

SECTION 15255

SEISMIC RESTRAINTS

PART 1 GENERAL

1.01 Not used

1.02 SUMMARY:

- A. Unless otherwise noted, all plumbing, fire suppression, mechanical and electrical equipment shall be mounted 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 deflections.
- B. All isolators and isolation materials shall be selected and certified using published or factory certified data. Any variance or noncompliance with these specification requirements shall be corrected by the Contractor in an approved manner.
- C. The Contractor shall provide Seismic Restraints in accordance with applicable seismic code requirements. The Contractor and subcontractors impacted by this requirement must determine the applicable local requirements which apply to this project type (Mercantile/ Retail Use or as otherwise designated on the drawings cover sheet at "Code Data").

1.03 WORK NOT INCLUDED:

- A. Seismic restraints may not be required for the following in order to meet seismic code requirements:
 - 1. Gas piping less than 1" I.D. and other piping less than 2-1/2" I.D.
 - 2. Piping in boiler and mechanical rooms less than 1-1/4" I.D.
 - 3. All rectangular ducts less than 6 sq. ft. in cross sectional area.
 - 4. All round ducts less than 28" in diameter.
 - 5. All clevis piping suspended by individual hangers 12" in length or less from the top of the pipe support to the bottom of the support for the hanger.

1.04 RELATED WORK: Section 09510- Acoustical Ceiling; Section 15300- Fire Suppression System; Section 15400- Plumbing Systems; Section 15500- HVAC Systems.

1.05 SUBMITTAL: No product submittal is required for the work of this Section IF provided per the construction documents. Any Request for Product Substitution must be submitted per Section 01340- Submittals.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER/MANUFACTURER RESPONSIBILITIES:

- A. All vibration isolation mounts shall be supplied by a single manufacturer. Acceptable suppliers are Mason Industries Inc., Peabody Noise Control Inc., Vibration Mountings & Controls Inc. or Amber/ Booth Company
 - 1. Manufacturer/ supplier shall determine vibration isolation and seismic restraint sizes and locations. Provide piping, equipment isolation systems and seismic restraints as required. Provide installation instructions and drawings.
 - 2. Manufacturer/ supplier shall provide calculations as may be required to determine restraint loads resulting from seismic forces required by applicable provisions of the

seismic code. Seismic calculations shall be certified by a licensed engineer, experienced in the design of restraints for flexibly mounted equipment.

2.02 VIBRATION ISOLATION MOUNT TYPES:

A. General:

1. All metal parts of vibration isolation units installed out-of-doors shall be cold-dip galvanized, cadmium plated or neoprene coated after fabrication. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 144.
2. 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. However, accessories must not degrade the vibration isolation system.

B. Type FSN (Housed Floor Spring and Neoprene):

1. Spring isolators shall be housed single spring mounts for seismic and restrained service. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the design load. Springs shall have a minimum additional travel to solid equal to 50% of the actual deflection. Springs shall be so designed that the ration of horizontal stiffness to vertical stiffness is approximately one. All mounts shall have leveling bolts.
2. The spring element in the isolator shall either be set in a neoprene cup and have a steel washer to distribute the load evenly over the neoprene or each isolator shall be mounted on a type DNP isolator. If the DNP isolator is used, a rectangular bearing plate of sufficient size to load the pad uniformly in the range of 40 to 50 psi shall be provided. If the spring isolator is supplied with a neoprene friction pad, a stainless steel, aluminum or galvanized steel plate shall be used between the friction pad and the type DNP isolator. The type DNP isolator, separator plate and friction pad shall be permanently adhered to one another and to the bottom of the bearing plate.
3. If the isolator is to be fastened to the building structure and a type DNP isolator is used under the bearing plate, neoprene grommets shall be provided for each bolt hole in the base plate. The hold down bolt assembly shall include washers to distribute load evenly to the grommet. Bolts and washers are to be galvanized.
4. Type FSN isolators shall be equal to Mason Model "SSLFH" with the appropriate neoprene pad (if used) selected from type DNP or approved equal.

C. Type FN (Floor Neoprene): Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base with a minimum static deflection of 0.35". All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment. Type FN isolators shall be equal to Mason Model "ND".

D. Type DNP (Neoprene Pad): neoprene pad isolators shall be of 3/4" thick waffled neoprene in 2" square modules separated by a thin web. Provide load distribution plate as required. Type DNP isolators shall be equal to Mason Model "Super W".

E. Type HS (Hanger Spring): Vibration isolation hangers shall consist of a freestanding laterally stable steel spring set into a neoprene cup, contained within a steel housing. The neoprene cup shall be manufactured with a grommet (or other means) to prevent the hanger rod from contacting the hanger housing. A steel washer shall be provided in the neoprene cup to evenly distribute load onto the neoprene. Spring diameter and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before

contacting the housing. Spring elements shall have a minimum additional travel to solid equal to 50% of the actual deflection. Type HS isolators shall be equal to Mason Type 30.

- F. Type HSN (Hanger Spring and Neoprene or Glass Fiber): Vibration isolation hangers shall consist of a freestanding, laterally stable steel spring and a neoprene or a glass fiber element in series, contained within a steel housing. A neoprene neck bushing (or other means) shall be provided where the hanger rod passes through the hanger housing. Spring diameters and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Spring elements shall have a minimum additional travel to solid equal to 50% of the actual deflection. The neoprene element shall be designed to have a 0.3" minimum static deflection. Type HSN isolators shall be equal to Mason Type 30N
- G. Type HN (Hanger neoprene or Glass Fiber): Vibration isolation hangers shall consist of a neoprene-in-shear or glass fiber element contained in a steel housing. A neoprene neck bushing (or other means) shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hold in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing. Type HN isolators shall be equal to Mason Model "HD".

2.03 EQUIPMENT BASES:

- A. Type BC (Base-Curb):
 - 1. Type BC vibration isolation curb bases shall be equal to Mason Model "CMAB", curb type isolation bases. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule; the static deflection shall be constant around the entire periphery of the base. Springs shall be freestanding, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel to solid that is at least 50% of the actual deflection. Resilient neoprene snubbers shall be provided at the corners of the base to limit movement of equipment under wind load to 1/4".
 - 2. The isolation curb base shall be made weathertight by sealing all around the periphery with closed cell neoprene or flexible vinyl. A closed cell sponge gasket or field caulking shall be used between the equipment unit and isolation curb for a weathertight seal.
- B. Type BSF (Base-Steel Frame): Type BSF bases shall be equal to Mason Model "WFSL". Steel base frames shall consist of structural steel sections sized, spaced and connected to form a rigid base which will not twist, rack, deform or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. The thickness of steel frame bases shall be at least 1/10 the longest dimension of the base but not more than 12".
- C. Type BK (Inertia Pad): Type BK bases shall be equal to Mason Model "K". Type BK shall consist of rectangular structural beam or channel concrete forms for floating foundations. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of 1/2" rebars or angles welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with steel members to hold anchor-bolt sleeves when the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations to maintain a 1 inch clearance below the base.

2.04 SEISMIC RESTRAINING TYPES:

- A. General: Restraints shall be capable of safely accepting 0.5 G external forces without failure, or 1.0 G for life safety equipment. Restraints shall maintain equipment, piping and ducts in a captive position. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise. Restraints shall be provided on all equipment as scheduled on drawings or as may be otherwise required by the local jurisdiction.
- B. Spring Seismic Restraint, Type I: Provide equal to Mason Model "SSLFH". Restraints shall comply with general characteristics of spring isolators have minimum O. D. to O. H. of 0.8 to 1 and minimum runout of 50% to solid. Restraints shall incorporate snubbing restraint in all directions. Restraints shall be capable of supporting equipment at a fixed elevation during equipment erection. Cast or aluminum housings, unless ductile iron, are not acceptable. System to be field bolted or welded to deck with 1.0 G acceleration capability.
- C. Seismic Restraint, Type II: Provide equal to Mason Model Z-10-11 and Z-1225. Each corner or side shall incorporate a seismic restraint having a minimum 5/8" thick resilient pad limit stops working in all directions. Restraints shall be made of plate, structural members or square metal tubing concentric within a welded assembly incorporating resilient pads. Angle bumpers are not acceptable. System to be field bolted or welded to deck with 1.0 G acceleration capability.
- D. Seismic Restraint, Type III: provide equal to Mason Model SCB. Metal cable type with approved and fastening devices to equipment and structure. System to be field bolted to deck or overhead structural members using two-sided beam clamps to steel or appropriately designed insert for concrete. All parts of system including cables and clamps, (excluding fastenings) are to be single vendor furnished to assure seismic compliance.
- E. Seismic Restraint, Type IV: Provide equal to Mason Model BR, RBA. Double deflection neoprene isolator encased in ductile iron or steel casing minimum 0.30 static deflection. System to be field bolted or welded to deck with 1.0 G acceleration capacity.
- F. Seismic Restraint, Type V: Non-isolated equipment to be field bolted or welded (powder shots not accepted) to resist seismic forces unless under 100% shear force is required.

2.05 FLEXIBLE PIPE CONNECTIONS:

- A. Type K:
 - 1. Flexible EPDM connectors shall be used on all equipment as indicated on the Drawings and as on the equipment schedule. Connectors shall be manufactured of multiple plies of friction nylon tire cord with an EPDM cover and liner. No steel wire or rings shall be used as internal pressure reinforcement. Straight connectors shall have two spheres with a centered molded-in external ductile iron ring to maintain the two spherical shapes. Two-inch and smaller sizes may have threaded ends. Floating flanges shall have a recess to lock the bead wire in the raised EPDM flanges. Tapered twin sphere connectors as described above shall be used where line size changes are required in straight piping runs.
 - 2. Twin sphere connectors shall have a minimum rating of 250 psi at 179°F. and 165 psi at 250°F. Elbows and reducing twin spheres shall have a minimum pressure rating of 220 psi at 170°F and 145 psi at 250° F. Neoprene materials shall be limited to 220° F. Certified safety factors shall be a nominal 4 to 1 with minimum acceptable test results of 3.6 to 1. Tests shall cover burst, flange leakage, extension without control rods and flange retention at 50% OF BURST PRESSURE WITHOUT CONTROL RODS.

- 3 Submittals shall include two test reports by independent consultants showing minimum reduction of 20DB in vibration accelerations and 10DB in sound pressure levels at typical blade passage frequencies.
4. Twin sphere, reducing twin sphere and reducing elbows shall be Superflex MFTNC or MFTFU, MFTCR and MFLRR; standard radius equal elbows Mason-Flex MFNEC; control rods Type ACR, as manufactured by Mason Industries Inc

2.06 PIPE ANCHORS: Type PA: Provide an all directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum half inch thickness of heavy duty neoprene material. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. All directional anchors shall be equal to Mason type 'ADA'

2.07 VIBRATION ISOLATION SCHEDULE:

UNIT	ISOLATOR TYPE	MIN. STATIC DEFL. (IN)	BASE TYPE	REMARKS
Air Handling Unit Fan on Floor & Grade	FSN	1.5"	---	
In-Line Return & Exhaust Fans Fan Coils Hung from Structure	HSN	1.5"	---	
Air Handling Unit Fans Hung from Structure	HSN	1.5"	---	
Pumps on Grade	FSN	0.75"	BSF	
Pumps on Suspended Floors	FSN	1.5"	BSF	
Curb Mounted Exhaust Fans<1 HP	---	---	---	Internal Neoprene Grommets
Curb Mounted Exhaust Fans>1 HP	---	1.0"	BC	

PART 3 EXECUTION

3.01 APPLICATION: Miscellaneous pieces of mechanical equipment such as expansion tanks shall be vibration isolated from the building structure by Type NH isolators unless their position in the piping system requires higher degrees of isolation.

3.02 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT:

- A. Installation of vibration isolation equipment shall be in accordance with the manufacturer's written instructions.
- B. Isolation Mounts:
 1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment
 2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints
 3. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plate shall rest entirely on the pad.
 4. Hanger rods for vibration isolated support shall be connected to structural beams or joints; not from the floor slab between beams and joists. Provide intermediate support members as necessary
 5. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly but not in contact with the building structure, and so that the hanger housing may rotate a full 360 degrees without contacting any object.
 6. Parallel running pipes may be hung together on a trapeze which is isolated from the building. Isolator deflections must be the largest determined by the provisions for pipe isolation. Do not mix isolated and non-isolated pipes on the same trapeze

7. No pipes or equipment shall be supported by other pipes or equipment.
8. Resiliently isolated pipes shall not contact any rigid building structure or equipment.
9. The installed and operating heights of vibration isolated equipment mounted on Unit FSNTL isolators shall be identical. Limit stops shall be out of contact during operation.
10. Adjust all leveling bolts and hanger rod bolts so the isolated equipment is level and in proper alignment with connecting ducts or pipes.
11. Vertical pipe risers shall be supported by or suspended from Type HSN hangers and piping anchored or guided with type PA anchors.
12. Plumbing water piping in mechanical rooms shall be suspended from Type HSN hangers.

3.03 SEISMIC RESTRAINTS FOR NON-ISOLATED EQUIPMENT:

A. Plumbing:

1. All ceiling suspended piping not excluded by diameter or distance requirement from support, and ceiling mounted equipment: Seismic Restraint Type III.
2. All floor mounted equipment, including but not limited to tanks, domestic water heaters, etc: Seismic Restraint Type V.

B. Mechanical Equipment:

1. All ceiling suspended piping and ductwork not excluded by diameter or distance requirement from support: Seismic Restraint Type III.
2. All ceiling mounted equipment including, but not limited to, fans, AHU's, tanks, stacks, VAV boxes, and unit heaters: Seismic Restraint Type III.
3. All floor mounted equipment: Seismic Restraint Type V.

END OF SECTION