

DRYWALL CEILING SUSPENSION CONVENTIONAL CONSTRUCTION – ONE LAYER

IR 25-3

References:

California Code of Regulations (CCR), Title 24
Part 2: California Building Code (CBC)
2007 CBC, Section 2506. 2010 CBC, Section 2508
ASTM C754-04, ASTM C840-07, ASTM E580-08
ASCE 7-05

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Discipline: Structural

This Interpretation of Regulations (IR) is intended for use by the Division of the State Architect (DSA) staff, and as a resource for design professionals, to promote more uniform statewide criteria for plan review and construction inspection of projects within the jurisdiction of DSA which includes State of California public elementary and secondary schools (grades K-12 and community colleges), and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is reviewed on a regular basis and is subject to revision at any time. Please check the DSA web site for currently effective IRs. Only IRs listed in the document at <http://www.dgs.ca.gov/dsa/Resources/IRManual.aspx> at the time of plan submittal to DSA are considered applicable.

Purpose: This Interpretation of Regulations (IR) describes prescriptive methods for the installation of suspended gypsum board ceiling systems. These methods represent a means of complying with the California Code of Regulations, Title 24 Part 2, and are acceptable to the Division of the State Architect (DSA). This IR does not preclude the designer from using other methods of installation, including proprietary systems discussed in Section 6, if submitted to and approved by the DSA.

This IR is applicable to projects submitted to the DSA for review under the 2007 and 2010 editions of the California Building Code (CBC). For projects submitted for review under the 2001 CBC, see [IR 25-3.01](#).

1. MATERIALS: Materials are to comply with CBC Section 2508 (Section 2506 for projects under the 2007 CBC) and applicable ASTM standards. Gypsum wallboard is either 1/2 inch or 5/8 inch in thickness. Cold-formed steel sections specified in this IR are identified by a product designator which has been standardized by the American Iron and Steel Institute (AISI) in collaboration with the Steel Stud Manufacturers Association (SSMA).

2. DESIGN: The prescriptive requirements of this IR shall be taken as the minimum requirements and apply to a ceiling that is not accessible, has a single layer of gypsum board not exceeding 5/8" thick, and has a total ceiling weight not to exceed 4 pounds per square foot (psf). A ceiling that is required by CCR Title 24 to be accessible, or otherwise does not meet these limitations, shall be designed to meet the applicable requirements of CBC Sections 1607A and 2508.1, and ASCE 7-05, Section 13.3.1.

3. DETAILS OF CONSTRUCTION:

3.1 General: Gypsum wallboard ceilings shall not support building components other than air conditioning/heating grills or light fixtures. All such components shall be supported either directly from main runners, or by supplemental framing which is supported by main runners. No vertical loads other than gypsum board dead load shall be applied to cross-furring.

3.2 Vertical Support System: There are many possible variations of main runner sizes, spacings, and spans listed in ASTM C754-04, Table 7. All of the combinations are acceptable, provided the main runner spacing does not exceed 4'-0" and the ceiling area supported by a hanger wire does not exceed 16 square feet.

3.2.1 Main Runner Spacing and Span: The main runner most frequently used is a 1-1/2 inch cold rolled channel designated 150U050-54 (1-1/2 inch cold rolled channels weighing 0.414 lbs/ft) spaced no more than 4'-0" o.c. with a hanger wire spacing not to exceed 4'-0" o.c. and no more than 6" from each end of the main runner.

3.2.2 Vertical hanger wires: #9 gage and galvanized soft-annealed steel.

3.2.3 Cross-furring: 7/8 inch galvanized steel hat sections, designated 087F125-18, at 24 inches o.c. maximum.

3.3 Connecting Hanger Wires, Steel Framing and Furring:

3.3.1 Hanger wires shall be saddle-tied to the main runners per IR 25-2.10 Figure 3A(F).

3.3.2 Cross furring should be saddle-tied to the main runners with one strand of #16 gage, or two strands of #18 gage tie wire.

3.3.3 Main runners should be spliced by lapping and interlocking flanges and tying near each end with double loops of #16 gage wire. The lap must be a minimum of 12 inches long.

3.3.4 Cross furring should be spliced by lapping and interlocking the pieces and tying near each end with double loops of #16 gage wire. The lap must be a minimum of eight (8) inches long.

3.4 Installation and Anchorage of Hanger and Bracing Wires: Fasten hanger wires with not less than three (3) tight turns within a distance of 3 inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops (see ASTM E580, Section 5.2.7.2). Fasten bracing wires with four (4) tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger and bracing wire anchors shall be installed in such a manner that the direction of the anchor aligns as closely as possible with the direction of the wire.

Note: For 2007 code projects only, wire turns made by machine where both strands have been deformed or bent in wrapping the 1-1/2 inch requirement can be waived, but the number of turns should be maintained, and be as tight as possible.

3.4.1 Separate all ceiling hanger and bracing wires at least six (6) inches from all unbraced ducts, pipes, conduit, etc.

3.4.2 When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 lbs in tension. Shot-in anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, see 2010 CBC Section 1916A.7.3 or 1916.1.11.3* (Section 1916A.8 in the 2007 CBC).

Note: Drilled-in or shot-in anchors require DSA approval when used in prestressed concrete.

3.4.3 Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have counter-sloping wires.

4. LIGHT FIXTURES AND MECHANICAL SERVICES

- 4.1** All recessed or drop-in light fixtures, as well as ceiling mounted mechanical air terminals and services, shall be supported directly by main runners or by supplemental framing which is supported by main runners and positively attached with screws or other approved connectors.
- 4.2** Surface mounted fixtures shall be attached to a main runner with a positive clamping device made of material with a minimum of 14 gage. Rotational spring clamps do not comply.
- 4.3 Access Panels:** Access to the space between the ceiling and the floor or roof above shall not be allowed. Small access panels for the inspection, adjustment or repair of utility switches, valves, sensor, etc., may be allowed if the panel is less than 300 square inches. Such panels shall also have a permanently attached warning label as follows:

Warning: 1) Do not climb, walk, or crawl on the gypsum board ceiling panels.
2) Do not store or stow anything on the gypsum board ceiling panels."

5. LATERAL SYSTEM: A gypsum board ceiling greater than 144 square feet in area shall be designed to resist its own seismic loads, per Section 2 above, and shall not be permitted to be used to resist primary structural loads or other loads. There are two optional lateral systems for this purpose:

- The brace wire system, per Section 5.1.
- The diaphragm system, per Section 5.2.

Either or both options may be shown on plans or noted in the specifications.

Note: 1. If both options are shown on the plans or noted in the specifications, only one option can be used for each separate ceiling area.

2. Fire-rated systems shall be installed per rated listing (i.e. UL, Factory Mutual, etc.) and manufacturers' instruction, and the rated listing may dictate the optional lateral system used.

5.1 Brace Wire System: Provide bracing assemblies per IR 25-2.10, Figure 1 (IR 25-2.07 for 2007 CBC), as follows:

5.1.1 For school buildings, place bracing assemblies at a spacing not more than 12 ft. by 12 ft. on center.

5.1.2 For Essential Services Buildings, place bracing assemblies not more than 8 ft. by 12 ft. on center.

5.1.3 There shall be a brace assembly a distance of not more than one half of the above spacing from each surrounding wall, expansion joint and at the edge of any ceiling vertical offset.

The slope of bracing wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted without DSA approval.

5.1.4 Ceiling grid members may be attached to not more than two (2) adjacent walls. Ceiling grid members shall be at least 3/4 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.

5.1.5 Suspended ceiling systems with an area of 144 square feet or less, and fire rated ceiling systems with an area of 96 square feet or less, surrounded by walls which connect directly to the structure above, do not require bracing assemblies when attached to at least two adjacent walls.

5.2 Diaphragm System: A suspended gypsum board ceiling may be designed as a horizontal diaphragm to resist its own seismic loads as prescribed in this section. Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by partitions.

5.2.1 Diaphragm Ratios:

Horizontal 2:1 maximum

Vertical 1:1 maximum

5.2.2 A maximum diaphragm shear equal to 50 lbs/ft is allowed with 1 inch or 1-1/4 inch Hi-Lo Type S, or S-12, bugle head screws at 12 inches o.c. at all gypsum board edges (3/8 inch screw edge distance) and at all intermediate supports. A wall constructed similarly can resist the same shear force provided the gypsum board is on the same side of the studs as the ceiling is, and a positive connection between the ceiling and the wall is detailed. The gypsum board diaphragms are to resist lateral loads due to their own weight and/or the ceiling diaphragm(s) only.

5.2.3 Details are required providing for lateral load transfer from the gypsum board to shear walls, or other lateral load resisting elements, on all four sides of the diaphragm. There shall be no steps or vertical offsets in the ceiling plane.

6. PROPRIETARY SUSPENDED GYPSUM BOARD CEILING SYSTEMS: At the discretion of the DSA, proprietary systems may be accepted under all the following conditions:

- Acceptance will be granted on a project specific basis.
- Proprietary systems must meet the requirements of the CBC.
- Proprietary systems must have valid evaluation reports meeting the provisions of IR A-5.