SECTION 230548

VIBRATION ISOLATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation.

1.2 RELATED SECTIONS

A. Division 03 - Cast-in-Place Concrete.

B. Section 23 05 16 - Piping Expansion Compensation.

C. Section 23 05 29 - Supports and Anchors.

D. Section 26 05 05 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over .25 HP, plus connected piping, and ductwork.

B. Provide minimum static deflection of isolators for equipment as indicated.
   1. Slab on Grade, Under 20 hp
      a) Under 400 rpm: 1 inch
      b) 400 - 600 rpm: 1 inch
      c) 600 - 800 rpm: 0.5 inch
      d) 800 - 900 rpm: 0.2 inch
      e) 1100 - 1500 rpm: 0.14 inch
      f) Over 1500 rpm: 0.1 inch
   2. Slab on Grade, Over 20 hp
      a) Under 400 rpm: 2 inch
      b) 400 - 600 rpm: 2 inch
      c) 600 - 800 rpm: 1 inch
      d) 800 - 900 rpm: 0.5 inch
      e) 1100 - 1500 rpm: 0.2 inch
      f) Over 1500 rpm: 0.15 inch
   3. Upper Floors Above Ceiling, Normal
      a) Under 400 rpm: 3.5 inch
      b) 400 - 600 rpm: 3.5 inch
      c) 600 - 800 rpm: 2 inch
      d) 800 - 900 rpm: 1 inch
      e) 1100 - 1500 rpm: 0.5 inch
      f) Over 1500 rpm: 0.2 inch
   4. Upper Floors Above Ceiling, Critical
      a) Under 400 rpm: 3.5 inch
      b) 400 - 600 rpm: 3.5 inch
      c) 600 - 800 rpm: 3.5 inch
      d) 800 - 900 rpm: 2 inch
      e) 1100 - 1500 rpm: 1 inch
      f) Over 1500 rpm: 0.5 inch

C. Upper floor locations shall be considered critical unless otherwise indicated.

D. Use bases and isolator types as indicated in schedule.

1.4 SUBMITTALS

A. Submit under the provisions of Division 01.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Include design for seismic and/or wind restraint in jurisdictions where required by code authority.

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

D. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

E. Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements and International Building Code requirements for wind and seismic bracing.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under the provisions of Division 01.

B. All vibration isolation shall be by a single manufacturer.

C. Record actual locations of hangers including attachment points.

1.6 REGULATORY REQUIREMENTS

A. Conform to Florida Plumbing and Mechanical Codes for support of plumbing hydronic piping.

B. Conform to the International Building Code for Support and Bracing of Mechanical and Plumbing Equipment, Piping and Ductwork. Provide engineering calculations as required to confirm conformance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Vibration Eliminator Company, Inc.

B. Kinetics Noise Control, Inc.

C. Vibration Mounting and Controls, Inc.

D. Vibro Acoustics.

E. Curbs Plus, Inc.

2.2 BASES

A. Direct Isolation: (Type A)
1. Direct isolation shall be used when equipment is unitary and requires no additional support. Confirm with the equipment manufacturer.

B. Structural Bases and Rails: (Type B)
   1. Bases and rails shall be rigid to prevent misalignment or undue stress on isolated equipment, and to transmit loads to isolator and snubbers.
   2. Bases and rails shall be of welded structural steel with gusseted brackets, supporting equipment and motor with motor slide rails.
   3. Bases for exterior use shall be painted or hot-dipped galvanized for complete corrosion resistance.

C. Concrete Bases: (Type C)
   1. Concrete base shall have a mass of 1.5 times the weight of isolated equipment.
   2. Concrete bases shall be constructed of structural steel channel perimeter frame with gusseted brackets and anchor bolts, welded in reinforcing bars, with provision for hold down and isolator brackets.
   3. Connection points shall be reinforced to connect isolators and snubbers to the base.
   4. Concrete: Reinforced 3,000 psi concrete.
   5. Inertia bases for pumps shall be of sufficient size to accommodate support for pipe elbows at pump suction and discharge connections.

D. Curb Isolation System: (Type D)
   1. The roof curb isolator system shall be specifically designed to support rooftop equipment and house master spring isolators in a watertight and airtight assembly.
   2. Small diameter spring isolators shall be provided with 1-3" static deflection as indicated and shall meet design criteria specified for Type 3 isolators.

2.3 VIBRATION ISOLATORS

A. Glass Fiber Pads: (Type 1)
   1. Neoprene jacketed pre-compressed molded glass fiber.

B. Neoprene Pad Isolators: (Type 1)
   1. Rubber or neoprene waffle pads.
      a) 45 durometers.
      b) Minimum ½ inch thick.
      c) Oil resistant compound.
      d) Maximum loading 60 psi.
      e) The height of ribs shall not exceed 0.7 times width.
   2. Configuration: ½ inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

C. Rubber Mount or Hanger: (Type 2)
   1. Molded, oil resistant compound, neoprene rubber designed for 0.5 inches deflection with threaded insert.

D. Open Spring Isolators: (Type 3)
   1. Spring Isolators:
      a) For Exterior and Humid Areas: Provide hot dipped galvanized housings and powder-coated enamel or neoprene coated springs.
      b) Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 100 percent vertical stiffness, designed for 50% overload to solid with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Provide 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.

E. Spring Hanger: (Type 3)
   1. Spring Isolators:
      a) For Exterior and Humid Areas: Provide hot dipped galvanized housings and powder-coated enamel or neoprene coated springs.
      b) Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 100 percent vertical stiffness, designed for 50% overload to solid with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
   4. Misalignment: Capable of 30-degree hanger rod misalignment.

F. Closed Spring Isolators: (Type 3)
   1. Spring Isolators:
      a) For Exterior and Humid Areas: Provide hot dipped galvanized housings and powder-coated enamel or 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 100 percent vertical stiffness, designed for 50% overload to solid 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.

G. Restrained Spring Isolators: (Type 4)
   1. Spring Isolators:
      a) For Exterior and Humid Areas: Provide hot dipped galvanized housings and powder-coated enamel or neoprene coated springs.
      b) Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 100 percent vertical stiffness, designed for 50% overload to solid with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Spring Mounts: Provide 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: Provide heavy mounting frame and limit stops.

H. Restrained Closed Spring Isolators: (Type 4)
   1. Spring Isolators:
      a) For Exterior and Humid Areas: Provide hot dipped galvanized housings and powder-coated enamel or 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 100 percent vertical stiffness, designed for 50% overload to solid 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.

I. 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. Snubbers shall be designed to limit equipment motion to no more than ¼" in any direction.
5. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's instructions.

B. All machines and devices shall be level, except where pitch or slope is specified or shown, and shall be securely fastened to the structure unless shown otherwise. Provide vibration mounts where shown and/or specified. Where machines are vibration isolated, provide flexible connections at control connections and at minor piping connections so that vibration is not transmitted to the structure. Provide steel bracing as shown, specified, or required to resist earthquake and wind loads.

C. Install isolation for motor driven equipment.

D. Bases:
1. Set steel bases for one 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.

E. Install spring hangers without binding.

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

G. 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 a full load is applied, adjust isolators to load to allow shim removal.

H. Provide pairs of horizontal limit springs on fans with more than 6.0-inch static pressure, and on hanger supported, horizontally mounted axial fans.

I. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Each inertia base shall have a 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.

J. Support piping connections to isolated equipment resiliently as follows:
1. Up to 4 Inch Diameter: First three points of support.
2. 5 to 8 Inch Diameter: 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 ½ static deflection of isolated equipment.

K. Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

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

3.3 PIPE ISOLATION SCHEDULE

Pipe Size Inch	Isolated Distance from Equipment
1	120 diameters
2	90 diameters
3	80 diameters
4	75 diameters
6	60 diameters
8	60 diameters

3.4 EQUIPMENT ISOLATION SCHEDULE

		Equipment Location Floor Span			
Equipment Type	Slab on grade Base/Isolation/Defl	20Ft. B/I/D	30Ft. B/I/D	40Ft. B/I/D	50Ft(N?A?) B/I/D
Refrigeration Machines					
Reciprocating compressors	C/3/.75	C/3/.75	C/3/1.5	C/3/1.5	C/3/2.5
Reciprocating condensing units and chilling units	A/2/.25	A/4/.75	A/4/1.5	A/4/2.5	A/4/2.5
Pumps					
Flexible coupled to 40 hp	C/3/.75	C/3/.75	C/3/1.5	C/3/1.5	C/3/1.5
Packaged Roof Air-Conditioning Units	A/1/.25	D/3/.75	D/3/2.5	D/3/3.5	D/3/3.5
Fans and Air Handling Equipment Axial Tubular and Fan Heads					
Up to 22 in. wheel dia.	A-B/2/.25	A-B/3/.75	A-B/3/.75	A-C/3/.75	A-C/3/1.5
301 to 500 rpm	B-C/3/.75	C/3/1.5	C/3/2.5	C/3/2.5	C/3/2.5
501 rpm and over	B-C/3/.75	C/3/1.5	C/3/1.5	C/3/1.5	C/3/2.5
Centrifugal Fans and Vent Sets					
Up to 22 in. wheel dia.	A-B/2/.25	A-B/3/.75	A-B/3/.75	A-C/3/.75	A-C/3/.75
301 to 500 rpm	B/3/1.5	B/3/1.5	B/3/2.5	B/3/2.5	B/3/2.5
501 rpm and over	B/3/.75	B/3/.75	B/3/.75	B/3/1.5	B/3/2.5
Packaged Air Handling Equipment					
Up to 10 hp	A/3/.75	A/3/.75	A/3/.75	A/3/.75	A/3/1.5
15 hp and over					
up to 500 rpm	A/3/.75	A/3/2.5	A/3/2.5	A/3/2.5	A/3/2.5
501 rpm and over	A/3/.75	A/3/1.5	A/3/1.5	A/3/1.5	A/3/2.5
Condensing Units	A/1/.25	A/4/.75	A/4/1.5	A/4/1.5	

END OF SECTION