



Designation: **D1761 – 12 D1761 – 20**

Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials¹

This standard is issued under the fixed designation D1761; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

INTRODUCTION

The use of wood and ~~wood-base~~wood-based materials in many structural and other applications often involves the use of mechanical fasteners, such as nails, screws, bolts, lag screws, and timber connectors. Data on the ~~strength~~resistance and performance of such fasteners are frequently needed for design and for comparative purposes. ~~Tests of mechanical fasteners (except nail withdrawal) have been generally regarded as special tests and have not been included in the standard methods already established for evaluating the properties of wood. Many such special tests have been extensively used over a considerable period but have not previously been established as standards. Presented herewith~~ Presented are methods of conducting tests for nail, staple, and screw (except machine screws) withdrawal ~~resistance; resistance and lateral load transmission by nail, staple, screw, bolt, and timber connector; and load transmission by nail plates connector.~~ The use of standard methods for these tests is recommended as a means of obtaining comparable data and of eliminating variables in test results because of variations in testing methods.

The tests appear in the following order:

	Nail, Staple, or Screw Withdrawal Test	Sections
	<u>Nail, staple, or screw withdrawal test</u>	<u>1 to 12</u>
	13 to 20	4 to 13
Lateral Nail, Staple, or Screw Resistance Test	Nail, staple, or screw lateral resistance test	14 to 21
	Testing Bolted and Timber Connector Joints	21 to 30
	Bolted or timber connector joint test	22 to 30
	Keywords	31

NAIL, STAPLE, OR SCREW WITHDRAWAL TEST

1. Scope

1.1 These test methods provide a basic procedure for evaluating the withdrawal and lateral resistance of wood and wood-base materials to direct withdrawal of nails, staples, and screws. ~~fasteners installed in wood and wood-based materials.~~ Spikes are included as nails in this standard.

1.2 The tests also provide a basis for determining comparable performance of different types and sizes of nails, staples, and screws in direct withdrawal from wood and wood-base fasteners installed in wood and wood-based materials.

1.3 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.

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

¹ These test methods are under the jurisdiction of ASTM Committee D07 on Wood and are the direct responsibility of Subcommittee D07.05 on Wood Assemblies. Current edition approved Nov. 1, 2012 April 15, 2020. Published November 2012 July 2020. Originally approved in 1960. Last previous edition approved in 2006 2012 as D1761 – 06 D1761 – 12. DOI: 10.1520/D1761-12.10.1520/D1761-20.

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

[D9 Terminology Relating to Wood and Wood-Based Products](#)

[D143 Test Methods for Small Clear Specimens of Timber](#)

[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](#)

[E4 Practices for Force Verification of Testing Machines](#)

[F547 Terminology of Nails for Use with Wood and Wood-Base Materials](#)

[F1667 Specification for Driven Fasteners: Nails, Spikes, and Staples](#)

2.2 Other Standards:

[ASME B18.6.1 Wood Screws \(Inch Series\)³](#)

[Federal Specification FF-W-92 for Washers, Metal, Flat \(Plain\)⁴](#)

[ANSI B18.6.1 American National Standard for Slotted and Recessed Head Wood Screws⁴](#)

3. Terminology

3.1 Definitions:

3.1.1 For general definitions of terms related to wood, refer to Terminologies [D9](#) and [F547](#).

NAIL, STAPLE, OR SCREW WITHDRAWAL TEST

4. Summary of Test Method

4.1 These test methods provide a basic procedure for evaluating the resistance of wood and wood-based materials to withdrawal of nails, staples, and screws. The tests also provide a basis for determining comparable performance of different types and sizes of nails, staples, and screws in withdrawal from wood and wood-based materials.

4.2 Specimens consist of ~~prisms~~ wood members (~~prisms of wood or wood-base products~~, wood-based products), with nails, staples, or screws ~~driven~~ installed at right angles to one or more faces. The fasteners are withdrawn at a uniform rate of speed by means of a testing machine, and the maximum load is recorded. Supplementary physical properties of the wood or ~~wood-base~~ wood-based product are also determined.

5. Significance and Use

5.1 The resistance of a species of wood or a ~~wood-base~~ wood-based product to ~~direct~~ withdrawal of nails, staples, or screws is a measure of its ability to hold or be held to an adjoining object by means of such fasteners. Factors that affect this withdrawal resistance include the physical and mechanical properties of the wood; the size, shape, and surface condition of the fasteners; the speed of withdrawal; physical changes to wood or fasteners between time of driving and time of withdrawal; orientation of the fastener relative to the fiber axis; and the occurrence and nature of ~~pre-bored~~ pre-bored lead holes.

5.2 By using a ~~standard size and type of nail, staple, or screw~~, consistent sizes and types of nails, staples, and screws, withdrawal resistance of a wood species or wood product can be determined, and such values for two or more wood species or wood products can be compared. ~~Throughout the method this is referred to as the basic withdrawal test.~~ Similarly, comparative performances of different sizes or types of ~~nail, staple, nails, staples, or screws~~ can be determined by using a standard procedure with a particular wood or ~~wood~~ wood-based product, which eliminates the wood or the ~~wood~~ wood-based product as a variable. Since differences in test methods can have considerable influence on results, it is important that a standard procedure be specified and adhered to, ~~to~~ if test values are to be related to other test results.

6. Apparatus

6.1 *Testing Machine*—Any suitable testing machine that is capable of operation at a constant rate of motion of the movable head and has an accuracy of $\pm 1\%$ when calibrated in accordance with Practices [E4](#).

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~~ standard's Document Summary page on the ASTM website.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098; American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036; DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

6.2 *Grips*—A gripping device shaped to fit the base of the fastener head and of such a design as to allow accurate specimen positioning and true axial loading, is required. A clamping assembly that will hold the specimen to one platen of the machine is also required. A suitable test mechanism for screw withdrawal is illustrated in Fig. 1.

7. Test Materials

7.1 Nails:

7.1.1 Nails used for withdrawal tests shall typically be described by Specification F1667; however, other nails shall be permitted to be tested in accordance with this method provided the fastener is fully described. The actual size and details of the nails selected shall be recorded. Nails shall be cleaned before use to remove any coating or surface film that may be present as a result of manufacturing operations and exposure. If collated nails that rely upon coating to adhere the fasteners together need to be installed with a tool that requires them to be adhered, then they shall be cleaned without removing the cohering coating that occurs between fasteners and the report shall indicate that some coating was present. Each nail shall be used only once.

7.1.2 Where the effect of coatings or surface film on the nail, treatments or conditioning of the wood, or other conditions are to be investigated, representative test specimens that are appropriate to the objectives of the testing program shall be selected.

7.2 Nails/Staples:

7.2.1 Nails/Staples used for basic withdrawal tests shall be bright plain-shank diamond-point typically be described by Specification F1667 round-wire, low-carbon-steel nails nominally 0.113 in. (2.87 mm) in diameter (; however, other staples shall be permitted to be tested in accordance with Note 1). They shall be this method provided the staple is fully described. The actual size and details of the staples selected shall be recorded. Hand-driven staples shall be cleaned before use to remove any coating or surface film that may be present as a result of manufacturing operations and exposure. Each nail If collated staples that rely upon coating to adhere the fasteners together need to be installed with a tool that requires them to be adhered, then they shall be cleaned without removing the cohering coating that occurs between fasteners and the report shall indicate that some coating was present. Each staple shall be used but only once.

NOTE 1—A sixpenny common wire nail meets this requirement.

7.2.2 For determining holding ability of different sizes or types of nails in wood or wood products, the respective sizes and types of nail will be as circumstances dictate. These nails shall be representative of the normal manufacturing process, and special cleaning of the shank shall normally not be undertaken. Where the effect of surface film on the staple legs, treatments or conditioning of the wood, or other conditions are to be investigated, representative test specimens that are appropriate to the objectives of the testing program shall be selected.

6.2 Staples:

6.2.1 Staples used for basic leg withdrawal resistance shall be standard 2 in. (51 mm) long, 7/16 in. (11.1 mm) crown, 15-gage (0.072 in.) (1.83 mm) galvanized steel staples. They shall be cleaned before use. Each staple shall be used but once.

6.2.2 For determining holding ability of different types or sizes of staples in wood or wood products, the respective staples shall be representative of the normal manufacturing process, and special cleaning of the legs shall not normally be undertaken.

7.3 Screws:

7.3.1 Screws used for basic withdrawal tests shall be standard 1-in. (25 mm) No. 10-gage flathead low-carbon-steel wood screws as described in the American National Standard for Slotted and Recessed Head Wood Screws (ANSI B18.6.1). typically be described by ASME B18.6.1; however, other screws shall be permitted to be tested in accordance with this method provided the fastener is fully described. Screws shall be cleaned before use to remove any coating or surface film that may be present as a result of manufacturing operations and exposure. Each screw shall be used but only once.

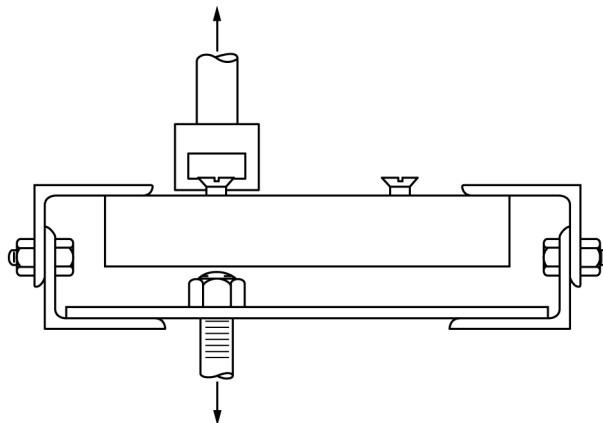


FIG. 1 Diagram of Assembly for Screw Withdrawal Test

7.3.2 For determining holding ability of different sizes and types of screws in wood or wood products, the respective size and types of screw will be as circumstances dictate. These screws shall be representative of the normal manufacturing process. Where the effect of coatings or surface film on the screw, treatments or conditioning of the wood, or other conditions are to be investigated, representative test specimens that are appropriate to the objectives of the testing program shall be selected.

7.4 *Wood and Wood Products—Members (Wood and Wood-Based Products)—Prisms*—Wood members shall be cut accurately and square to the required dimensions, and be planned smooth. They shall be of representative density, dimensions and have a smooth surface to ensure proper fastener penetration measurement. The wood fibers shall be aligned with the longitudinal axis of the wood member. The wood member shall have a specific gravity that is representative of the assigned specific gravity of the species of wood, free of defects and growth irregularities, and of specified moisture content.

8. Sampling

8.1 Sampling should provide for selection of representative test wood or wood-based material on an objective and unbiased basis, covering an appropriate range in density (specific gravity) and properties as circumstances suggest.

8.2 The tests should be sufficiently extensive to provide reliable results. Where analysis by statistical procedures is contemplated, experience and sometimes advance estimates can be used to establish the scope of testing and type of sampling. Specific objectives of the test program shall be used to determine the required precision and number of tests in accordance with Practice [D2915](#) needed to achieve the expected reliability.

NOTE 1—The precision required, and thus the manner of sampling and number of tests, will depend upon specific objectives. No specific criteria therefore can be established. General experience indicates that the coefficient of variation from tests of fasteners for fastener tests ranges from about 15 % to 30 %. When such is the case, a precision of 5 % to 10 % with 95 % confidence (an often accepted general measure of reliability for testing wood) cannot be achieved without making a rather large number of tests. The present recommendation is to make at least 10 replications for each variable as a minimum requirement. 75 % or 95 % confidence are typical expectations for data.

9. Conditioning

9.1 Except for special tests evaluating the effect of moisture content of wood on withdrawal resistance, the tests shall be made on seasoned material. The wood or wood-based product, whether kiln-dried, air-dried, or as received from the manufacturer, shall be stored in a room having a controlled temperature of $20 \pm 3^\circ\text{C}$ ($68 \pm 6^\circ\text{F}$) and a controlled relative humidity of $65 \pm 3\%$ for a period sufficiently long to bring it to approximate moisture equilibrium. The fasteners shall not be installed in the wood members until the moisture equilibrium is attained.

9.2 Where required, withdrawal tests may be made on drier, partially seasoned or unseasoned material. It is sometimes desired to apply the fasteners to unseasoned material and allow the completed specimen to season prior to withdrawal.

NOTE 2—As in 9.1 these specimens should attain the desired moisture equilibrium in a controlled atmosphere to ensure uniform moisture content at the time of test. Soaking in water will produce and maintain an unseasoned condition of the wood, but it may result in an extremely high moisture content, particularly at the surface, and undesirable and non-representative corrosion of the fasteners near the wood surface.

10. Test Specimen

10.1 *Nail and Staple Withdrawal:*

8.1.1 For basic withdrawal tests from wood, the wood prism shall be 2 by 2 by 6 in. (51 by 51 by 152 mm). Nails of the type outlined in 6.1.1 and staples of the type outlined in 6.2.1 shall be driven at right angles to the face of the specimen to a total penetration of 1¼ in. (32 mm). Two fasteners shall be driven into a tangential surface, two into a radial surface, and one into each end. End and edge distances shall be sufficient to avoid splitting. In general, edge distances should not be less than ¾ in. (19 mm); end distances not less than 1½ in. (38 mm) and two fasteners shall not be driven in line with each other or less than 2 in. (51 mm) apart on radial or tangential faces. Nails shall be driven manually with a hammer. Staples shall be inserted with an appropriate tool, as nearly as possible perpendicular to the specimen surface, with the staple crown at a 45° ($\pm 10^\circ$) angle to the grain direction of the prism.

10.1.1 For basic withdrawal tests from wood products, the test prism shall be a single thickness of convenient size not smaller than 3 in. (76 mm) wide and 6 in. (152 mm) long. Nails of the type outlined in Nails and staples shall be driven into the wood member at 6.1.1 and staples of the type outlined in a right angle to the face of the wood member. Where 6.2.1 the specimen includes only the single wood member, the fastener shall be driven through the wood product at right angles to the face, permitting at least assuring enough of the nail shank or staple legs remains above the surface ½ in. (13 mm) of the shank portion to remain above the surface. Nails to allow the test apparatus to grip the fastener. Where the specimen includes a holding member and one or more members attached thereto, the fastener shall be driven manually by means of a hammer. Staples shall be inserted with an appropriate tool as in as expected in use. For staples, the crown shall be oriented parallel to the grain of the 8.1.1, holding member, but if there is no discernible grain direction in the wood product, the direction, the staple crown shall be oriented at a 45° ($\pm 10^\circ$) angle to the length-long dimension of the prism-wood member.

10.1.2 For determining the withdrawal resistance of particular sizes and shapes of nails or staples in wood or wood products, the specimen—The wood member shall be of convenient size to accommodate the quantity of fasteners to be tested in each specimen, without exceeding the edge and end distances and spacings necessary to avoid splitting. In wood, fasteners should—Fasteners shall

be driven to 70 % of their length; in thin panel wood products they should penetrate the holding member at least 9 times the nail diameter or staple leg thickness (penetration measurement includes the nail or staple tip length). In thin wood products where the minimum thickness is less than 9 times the nail diameter or staple leg thickness, the fastener shall be driven completely through the thickness with at least and ½ in. (13 mm) of the shank portion remaining above the surface. The fasteners shall be driven by the method intended to be used in practice, that is, either manually with a hammer, or with an applicator or appropriate tool if this is the normal method; the penetration shall be reported as the thickness of the thin wood product.

8.1.3.1 If the withdrawal resistance may be influenced by the material through which the fastener is to be driven, the fastener shall be driven through the fastened member (cleat) into the fastening member.

10.1.3 The fasteners shall be driven by the method intended to be used in practice, that is, either manually with a hammer, or with an applicator or appropriate tool if this is the normal method. Power-driven fasteners shall be installed either manually or with an appropriate tool.

NOTE 3—Power-driven fasteners are permitted to be installed manually as a means to reliably control the depth of penetration and as an option to test without coatings or collating adhesion materials.

10.1.4 If the withdrawal resistance is influenced by the attached member through which the fastener is to be driven, such as a metal plate with no holes, the fastener shall be driven through the attached member and into the holding member to be evaluated as it would be used.

10.2 Screw Withdrawal:

8.2.1 For basic withdrawal tests from wood, the specimen shall be 2 in. (51 mm) wide, 6 in. (152 mm) long, with depth at least equal to the length of the screw. Two screws of the type outlined in 6.2.1 shall be threaded into lead holes at right angles to the tangential face, to a total penetration equal to the length of the threaded portion. End and edge distance shall be sufficient to avoid splitting, which in general will be at least ¾ in. (19 mm) from the edge and 1½ in. (38 mm) from the end, and spacing will be at least 2½ in. (63 mm). The size of the lead hole shall be 70 % of the root diameter of the screw for softwoods and hardwoods and shall extend ½ in. (13 mm) into the face of the specimen. The screws may be coated with paraffin wax or other similar lubricant when necessary to facilitate driving.

10.2.1 For basic withdrawal tests from wood products, the specimen shall be 3 in. (76 mm) in width, and 6 in. (152 mm) in length. The depth of the specimen shall be at least equal to the Screws shall be installed into the wood member at a right angle to the face of the wood member. Where the specimen includes only the single wood member, the screw shall be installed assuring enough of the screw shank remains above the surface to allow the test apparatus to grip the fastener. The minimum penetration of the screw into the holding member shall be 9 times the screw diameter (penetration measurement includes the screw tip). Screws shall be installed into the wood member for the length of the screw, and it may be necessary to glue together two or more thicknesses of material to provide the required depth. Screws of the type outlined in threaded portion of the shank or at least two thirds of the shank length if 6.2.1 shall be threaded into the specimen a distance of it is threaded throughout. In thin wood products where the minimum thickness is less ¾ in. (17 mm) at midwidth, at least 2 in. (51 mm) from the end of the specimen. The size of lead hole shall be 70 % of the root diameter of the screw and it shall extend than 9 times the screw diameter, the screw shall be screwed completely through the thickness and the penetration shall be reported as the thickness of the thin wood product. ½ in. (13 mm) into the face of the specimen. The screws may be The screws shall be permitted to be coated with paraffin wax or other similar lubricant when necessary to facilitate driving; installing and its use shall be reported.

10.2.2 For determining the withdrawal resistance of particular sizes and types of screws in wood or wood products, the specimen The wood member shall be of convenient size to accommodate the quantity of screws to be tested in each specimen, without exceeding the edge and end distances and spacings necessary to avoid splitting. Screws shall be threaded into the specimen for the length of the threaded portion of the shank or two thirds of the shank length if it is threaded throughout. The size of lead hole, if one is to be drilled, shall be 70 % of the root diameter of the screw for a distance of one half of the screw length; length unless otherwise specified by the screw manufacturer or required for the purpose of the test program. The size of the lead hole shall be documented.

8.2.3.1 If the withdrawal resistance may be influenced by the material through which the screw is to be threaded the screw shall be threaded through a held member into the holding member.

10.2.3 If the withdrawal resistance can be influenced by the attached material through which the screw is to be installed, the screw shall be screwed through the attached material and into the holding member. The length of penetration into the holding member shall be reported.

9. Conditioning

9.1 Nail, staple, and screw withdrawal tests are normally made on seasoned material. The wood or wood product, whether kiln dried or air-dried, shall be stored in a room having a controlled temperature of $20 \pm 3^\circ\text{C}$ ($68 \pm 6^\circ\text{F}$) and a controlled relative humidity of $65 \pm 3\%$ for a period sufficiently long to bring it to approximate equilibrium. The fasteners shall not be driven until equilibrium is attained in the wood component.

9.2 Where required, withdrawal tests may be made on drier, partially seasoned or unseasoned material. It may sometimes be desired to apply the fasteners to unseasoned material and allow the completed specimen to season prior to withdrawal. As in 9.1

these specimens should attain the desired moisture equilibrium in a controlled atmosphere to ensure uniform moisture content at the time of test. Soaking in water will produce and maintain an unseasoned condition of the wood, but it may result in an extremely high moisture content, particularly at the surface, and undesirable and nonrepresentative corrosion of the fasteners near the wood surface.

11. Procedure

11.1 *General*—~~Except for special circumstances requiring delayed withdrawal, withdraw fasteners as quickly~~Withdraw fasteners as soon as practical after driving, and in all cases installation, and within 1 h. If longer delays are required for the purposes of the test program, then the time elapsed between installation of the fastener and the test shall be reported.

11.2 *Basic Loading Method:*

11.2.1 Where the specimen ~~consists of~~includes only the fastening ~~prism~~holding member and the fasteners, withdraw the fasteners by means of a tensile force applied at a uniform rate of withdrawal. Attach the ~~specimen~~wood member to one platen of the testing machine. Attach the fastener head (for headed fasteners) or staple legs to a suitably designed grip which is fastened to the other platen through a universal joint. Apply the load by separation of the platens of the testing machine at a uniform rate of ~~withdrawal~~withdrawal (see 11.4). Read the maximum load required to withdraw the fastener ~~from the wood or wood product~~ to three significant figures. Disregard test values resulting from any failure of the fastener in the evaluation of the performance of wood and ~~wood~~wood-based materials but report them; consider such failures in the evaluation of the performance of different types and sizes of fasteners. In such cases, ~~an additional replication is~~replications are desirable.

11.2.2 Where the specimen consists of a fastening ~~prism~~holding member plus one or more (~~cleats~~)attached members fastened thereto with a fastener, two test procedures are possible: (a) ~~The fastened member can be grasped and pushed or pulled away from the fastening prism in the axial direction of the fastener, whereby the fastener head exerts a force on the fastened member. Under this procedure, if the fastened member exerts less resistance to the passage of the fastener head than the fastening member exerts on fastener withdrawal head pull-through can occur. In such a case, the pull-through resistance of the fastened material will be indicated.~~ (b) ~~The fastened member can be split off and the fastener withdrawn as in 10.2.1.~~

(1) The attached member can be grasped and pushed or pulled away from the holding member in the axial direction of the fastener, whereby the fastener head exerts a force on the attached member. Under this procedure, if the attached member exerts less resistance to the passage of the fastener head than the holding member exerts on fastener, head pull-through can occur. In such a case, the fastener head pull-through resistance of the attached member material will be indicated, but shall not be recorded as the fastener withdrawal from the holding member and an additional specimen shall be tested.

(2) The attached member can be split off and the fastener withdrawn as in 11.2.1.

11.3 *Special Loading Methods*—It may sometimes be necessary to determine the resistance to withdrawal as a result of an impact force or by repetitive loads. In the case of the former, this can be accomplished with standard apparatus such as the U.S. FPL toughness testing machine suitably modified to hold and grip the ~~withdrawal~~ specimen. The latter test may require the use of a cycling or pulsating loading head. The resulting data are based on the displacement angle of the pendulum and the forces resulting from the setting of the repetitive loading mechanism, respectively, required to withdraw the fastener from the wood or ~~wood~~wood-based product. Disregard test values resulting from any failure of the fastener in the evaluation of the performance of wood and ~~wood~~wood-based materials but report if desired; consider such failures in the evaluation of the performance of different types and sizes of fasteners. In such cases, ~~an additional replication is~~are desirable.

11.4 *Speed of Testing:*

11.4.1 For the basic loading method for fastener withdrawal, apply the load throughout the test at a uniform rate of platen separation of 0.10 in. (2.54 mm)/min \pm 25 %.

11.4.2 For special loading methods, special rates of withdrawal may be required. Record the rate used and the reasons for choosing it in the report.

NOTE 4—The rate of platen separation shall mean the free-running, or no-load, crosshead speed for testing machines of the mechanical drive type, and the loaded crosshead speed for testing machines of the hydraulic loading type.

11.5 *Supplementary Tests*—If information on the actual withdrawal during load application is desired or may be of influence on the interpretation of the withdrawal resistance of a given fastener, measure and record such withdrawal, in ~~inches~~inches (millimetres), at given withdrawal loads or at the ultimate withdrawal ~~resistance, in pounds,~~resistance to three significant numbers. Under given conditions, it may be expeditious to obtain an automatic plot of withdrawal load versus withdrawal distance in order to determine the stiffness of the joint and the work involved up to a given point of withdrawal of the fastener under construction.

11.6 *Minor Tests*—~~Determine the oven-dry~~For all tested specimens, determine the oven-dry specific gravity and moisture content of the ~~wood or wood products, both during driving~~each wood member at the time of testing using Test Methods D2395 and D4442 withdrawal of the fastener. Procedures for determining these properties are given in ~~, respectively. For wood-based members, determine the density and moisture content at the time of testing using Test Methods D2016~~D2395 and D4442, respectively.

12. Report

12.1 The report shall include the following:

- 12.1.1 Failure loads for individual fasteners, average test values, and statistical evaluation of the test data, ~~if justified;~~justified;
- 12.1.2 A complete description of the test method and loading procedure ~~used;~~used;
- 12.1.3 A description of the specimen, including the dimensions of the wood or ~~wood-product~~wood-based product components, size of fastener, ~~fastener penetration,~~ end and edge distances, and ~~spacings;~~spacings;
- 12.1.4 Number of ~~tests;~~tests;
- 12.1.5 Specific gravity and moisture content of wood ~~components;~~components;;
- 12.1.6 Details of any deviations from the prescribed or recommended methods as outlined in the ~~standard;~~standard; and
- 12.1.7 Details of any factors not included above that might have a bearing on results.

13. Precision and Bias

13.1 Precision—It is not possible to specify the precision of the withdrawal test procedure in Test Method D1761 for measuring fastener withdrawal because the data is not available.

13.2 Bias—The precision and bias of this test method have not yet been determined for measuring fastener withdrawal because no fastener withdrawal having an accepted reference value is available.

LATERAL

NAIL, STAPLE, OR SCREW RESISTANCE TEST NAIL, STAPLE, OR SCREW LATERAL RESISTANCE TEST

13. Scope

~~13.1 This test method covers the determination of the resistance to lateral movement offered by a single nail, staple, or screw in wood members. The test provides comparative data for various species of wood. This general test method can also be used for evaluating other types and sizes of fastenings either in wood or other building materials such as plywood, hardboard, etc., or combinations of materials. Furthermore, where required for specific purposes, the general method can be used for evaluating the lateral resistance of sizes of nails, staples, and screws other than those specified, and joints employing two or more fasteners. It is recommended that when such tests are made, the specified procedure be followed as closely as possible and all deviations be completely described.~~

14. Summary of Test Method

14.1 This test method covers the determination of the resistance to lateral movement offered by a single nail, staple, or screw in wood members. The test provides comparative data for various species of wood. This general test method can also be used for evaluating other types and sizes of fasteners either in wood or wood-based building materials such as plywood, hardboard, etc., or combinations of materials. Furthermore, where required for specific purposes, the general method can be used for evaluating the lateral resistance of nails, staples, and screws other than those specified in Section 15, and joints employing two or more fasteners. It is recommended that when such tests are made, the specified procedure be followed as closely as possible and all deviations be completely described.

15. Test Nails, Staples, or Screws

~~15.1 Nails used shall be bright plain-shanked medium for lateral tests shall typically be described by Specification F1667 diamond-point steel nails nominally 0.131 in. (3.33 mm) in diameter and 2; however, other nails shall be permitted to be tested in accordance ½ in. (63 mm) in length, with a head with this method ¾ in. (7.14 mm) in diameter. The nails provided the fastener is fully described. Nails selected for test shall be representative of the product. Nails shall be cleaned before use to remove any coating or surface film that may be present as a result of manufacturing operations and exposure unless the effects of any coatings or surface film are to be evaluated. Each nail shall be used only once. The actual size and details of the nails selected shall be recorded, including data on the properties of the metal.~~

~~NOTE 4—An eightpenny common wire nail meets this requirement.~~

15.2 Staples used shall be standard 2 in. for lateral tests shall typically be described by Specification F1667 (51 mm) long; however, other ¾ in. (11.1 mm) crown, 15-gage (0.072 in.) (1.83 mm) galvanized steel staples. They shall be staples shall be permitted to be tested in accordance with this method provided the fastener is fully described. Staples shall be representative of the product. Hand-driven staples shall be cleaned before use to remove any coatings or surface film that may be present unless the effects of coatings or surface film are to be evaluated. If collated staples that rely upon coating to adhere the fasteners together need to be driven with a tool that requires them to be adhered, then they shall be cleaned without removing the cohering coating that occurs between fasteners and the report shall indicate that some coating was present. Each staple shall be used ~~but~~only once. Actual size and details of the staple used shall be recorded.