.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Isolation Technology, Inc.

B. Kinetics Noise Control, Inc.

C. Mason Industries

D. Korfund/VMC

E. Amber -Booth

F. Vibration Eliminator Company

2.02 TECHNICAL REQUIREMENTS

A. Equipment driven by motors, 2 horsepower and smaller, shall be isolated by means of elastomeric mounts or elastomeric hangers, sized for 1/2-inch deflection. Larger equipment shall be isolated by means of open spring mounts or open spring hangers, sized for the specified deflection.

B. Steel components shall be phosphatized and painted. Nuts, bolts and washers shall be zinc electroplated. Structural steel bases shall be cleaned of welding slag and primed with zinc chromate or metal etching primer.

C. Isolators exposed to the weather shall have steel parts PVC coated or minimum of G-90 hot-dip galvanized. Aluminum components shall be etched and painted. Nuts, bolts and washers may be zinc electroplated.

D. Elastomeric components shall be of neoprene or synthetic rubber with anti-ozone and anti-oxidant additives.

2.03 INERTIA BASES

A. Structural Bases (Type R):

1. Construction: Welded structural steel with gusseted brackets, to support equipment and motor, with motor slide rails.

2. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

B. Concrete Inertia Bases (Type I):

1. Construction: Structural steel channel perimeter frame, with gusseted brackets and anchor bolts, reinforcing; concrete filled.

2. Mass: Minimum of 1.5 times weight of isolated equipment.

3. Connecting Point: Reinforced to connect isolators and snubbers to base.

4. Concrete: Minimum 3000 psi concrete.

2.04 VIBRATION ISOLATORS

A. Open Spring Isolators (Type S, SP):

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.

2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.

3. Sound Pads: Size for minimum deflection of 0.05 inch, meet requirements for neoprene pad isolators.

4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

B. Spring Hanger (Type H, HS):

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.

2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, or rubber hanger with threaded insert.

3. Misalignment: Capable of 20 degree hanger rod misalignment.

C. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

D. Seismic Snubbers:

1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.

2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.

3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.

4. Attachment Points and Fasteners: Capable of withstanding three times rated load capacity of seismic snubber.

E. Roof Mounting Curb: Minimum 14 inches high with rigid steel lower section containing adjustable spring pockets with restrained spring isolators, steel upper section to support rooftop equipment, and continuous elastomeric membrane extending from upper section for counterflashing over roofing. Provide acoustical package consisting of interior perimeter angles and cross members to support up to two layers of gypsum board. Where the curb is specified to act as a plenum, provide flexible membrane plenum dividers to form an airtight seal. The curb shall be provided with duct supports, sized to match the unit manufacturer's inlet and outlet duct connections. Provide curb manufacturer's certification that the curb is in compliance with seismic loading requirements.

F. Resilient Pipe Guide: Steel clamp and neoprene mount. Provide where piping rises vertically through floor slabs. Equal to VMC Series RPG.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions. No metal-to-metal contact will be permitted between fixed and floating parts.

B. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.

2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs (thrust restraints, Type THR) on fans with more than 4.0 inches w.c. static pressure, and on hanger supported, horizontally mounted axial fans.

F. Provide seismic snubbers for all equipment, piping, and ductwork mounted on isolators. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance. Other snubbers shall have clearance between 0.15 inch and 0.25 inch.

G. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance, to nearest flexible pipe connector, or as follows:

1. Up to 4 Inches Pipe Size: First three points of support.

2. 5 to 8 Inches Pipe Size: First four points of support.

3. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

B. In high wind areas, provide uplift resistance on spring isolators exposed to weather.

3.03 SCHEDULE

A. Pipe Isolation Schedule.

1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.

2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.

3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.

4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.

B. Vibration isolators shall be installed where specified herein and where shown on the drawings, and as follows:

Equipment Type	**Slab on Grade**			**Structural Spans up to 30-Feet Between Columns**		
	Base Deflection	Isolator	Min.	Base Deflection	Isolator	Min.
Heat pumps	--- 0.75"		S,H	--- 0.75"		S,H
Condensing Units	--- 0.25"		P	--- 1.50"		SP
Air handling units/H&V unit, up to 4" TSP	--- 0.75"		S,SP	---	S,SP	1.50"
Air handling units/H&V units, 4" TSP and up	R 0.75"		S,SP	I 2.50"		S,SP

Packaged rooftop units	Curb	P	Curb	S,SP	2.50"
	0.25"				
Piping in Mechanical Rooms	---	H	---	H	1.00"
	1.00"				
Centrifugal fan up to 22" wheel (floor-mounted)	R	M	R		S
	0.25"		0.75"		
Centrifugal fan up to 22" wheel (suspended)	---	---	R		H
	---		0.75"		
Centrifugal fan 24" wheel and up (floor-mounted)	R	S	R	S,SP	1.50"
	1.50"				
Centrifugal fan 24" wheel and up (suspended)	---	---	R	H,HS	1.50"

C. Mount thrust restraints at the horizontal centerline of the air flow. Provide mounting brackets on both sides of flexible connection at fan discharge.

D. Vibration isolators for small fans, air handling units and refrigerant compressors may be supplied as part of packaged equipment.

END OF SECTION 23 0548