Designation: E3090/E3090M – 17

Standard Test Methods for Strength Properties of Metal Ceiling Suspension Systems[1]

This standard is issued under the fixed designation E3090/E3090M; 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.

INTRODUCTION

In the past mechanical properties of metal ceiling suspension systems have been buried in other standards such as Specification C635 and Practice E580. This test method is an attempt to pull all testing requirements into one document.

1. Scope

1.1 These test methods cover metal ceiling suspension systems used primarily to support acoustical tile, acoustical lay-in panels, or suspended T-bar type ceiling systems.

1.2 These test methods cover the determination of strength properties of suspended ceiling grid system components as follows:

Tests	Subsections
Load Carrying Capacity	5.1
Connection Strength in Tension	5.2.2; 5.2.4
Connection Strength in Compression	5.2.3; 5.2.5
Wire Pullout Resistance	5.3

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *The following safety hazards caveat pertains only to the test methods described in this specification. 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 and health 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]

C634 Terminology Relating to Building and Environmental Acoustics

C635 Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

E580 Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint

E631 Terminology of Building Constructions

3. Terminology

3.1 For terminology relating to Building and Environmental Acoustics, see Terminology C634.

3.2 For terminology relating to Building Constructions, see Terminology E631.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *carrying channel, n*—metal section that supports the entire structural grid network in some forms of mechanical ceiling suspension systems.

3.3.1.1 *Discussion*—The carrying channels are usually suspended by hanger wires from the existing structure and the main runners are then attached to the channels.

3.3.2 *ceiling suspension system, n*—the entire network or grid of structural components, as defined by the ceiling suspension system manufacturer, that provides support for acoustical ceiling tile, acoustical ceiling panels, lighting fixtures, flexible sprinkler hose fittings and air diffusers.

3.3.2.1 *Discussion*—The manufacturer of the ceiling suspension system will define/designate which elements of the system are the structural components.

[1] These test methods are under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and are the direct responsibility of Subcommittee E33.04 on Application of Acoustical Materials and Systems.

Current edition approved April 1, 2017. Published April 2017. DOI: 10.1520/E3090_E3090M-17.

[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.

3.3.3 *cross runner, n*—the secondary or cross beams of a mechanical ceiling suspension system.

3.3.3.1 *Discussion*—The cross runners usually support only the acoustical tile. In some forms of suspension systems, however, the cross runners also provide support for lighting fixtures, air diffusers, flexible sprinkler hose fittings, and other cross runners.

3.3.4 *cross runner connection, n*—cross runners are interconnected to each other at a cross runner to main runner intersection.

3.3.5 *cross runner to main runner intersection, n*—cross runners intersect a main runner along the length of the main runner and are terminated at the a slot or *rout* along the main runner length.

3.3.5.1 *Discussion*—In a typical intersection two cross runners intersect a main runner from opposing sides and share the same slot or *rout hole*.

3.3.6 *main runner splice, n*—the primary main tees of the ceiling suspension system are connected along their lengths with a splice that is typically made from the body material or a secondary material attached to the main tee.

3.3.6.1 *Discussion*—The 'splice' connection ensures the modularity of the connection and typically has no intersecting cross runners at the location of the splice.

3.3.7 *main runner, n*—the primary or main beams of the type of ceiling suspension system in which the structural members are mechanically locked together.

3.3.7.1 *Discussion*—The main runners provide direct support for cross runners, and may support lighting fixtures and air diffusers. In addition, the acoustical tile may also be directly supported by the main runners. In some forms of mechanical ceiling suspension systems, the main runners are supported by hanger wires attached directly to the existing structure. In other forms, the main runners (also referred to as "H" runners, "Z" bars, etc.) are installed perpendicular to carrying channels and are supported by specially designed sheet metal or wire clips attached to the carrying channels.

3.3.8 *primary structural member, n*—the member that is under test in the load carrying capacity test (5.1).

3.3.8.1 *Discussion*—The primary structural member is typically a main runner.

3.3.9 *rout or rout hole, n*—a slot in the web of the main runner which is designed to accept interlocking cross runner ends.

3.3.10 *secondary structural member, n*—optional member that is added to the load carrying capacity test (5.1) to provide horizontal support to the primary structural member.

3.3.10.1 *Discussion*—The secondary structural member is typically a cross runner.

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

3.3.11.1 *Discussion*—Fig. 1 illustrates several common ceiling suspension systems.

4. Significance and Use

4.1 *Load Carrying Capacity:*

4.1.1 Most architectural specifications contain a uniform load requirement based on Specification C635. Additionally, it is useful to know the uniform loads of cross runners to evaluate their suitability for various ceiling loads.

4.1.2 The procedure detailed in this standard is intended to be used for the simple four foot span specified in Specification C635. It can be used for simple spans other than four feet, but an engineering analysis is required to determine the proper spacing of concentrated loads necessary to simulate a uniform load.

4.1.3 Various concentrated load combinations can be similarly tested or they can be calculated from the uniform load results by engineering analysis.

4.2 *Connection Strength in Tension and Compression:*

4.2.1 Structural failure of grid systems under axial loading is controlled by the failure of connections between the grid members. Specification of the allowable axial loads is useful for designers and specifiers for determining which grid systems will be appropriate for specific job conditions.

4.2.2 Connection strength is particularly important where the grid installation is expected to experience lateral loads due to earthquake or wind.

4.2.3 Connection strength in both compression and in tension are specified in Practice E580 as mean ultimate test load in tension and in compression.

5. Test Methods

5.1 *Load Carrying Capacity:*

5.1.1 *Apparatus – Support Frame*—Provide a rectangular support frame having the essential features of the unit described below:

5.1.1.1 The frame (Fig. 2) shall have the capability for length adjustment to permit testing of structural members on clear spans for a maximum of 8 ft [2400 mm] to a minimum of 3 ft [900 mm]. It shall have the capability for overall width adjustment from a maximum of 4 ft [1200 mm] to a minimum of 2 ft [600 mm].

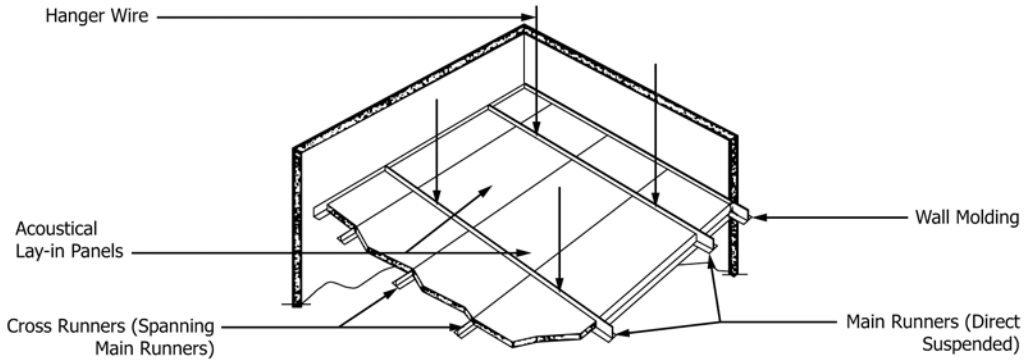
5.1.1.2 The support frame shall have sufficient stiffness so that no significant deflection occurs within the frame during load tests of suspension system structural members.

5.1.1.3 The support frame shall be either ceiling mounted or floor supported.

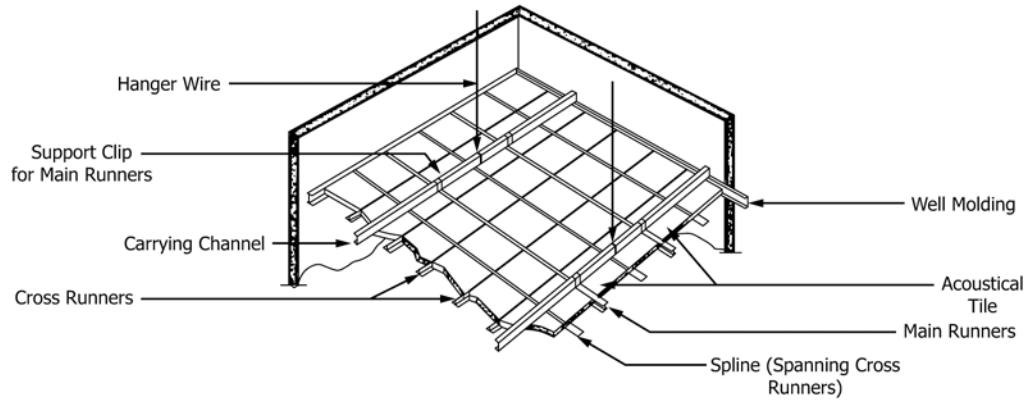
5.1.1.4 Both ends of the test specimen must be supported by a ¼ in. [6 mm] radius support.

5.1.2 *Test Specimen*—The structural 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 sections evaluated.

5.1.2.1 Main runners/cross runners 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.



a) Direct Hung Suspension System



b) Indirect Hung Suspension System

FIG. 1 Suspension System Types

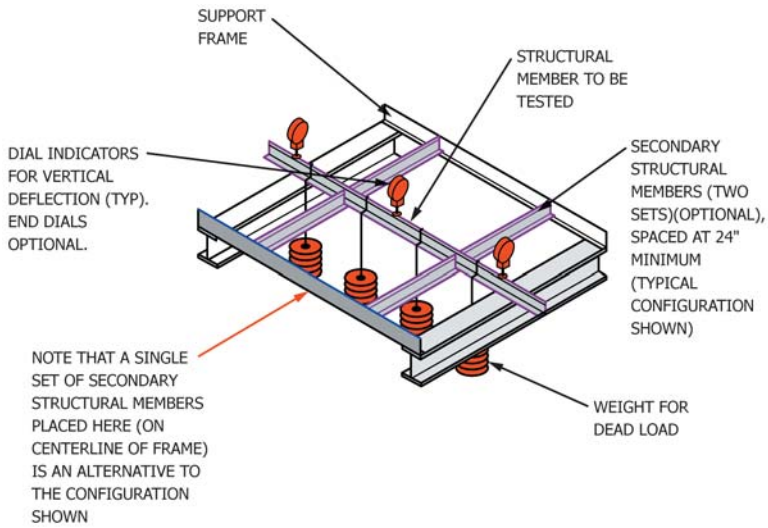


FIG. 2 Support Frame

5.1.2.2 Allowable mill variations of sheet stock thickness can have a significant effect on section stiffness and load carrying ability. Consequently, load-deflection studies of structural members shall utilize sections fabricated in accordance with the system manufacturers' published metal thicknesses and dimensions.