SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**NOTE TO SPECIFIER**

*Use this Specification Section for Mail Processing Facilities.*

***This is a Type 1 Specification with completely editable text; therefore, any portion of the text can be modified by the A/E preparing the Solicitation Package to suit the project.***

*For Design/Build projects, do not delete the Notes to Specifier in this Section so that they may be available to Design/Build entity when preparing the Construction Documents.*

*For the Design/Build entity, this specification is intended as a guide for the Architect/Engineer preparing the Construction Documents.*

*The MPF specifications may also be used for Design/Bid/Build projects. In either case, it is the responsibility of the design professional to edit the Specifications Sections as appropriate for the project.*

*Text shown in brackets must be modified as needed for project specific requirements.* *See the “Using the USPS Guide Specifications” document in Folder C for more information.*

*The last date that USPS revised this standard specification section occurs in two places, at the end of this section and in the Table of Contents. If the date in this section matches the date in the Table of Contents, then you are using the latest version. Do not delete or revise the “last revised” date at the end of the section during the development of the Project Manual.*

*The footer in this section should be edited to replace the text, “USPS MPF SPECIFICATION” with the project name, and the blank date in the center should be replaced with the submission date, for interim design reviews, or the issue date of the completed Project Manual.*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Inertia bases.

Vibration isolation.

* + - 1. REFERENCES
         1. General:

The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

Refer to Division 23 Section "Common Results for HVAC" for codes and standards, vibration and noise, and other general requirements.

* + - 1. SUBMITTALS
         1. Product Data:

Provide specific information for items described under the products section of this Specification, including specifications, descriptive drawings, catalog cuts, and descriptive literature, including make, model, dimensions, weight and interface description with other work, and indicating full compliance with specifications as outlined.

An itemized list showing items to be isolated, the isolator type, model number, isolator loading and deflection, and reference to specific drawing showing frame construction where applicable.

* + - * 1. Shop Drawings:

Indicate inertia bases and vibration isolator locations, with static and dynamic load on each.

Drawings showing intended locations.

Drawings showing equipment frame construction for each machine, including dimensions, structural member sizes, and support point locations.

Drawings showing methods for suspension, of support, and guides.

Drawings showing methods for isolation of piping, at penetrations of walls, slabs, etc.

* + - * 1. Maintenance and Operations Data: Submit manufacturer's certificate that isolators are installed and adjusted to meet or exceed specified requirements.
      1. QUALITY ASSURANCE
         1. Maintain ASHRAE criteria for average noise criteria curves for equipment at full-load condition

1. PRODUCTS
   * + 1. GENERAL REQUIREMENTS
          1. Vibration isolation components (isolators, snubbers, rails, and inertia bases) to be hot-dip galvanized. Welded steel channel perimeter frame with welded-in reinforcing bars, pre-located welded-in anchor bolts or pre-located bolt holes suitable for the number and size required, and height saving brackets where required. Inertia bases shall be 1.5 times of the weight of the equipment. Snubbers shall be provided. Delete inertia base requirement if the equipment is provided with motor rating of less than 15 hp and is provided with steel frame base.
       2. VIBRATION ISOLATORS
          1. General:

Metal parts of vibration-isolation units shall be as follows:

Housing: Hot-dipped galvanized outdoors, and inside air handlers and painted indoors. Galvanizing shall meet ASTM Salt Spray test Standards and Federal Test Standard no. 14.

Hardware (washers, nuts, bolts, etc.): Galvanized outdoors, and inside air handlers, and cadmium plated indoors.

Springs: Neoprene coated outdoors, inside air handlers, and painted indoors.

Isolator types are scheduled to establish minimum standards. At the Subcontractor's option, accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevation during installation and initial system filling operations, and similar installation advantages. Accessories shall not degrade the vibration isolation system.

Static deflection of isolators are indicated in Vibration Isolation Schedule. Static deflections stated are the minimum acceptable deflection for the mounts under actual load.

The use of nested springs or of multiple parallel springs within a single mount is not permitted.

* + - * 1. Floor Spring and Neoprene:

Spring isolators to be free-standing and laterally stable without housing. Spring diameter shall be not less than 0.8 times the compressed height of the spring at the design load. Springs shall have a minimum additional travel to solid equal to 50 percent of the actual deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1. Mounts shall have leveling bolts.

The spring element in the isolator shall be set in a neoprene cup and have a steel washer to distribute the load evenly over the neoprene. A rectangular bearing plate of appropriate size to load the pad uniformly in the range of 40 to 50 psi shall be provided. A neoprene friction pad, a stainless steel, aluminum, or galvanized steel plate shall be used between the friction pad and the isolator. The isolator, separator plate, and friction pad shall be permanently adhered to one another and to the bottom of the bearing plate.

* + - * 1. Hanger Spring:

Vibration-isolation hangers shall consist of a free-standing 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 element) 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.

The plate or washer at the top of the spring shall be welded to the spring. The hanger rod shall be securely fastened to this plate or washer using lock nuts. The hanger rod shall have a diameter not less than 5/8 inch. This design represents a modification to the unit types given below. The modification is intended to limit the side-to-side motion of the hanger rod relative to the hanger casing.

Spring diameter and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the housing. Spring elements shall have minimum additional travel to solid equal to 50 percent of the actual deflection.

Upper hanger rod attachment shall be made through a neoprene rubber-in-shear element designed to avoid direct contact between the hanger rod and the isolator frame.

Springs shall be color coded for ease of identification and removable, for field connection.

* + - 1. EQUIPMENT BASES
         1. Base Steel Frame:

Steel base frames shall consist of structural steel sections sized, spaced, connected, and cross-connected to form a rigid base which will not twist, deform, or deflect in any manner which will negatively affect the operation of the supported equipment of the vibration-isolation mounts. Frames shall be adequately sized to support basic equipment units and mounts plus associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame bases shall be at least 1/10 the longest dimension of the base with a minimum depth of 6 inches, but not more than 12 inches. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

* + - * 1. Concrete Inertia Base:

Concrete inertia bases shall be formed of stone-aggregate concrete (150 pounds per cubic ft.) and appropriate steel reinforcing cast between perimeter structural steel channels. Inertia bases shall be built to form a rigid base which will not twist, deform, or deflect, in any manner which would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base but not less than 6 inches and not more than 12 inches. The weight of the inertia base, as a minimum, shall be 1 to 2 times that of the total weight of the equipment, as scheduled (including the attached piping it is supporting and other applicable loads). Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

The steel frame and reinforcement are to be supplied by the vibration isolator manufacturer. Concrete shall be provided in the field.

Inertia bases used to support vibration-isolated pumps are to be sized to provide support for valves, pipe elbows and suction diffuser.

* + - 1. SNUBBERS
         1. Snubbers to limit the vertical and horizontal motion of the isolated equipment shall be fabricated from steel. A neoprene pad, 1/4-inch minimum thickness, shall be affixed at the point of contact. There will be no contact between snubbers and the inertia base or equipment support frame during normal operation. Minimum of one snubber per side, four total, shall be required on each base. Seismic snubbers shall have a minimum of 1.0G ratings and anchorages.
         2. Snubbers shall not be finally installed until vibration isolators are in place and adjusted with actual operating loads.
      2. PIPING ISOLATORS
         1. Specialty Products Co. Acousto-Plumb isolators, or equal, for pipe 3/4-inch and smaller, and Trisolator for pipes 1 inch and larger, or equal.

1. EXECUTION
   * + 1. GENERAL
          1. The Subcontractor is to obtain written and/or oral instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices.
          2. The Subcontractor is to correct, at no additional cost, installations which are deemed defective in workmanship or materials.
          3. The Subcontractor is responsible for proper operation of systems, minor sub-systems, and services provided under this Section. The Subcontractor is to coordinate startup procedures, calibration, and system check-out with Subcontractors involved. Any system operational problems shall be diagnosed. Correctional procedures shall be initiated by the various Subcontractors as required to bring the system into compliance with the design, and the problem shall then be rechecked to verify that the system operates normally. Any remaining difficulties shall be brought to the attention of the USPS.
          4. Do not install equipment, ductwork, piping and conduit which makes rigid contact with the structure unless it is allowed by this specification.
          5. The Subcontractor is to bring to the USPS’s attention prior to installation conflicts which will result in unavoidable contact between the building structure and the isolated equipment, piping, etc., described herein, due to inadequate space, etc. Corrective work necessitated by conflicts after installation is at the expense of the Subcontractor.
          6. The Subcontractor is to bring to the USPS’s attention prior to installation discrepancies between the requirements of this Specification and field conditions, changes required due to specific equipment selection, etc. Corrective work necessitated by discrepancies after installation is at the expense of the responsible Subcontractor.
          7. Resilient Wall, Ceiling, and Floor Penetrations: Provide resilient wall and ceiling penetrations for piping, conduit, ductwork, etc.
          8. Support vibration isolated ducts, pipes, and equipment directly from structural steel, not the concrete deck.
       2. ISOLATOR INSTALLATION
          1. The installation or use of vibration isolators must not cause change of position of equipment, conduit, piping or ducting, which would result in stresses in connections or misalignment of shafts or bearings. To meet this objective, maintain equipment and attached systems in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load. Plumbing, piping, and ducting at mechanical equipment connections is to be fully supported by specified hangers. Mechanical equipment and vibration mounts shall not carry plumbing, piping, or ducting loads. Utilize flexible metal, liquid-tight conduit for electrical connections.
          2. Isolation/Absorption Products: The completed installation must be free of vibration and noise. Systems, equipment, or parts which vibrate or generate vibration unduly, or which generate or emit undue noise while in operation shall: 1) be adjusted, repaired or replaced as appropriate to obtain acceptable levels of vibration or noise; or 2) be supported on, or fitted with, suppression or absorption devices or other means, which effectively prevent the transmission of vibration or noise beyond the offending item.
          3. Equipment Isolator Installation:

The minimum operating clearance between the underside of the frame or inertia base and the pad or floor is 1 inch.

Place the frame in position and support temporarily by shims prior to the installation of the machine or isolators.

After the entire system installation is completed and under full operational load, adjust the isolators so that the load is transferred from the shims to the isolators, and that the shims are barely free. Remove the shims.

Seismic snubbers shall not be finally installed until vibration isolators are in-place and adjusted with actual operating loads.

* + - * 1. Isolator Hangers**:**

The isolators shall be installed with the isolator hanger box as close as possible to the structure.

The isolators shall be suspended from massive beams, never from slab diaphragms between beams.

Orientation of isolator assembly including support and load rods shall be within five degrees of vertical.

* + - 1. EQUIPMENT ISOLATION
         1. Install isolators for fans, chillers, compressors, pumps and other such equipment as shown on Vibration Isolation Schedule or as otherwise required.
         2. Approve completed vibration isolation system for isolated equipment.
      2. PIPING ISOLATION
         1. Where specifically indicated only, use specified pipe isolation system.
      3. Vibration Isolation Schedule

| **Equipment** | **Base Type**  **and**  **Weight1** | **Isolator**  **Type** | Minimum  Static Deflector (inches) |
| --- | --- | --- | --- |
| HVAC Chillers: ARU- XXX | BSF | FSN | 2 (50 mm) |
| Cooling Towers: CT-XXX | NA | NA | NA |
| Boilers: BR-XXX | NA | NA | NA |
| Water Heaters: WH-XXX | NA | NA | NA |
| In-Line Pumps: GP-XXX | NA | NA | NA |
| Base-Mounted Pumps: GP-XXX | CIB IX | FSN | 2 |
| Vacuum Pump: MP- XXX | CIB 2X | FSN | 2 |
| Air Compressor: KC-XXX | CIB 2X | FSN | 2 |
| Floor-Mounted Air Handler Fans: AHU-XXX | CIB 1X | FSN Internal to air handler | 3 |
| Floor-Mounted Fans:  BL-XXX  BL-XXX | CIB 1X  CIB 1X | FSN  FSN | 3  2 |
| Hung Fans and Air Handlers in Utility Building | NA | HS | 1 |
| Engine Generator Exhaust Muffler and Air Purifier | NA | HS | 1 |
| Engine Generator Exhaust Pipe (horizontal) | NA | HS | 1 |
| Boiler Flues | NA | NA | NA |
| Pipes with water pressure (ICW, IHW, DIWS, DIWR, TRWS, TRWR, HHWS, HHWR) in rooms XXX (list rooms). | NA | Acousto-Plumb (or equal) and insulate pipes at each partition penetration with one inch thick insulation | NA |

11X = 1 time the weight of the equipment supported.

2X = 2 times the weight of the equipment supported.

NA = Not applicable

END OF SECTION

USPS MPF Specification Last Revised: 10/1/2022