



# Standard Test Methods of Conducting Strength Tests of Panels for Building Construction<sup>1</sup>

This standard is issued under the fixed designation E72; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## INTRODUCTION

Sound engineering design of structures using existing or new materials requires accurate technical data on the strength and rigidity of the basic elements employed in various construction systems. It is the purpose of these test methods to provide a systematic basis for obtaining engineering data on various construction elements and structural details of value to designers, builders, building officials, and others interested in this field. The results should closely approximate the performance in actual service.

### 1. Scope

1.1 These test methods cover the following procedures for determining the structural properties of segments of wall, floor, and roof constructions:

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1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.2.1 *Exception*—SI units are used in Fig. 6.

### 2. Referenced Documents

- 2.1 *ASTM Standards*:<sup>2</sup>
- D2395 Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials
  - D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials
  - D7438 Practice for Field Calibration and Application of Hand-Held Moisture Meters
  - E4 Practices for Force Verification of Testing Machines
  - E73 Practice for Static Load Testing of Truss Assemblies
  - E564 Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings
  - E575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies
  - E661 Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads

<sup>2</sup> 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.

**E695** Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

**E2126** Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings

**E2309/E2309M** Practices for Verification of Displacement Measuring Systems and Devices Used in Material Testing Machines

**E2322** Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction

2.2 *Other Document*:<sup>3</sup>

**NIST Voluntary Product Standard PS20** American Softwood Lumber Standard

### 3. Test Specimens

3.1 *Size*—There shall be at least three specimens for each test. Specimens shall be constructed to represent sections of the wall, floor, or roof assembly. The specimens shall be representative as to material and workmanship and shall be of the largest practical size to predict structural performance attributes of the assembly. Unsymmetrical assemblies shall be tested in each axis for which the results may be different.

3.2 *Length or Height*—The length or height of specimen for each element shall be chosen to conform to the length or height of that element in actual use.

3.3 *Width*—The width of specimen shall be chosen, insofar as possible, to include several of the principal load-carrying members to ensure that the behavior under load will simulate that under service conditions. With the exception of specimens for the racking load test, the nominal width of wall specimens shall be 4 ft (1.2 m). The actual width of specimens shall be a whole number multiplied by the spacing of the principal load-carrying members except for prefabricated panels, for which the actual width shall be the width of panel used. If the structural properties of a particular construction are to be compared with another construction, there should not be a great difference in the actual widths of the specimens.

3.4 *Age*—Constructions, such as concrete and masonry (brick, structural clay tile, concrete block) for which the structural properties depend upon the age of the specimen, shall be tested not less than 25 days nor more than 31 days after fabrication. This age requirement applies also to plastered and stuccoed constructions.

### 4. Loading

4.1 *Apparatus*—The testing machine or load-measuring apparatus shall comply with the requirements prescribed in Practices **E4**.

4.2 *Application of Load*—Apply the load to all of the specimens in any test in increments so chosen that a sufficient number of readings will be obtained to determine definitely the load-deformation curve (see Section **6**). Record the initial reading of the load and the reading of the deformation, either

with no load on the specimen or under a small initial load. Increase the load to the first increment and record the deformation. Unless otherwise specified, decrease the load to the initial load and record the set (sometimes designated “permanent set”). Increase the load to two increments and record the set, when it is released to the initial load. Follow this sequence of readings for three increments, four increments, and so forth, of load. When for each specimen the behavior of the specimen under load indicates that the specimen might fail suddenly and damage the deformation-measuring apparatus, remove this apparatus from the specimen and increase the load continuously until the maximum load that can be applied to the specimen is determined.

4.3 *Duration of Load Application*—Except for racking tests, after each increment of load is applied, maintain the load level as constant as possible for a period of 5 min (see **Note 1**). Take deformation readings as soon as practical after load application, at the end of the 5-min period under constant load, and immediately and at the end of the 5-min period after any partial or complete load release. Plot initial and 5-min readings in the form of load-deformation curves. Maintain complete load-deformation-time records throughout the test. If application of a given load is required for a certain period, such as 24 h, take deformation readings at the beginning, at intervals during this period, and at the end of this period, to allow the satisfactory plotting of a time-deformation curve for the complete period.

**NOTE 1**—Reasons for the 5-min application of constant-level increment loads are as follows:

(1) To permit the assembly to come to a substantial rest prior to taking the second set of readings (Depending on the method employed for applying the test load, it may be necessary to continue, at a reduced rate, the motion of the loading device in order to maintain the constant load level during the 5-min period.)

(2) To provide sufficient time for making all observations. (Longer time intervals may be required under certain conditions.)

(3) To observe any time-dependent deformation or load redistribution, or both, and to record accurately the load level when time-dependent deformation starts, that is, at the divergence of the immediate and delayed load-deformation curves. This load level may, under certain conditions, have an important bearing on the design load.

(4) To be able to stop the test, if this should be desirable, prior to total failure, after initial failure has been anticipated as a result of the observations.

(5) To assure uniformity in test performance and consistency in test results.

### 5. Deformation Measurements

5.1 Measure the deformations with sufficient precision to define the load-deformation relationship, and report at least to the nearest 0.01 in. (0.25 mm). The deformation-measuring apparatus specified for any loading may be replaced by other apparatus, provided that it permits readings of deformation that are equivalent in accuracy to those from the specified apparatus.

### 6. Reports

6.1 Show the results of each of the tests graphically, as illustrated in **Fig. 1**. Plot loads as ordinates and the deformations as abscissas for all tests. There shall be at least three specimens for each test, and the results for each test shall be

<sup>3</sup> Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

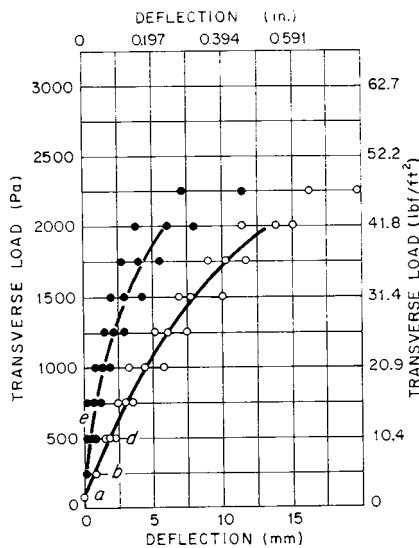


FIG. 1 Typical Graph Showing Results

shown on the same graph. Show the points for deformation under load by open circles and those for set by solid circles. Average the three values for either the deformation or the set and plot this average value in pencil on the graph. Draw a smooth curve among the average points to show the average behavior of the construction. The load-deformation curves shall be continuous lines and the load-set curves shall be dashed lines. Although the particular specimen for each point on the graph is not designated, record it on the laboratory data sheets. If readings are obtained under greater loads for some specimens than for others, plot all the values, but draw the curves only to the average values for which there are three values.

6.2 Prepare the test report in accordance with Practice E575.

## 7. Precision and Bias

7.1 No statement is made either on the precision or on the bias of these test methods due to the variety of materials and combinations of materials involved.

## TESTING WALLS

## 8. Significance and Use

8.1 The procedures described are those that will test the behavior of segments of wall construction under conditions representative of those encountered in service. Performance criteria based on data from those procedures can ensure structural adequacy and service life.

## 9. Compressive Load

9.1 *Test Specimens*—Tests shall be made on three like specimens, each having a height equal to the length of the element and a nominal width of 4 ft (1.2 m) (see Section 3).

9.2 *Apparatus*—The apparatus shall be assembled as shown in Fig. 2 and shall conform to the detailed requirements for component parts prescribed in 9.2.1 and 9.2.2, or the equivalent.

9.2.1 *Compressometer*—A bracket shall be attached to the specimen near the upper end, supporting a metal rod. A bracket shall also be attached to the specimen near its lower end, supporting a deflection—measuring device with the spindle up and the gage length shall be recorded. The conical end of the rod shall seat in a hole in the end of the spindle and the rod and spindle shall be held in contact by stretched rubber bands. The deflection—measuring device shall be graduated to 0.001 in. (0.025 mm) or less.

9.2.2 *Deflectometer*—A fine wire shall be attached to a clamp near the upper end of the specimen. The free end connected to stretched rubber bands shall be attached to a clamp near the lower end of the specimen. A mirror having a

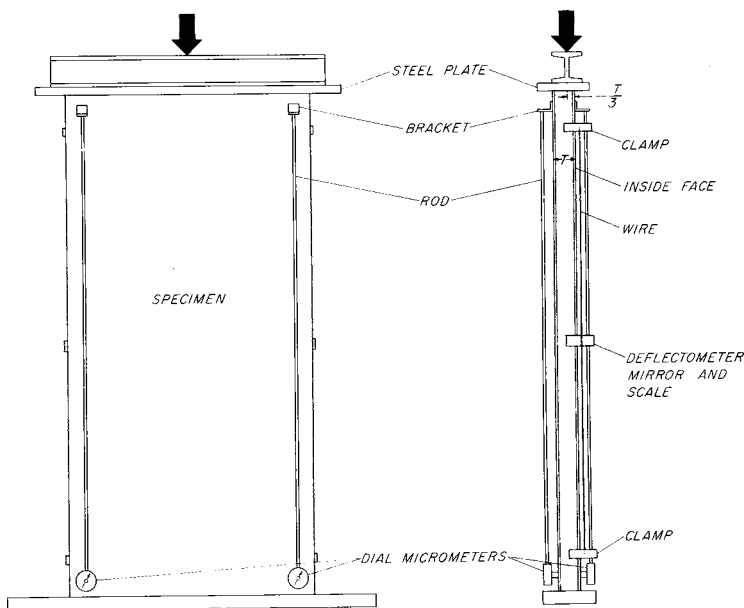


FIG. 2 Compressive Load Test on Wall Specimen