DSA IR 16-9

PENDANT LUMINAIRES: 2025 CBC

Disciplines: Structural

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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 design 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 systems. 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 (ASCE) 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. Past failures of pendant luminaires in school buildings during seismic activity have been 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 the construction drawings detailing support identical to that used in the tests.

2. FREE TO SWING LUMINAIRES

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 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.

2.2 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

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

2.3 The 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.

2.4 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.

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

2.4.2 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 resist the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

2.4.3 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 2.4.2 above. Alternatively, the luminaire may be restrained in accordance with Section 3 below.

2.5 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.

2.6 Cable clamping devices (described as “gripping connections” in FEMA P-1024 Section 6.2.1) shall not be permitted unless they comply with one of the following:

2.6.1 Load resisting capacity is documented in an evaluation report in accordance with *IR A-5: Product and Material Acceptance Based on a Valid Evaluation Report.*

2.6.2 Load resisting capacity is substantiated to the satisfaction of DSA by supporting test data supplied by the manufacturer.

2.6.3 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 resist the loads prescribed by ASCE 7 Section 13.6.1 Exception item 1.

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

2.6.5 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 defined on the construction documents.

3. RESTRAINED LUMINAIRES

Luminaires restrained against lateral movement shall be designed to demonstrate the adequacy of restraints, connections, and supports to resist all code prescribed forces.

3.1 Restraint by catenary action (i.e., horizontal cables in only one orthogonal plan direction) is not permitted unless the displacements required to achieve the catenary geometry can be determined by rational analysis and all components of the load path are demonstrated to have adequate capacity. The small magnitude of these displacements typically causes significant

amplification of the forces resisted by the cables, cable to pendant or luminaire connections, and cable to structure (e.g., wall) connections.

3.2 Where restraint is provided by diagonal cable or wire braces that fasten to competent structure above, the vertical support shall have sufficient strength and stiffness to resist the vertical component of the brace force in combination with the vertical seismic force prescribed by ASCE 7 Section 13.3.1.2 without buckling, unless it can be demonstrated by rational analysis that no net upward vertical force will occur.

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. PENDANTS PENETRATING SUSPENDED CEILINGS

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.

4.1 In accordance with American Society for Testing and Materials (ASTM) E580: Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions, 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.

4.2 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 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 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 on the construction drawings.

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

REFERENCES:

2025 California Code of Regulations (CCR)
Part 2: California Building Code (CBC) Section 1617A.1.18.