DrJ™ CERTIFICATION

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Technical Evaluation Report

TER 1603-06

Tstud™

US Engineered Wood, Inc.

Product:

Tstud™ Structural Insulated Wall Stud

Issue Date:

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September 21, 2022

Subject to Renewal:

October 1, 2023

COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 10 00 - Rough Carpentry

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

SECTION: 07 21 00 - Thermal Insulation

SECTION: 07 21 13 - Foam Board Insulation

1 Product Evaluated[1]

1.1 Tstud™ Structural Insulated Wall Stud

2 Applicable Codes and Standards[2,3]

2.1 *Codes*

2.1.1 *IBC—15, 18, 21: International Building Code®*

2.1.2 *IRC—15, 18, 21: International Residential Code®*

2.2 *Standards and Referenced Documents*

2.2.1 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

2.2.2 *ANSI/AWC SDPWS: Special Design Provisions for Wind and Seismic*

2.2.3 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

2.2.4 *ASTM D198: Standard Test Methods of Static Tests of Lumber in Structural Sizes*

2.2.5 *ASTM D2559: Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions*

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

2.2.7 *ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*

[1] For more information, visit drjcertification.org or call us at 608-310-6748.

[2] Unless otherwise noted, all references in this TER are from the 2021 version of the codes and the standards referenced therein. This material, design, or method of construction also complies with the 2000-2018 versions of the referenced codes and the standards referenced therein.

[3] All terms defined in the applicable building codes are italicized.

3 Performance Evaluation

3.1 Tstud™ was evaluated to determine its applicability for use as an alternative material where nominal 2x4 and 2x6 solid sawn lumber is specified in accordance with the *IBC* and *IRC* including use as wall studs, top and bottom wall plates, and headers.

3.2 Tstud™ testing and analysis was conducted to determine its compression, flexural strengths, and flexural stiffness.

3.3 This TER examines Tstud™ for the following:

3.3.1 Use as an alternative material to that described in *IBC* Chapter 23, in particular, compliance with requirements for the design and construction of wood-based products as described in *IBC* Section 2301.2 for allowable stress design (ASD).

3.3.2 Structural performance under lateral load conditions for use with the *IBC* performance-based provisions, *IBC* Section 2306.1 and *IBC* Section 2306.3, for light-frame wood wall assemblies.

3.3.2.1 Table 14 provides seismic design coefficients (SDC) that conform to the requirements in *ASCE 7* Section 12.2.1 and Table 12.2-1 for design of wall assemblies in buildings that require seismic design in accordance with *ASCE 7* (i.e., all seismic design categories).

3.3.2.2 The basis for equivalency testing is outlined in Section 12.2.1 of *ASCE 7*:

> **12.2.1.1 Alternative Structural Systems.** Use of seismic force-resisting systems not contained in Table 12.2-1 shall be permitted contingent on submittal to and approval by the Authority Having Jurisdiction and independent structural design review of an accompanying set of design criteria and substantiating analytical and test data. The design criteria shall specify any limitations on system use, including Seismic Design Category and height; required procedures for designing the system's components and connections; required detailing; and the values of the response modification coefficient, R; overstrength factor, Ω_o; and deflection amplification factor, C_d.

3.3.3 Structural performance under lateral load conditions for use as an alternative to *SDPWS* Section 4.3 Wood-Frame Shear Walls.

3.3.4 Compliance with *IBC* Section 2308 and Section 2304 and *IRC* Chapter 6 for conventional light-frame construction applications.

3.3.5 Use as an alternative material and method of construction in compliance with *IBC* Section 104.11 and *IRC* Section R104.11.

3.3.5.1 When used in an application that exceeds the limits of *IBC* Section 2308 or *IRC* Section R301, an engineered design shall be submitted in accordance with *IRC* Section R301.1.3 and this TER.

3.4 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

3.5 Any engineering evaluation conducted for this TER was performed within DrJ's ANAB accredited ICS code scope and/or the defined professional engineering scope of work on the dates provided herein.

4 Product Description and Materials

4.1 The product evaluated in this TER is shown in Figure 1.

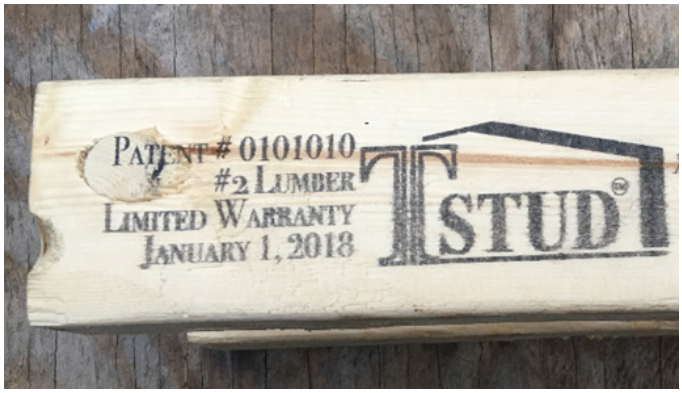

Figure 1. Tstud™

4.2 Tstud™ is made from a minimum of 2x3 No. 2 Spruce Pine Fir (SPF) lumber, wooden dowels, and approximately 2½" of polyisocyanurate (polyiso) insulation.

4.2.1 Overall size of Tstud™ is 2½" x 5½".

4.2.2 Any lumber species can be used, as long as the design values of the lumber are equal to or greater than No. 2 SPF.

4.2.3 The lumber is placed in a form that leaves a gap of approximately 2½" between members. Wooden dowels are installed through one member into the other at opposing angles, forming a web-like pattern. Dowels are spaced evenly at a distance not to exceed 6½" on center and glued in place using an adhesive that conforms to the specifications of *ASTM D2559*.

4.2.4 Once the lumber has been fastened together, liquid polyiso is poured into the void between members and given time to harden.

4.3 *Materials*

4.3.1 *Lumber:*

4.3.1.1 Grade: No. 2 SPF or 1650f – 1.5E SPF

4.3.1.2 Thickness: 1½" (38.1 mm)

4.3.1.3 Width: 2½" (63.5 mm)

4.3.1.4 Length: up to 16' (4.9 m)

4.3.2 *Dowels:*

4.3.2.1 Grade: No. 2 SPF or 1650f – 1.5E SPF

4.3.2.2 Diameter: $^{11}/_{16}$" (17.5 mm)

4.3.3 *Polyiso:*

4.3.3.1 The polyiso is manufactured with a minimum density of 2.2 pounds per cubic foot.

5 Applications

5.1 *Prescriptive Provisions*

5.1.1 Tstud™ is an alternative to solid sawn 2x4 lumber in all cases and 2x6 lumber in most cases for wall structural members.

5.1.1.1 For use as a 2x6, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment. In these cases, referenced design values as specified in Table 2 shall be used in accordance with *IBC* Section 2308 and *IRC* Section R602.

5.1.1.2 Polyiso insulation is in accordance with *IBC* Chapter 26, specifically Section 2603.2, Section 2603.3, Section 2603.4, and *IRC* Section R316, specifically Section R316.2, Section R316.3, and Section R316.4.

5.1.1.3 *Cutting, notching, and boring:*

5.1.1.3.1 Notches in structural members (2x3 or dowels) are not permitted.

5.1.1.3.2 Holes may only be bored in polyiso insulation of Tstud™. Holes shall be spaced a minimum of 24" o.c., shall not exceed 2½" (50.8 mm) in diameter and are not permitted within 24" from either end of the stud.

5.1.2 Tstud™ used as structural members of a wall shall be fastened as specified in Table 1.

Table 1. Acceptable Fastening Schedule for Tstud™

Application[1]	Number & Type of Fastener	Fastener Spacing (in)	Installation
Ceiling joists to plate (toe nail)	3 (4" x 0.131")	-	Fasten two (2) toe nails into interior wood member and one (1) toe nail into exterior wood member
Rafter or roof truss to plate (toe nail)	3 (3½" x 0.135")	-	Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two (2) toe nails on one (1) side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
	4 (4" x 0.131")		Fasten two (2) toe nails into interior wood member and two (2) toe nails into exterior wood member
Built-up studs (face nail)	(4" x 0.131")	16 o.c.	Fasten two (2) face nails, one (1) into each wood member
Abutting studs at intersection wall corner (face nail)	(4" x 0.131")	12 o.c.	Fasten one (1) face nail into exterior-facing wood member
Double 2x6 top plates (face nail)	(4" x 0.131")	12 o.c.	Fasten two (2) face nails, one (1) into each wood member
Double top plates, minimum 24" offset of end joints, face nail in lapped area	12 (4" x 0.131")	-	Fasten twelve (12) face nails on each side of end joint (minimum 24" lap splice length each side of joint)
Stud to plate (toe nail)	4 (4" x 0.131")	-	Fasten two (2) toe nails into sole plate on each side of the stud (each wood member)
Plate to stud (end nail)	3 (4" x 0.131")	-	Fasten two (2) 4" x 0.135" nails into one wood member and one (1) 4" x 0.135" nail into other wood member
	2 (4½" x 0.162")		Fasten two (2) 4½" x 0.162" nails, one (1) into each wood member
Top plates, laps at corners & intersections (face nail)	2 (4" x 0.131")	-	Fasten two (2) 4" x 0.135" face nails, one into each wood member
Rim joist to sill or top plate	(2½" x 0.113")	4 o.c.	Fasten by toe-nailing
	(2½" x 0.131")	6 o.c.	

SI: 1 in = 25.4 mm

1. For all connections, care must be taken to avoid splitting.

5.1.3 Tstud™ may be used as a single top plate in accordance with *IRC* Section R602.3.2 and the following:

5.1.3.1 Fasteners for Tstud™ connections shall be distributed in each Tstud™ wood member (top plate to stud connections shall be fastened using three (3) 4" x 0.131" nails, one (1) into one wood member and two (2) into the other wood member).

5.1.4 Tstud™ may be used as a flat header.

5.1.4.1 Fasten multi-ply Tstud™ header members using 4" x 0.131" nails. Drive one nail into each Tstud™ wood member at 16" o.c. (16" o.c. along each side of the Tstud™).

5.1.5 Use as jack, trimmer, and cripple studs is permitted.

5.1.5.1 Install cripple studs between the bottom plate and rough sill using three (3) 4" x 0.131" nails – one into one wood member and two (2) into the other wood member.

5.1.6 Structural sheathing shall be installed on one side of the wall and minimum ½" (12.7 mm) gypsum wallboard (GWB), or equivalent, on the other side of the wall fastened in accordance with the applicable building code. Sheathing attached to only one side of the wall is not permitted.

5.1.7 For trusses and rafters placed on Tstud™ wall studs, see Table 3 for SPF No. 2 Tstud™ and Table 4 for 1650f – 1.5E Tstud™ design values.

5.1.7.1 For cases where a higher reaction needs to be supported, use of built-up studs fastened in accordance with Table 1 is permitted with a compression limit per-ply specified in Table 3 and Table 4.

5.1.7.1.1 For example, for SPF No. 2 Tstud™ and SPF top plate, the maximum compression load is 3,665 lbs. per ply. Therefore, for a 2-ply built-up stud, the maximum reaction is 7,330 lbs.

5.1.7.1.2 In this case, the built-up stud shall be located directly under the applied load.

5.1.7.2 Walls with nominal 2x6 lumber top plates shall be in accordance with *IRC* Section R602.3.2.

5.2 *Engineered Design*

5.2.1 The design provisions for wood construction noted in *IBC* Section 2302.1[4] and *IRC* Section R301.1.3 apply to Tstud™ for allowable stress design (ASD), unless otherwise noted in this TER.

5.2.2 *Material Properties:*

5.2.2.1 Reference design values for Tstud™ are specified in Table 2.

Table 2. Tstud™ Reference Design Values

Reference Design Values	No. 2 SPF Tstud™	1650f – 1.5E SPF Tstud™
Bending, F_bS	889 lb-ft	889 lb-ft
Compression Parallel to Grain, F_c	1,150 psi	1,700 psi
Tension Parallel to Grain, F_t	450 psi	1,020 psi
Compression Perpendicular to Grain, $F_{c\perp}$	425 psi	425 psi
Shear Force, V	320 lbs	320 lbs
Bending Stiffness, EI	30,300,000 lb-in^2	30,500,000 lb-in^2
Bending Stiffness for Beam and Column Stability, EI_{min}	14,900,000 lb-in^2	15,000,000 lb-in^2
SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa		

5.2.2.2 Reference design values for Tstud™ shall be multiplied by the adjustment factors specified in *NDS* Section 4.3.

[4] 2015 *IBC* Section 2301.2

5.2.3 *Design for Compression Loads:*

5.2.3.1 The maximum allowable compression load for Tstud™ is specified in Table 3 for SPF No. 2 Tstud™ and Table 4 for 1650Fb-1.5E MSR Tstud™.

5.2.3.2 The maximum allowable compression load is based on perpendicular-to-grain crushing of SPF, SP, LVL, or LSL top and bottom plates.

5.2.3.3 The allowable axial compression for Tstud™ can be calculated using the provisions of *NDS* Section 3.6 and 3.7.

5.2.3.4 For computing the column stability factor, the critical bucking design value, F_{cE}, shall be computed using the formula in Equation 1.

Equation 1. Critical Bucking Design Value

$$F_{cE} = \frac{\pi^2 EI_{min}}{A(l_e)^2}$$

Where: EI_{min} = bending stiffness for beam and column stability (lb-in^2)

A = minimum net section area of Tstud™ (in^2) = (2.5" x 1.5") + ((2.5" – 0.6875") x 1.5") = 6.47 in^2

l_e = Effective column length (in) = K_e x h

Table 3. Allowable Compressive Load for Walls Framed with SPF No. 2 Tstud™

Stud Height (ft)	Allowable Compressive Load[1] (lbs)			
	Top/Bottom Plate[2]			
	Tstud™ (SPF) (SG = 0.42)[3]	Southern Pine (SP) (SG = 0.55)[4]	LVL[5]	LSL[6]
8	3665	4875	7070	6900
9	3665	4875	7035	6900
10	3665	4875	6565	6565
11	3665	4875	6045	6045
12	3665	4875	5505	5505
13	3665	4875	4975	4975
14	3665	4475	4475	4475
15	3665	4025	4025	4025
16	3625	3625	3625	3625

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Maximum stud spacing of 24".
2. Compression perpendicular to grain is assumed to be 425 psi for Tstud™ and SPF, 565 psi for SP, 820 for LVL, and 800 for LSL (adjusted per *NDS* Section 3.10.4). Adjustment for plates having a higher or lower compression perpendicular to grain value is required.
3. Compression perpendicular to grain of the Tstud™ or SPF top and bottom plates controls for walls less than or equal to 15 ft. in height.
4. Compression perpendicular to grain of the SP top and bottom plates controls for walls less than or equal to 13 ft. in height.
5. Compression perpendicular to grain of the LVL top and bottom plates controls for walls less than or equal to 8 ft. in height.
6. Compression perpendicular to grain of the LSL top and bottom plates controls for walls less than or equal to 9 ft. in height.

Table 4. Allowable Compressive Load for Walls Framed with 1650Fb-1.5E MSR Tstud™

Stud Height (ft)	Allowable Compressive Load[1] (lbs)			
	Top/Bottom Plate[2]			
	Tstud™ (SPF) (SG = 0.42)[3]	Southern Pine (SP) (SG = 0.55)[4]	LVL[5]	LSL[6]
8	3665	4875	7070	6900
9	3665	4875	7070	6900
10	3665	4875	7070	6900
11	3665	4875	6805	6805
12	3665	4875	6055	6055
13	3665	4875	5370	5370
14	3665	4765	4765	4765
15	3665	4240	4240	4240
16	3665	3785	3785	3785

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Maximum stud spacing of 24".
2. Compression perpendicular to grain is assumed to be 425 psi for Tstud™ and SPF, 565 psi for SP, 820 for LVL, and 800 for LSL (adjusted per *NDS* Section 3.10.4). Adjustment for plates having a higher or lower compression perpendicular to grain value is required.
3. Compression perpendicular to grain of the Tstud™ or SPF top and bottom plates controls for walls less than or equal to 16 ft. in height.
4. Compression perpendicular to grain of the SP top and bottom plates controls for walls less than or equal to 13 ft. in height.
5. Compression perpendicular to grain of the LVL top and bottom plates controls for walls less than or equal to 10 ft. in height.
6. Compression perpendicular to grain of the LSL top and bottom plates controls for walls less than or equal to 10 ft. in height.

5.2.4 *Design for Bending:*

5.2.4.1 The maximum bending moment and shear forces shall not exceed the reference design values for the Tstud™ specified in Table 2.

5.2.5 *Design for Combined Bending and Axial Compression Loads:*

5.2.5.1 The Tstud™ resists bending using tension and compression stresses in the wood members.

5.2.5.2 The axial compressive stress due to combined bending and axial load can be computed using Equation 2.

Equation 2. Axial Compressive Stress

$$f_a = \frac{P}{A} + \frac{M}{A_m \cdot d_{eff}}$$

Where: P = axial load applied to Tstud™ (lb)

A = minimum net section area of Tstud™ (in^2) = (2.5" x 1.5") + ((2.5" – 0.6875") x 1.5") = 6.47 in^2

M = bending moment applied to Tstud™ (lb-in)

A_m = minimum net section area of single Tstud™ member (in^2) = ((2.5" – 0.6875") x 1.5") = 2.72 in^2

d_{eff} = distance from center to center of Tstud™ member (in) = 4.00 in

5.2.5.3 The axial stresses in Tstud™ member shall be checked in accordance with *NDS* Section 3.6 and 3.7.

5.2.5.4 The Tstud™ shall also be checked in bending only to insure the allowable bending moment in Table 2 is not exceeded.

5.2.5.5 Allowable wind pressures for Tstud™ subject to axial loads are specified in the following tables:

5.2.5.5.1 SPF No. 2 Tstud™

5.2.5.5.1.1 SPF top/bottom plate: Table 5

5.2.5.5.1.2 SP top/bottom plate: Table 6

5.2.5.5.1.3 LVL top/bottom plate: Table 7

5.2.5.5.1.4 LSL top/bottom plate: Table 8

5.2.5.5.2 1650Fb-1.5E MSR Tstud™

5.2.5.5.2.1 SPF top/bottom plate: Table 9

5.2.5.5.2.2 SP top/bottom plate: Table 10

5.2.5.5.2.3 LVL top/bottom plate: Table 11

5.2.5.5.2.4 LSL top/bottom plate: Table 12

5.2.5.6 Tstud™ used as headers in a wall have the allowable loads as specified in Table 13.

Table 5. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(SPF No. 2 Tstud™ and SPF Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	3665 (L/3401)	3665 (L/2551)	3665 (L/2041)	3665 (L/1701)	3665 (L/1458)	3665 (L/1276)	3665 (L/1134)	3665 (L/1020)	3665 (L/928)	3665 (L/850)
	9	3665 (L/2356)	3665 (L/1767)	3665 (L/1413)	3665 (L/1178)	3665 (L/1010)	3665 (L/883)	3665 (L/785)	3665 (L/707)	3665 (L/642)	3665 (L/589)
	10	3665 (L/1698)	3665 (L/1274)	3665 (L/1019)	3665 (L/849)	3665 (L/728)	3665 (L/637)	3665 (L/566)	3665 (L/509)	3665 (L/463)	3665 (L/425)
	12	3665 (L/967)	3665 (L/725)	3665 (L/580)	3640 (L/483)	3185 (L/414)	2725 (L/362)	2270 (L/322)	1815 (L/290)	1360 (L/264)	900 (L/242)
	14	3030 (L/602)	2405 (L/451)	1780 (L/361)	1155 (L/301)	530 (L/258)	--	--	--	--	--
	16	1385 (L/399)	565 (L/300)	--	--	--	--	--	--	--	--
16	8	3665 (L/2551)	3665 (L/1913)	3665 (L/1531)	3665 (L/1276)	3665 (L/1093)	3665 (L/957)	3665 (L/850)	3665 (L/765)	3665 (L/696)	3665 (L/638)
	9	3665 (L/1767)	3665 (L/1325)	3665 (L/1060)	3665 (L/883)	3665 (L/757)	3665 (L/663)	3665 (L/589)	3665 (L/530)	3665 (L/482)	3665 (L/442)
	10	3665 (L/1274)	3665 (L/955)	3665 (L/764)	3665 (L/637)	3665 (L/546)	3665 (L/478)	3665 (L/425)	3665 (L/382)	3665 (L/347)	3310 (L/318)
	12	3665 (L/725)	3665 (L/544)	3335 (L/435)	2725 (L/362)	2120 (L/311)	1510 (L/272)	900 (L/242)	295 (L/217)	--	--
	14	2405 (L/451)	1570 (L/338)	735 (L/271)	--	--	--	--	--	--	--
	16	565 (L/300)	--	--	--	--	--	--	--	--	--
24	8	3665 (L/1701)	3665 (L/1276)	3665 (L/1020)	3665 (L/850)	3665 (L/729)	3665 (L/638)	3665 (L/567)	3665 (L/510)	3665 (L/464)	3665 (L/425)
	9	3665 (L/1178)	3665 (L/883)	3665 (L/707)	3665 (L/589)	3665 (L/505)	3665 (L/442)	3665 (L/393)	3665 (L/353)	3665 (L/321)	3370 (L/294)
	10	3665 (L/849)	3665 (L/637)	3665 (L/509)	3665 (L/425)	3665 (L/364)	3310 (L/318)	2680 (L/283)	2055 (L/255)	1430 (L/232)	805 (L/212)
	12	3640 (L/483)	2725 (L/362)	1815 (L/290)	900 (L/242)	--	--	--	--	--	--
	14	1155 (L/301)	--	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with No. 2 Tstud™ studs and SPF top and bottom plates.

Table 6. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(SPF No. 2 Tstud™ and SP Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	4875 (L/3401)	4875 (L/2551)	4875 (L/2041)	4875 (L/1701)	4875 (L/1458)	4875 (L/1276)	4875 (L/1134)	4875 (L/1020)	4875 (L/928)	4875 (L/850)
	9	4875 (L/2356)	4875 (L/1767)	4875 (L/1413)	4875 (L/1178)	4875 (L/1010)	4875 (L/883)	4875 (L/785)	4875 (L/707)	4875 (L/642)	4875 (L/589)
	10	4875 (L/1698)	4875 (L/1274)	4875 (L/1019)	4875 (L/849)	4875 (L/728)	4875 (L/637)	4875 (L/566)	4875 (L/509)	4875 (L/463)	4565 (L/425)
	12	4875 (L/967)	4550 (L/725)	4095 (L/580)	3640 (L/483)	3185 (L/414)	2725 (L/362)	2270 (L/322)	1815 (L/290)	1360 (L/264)	900 (L/242)
	14	3030 (L/602)	2405 (L/451)	1780 (L/361)	1155 (L/301)	530 (L/258)	--	--	--	--	--
	16	1385 (L/399)	565 (L/300)	--	--	--	--	--	--	--	--
16	8	4875 (L/2551)	4875 (L/1913)	4875 (L/1531)	4875 (L/1276)	4875 (L/1093)	4875 (L/957)	4875 (L/850)	4875 (L/765)	4875 (L/696)	4875 (L/638)
	9	4875 (L/1767)	4875 (L/1325)	4875 (L/1060)	4875 (L/883)	4875 (L/757)	4875 (L/663)	4875 (L/589)	4875 (L/530)	4875 (L/482)	4875 (L/442)
	10	4875 (L/1274)	4875 (L/955)	4875 (L/764)	4875 (L/637)	4875 (L/546)	4875 (L/478)	4565 (L/425)	4145 (L/382)	3725 (L/347)	3310 (L/318)
	12	4550 (L/725)	3945 (L/544)	3335 (L/435)	2725 (L/362)	2120 (L/311)	1510 (L/272)	900 (L/242)	295 (L/217)	--	--
	14	2405 (L/451)	1570 (L/338)	735 (L/271)	--	--	--	--	--	--	--
	16	565 (L/300)	--	--	--	--	--	--	--	--	--
24	8	4875 (L/1701)	4875 (L/1276)	4875 (L/1020)	4875 (L/850)	4875 (L/729)	4875 (L/638)	4875 (L/567)	4875 (L/510)	4875 (L/464)	4875 (L/425)
	9	4875 (L/1178)	4875 (L/883)	4875 (L/707)	4875 (L/589)	4875 (L/505)	4875 (L/442)	4875 (L/393)	4375 (L/353)	3870 (L/321)	3370 (L/294)
	10	4875 (L/849)	4875 (L/637)	4875 (L/509)	4565 (L/425)	3935 (L/364)	3310 (L/318)	2680 (L/283)	2055 (L/255)	1430 (L/232)	805 (L/212)
	12	3640 (L/483)	2725 (L/362)	1815 (L/290)	900 (L/242)	--	--	--	--	--	--
	14	1155 (L/301)	--	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with SPF No. 2 Tstud™ studs and SP top and bottom plates.

Table 7. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(SPF No. 2 Tstud™ and LVL Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	7070 (L/3401)	7070 (L/2551)	7070 (L/2041)	7070 (L/1701)	7070 (L/1458)	7070 (L/1276)	7070 (L/1134)	7070 (L/1020)	7070 (L/928)	7070 (L/850)
	9	7035 (L/2356)	7035 (L/1767)	7035 (L/1413)	7035 (L/1178)	7035 (L/1010)	7035 (L/883)	7035 (L/785)	6895 (L/707)	6645 (L/642)	6390 (L/589)
	10	6565 (L/1698)	6565 (L/1274)	6565 (L/1019)	6445 (L/849)	6130 (L/728)	5815 (L/637)	5505 (L/566)	5190 (L/509)	4875 (L/463)	4565 (L/425)
	12	5010 (L/967)	4550 (L/725)	4095 (L/580)	3640 (L/483)	3185 (L/414)	2725 (L/362)	2270 (L/322)	1815 (L/290)	1360 (L/264)	900 (L/242)
	14	3030 (L/602)	2405 (L/451)	1780 (L/361)	1155 (L/301)	530 (L/258)	--	--	--	--	--
	16	1385 (L/399)	565 (L/300)	--	--	--	--	--	--	--	--
16	8	7070 (L/2551)	7070 (L/1913)	7070 (L/1531)	7070 (L/1276)	7070 (L/1093)	7070 (L/957)	7070 (L/850)	7070 (L/765)	7070 (L/696)	7070 (L/638)
	9	7035 (L/1767)	7035 (L/1325)	7035 (L/1060)	7035 (L/883)	7035 (L/757)	6730 (L/663)	6390 (L/589)	6055 (L/530)	5720 (L/482)	5385 (L/442)
	10	6565 (L/1274)	6565 (L/955)	6235 (L/764)	5815 (L/637)	5400 (L/546)	4980 (L/478)	4565 (L/425)	4145 (L/382)	3725 (L/347)	3310 (L/318)
	12	4550 (L/725)	3945 (L/544)	3335 (L/435)	2725 (L/362)	2120 (L/311)	1510 (L/272)	900 (L/242)	295 (L/217)	--	--
	14	2405 (L/451)	1570 (L/338)	735 (L/271)	--	--	--	--	--	--	--
	16	565 (L/300)	--	--	--	--	--	--	--	--	--
24	8	7070 (L/1701)	7070 (L/1276)	7070 (L/1020)	7070 (L/850)	7070 (L/729)	7070 (L/638)	6930 (L/567)	6535 (L/510)	6140 (L/464)	5750 (L/425)
	9	7035 (L/1178)	7035 (L/883)	6895 (L/707)	6390 (L/589)	5890 (L/505)	5385 (L/442)	4880 (L/393)	4375 (L/353)	3870 (L/321)	3370 (L/294)
	10	6445 (L/849)	5815 (L/637)	5190 (L/509)	4565 (L/425)	3935 (L/364)	3310 (L/318)	2680 (L/283)	2055 (L/255)	1430 (L/232)	805 (L/212)
	12	3640 (L/483)	2725 (L/362)	1815 (L/290)	900 (L/242)	--	--	--	--	--	--
	14	1155 (L/301)	--	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with SPF No. 2 Tstud™ studs and LVL (compression perpendicular to grain is assumed to be 820 psi) top and bottom plates.

Table 8. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(SPF No. 2 Tstud™ and LSL Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	6900 (L/3401)	6900 (L/2551)	6900 (L/2041)	6900 (L/1701)	6900 (L/1458)	6900 (L/1276)	6900 (L/1134)	6900 (L/1020)	6900 (L/928)	6900 (L/850)
	9	6900 (L/2356)	6900 (L/1767)	6900 (L/1413)	6900 (L/1178)	6900 (L/1010)	6900 (L/883)	6900 (L/785)	6895 (L/707)	6645 (L/642)	6390 (L/589)
	10	6565 (L/1698)	6565 (L/1274)	6565 (L/1019)	6445 (L/849)	6130 (L/728)	5815 (L/637)	5505 (L/566)	5190 (L/509)	4875 (L/463)	4565 (L/425)
	12	5010 (L/967)	4550 (L/725)	4095 (L/580)	3640 (L/483)	3185 (L/414)	2725 (L/362)	2270 (L/322)	1815 (L/290)	1360 (L/264)	900 (L/242)
	14	3030 (L/602)	2405 (L/451)	1780 (L/361)	1155 (L/301)	530 (L/258)	--	--	--	--	--
	16	1385 (L/399)	565 (L/300)	--	--	--	--	--	--	--	--
16	8	6900 (L/2551)	6900 (L/1913)	6900 (L/1531)	6900 (L/1276)	6900 (L/1093)	6900 (L/957)	6900 (L/850)	6900 (L/765)	6900 (L/696)	6900 (L/638)
	9	6900 (L/1767)	6900 (L/1325)	6900 (L/1060)	6900 (L/883)	6900 (L/757)	6730 (L/663)	6390 (L/589)	6055 (L/530)	5720 (L/482)	5385 (L/442)
	10	6565 (L/1274)	6565 (L/955)	6235 (L/764)	5815 (L/637)	5400 (L/546)	4980 (L/478)	4565 (L/425)	4145 (L/382)	3725 (L/347)	3310 (L/318)
	12	4550 (L/725)	3945 (L/544)	3335 (L/435)	2725 (L/362)	2120 (L/311)	1510 (L/272)	900 (L/242)	295 (L/217)	--	--
	14	2405 (L/451)	1570 (L/338)	735 (L/271)	--	--	--	--	--	--	--
	16	565 (L/300)	--	--	--	--	--	--	--	--	--
24	8	6900 (L/1701)	6900 (L/1276)	6900 (L/1020)	6900 (L/850)	6900 (L/729)	6900 (L/638)	6900 (L/567)	6535 (L/510)	6140 (L/464)	5750 (L/425)
	9	6900 (L/1178)	6900 (L/883)	6895 (L/707)	6390 (L/589)	5890 (L/505)	5385 (L/442)	4880 (L/393)	4375 (L/353)	3870 (L/321)	3370 (L/294)
	10	6445 (L/849)	5815 (L/637)	5190 (L/509)	4565 (L/425)	3935 (L/364)	3310 (L/318)	2680 (L/283)	2055 (L/255)	1430 (L/232)	805 (L/212)
	12	3640 (L/483)	2725 (L/362)	1815 (L/290)	900 (L/242)	--	--	--	--	--	--
	14	1155 (L/301)	--	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with SPF No. 2 Tstud™ studs and LSL (compression perpendicular to grain is assumed to be 800 psi) top and bottom plates.

Table 9. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(1650f – 1.5E Tstud™ and SPF Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	3665 (L/3424)	3665 (L/2568)	3665 (L/2054)	3665 (L/1712)	3665 (L/1467)	3665 (L/1284)	3665 (L/1141)	3665 (L/1027)	3665 (L/934)	3665 (L/856)
	9	3665 (L/2371)	3665 (L/1778)	3665 (L/1423)	3665 (L/1186)	3665 (L/1016)	3665 (L/889)	3665 (L/790)	3665 (L/711)	3665 (L/647)	3665 (L/593)
	10	3665 (L/1710)	3665 (L/1282)	3665 (L/1026)	3665 (L/855)	3665 (L/733)	3665 (L/641)	3665 (L/570)	3665 (L/513)	3665 (L/466)	3665 (L/427)
	12	3665 (L/973)	3665 (L/730)	3665 (L/584)	3665 (L/486)	3520 (L/417)	3060 (L/365)	2605 (L/324)	2150 (L/292)	1690 (L/265)	1235 (L/243)
	14	3205 (L/606)	2580 (L/454)	1955 (L/363)	1325 (L/303)	700 (L/260)	75 (L/227)	--	--	--	--
	16	1485 (L/402)	665 (L/302)	--	--	--	--	--	--	--	--
16	8	3665 (L/2568)	3665 (L/1926)	3665 (L/1541)	3665 (L/1284)	3665 (L/1101)	3665 (L/963)	3665 (L/856)	3665 (L/770)	3665 (L/700)	3665 (L/642)
	9	3665 (L/1778)	3665 (L/1334)	3665 (L/1067)	3665 (L/889)	3665 (L/762)	3665 (L/667)	3665 (L/593)	3665 (L/534)	3665 (L/485)	3665 (L/445)
	10	3665 (L/1282)	3665 (L/962)	3665 (L/769)	3665 (L/641)	3665 (L/549)	3665 (L/481)	3665 (L/427)	3665 (L/385)	3665 (L/350)	3665 (L/321)
	12	3665 (L/730)	3665 (L/547)	3665 (L/438)	3060 (L/365)	2455 (L/313)	1845 (L/274)	1235 (L/243)	630 (L/219)	20 (L/199)	--
	14	2580 (L/454)	1745 (L/341)	910 (L/272)	75 (L/227)	--	--	--	--	--	--
	16	665 (L/302)	--	--	--	--	--	--	--	--	--
24	8	3665 (L/1712)	3665 (L/1284)	3665 (L/1027)	3665 (L/856)	3665 (L/734)	3665 (L/642)	3665 (L/571)	3665 (L/514)	3665 (L/467)	3665 (L/428)
	9	3665 (L/1186)	3665 (L/889)	3665 (L/711)	3665 (L/593)	3665 (L/508)	3665 (L/445)	3665 (L/395)	3665 (L/356)	3665 (L/323)	3665 (L/296)
	10	3665 (L/855)	3665 (L/641)	3665 (L/513)	3665 (L/427)	3665 (L/366)	3665 (L/321)	3415 (L/285)	2790 (L/256)	2160 (L/233)	1535 (L/214)
	12	3665 (L/486)	3060 (L/365)	2150 (L/292)	1235 (L/243)	325 (L/208)	--	--	--	--	--
	14	1325 (L/303)	75 (L/227)	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with 1650f – 1.5E Tstud™ studs and SPF top and bottom plates.

Table 10. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(1650f – 1.5E Tstud™ and SP Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	4875 (L/3424)	4875 (L/2568)	4875 (L/2054)	4875 (L/1712)	4875 (L/1467)	4875 (L/1284)	4875 (L/1141)	4875 (L/1027)	4875 (L/934)	4875 (L/856)
	9	4875 (L/2371)	4875 (L/1778)	4875 (L/1423)	4875 (L/1186)	4875 (L/1016)	4875 (L/889)	4875 (L/790)	4875 (L/711)	4875 (L/647)	4875 (L/593)
	10	4875 (L/1710)	4875 (L/1282)	4875 (L/1026)	4875 (L/855)	4875 (L/733)	4875 (L/641)	4875 (L/570)	4875 (L/513)	4875 (L/466)	4875 (L/427)
	12	4875 (L/973)	4875 (L/730)	4430 (L/584)	3975 (L/486)	3520 (L/417)	3060 (L/365)	2605 (L/324)	2150 (L/292)	1690 (L/265)	1235 (L/243)
	14	3205 (L/606)	2580 (L/454)	1955 (L/363)	1325 (L/303)	700 (L/260)	75 (L/227)	--	--	--	--
	16	1485 (L/402)	665 (L/302)	--	--	--	--	--	--	--	--
16	8	4875 (L/2568)	4875 (L/1926)	4875 (L/1541)	4875 (L/1284)	4875 (L/1101)	4875 (L/963)	4875 (L/856)	4875 (L/770)	4875 (L/700)	4875 (L/642)
	9	4875 (L/1778)	4875 (L/1334)	4875 (L/1067)	4875 (L/889)	4875 (L/762)	4875 (L/667)	4875 (L/593)	4875 (L/534)	4875 (L/485)	4875 (L/445)
	10	4875 (L/1282)	4875 (L/962)	4875 (L/769)	4875 (L/641)	4875 (L/549)	4875 (L/481)	4875 (L/427)	4875 (L/385)	4460 (L/350)	4045 (L/321)
	12	4875 (L/730)	4280 (L/547)	3670 (L/438)	3060 (L/365)	2455 (L/313)	1845 (L/274)	1235 (L/243)	630 (L/219)	20 (L/199)	--
	14	2580 (L/454)	1745 (L/341)	910 (L/272)	75 (L/227)	--	--	--	--	--	--
	16	665 (L/302)	--	--	--	--	--	--	--	--	--
24	8	4875 (L/1712)	4875 (L/1284)	4875 (L/1027)	4875 (L/856)	4875 (L/734)	4875 (L/642)	4875 (L/571)	4875 (L/514)	4875 (L/467)	4875 (L/428)
	9	4875 (L/1186)	4875 (L/889)	4875 (L/711)	4875 (L/593)	4875 (L/508)	4875 (L/445)	4875 (L/395)	4875 (L/356)	4875 (L/323)	4475 (L/296)
	10	4875 (L/855)	4875 (L/641)	4875 (L/513)	4875 (L/427)	4670 (L/366)	4045 (L/321)	3415 (L/285)	2790 (L/256)	2160 (L/233)	1535 (L/214)
	12	3975 (L/486)	3060 (L/365)	2150 (L/292)	1235 (L/243)	325 (L/208)	--	--	--	--	--
	14	1325 (L/303)	75 (L/227)	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with 1650f – 1.5E Tstud™ studs and SP top and bottom plates.

Table 11. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(1650f – 1.5E Tstud™ and LVL Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	7070 (L/3424)	7070 (L/2568)	7070 (L/2054)	7070 (L/1712)	7070 (L/1467)	7070 (L/1284)	7070 (L/1141)	7070 (L/1027)	7070 (L/934)	7070 (L/856)
	9	7070 (L/2371)	7070 (L/1778)	7070 (L/1423)	7070 (L/1186)	7070 (L/1016)	7070 (L/889)	7070 (L/790)	7070 (L/711)	7070 (L/647)	7070 (L/593)
	10	7070 (L/1710)	7070 (L/1282)	7070 (L/1026)	7070 (L/855)	6865 (L/733)	6550 (L/641)	6240 (L/570)	5925 (L/513)	5610 (L/466)	5300 (L/427)
	12	5345 (L/973)	4885 (L/730)	4430 (L/584)	3975 (L/486)	3520 (L/417)	3060 (L/365)	2605 (L/324)	2150 (L/292)	1690 (L/265)	1235 (L/243)
	14	3205 (L/606)	2580 (L/454)	1955 (L/363)	1325 (L/303)	700 (L/260)	75 (L/227)	--	--	--	--
	16	1485 (L/402)	665 (L/302)	--	--	--	--	--	--	--	--
16	8	7070 (L/2568)	7070 (L/1926)	7070 (L/1541)	7070 (L/1284)	7070 (L/1101)	7070 (L/963)	7070 (L/856)	7070 (L/770)	7070 (L/700)	7070 (L/642)
	9	7070 (L/1778)	7070 (L/1334)	7070 (L/1067)	7070 (L/889)	7070 (L/762)	7070 (L/667)	7070 (L/593)	7070 (L/534)	6830 (L/485)	6495 (L/445)
	10	7070 (L/1282)	7070 (L/962)	6970 (L/769)	6550 (L/641)	6135 (L/549)	5715 (L/481)	5300 (L/427)	4880 (L/385)	4460 (L/350)	4045 (L/321)
	12	4885 (L/730)	4280 (L/547)	3670 (L/438)	3060 (L/365)	2455 (L/313)	1845 (L/274)	1235 (L/243)	630 (L/219)	20 (L/199)	--
	14	2580 (L/454)	1745 (L/341)	910 (L/272)	75 (L/227)	--	--	--	--	--	--
	16	665 (L/302)	--	--	--	--	--	--	--	--	--
24	8	7070 (L/1712)	7070 (L/1284)	7070 (L/1027)	7070 (L/856)	7070 (L/734)	7070 (L/642)	7070 (L/571)	7070 (L/514)	7070 (L/467)	7070 (L/428)
	9	7070 (L/1186)	7070 (L/889)	7070 (L/711)	7070 (L/593)	6995 (L/508)	6495 (L/445)	5990 (L/395)	5485 (L/356)	4980 (L/323)	4475 (L/296)
	10	7070 (L/855)	6550 (L/641)	5925 (L/513)	5300 (L/427)	4670 (L/366)	4045 (L/321)	3415 (L/285)	2790 (L/256)	2160 (L/233)	1535 (L/214)
	12	3975 (L/486)	3060 (L/365)	2150 (L/292)	1235 (L/243)	325 (L/208)	--	--	--	--	--
	14	1325 (L/303)	75 (L/227)	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with 1650f – 1.5E Tstud™ studs and LVL (compression perpendicular to grain is assumed to be 820 psi) top and bottom plates.

Table 12. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(1650f – 1.5E Tstud™ and LSL Top/Bottom Plate)

Stud Spacing (in)	Wall[2] Height (ft)	Allowable Compression Load (lb) & (Deflection Ratio)									
		Components & Cladding Wind Pressure[1] (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	6900 (L/3424)	6900 (L/2568)	6900 (L/2054)	6900 (L/1712)	6900 (L/1467)	6900 (L/1284)	6900 (L/1141)	6900 (L/1027)	6900 (L/934)	6900 (L/856)
	9	6900 (L/2371)	6900 (L/1778)	6900 (L/1423)	6900 (L/1186)	6900 (L/1016)	6900 (L/889)	6900 (L/790)	6900 (L/711)	6900 (L/647)	6900 (L/593)
	10	6900 (L/1710)	6900 (L/1282)	6900 (L/1026)	6900 (L/855)	6865 (L/733)	6550 (L/641)	6240 (L/570)	5925 (L/513)	5610 (L/466)	5300 (L/427)
	12	5345 (L/973)	4885 (L/730)	4430 (L/584)	3975 (L/486)	3520 (L/417)	3060 (L/365)	2605 (L/324)	2150 (L/292)	1690 (L/265)	1235 (L/243)
	14	3205 (L/606)	2580 (L/454)	1955 (L/363)	1325 (L/303)	700 (L/260)	75 (L/227)	--	--	--	--
	16	1485 (L/402)	665 (L/302)	--	--	--	--	--	--	--	--
16	8	6900 (L/2568)	6900 (L/1926)	6900 (L/1541)	6900 (L/1284)	6900 (L/1101)	6900 (L/963)	6900 (L/856)	6900 (L/770)	6900 (L/700)	6900 (L/642)
	9	6900 (L/1778)	6900 (L/1334)	6900 (L/1067)	6900 (L/889)	6900 (L/762)	6900 (L/667)	6900 (L/593)	6900 (L/534)	6830 (L/485)	6495 (L/445)
	10	6900 (L/1282)	6900 (L/962)	6900 (L/769)	6550 (L/641)	6135 (L/549)	5715 (L/481)	5300 (L/427)	4880 (L/385)	4460 (L/350)	4045 (L/321)
	12	4885 (L/730)	4280 (L/547)	3670 (L/438)	3060 (L/365)	2455 (L/313)	1845 (L/274)	1235 (L/243)	630 (L/219)	20 (L/199)	--
	14	2580 (L/454)	1745 (L/341)	910 (L/272)	75 (L/227)	--	--	--	--	--	--
	16	665 (L/302)	--	--	--	--	--	--	--	--	--
24	8	6900 (L/1712)	6900 (L/1284)	6900 (L/1027)	6900 (L/856)	6900 (L/734)	6900 (L/642)	6900 (L/571)	6900 (L/514)	6900 (L/467)	6900 (L/428)
	9	6900 (L/1186)	6900 (L/889)	6900 (L/711)	6900 (L/593)	6900 (L/508)	6495 (L/445)	5990 (L/395)	5485 (L/356)	4980 (L/323)	4475 (L/296)
	10	6900 (L/855)	6550 (L/641)	5925 (L/513)	5300 (L/427)	4670 (L/366)	4045 (L/321)	3415 (L/285)	2790 (L/256)	2160 (L/233)	1535 (L/214)
	12	3975 (L/486)	3060 (L/365)	2150 (L/292)	1235 (L/243)	325 (L/208)	--	--	--	--	--
	14	1325 (L/303)	75 (L/227)	--	--	--	--	--	--	--	--

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Wind pressure provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'.
2. Walls constructed with 1650f – 1.5E Tstud™ studs and LSL (compression perpendicular to grain is assumed to be 800 psi) top and bottom plates.

Table 13. Allowable Loads for Tstud™ used as Headers[1,2,3]

No. of Members	Allowable Load (plf) & (Deflection Ratio)						
	Span (ft)						
	3	4	5	6	7	8	9
1	304 (L/356)	171 (L/267)	97 (L/240)	56 (L/240)	35 (L/240)	24 (L/240)	17 (L/240)
2	608 (L/356)	342 (L/267)	194 (L/240)	113 (L/240)	71 (L/240)	47 (L/240)	33 (L/240)
3	911 (L/356)	513 (L/267)	292 (L/240)	169 (L/240)	106 (L/240)	71 (L/240)	50 (L/240)
4	1215 (L/356)	684 (L/267)	389 (L/240)	225 (L/240)	142 (L/240)	95 (L/240)	67 (L/240)
5	1519 (L/356)	854 (L/267)	486 (L/240)	281 (L/240)	177 (L/240)	119 (L/240)	83 (L/240)
6	1823 (L/356)	1025 (L/267)	583 (L/240)	338 (L/240)	213 (L/240)	142 (L/240)	100 (L/240)
7	2127 (L/356)	1196 (L/267)	681 (L/240)	394 (L/240)	248 (L/240)	166 (L/240)	117 (L/240)

SI: 1 in = 25.4 mm

1. Table values are based on Tstud™ of No. 2 SPF lumber
2. Table values are based on a load duration factor of 1.0
3. Deflection checks of L/360 for live load and L/240 for total load are based on a live load to dead load ratio of 2:1.

5.2.6 *Use of Tstud™ in Shear Walls:*

5.2.6.1 Tstud™ used in wall assemblies designed as shear walls are permitted to be designed in accordance with the methodology used in *SDPWS* for WSP using the seismic parameters shown in Table 14.

5.2.6.1.1 The response modification coefficient, R; system overstrength factor, Ω_0; and deflection amplification factor, C_d, indicated in Table 14 shall be used to determine the base shear, element design forces, and design story drift in accordance with *ASCE 7* Chapter 12 and Section 14.5.

Table 14. Seismic Design Coefficients for Tstud™ Shear Walls

Wall System	Response Modification Coefficient[1], R	Overstrength Factor[2], Ω_0	Deflection Amplification Factor[3], C_d	Structural Height Limits[4] (ft)				
				Seismic Design Category				
				B	C	D	E	F
Tstud™ framed walls sheathed with wood structural panels rated for shear resistance	6.5	3	4	NL	NL	65	65	65

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Response modification coefficient, R, for use throughout *ASCE 7*.
2. The tabulated value of the overstrength factor, Ω_0, is permitted to be reduced by subtracting one-half (0.5) for structures with flexible diaphragms.
3. Deflection amplification factor, C_d, for use with *ASCE 7* Section 12.8.6, 12.8.7, and 12.9.2.
4. NL = Not Limited. Heights are measured from the base of the structure as defined in *ASCE 7* Section 11.2.

5.3 For applications outside of the scope of the applicable code, consult the manufacturer installation instructions or a registered design professional (RDP).

5.4 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

6 Installation

6.1 Tstud™ shall be installed in accordance with the applicable code, the approved construction documents, this TER, the manufacturer installation instructions, *NDS,* and otherwise standard framing practices as applied to solid-sawn lumber. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2 *Installation Procedure*

6.2.1 Tstud™ is pre-assembled and designed to be used as a direct replacement of nominal 2x4 (38 mm x 89 mm) solid sawn lumber, and in most cases, but not all, nominal 2x6 (38 mm x 140 mm) solid sawn lumber, as wall studs, top and bottom plates, and headers.

6.2.1.1 For use as a 2x6, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment. In these cases, referenced design values as specified in Table 2. Tstud™ Reference Design Values shall be used in accordance with *IBC* Section 2308 and *IRC* Section R602.

6.2.2 Install Tstud™ in the same manner as solid sawn lumber, except as noted herein.

6.2.2.1 For *IBC* Section 2308 and the *IRC*, install in accordance with the provisions therein, except as noted in this TER.

6.2.2.2 For engineered design, walls shall be designed in accordance with the *IBC* and the referenced standards therein using the material properties and design limitations as noted in Section 5.

6.2.2.3 Design of connections using Tstud™ shall be in accordance with *NDS*.

6.2.3 *Anchorage:*

6.2.3.1 Stand walls and set into correct position. Ensure anchor bolts in foundation penetrate the center of the foam in the Tstud™ bottom plate.

6.2.3.2 Place metal plate over anchor bolts and fasten with a washer and nut. Once nut is tightened and the wall has been sufficiently anchored tight to the sill plate, drive four (4) 2½" #12 (0.216 dia.) screws (two [2] in each wood member) into the pre drilled holes in the metal plate.

7 Substantiating Data

7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

7.1.1 Compressive load testing of Tstud™ in accordance with *ASTM E72*

7.1.2 Bending tests in accordance with *ASTM D198*

7.1.3 Bending tests of Tstud™ top plates

7.1.4 Lateral load resistance in accordance with *ASTM E2126*

7.2 Information contained herein is the result of testing and/or data analysis by sources which conform to *IBC* Section 1703 and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

7.3 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through state or local adoption of codes and standards. The providers of the codes and standards are legally responsible for their content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes a product as being equivalent to that prescribed in this code in quality, *strength*, effectiveness, *fire resistance*, durability, and safety. Where the accuracy of the provisions provided herein is reliant upon the published properties of materials, DrJ relies upon the grade mark, grade stamp, mill certificate, and/or test data provided by material suppliers to be minimum properties. DrJ analysis relies upon these properties to be accurate.

8 Findings

8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product listed in Section 1.1 is approved for the following:

8.1.1 Tstud™ insulated wall studs installed as framing members in walls, as described in this TER, are compliant with the codes listed in Section 2 and are approved for use as an alternative to nominal 2x4 (38 mm x 89 mm) solid sawn lumber in all cases and 2x6 (38 mm x 140 mm) solid sawn lumber in most cases for wall structural members.

8.1.2 For use as a 2x6, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment. In these cases, referenced design values as specified in Table 2 shall be used in accordance with *IBC* Section 2308 and *IRC* Section R602.

8.2 Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity is listed by the licensing board of the relevant *jurisdiction*.

8.3 Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the *building official*. DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs RDPs.

8.4 Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any *jurisdiction* or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "certified once, accepted everywhere."

8.5 *IBC* Section 104.11 (*IRC* Section R104.11 and *IFC* Section 104.10[5] are similar) states:

> **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code…Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

9 Conditions of Use

9.1 Tstud™ complies with, or is a suitable alternative to, sawn lumber as permitted by the codes listed in Section 2, subject to the following conditions:

9.1.1 The maximum wall height for Tstud™ is 16' (3.05 m).

9.1.2 Increases for duration of load shall be in accordance with the limitations of the applicable building code for sawn lumber.

9.1.3 Creep factors applicable to sawn lumber may be applied to this product, in accordance with the applicable building code.

9.2 Where Tstud™ is used as a top plate, a separate means of fireblocking shall be provided in accordance with *IBC* Section 718 and *IRC* Section R302.11.

9.3 Where required by the *building official*, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of *permit* application.

9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.

9.5 Design loads shall be determined in accordance with the building code adopted by the *jurisdiction* in which the project is to be constructed and/or by the building designer (e.g., *owner* or RDP).

9.6 At a minimum, this product shall be installed per Section 6 of this TER.

[5] 2018 *IFC* Section 104.9

9.7 This product has an internal quality control program and a third-party quality assurance program in accordance with *IBC* Section 104.4 and Section 110.4 and *IRC* Section R104.4 and Section R109.2.

9.8 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the *owner* or the owner's authorized agent.

9.9 This TER shall be reviewed for code compliance by the AHJ in concert with *IBC* Section 104.

9.10 The implementation of this TER for this product is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections required by *IBC* Section 110.3, and any other code or regulatory requirements that may apply.

10 Identification

10.1 The product(s) listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.

10.2 Additional technical information can be found at www.tstud.com.

11 Review Schedule

11.1 This TER is subject to periodic review and revision. For the most recent version, visit drjcertification.org.

11.2 For information on the current status of this TER, contact DrJ Certification.

Appendix A: Tstud™ Example Calculation

Determine the allowable axial load for an 10' Tstud™ of No. 2 SPF lumber spaced 24" o.c. and subject to wind speeds of 170 mph.

Material Properties of Tstud™:

The material properties of the Tstud™ are given in Table 2 of the TER.

$F_bS := 889\ lbf \cdot ft$	Bending
$F_c := 1150\ psi$	Compression Parallel to Grain
$F_t := 450\ psi$	Tension Parallel to Grain
$F_{c\_perp} := 425\ psi$	Compression Perpendicular to Grain
$V_n := 320\ lbf$	Shear Force
$EI := 30300000\ lbf \cdot in^2$	Bending Stiffness
$EI_{min} := 14900000\ lbf \cdot in^2$	Bending Stiffness for Beam and Column Stability
$C_{fc} := 1.15$ $\quad C_{ft} := 1.5$	Size factors for 2x3 lumber

Section Properties of Tstud™:

$w := 5.5\ in$	Overall width
$d_1 := 1.5\ in$	Wide face dimension
$d_2 := 2.5\ in$	Narrow face dimension
$d_{dowel} := \frac{11}{16}\ in$	Dowel diameter
$d_{eff} := w - \left(\frac{d_1}{2}\right) - \left(\frac{d_1}{2}\right) = 4\ in$	Moment arm between members
$A_{net} := \left(d_1 \cdot d_2\right) + \left(\left(d_2 - d_{dowel}\right) \cdot d_1\right) = 6.47\ in^2$	Net section area of Tstud™, NDS Section 3.6.3 and Section 3.1.2.1
$h := 116.125\ in = 10\ ft$	Height of Tstud™

Compression Capacity of Tstud™ under Vertical Load only:

$C_D := 1.0$	Load Duration Factor for Occupancy Live Load, NDS Table 2.3.2
$F_{c.star} := F_c \cdot C_{fc} \cdot C_D = 1323\ psi$	Reference compression design value multiplied by all adjustment factors except for Cp
$A_b := 2 \cdot d_1 \cdot d_2 = 7.5\ in^2$	Net bearing area of Tstud™

$c := 0.8$ Constant for sawn lumber, NDS Section 3.7.1

$K := 1.0$ Buckling effective length factor for pinned-pinned column.

$l_e := K \cdot h = 10\ ft$ Effective column length

$F_{cE} := \frac{\pi^2\ EI_{min}}{A_{net} \cdot l_e^{\ 2}} = 1686\ psi$ Critical buckling design value, TER Equation 1

$$C_P := \frac{1 + \left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c} - \sqrt{\left(\frac{1 + \left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c}\right)^2 - \frac{\left(\frac{F_{cE}}{F_{c.star}}\right)}{c}} = 0.768$$

Column stability factor, NDS Section 3.7.1.5

$F'_c := F_{c.star} \cdot C_P = 1015\ psi$ < $F_{cE} = 1686\ psi$ **OK**

$P_{buckling} := F_{c.star} \cdot C_P \cdot A_{net} = 6567\ lbf$ Force, Buckling

$C_b := \frac{d_2 + 0.375\ in}{d_2} = 1.15$ Bearing Area Factor, NDS Section 3.10.4

$P_{comp\_perp} := F_{c\_perp} \cdot C_b \cdot A_b = 3666\ lbf$ Force, Compression Perpendicular

Bending Capacity of Tstud™:

$C_D := 1.6$ Load Duration Factor

$A_{eff} := h \cdot \frac{h}{3} = 31\ ft^2$ Effective wind area for a single Tstud.

$p_{pos} := 29.7\ psf$
$p_{neg} := -39.0\ psf$
Wind pressures for a basic wind speed, Vult, of 170 mph, mean roof height of 30 ft, and Exposure B per IRC Table R301.2(2)

$S_{stud} := 24\ in$ Stud spacing

$w := \left(-p_{neg}\right) \cdot S_{stud} = 78.0\ plf$

$M_{req'd} := \frac{w \cdot h^2}{8} = 10957\ lbf \cdot in$ < $M_{all} := F_b S \cdot C_D = 17069\ lbf \cdot in$

Check shear load:

$V_{req'd} := \frac{w \cdot h}{2} = 377\ lbf$ < $V_{all} := V_n \cdot C_D = 512\ lbf$ **OK**

Combined Axial Load and Component & Cladding Wind Load on Tstud™:

$C_D := 1.6$ Load Duration Factor

$F_{c.star} := F_c \cdot C_{fc} \cdot C_D = 2116\ psi$ Reference compression design value multiplied by all adjustment factors except for Cp

$$C_P := \frac{1+\left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c} - \sqrt{\left(\frac{1+\left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c}\right)^2 - \frac{\left(\frac{F_{cE}}{F_{c.star}}\right)}{c}} = 0.608$$

Column stability factor, NDS Section 3.7.1.5

$F_c' := F_{c.star} \cdot C_P = 1287\ psi$

Check combined bending and compression on the member:

$A_m := d_1 \cdot \left(d_2 - d_{dowel}\right) = 2.72\ in^2$

$M_{applied} := \frac{0.75\ w \cdot h^2}{8} = 8217\ lbf \cdot in$ A 0.75 factor is applied to the wind load in accordance with load combination 6a in ASCE 7 Section 2.4.1

$P := 3435\ lbf$ Axial load on the Tstud™ is selected to result in a CSI of 1.0.

$f_a := \frac{P}{A_{net}} + \frac{M_{applied}}{A_m \cdot d_{eff}} = 1287\ psi$ Axial compressive stress, TER Equation 2

$f_a = 1287\ psi$ < $F_{cE} = 1686\ psi$ and < $F_c' = 1287\ psi$ **OK**

$CSI := \frac{f_a}{F_c'} = 1.000$

Check Deflection Limit for Tstud™:

$\Delta := \frac{5 \cdot \left(0.7\ w\right) \cdot h^4}{384 \cdot EI} = 0.356\ in$

$\frac{h}{\Delta} = 327$ > 240 **OK**

Summary of Design Calculations for Tstud™:

The Tstud™ has a calculated axial load capacity of 3435 lbs for an 10' tall wall with a 170 mph wind load. The axial load is limited by the compression strength of the Tstud™ member under combined axial and wind loading.