

**SECTION 13 48 53**  
**SEISMIC ANCHORAGE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. The purpose of this section is to provide instructions relating to the design and construction of anchorage requirements for mechanical and electrical items, equipment and other components. It is required that these items be anchored to the facility in a manner whereby the overall reliability of the facility is not compromised.
  - 1. Provide bracing and anchorage as required to meet Oregon Structural Specialty Code (OSSC) requirements.
- B. Unless otherwise determined by the Architect, it is not intended that any item of purchased equipment be modified to meet the requirements of this section.

**1.02 RELATED SECTIONS**

- A. Section 09 51 00 - Acoustical Ceilings: Coordination of seismic bracing of ceilings and separate components, such as equipment that maybe mounted above or within finish ceilings.
- B. Divisions 21, 22, 23, 26, 27 and 28: Provide and coordinate bracing of switchgear, patch panel racks, fire suppression and all other building components as dictated by code.

**1.03 REFERENCES**

- A. As indicated in individual technical sections.

**1.04 SYSTEM DESCRIPTION**

- A. General Connection Requirements:
  - 1. All supports and connections in construction shall be provided by the Contractor in accordance with the code for the criteria per contractor-supplied Structural Drawings, coordinated with the particular items included in the contract. The Contractor shall retain a registered professional engineer licensed in the State of Oregon to perform and seal this design work.

**1.05 DESIGN REQUIREMENTS**

- A. Delegated Design: Design seismic anchorage, including comprehensive engineering analysis by a registered professional engineer licensed in the State of Oregon, using performance requirements and design criteria indicated.
- B. Code: 2019 Oregon Structural Specialty Code shall be used for the design of seismic restraints of items indicated, with the additional requirements dictated by the referenced standards and the specific requirements and exceptions specified in this section.
- C. Acquisition of design data and installation of gravity and seismic anchorages (restraints) shall be the responsibility of the Contractor unless otherwise noted in this section. Design data and shop drawings shall be provided for review and approval in accordance with the General Guidelines for Connecting to Structure below.
- D. Distribution of Gravity and Seismic Loads to Structure:
  - 1. It is the responsibility of the Contractor to see that the combined equipment, system and piping loads do not exceed the capacity of any individual supporting structural member or group of structural members prior to the construction of the supporting members. If modifications are required, these modifications shall be brought to the attention of the Structural Engineer of Record.
  - 2. Supplemental structural distribution members shall be required when equipment gravity and seismic loads exceed design loads shown on the structural drawings and specifications.
  - 3. All systems, equipment and casework, shall be connected to the buildings structural system in a rigid manner except units with special vibration isolation mounting requirements.

4. The Contractor shall make available to the Architect information required to verify the anchorage (restraint) of the following critical equipment as applicable to the project, including, but not limited to:
  - a. Exhaust fans/supply fans.
  - b. Cabinet heaters/fans.
  - c. Air handling units.
  - d. Make-up air units.
  - e. Chilled water pumps.
  - f. Hot water heating and circulation pumps.
  - g. Compression tanks.
  - h. Air compressors.
  - i. Air separators.
  - j. Converters.
  - k. Domestic water booster pump assembly.
  - l. Air conditioning units.
  - m. Equipment exceeding 400 lbs. or where recommended by manufacturer or required by code including Owner furnished equipment.
  - n. Terminal units or VAV boxes.
  - o. Switch boards.
  - p. Transfer switches.
  - q. Panel boards.
  - r. Light fixtures.
  - s. Owner furnished equipment.
  - t. Telecommunications and low voltage systems equipment racks and cabinets.
  - u. Cable tray, all types proposed, including, but not limited to, ladder, solid bottom and wire basket trays.
5. Information to be included, but not limited to the following:
  - a. Center of gravity
  - b. Weight
  - c. Footprint
  - d. Space envelope
  - e. Tie-down provisions

#### 1.06 SUBMITTALS

- A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide Structural characteristics of all proposed components.
- C. Shop Drawings: Indicate actual components and field configuration or limitations for each seismic restraint. Provide structural calculations.
- D. Delegated Design and Certification of Connection Design:
  1. All design data and shop drawings shall be sealed by a professional engineer licensed in the State of Oregon and submitted for review to the Architect and structural engineer of record before submittal to the Authority Having Jurisdiction (AHJ). Obtain approval for the AHJ before the equipment anchorage is fabricated or installed. Allow 4 weeks from time of Architect's receipt of submittal of design data and shop drawings for review. The following information must be included in the design data and shop drawings.
    - a. Exact dimension and intended locations of each unit.
    - b. Verification and location of weight relative to existing and new building structures (e.g., plan and height location of the center of gravity).
    - c. Scale drawings showing base details with original intended connection system.
    - d. Anchors to be installed per manufacturer's recommendations or as indicated. All anchors subject to field testing where loading appears to approach or exceed capacity of the anchor.

2. Submit submittals as "Deferred Submittals" in accordance with Section 01 30 00 - Administrative Requirements. Transmit a copy of each submittal indicating agency approval to the Architect for record.

### 1.07 QUALITY ASSURANCE

- A. Perform design under direct supervision of a registered professional engineer experienced in design of this Work and licensed in Oregon.

## PART 2 PRODUCTS

### 2.01 CONNECTION REQUIREMENT BY LOCATION AND STRUCTURAL MEMBER

- A. Concrete Floor Slabs:
  1. Conduits, pipe and ducts may be fastened to the grade slab with supports spaced in accordance with the requirements of Divisions 21, 22, 23, 26, 27 and 28.
  2. For heavy building equipment (400 pounds or more), submit information on the following for review:
    - a. Weight
    - b. Dimensions
    - c. Center of gravity
    - d. Vibration criteria
    - e. Base connection details
  3. The type of fastener to be used on the grade slab connections shall be either cast-in-place anchor bolts or wedge-anchors as specified below.
- B. Suspended Ceilings: Support and brace in accordance with code and specified requirements.
- C. Light Fixtures: In suspended ceilings, provide auxiliary supports to the structure in accordance with code requirements.
- D. Maximum spacing of supports of equipment and systems suspended from underside of structure.
  1. Provide gravity hangers or frames for conduit and pipes (copper or steel) running perpendicular to the joists or beams. Space the hangers as follows:

| Pipe Size        | Maximum Spacing                         |
|------------------|---|
| 2-1/2-inch       | 11 feet                                 |
| 4-inch           | 14 feet                                 |
| 5-inch           | 16 feet                                 |
| 6-inch           | 16 feet                                 |
| 8-inch           | 14 feet                                 |
| 10-inch and over | Layout subject to approval of Architect |

Note that sizes smaller than 2-1/2-inch shall be determined by analysis.
  2. Provide gravity hangers at 10 feet maximum for ducts running perpendicular to joists and beams.
  3. Pipes, conduits and ducts that are oriented parallel to joists or beams shall have vertical supports spaced at a maximum of 10 feet. Supports shall be attached to spreader beams connected to two or more joists as required by the Architect.
  4. Lateral or transverse seismic sway bracing shall be provided at 20 feet maximum. It may be anchored at each girder that is oriented perpendicular to the pipe, conduit or duct. Location of the intermediate bracing between main girders lines shall be staggered to the individual runs and trades to avoid the concentration of loads on any individual joist or beam.
  5. Longitudinal seismic bracing may be located at girders, with a maximum spacing of 40 feet on center and at ends, turns and bends with the same restriction as noted in paragraphs above.
  6. Vertical Runs Between Floors: Provide tube or metal stud supports in accordance with requirements of this section. Connect to concrete floor or steel framing as noted in the General Guidelines for Connecting to Structure (below).

## **2.02 GENERAL GUIDELINES FOR CONNECTION TO STRUCTURE**

- A. Wedge-anchors (approved by ICC) may be used as attachments to the concrete slabs. For seismic design of the anchorage, a safety factor of 3 shall be used with the ultimate-rated capacity of the anchorage. For gravity load design at working stress, a safety factor of 5 shall be applied to the ultimate-rated capacity of the anchorage.
- B. At suspended slabs, wedge-anchors shall be located at the thickened areas of slabs with metal deck.
- C. Welded and bolted connections are not permitted to the main structural members (e.g., beams girders, columns, braces, etc.) except as noted in the following or by special approval:
  - 1. Clip angles or plate angles may be welded to structural columns, girders and beams (flanges and webs) with 3/16-inch by 3-inch maximum fillet welds.
  - 2. All bolted connections used to webs of steel shapes shall be verified by the Architect.
- D. Clamps with positive grip or threaded fasteners may be used to attach to steel beam or girder webs. No "C" clamps are permitted.

## **PART 3 EXECUTION**

### **3.01 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01 40 00.
  - 1. Installation of all wedge-anchors shall be performed under the continuous inspection of a certified inspector.
  - 2. Field tests of the anchorage shall be performed by a licensed testing laboratory under the supervision of a certified inspector.
- B. Field Tests:
  - 1. A calibrated torque wrench shall be used to field test the installation of selected wedge anchorage. The wrench shall be calibrated by a licensed testing laboratory through tensile tests on the wedge-anchors. In the field verification test, the wedge-anchors shall be torque-tested to 1/2 the ultimate pull-out capacity.
  - 2. Fifty percent of the wedge-anchors shall be field tested if their design tensile load is more than 250 pounds. If the design tensile load is 250 pounds or less, 10 percent of the anchorages shall be field tested.
  - 3. One percent of the wedge-anchors shall be field tested for withdrawal at 1-1/2 times the design loading.

**END OF SECTION**