Eng-Fm-011 – Specification

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Specification Title & Description: (List attached Specifications by Section number, revision, date, and number of pages for each Section Specification compiled under this cover page. Attached Specifications are to have sequentially numbered pages.)
Seismic Anchorage and Bracing

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Document Review & Approval:

**Originator:**
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PART 1    GENERAL

1.01    SCOPE

A.  This section provides design requirements necessary for procurement and anchorage of equipment. Requirements for the installation of the equipment, which will be done by the Construction Contractor, are not addressed herein.

B.  This section covers requirements for seismic anchorage and lateral bracing for equipment, nonstructural components, and non-building structures in conformance to the 2006 International Building Code (IBC).

C.  Importance factors specified herein are considered project-specific and have been increased to satisfy DoE design requirements accounting for 2006 IBC and 1997 UBC load conditions.

1.02    REFERENCES AND RELATED SECTIONS

A.  The following is a list of standards which may be referenced in this section:

1.  American Institute of Steel Construction (AISC).

B.  Specification Section 05 50 00, Metal Fabrications.

1.03    DESIGN AND PERFORMANCE REQUIREMENTS

A.  General: Manufacturer/supplier shall be responsible for designing code required seismic attachments, braces, and anchors to the structure for elements of architectural, mechanical, and electrical systems included in the Work in accordance with this section unless a design is specifically provided within the Contract Documents.

B.  In accordance with 2006 IBC, Section 1613, and with applicable sections of ASCE 7-05 Chapters 13 and 15 except as modified herein.
C. Design Requirements: All materials and equipment including mechanical and electrical equipment, nonstructural components, non-building structures, cladding, supports, and anchorages shall be designed in accordance with 2006 IBC using the following design parameters:

1. Wind: 85 mph basic wind speed (3-second gust), Exposure C, Project-Specific Importance Factor of 1.30.
2. Seismic: Occupancy Category II, Site Class “C”, Seismic Design Category “C”, and spectral response acceleration parameters as follows:
   \[
   S_s = 0.463g \quad S_{MS} = 0.555g \quad S_{DS} = 0.370g \quad Fa = 1.20 \\
   S_1 = 0.148g \quad S_{M1} = 0.244g \quad S_{D1} = 0.163g \quad Fa = 1.65
   \]
3. Unless specifically noted otherwise herein, all equipment, nonstructural components, and non-building structures shall have a project specific Component Importance Factor \(I_p\) of 1.75 for all seismic loads.

D. Design forces for anchors in concrete and masonry shall be in accordance with ASCE 7-05 Section 13.4.2.

E. Design of seismic anchorage and lateral bracing systems shall be signed and sealed by a qualified professional engineer responsible for their preparation.

F. The most critical effect of lateral bracing and anchorage shall be determined based on load cases and combinations specified in 2006 IBC Chapter 16.

G. Unless otherwise noted, seismic bracing is not required for all mechanical and electrical components as identified in ASCE 7-05 Chapter 13 including HVAC equipment, mechanical HVAC and process piping, pressure piping systems designed and constructed in accordance with ASME B31, and electrical lighting fixtures.

H. Seismic bracing in accordance with ASCE 7-05 Chapter 13 shall be provided for the following nonstructural components:

1. Fire protection sprinkler systems including systems designed and constructed in accordance with NFPA 13.
2. Interior nonstructural walls and partitions.
3. Suspended ceilings.
4. HVAC ductwork having a cross-sectional area of more than 6 square feet and suspended from hangers more than 12 inches from supports.

I. Seismic bracing in accordance with ASCE 7-05 Chapter 15 shall be provided for nonbuilding structures identified in ASCE 7-05 Chapter 15 including elevated tanks, flat-bottom ground-supported tanks, cooling towers, and other self-supporting structures.
J. Other seismic design and detailing requirements identified in ASCE 7-05, Chapters 13 and 15 are required to be provided for new architectural, mechanical and electrical component, system, or equipment.

1.04 SUBMITTALS

A. Approval Prior to Work Submittals:

1. Shop Drawings:
   a. Submit shop drawings, including electronic AutoCAD files, with supporting calculations no less than 4 weeks in advance of installation of component, equipment or distribution system to be anchored to structure.
   b. Submitted anchorage drawings and calculations are identified as IBC deferred submittals and will be submitted to and accepted by permitting agency prior to installation of component, equipment or distribution system.
   c. Manufacturers’ engineered seismic hardware product data.
   d. Seismic attachment assemblies’ drawing(s); include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.
   e. Submittals will be rejected if proposed anchorage method would create an overstressed condition of supporting member. Revise anchorages and strengthening of structural support as required so there is no overstressed condition.

B. Informational Submittals:

1. Seismic Anchorage and Bracing Calculations: For seismic attachments, lateral braces, and anchorages. Include IBC and project-specific criteria as noted in this Specification, in addition to manufacturer’s specific criteria used for the design; sealed by a professional engineer responsible for their preparation and registered in the State of Washington.

2. Manufacturer’s seismic hardware installation requirements including torque requirements as needed.

PART 2 PRODUCTS

2.01 GENERAL

A. Attachments and supports transferring seismic and lateral loads to structure shall be constructed of materials and products suitable for the application and be designed and constructed in accordance with the design criteria specified herein.

B. Provide materials for anchorage and bracing of equipment in accordance with Section 05 50 00, Metal Fabrications.
C. Provide anchor bolts, and concrete and masonry anchors for anchorage of equipment in concrete or masonry in accordance with Section 05 50 00, Metal Fabrications. Size of anchor bolts and anchors, and required minimum embedment and spacing shall be based on calculations submitted by manufacturer/supplier.

D. Powder actuated fasteners and sleeve anchors shall not be used for seismic attachments and anchorage where resistance to tension loads is required. Expansion anchors, other than undercut anchors, shall not be used for nonvibration isolated mechanical equipment rated over 10 hp.

E. Provide fall protection tie-off points for all tanks.

PART 3 EXECUTION

3.01 GENERAL

A. Make seismic attachments, bracing, and anchorage in such a manner that component seismic force is transferred to the lateral force resisting system of the structure through a complete load path.

B. Overall seismic and lateral load anchorage system shall provide restraint in all directions, including vertical, for each component or system so anchored.

C. Components mounted on vibration isolation systems shall have snubbers in each horizontal direction and vertical restraints as required to resist overturning.

D. Anchor piping in such a manner as to ensure piping system has adequate flexibility and expansion capabilities at flexible connections and expansion joints. Piping and ductwork suspended more than 12 inches below the supporting structure shall be braced for seismic effects to avoid significant bending of the hangers and their attachments, unless high-deformability piping is used per ASCE 7, Section 13.6.8 or HVAC ducts have a cross-sectional area of less than 6 square feet.

E. Tall and narrow equipment such as motor control centers and telemetry equipment shall be anchored at the base and within 12 inches from the top of the equipment, unless approved otherwise by Engineer.

F. Architectural, mechanical, or electrical components shall not be attached to two or more portions of the building that are seismically isolated from each other.

G. Attachments shall not be made across building expansion and contraction joints.

END OF SECTION