

Grid Ceiling Construction Guidance

Suspended Acoustical Grid Ceilings

2018 International Building Code

SECTION 808 ACOUSTICAL CEILING SYSTEMS
808.1.1.1 Suspended acoustical ceilings.
Suspended acoustical ceiling systems shall be installed in accordance with the provisions of ASTM C 635 and ASTM C 636.

SECTION 1613 EARTHQUAKE LOADS 1613.1 SCOPE

Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7, excluding Chapter 14 and Appendix 11A. The seismic design category for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

EXCEPTIONS

- 1 Detached one & two family dwellings, assigned to Seismic Design Category A, B or C, or located where the mapped short-period spectral response acceleration, S_s , is less than 0.4 g
- 2 The seismic-force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section
- 3 Agricultural storage structures intended only for incidental human occupancy
- 4 Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

ASCE STANDARD ASCE/SEI 7-10 American Society of Civil Engineers

Minimum Design Loads for Buildings and Other Structures

13.5.6.2.2 SEISMIC DESIGN CATEGORIES D THROUGH F

Acoustical tile or lay-in panel ceilings in Seismic Design Categories D, E, and F shall be designed and installed in accordance with ASTM C635, ASTM C636, and ASTM E580, Section 5—Seismic Design Categories D, E, and F as modified by this section.

Acoustical tile or lay-in panel ceilings shall also comply with the following

- a The width of the perimeter supporting closure angle or channel shall be not less than 2.0 in. (50 mm). Where perimeter supporting clips are used, they shall be qualified in accordance with approved test criteria. In each orthogonal horizontal direction, one end of the ceiling grid shall be attached to the closure angle or channel. The other end in each horizontal direction shall have a 0.75 in. (19 mm) clearance from the wall and shall rest upon and be free to slide on a closure angle or channel.
- b For ceiling areas exceeding 2,500 ft² (232 m²), a seismic separation joint or full height partition that breaks the ceiling up into areas not exceeding 2,500 ft² (232 m²), each with a ratio of the long to short dimension less than or equal to 4, shall be provided unless structural analyses are performed of the ceiling bracing system for the prescribed seismic forces that demonstrate ceiling penetrations and closure angles or channels provide sufficient clearance to accommodate the anticipated lateral displacement. Each area shall be provided with closure angles or channels in accordance with Section 13.5.6.2.2.a and horizontal restraints or bracing.

ASTM International, Designation C636/C636M-08

SUMMARY OF STANDARD PRACTICE FOR SUSPENSION CEILING INSTALLATION

- 1 Hangers for carrying channels or main runners 4 ft 0 in. [1200 mm] on centers.
- 2 Each suspension wire shall not hang more than one in six out of plumb unless a countersloping wire or horizontal bracing is provided. Suspension wires should not press against ducts or pipes.

- 3 Wire hangers shall be a minimum of No. 12-gage [2.70 mm] galvanized, soft-annealed, mild steel wire.
- 4 Local kinks or bends shall not be made in hanger wires as a means of leveling carrying channels.
- 5 In installations where hanger wires are wrapped around carrying channels, the wire loops shall be tightly formed to prevent any vertical movement or rotation of the member within the loop.

MAIN RUNNERS

- 1 Install main runners so that they are all level to within 1/4 in. in 10 ft [6 mm in 3000 mm] after completion of the ceiling installations but prior to building occupancy.
- 2 Local kinks or bends shall not be made in hanger wires as a means of leveling main runners.
- 3 In installations where hanger wires are wrapped through or around main runners, the wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. The wire must be wrapped around itself a minimum of three full turns (360° each) within a 3-in. [75 mm] length. For safety purposes, the bottom of the hanger wires shall either be cut close to the vertical portion of the wire or shall be bent upward parallel to the vertical portion of the hanger wire.

CROSS RUNNERS

- 1 Install cross runners supported by either main runners or by other cross runners to within 1/32 in. [.8 mm] of the required center distances. This tolerance shall be noncumulative beyond 12 ft [3600 mm].
- 2 The exposed surfaces of the two intersecting runners shall lie within a vertical distance of .015 in. [.4 mm] of each other with the abutting (cross) member always above the continuous (main) member.

ASSEMBLY DEVICES

- 1 Join abutting sections of the main runner by means of suitable connection such as splices, interlocking ends, tab locks, pin locks, and so forth. A joint connection shall be judged suitable both before and after ceiling loads are imposed if the joint provides sufficient alignment so that the exposed surfaces of two abutting main runners lie within a vertical distance of .015 in. [.40 mm] of each other.

- 2 There shall be no visually apparent angular displacement of the longitudinal axis of one runner with respect to the other.
- 3 Assembly devices shall provide sufficient spacing control so that horizontal gaps between exposed surfaces of either abutting or intersecting member shall not exceed .020 in. [.50 mm].
- 4 Fixtures shall not be supported from main runners or cross runners if the weight of the fixture causes the total dead load to exceed the deflection capability of the ceiling suspension system. In such cases, the fixture load shall be support by supplemental hangers within 6 in. [150 mm] of each corner, or the fixture shall be separately supported.

INSPECTION

- 1 Ceiling inspection shall be made with final building occupancy lighting conditions. If temporary lighting must be used, temporary conditions will approximate the final lighting condition.

ASTM International, Designation E580/E580M-09a

SUMMARY OF STANDARD PRACTICE FOR SUSPENSION CEILING INSTALLATION IN SEISMIC ACTIVITY ZONES, IN ADDITION TO ASTM 636

- 1 Ceiling areas of 1000 ft² [92.9m²] or less are exempt from lateral force bracing requirements.

SUSPENSION SYSTEM COMPONENTS

- 1 The main runners and cross runners of the ceiling system and their splices, intersection connectors, and expansion devices shall be designed and constructed to carry a mean ultimate test load of not less than 1800 lb [80 kg] in compression and in tension. The tensile test shall allow for a 5° offset of the connection in any direction. Instead of a 5° misalignment, the load can be applied with a 1-in. [25 mm] eccentricity on a sample not more than 24 in. [600 mm] long on each side of the splice or intersection. The connectors at splices and intersection shall be the mechanical interlocking type.
- 2 The perimeter support angle shall supply a support ledge of not less than 2 in. [50 mm].

3 Main runner and/or cross runner ends shall be attached to the perimeter on two adjacent walls. A clearance of 3/4 in. [18 mm] shall be maintained between the main runner and cross runner ends and the perimeter members on the two opposite walls. On the walls where the terminal end runners are not fixed to the perimeter supporting closure, allow for 3/4 in. [18 mm] of axial movement.

4 Terminal ends of the main runners and cross members shall be tied together or have some other approved means to prevent their spreading. Stabilizer bars, cross tees or other means to prevent spreading shall occur within 8 in. [200 mm] of each wall.

5 Direct concealed suspended ceiling systems shall have positively connected stabilizer bars or mechanically connected cross runners at a maximum spacing of 60 in. [1500 mm] perpendicular to the main runners. Stabilization shall occur within 24 in. [600 mm] of each wall.

6 The terminal end of each cross runner and main runner shall be supported independently, a maximum of 8 in. [200 mm] from each wall or ceiling discontinuity with No. 12 gauge [2.70 mm] wire or approval wall support.

SUSPENSION WIRE APPLICATOR

1 Connection devices to the supporting construction shall be capable of carrying not less than a 100-lb [45 kg] allowable load.

2 Wires shall not attach to or bend around interfering material or equipment. A trapeze or equivalent device shall be used where obstructions preclude direct suspension. Trapeze suspensions shall be sized to resist the dead load and lateral forces appropriate for the seismic design category.

LATERAL FORCE BRACING

1 Lateral force bracing is required for all ceiling areas greater than 1000 ft² [92.9 m²].

2 Horizontal restraints shall be effected by four No. 12-gauge [2.70 mm] wires secured to the main runner within 2 in. [50 mm] of the cross runner intersection and splayed 90° from each other at an angle not exceeding 45° from the plane of the bracing wires shall be extended to and fastened to the structural members supporting the roof or floor above. The strut shall be adequate to resist the vertical component induced by the bracing wires. These horizontal restraint points shall be placed 12 ft [3600 mm] on center in both directions with the first point within 6 ft [1800 mm] from each wall. Attachment of the restraint wires to the structure above and to the main runner shall be adequate for the load imposed.

3 Lateral force bracing members shall be spaced a minimum of 6 in. [150 mm] from all horizontal piping or duct work that is not provided with bracing restraints for horizontal forces. Bracing wire shall be attached to the grid and to the structure in such a manner that they can support a load of not less than 200 lb [90 kg] or two times the actual design load, whichever is greater.

4 Rigid braces that have been designed to limit relative lateral deflections at the point of attachment of the ceiling grid to less than .25 in. [6 mm] are permitted to be used in the place of diagonal splay wires.

SEISMIC SEPARATION JOINT

1 All continuous ceiling areas exceeding 2500 ft² [232 m²], shall have a seismic separation joint, bulkhead braced to the structure or full height partition that breaks the ceiling into areas of no more than 2500 ft² [232 m²] and having a ratio of the long to short dimension less than or equal to 4. Each area shall be capable of allowing ± 3/4 in. [18 mm] axial movement. Areas surrounded by bulkheads or full height partitions shall be provided with closure angles.

2 Each area with a seismic separation joint, bulkhead or full height partition shall have horizontal bracing or restraints.

3 When the load carrying capability of cross tees supporting light fixtures is less than 16 lbs/ft (241.7 N/m), supplemental hanger wires shall be required.

4 Lighting fixtures weighing greater than 10 lb [5 kg] shall have one, No. 12 gauge [2.70 mm] safety wire connect from the fixture housing to the structure above. It is not necessary for these safety wires to be taut.

5 Lighting fixtures weighing greater than 10 lb [5 kg] but less than 56 lb [25 kg] shall have in addition to the requirements outlined in 5.3.4, two No. 12 gauge [2.70 mm] hanger wires connected from the fixture housing (not the detachable end plates) to the structure above that act as safety wires. It is not necessary for these safety wires to be taut.

6 Lighting fixtures weighing 56 lb [25 kg] or more shall be supported directly from the structure above by approved hangers.

7 Pendant-hung lighting fixtures shall be supported directly from the structure above using no less than No. 9-gauge [3.70 mm] wire or an approved alternative support. The ceiling suspension system shall not provide any direct support.

8 Rigid conduit shall not be used for attachment of the fixtures.

SERVICES WITHIN THE CEILING

1 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing less than 20 lb [9 kg] shall be positively attached to the ceiling suspension main runners or to cross runners that have the same carrying capacity as the main runners.

2 Flexibility sprinkler hose fittings, air terminals or other services weighing less than 20 lb [9 kg] but less than 56 lb [25 kg] shall have, in addition to the requirements in 5.4.1, two No 12-gauge [2.70 mm] hanger wires connected from the terminal or service to the ceiling system hangers or to the structure above that act as safety wires. It is not necessary for these wires to be taut.

3 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 56 lb [25 kg] shall be supported directly from the structure above by approved hangers.

DRAWINGS & SPECIFICATIONS

1 The drawing shall clearly identify all systems and shall define or show all supporting details, lighting fixture attachment, lateral force bracing, partition bracing, etc. When this standard is referenced in a drawing, this standard shall be considered part of the requirements of the drawing to the prescribed extent of such reference. Where differences occur between provisions of this standard and referenced codes, the provisions of this standard and referenced codes, the provisions of the code shall apply. Deviations or variation shall be shown or defined in details.