

SECTION 01190
SEISMIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section is applicable to the following secondary structural system elements, non-structural components, and/or equipment supported by structures.
 - 1. Mechanical, electrical, and plumbing equipment and appurtenances.
 - 2. Conduit, piping, cable trays, raceways, ducts, and similar systems.
 - 3. Tanks and vessels (include contents), including support systems.
 - 4. Storage racks, suspended ceilings, light fixtures, raised floors, partitions, store-front, windows, louvers, architectural features, and other non-structural components.
- B. This Section is applicable to the following elements of the primary structural system:
 - 1. Pre-Engineered Metal Buildings
 - 2. Open web steel joists
 - 3. Aluminum covers in section 13340

1.02 REFERENCES

- A. American Society of Civil Engineers Standard ASCE 7-05, Minimum Design Loads for Buildings and Other Structures, Chapters 11, 13, 15.
- B. International Building Code 2006 Edition with Amendments adopted by the Washington State Building Code Council

1.03 DEFINITIONS

- A. Engineer of Record: The Engineer responsible for the preparation of Contract Documents.
- B. Specialty Engineer: Structural or Civil Engineer provided by the Contractor licensed in the State of Washington responsible for specific elements of the primary structural system, the secondary structural system, non-structural elements, and/or equipment supported by structures.

1.04 GENERAL DESIGN REQUIREMENTS

- A. The Contractor is responsible for producing designs that resist the total seismic forces in accordance with the seismic design criteria. The Contractor is responsible for coordinating between the Engineer of Record and the Specialty Engineer.
- B. The seismic design for non-structural components and equipment shall be in accordance with the IBC Chapter 16, and the required coefficients and factors for determining the total design seismic forces are shown on the Drawings.

- C. Coordinate the layout so that adequate space is provided between items for relative motion. Provide additional supports and restraints between items of different systems when necessary to prevent seismic impacts or interaction.
- D. Design anchorages of all elements of structures, nonstructural components, equipment supported by structures, and non-building structures to resist static and dynamic operational loads, plus total seismic loads specified in the IBC, ASCE 7-05 section 13.3.1, and as follows:
 - 1. For suspended equipment, multiply dead load by 1.2 and add $0.2S_{DS}$ to account for vertical seismic effects in the downward direction.
 - 2. For anchorage uplift, multiply dead load by 0.9 and subtract $0.2S_{DS}$ if used to reduce vertical seismic effects.
- E. Design anchorages utilizing a Component Coefficient, $R_p = 1.5$, unless supporting documentation for embedment length, showing compliance with section 13.4.2 of ASCE 7, is provided for expansion anchor bolts, chemical anchors, or cast-in-place anchors.

1.05 DESIGN REQUIREMENTS FOR PIPING, CONDUIT, AND DUCTS

- A. The Contractor is responsible for producing designs for support of piping, conduit, duct or other systems to resist total seismic forces based on the seismic design criteria coefficients specified above, unless shown on the Contract Documents. Except where the technical specifications give specific exemption from resistance of seismic forces, all supports shall be designed to meet seismic criteria. Support systems for piping, conduit, duct or other systems greater than 5 inches in diameter are shown on the Contract Documents.
- B. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (e.g., copper, ductile iron, steel, or aluminum and brazed, welded, or screwed connections). Pipes, conduits, and their connections, constructed of non-ductile materials (e.g., cast iron, no-hub pipe, and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material.
- C. Seismic restraints may be omitted for the following conditions, where flexible connections are provided between components and the associated ductwork, piping and conduit:
 - 1. Fuel piping less than 1-inch inside diameter.
 - 2. All other piping less than 2.5 inches inside diameter or all piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the structural support for the hanger or electrical conduit less than 2.5 inches trade size.
 - 3. All rectangular air-handling ducts less than 6 square feet in cross-sectional area or all round air-handling ducts less than 28 inches in diameter or all ducts suspended by individual hangers 12 inches or less in length from the top of the duct to the bottom of the structural support for the hanger, where the hangers are detailed to avoid bending of the hangers and their connections.
- D. All trapeze assemblies supporting pipes, ducts, and conduit shall be braced to resist the total seismic forces considering the weight of the elements on the trapeze. Pipes, ducts, and conduit supported by a trapeze where none of those elements would individually be braced need not be braced if connections to the pipe/conduit/ductwork or directional changes do not restrict the movement of the

trapeze. If this flexibility is not provided, bracing will be required when the aggregate weight of the pipes and conduit exceed 10 pounds/foot. The weight shall be determined assuming all pipes and conduit are filled with water.

- E. As an alternative to designing the supports and anchorage, where an approved national standard provides a basis for the earthquake-resistant design, submit standard, data, and details for piping, conduit, duct, or other systems:
 - 1. For ductwork, mechanical piping, process piping, and electrical conduits, follow Guidelines for Seismic Restraints of Mechanical Systems by SMACNA modified as follows:
 - a. Seismically brace piping regardless of size or location. Provide transverse braces at all changes in direction and at the end of all pipe runs. Space transverse braces not more than 20 feet apart. Provide longitudinal braces at 40-foot centers.
 - b. Seismically brace all ductwork regardless of size or location. Provide transverse braces at all changes in direction and at each end of run. Space braces not over 20 feet apart. Provide longitudinal braces at 40-foot centers.
 - 2. For fire protection systems, follow NFPA 13 modified as in paragraph 1.b above. Ensure that no seismic interaction occurs with items of other systems.

1.06 DESIGN REQUIREMENTS FOR UNDERWATER ITEMS

- A. To allow for water sloshing, design rigid items such as piping or equipment supports for twice the lateral force, computed as if the item were above water.

1.07 SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Shop Drawings: Submit signed and sealed structural calculations and detailed drawings for the following listed elements and where required in Divisions 2 through 17 of the primary structural system and their attachments, the secondary structural system and their attachments, permanent non-structural components and their attachments, and the attachments and anchorage for permanent equipment supported by the structure:
 - 1. List items
- C. Structural calculations and detailed drawings shall be prepared by a Specialty Engineer licensed in the state of Washington.
- D. Structural calculations and detailed drawings shall clearly show the total design seismic forces which will be transferred from the elements of the structural system, non-structural components, and/or equipment and their attachments to the primary structure.
- E. The Engineer's review of items within a Specification Section cannot be completed until all related items have been coordinated and submitted for review.

F. Quality Assurance Submittals

1. Test Reports: Submit test reports for tension testing of anchors.
2. Where required in the equipment specifications in Divisions 2 through 17 submit certification that the equipment itself is designed to resist all internal seismic forces based on the seismic design criteria for the project.
3. Where required in the equipment specifications in Divisions 2 through 17, submit signed and sealed structural calculations and detailed drawings from a specialty Structural or Civil Engineer licensed in the State of Washington for the attachments and anchorage to the primary structure.
4. Where required in the equipment specifications in Divisions 2 through 17, submit certification that the attachments and anchorage are designed to resist all seismic forces based on the seismic design criteria for the project.

1.08 QUALITY ASSURANCE

- A. Qualifications: The Contractor is responsible for submitting signed and sealed structural calculations and detailed drawings from a Specialty Structural or Civil Engineer licensed in the State where the project is being built.
- B. Regulatory Requirements: Comply with the State with jurisdiction adopted and amended versions of the International Building Code (IBC) Section 1613, the referenced sections of ASCE 7, plus clarifications and additions specified in this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Site Tests: Tension testing of expansion or adhesive anchors utilized for anchorage shall be done in the presence of the inspector and a report of the test results shall be submitted. See Specification Section 05100 for additional requirements.
- B. Inspection: Special inspection shall be provided for high strength bolting or bolts installed in concrete. See Specification Section 05100 for additional requirements.

END OF SECTION