

## **PART 1 GENERAL**

### **1.1 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
  - 1. Section 21 00 10 - General Requirements
  - 2. Section 21 00 20 - Fire Suppression Scope of Work
  - 3. Section 21 05 07 - Design Conditions
  - 4. Section 21 05 93 - Testing
  - 5. Section 21 12 00 - Fire Suppression Standpipe Systems
  - 6. Section 21 13 00 - Fire Suppression Sprinkler Systems
  - 7. Section 21 30 00 - Fire Pumps and Controllers

### **1.2 SUMMARY**

- A. Furnish and install foundation vibration isolation, and associated equipment for piping, rotating equipment, etc., as specified herein.
- B. The Division 21 Subcontractor shall assume complete responsibility for the anchoring of the equipment, piping systems, etc., specified hereinafter to the concrete foundation pads, to the concrete inertia bases and to the supporting structural steel and concrete beams.
- C. Coordinate piping supports for use in the parking garage structure.
- D. The Division 21 Subcontractor shall provide all miscellaneous steel for support of equipment and piping systems.

### **1.3 REFERENCE STANDARDS**

- A. All vibration isolation devices and components shall be designed, manufactured and tested in accordance with the latest applicable standards including the following:
  - 1. ANSI R211
- B. All equipment and material to be furnished and installed on this Project shall be in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this Project.

### **1.4 SUBMITTALS**

- A. The following submittal data shall be furnished according to the General Conditions and Section 21 00 10 and shall include, but not be limited to:
  - 1. Vibration Isolation including calculations, Drawings, etc. Submittal data shall include size, type, load and deflection of each isolator selected and shall clearly outline procedures for setting and adjusting all isolation devices.
  - 2. Pipe Risers including pipe riser diagrams and loads imposed upon the structure at support points.
  - 3. Shop Drawings shall be submitted to the Project Structural Engineer for review of loads exceeding [1000 lb.] imposed on the building structure. The Shop Drawing shall be submitted to the Engineer for review after review by the Project Structural Engineer.
  - 4. Field Test Reports.
  - 5. A computer stress analysis listing stress, movement and forces to the structure must be submitted for the diesel fire pump engine exhaust piping vibration isolation system to insure the integrity of the entire system after expansion. The computer program must use accepted principles of finite element analysis. Maximum stress must comply with ANSI R211 code. Submit stress analysis to the Engineer for review.
  - 6. Seismic restraint calculations stamped by a California State licensed structural or civil engineer, confirming compliance with ASCE 7-05.
  - 7. Provide calculations to demonstrate compliance with the requirements of regulatory agencies.
  - 8. Note compliance with seismic code regulations and the project specification on the submittals.

9. Number and location of seismic restraints and anchors for each piece of equipment including but not limited to bolted or welded connections between cooling tower and support beams, vertical pipe risers, bolt sizing and embedment depth, and seismic cable strength and diameters.
10. Specific details of restraints including anchor bolts for mounting and maximum loading at each location.
- 11.

#### **1.5      WARRANTY**

- A. Comply with the requirements of the General Conditions and Section 21 00 10.

### **PART 2 PRODUCTS**

#### **2.1      ACCEPTABLE MANUFACTURERS**

- A. If it complies with these Specifications, one of the following vibration isolation manufacturers will be acceptable:
  1. Amber/Booth Company (The VMC Group)
  2. Grinnell Corporation
  3. Korfund Dynamics Corporation (The VMC Group)
  4. Mason Industries, Inc.
  5. Peabody Kinetics
  6. Vibration Eliminator Company
  7. Vibration Mounting and Controls, Inc. (The VMC Group)
  8. Vibrex Vibration Control Systems (Sausse)
  9. Vibro-Acoustics
  10. Victaulic Corporation
- B. Unless otherwise noted, the vibration isolation devices described herein are products of the Amber/Booth Company.

#### **2.2      GENERAL**

- A. All vibration isolators shall be furnished with zinc electroplated hardware to prevent corrosion and bolt freeze up and to maintain attractive appearance. To prevent corrosion, steel or cast iron housing shall be treated by phosphating and painting while aluminum housing shall be etched in Chromi Coat solution and painted. Isolators exposed to weather shall have the springs fully PVC coated or enamel powder coated. Housings shall be of cast aluminum, or hot dipped galvanized steel after fabrication.
- B. The isolation devices for all piping systems and channel frames shall be products of a single vibration isolation manufacturer. The isolation manufacturer's local representative shall maintain an adequate stock of springs and isolators of the type used so that any changes required during construction and checking can be accomplished promptly. Complete installation instructions including details and sizing of anchor devices or plates required shall be furnished by the manufacturer.
- C. The Subcontractor shall coordinate the vibration isolation supports with the manufacturers of the equipment to be isolated. See the Paragraph titled "Coordination Drawings" in Section 21 00 10 for additional requirements.
- D. Seismic restraints and anchorage shall be designed for the lateral and vertical forces required by the Building Code for the specific project type and site. Confirm lateral and vertical forces and site-specific design criteria with the project Structural Engineer.

#### **2.3      VIBRATION ISOLATION FOR PUMPS**

- A. Pumps for the service listed below shall be installed on reinforced concrete pads with minimum thickness as specified below and designed for support of the pump and pump elbows as listed hereinafter. The following pumps require this type of installation:
  1. Fire pumps
  2. Jockey pumps

- B. Minimum Thickness of Concrete Pad or Inertia Base shall be:

Motor HP	Minimum Thickness (Inches)
5-15	6
20-50	8
60-75	10
100-250	12
300-400	14

## 2.4 SEISMIC RESTRAINTS

- A. Provide restrains capable of safely accepting forces specified and/or as required by the authorities having jurisdiction without failure, to maintain equipment, piping, in a captive position. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise. If required by the authorities having jurisdiction, submit calculations by Structural Engineer licensed and registered in the State of the project to verify seismic restraint and sway cable capacities. Provide products with certification numbers or provide calculations demonstrating compliance with regulatory requirements.
- Spring Seismic Restraint, Type 1: Comply with general characteristics of Spring Isolators. Incorporate snubbing restraint in all directions. Restraint shall be capable of supporting equipment at a fixed elevation during equipment erection.  
Type CT-LR.
  - Seismic Restraint, Type II: Each corner or side seismic restraint shall incorporate minimum 5/8 inch thick pad limit stops. Restraints shall be made of plate, structural members or square metal tubing in a welded assembly incorporating resilient pads.  
Type ER.
  - Seismic Restraint, Type III: Cable type with approved end fastening devices (minimum of two per end) to equipment and structure. Cable to comply with Federal Specifications MIL-W-83420 military grade 7x19 galvanized steel.  
Type SSB – Mason Industries, Inc.
- B. Provide diagonal thrust restraint consisting of hangers with the same deflection as specified for the spring mountings. Design the spring element so it can be preset for thrust and adjusted to allow for a maximum of 1/4 inch Type WB – Mason Industries, Inc.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. The complete vibration isolation installation shall be in accordance with the manufacturer's recommendations and as indicated on the Drawings.

### 3.2 SEISMIC RESTRAINTS

- A. General:
- Cable restrains shall be installed slightly slack to avoid short circuiting the isolated suspended equipment or piping. Cable restrains shall be installed taut on non-isolated systems. Seismic solid brace restrains may be used in lieu of cables on non-isolated rigidly attached systems only.
  - Where cable or solid brace restrains are located, the equipment, or piping support rods shall be angle braced for compression loads.
  - At all locations where cable or solid brace restrains are attached to pipe clevises, the clevis cross bolt shall be reinforced with cross braces or a pipe spacer placed over the clevis bolt.
  - Provide drill-in concrete anchors for ceiling and wall installation and female wedge type for floor-mounted equipment.
- B. Seismic Restraint of Piping:
- Transverse piping restrains shall be at 40-foot maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

2. Longitudinal restraints shall be at 80-foot maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
  3. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
  4. Cast iron piping transverse restraints must be at 20-foot maximum and longitudinal restraints at 40-foot maximum spacing.
  5. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within a specified distance (based on engineered data) of the elbow or tee or combined stresses are within allowable limits at longer distances.
  6. Hold-down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
  7. Branch lines may not be used to restrain main lines.
- C. Seismic Restraint of Equipment:
1. All mechanical equipment shall be vibration isolated and seismically restrained as scheduled using either inherently restrained vibration isolators or separate all-directional seismic snubbers as specified. Suspended equipment shall be restrained by cable restraints.
- D. Seismic Restraint Exclusions (Flexible connectors are required between pipe and equipment):
1. Piping:
    - a. For  $I_p = 1.5$  projects or systems, all piping 1-inch nominal diameter and smaller, except cast iron piping, regardless of size.
    - b. For  $I_p = 1.0$  projects, all steel and copper piping 3-inch diameter and smaller, except cast iron piping, regardless of size.
    - c. All piping suspended by individual hangers 12 inches or less as measured from the top of the pipe to the bottom of the support where the hanger is attached provided the hanger rod connection to the structure will not develop a moment. However, if the 12-inch limit is exceeded by any hanger in the run, seismic bracing is required for the run.
    - d. The 12-inch exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.

### 3.3 FACTORY TESTING

- A. All vibration isolation devices and components shall be tested in accordance with the latest applicable industry standards.

### 3.4 FIELD TESTING

- A. After installation and prior to "Final Review", the isolation manufacturer's factory trained technician shall check all the various isolators and certify in writing to the Subcontractor and Owner that they have been installed properly and are in accordance with the manufacturer's recommendations.
- B. Refer to Section 21 05 93 for additional testing requirements for equipment installed with vibration isolation.

**END OF SECTION**