

SECTION - MECHANICAL VIBRATION AND SEISMIC CONTROLS

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

GENERAL

DESCRIPTION

Furnish and install vibration and seismic control devices, materials, and related items. Perform all work as shown on the drawings and as specified herein for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restrain piping, ductwork and equipment per the applicable codes against wind and seismic forces in any direction.

All mechanical equipment with motors, unless otherwise detailed on the drawings, shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. For specific equipment and location please refer to the latest ASHRAE handbook for mount type and minimum rated deflections.

This specification is to be a minimum requirement for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements.

QUALITY ASSURANCE

All vibration isolators described in this section shall be the product of a single manufacturer. California Dynamics products are the basis of these specifications; products of other manufacturers will be considered provided samples strictly comply with the specification and have the approval of the specifying engineer.

1. **California Dynamics Corp**
2. Kinetic Noise Control
3. Tomarco
4. ISAT
6. Vibration Eliminator Co., Inc.

Wind and seismic restraint systems must have approvals by OSHPD for California or other recognized authority, or be able to demonstrate by physical tests or comprehensive analysis that the load resisting capabilities are adequate. It is the intent of the seismic portion of this specification to keep all mechanical building system components in place during a seismic event. All such systems must be installed in strict accordance with SMACNA guidelines, seismic codes, component manufacturers and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.

Seismic restraint and anchorage calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional civil or structural engineer with at least five years of seismic design experience.

All isolation and restraint materials shall be of the same manufacturer and shall be certified by the manufacturer.

Coordinate the size, location, and special requirements of vibration isolation and seismic restraint equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

PART ONE: GENERAL REQUIREMENTS

- A. All steel components shall be cleaned of welding slag and coated with an approved primer. All steel components on a project within 10 miles of salt water, exposed to the weather, shall be hot dip galvanized after welding and springs cadmium plated, powder coated, epoxy or PVC coated and dipped in liquid neoprene.
- B. Provide vibration isolators, base frames, inertia bases and seismic restraints of sufficient size and distribution to assure that deflection, stability and seismic restraint requirements are met. Isolators shall be provided to deflect uniformly under operating loads to within $\pm 10\%$ of specified deflection values.
- C. Springs shall be selected to perform their function without undue stress or overloading. All isolators shall have a minimum $\frac{1}{4}$ " thick neoprene acoustical pad under the spring base plate.
- D. Springs shall be designed to operate in the linear portion of their load versus deflection curve and must be linear over a deflection range of not less than 50 percent above the design deflection. To be considered a Stable Spring, the ratio of lateral to vertical stiffness shall be not less than 0.8 or greater than 1.5. The spring diameter to operating height ratio shall be no less than 0.8.
- E. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
- F. Where called for in the specifications or on the drawings, all structural steel bases supporting mechanical equipment, including concrete filled inertia bases, shall be designed and fabricated by the isolation manufacturer.
- G. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support beneath. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.

1.2 SUBMITTALS

A. Submit Shop Drawings and Manufacturer's Literature including:

1. *Submittals that demonstrate that the specific vibration isolators and seismic restraints utilized are in compliance with the specifications. Submittals shall include spring diameters and deflections.*
2. *Drawings showing equipment frame construction for each machine including dimensions, structural member size, support point, vibration isolators and seismic restraints.*
3. *Seismic restraint and anchor calculations signed and stamped by a professional engineer.*
4. *Drawings indicating methods for suspension, support, seismic restraints, guides, etc., for piping and ductwork.*
5. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

PART TWO: ISOLATOR TYPES:

SS Spring isolators shall be free standing and laterally stable without any housing and complete with a Neoprene acoustical pad between the baseplate and the spring support. All mountings shall have load transfer bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Mountings shall be type SSL/K, as manufactured by California Dynamics Corporation or approved equal

JQ Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A steel housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. The housing shall be Hot-Dipped galvanized. Hot-Dipped zinc coating shall be not less than 2 ounces per square foot complying with ASTM A123, springs to be zinc or powder coated. A clearance of 1/4" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be JQ as manufactured by California Dynamics Corporation or approved equal.

9842 Salt air protected restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A steel housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. The housing shall be Hot-Dipped galvanized and Hypalon coated. Hot-Dipped zinc coating shall be not less than 2 ounces

per square foot complying with ASTM A123, springs to be zinc or powder coated and Hypalon coated. Restraining bolts will be stainless steel. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be 9842 as manufactured by California Dynamics Corporation or approved equal.

DLK/GENX Restrained spring isolators shall be free standing, laterally stable, springs with seismic restraints. A welded housing with cushioned lateral and vertical limit stops to restrict spring extension due to wind loads, or when weight is removed. A clearance of ¼" maximum shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Outside spring diameter not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel 50 percent of the required deflection at rated load. Isolator/Restraint shall be DLK/ GENX as manufactured by California Dynamics Corporation or approved equal.

RH/RHD Hanger shall consist of a rigid steel frame and up to ½" deflection of a molded Neoprene element projecting thru the steel box so that no metal-to-metal contact occurs. Hanger shall be type RH/RHD as manufactured by California Dynamics Corporation or approved equal.

CH30 Hanger shall consist of a rigid steel frame containing a steel spring with a Neoprene sleeve to prevent steel to steel contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc from side to side before contacting the Neoprene sleeve and short circuiting the spring. Hanger shall be type CH30 as manufactured by California Dynamics Corporation or approved equal.

HH30 Hangers shall consist of rigid steel frames containing double deflection Neoprene element at the top and a steel spring and a Neoprene sleeve on bottom to position spring and prevent steel to steel contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side. Hangers shall be type HH30 as manufactured by California Dynamics Corporation or approved equal.

TL Thrust Restraints shall be installed on equipment to limit excessive motion due to thrust force if greater than 10% of the weight of the equipment. For balanced restraint, a matched pair of spring restraints shall be installed opposite each other equidistant from the equipment horizontal center of pressure of thrust on the same elevation as the vertical center of pressure of the thrust. Both restraints shall include a threaded tension rod bridging across the flexible connection between the equipment and the downstream ductwork. Adjustment nuts shall enable optimum setting of spring force restraining thrust force for 1/4" maximum movement. The deflection rating of the restraining springs shall be the same rating as the equipment mountings (or hangers). The assembly shall

include angle brackets with backup plates for attachment to both the equipment and the ductwork or the equipment and the structure if the ductwork is inadequate. Thrust Restraints shall be Type TL as manufactured by California Dynamics Corporation or approved equal.

JQTQN Restrained Neoprene isolators shall be free standing, with a rated static deflection of .5". A steel housing with cushioned lateral and vertical limit stops to restrict extension due to wind loads, or when weight is removed. The housing shall be hot-dipped galvanized. Hot-Dipped zinc coating shall be not less than 2 ounces per square foot complying with ASTM A123. A clearance of 1/4 "maximum shall be maintained around restraining bolts and between the housing and the Neoprene so as not to interfere with the isolator action. Limit stops shall be out of contact during normal operation. Isolator/Restraint shall be JQTQN as manufactured by California Dynamics Corporation.

RM/RMD Elastomeric mounts single or double-deflection type, oil-resistant rubber or Neoprene isolator element with factory-drilled, bonded in place top plate for bolting to equipment and factory drilled base plate for bolting to structure. Color-coded or otherwise identify to indicate capacity range. Mount shall be type RM/RMD as manufactured by California Dynamics Corporation or approved equal.

RQ/RQD All-directional Neoprene mount with integral seismic restraints, shall have a rated single deflection of 0.25" or .5 for double deflection. Anchor holes shall be provided on the bottom and a threaded stud on top. Neoprene shall be sunlight, ozone and oil-resistant in a single or double deflection type. Mountings shall be type RQ or RQD as manufactured by California Dynamics Corporation or approved equal.

XW Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be type XW as manufactured by California Dynamics Corporation or approved equal.

WW Vibration isolation manufacturer shall provide steel members welded to height saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent misalignment of equipment. Structural steel rails shall be type, WW as manufactured by California Dynamics Corporation or approved equal.

CW Rectangular steel concrete pouring forms for floating concrete frames. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6". The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 12" centers running both ways in a layer 1 1/2" above the bottom. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Base shall be type CW as manufactured by California Dynamics Corporation or approved equal.

MW Curb mounted rooftop equipment shall be mounted on 2" static deflection spring isolation curbs. The lower member shall be a full perimeter base curb with a wood nailer and OSHPD Pre-Approved spring isolators that support the upper floating perimeter frame. The upper frame shall be fully welded and must support the equipment and must be captive so as to resist wind and seismic forces. Steel springs shall be laterally stable. Housing must be zinc plated and the springs provided with zinc or powder coating. The upper curbs waterproofing shall consist of a continuous galvanized flashing with a bulb seal. All spring locations shall have access ports with removable waterproof covers for adjusting isolators. Lower curbs shall have provision for 2" of insulation. Curb shall be type MW as manufactured by California Dynamics Corporation

RL-A,C All directional seismic restraints shall consist of interlocking steel members. Neoprene shall have a minimum thickness of 1/4". Incorporate a minimum air gap of 1/8", and a maximum air gap of 1/4" in the design, before contact is made between the rigid and resilient surfaces. Provide removable end plate to allow inspection of internal clearances. Restraints shall be type RL-A/ RL-C as manufactured by California Dynamics Corporation.

Pipe Riser Installation System

Includes a designed combination of devices with appropriate performance characteristics to:

1. Properly distribute pipe weight to avoid floor overloading,
2. Minimize pipe motion if water is drained,
3. provide seismic protection for the pipe,
4. Prevent tall vertical pipe columns from collapsing,
5. Prevent overstressing piping connections to equipment,
6. minimize transmission of objectionable pipe noise with spring support and suspension devices and proper hardness elastomeric material compatible with temperature, environment and aging needs,
7. When job installation requirements prevent access to the complete system of devices and pipe for final adjustment, as nearly as possible, achieve all previous benefits. The design must cope with long lengths of small diameter or heavy pipe with perhaps changing weight due to presence or absence of water and operating length perhaps significantly different from installed length due to significant differential between installed and operating temperatures.

Pipe Riser Installation System devices include the following:

PRI Pre-Loaded Spring Isolators: consist of a free standing laterally stable spring bearing on a raised pedestal with a central threaded rod. Attached to a riser clamp or other pipe attached member, the threaded rod adjustably transfers spring force through a plate above the spring using a nut over the spring. PRI set at factory to minimize field labor. Pre-Loaded Spring Isolators shall be Type PRI as manufactured by California Dynamics Corporation or approved equal.

RG Pipe Guides:

guide vertically and consist of 2 telescoping tubes separated by 2 layers of 1/4" acoustical elastomeric material compatible with loads, temperature, environment and aging needs. Factory set height for 1-3/4" vertical travel shall be held in place by a bond between layers adequate for handling/installation needs but made to break free in service if needed. Pipe Guides shall be Type RG as manufactured by California Dynamics Corporation or approved equal.

PA Pipe Anchors:

limit motion in all directions and consist of 2 telescoping tubes with closed ends separated by 1/2" acoustical elastomeric material compatible with loads, temperature environment and aging needs. Pipe Anchors shall be Type PA as manufactured by California Dynamics Corporation or approved equal.

Flexible Connections:

Are stainless steel devices installed horizontally on the equipment side of shut-off valves allowing motion due to thermal expansion to prevent overstressing piping connections to equipment. Flexible Connections shall be compatible with motions, pressures, temperature environment and aging needs.

PART THREE EXECUTION - INSTALLATION

3.1.1 General:

- (a) Install in accordance with manufacturer's written instructions. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.
- (b) The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.
- (c) After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.

- (d) Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.
- (e) All piping 1-1/4" and over, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.
- (f) All HVAC piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.
- (g) All piping and ductwork to be isolated shall freely pass through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.
- (h) No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.
- (i) Bring to the Architect's attention prior to installation any conflicts with other trades that will result in unavoidable rigid contact with equipment or piping as described herein due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- (j) Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- (k) Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.
- (l) Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.
- (m) Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.
- (n) The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to approved locations on the supporting structure.
- (o) The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.

(p) Hanger rods shall be aligned to clear the hanger box.

3.3 INSPECTION

On completion of installation of all vibration isolation and seismic control devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation error, improperly adjusted isolation devices, or other faults in the system that could affect the performance of the system. The contractor shall submit a report to the Architect, including the above report with consequent steps taken to properly complete the isolation work.

END OF SECTION