

## SECTION 15210 - VIBRATION ISOLATION

## PART 1 – GENERAL

## 1.01 SCOPE

- A. Unless otherwise noted on the equipment schedule, all mechanical equipment shall be mounted or suspended on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonable uniform deflection.
- B. All piping over 1" outside diameter located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters, whichever is greater, from any connection to vibration isolated mechanical or electrical equipment shall be isolated from the building structure by means of noise and vibration isolation hangers. All piping in the building, which is connected to vibration isolated equipment shall be isolated at connections to the building structure.
- C. All ductwork located in mechanical equipment rooms, and for a minimum of fifty (50) feet from any connection to vibration isolated air moving equipment shall be isolated from the building structure by means of noise and vibration isolation hangers.
- D. All piping and ductwork vertical risers shall be isolated from the building structure by means of noise and vibration isolation guides and supports.
- E. All piping and ductwork to be isolated according to this section of the specification shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain a minimum of 3/4" and maximum of 1-1/4" clearance around the outside surfaces. This clearance space shall be tightly packed with 1.58 P.C.F. glass fiber and shall be caulked airtight after installation of the piping or ductwork.
- F. Approval for substitution of "Internally Isolated" mechanical equipment in lieu of the specified isolation of this section must be secured for individual equipment units a minimum of ten (10) days prior to the project bid date.

## 1.02 SYSTEM DESIGN

- A. The isolation materials manufacturer shall be responsible for the proper selection of isolators to accomplish the specified minimum static deflections, for all isolators, based on the actual weight distribution of equipment to be isolated.
- B. The isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases, to support mechanical equipment scheduled to receive such supplementary base.
- C. The contractor shall furnish a complete set of approved shop drawings of all mechanical equipment to receive vibration isolation devices to the vibration isolation materials manufacturer, based upon which the selection of vibration isolators and design of supplementary bases will be completed. The shop drawings to be furnished shall include operating weights of the equipment to be isolated and the distribution of weight at support points.
- D. The contractor shall furnish a complete layout of piping and ductwork to be isolated, including vertical risers, showing size or weight and support points of the piping or

ductwork system, to the vibration isolation materials manufacturer, for selection and layout of isolation hangers.

### 1.03 SUBMITTALS

- A. The Contractor shall have prepared by the isolation materials manufacturer, and shall submit to the Engineer for approval, drawings showing the construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project, and shall include the complete design of supplementary bases; a tabulation of the design data for each isolator, including spring OD, free operating, and solid heights, and ratio of horizontal to vertical stiffness, and other required data to clearly indicate that the specified isolator types and minimum static deflections are provided by the system submitted.

## PART 2 – PRODUCTS

### 2.01 QUALITY CONTROL - VIBRATION ISOLATORS

- A. All vibration isolation materials specified herein shall be provided by a single manufacturer to assure single source responsibility for the proper performance of materials used.
- B. Subject to compliance with requirements, provide vibration isolation as manufactured by one of the following:
  - 1. B-Line Systems, Inc.
  - 2. Kinetics Div. of Peabody Noise Control.
  - 3. Mason Industries, Inc.

### 2.02 ISOLATOR TYPES

- A. TYPE 1, FLOOR-MOUNTED EQUIPMENT
  - 1. Vibration isolators shall be precompressed molded fiberglass pads individually coated with a flexible, moisture impervious elastomeric membrane. Vibration isolation pads shall be molded from glass fibers with fiber diameters not exceeding 0.00027 in. and with a modulus of elasticity of 10.5 million PSI. Natural frequency of fiberglass vibration isolators shall be essentially constant for the operating load range of the supported equipment. Vibration isolators shall be color coded or otherwise identified to indicate the load capacity. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents. Vibration isolation pads shall be Model KIP, as manufactured by Peabody Noise Control, Inc.
  - 2. Vibration isolators shall be as described above but bonded to a steel load transfer plate and a formed steel bolt-down bracket, and shall also include an equipment mounting bolt with an anti-short circuit neoprene grommet. Anchored vibration isolators shall be Model AC as manufactured by Peabody Noise Control, Inc.
  - 3. Vibration isolators shall be neoprene, molded from oil-resistant compounds, with cast-in-top steel load transfer plate for bolting to supported equipment and a bolt-down plate with holes provided for anchoring to supporting structure. Top and bottom surfaces shall have non-skid ribs. Neoprene vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule or as indicated on the project documents but not exceeding published load capabilities. Neoprene vibration isolators shall be Model RD, as manufactured by Peabody Noise Control, Inc.

**B. TYPE 1, SUSPENDED EQUIPMENT**

1. Vibration isolators with maximum static deflection requirements under the operating load conditions not exceeding .40" shall be hangers consisting of an elastomer-in-shear insert encased in a welded steel bracket and provided with a stamped load transfer cap. The elastomer insert shall be neoprene, molded from oil resistant compounds and shall be color-coded to indicate load capacity and selected to operate within its published load range.
2. The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30-degree arc without metal-to-metal contact or other short circuit. Vibration isolation hanger assembly shall be Model RH, as manufactured by Peabody Noise Control, Inc.

**C. TYPE 2, FLOOR-MOUNTED EQUIPMENT**

1. Vibration isolators shall be freestanding, unhooused, laterally stable steel springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections shown on the Vibration Isolation Schedule or as indicated on the project documents. Springs shall be color coded or otherwise identified to indicate load capacity. Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock-nut and washer for attachment to the supported equipment. The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure. Spring isolation mounts for floor mounted equipment shall be Model FDS, as manufactured by Peabody Noise Control, Inc.

**D. TYPE 2, SUSPENDED EQUIPMENT, PIPING, & DUCTWORK**

1. Vibration isolators for suspended equipment, with minimum static deflection requirement exceeding 0.4" shall be hangers consisting of a free-standing, laterally stable steel spring and elastomeric washer in series, assembled in a stamped or welded steel bracket. The spring element shall meet all the specified characteristics described in Section 2.02.C, first paragraph. Vibration isolation hangers shall be Model SH, as manufactured by Peabody Noise Control, Inc.
2. Vibration isolators for suspended equipment with minimum static deflection requirement exceeding 4", and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable steel spring in series with a precompressed molded fiberglass insert, complete with load transfer plated and assembled in a stamped or welded steel bracket. The fiberglass insert element shall meet all the specified characteristics described in Section 2.02.A, first and second paragraphs. The spring element shall meet all the specified characteristics described in Section 2.02.C, meet all the specified characteristics described in Section 2.02.B, third paragraph.
3. The combination isolation hanger assembly with fiberglass inserts shall be Model SFH, as manufactured by Peabody Noise Control, Inc."

**E. TYPE 3, RESTRAINED SPRING ISOLATORS**

1. Vibration isolators for equipment which is subject to load variations and large external or torquing forces shall consist of large diameter laterally stable steel springs assembled into formed or welded steel housing assemblies designed to limit vertical movement of the supported equipment. Housing assembly shall be formed or fabricated steel members and shall consist of a top-load plate complete with adjusting and leveling bolts, vertical restraints, isolation washers and a bottom plate with non-skid noise stop pads and holes provided for

anchoring to supporting structure. Spring elements shall meet all the specified characteristics described in Section 2.02.C, first paragraph. Vibration isolators shall be Model FLS, as manufactured by Peabody Noise Control, Inc.

## 2.03 BASE TYPES

### A. TYPE 1, STRUCTURAL RAIL BASES

1. Bases shall be structural beam sections, with welded on isolator support brackets and prelocated and drilled anchor bolt holes or skids, and shall be designed and supplied by the isolation materials manufacturer. Beam sections shall not be structurally connected to each other. Minimum section depth of each member shall be equal to 8% of the longest span between supporting isolators, or as shown on the drawings or indicated on the project documents. Isolator support brackets shall be welded to the structural beams as required to obtain the lowest mounting height for the supported equipment. Structural Rail Bases shall be Model SBB, as manufactured by Peabody Noise Control, Inc.

### B. TYPE 6, INTEGRAL STRUCTURAL RAIL BASES

1. Bases shall be fabricated from structural beam sections as described above, except that lateral cross members will be added to form a structurally integral, welded frame to provide a rigid, distortion-free common frame to support and anchor separate equipment components or driving and driven members. Structural fabricated bases shall be Model SFB, as manufactured by Peabody Noise Control, Inc.

### C. TYPE 7, CONCRETE INERTIA BASES

1. Bases shall be constructed of concrete cast into a prefabricated inertia base frame assembly designed and supplied by the isolation materials manufacturer. Frame members shall be welded to form a structurally integral assembly, complete with primer-painted steel perimeter members, welded and tied reinforcing rods, recessed isolator brackets and equipment anchoring bolts. Bases shall be shipped ready for pouring of concrete fill in the field. Concrete inertia bases shall be Model CIB, as manufactured by Peabody Noise Control, Inc.

## 2.04 VIBRATION ISOLATOR SELECTION

- A. Noise and vibration isolator types, minimum operating static deflections, and supplemental bases shall be provided for individual mechanical equipment units according to selection criteria delineated in the table incorporated as part of this specification or as tabulated in the equipment schedules of the project drawings.

- B. Noise and vibration isolator types and minimum operating static deflections for suspended or floor mounted piping shall be as follows:

1. Types 1 and 2 hangers, or Type 2 floor mounts, with minimum operating static deflections equal to 50% of connected equipment isolator deflection, or one (1) inch, whichever is greater, shall be used to support all piping over one (1) inch outside diameter located within mechanical equipment rooms, traveling between equipment rooms, and for a minimum of 50 feet or 100 pipe diameters, whichever is greater, from connections to vibration isolated mechanical or electrical equipment.
2. Type 1 hangers or floor mounts, with a maximum natural frequency of 12 Hz, shall be used to support all piping throughout the building which is connected to vibration isolated equipment, and not specified to receive Type 2 isolators.
3. All piping connected to fire pumps or sprinkler systems is excluded from vibration or noise isolation requirements.

- C. Noise and vibration isolator types and minimum operating static deflections for suspended, or floor mounted, sheet metal ductwork air plenums, pressure reducing valves, sound traps and similar air distribution elements shall be as follows:
  - 1. Type 2 hangers, or Type 2 floor mounts with minimum operating static deflections equal to 50% of connected equipment isolator deflection, or one (1) inch, which ever is greater, shall be used to support all sheet metal air distribution elements located within mechanical equipment rooms, traveling between equipment rooms, and for a minimum of 50 feet from connections to vibration isolation mechanical equipment.
- D. Isolator types are scheduled to establish minimum standards. At the contractor's option, labor saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages, provided isolators supplied incorporate the specified isolator type, and do not degrade the noise and vibration isolation of equipment mounted.
- E. Supplemental equipment bases Type 2 and 3 as required shall be provided for all mechanical equipment having non-unitary driving and driven members, or equipment configurations such that mounting on vibration isolators would cause increased strain on connected piping or ductwork if supplemental bases are not provided.

#### 2.05 QUALITY CONTROL - FLEXIBLE CONNECTORS

- A. All flexible connectors specified herein shall be provided by a single manufacturer to assure single source responsibility for the proper performance of materials used.
- B. Subject to compliance with requirements, provide flexible connectors as manufactured by one of the following:
  - 1. Mason Industries, Inc.
  - 2. Metraflex Company

#### 2.06 CONNECTOR TYPES

- A. TYPE 1, RUBBER SPHERICAL
  - 1. Flexible neoprene or EPDM connectors shall be used on all pipe connections to pumps, air handling units and other vibration-causing devices within mechanical equipment rooms except boilers or heat exchangers. They shall be manufactured of multiple plies of nylon tire cord and EPDM both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Connectors shall have two spheres. Connectors up to and including 1-1/2" may have threaded ends. Connectors 2" and larger shall be manufactured with floating galvanized flanges recessed to lock the connector's raised face neoprene flanges. Hoses shall be connected on the equipment side of shut-off valves. Connectors shall be rated at a minimum of 150 psi at 220 F. All connections shall be made with spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. Connectors 12" and larger operating above 100 psi shall employ control rods with end fittings isolated by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1,000 psi. Connectors shall be type MFTFU or MFTFC as manufactured by Mason Industries, Inc.
- B. TYPE 2, STAINLESS STEEL
  - 1. Stainless steel hoses shall be used on all piping connections to pumps, air handling units, coils and other vibration producing devices outside of mechanical

equipment rooms and at piping connections to boilers and heat exchangers. Hoses shall have stainless steel braid and carbon steel braid and carbon steel flanges. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Lengths shall be as tabulated:

Flanged		Male Nipples	
3" x 14"	10" x 26"	½" x 9"	1 ½" x 13"
4" x 15"	12" x 28"	¾" x 10"	2" x 14"
5" x 19"	14" x 30"	1" x 11"	2 ½" x 18"
6" x 20"	16" x 32"	1 ¼" x 12"	
8" x 22"			

Hoses shall be installed on the equipment side of shut-off valves, horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

### PART 3 – EXECUTION

#### 3.01 EXECUTION

- A. Installation of all vibration isolation materials and supplemental equipment bases specified in this section shall be accomplished as per manufacturer's written instructions.
- B. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Coordinate with Division 16 to assure flexibility of electrical connections to isolated equipment.

END OF SECTION 15210A