INTERNATIONAL

Designation: C1925 – 22

Standard Test Method for Strength Properties of Direct Hung, Suspended T-bar Type Ceiling System Components Intended to Receive Gypsum Panel Products[1]

This standard is issued under the fixed designation C1925; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers metal ceiling suspension systems used primarily to support screw-attached gypsum panel products.

1.2 The method of determining strength properties of suspended ceiling grid system components is as follows:

Tests	Sections
Uniform Load Testing	6 – 10
Connection Strength Testing	11 – 15
Wire Pullout Resistance	16 – 20

1.3 The values stated in inch-pound and SI (metric) units are to be regarded separately as standard. Within the text, the SI (metric) units are shown in brackets. The values stated in each system of units shall be used independently of the other. Values from the two systems of units shall not be combined.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

E631 Terminology of Building Constructions

2.2 *Other Standards:*[3]

AISI S220 North American Standard for Cold-Formed Steel Nonstructural Framing

3. Terminology

3.1 For definitions relating to building constructions, see Terminology E631.

3.2 For definitions relating to gypsum and related building materials and systems, see Terminology C11.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *cross runner, n*—a member installed perpendicularly to the main runner members designed to receive screw-attached gypsum panel products.

3.3.2 *grid suspension system, n*—a ceiling system composed of modular interlocking steel components designed to receive screw-attached gypsum panel product.

3.3.3 *main runner, n*—the main support member of a grid suspension system that receives cross runner members.

3.3.4 *suspended ceiling, n*—a ceiling in which the main runner members and cross runner members are suspended below the structural members of the building.

3.3.5 *ultimate load, n*—the maximum load applied before test specimen failure.

4. Summary of Test Method

4.1 This test method can be used to determine the strength properties of nonstructural steel framing members to receive screw-attached gypsum panel products. Strength properties are determined by application of uniformly distributed loads to suspended ceiling main runner and cross runner members, tension and compression loading to splices, and wire pullout resistance testing.

[1] This test method is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.02 on Specifications and Test Methods for Accessories and Related Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Iron and Steel (AISI), https://www.steel.org, or the Cold-Formed Steel Engineers Institute (CFSEI), https://www.cfsei.org, 25 Massachusetts Avenue, NW, Suite 800, Washington, DC 20001.

5. Significance and Use

5.1 This test method provides a standard for determining ultimate load and loads at design deflection of main runner and cross runner members to evaluate their suitability for suspended ceiling installations. Design of cold-formed steel nonstructural framing members shall be in accordance with AISI S220. Installation of cold-formed steel nonstructural framing members shall be in accordance with Specification C754.

5.2 The procedure detailed in this standard is intended to be used for determining allowable uniform loads for member spans of 2 ft [600 mm] or greater. Spans tested shall be determined by the manufacturer and documented in the test report. Each member shall be tested in both the upward and downward loading directions.

Uniform Load Testing

6. Support Frame Apparatus

6.1 Provide a rectangular support frame having the essential features of the unit described below:

6.2 The support frame (Fig. 1) shall have the capability for length adjustment to permit testing of members on clear spans of various lengths.

6.3 The support frame shall have sufficient stiffness so that no significant deflection occurs during load testing.

6.4 The support frame must allow the test specimen to be simply supported for both the upward and downward loading direction tests (Fig. 2). The specimen supports shall be ¼ in. [6 mm] radius, maximum. The supports shall inhibit the runner from any downward vertical movement at the supports, while allowing freedom to move axially in the horizontal direction.

7. Test Specimens

7.1 The members tested shall be identical to the sections used in the final system design. All cutouts, slots, etc., as exist in the system component shall be included in the test specimens evaluated.

7.2 Main runner/cross runner members that are part of a fire resistance rated assembly that contain fire expansion relief cutouts shall be evaluated for load performance where field application of the expansion relief is designed to be more than 3 in. [75 mm] from the closest support point.

7.3 Each weight attachment to the test specimen must be such that the contact surface is no greater than 1 in. [25.4 mm] in the direction of the length of the test specimen to ensure that the weight attachment does not increase the rigidity of the test specimen. The weight attachment device shall bear on either the flange, the bulb, or hanger wire hole in the web of the member.

7.4 The length of the specimen shall not exceed the length of the span being tested by more than 12 in. [300 mm].

7.5 The specimens shall be tested in both upward and downward loading directions (Fig. 2).

8. Preparation of Support Frame Apparatus

8.1 In actual ceiling installations, the lateral (horizontal) buckling of members is prevented by the lateral support provided by intersecting members and screw attached gypsum panel products. When secondary members are used in a test system, they shall provide the needed lateral (horizontal) support but shall not directly contribute to the load-deflection performance in terms of vertical support of the primary member being tested.

8.2 Prevent lateral (horizontal) buckling of the test section by installing secondary members between the test specimen and the vertical sides of the support frame. Install secondary members normal to the direction of the test specimen. Install secondary members no closer than 24 in. [600 mm] apart. Do not use additional materials to provide lateral support.

8.3 The secondary members shall be either interlocking type (such as with use of an actual cross runner member) or non-interlocking type. Where interlocking secondary members are used, assemble them into the test specimen, spaced no

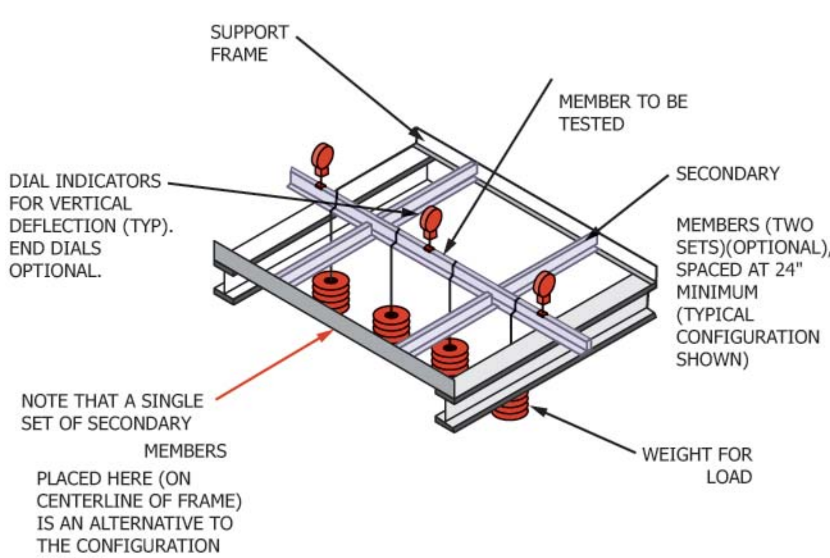

FIG. 1 Support Frame

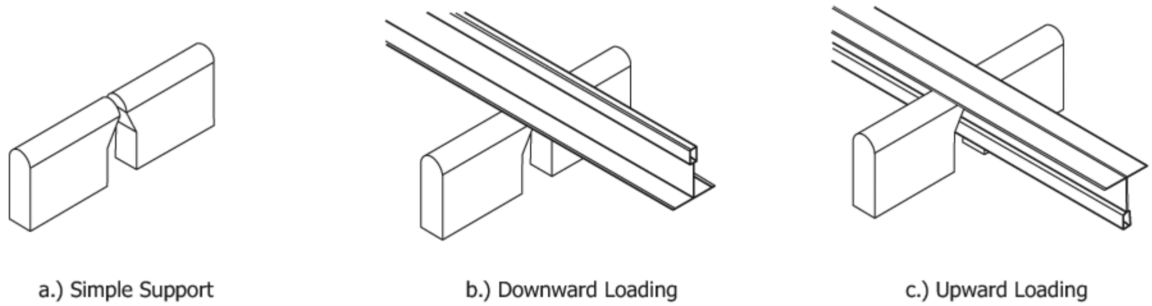

FIG. 2 Test Specimen Simple Support & Loading Direction Orientation

closer than 24 in. [600 mm] on center. Support the other end with the side of the support frame. Where non-interlocking secondary members are used, support one end of secondary members from the flange of the primary member (Fig. 1) and support the other end with the side of the support frame.

8.4 Secondary members must not interlock with the perimeter support frame and shall not provide vertical support to the primary member.

8.5 Determine the load-deflection performance of cross runner members by setting up and testing the members in a manner appropriate to their use in grid suspension systems.

9. Test Procedure

9.1 With the test specimen to be evaluated installed in the support frame, position the support frame to mount the vertical displacement deflection gauges directly over the test specimen at the mid-span. As an option, mount additional deflection gauges at each end of the test specimen at the rest supports. Use the optional end gauges when a test section exhibits a tendency to compact at the rest supports. Position the gauges to read zero with reference to a horizontal plane that runs through the supports of the test specimen in the test support frame. Incorporate the weight of load attachment devices, pans, etc., as part of the first incremental test load.

9.2 Apply the test weights (Fig. 3 and Fig. 4) to the test specimen starting 6 in. [150 mm] from the end supports, and at intervals of 12 in. [300 mm] thereafter, always proceeding from the ends toward the center of the span in applying the load.

9.3 For test specimens of lengths other than whole-foot integers (that is, length ≠ 2 ft, 3 ft, 4 ft, etc.), apply the test weights starting 6 in. [150 mm] from the end supports, and at evenly distributed intervals no greater than 12 in. [300 mm] thereafter, always proceeding from the ends toward the center of the span in applying the load. Load application intervals shall be established by Eq 1 (inch-pound) or Eq 2 (SI [metric]):

$$S = \frac{L - 12}{n} \quad (1)$$

where:

S = interval spacing, in.,
L = span length, in., and
n = number of intervals = $L/12$, rounded down to the nearest whole number.

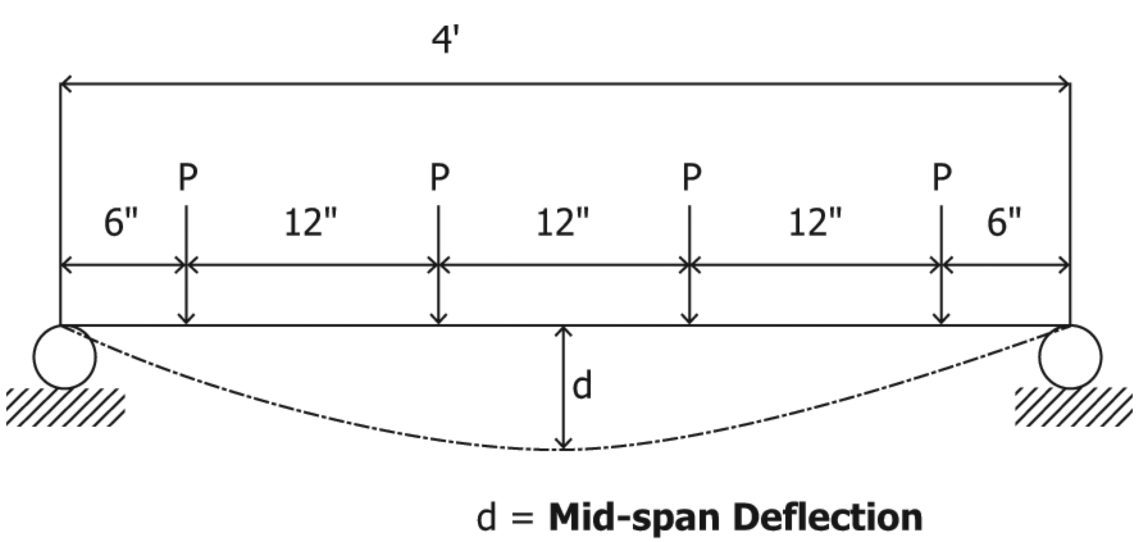

FIG. 3 Load-Carrying Test Configuration for Inch-Pound Units

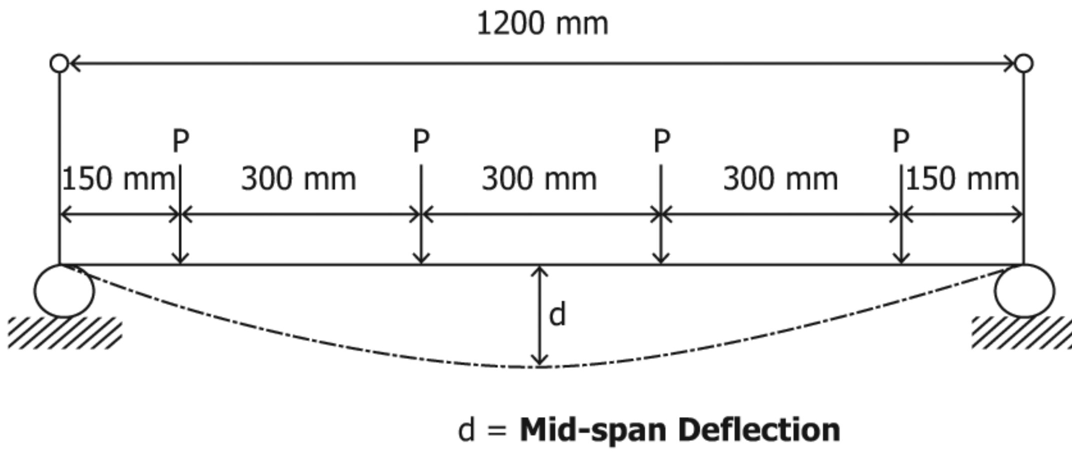

FIG. 4 Load-Carrying Test Configuration for SI (Metric) Units

$$S = \frac{L - 300}{n} \quad (2)$$

where:

S = interval spacing, mm,
L = span length, mm, and
n = number of intervals = L⁄300, rounded down to the nearest whole number.

9.4 After the first uniformly distributed load increment has been applied, measure and record the mid-span deflection of the test specimen. Also record the end gauge deflections when the end gauges are present. Measure and record the total uniform load on the test specimen. Continue loading of the test specimen in the same manner, applying successive increments of uniformly distributed load and recording the deflections after each increment. Continue loading until it is apparent that the test specimen has collapsed and record as the ultimate load.

9.5 For each member under evaluation and each span length, test and perform calculations and record results on three replicate test specimens.

9.6 Record the incrementally applied, uniformly distributed loads and the resultant mid-span deflection measurements for each loading increment. When end gauges are used, subtract the average value of the two end gauges from the corresponding mid-span deflection, and report the resultant net mid-span deflection for each increment. Subtracting the average end gauge readings will compensate for vertical translation of the test specimen due to compaction at the rest supports.

10. Calculation

10.1 The performance of members of suspension systems is represented by individual load-deflection tests performed at each different span length used in service.

10.2 Use the average load data to establish the maximum uniformly distributed load that the member can successfully sustain at the deflection limit of L⁄240 of the span length in inches [millimeters] according to Eq 3.

$$P_{\frac{L}{240}} = p_1 + (p_2 - p_1) \cdot \left(\frac{\left(\frac{L}{240} - \delta_1 \right)}{(\delta_2 - \delta_1)} \right) \quad (3)$$

where:

$P_{L/240}$ = load at L⁄240 deflection,
L = span length,
p_1 = recorded load interval before reaching L⁄240 deflection,
p_2 = recorded load interval after reaching L⁄240 deflection,
δ_1 = recorded deflection before reaching L⁄240 deflection, and
δ_2 = recorded deflection after reaching L⁄240 deflection.

10.3 To establish the maximum uniformly distributed load that the member can successfully sustain at the deflection limit of L⁄360 of the span length, Eq 3 shall be used, substituting L⁄240 with L⁄360 .

Connection Strength Testing

11. Test Apparatus

11.1 A universal testing machine capable of applying and measuring the required tension and compression loads within an accuracy of 1 % shall be used.

12. Test Specimens

12.1 The length of each of the two sections of main runner used in the tension and compression tests for main runner splices shall be a minimum of 6 in. [150 mm].

13. Preparation of Test Apparatus

13.1 Attach the test specimen to the testing machine using a fixture designed to prevent failure or slippage at the machine/specimen connection point before failure at the specimen connection point.

14. Test Procedure

14.1 *Main Runner Splice Tension Test:*

14.1.1 Attach the test specimen to the test fixture, as shown in Fig. 5. Position the testing machine to remove any slack and impose a preload of 5 lb [22 N] before beginning the test.

14.1.2 Ensure that the fixtures are in line so that the force is applied axially, with no significant moments induced.