PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 230500 - Basic HVAC Materials and Methods, and other Sections in Division 23 specified herein.

1.2 SUMMARY

A. This Section includes the following:
1. Seismic restraint and support of piping, ductwork and mechanical equipment as required by code and as designed by project registered professional Structural Engineer.
2. Mechanical component supports and the means by which that are attached to the mechanical component shall be designed for the forces and displacements determined in ASCE 7-10 Section 13.3.1 and 13.3.2. Such supports include structural members, braces, frames, skirts, legs, saddles, pedestals, cables, guys, stays, snubbers, and tethers, as well as elements forged or cast as a part of the mechanical component.

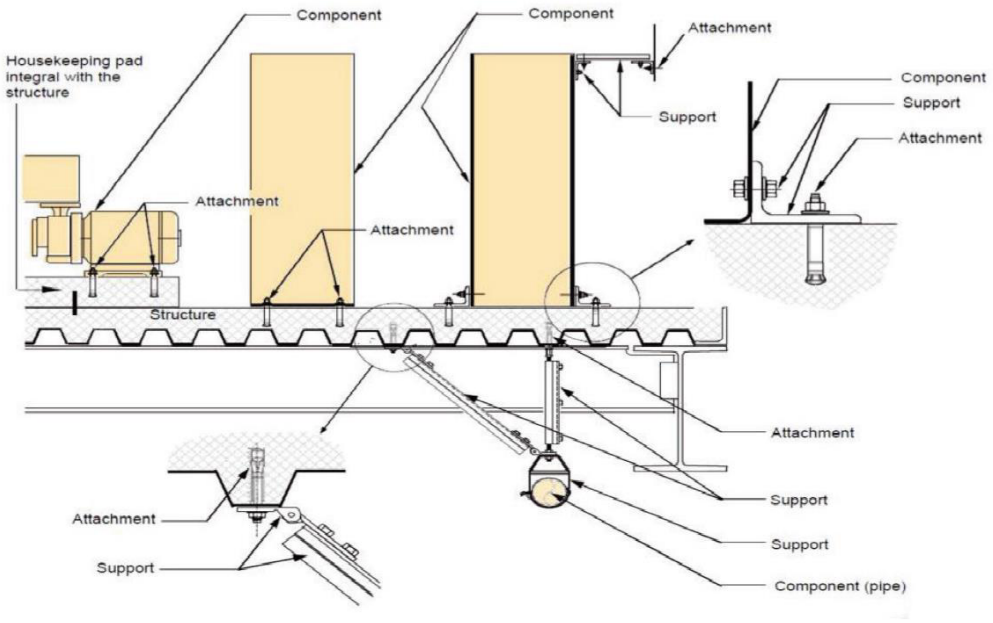
1.3 DEFINITIONS

A. AHJ: Authority Having Jurisdiction

B. IBC: International Building Code with AHJ Amendments.

C. ICC-ES: ICC-Evaluation Service.

D. Mechanical Components: Examples of attachments and supports for a variety of mechanical components are shown as follows:



E. Mechanical Supports: Those members, assemblies of members, or manufactured elements, including braces, frames, legs, lugs, snubbers, hangers, saddles, or struts, and associated fasteners that transmit loads between nonstructural components and their attachments to the structure.

F. Mechanical Attachments: Means by which components or supports of nonstructural components are secured or connected to the seismic force-resisting system of the structure. Such attachments include anchor bolts, welded connections, and mechanical fasteners.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230500: Basic HVAC Materials and Methods

B. Section 230548: Vibration Isolation for Piping, Ductwork and Equipment

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide systems that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.

B. Structural Performance: Restraint devices and systems shall withstand the effects of locally defined gravity loads, seismic loads, dead loads, live loads, winds loads and stresses within limits and under conditions indicated according to the Building Code and ASCE 7. Coordinate all support structures and restraint systems with project registered professional Structural Engineer.

C. Codes and Standards: Provide components conforming to the seismic load requirements of the latest addition of the local building code and the following:
   1. International Building Code with State Amendments:
      a. Section 1613: Standard Occupancies
   2. American Society of Civil Engineers (ASCE):
      a. ASCE 7-10 - Minimum Design Loads for Buildings and Other Structures
   3. Mason West Inc., Seismic Restraint Guidelines
      a. OPM-0043-13 for all suspended piping, suspended ductwork and suspended electrical raceways.

1.6 PERFORMANCE REQUIREMENTS

A. Component Importance Factor:
   1. Ip=1.0: Standard Occupancies and components associated with Risk Category I, II, and III, including offices and schools.

1.7 SUBMITTALS

A. Product Data:
   1. Include rated load, rated deflection, and overload capacity for each device or system.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service or agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.

      Submit seismic brace product details from the Mason West Seismic Restraint of Suspended Distribution Systems where products from the Mason West Seismic Restraint of Suspended Distribution Systems cannot be used, special details must be submitted for approval.

B. Seismic Restraint Calculations
   1. Where additional information is required:
      a. Seismic restraint calculations must be provided for all connections to the structure.
      b. Calculations must be stamped by a registered professional Structural Engineer.

1.8 ENGINEERED PIPING SYSTEMS

A. Where the piping system design indicated on the plans utilizes Mason Industries, Inc. - Mason West, Inc. seismic restraint components, vibration isolators, guides, anchors, expansion compensators and flexible connectors the following requirements apply:
   1. Mason Industries, Inc. - Mason West, Inc. products must be installed as shown.
   2. If product substitutions or design changes are made the contractor must provide certified design of the piping system and meet the following conditions:

a. Certification must be provided by a registered professional Structural Engineer.
b. Certification shall include a statement that all systems have been checked for loads and stresses and that no excessive loads or stresses exist.
c. Forces on all anchors, guides, supports, and restraints must not exceed those shown in the original design unless the structure is checked for the larger loads at no cost to the owner.

B. Where the piping system design is not indicated on the drawings the design is delegated to the contractor with the following requirements for piping certification and analysis:
1. The supports, anchors, guides and seismic braces for systems with significant thermal motion including steam, condensate, high temperature hot water and heating hot water systems must be designed for combined gravity, seismic, pressure and thermal loads.
2. Small diameter pipes (2” diameter and smaller) may not require analysis as determined by the project registered professional Structural Engineer.
3. The results of the analysis shall include reactions at restraints and anchors, maximum pipe displacements and a code compliant report indicating maximum pipe stresses.
4. Where required, seismic restraint components, vibration isolators, guides, anchors, expansion compensators and flexible connectors manufactured by Mason Industries, Inc. and Mason West, Inc. shall be incorporated into the design of the systems.
5. The analysis and design must be performed by a Structural Engineer with 5 years of experience in this field.

1.9 MANUFACTURER AND CONTRACTOR RESPONSIBILITIES

A. All seismic restraints shall be designed by a registered professional Structural Engineer.

B. Seismic restraint layouts for piping and ductwork shall be added to the contractor’s shop drawings and shall include:
1. The number, size and location of seismic braces.
2. Maximum support loads and seismic loads at the seismic brace locations.
3. Reference to specific details or pages from the Mason West Seismic Restraint of Suspended Distribution Systems ~~OSHPD~~ pre-approval OPM-0043-13.

C. Installations not addressed by the OPM approval must be designed, detailed and submitted along with the shop drawings.

D. Submit seismic restraint layout drawings and special details for approval of the project registered professional Structural Engineer per the requirements listed in the Mason West Seismic Restraint of Suspended Distribution Systems OSHPD pre-approval OPM-0043-13.

E. Seismic restraint layout drawings shall bear the stamp and signature of the registered professional Structural Engineer who designed the layout of the braces.

1.10 LOADS ON STRUCTURE

A. The responsibility of determining allowable loads on the structure is the sole responsibility of the project registered professional Structural Engineer.

B. Maximum support loads and seismic brace loads on the structure must be less than the maximum allowable loads defined by the project registered professional Structural Engineer, as shown on the plans.

C. Where maximum loads are not listed on the plans or the maximum allowable loads cannot be met, any additional support steel required to reduce support and seismic bracing loads on the structure shall be designed by the project registered professional Structural Engineer.

D. Mechanical component supports and the means by which that are attached to the component shall be designed for the forces and displacements determined in ASCI 7-10 Section 13.3.1 and 13.3.2. Such supports include structural members, braces, frames, skirts, legs, saddles, pedestals, cables, guys, stays, snubbers, and tethers, as well as elements forged or cast as a part of the mechanical component.

E. Mechanical supports are those members, assemblies of members, or manufactured elements, including braces, frames, legs, lugs, snubbers, hangers, saddles, or struts, and associated fasteners that transmit loads between nonstructural components and their attachments to the structure.

F. Mechanical attachments are the means by which components or supports of nonstructural components are secured or connected to the seismic force-resisting system of the structure. Such attachments include anchor bolts, welded connections, and mechanical fasteners.

PART 2 - PRODUCTS

2.1 INTENT

A. All seismic restraints described in this section shall be the product of a single manufacturer.

B. Mason Industries products are the basis of these specifications; products of other manufacturers may be submitted for review provided their systems strictly comply with the specifications.

2.2 SEISMIC SWAY BRACING

A. Seismic sway braces shall consist of galvanized steel aircraft cables, steel angles or steel struts.

B. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads. Brace end connections shall be steel assemblies that swivel to the final installation angle.

C. Cable brace assemblies shall have published strength and stiffness ratings based on testing per FM-1950 standards.

D. Angle or strut bracket assemblies shall be FM Approved except as noted below.

E. Steel angles or struts, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps.

F. Cable brace bracket assemblies shall be Type SCB or SCBH. Solid brace bracket assemblies shall be Type SSB-FM, SSBS-FM or SHB-FM. All bracket assemblies shall have published strength and stiffness values based on testing per FM-1950.

G. Rod clamps shall be Type SRC or UCC.

H. All brace components shall be as manufactured by Mason Industries, Inc. and Mason West, Inc. as included in the Mason West Seismic Restraint of Suspended Distribution Systems -pre-approval OPM-0043-13.

PART 3 - EXECUTION

A. Contractor's Statement of Responsibility:Each contractor responsible for installing a Designated Seismic System or any seismic resisting component must submit a statement of responsibility prior to the commencement of work to include acknowledgment of awareness of the need for special inspections contained in the statement of special inspections.

B. All seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

C. Installation of seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

D. No connections between the piping or ductwork and the building structure shall be made that degrades the seismic restraint system herein specified.

E. Any conflicts with other trades due to inadequate space or other unforeseen conditions should be brought to the attention of the Owner's Representative prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

END OF SECTION