



Design Standard

Vibration and Seismic Controls for Plumbing, HVAC Piping, Ductwork, and Equipment

Purpose:

The vibration and seismic controls for plumbing, heating, ventilating, and air-conditioning piping and equipment is an essential element of the mechanical systems. This design standard has the purpose of creating a consistent application of vibration and seismic control requirements throughout the South San Francisco Unified School District therefore achieving a standard of quality for maintenance and reliability throughout all renovation and new building projects.

Design Standard:

Design and specify work to include materials and installation of seismic restraint devices, vibration isolation systems, and related items for a complete and operable system.

- Vibration Control
 - Mechanical and electrical equipment and associated piping and duct work shall be mounted by vibration isolators as required to minimize transmission of vibrations and noise to building structures or spaces.
 - Selection of isolator type shall be as given in Table 42, Selection Guide for Vibration Isolation, Chapter 47, “Sound and Vibration Control,” of the latest edition of the ASHRAE Applications Handbook.
 - All rotating equipment shall be balanced both statically and dynamically. Vibration shall not exceed the guidelines given in Table 42, Selection Guide for Vibration Isolation, Chapter 47, “Sound and Vibration Control,” of the latest edition of the ASHRAE Applications Handbook.
 - To minimize alignment problems, all motors over 5 hp must be designed to be solidly attached to a common base with the driven unit.
 - In order to minimize vibration, solid sheaves and band belts shall be designed to be used in multiple V-belt driven equipment over 15 hp.
- Isolation Equipment
 - Isolation shall be designed to be stable during starting and stopping of equipment without any transverse and eccentric movement of equipment that would damage or adversely affect operation of the equipment or appurtenances.
 - Isolation shall be designed for the operating speed of the equipment.
 - Isolators, including springs, exposed to the weather shall be hot dipped galvanized after fabrication. Hot dipped zinc coating shall comply with



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ASTM Method A-123 and shall not be less than 2 oz per square foot. Isolators at school in harsh outdoor environments (heavy salt laden ocean fog), shall not be designed to be exposed to the environment, if absolutely impossible; the isolators will be required to have extra corrosion protection. A request to install isolators exposed to the elements shall be submitted to SSFUSD.

- Isolators shall be selected and located to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- Isolation equipment includes: neoprene pads, hanger spring and neoprene, travel limited floor spring and neoprene, inertia base, flexible duct connections, flexible pipe connections, thrust limits, grommets, and snubbers.
- Seismic Control and Restraint
 - Brace or anchor plumbing & mechanical equipment to resist horizontal forces acting in any direction using the CBC latest edition.
 - Provide factory fabricated seismic restrained vibration isolating components. Earthquake resistant designs for equipment, i.e., air handling units, blowers, motors, ductwork, and mechanical piping, to conform to the regulations of the CBC, latest edition. It is the District's desire to use standard factory fabricated components, if they are not available, provide properly designed custom components which meet the requirements herein.
 - Design shall include earthquake bumpers to prevent excessive motion during starting and stopping of equipment and for earthquake bracing. Install bumpers after equipment is in operation to allow proper placement and alignment and ensure that bumpers are not engaged during normal system operation
 - Design the seismic bracing and anchorage of piping per Section 23 05 29
 - Design piping and ductwork seismic restraints using the document "Seismic Restraints Manual Guidelines for Mechanical Systems." Secure piping, ductwork, and the like to withstand a force in any direction.
 - Design restraints to meet CBC Seismic Restraint requirements. Provide structural engineering calculations sealed by a professional engineer registered in state of California.
- Seismic Pipe Loops and Pipe Expansion
 - The design shall examine the piping system and shall design expansion compensation into the system by use of expansion loops, flexible connectors or, where space is limited, self-aligning bellows-type expansion joints.
 - The design shall design all anchors and guide supports as needed.
 - Seismic connectors for straight pipe runs to be designed with sufficient live length on each flexible leg to provide the minimum movement in directions



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as required by movement allowed at joint. Verify with structural total movement required in planes.

Approved Manufacturers:

- Isolation Equipment
 - Amber Booth
 - Mason
 - Vibrex
- Seismic Pipe Loops and Expansion Joints
 - Amber Booth
 - Mason
 - Metraflex
 - Vibrex

Substitutes Allowed:

Yes, if performance and quality equivalency can be evidenced.

Associated Design Standards

- 23 05 29 - Hangers And Supports for HVAC Piping And Equipment Design Standard

End of Document