Designation: D143 – 22

Standard Test Methods for Small Clear Specimens of Timber[1]

This standard is issued under the fixed designation D143; 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

The need to classify wood species by evaluating the physical and mechanical properties of small clear specimens has always existed. Because of the great variety of species, variability of the material, continually changing conditions of supply, many factors affecting test results, and ease of comparing variables, the need will undoubtedly continue to exist.

In the preparation of these methods for testing small clear specimens, consideration was given both to the desirability of adopting test methods that would yield results comparable to those already available and to the possibility of embodying such improvements as experience has shown desirable. In view of the many thousands of tests made under a single comprehensive plan by the U.S. Forest Service, the former Forest Products Laboratories of Canada (now FPInnovations), and other similar organizations, these test methods naturally conform closely to the methods used by those institutions. These test methods are the outgrowth of a study of both American and European experience and methods. The general adoption of these test methods will tend toward a world-wide unification of results, permitting an interchange and correlation of data, and establishing the basis for a cumulative body of fundamental information on the timber species of the world. Many of the figures in this standard use sample data and computation sheets from testing done in the 1950s and earlier. These figures remain in the standard because they are still valid depictions of the recording and plotting of test results and also provide a historical link to the large body of test data on small clear specimens already in existence for this long-standing test method.

Descriptions of some of the strength tests refer to primary methods and secondary methods. Primary methods provide for specimens of 2-in. by 2-in. (50 mm by 50 mm) cross section. This size of specimen has been extensively used for the evaluation of various mechanical and physical properties of different species of wood, and a large number of data based on this primary method have been obtained and published.

The 2-in. by 2-in. (50 mm by 50 mm) size has the advantage in that it embraces a number of growth rings, is less influenced by earlywood and latewood differences than smaller size specimens, and is large enough to represent a considerable portion of the sampled material. It is advisable to use primary method specimens wherever possible. There are circumstances, however, when it is difficult or impossible to obtain clear specimens of 2 by 2-in. cross section having the required 30 in. (760 mm) length for static bending tests. With the increasing incidence of smaller second growth trees, and the desirability in certain situations to evaluate a material which is too small to provide a 2-in. by 2-in. cross section, a secondary method which utilizes a 1-in. by 1-in. (25 mm by 25 mm) cross section has been included. This cross section is established for compression parallel to grain and static bending tests, while the 2-in. by 2-in. cross section is retained for impact bending, compression perpendicular to grain, hardness, shear parallel to grain, cleavage, and tension perpendicular to grain. Toughness and tension parallel to grain are special tests using specimens of smaller cross section.

The user is cautioned that test results between two different sizes of specimens are not necessarily directly comparable. Guidance on the effect of specimen size on a property being evaluated is beyond the scope of these test methods and should be sought elsewhere.

Where the application, measurement, or recording of load and deflection can be accomplished using electronic equipment and computerized apparatus, such devices are encouraged. It is important that all data measurement and recording equipment, whether electronic or mechanical, be accurate and reliable to the degree specified.

1. Scope

1.1 These test methods cover the determination of various strength and related properties of wood by testing small clear specimens.

1.1.1 These test methods represent procedures for evaluating the different mechanical and physical properties, controlling factors such as specimen size, moisture content, temperature, and rate of loading.

1.1.2 Sampling and collection of material is discussed in Practice D5536. Sample data, computation sheets, and cards have been incorporated, which were of assistance to the investigator in systematizing records.

1.1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard. When a weight is prescribed, the basic inch-pound unit of weight (lbf) and the basic SI unit of mass (Kg) are cited.

1.2 The procedures for the various tests appear in the following order:

	Sections
Photographs of Specimens	5
Control of Moisture Content and Temperature	6
Record of Heartwood and Sapwood	7
Static Bending	8
Compression Parallel to Grain	9
Impact Bending	10
Toughness	11
Compression Perpendicular to Grain	12
Hardness	13
Shear Parallel to Grain	14
Cleavage	15
Tension Parallel to Grain	16
Tension Perpendicular to Grain	17
Nail Withdrawal	18
Specific Gravity and Shrinkage in Volume	19
Radial and Tangential Shrinkage	20
Moisture Determination	21
Permissible Variations	22
Calibration	23

1.3 *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.*

1.4 *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.*

[1] These test methods are under the jurisdiction of ASTM Committee D07 on Wood and are the direct responsibility of Subcommittee D07.01 on Fundamental Test Methods and Properties.

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2. Referenced Documents

2.1 *ASTM Standards:*[2]

D9 Terminology Relating to Wood and Wood-Based Products

D198 Test Methods of Static Tests of Lumber in Structural Sizes

D2395 Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials

D3043 Test Methods for Structural Panels in Flexure

D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials

D4761 Test Methods for Mechanical Properties of Lumber and Wood-Based Structural Materials

D5536 Practice for Sampling Forest Trees for Determination of Clear Wood Properties

E4 Practices for Force Calibration and Verification of Testing Machines

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

3. Summary of Test Methods

3.1 The mechanical tests are static bending, compression parallel to grain, impact bending toughness, compression perpendicular to grain, hardness, shear parallel to grain, cleavage, tension parallel to grain, tension-perpendicular-to-grain, and nail-withdrawal tests. These tests are permitted for both green and air-dry material as specified in these test methods. In addition, test methods for evaluating such physical properties as specific gravity, shrinkage in volume, radial shrinkage, and tangential shrinkage are presented.

NOTE 1—The test for shearing strength perpendicular to the grain (sometimes termed "vertical shear") is not included as one of the principal mechanical tests since in such a test the strength is limited by the shearing resistance parallel to the grain.

4. Significance and Use

4.1 These test methods cover tests on small clear specimens of wood that are made to provide the following:

4.1.1 Data for comparing the mechanical properties of various species,

4.1.2 Data for the establishment of correct strength functions, which in conjunction with results of tests of timbers in structural sizes (see Test Methods D198 and Test Methods D4761), afford a basis for establishing allowable stresses, and

4.1.3 Data to determine the influence on the mechanical properties of such factors as density, locality of growth, position in cross section, height of timber in the tree, change of properties with seasoning or treatment with chemicals, and change from sapwood to heartwood.

[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.

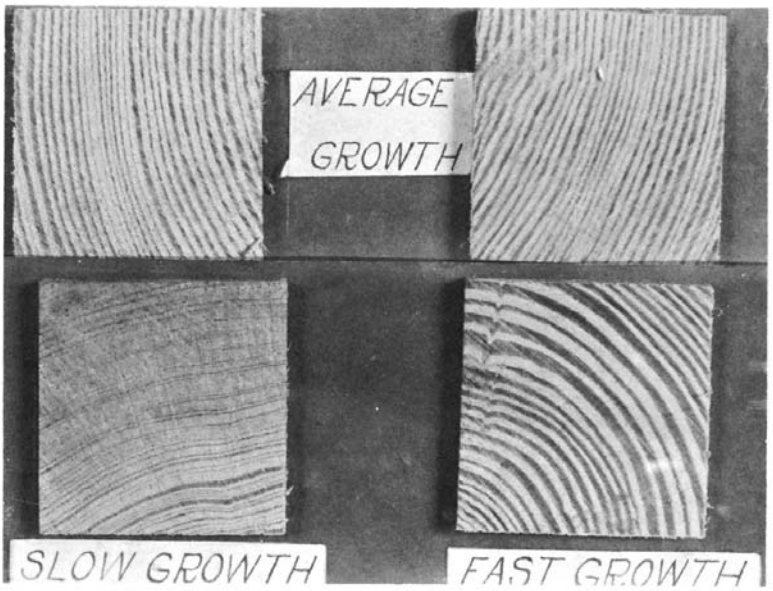

FIG. 1 Cross Sections of Bending Specimens Showing Different Rates of Growth of Longleaf Pine (2-in. by 2-in. (50 mm by 50 mm) Specimens)

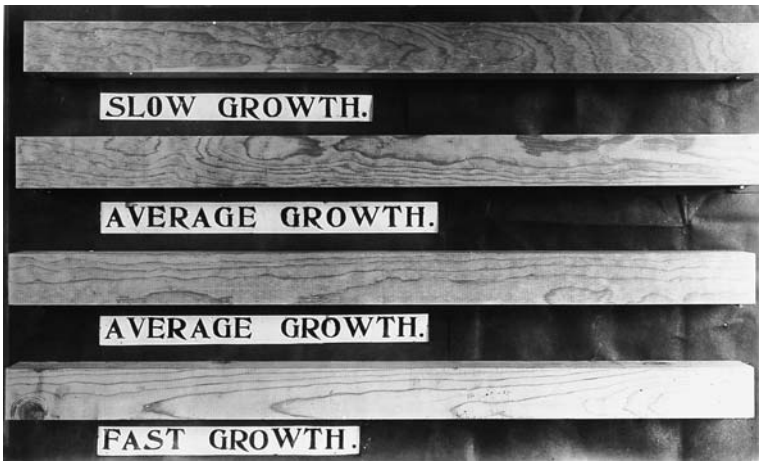

FIG. 2 Tangential Surfaces of Bending Specimens of Different Rates of Growth of Jeffrey Pine 2-in. by 2-in. by 30-in. (50 mm by 50 mm by 760 mm) Specimens

5. Photographs of Specimens

5.1 Four of the static bending specimens from each species shall be selected for photographing, as follows: two average growth, one fast growth, and one slow growth. These specimens shall be photographed in cross section and on the radial and tangential surfaces. Fig. 1 is a typical photograph of a cross section of 2-in. by 2-in. (50 mm by 50 mm) test specimens, and Fig. 2 is the tangential surface of such specimens.

6. Control of Moisture Content and Temperature

6.1 In recognition of the significant influence of temperature and moisture content on the strength of wood, it is highly desirable that these factors be controlled to ensure comparable test results.

6.2 *Control of Moisture Content*—Specimens for the test in the air-dry condition shall be dried to approximately constant weight before test. If any changes in moisture content occur during final preparation of specimens, the specimens shall be reconditioned to constant weight before test. Tests shall be carried out in such manner that large changes in moisture content will not occur. To prevent such changes, it is desirable that the testing room and rooms for preparation of test specimens have some means of humidity control.

6.3 *Control of Temperature*—Temperature and relative humidity together affect wood strength by fixing its equilibrium moisture content. The mechanical properties of wood are also affected by temperature alone. When tested, the specimens shall be at a temperature of 68 ± 6 °F (20 ± 3 °C). The