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**PENDANT LUMINAIRES: 2022 CBC**

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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpages.

**PURPOSE**

This Interpretation of Regulations (IR) clarifies acceptable methods for the support of pendant luminaires.

**SCOPE**

This IR is applicable to luminaires (i.e., light fixtures) that are suspended from structural framing by cables, wires, solid rods, hollow tubes, or other similar suspension system. This includes single luminaire suspensions, or linear luminaire suspended from multiple support points.

**BACKGROUND**

As adopted by the California Building Code (CBC), the American Society of Civil Engineers Standard 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7), Chapter 13 defines seismic design requirements for pendant luminaires, which are therein referred to as light fixtures. Luminaires free to swing are addressed in the Exception of ASCE 7 Section 13.6.1. CBC Section 1617A.1.18 amends ASCE 7 Section 13.1.4, which may affect pendant luminaires, depending on the application. Recent failures of pendant luminaires in school buildings during seismic activity are documented in FEMA P-1024: Performance of Buildings and Nonstructural Components in the 2014 South Napa Earthquake, Section 6.2.1.

**1. GENERAL**

- 1.1 All pendant connections, including those to the luminaire housing, shall be fully detailed on the construction drawings.
- 1.2 The project inspector shall verify the installation of pendant luminaires in the field.
- 1.3 Luminaires qualified by shake table tests may be exempt from the requirements below pending DSA acceptance of the qualification testing and specification of support identical to that used in the tests.

**2. FREE TO SWING LUMINAIRES**

2.1 Pendant luminaires that are free to swing laterally shall be detailed and installed so that they can swing at least 45 degrees from the vertical in any direction without contacting an obstruction. When the free movement requirement is not met, luminaires shall be restrained per Section 3 below.

2.1.1 Adjacent luminaires with equal pendant lengths shall be separated by a clear distance equal to at least 1.5 times the pendant length. The length of the pendant shall be measured from the bottom of the luminaire.

2.1.2 When it can be demonstrated by rational analysis that pendant luminaires (or adjacent unbraced components) will swing less than 45 degrees in the design earthquake, luminaire

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location and spacing may be based on such analysis in lieu of the limits prescribed above. Such alternative spacing dimensions shall be explicitly shown on the construction drawings.

**2.2** Luminaire suspension system (including connections and support structure) shall be designed to support the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

**2.3** When a pendant luminaire is supported by a rigid (e.g., rod or hollow shaft) pendant, the pendant shall be attached to the structure above with a device that allows free rotation in any direction (e.g., ball and socket joint, hook and eye, etc.) in accordance with ASCE 7 Section 13.6.1 Exception item 3.

**2.3.1** Devices that allow rotation around only one axis (e.g., hinge-type devices) are not acceptable.

**2.3.2** Luminaires supported by hollow rods or other rigid pendant types shall be provided with a safety cable attached directly to the luminaire and the supporting structure above. The safety cable, its connections, and supporting structure shall be designed to support the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

**2.3.3** When a linear luminaire is supported by more than one rigid pendant, each pendant shall be attached to both the structure above and the luminaire with devices that allow free rotation in any direction. A separate safety cable shall be provided at each rigid pendant location in accordance with Section 2.3.2 above. Alternatively, the luminaire may be restrained in accordance with Section 3 below.

**2.4** When a luminaire is composed of multiple interconnected components, the connection between each component shall be sufficient to transfer a horizontal force equal to 1.4 times the greater cumulative weight of all components on either side of the connection.

**2.5** Cable clamping devices (described as “gripping connections” in FEMA P-1024 Section 6.2.1) shall not be permitted unless one of the following is provided:

**2.5.1** Load carrying capacity is documented in an evaluation report in accordance with *IR A-5: Acceptance of Products, Materials, and Evaluation Reports*.

**2.5.2** Load carrying capacity is substantiated to the satisfaction of DSA by supporting test data supplied by the manufacturer.

**2.5.3** A separate safety cable attached directly to the luminaire and the supporting structure above is provided. The safety cable, its connections, and supporting structure shall be designed to support the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

**2.5.4** Where the cable clamping device is used for height adjustment and excess cable exists beyond the clamping device, provide a positive connection of the free end of the cable (beyond the clamping device) to the luminaire designed to support the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

**2.5.5** Clamping devices are field tested by the laboratory of record for a minimum test load equal to two times that prescribed by ASCE 7 Section 13.6.1 Exception item 1. The test load and protocol shall be shown on the construction documents.

### **3. RESTRAINED LUMINAIRES**

**3.1** When luminaires are restrained from lateral movement, the restraints, connections, and supports shall be designed to resist all applicable code prescribed forces. Restraint by catenary action is not permitted unless it can be demonstrated that the fixture, the fixture connections, the cable restraint, cable restraint connections, and the cable to structure (e.g., wall) connections have adequate capacity to resist the code prescribed forces.

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**3.2** Where restraint is provided by diagonal cable or wire braces that fasten to competent structure above, the vertical suspension support shall be stiffened against compression buckling resulting from the vertical component of the brace force in combination with the vertical seismic force prescribed by ASCE 7 Section 13.3.1.2.

**Exception:** When it can be demonstrated by rational analysis that no upward vertical forces will occur given the configuration of the braces, the magnitude of the forces, and weight of the luminaire, stiffening of the vertical suspension support is not required.

**3.3** Where linear luminaires with multiple pendants are restrained, lateral restraint shall be provided in both the transverse and longitudinal axes of the luminaire. In the transverse direction, restraint shall be provided at each pendant. In the longitudinal direction, lateral restraint may be provided at each end of the luminaire, provided the luminaire components are interconnected with adequate capacity and the restraint is designed for the seismic force generated by all components of the luminaire.

### 4. LUMINAIRES WITH PENDANTS PENETRATING SUSPENDED CEILINGS

**4.1** Where pendants penetrate suspended ceilings, they shall be coordinated with *IR 25-2: Suspended Lay-In Panel Ceiling* or *IR 25-3: Suspended Gypsum Board Ceiling* as applicable.

**4.2** In accordance with American Society for Testing and Materials (ASTM) E580 Section 5.3.7 pendant luminaires shall be supported directly from the structure above through a vertical suspension system capable of supporting all loads required by ASCE 7 and the CBC as described in Section 2 or 3 above. Wire pendants used to support luminaires shall be 9 gauge or larger.

**4.3** If a pendant luminaire is directly and independently braced below the ceiling (e.g., cable or other restraints to fastened to walls) in accordance with Section 3 above, then a brace assembly is not required above the ceiling.

**4.4** If a pendant luminaire is free to swing below the ceiling in accordance with Section 2 above, then a bracing assembly is required to restrain the point where each pendant hanger penetrates the ceiling.

**4.4.1** The bracing assembly required for the pendant luminaire may be of the same or similar type as used in the ceiling construction but is in addition to those assemblies prescribed by IR 25-2 or IR 25-3, as applicable. If an additional bracing assembly per IR 25-2 is used to restrain the pendant above a ceiling and the luminaire weighs less than 20 pounds per pendant the compression post may be omitted.

**4.4.2** Special details are required to attach the pendant hanger to the bracing assembly and transmit the horizontal and vertical forces. These details shall be included on the construction drawings.

**4.5** Rigid conduit shall not be used for attachment of the luminaire.

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### REFERENCES:

2022 California Code of Regulations (CCR)

Part 2: California Building Code (CBC) Sections 1617A.1.18 through 1617A.1.21

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