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Building Services Engineering Guide 4

## Mechanical and Electrical Components and Piping Systems Seismic Design Requirements - OSSC Section 1613.7.5 and ASCE 7-05 Section 13.2 & 13.6

Mechanical and electrical components and piping systems (including supporting structures) shall be attached to the building structure and meet the requirements of ASCE 7-05 Sections 13.2 & 13.6 when any of the criteria listed below are present.

**Mechanical Components (ASCE 7-05 Sections 13.6.3, (13.6.5) & 13.6.11, OSSC 1613.7.4 and 13.6.11)** Mechanical equipment designated as having a **Component Importance Factor,  $I_p$ , greater than 1.0.** (13.1.3) Mechanical components designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and weighing **more than 400 lb** and mounted **less than 4-feet** above floor and roof levels or mounted with **rigid connections** between the components and associated ductwork, piping, and conduit. (13.1.4 [4b])  
Mechanical components designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and weighing **more than 75 lbs. or less** and attached **more than 4-feet** above floor and roof levels **with rigid connections** between the component and associated ductwork and, piping, or for distribution systems, **weighing more than 5 lb/ft.** (13.1.4 Exception 5)

### **Electrical Systems and Components (ASCE 7-05 Sections 13.6.4, 13.6.5 & 13.6.11 and 13.6.11)**

Electrical components designated as having a **Component Importance Factor,  $I_p$ , greater than 1.0.** (13.1.3) When the conduit system **crosses seismic isolation interface or joint.**

Electrical components designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and weighing **more than 400 lb** and mounted **less than 4-feet** above floor and roof levels or mounted with **rigid connections** between the components and associated ductwork, piping, and conduit. (13.1.4 [4b])

Electrical components designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and weighing **more than 20 lb** and attached **more than 4-feet** above floor and roof levels **with rigid connections** between the component and conduit, or for distribution systems (i.e. conduits, electrical gutters, cable trays, etc.), **weighing more than 5 lb/ft.** (13.1.4 [5])

All **emergency power circuits** and any element serving emergency systems such as shaft pressurization ducts. When loads are imposed on component by attached utility or service lines that are attached to separate structures.

If any of the following conditions apply for supports for linear electrical equipment (i.e. cable trays, conduit, bus ducts):

- Supports cantilevered from floor.
- Supports have bracing.
- Supports are constructed as rigid welded frames
- Attachments into concrete utilizing non-expanding insets, shot pins, or cast iron embed.
- Attachments utilizing spot welds, plug welds or minimum size welds.

### **HVAC Ductwork (ASCE 7-05 Sections 13.6 & 13.6.7)**

Ductwork systems designated as having a **Component Importance Factor,  $I_p$ , greater than 1.0.** (13.6.7) When the ductwork **crosses seismic isolation interface or joint.**

Ductwork designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and whose **cross-sectional area is larger than 6-feet square** (0.557 m<sup>2</sup>) and the unbraced length of the supporting hanger rod is more than **12-inches** or the hanger rod is subject to bending moment. For round shaped ducts, the diameter should be more than 33-inches. (9.6.1.5 and 9.6.3.10)

Equipment installed in-line with duct system weighing **more than 75 pounds.** (13.6.7)

#### **Mission Statement**

"Partnering to promote completeness of design calculations and plan submission necessary to expedite structural engineering review and approval for buildings that satisfy Oregon Structural Specialty Code (OSSC). Partial or incomplete engineering design submittal has been found to create unnecessary protracted review period."

## **Piping Systems (ASCE 7-05 Sections 13.6.8 and 13.6.8.4)**

Piping designated as having a **Component Importance Factor,  $I_p$ , greater than 1.0** and a nominal pipe size greater than 1-inch diameter. (13.6.8 [2a])

Piping designated as having a **Component Importance Factor,  $I_p$ , equal to 1.0** and a nominal pipe size greater than 3-inch diameter. (13.6.8 [2b])

Piping supported by hanger rods that are **more than 12-inches** or the hanger rod is subject to bending moment. (13.6.8 [1])

Per 13.6.8, seismic restraint of fire protection sprinkler systems designed in accordance with NFPA 13 the latest edition is acceptable provided Section 13.6.8.3 (1b) is satisfied.

When the piping system **crosses seismic isolation interface or joint**.

<p><b>Action Required:</b> The following information is required for review and approval.</p>
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1. List of all components, their weights and their locations within the building on the plans.
2. Anchorage points design calculations and structural details stamped by a **Registered Design Professional** or the components are installed per an **Accepted Standard**.
3. Special inspection may be required during installation of the components per OSSC Chapter 17.

Buildings classified in **Occupancy Category III or IV** (Hospitals, Fire and Police Stations, Hazardous Facilities, etc.) will have additional requirements that need to be addressed on a case-by-case basis per section 1.5.

**Note:** Component attachments force transfer shall include anchorage connection details and all required bracing. Friction force resulting from gravity loads shall **not** be considered to provide resistance to seismic forces per ASCE 7-05, section 13.4. All **non-rigid components or equipment** anchorage connections whose structural failure would result in life hazard that do not fall under the criteria below shall be anchored per ASCE 7-05 Section 13.4.

### **Definitions:**

**Accepted Standard:** Standards developed within the industry and represent acceptable procedures for design and construction. Individual Standards must be approved by the Local Jurisdiction.

**Component:** Architectural, mechanical, electrical, and non-structural systems, components and elements permanently attached to structures including supporting structures and attachments.

**Component Support:** As defined by ASCE 7-05 Section 13.6.5.

**Elements of Structures:** Miscellaneous assemblies or portions of structures having function related to the structure. (i.e. Walls, Penthouses, Prefabricated structural elements other than walls, Diaphragms, etc.)

**Permanent Equipment:** Consists of pressure vessels, boilers, chillers, heat exchangers, pumps, air-handling units, cooling towers, mechanical, plumbing, and electrical assemblies, tanks, vessels, HVAC units, switchgear control panels, motors, transformers, piping systems including trapeze hangers with conduit, cable trays, emergency power supply systems, fire protection sprinklers, etc.

**Registered Design Professional:** An individual who is registered or licensed to practice his or hers respective design profession as defined by statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

**Rigid Connection:** Connection between equipment components that restrains rotational and/or translational movement without degradation of performance.

**Occupancy Category:** A classification assigned to a building based on its use as defined in OSSC Section 1604.5 and OSSC Table 1604.5.