

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Vibration isolation materials and components and their installation.

1.2 SCOPE OF WORK

- .1 All mechanical equipment, piping and ductwork as indicated on the drawings or as noted in the specifications 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 reasonably uniform deflections.
- .2 All vibration isolators described in this section or supplied by a single trade shall be the product of a single manufacturer and shall be certified by the manufacturer. Items supplied by each trade in Specification Section 23 05 48 – Vibration Controls for Piping and Equipment shall be supplied by same supplier.
- .3 Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
- .4 The work in this section includes, but is not limited to the following:
 - .1 Vibration isolation for piping, ductwork and equipment.
 - .2 Equipment isolation bases.
 - .3 Flexible piping connections.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA):
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) – 2010.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Division 01 – General Requirements:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 – General Requirements. Include product characteristics, performance criteria, and limitations:
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 – General Requirements.
 - .2 Indicate VOC's for all adhesives and solvents during application and curing.

- .2 Quality assurance submittals: submit following in accordance with Division 01 – General Requirements:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .4 Manufacturer's Field Reports: manufacturer's field reports specified.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Division 01 – General Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

1.7 MANUFACTURER'S RESPONSIBILITY

- .1 Manufacturer's Responsibility:
 - .1 Manufacturer of vibration isolation equipment shall have the following responsibilities:
 - .1 Determine vibration isolation restraint sizes and locations.
 - .2 Provide vibration isolation as scheduled or specified.
 - .3 Provide calculations and materials if required for restraint of un-isolated equipment.
 - .4 Provide installation instructions, drawings and trained field supervision to ensure proper installation and performance.

1.8 RELATED WORK

- .1 Supplementary Support Steel:
 - .1 Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. as required.
- .2 Attachments:
 - .1 Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements.

2.2 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.3 NEOPRENE PAD ISOLATORS

- .1 Two layers of 19mm thick neoprene pad consisting of 50mm square waffle modules separated horizontally by a 1.5mm gauge galvanized shim. Load distribution plates shall be used as required.

2.4 NEOPRENE MOUNT

- .1 Bridge-bearing neoprene mountings shall have a minimum static deflection of 5mm and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing moulded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Pre-approval Number from a recognized government agency verifying the maximum certified horizontal and vertical load ratings.

2.5 SHEET METAL SUPPORT ATTACHMENT ISOLATORS

- .1 Neoprene bushing cushioned between 2 steel sleeves. Steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. All neoprene shall be bridge bearing quality.

2.6 OPEN SPRING ISOLATORS

- .1 Spring isolators shall be free standing and laterally stable without any housing and complete with a moulded neoprene cup or 6mm neoprene acoustical friction pad between the base plate and the support. All mountings shall have levelling bolts that must be rigidly bolted to the equipment.
- .2 Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

2.7 RESTRAINED SPRING ISOLATORS

- .1 Restrained spring mountings shall have a mounting as described in Paragraph 2.7, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. A minimum clearance of 12mm 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.

Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces.

- .2 Mountings shall have Anchorage Pre-approval Number from a recognized government agency certifying the maximum certified horizontal and vertical load ratings.

2.8 HOUSED SPRING ISOLATORS

- .1 Spring mountings as described in Paragraph 2.7 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 6mm travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Pre-approval number from a recognized government agency verifying the maximum certified horizontal and vertical load ratings.

2.9 SPRING AND NEOPRENE HANGERS

- .1 Hangers shall consist of rigid steel frames containing minimum 32mm thick neoprene elements at the top and a steel spring with general characteristics as described in Paragraph 2.7 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. 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 before contacting the rod bushing and short circuiting the spring.

2.10 STRUCTURAL STEEL BASE

- .1 Provide integral structural steel bases to maintain alignment of component parts (motors, drives, equipment, and isolators) and to support equipment, vibration isolation and seismic restraint devices. Pump bases for split case pump shall include supports for suction and discharge elbows.
- .2 All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 350 mm provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 25 mm.
- .3 Type B1 – Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
- .4 Type B2 – Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
- .5 Bases to clear housekeeping pads by 25 mm minimum.

2.11 METAL FLEXIBLE HOSES

- .1 Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 75mm and larger shall be flanged. Smaller sizes shall have male nipples. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.

2.12 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.13 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 All vibration isolators systems must be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.
- .6 At locations where seismic restraints are located, the support rods must be braced when necessary to accept compressive loads with Hanger Seismic Restrain Clamps.
- .7 At all locations where seismic restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with Clevis Seismic Braces.

- .8 Vibration isolation manufacturer shall furnish integral structural steel bases or reinforced concrete inertia bases as required. Independent steel rails are not permitted on this project.
- .9 Use In-Line Pump Securement Brackets for in-line pump installation.
- .10 Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight by Horizontal thrust restraints.
- .11 Locate isolation hangers as near to the overhead support structure as possible.

3.3 VIBRATION ISOLATION OF PIPING

- .1 Horizontal pipe isolation:
 - .1 The first three pipe hangers in the main lines near the mechanical equipment shall be pre-compressed Spring and Neoprene Hangers.
 - .2 This type of pre-compressed spring hangers must also be used in all transverse braced isolated locations. Brace hanger rods with seismic restraint clamps. Horizontal runs in all other locations throughout the building shall be isolated by Spring and Neoprene Hangers. Floor supported piping shall rest on Restrained Spring Isolators. The first pipe support isolators from the isolated equipment will have the static deflection twice the deflection as specified for the mountings under the connected equipment and 25mm deflection for pipe support isolators thereafter.
 - .3 Provide spring isolators for pipe support at first three supports for piping up to NPS 4; first four supports.
 - .4 Where piping connects to mechanical equipment install Metal Flexible Hoses. Isolate, with acoustic barrier material, at anchors and guides within pipe shafts, duct shafts, equipment and fan rooms, and up to first anchor outside these rooms or areas.
- .2 Riser Isolation:
 - .1 Risers shall be suspended from Spring and Neoprene Hangers or supported by Open Spring Isolators, anchored with Acoustical Pipe Anchors, and guided with Acoustical Pipe Guides. Steel springs shall be a minimum of 19mm except in those expansion locations where additional deflection is required to limit load changes to $\pm 25\%$ of the initial load.

3.4 VIBRATION ISOLATION OF DUCTWORK

- .1 All discharge runs for a distance of 15m from the connected equipment shall be isolated from the building structure by means of Spring and Neoprene Hangers or Open Spring Isolators. Spring deflection shall be a minimum of 19mm.
- .2 All duct runs having air velocity of 5 m/s or more shall be isolated from the building structure by specification Pre-compressed Spring and Neoprene Hangers or Open Spring Isolators. Spring deflection shall be a minimum of 19mm.

3.5 LIFE SAFETY SYSTEMS

- .1 All mechanical equipment shall be vibration isolated and seismically restrained.

3.6 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After preparatory work is complete but before installation commences.
 - .2 Twice during the installation, at 25% and 60% completion stages.
 - .3 Upon completion of installation.
 - .3 Submit manufacturer's reports to Departmental representative and Engineer within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing company to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Take vibration measurements for equipment as per Manufacturer's recommendations.
 - .3 Provide Departmental representative and Engineer with notice 24 h in advance of commencement of tests.
 - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .5 Submit complete report of test results.
- .3 Verification requirements in accordance with Division 01 – General Requirements.

3.7 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION