Designation: D7470 – 08 (Reapproved 2015)

Standard Practice for Evaluating Elevated Temperature Performance of End-Jointed Lumber Studs[1]

This standard is issued under the fixed designation D7470; 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.

1. Scope

1.1 This practice is to be used to evaluate the elevated temperature performance of end-jointed lumber studs.

1.2 A symmetric wall assembly containing end-jointed lumber studs is exposed to a standard fire exposure specified in Test Methods E119.

1.3 End-jointed lumber studs are deemed qualified if the wall assembly resists a standard fire exposure specified in Test Methods E119 for a period of 60 min or more. Qualification of end-jointed lumber studs are restricted to the joint configuration and adhesive tested.

1.4 This practice is used to evaluate the performance of end-jointed lumber studs to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment under actual fire conditions.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C1396/C1396M Specification for Gypsum Board

D4688 Test Method for Evaluating Structural Adhesives for Finger Jointing Lumber

D6513 Practice for Calculating the Superimposed Load on Wood-frame Walls for Standard Fire-Resistance Tests

E119 Test Methods for Fire Tests of Building Construction and Materials

F1667 Specification for Driven Fasteners: Nails, Spikes, and Staples

2.2 *Other Standards:*

NDS National Design Specification for Wood Construction[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *end-jointed lumber*—Lumber containing one or more end-joints.

3.1.2 *end-joints*—a joint formed by bonding two pieces of lumber end-to-end, often by machining a set of interlocking "fingers" (finger-joint) into each end of adjoining pieces, using an adhesive to form an adhesive bonded joint.

3.1.3 *qualified agency*—an organization, hereafter referred to as the agency, that has trained personnel and procedures to ensure the grades comply with all applicable requirements of this practice. The agency shall have no financial interest in, nor shall be financially dependent upon, any single company manufacturing the product being inspected or tested; and shall not be owned, operated, or controlled by any such company.

4. Summary of Practice

4.1 This practice shall be used to evaluate end-jointed lumber studs manufactured with a specific joint configuration and adhesive. This practice is intended to be limited to the evaluation of end-jointed lumber studs with a specific joint configuration, adhesive, and limited design properties. The results are only applicable to end-jointed lumber studs using a joint configuration with the same number of fingers and a finger length of at least equal length as qualified in 7.1.2 and shall have assigned design properties no greater than the grade level qualified in 7.1.2.

5. Significance and Use

5.1 End-jointed lumber studs used in fire resistance-rated assemblies shall be able to support the superimposed design

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[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] Available from American Wood Council (AWC), 1111 Nineteenth Street, NW, Suite 800, Washington, DC 20036, http://www.awc.org.

load for the specified time under an elevated temperature exposure, when a wall assembly is exposed to a standard fire specified in Test Methods E119. Light-weight wood assemblies utilize gypsum wallboard or other types of membrane protection to accomplish a requisite fire resistance rating for the assembly. However, wood studs and the end-joints in the studs shall resist the developed elevated temperature environment for the duration of the rating. This practice provides a method for evaluating the elevated temperature performance of an assembly constructed with end-jointed studs having fire performance comparable to an assembly constructed with solid-sawn studs.

6. Wall Assembly

6.1 A load-bearing wall meeting the following assembly description shall be used:

6.1.1 *Framing Elements:*

6.1.1.1 *Studs*—Nine pieces of 2 by 4 (nominal) end-jointed lumber shall be used for wall studs. Each piece of end-jointed lumber shall be 115.5 in. (2934 mm) long and have at least one end-joint within the middle third of the length. Studs shall be symmetrically placed within the 10-ft (3 m) long by 10-ft (3 m) high wall assembly with interior studs spaced 16 in. (406 mm) on center as shown in Fig. 1. The moisture content of the end-jointed lumber shall be no greater than 15 % at the time of the fire test.

NOTE 1—When producing end-jointed lumber for use in this standard practice, consideration should be given to the unique production conditions, such as wood moisture content, applied spread rate, pressure, and curing temperature of the adhesive in accordance with the adhesive manufacturer's recommendations.

6.1.1.2 *Plates*—Studs shall be attached to a double top plate and a single bottom plate as shown in Fig. 1. Plates shall be the same species as the stud material. The first top plate and the bottom plate shall be attached to the studs using 2-16d common nails or 3-16d box nails. The second top plate is attached to the first top plate using a single row of 16d common nail at 16 in. (406 mm) on center or 1-16d box nails at 12 in. (305 mm) on center. Nails shall be in accordance with Specification F1667.

NOTE 2—In Fig. 1, double top plates are located at the bottom of test wall to be adjacent to the movable load beam. Double top plates are located at the top of the test wall when the load beam is along the top.

6.1.1.3 *Blocking*—Blocking between studs shall not be permitted.

6.1.2 *Insulation*—The cavity between studs shall be filled with 3½-in. (89-mm) thick mineral wool insulation having a nominal density of 2.5 pcf (40 kg/m^3).

6.1.3 *Sheathing*—A single layer of ⅝-in. (16-mm) Type X gypsum wallboard (in accordance with Specification C1396/C1396M), 4 ft (1.22 m) wide, shall be applied to each side of the assembly with the long axis perpendicular to the studs as shown in Fig. 1. Horizontal joints shall be unblocked. No vertical joints are required.

6.1.4 *Fasteners*—Gypsum wallboard shall be attached to all framing members, including top and bottom plates, as shown in

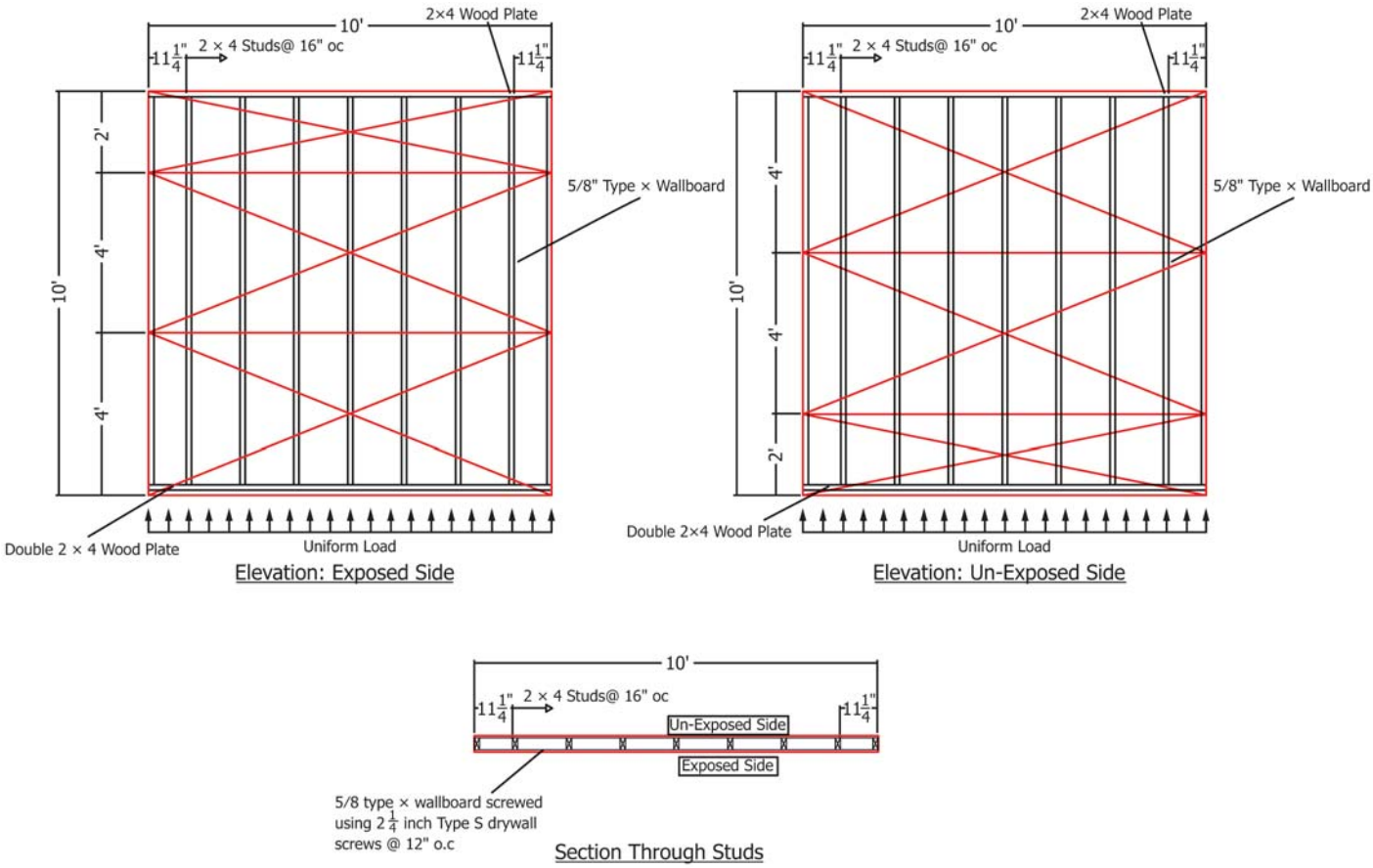

FIG. 1 Assembly Details

Fig. 1 using 2¼-in. (57-mm) Type S drywall screws spaced 12 in. (305 mm) on center.

NOTE 3—Screws have been shown to increase the temperature in the surrounding wood and insertion into end-joints should be minimized.

6.1.5 *Joints and Fastener Heads*—On both faces of the wall, all wallboard joints shall be covered with paper tape and joint compound and fastener heads shall be covered with joint compound.

7. Loading

7.1 The superimposed load on the wall assembly throughout the fire resistance test shall be nine times the load per stud calculated in 7.1.2.

7.1.1 *Joint Strength Qualification*—An agency shall qualify the sample of end-jointed lumber for the highest grade for the species being tested. The lumber used for the vertical framing in the fire test wall assembly shall be selected from the lot used to qualify the joint strength.

NOTE 4—In the United States and Canada, criteria for agency accreditation are contained in PS-20, and CSA O141, respectively.

NOTE 5—In the United States, the minimum strength qualification requirements for end-jointed lumber are given in the ALSC Glued Lumber Policy.

7.1.2 *Load Calculation*—The load per stud shall be calculated using 100 % of the adjusted compression design value parallel to grain (F_c') calculated in accordance with the procedures of Practice D6513 for the highest grade qualified in 7.1.1. The load per stud shall be calculated using minimum dressed size dimensions [1.5 in. (38 mm) by 3.5 in. (89 mm)].

NOTE 6—The design values parallel-to-grain (F_c') in Appendix A of Practice D6513 are calculated using ANSI/AF&PA NDS–2005.

8. Test Method

8.1 The wall assembly shall be tested in accordance with Test Methods E119.

9. Acceptance Criteria

9.1 The wall assembly shall sustain the applied load for a minimum of 60 min, rounded to the nearest minute.

10. Report

10.1 The report shall contain the following minimum information:

10.1.1 A description of the wall assembly tested including height of wall, stud length, stud species and grade, stud moisture content, gypsum wallboard description including type used, attachment, joint compound, and insulation type and density.

10.1.2 A description of the end-joint, including its length, number of fingers, and finger orientation.

10.1.3 The joint strength qualification information from 7.1.1 shall be included.

10.1.4 Adhesive manufacturer, adhesive type, and adhesive formulation identification.

10.1.5 Load per stud.

10.1.6 Fire resistance time rounded to the nearest minute.

10.1.7 Whether the structural failure was located at or away from the end-joint for each stud. If at the joint, describe the failure using Test Method D4688, Annex A1.

11. Keywords

11.1 adhesive; end-joint; end-jointed lumber; qualification