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Standard Test Methods for Evaluating the Cross-Grain Compression Strength and Stiffness of Wood and Wood-Based Products¹

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INTRODUCTION

Structural wood and wood-based products are often used in applications where their compression perpendicular-to-grain (or “cross-grain”) bearing strength and stiffness are critical. For most general framing applications, deformation-based design values derived from compression perpendicular-to-grain tests, as outlined in Test Methods **D143**, have been sufficient. However, certain applications—particularly those involving slender members or non-rectangular cross-sections—may experience cross-grain crushing, rolling shear, and buckling failure modes that lead to excessive deformation and loss of load capacity that are not addressed by Test Methods **D143**.

While Specification **D7672** provides test methods to assess the cross-grain crushing and buckling capacities of various rim board products defined in that standard and Specification **D5055** addresses the end and intermediate bearing capacities of pre-fabricated wood I-Joists, no general test methods existed for other materials prior to the development of these test methods. The purpose of these test methods is to establish standardized evaluation procedures that can be referenced in various wood and wood-based product performance standards where cross-grain crushing and buckling failure modes are a relevant concern.

It is anticipated that further refinement and interpretation of these test methods will become necessary as they become more commonly utilized by additional product types. To assist with this, an extensive commentary was concurrently developed to aid with interpretation of the standard and its original intent. The user is encouraged to review its related provisions as these test methods are cited, most especially for the purposes of related design value or procedure development.

1. Scope

1.1 These test methods cover standardized procedures for evaluating the cross-grain compression strength and stiffness of wood and wood-based products.

1.2 Two types of test methods are provided: fundamental and application methods.

1.2.1 *Fundamental Test Methods*—These test methods characterize the general cross-grain compression strength and stiffness of the material using specimens that are not necessarily

of commercial size. The results from these tests are intended to serve as potential inputs for modeling and analysis.

1.2.2 *Application Test Methods*—These test methods are designed to develop test data that represent the cross-grain compression stress states encountered in service. This is achieved by testing specimens of commercial size for determining their cross-grain compression strength, and sometimes deformation, in either direct or indirect bearing conditions.

1.3 These test methods do not address the development of design values, analytical models for specific applications, or performance requirements, or combinations thereof. These aspects are expected to be covered by the product standards that reference these test methods.

1.4 These test methods are not intended to replace the related provisions of Specifications **D7672** or **D5055**, which

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provide specific test guidance to be used when evaluating rim board or pre-fabricated wood I-joist products, respectively.

1.5 These test methods apply to situations where full support is provided for the product thickness. Situations with partial bearing for the product thickness are outside the scope of these test methods.

1.6 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.

1.7 *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.*

1.8 *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 The documents referenced in this section shall be the latest version published prior to this version of these test methods unless a particular version of the referenced document is specified.

2.2 ASTM Standards:²

- D9 Terminology Relating to Wood and Wood-Based Products**
- D143 Test Methods for Small Clear Specimens of Timber**
- 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**
- D2915 Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products**
- D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials**
- D5055 Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists**
- D5456 Specification for Evaluation of Structural Composite Lumber Products**
- D7672 Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies**
- E4 Practices for Force Calibration and Verification of Testing Machines**
- E2309/E2309M Practices for Verification of Displacement Measuring Systems and Devices Used in Material Testing Machines**

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

3. Terminology

3.1 *Definitions*—Standard definitions of terms relating to wood are given in Terminology **D9**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *cross-grain, n*—perpendicular to the grain of wood or the major strength axis of wood-based product.

3.2.2 *direct bearing, n*—loading condition where load and reaction bearings are aligned and acting on opposing surfaces of the member so that the applied force is transferred without generating shear in the member and cross-grain compression is continuous through the depth.

3.2.2.1 *Discussion*—Examples include loads over or near supports or vertically aligned wall bearing conditions.

3.2.3 *indirect bearing, n*—loading condition where load and reaction bearings are not aligned on opposing surfaces of the member so that the applied force generates shear in the member.

3.2.3.1 *Discussion*—Examples include loads applied away from supports or offset wall bearing conditions.

3.2.4 *test bearing area, n*—specimen thickness times the test bearing length.

4. Summary of Test Methods

4.1 This standard provides a variety of test methods for evaluating the cross-grain compression strength and stiffness of wood and wood-based products.

4.2 *Fundamental Test Methods*—Small specimens are loaded in cross-grain compression to determine their strength and stiffness using separate test methods provided in Section 10.

4.3 *Application Test Methods*—These test methods, in Section 11, provide procedures for evaluating the cross-grain compression strength of full-sized members. They cover a range of direct and indirect bearing conditions where the cross-grain compression behavior is more accurately represented by a full-sized member.

5. Significance and Use

5.1 The fundamental test methods of this standard provide uniform procedures for measuring the cross-grain compression strength and stiffness of wood and wood-based products that are representative of typical production. These test methods are intended to serve as inputs for related product standards that provide guidance on the development of structural design values. It is anticipated that such product standards will address aspects such as sample sizes (if they vary from the defaults specified herein), the establishment of design values, and design procedures to adjust these values to specific application conditions, using cross-grain bearing strength and stiffness data derived from these test methods.

5.2 The application test methods provide a variety of procedures for testing full-size members under different conditions and loading scenarios, and complement established methods such as Test Methods **D143** to develop design data more appropriate for modern structural wood applications. These test methods are designed to support the development or