DrJ™ CERTIFICATION

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Technical Evaluation Report

TER 1908-03

BareNaked Tstud™ Structural Wall Studs, Columns, and Headers – Canada – Limit States Design

US Engineered Wood, Inc.

Product:

BareNaked Tstud™ Structural Wall Stud and BareNaked TStud™ Header

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COMPANY
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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 10 00 - Rough Carpentry

1 Product Evaluated[1]

1.1 BareNaked Tstud™ Structural Wall Stud and BareNaked Tstud™ Header

2 Applicable Codes and Standards[2,3]

2.1 *Codes*

2.1.1 *NBC—10, 15, 20: National Building Code of Canada*

2.1.2 *NECB—17, 20: National Energy Code of Canada for Buildings*

2.1.3 *O Reg. 332/12: Ontario Building Code (OBC)*[4]

2.2 *Standards and Referenced Documents*

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

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

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

2.2.4 *CSA O86: Engineering Design in Wood*

[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 2020 version of the *NBC*. References to CSA O86 are to the 2019 version with the 2014 references per the 2020 *NBC* footnoted. This *alternative solution* is also approved for use with the 2010 and 2015 *NBC* and the standards referenced therein.

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

[4] References in this TER to the National Building Code of Canada (*NBC*) apply to the Ontario Building Code (*OBC*), unless noted otherwise.

3 Performance Evaluation

3.1 BareNaked Tstud™ was evaluated for the following:

3.1.1 Use as an alternative material where 2x4 (38 mm x 89 mm) and 2x6 (38 mm x 140 mm) solid sawn lumber is specified in accordance with the *NBC* for use as wall studs, top plates, and bottom plates.

3.1.2 Use as an alternative solution to that described in *NBC* Division B Part 4, in particular, compliance with requirements for the design and construction of wood-based products as described in *NBC* Subsection 4.1.3 for limit states design (LSD).

3.1.3 Structural performance under lateral load conditions (wind and seismic) for use with the *CSA O86* performance-based provisions, *CSA O86* Section 11.3 and Subsection 11.6.2[5], for light-frame shearwalls.

3.1.3.1 Table 13 provides seismic design coefficients (SDC) that conform to the requirements in *NBC* Division B Subsection 4.1.8 for design of wall assemblies in buildings that require seismic design in accordance with *NBC*.

3.1.3.2 The basis for equivalency testing is outlined in Sentence 4.1.8.9.(5) of *NBC*:

> If it can be demonstrated through testing, research and analysis that the seismic performance of a structural system is at least equivalent to one of the types of SFRS mentioned in Table 4.1.8.9., then such structural system will qualify for values of Rd and Ro corresponding to the equivalent type in that Table. (See Note A-4.1.8.9.(5)).

3.1.4 Compliance with *NBC* Section 4.1, *CSA O86* per *NBC* Subsection 4.3.1 and *NBC* Section 9.23 for wood frame construction applications.

3.1.5 Use as an alternative material and method of construction in compliance with *NBC* Article 1.2.1.1.

3.1.6 Use as built-up columns in accordance with *CSA O86* Article 6.5.5.4[6].

3.1.7 Use as headers in accordance with *CSA O86* Article 6.5.3.2.4[7].

3.2 BareNaked Tstud™ testing and analysis was conducted to determine its flexural strength and stiffness.

3.3 When used in an application that exceeds the limits of *NBC* Section 4.1 or *NBC* Section 9.23, an engineered design shall be submitted in accordance with *NBC* Volume 1 commentary on Conformity Assessment and this TER.

3.4 The insulation used with BareNaked Tstud™ is outside the scope of this TER.

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

3.6 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

3.7 Douglas Consultants Inc. has collaborated with DrJ through the review of this technical evaluation.

[5] 2014 *CSA O86* Clause 11.5.1

[6] 2014 *CSA O86* Article 6.5.6.4

[7] 2014 *CSA O86* Article 6.5.4.2.2

4 Product Description and Materials

4.1 The product evaluated in this TER is shown in Figure 1 and Figure 2.

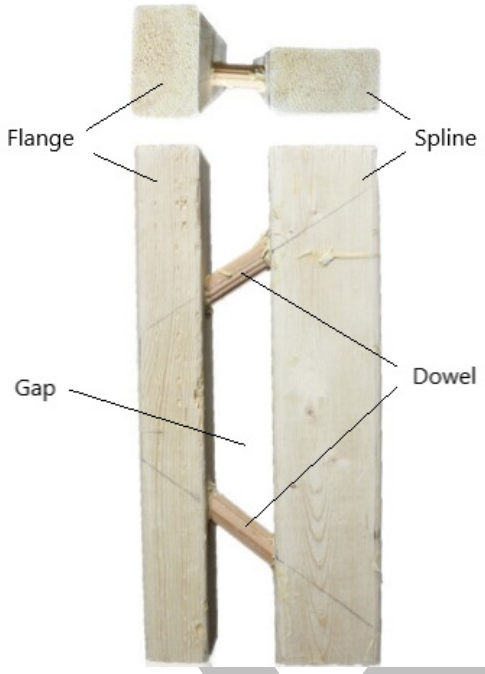

Figure 1. BareNaked Tstud™

Figure 2. BareNaked Tstud™ Label

4.2 BareNaked Tstud™ has two available depths, 140 mm (5.5") and 185 mm (7.25").

4.3 The BareNaked Tstud™ is made from a minimum of No. 2 Spruce Pine Fir (SPF) lumber and wooden dowels.

4.4 The BareNaked Tstud™ is composed of two sawn lumber members (flange and spline) with wooden dowel connectors between the members. The sawn lumber members are either 2" x 3" (38 x 64 mm) or 2" x 4" (38 x 90 mm).

4.5 The overall sizes of BareNaked Tstud™ are as follows.

4.5.1 64 x 140 mm (2½″ x 5½″) (2x3 spline and 2x3 flange)

4.5.2 64 x 185 mm (2½″ x 7¼″) (2x4 spline and 2x3 flange)

4.5.3 90 x 185 mm (3½″ x 7¼″) (2x4 spline and 2x4 flange)

4.6 The flange and spline are oriented perpendicular to one another to form an L-shape. The dowels are connected to the flange and spline with adhesive.

4.7 Dowels are spaced evenly at a distance not to exceed 165 mm (6½") on center and glued in place using an adhesive that conforms to the specifications of *ASTM D2559*.

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

4.9 The BareNaked Tstud™ can used as a built-up column when back-to-back BareNaked Tstud™ are nailed together as specified in Section 5.2.8.

4.10 The BareNaked Tstud™ headers consist of two BareNaked Tstud™ members glued together to form a box section. Headers are shipped from the manufacturer glued together and filled with foam, as shown in Figure 3. In order to obtain the properties and loading in the TER, the headers shall be installed as received from the manufacturer. Field gluing of BareNaked Tstud™ for use as headers is not permitted.

Figure 3. BareNaked Tstud™ Header

4.11 *Minimum Materials*

4.11.1 *Lumber:*

4.11.1.1 Grade & Species: No. 2 SPF

4.11.1.2 Thickness: 38 mm (1½")

4.11.1.3 Width: 64 mm (2½") or 90 mm (3½")

4.11.1.4 Length: up to 4.3 m (16')

4.11.2 *Dowels:*

4.11.2.1 Grade & Species: No. 2 SPF

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

5 Applications

5.1 *Prescriptive Provisions*

5.1.1 BareNaked Tstud™ is an alternative to solid sawn 2x4 (38 x 90 mm) lumber for wall structural members.

5.1.1.1 For use as a 2x6 (38 x 140 mm), 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 *NBC* Section 4.1 and *CSA O86* per *NBC* Subsection 4.3.1.

5.1.2 BareNaked Tstud™ used as wall framing members shall be fastened as specified in Table 1.

Table 1. Acceptable Fastening Schedule for BareNaked Tstud™

Application[1,5]	Fastening	Number & Type of Fastener[2,3]	Installation[4]
Ceiling joists to top plate	Toe nail	3 (4″ x 0.131″)	Fasten two (2) toe nails into interior flange/spline and one (1) toe nail into exterior flange/spline per joist
Rafter or roof truss to plate	Toe nail	3 (3½″ x 0.135″)	Two (2) toe nails on one side and one (1) toe nail on opposite side of each rafter or truss
		4 (4″ x 0.131″)	Fasten two (2) toe nails into interior flange/spline and two (2) toe nails into exterior flange/spline
Stud to stud[4]	Face nail through spline	2 (3" x 0.131")	Fasten two (2) face nails, one (1) into each flange/spline, spaced 400 mm (16") o.c.
	Face nail through 2x3 flange	2 (3½″ x 0.131″)	
	Face nail through 2x4 flange	2 (4½" x 0.131")	
Abutting studs at intersecting wall corners	Face nail through spline	(3" x 0.131")	Fasten one (1) face nail into exterior-facing flange/spline spaced 300 mm (12") o.c.
	Face nail through 2x3 flange	(3½" x 0.131")	
	Face nail through 2x4 flange	(4½″ x 0.131″)	
Double top plate splice	Face nail in lapped area through spline or 2x lumber	12 (3″ x 0.131″)	Fasten twelve (12) face nails on each side of end joint [minimum 600 mm (24″) lap splice length each side of joint]
	Face nail in lapped area through 2x3 flange	12 (3½" x 0.131")	
	Face nail in lapped area through 2x4 flange	12 (4½" x 0.131")	
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 flange/spline)
Plate to stud	End nail into stud through spline or 2x lumber	3 (3″ x 0.131″)	Fasten two (2) nails into the flange and one (1) nail into the spline
		2 (3½″ x 0.162″)	Fasten two (2) nails, one (1) into each flange/spline
	End nail into stud through 2x3 flange	3 (3½″ x 0.131″)	Fasten two (2) nails into the flange and one (1) nail into the spline
		2 (3½″ x 0.162″)	Fasten two (2) nails, one (1) into each flange/spline
	End nail into stud through 2x4 flange	3 (4½″ x 0.131″)	Fasten two (2) nails into the flange and one (1) nail into the spline
		2 (4½″ x 0.162″)	Fasten two (2) nails, one (1) into each flange/spline
Top plates, laps at corners and intersections	Face nail through spline	2 (3½" x 0.162")	Fasten two (2) face nails, one (1) into each flange/spline
Rim joist to sill or top plate	Toe nail	(2½″ x 0.113″)	100 mm (4") o.c. toe nail
		(2½″ x 0.131″)	150 mm (6") o.c. toe nail

Application[1,5]	Fastening	Number & Type of Fastener[2,3]	Installation[4]

SI: 1 in. = 25.4 mm

1. See Figure 1 for spline and flange orientations. Spline and flange sizes vary depending on the stud depth (see Section 4.5).
2. #6 wood screws are permitted in place of 0.113" diameter nails. #8 wood screws are permitted in place of 0.131" and 0.135" diameter nails. #10 wood screws are permitted in place of 0.162" diameter nails. The screws must be of equal or greater length.
3. Fastener diameter conversions: 0.113" = 2.9 mm, 0.131" = 3.3 mm, 0.135" = 3.4 mm, 0.162" = 4.1 mm
4. Care must be taken to avoid splitting.
5. When used as built-up column for strength, installation must be in accordance with Section 5.2.8.

5.1.3 BareNaked Tstud™ may be used as a single top plate in accordance with *NBC* Division B Article 9.23.11.3 and the following:

5.1.3.1 Fasteners for BareNaked Tstud™ connections shall be distributed in each BareNaked Tstud™ flange and spline (top plate to stud connections shall be fastened as specified in Table 1).

5.1.3.2 Where BareNaked Tstud™ is used as a top plate, a separate means of fire-blocking shall be provided in accordance with Section 9.4.

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

5.1.4.1 Install cripple studs between the bottom plate and rough sill using three (3) 4" x 0.131" (3.3 mm) nails, one (1) into the spline and two (2) into the flange.

5.1.5 Structural sheathing shall be installed on one side of the wall and fastened in accordance with the applicable building code.

5.1.5.1 Where load bearing interior walls are not finished in accordance with *NBC* Division B Section 9.29, blocking or strapping shall be fastened at mid-height in accordance with *NBCS* Division B Article 9.23.10.2.

5.1.5.2 For trusses and rafters placed on BareNaked Tstud™ wall studs, see Table 3 for 5.5" BareNaked Tstud™ and Table 4 for 7.25" BareNaked Tstud™ design values.

5.2 *Engineered Design*

5.2.1 The design provisions for wood construction noted in *NBC* Division B Subsection 4.1.3 apply to BareNaked Tstud™ for LSD, unless otherwise noted in this TER.

5.2.2 Design of connections using BareNaked Tstud™ shall be in accordance with *CSA O86*.

5.2.3 *Material Properties:*

5.2.3.1 Specified design values for BareNaked Tstud™ are provided in Table 2.

5.2.3.1.1 Specified design values for BareNaked Tstud™ shall be multiplied by the adjustment factors in *CSA O86* Subsection 15.3.2 and Section 6.4.

Table 2. BareNaked Tstud™ Specified Design Values for LSD[1]

Specified Design Value	5.5" BareNaked Tstud™	7.25" BareNaked Tstud™
Specified Bending, f_bS	1,650 N-m (1,220 lb-ft)	2,440 N-m (1,800 lb-ft)
Specified Compression Parallel to Grain, f_c	11.5 MPa (1,665 psi)	11.5 MPa (1,665 psi)
Specified Tension Parallel to Grain, f_t	5.5 MPa (795 psi)	5.5 MPa (795 psi)
Specified Compression Perpendicular to Grain, $f_{c\perp}$	5.3 MPa (765 psi)	5.3 MPa (765 psi)
Specified Shear Force, V	2,130 N (480 lb)	1,890 N (425 lb)
Bending Stiffness, EI	55,200 N-m^2 (19,300,000 lb-in^2)	107,800 N-m^2 (37,100,000 lb-in^2)
Bending Stiffness for Beam and Column Stability, EI_{05}	48,100 N-m^2 (16,800,000 lb-in^2)	92,700 N-m^2 (32,300,000 lb-in^2)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. BareNaked Tstud™ made from No. 2 SPF.

5.2.4 *Design for Compression Loads:*

5.2.4.1 The maximum factored compressive load for walls framed with BareNaked Tstud™ is defined in Table 3.

5.2.4.2 The maximum factored compressive load is based on the minimum of perpendicular-to-grain crushing of SPF top and bottom plates and of compression parallel to grain of the BareNaked Tstud™.

5.2.4.3 The factored compressive resistance parallel to grain for BareNaked Tstud™ can be calculated using the provisions of *CSA O86* Article 15.3.3.4.

5.2.4.4 The factored compressive resistance parallel to grain, P_r, shall be computed using Equation 1.

Equation 1. Factored Compressive Resistance Parallel to Grain

$$P_r = \varphi F_c A K_C K_{Zc}$$

Where: F_c = factored strength in compression parallel to grain (MPa)

A = minimum net section area of BareNaked Tstud™ (mm^2)
= (38 mm x 63.5 mm) + ((38 mm – 17.5 mm) x 63.5 mm) = 3,715 mm^2

K_c = Slenderness factor

K_{zc} = Size factor for compression parallel to grain (1.0)

5.2.4.5 For computing stability, the Euler buckling load in the plane of the applied moment, P_E, shall be computed using Equation 2.

Equation 2. Buckling Load

$$P_E = \frac{\pi E_{05} K_{SE} K_T I}{L_e^2}$$

Where: E_{05} = Modulus of elasticity for design of compression members

K_{SE} = Service condition factor for MOE

K_T = Treatment factor

I = Moment of inertia

L_e = effective length = K_e x h

Table 3. Maximum Factored Compressive Load for Walls Framed with 5.5" BareNaked Tstud™ [1,2]

Stud Height m (ft)	Factored Compressive Load, kN (lb)			
	Top/Bottom Plate[3]			
	BareNaked Tstud™ (SPF, G = 0.42)	2100F_b - 1.8E SPF	LVL	LSL
2.43 (8)	23.1 (5193)	25.5 (5735)	24.7 (5555)	24.1 (5420)
2.74 (9)	22.9 (5148)	22.9 (5150)	22.9 (5150)	22.9 (5150)
3.05 (10)	20.3 (4564)	20.3 (4565)	20.3 (4565)	20.3 (4565)
3.35 (11)	17.9 (4024)	17.9 (4025)	17.9 (4025)	17.9 (4025)
3.66 (12)	15.6 (3507)	15.6 (3505)	15.6 (3505)	15.6 (3505)
3.96 (13)	13.5 (3035)	13.5 (3035)	13.5 (3035)	13.5 (3035)
4.27 (14)	11.7 (2630)	11.7 (2630)	11.7 (2630)	11.7 (2630)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Maximum stud spacing of 610 mm (24").
2. Specified compression perpendicular-to-grain strength is 5.3 MPa for SPF (per *CSA O86* Table 6.3.1A), 6.5 MPa for 2100F_b – 1.8E SPF (per *CSA O86* Table 6.3.1A), 5.7 MPa for LVL, and 5.5 MPa for LSL.
3. For plates having a lower specified strength for compression perpendicular to grain, an engineered design is required.

Table 4. Maximum Factored Compressive Load for Walls Framed with 7.25" BareNaked Tstud™ [1,2]

Stud Height m (ft)	Factored Compressive Load, kN (lb)			
	Top/Bottom Plate[3]			
	BareNaked Tstud™ (SPF, G = 0.42)	2100F_b - 1.8E SPF	LVL	LSL
2.43 (8)	27.8 (6250)	33.5 (7530)	29.9 (6720)	28.8 (6475)
2.74 (9)	27.8 (6250)	31.5 (7080)	29.9 (6720)	28.8 (6475)
3.05 (10)	27.8 (6250)	29.3 (6585)	29.3 (6585)	28.8 (6475)
3.35 (11)	27.0 (6070)	27.0 (6070)	27.0 (6070)	27.0 (6070)
3.66 (12)	24.7 (5553)	24.7 (5555)	24.7 (5555)	24.7 (5555)
3.96 (13)	22.4 (5036)	22.4 (5035)	22.4 (5035)	22.4 (5035)
4.27 (14)	20.1 (4519)	20.1 (4520)	20.1 (4520)	20.1 (4520)
4.57 (15)	18.1 (4069)	18.1 (4070)	18.1 (4070)	18.1 (4070)
4.88 (16)	16.2 (3642)	16.2 (3640)	16.2 (3640)	16.2 (3640)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Maximum stud spacing of 610 mm (24").
2. Specified compression perpendicular-to-grain strength is 5.3 MPa for SPF (per *CSA O86* Table 6.3.1A), 6.5 MPa for 2100F_b – 1.8E SPF (per *CSA O86* Table 6.3.1A), 5.7 MPa for LVL, and 5.5 MPa for LSL.
3. For plates having a lower specified strength for compression perpendicular to grain, an engineered design is required.

5.2.5 *Design for Bending:*

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

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

5.2.6.1 The BareNaked Tstud™ resists bending using tension and compression stresses in the flange and spline.

5.2.6.2 The resistance to combined bending and axial loads can be computed using Equation 3. As an example, variables for the design of the 5.5" BareNaked Tstud™ are defined below Equation 3.

Equation 3. Combined Bending and Axial Load Resistance

$$\left(\frac{P_f}{P_r}\right)^2 + \frac{M_f}{M_r}\left[\frac{1}{1-\frac{P_f}{P_E}}\right] \leq 1$$

Where: P_f = factored compressive axial load applied to BareNaked Tstud™ (N)

P_r = factored compressive resistance parallel to grain of BareNaked Tstud™ (N)

M_f = factored bending moment applied to BareNaked Tstud™ (N-m)

M_r = factored bending moment resistance of BareNaked Tstud™ (N-m)

P_E = Euler buckling load (N)

5.2.6.3 The axial loads in BareNaked Tstud™ member shall be checked in accordance with *CSA O86* Article 15.3.3.4 and Article 15.3.3.6.

5.2.6.4 Equation 3 includes a check to ensure that the factored bending moment of the BareNaked Tstud™ is not exceeded.

5.2.6.5 Factored axial loads and deflection ratios for BareNaked Tstud™ stud walls subject to axial loads are specified in the following tables:

5.2.6.5.1 5.5" BareNaked Tstud™

5.2.6.5.1.1 SPF top and bottom plates: Table 5

5.2.6.5.1.2 MSR top and bottom plates: Table 6

5.2.6.5.1.3 LVL top and bottom plates: Table 7

5.2.6.5.1.4 LSL top and bottom plates: Table 8

5.2.6.5.2 7.25" BareNaked Tstud™

5.2.6.5.2.1 SPF top and bottom plates: Table 9

5.2.6.5.2.2 MSR top and bottom plates: Table 10

5.2.6.5.2.3 LVL top and bottom plates: Table 11

5.2.6.5.2.4 LSL top and bottom plates: Table 12

Table 5. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(5.5" BareNaked Tstud™ with SPF Top/Bottom Plates)[1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	23.1 (L/4825)	23.1 (L/2496)	22.7 (L/1683)	21.8 (L/1281)	20.9 (L/1027)	20.0 (L/856)	19.1 (L/735)	18.2 (L/646)	17.3 (L/574)	16.3 (L/517)
	2.74 (9)	21.7 (L/3341)	20.5 (L/1728)	19.3 (L/1166)	18.2 (L/887)	17.0 (L/711)	15.9 (L/593)	14.7 (L/509)	13.5 (L/448)	12.4 (L/398)	11.2 (L/358)
	3.05 (10)	18.8 (L/2409)	17.3 (L/1246)	15.9 (L/840)	14.4 (L/640)	13.0 (L/513)	11.5 (L/428)	10.1 (L/367)	8.7 (L/323)	7.2 (L/287)	5.7 (L/258)
	3.66 (12)	13.3 (L/1371)	11.1 (L/709)	9.0 (L/478)	7.0 (L/364)	4.8 (L/292)	2.7 (L/243)	0.6 (L/209)	--	--	--
	4.27 (14)	8.5 (L/853)	5.6 (L/441)	2.7 (L/298)	--	--	--	--	--	--	--
400 (16)	2.44 (8)	23.1 (L/3619)	23.0 (L/1872)	21.8 (L/1262)	20.6 (L/961)	19.4 (L/770)	18.1 (L/642)	16.9 (L/551)	15.7 (L/485)	14.5 (L/431)	13.3 (L/388)
	2.74 (9)	21.3 (L/2506)	19.7 (L/1296)	18.1 (L/874)	16.6 (L/665)	15.1 (L/533)	13.5 (L/445)	11.9 (L/382)	10.4 (L/336)	8.8 (L/298)	7.3 (L/269)
	3.05 (10)	18.3 (L/1807)	16.3 (L/934)	14.4 (L/630)	12.5 (L/480)	10.5 (L/384)	8.6 (L/321)	6.6 (L/275)	4.8 (L/242)	2.8 (L/215)	0.9 (L/194)
	3.66 (12)	12.5 (L/1028)	9.7 (L/532)	6.8 (L/359)	4.1 (L/273)	1.3 (L/219)	--	--	--	--	--
	4.27 (14)	7.5 (L/640)	3.6 (L/331)	--	--	--	--	--	--	--	--
600 (24)	2.44 (8)	23.1 (L/2412)	21.7 (L/1248)	19.9 (L/842)	18.1 (L/640)	16.3 (L/513)	14.4 (L/428)	12.6 (L/367)	10.8 (L/323)	9.0 (L/287)	7.1 (L/258)
	2.74 (9)	20.4 (L/1671)	18.1 (L/864)	15.7 (L/583)	13.5 (L/444)	11.1 (L/355)	8.8 (L/297)	6.4 (L/254)	4.1 (L/224)	1.8 (L/199)	--
	3.05 (10)	17.2 (L/1204)	14.3 (L/623)	11.4 (L/420)	8.5 (L/320)	5.6 (L/256)	2.7 (L/214)	--	--	--	--
	3.66 (12)	11.0 (L/686)	6.7 (L/355)	2.5 (L/239)	--	--	--	--	--	--	--
	4.27 (14)	5.4 (L/427)	--	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 6. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures (5.5" BareNaked Tstud™ with MSR Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	24.6 (L/4825)	23.6 (L/2496)	22.7 (L/1683)	21.8 (L/1281)	20.9 (L/1027)	20.0 (L/856)	19.1 (L/735)	18.2 (L/646)	17.3 (L/574)	16.3 (L/517)
	2.74 (9)	21.7 (L/3341)	20.5 (L/1728)	19.3 (L/1166)	18.2 (L/887)	17.0 (L/711)	15.9 (L/593)	14.7 (L/509)	13.5 (L/448)	12.4 (L/398)	11.2 (L/358)
	3.05 (10)	18.8 (L/2409)	17.3 (L/1246)	15.9 (L/840)	14.4 (L/640)	13.0 (L/513)	11.5 (L/428)	10.1 (L/367)	8.7 (L/323)	7.2 (L/287)	5.7 (L/258)
	3.66 (12)	13.3 (L/1371)	11.1 (L/709)	9.0 (L/478)	7.0 (L/364)	4.8 (L/292)	2.7 (L/243)	0.6 (L/209)	--	--	--
	4.27 (14)	8.5 (L/853)	5.6 (L/441)	2.7 (L/298)	--	--	--	--	--	--	--
400 (16)	2.44 (8)	24.2 (L/3619)	23.0 (L/1872)	21.8 (L/1262)	20.6 (L/961)	19.4 (L/770)	18.1 (L/642)	16.9 (L/551)	15.7 (L/485)	14.5 (L/431)	13.3 (L/388)
	2.74 (9)	21.3 (L/2506)	19.7 (L/1296)	18.1 (L/874)	16.6 (L/665)	15.1 (L/533)	13.5 (L/445)	11.9 (L/382)	10.4 (L/336)	8.8 (L/298)	7.3 (L/269)
	3.05 (10)	18.3 (L/1807)	16.3 (L/934)	14.4 (L/630)	12.5 (L/480)	10.5 (L/384)	8.6 (L/321)	6.6 (L/275)	4.8 (L/242)	2.8 (L/215)	0.9 (L/194)
	3.66 (12)	12.5 (L/1028)	9.7 (L/532)	6.8 (L/359)	4.1 (L/273)	1.3 (L/219)	--	--	--	--	--
	4.27 (14)	7.5 (L/640)	3.6 (L/331)	--	--	--	--	--	--	--	--
600 (24)	2.44 (8)	23.6 (L/2412)	21.7 (L/1248)	19.9 (L/842)	18.1 (L/640)	16.3 (L/513)	14.4 (L/428)	12.6 (L/367)	10.8 (L/323)	9.0 (L/287)	7.1 (L/258)
	2.74 (9)	20.4 (L/1671)	18.1 (L/864)	15.7 (L/583)	13.5 (L/444)	11.1 (L/355)	8.8 (L/297)	6.4 (L/254)	4.1 (L/224)	1.8 (L/199)	--
	3.05 (10)	17.2 (L/1204)	14.3 (L/623)	11.4 (L/420)	8.5 (L/320)	5.6 (L/256)	2.7 (L/214)	--	--	--	--
	3.66 (12)	11.0 (L/686)	6.7 (L/355)	2.5 (L/239)	--	--	--	--	--	--	--
	4.27 (14)	5.4 (L/427)	--	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum $2100F_b$ – 1.8E SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 7. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(5.5" BareNaked Tstud™ with LVL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	24.6 (L/4825)	23.6 (L/2496)	22.7 (L/1683)	21.8 (L/1281)	20.9 (L/1027)	20.0 (L/856)	19.1 (L/735)	18.2 (L/646)	17.3 (L/574)	16.3 (L/517)
	2.74 (9)	21.7 (L/3341)	20.5 (L/1728)	19.3 (L/1166)	18.2 (L/887)	17.0 (L/711)	15.9 (L/593)	14.7 (L/509)	13.5 (L/448)	12.4 (L/398)	11.2 (L/358)
	3.05 (10)	18.8 (L/2409)	17.3 (L/1246)	15.9 (L/840)	14.4 (L/640)	13.0 (L/513)	11.5 (L/428)	10.1 (L/367)	8.7 (L/323)	7.2 (L/287)	5.7 (L/258)
	3.66 (12)	13.3 (L/1371)	11.1 (L/709)	9.0 (L/478)	7.0 (L/364)	4.8 (L/292)	2.7 (L/243)	0.6 (L/209)	--	--	--
	4.27 (14)	8.5 (L/853)	5.6 (L/441)	2.7 (L/298)	--	--	--	--	--	--	--
400 (16)	2.44 (8)	24.2 (L/3619)	23.0 (L/1872)	21.8 (L/1262)	20.6 (L/961)	19.4 (L/770)	18.1 (L/642)	16.9 (L/551)	15.7 (L/485)	14.5 (L/431)	13.3 (L/388)
	2.74 (9)	21.3 (L/2506)	19.7 (L/1296)	18.1 (L/874)	16.6 (L/665)	15.1 (L/533)	13.5 (L/445)	11.9 (L/382)	10.4 (L/336)	8.8 (L/298)	7.3 (L/269)
	3.05 (10)	18.3 (L/1807)	16.3 (L/934)	14.4 (L/630)	12.5 (L/480)	10.5 (L/384)	8.6 (L/321)	6.6 (L/275)	4.8 (L/242)	2.8 (L/215)	0.9 (L/194)
	3.66 (12)	12.5 (L/1028)	9.7 (L/532)	6.8 (L/359)	4.1 (L/273)	1.3 (L/219)	--	--	--	--	--
	4.27 (14)	7.5 (L/640)	3.6 (L/331)	--	--	--	--	--	--	--	--
600 (24)	2.44 (8)	23.6 (L/2412)	21.7 (L/1248)	19.9 (L/842)	18.1 (L/640)	16.3 (L/513)	14.4 (L/428)	12.6 (L/367)	10.8 (L/323)	9.0 (L/287)	7.1 (L/258)
	2.74 (9)	20.4 (L/1671)	18.1 (L/864)	15.7 (L/583)	13.5 (L/444)	11.1 (L/355)	8.8 (L/297)	6.4 (L/254)	4.1 (L/224)	1.8 (L/199)	--
	3.05 (10)	17.2 (L/1204)	14.3 (L/623)	11.4 (L/420)	8.5 (L/320)	5.6 (L/256)	2.7 (L/214)	--	--	--	--
	3.66 (12)	11.0 (L/686)	6.7 (L/355)	2.5 (L/239)	--	--	--	--	--	--	--
	4.27 (14)	5.4 (L/427)	--	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LVL (compression perpendicular to grain strength is 5.7 MPa) top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 8. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(5.5" BareNaked Tstud™ with LSL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	24.1 (L/4825)	23.6 (L/2496)	22.7 (L/1683)	21.8 (L/1281)	20.9 (L/1027)	20.0 (L/856)	19.1 (L/735)	18.2 (L/646)	17.3 (L/574)	16.3 (L/517)
	2.74 (9)	21.7 (L/3341)	20.5 (L/1728)	19.3 (L/1166)	18.2 (L/887)	17.0 (L/711)	15.9 (L/593)	14.7 (L/509)	13.5 (L/448)	12.4 (L/398)	11.2 (L/358)
	3.05 (10)	18.8 (L/2409)	17.3 (L/1246)	15.9 (L/840)	14.4 (L/640)	13.0 (L/513)	11.5 (L/428)	10.1 (L/367)	8.7 (L/323)	7.2 (L/287)	5.7 (L/258)
	3.66 (12)	13.3 (L/1371)	11.1 (L/709)	9.0 (L/478)	7.0 (L/364)	4.8 (L/292)	2.7 (L/243)	0.6 (L/209)	--	--	--
	4.27 (14)	8.5 (L/853)	5.6 (L/441)	2.7 (L/298)	--	--	--	--	--	--	--
400 (16)	2.44 (8)	24.1 (L/3619)	23 (L/1872)	21.8 (L/1262)	20.6 (L/961)	19.4 (L/770)	18.1 (L/642)	16.9 (L/551)	15.7 (L/485)	14.5 (L/431)	13.3 (L/388)
	2.74 (9)	21.3 (L/2506)	19.7 (L/1296)	18.1 (L/874)	16.6 (L/665)	15.1 (L/533)	13.5 (L/445)	11.9 (L/382)	10.4 (L/336)	8.8 (L/298)	7.3 (L/269)
	3.05 (10)	18.3 (L/1807)	16.3 (L/934)	14.4 (L/630)	12.5 (L/480)	10.5 (L/384)	8.6 (L/321)	6.6 (L/275)	4.8 (L/242)	2.8 (L/215)	0.9 (L/194)
	3.66 (12)	12.5 (L/1028)	9.7 (L/532)	6.8 (L/359)	4.1 (L/273)	1.3 (L/219)	--	--	--	--	--
	4.27 (14)	7.5 (L/640)	3.6 (L/331)	--	--	--	--	--	--	--	--
600 (24)	2.44 (8)	23.6 (L/2412)	21.7 (L/1248)	19.9 (L/842)	18.1 (L/640)	16.3 (L/513)	14.4 (L/428)	12.6 (L/367)	10.8 (L/323)	9.0 (L/287)	7.1 (L/258)
	2.74 (9)	20.4 (L/1671)	18.1 (L/864)	15.7 (L/583)	13.5 (L/444)	11.1 (L/355)	8.8 (L/297)	6.4 (L/254)	4.1 (L/224)	1.8 (L/199)	--
	3.05 (10)	17.2 (L/1204)	14.3 (L/623)	11.4 (L/420)	8.5 (L/320)	5.6 (L/256)	2.7 (L/214)	--	--	--	--
	3.66 (12)	11.0 (L/686)	6.7 (L/355)	2.5 (L/239)	--	--	--	--	--	--	--
	4.27 (14)	5.4 (L/427)	--	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LSL (compression perpendicular to grain strength is 5.5 MPa) top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 9. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(7.25" BareNaked Tstud™ with SPF Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	27.8 (L/9422)	27.8 (L/4874)	27.8 (L/3287)	27.8 (L/2501)	27.8 (L/2005)	27.8 (L/1673)	27.8 (L/1435)	27.8 (L/1262)	27.4 (L/1122)	26.7 (L/1010)
	2.74 (9)	27.8 (L/6526)	27.8 (L/3375)	27.8 (L/2276)	27.8 (L/1732)	27.2 (L/1388)	26.3 (L/1158)	25.4 (L/994)	24.6 (L/874)	23.7 (L/777)	22.9 (L/699)
	3.05 (10)	27.8 (L/4704)	27.1 (L/2433)	26.0 (L/1641)	25.0 (L/1249)	23.9 (L/1001)	22.8 (L/835)	21.7 (L/716)	20.7 (L/630)	19.6 (L/560)	18.6 (L/504)
	3.66 (12)	23 (L/2678)	21.4 (L/1385)	19.8 (L/934)	18.3 (L/711)	16.8 (L/570)	15.2 (L/475)	13.6 (L/408)	12.1 (L/359)	10.5 (L/319)	9.0 (L/287)
	4.27 (14)	17.8 (L/1666)	15.7 (L/862)	13.5 (L/581)	11.5 (L/442)	9.3 (L/355)	7.2 (L/296)	5.0 (L/254)	2.9 (L/223)	0.8 (L/198)	--
	4.88 (16)	13.2 (L/1106)	10.3 (L/572)	7.5 (L/386)	4.8 (L/294)	1.9 (L/235)	--	--	--	--	--
400 (16)	2.44 (8)	27.8 (L/7067)	27.8 (L/3655)	27.8 (L/2465)	27.8 (L/1876)	27.8 (L/1504)	27.8 (L/1254)	27.2 (L/1076)	26.3 (L/946)	25.4 (L/841)	24.5 (L/757)
	2.74 (9)	27.8 (L/4894)	27.8 (L/2531)	27.8 (L/1707)	26.9 (L/1299)	25.7 (L/1041)	24.6 (L/869)	23.4 (L/745)	22.3 (L/655)	21.1 (L/583)	20.0 (L/524)
	3.05 (10)	27.8 (L/3528)	26.4 (L/1825)	24.9 (L/1231)	23.5 (L/937)	22.1 (L/751)	20.7 (L/626)	19.2 (L/537)	17.8 (L/473)	16.4 (L/420)	15.0 (L/378)
	3.66 (12)	22.4 (L/2008)	20.3 (L/1039)	18.2 (L/701)	16.2 (L/533)	14.1 (L/427)	12.0 (L/356)	10.0 (L/306)	7.9 (L/269)	5.8 (L/239)	3.8 (L/215)
	4.27 (14)	17.1 (L/1250)	14.2 (L/646)	11.3 (L/436)	8.6 (L/332)	5.7 (L/266)	2.8 (L/222)	--	--	--	--
	4.88 (16)	12.1 (L/830)	8.4 (L/429)	4.6 (L/289)	1.0 (L/220)	--	--	--	--	--	--
600 (24)	2.44 (8)	27.8 (L/4711)	27.8 (L/2437)	27.8 (L/1643)	27.8 (L/1251)	26.7 (L/1002)	25.3 (L/836)	24.0 (L/717)	22.7 (L/631)	21.3 (L/561)	20.0 (L/505)
	2.74 (9)	27.8 (L/3263)	27.8 (L/1688)	26.2 (L/1138)	24.5 (L/866)	22.8 (L/694)	21.1 (L/579)	19.3 (L/497)	17.7 (L/437)	15.9 (L/388)	14.2 (L/350)
	3.05 (10)	27 (L/2352)	24.9 (L/1217)	22.7 (L/821)	20.6 (L/624)	18.5 (L/500)	16.3 (L/418)	14.2 (L/358)	12.1 (L/315)	9.9 (L/280)	7.8 (L/252)
	3.66 (12)	21.3 (L/1339)	18.2 (L/692)	15.0 (L/467)	12.0 (L/355)	8.9 (L/285)	5.7 (L/238)	2.6 (L/204)	--	--	--
	4.27 (14)	15.5 (L/833)	11.2 (L/431)	6.9 (L/291)	2.8 (L/221)	--	--	--	--	--	--
	4.88 (16)	10.1 (L/553)	4.5 (L/286)	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 10. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(7.25" BareNaked Tstud™ with MSR Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	32.8 (L/9422)	32.1 (L/4874)	31.4 (L/3287)	30.8 (L/2501)	30.1 (L/2005)	29.4 (L/1673)	28.8 (L/1435)	28.1 (L/1262)	27.4 (L/1122)	26.7 (L/1010)
	2.74 (9)	30.6 (L/6526)	29.7 (L/3375)	28.9 (L/2276)	28.0 (L/1732)	27.2 (L/1388)	26.3 (L/1158)	25.4 (L/994)	24.6 (L/874)	23.7 (L/777)	22.9 (L/699)
	3.05 (10)	28.2 (L/4704)	27.1 (L/2433)	26 (L/1641)	25.0 (L/1249)	23.9 (L/1001)	22.8 (L/835)	21.7 (L/716)	20.7 (L/630)	19.6 (L/560)	18.6 (L/504)
	3.66 (12)	23 (L/2678)	21.4 (L/1385)	19.8 (L/934)	18.3 (L/711)	16.8 (L/570)	15.2 (L/475)	13.6 (L/408)	12.1 (L/359)	10.5 (L/319)	9.0 (L/287)
	4.27 (14)	17.8 (L/1666)	15.7 (L/862)	13.5 (L/581)	11.5 (L/442)	9.3 (L/355)	7.2 (L/296)	5.0 (L/254)	2.9 (L/223)	0.8 (L/198)	--
	4.88 (16)	13.2 (L/1106)	10.3 (L/572)	7.5 (L/386)	4.8 (L/294)	1.9 (L/235)	--	--	--	--	--
400 (16)	2.44 (8)	32.6 (L/7067)	31.6 (L/3655)	30.7 (L/2465)	29.9 (L/1876)	29 (L/1504)	28.1 (L/1254)	27.2 (L/1076)	26.3 (L/946)	25.4 (L/841)	24.5 (L/757)
	2.74 (9)	30.3 (L/4894)	29.1 (L/2531)	28 (L/1707)	26.9 (L/1299)	25.7 (L/1041)	24.6 (L/869)	23.4 (L/745)	22.3 (L/655)	21.1 (L/583)	20.0 (L/524)
	3.05 (10)	27.8 (L/3528)	26.4 (L/1825)	24.9 (L/1231)	23.5 (L/937)	22.1 (L/751)	20.7 (L/626)	19.2 (L/537)	17.8 (L/473)	16.4 (L/420)	15.0 (L/378)
	3.66 (12)	22.4 (L/2008)	20.3 (L/1039)	18.2 (L/701)	16.2 (L/533)	14.1 (L/427)	12 (L/356)	10.0 (L/306)	7.9 (L/269)	5.8 (L/239)	3.8 (L/215)
	4.27 (14)	17.1 (L/1250)	14.2 (L/646)	11.3 (L/436)	8.6 (L/332)	5.7 (L/266)	2.8 (L/222)	0.0 (L/190)	--	--	--
	4.88 (16)	12.1 (L/830)	8.4 (L/429)	4.6 (L/289)	1.0 (L/220)	--	--	--	--	--	--
600 (24)	2.44 (8)	32.1 (L/4711)	30.7 (L/2437)	29.4 (L/1643)	28 (L/1251)	26.7 (L/1002)	25.3 (L/836)	24.0 (L/717)	22.7 (L/631)	21.3 (L/561)	20.0 (L/505)
	2.74 (9)	29.7 (L/3263)	27.9 (L/1688)	26.2 (L/1138)	24.5 (L/866)	22.8 (L/694)	21.1 (L/579)	19.3 (L/497)	17.7 (L/437)	15.9 (L/388)	14.2 (L/350)
	3.05 (10)	27 (L/2352)	24.9 (L/1217)	22.7 (L/821)	20.6 (L/624)	18.5 (L/500)	16.3 (L/418)	14.2 (L/358)	12.1 (L/315)	9.9 (L/280)	7.8 (L/252)
	3.66 (12)	21.3 (L/1339)	18.2 (L/692)	15.0 (L/467)	12.0 (L/355)	8.9 (L/285)	5.7 (L/238)	2.6 (L/204)	--	--	--
	4.27 (14)	15.5 (L/833)	11.2 (L/431)	6.9 (L/291)	2.8 (L/221)	--	--	--	--	--	--
	4.88 (16)	10.1 (L/553)	4.5 (L/286)	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum $2100F_b$ – 1.8E SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 11. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(7.25" BareNaked Tstud™ with LVL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	29.9 (L/9422)	29.9 (L/4874)	29.9 (L/3287)	29.9 (L/2501)	29.9 (L/2005)	29.4 (L/1673)	28.8 (L/1435)	28.1 (L/1262)	27.4 (L/1122)	26.7 (L/1010)
	2.74 (9)	29.9 (L/6526)	29.7 (L/3375)	28.9 (L/2276)	28 (L/1732)	27.2 (L/1388)	26.3 (L/1158)	25.4 (L/994)	24.6 (L/874)	23.7 (L/777)	22.9 (L/699)
	3.05 (10)	28.2 (L/4704)	27.1 (L/2433)	26 (L/1641)	25 (L/1249)	23.9 (L/1001)	22.8 (L/835)	21.7 (L/716)	20.7 (L/630)	19.6 (L/560)	18.6 (L/504)
	3.66 (12)	23 (L/2678)	21.4 (L/1385)	19.8 (L/934)	18.3 (L/711)	16.8 (L/570)	15.2 (L/475)	13.6 (L/408)	12.1 (L/359)	10.5 (L/319)	9.0 (L/287)
	4.27 (14)	17.8 (L/1666)	15.7 (L/862)	13.5 (L/581)	11.5 (L/442)	9.3 (L/355)	7.2 (L/296)	5.0 (L/254)	2.9 (L/223)	0.8 (L/198)	--
	4.88 (16)	13.2 (L/1106)	10.3 (L/572)	7.5 (L/386)	4.8 (L/294)	1.9 (L/235)	--	--	--	--	--
400 (16)	2.44 (8)	29.9 (L/7067)	29.9 (L/3655)	29.9 (L/2465)	29.9 (L/1876)	29.0 (L/1504)	28.1 (L/1254)	27.2 (L/1076)	26.3 (L/946)	25.4 (L/841)	24.5 (L/757)
	2.74 (9)	29.9 (L/4894)	29.1 (L/2531)	28 (L/1707)	26.9 (L/1299)	25.7 (L/1041)	24.6 (L/869)	23.4 (L/745)	22.3 (L/655)	21.1 (L/583)	20.0 (L/524)
	3.05 (10)	27.8 (L/3528)	26.4 (L/1825)	24.9 (L/1231)	23.5 (L/937)	22.1 (L/751)	20.7 (L/626)	19.2 (L/537)	17.8 (L/473)	16.4 (L/420)	15.0 (L/378)
	3.66 (12)	22.4 (L/2008)	20.3 (L/1039)	18.2 (L/701)	16.2 (L/533)	14.1 (L/427)	12.0 (L/356)	10.0 (L/306)	7.9 (L/269)	5.8 (L/239)	3.8 (L/215)
	4.27 (14)	17.1 (L/1250)	14.2 (L/646)	11.3 (L/436)	8.6 (L/332)	5.7 (L/266)	2.8 (L/222)	--	--	--	--
	4.88 (16)	12.1 (L/830)	8.4 (L/429)	4.6 (L/289)	1.0 (L/220)	--	--	--	--	--	--
600 (24)	2.44 (8)	29.9 (L/4711)	29.9 (L/2437)	29.4 (L/1643)	28 (L/1251)	26.7 (L/1002)	25.3 (L/836)	24.0 (L/717)	22.7 (L/631)	21.3 (L/561)	20.0 (L/505)
	2.74 (9)	29.7 (L/3263)	27.9 (L/1688)	26.2 (L/1138)	24.5 (L/866)	22.8 (L/694)	21.1 (L/579)	19.3 (L/497)	17.7 (L/437)	15.9 (L/388)	14.2 (L/350)
	3.05 (10)	27 (L/2352)	24.9 (L/1217)	22.7 (L/821)	20.6 (L/624)	18.5 (L/500)	16.3 (L/418)	14.2 (L/358)	12.1 (L/315)	9.9 (L/280)	7.8 (L/252)
	3.66 (12)	21.3 (L/1339)	18.2 (L/692)	15.0 (L/467)	12.0 (L/355)	8.9 (L/285)	5.7 (L/238)	2.6 (L/204)	--	--	--
	4.27 (14)	15.5 (L/833)	11.2 (L/431)	6.9 (L/291)	2.8 (L/221)	--	--	--	--	--	--
	4.88 (16)	10.1 (L/553)	4.5 (L/286)	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit states (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LVL (compression perpendicular to grain strength is 5.7 MPa) top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 12. Stud LSD Factored Axial Load for Walls Subject to Wind Pressures
(7.25" BareNaked Tstud™ with LSL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	28.8 (L/9422)	28.8 (L/4874)	28.8 (L/3287)	28.8 (L/2501)	28.8 (L/2005)	28.8 (L/1673)	28.8 (L/1435)	28.1 (L/1262)	27.4 (L/1122)	26.7 (L/1010)
	2.74 (9)	28.8 (L/6526)	28.8 (L/3375)	28.8 (L/2276)	28 (L/1732)	27.2 (L/1388)	26.3 (L/1158)	25.4 (L/994)	24.6 (L/874)	23.7 (L/777)	22.9 (L/699)
	3.05 (10)	28.2 (L/4704)	27.1 (L/2433)	26 (L/1641)	25 (L/1249)	23.9 (L/1001)	22.8 (L/835)	21.7 (L/716)	20.7 (L/630)	19.6 (L/560)	18.6 (L/504)
	3.66 (12)	23 (L/2678)	21.4 (L/1385)	19.8 (L/934)	18.3 (L/711)	16.8 (L/570)	15.2 (L/475)	13.6 (L/408)	12.1 (L/359)	10.5 (L/319)	9.0 (L/287)
	4.27 (14)	17.8 (L/1666)	15.7 (L/862)	13.5 (L/581)	11.5 (L/442)	9.3 (L/355)	7.2 (L/296)	5.0 (L/254)	2.9 (L/223)	0.8 (L/198)	--
	4.88 (16)	13.2 (L/1106)	10.3 (L/572)	7. 5 (L/386)	4.8 (L/294)	1.9 (L/235)	--	--	--	--	--
400 (16)	2.44 (8)	28.8 (L/7067)	28.8 (L/3655)	28.8 (L/2465)	28.8 (L/1876)	28.8 (L/1504)	28.1 (L/1254)	27.2 (L/1076)	26.3 (L/946)	25.4 (L/841)	24.5 (L/757)
	2.74 (9)	28.8 (L/4894)	28.8 (L/2531)	28.0 (L/1707)	26.9 (L/1299)	25.7 (L/1041)	24.6 (L/869)	23.4 (L/745)	22.3 (L/655)	21.1 (L/583)	20.0 (L/524)
	3.05 (10)	27.8 (L/3528)	26.4 (L/1825)	24.9 (L/1231)	23.5 (L/937)	22.1 (L/751)	20.7 (L/626)	19.2 (L/537)	17.8 (L/473)	16.4 (L/420)	15.0 (L/378)
	3.66 (12)	22.4 (L/2008)	20.3 (L/1039)	18.2 (L/701)	16.2 (L/533)	14.1 (L/427)	12.0 (L/356)	10.0 (L/306)	7.9 (L/269)	5.8 (L/239)	3.8 (L/215)
	4.27 (14)	17.1 (L/1250)	14.2 (L/646)	11.3 (L/436)	8.6 (L/332)	5.7 (L/266)	2.8 (L/222)	--	--	--	--
	4.88 (16)	12.1 (L/830)	8.4 (L/429)	4.6 (L/289)	1.0 (L/220)	--	--	--	--	--	--
600 (24)	2.44 (8)	28.8 (L/4711)	28.8 (L/2437)	28.8 (L/1643)	28.0 (L/1251)	26.7 (L/1002)	25.3 (L/836)	24.0 (L/717)	22.7 (L/631)	21.3 (L/561)	20.0 (L/505)
	2.74 (9)	28.8 (L/3263)	27.9 (L/1688)	26.2 (L/1138)	24.5 (L/866)	22.8 (L/694)	21.1 (L/579)	19.3 (L/497)	17.7 (L/437)	15.9 (L/388)	14.2 (L/350)
	3.05 (10)	27 (L/2352)	24.9 (L/1217)	22.7 (L/821)	20.6 (L/624)	18.5 (L/500)	16.3 (L/418)	14.2 (L/358)	12.1 (L/315)	9.9 (L/280)	7.8 (L/252)
	3.66 (12)	21.3 (L/1339)	18.2 (L/692)	15.0 (L/467)	12.0 (L/355)	8.9 (L/285)	5.7 (L/238)	2.6 (L/204)	--	--	--
	4.27 (14)	15.5 (L/833)	11.2 (L/431)	6.9 (L/291)	2.8 (L/221)	--	--	--	--	--	--
	4.88 (16)	10.1 (L/553)	4.5 (L/286)	--	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LSL (compression perpendicular to grain strength is 5.5 MPa) top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

5.2.7 *Use of BareNaked Tstud™ in Shear Walls:*

5.2.7.1 BareNaked Tstud™ used in wall assemblies designed as shear walls are permitted to be designed in accordance with the methodology used in *CSA O86* Subsection 11.6.2[8] for wood structural panels using the seismic parameters shown in Table 13.

5.2.7.1.1 The ductility response modification factor, R_d, and Overstrength-related force modification factor, R_o, indicated in Table 13 shall be used to determine the base shear, element design forces, and design storey drift in accordance with *NBC* Division B Subsection 4.1.8.

Table 13. Seismic Design Coefficients for BareNaked Tstud™ Shear Walls[5]

Wall System	Ductility Factor, R_d[1,2]	Overstrength Force Modification Factor, R_o[2]	Structural Height Limits[3,4] (m)				
			$I_E F_a S_a(0.2)$				$I_E F_a S_a(1.0)$
			< 0.2	≥ 0.2 to < 0.35	≥ 0.35 to ≤ 0.75	> 0.75	> 0.3
Shear walls – Nailed shear walls wood-based panel	3.0	1.7	NL	NL	30	20	20

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

1. Response modification coefficient, R_d, for use throughout *NBC*.
2. For combinations of different types of SFRS acting in the same direction in the same storey, R_dR_o shall be taken as the lowest value of R_dR_o corresponding to these systems. See *NBC* Division B Artiicle 4.1.8.9.
3. Consider the additional system restrictions in *NBC* Division B Article 4.1.8.10.
4. NL = Not Limited. Heights are maximum height limits above grade, as defines in *NBC* Division B Table 4.1.8.9.
5. BareNaked Tstud™ is permitted to be installed such that either the splines or the flanges are against the sheathing panels.

[8] 2014 *CSA O86* Subsection 11.5.1

5.2.8 *Design for Built-Up Compression Members:*

5.2.8.1 BareNaked Tstud™ may be used as built-up compression members per *CSA O86* Article 6.5.5.4[9] when installed and nailed together as shown in Figure 4 and Figure 5.

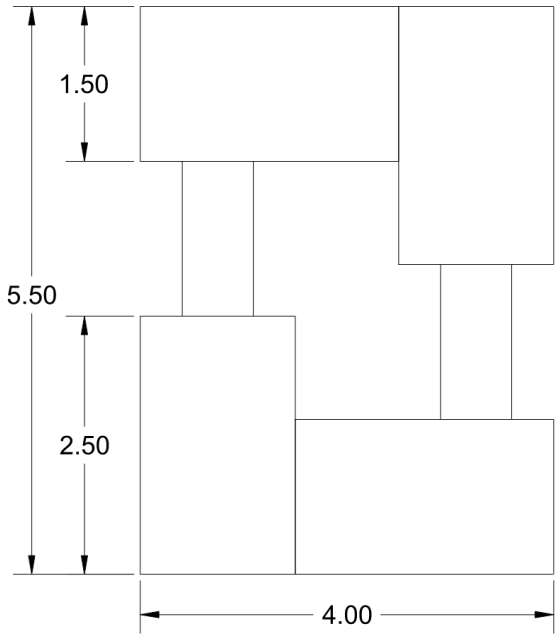

Figure 4. 5.5" BareNaked Tstud™ Built-Up Column

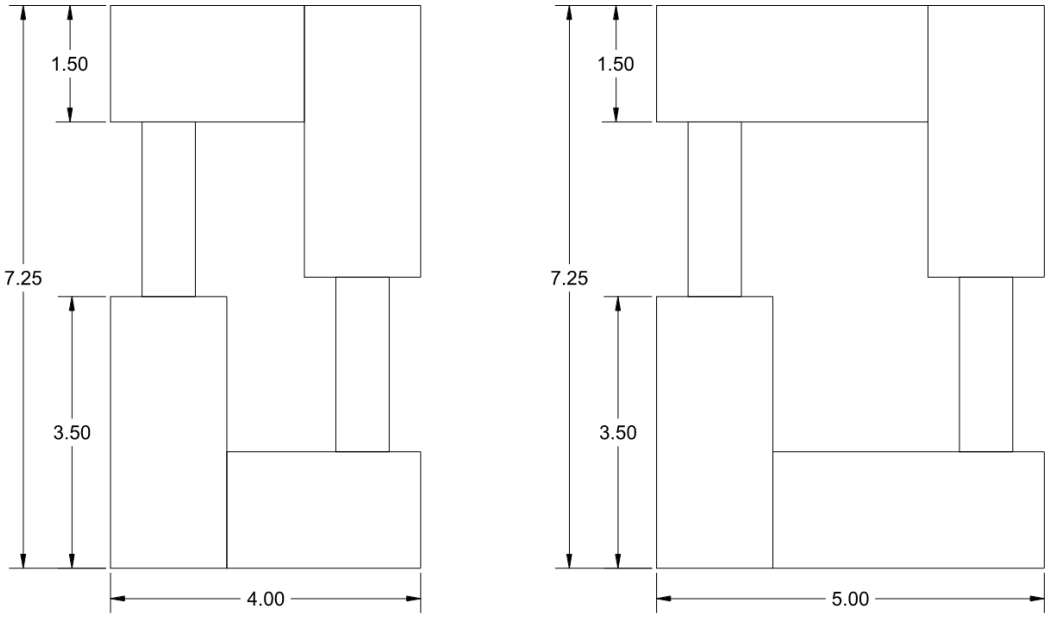

Figure 5. 7.25" BareNaked Tstud™ Built-Up Columns with 2x3 Flange and 2x4 Flange

[9] 2014 *CSA O86* Article 6.5.6.4

5.2.8.2 When used as built-up compression members, the BareNaked Tstud™ shall be designed and installed in accordance with *CSA O86* Article6.5.5.4[10], *CSA O86* Article6.5.5.4.2[11], and *CSA O86* Article6.5.5.4.5[12].

5.2.8.3 BareNaked Tstud™ shall be fastened together in accordance with *CSA O86* Article6.5.5.4.2[13], Figure 6, Figure 7, and the following provisions:

5.2.8.3.1 Nails can be driven from either side of the BareNaked Tstud™ built-up compression member (Figure 6 and Figure 7).

5.2.8.3.2 Minimum fastener diameter of 3.3 mm (0.131") (8d common wire nail).

5.2.8.3.3 Spacing of nails along the member length shall not exceed 200 mm (8").

5.2.8.3.4 See Figure 6 and Figure 7 for minimum fastener lengths.

5.2.8.3.5 The end distance, edge distance, and spacing for fasteners shall conform to the appropriate requirements in *CSA O86* Clause 12, specifically:

5.2.8.3.5.1 15d ≤ end distance ≤ 18d

5.2.8.3.5.2 5d ≤ edge distance from exterior of BareNaked Tstud™ column ≤ 20d

5.2.8.3.6 Single row of nails per spline/flange.

5.2.8.3.7 Both flange/spline pairs of the BareNaked Tstud™ column must have a row of nails.

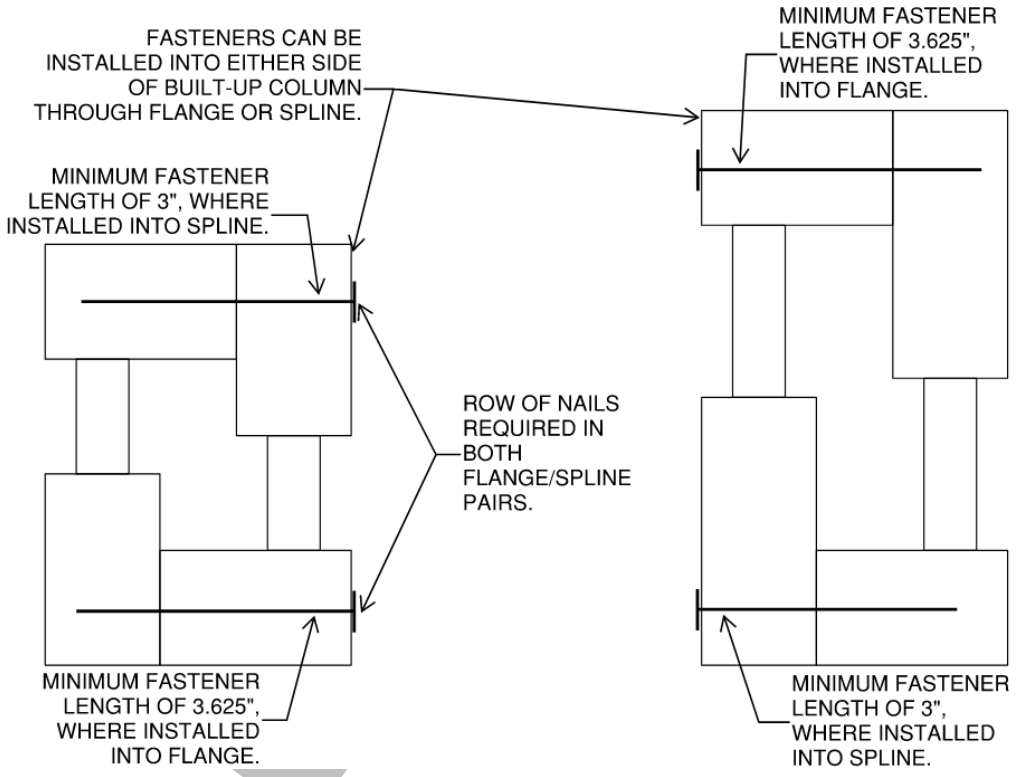

Figure 6. Fastening Requirements for BareNaked Tstud™ Built-Up Column with 2x3 Flange

[10] 2014 *CSA O86* Article 6.5.6.4

[11] 2014 *CSA O86* Article 6.5.6.4.2

[12] 2014 *CSA O86* Article 6.5.6.4.5

[13] 2014 *CSA O86* Article 6.5.6.4.2

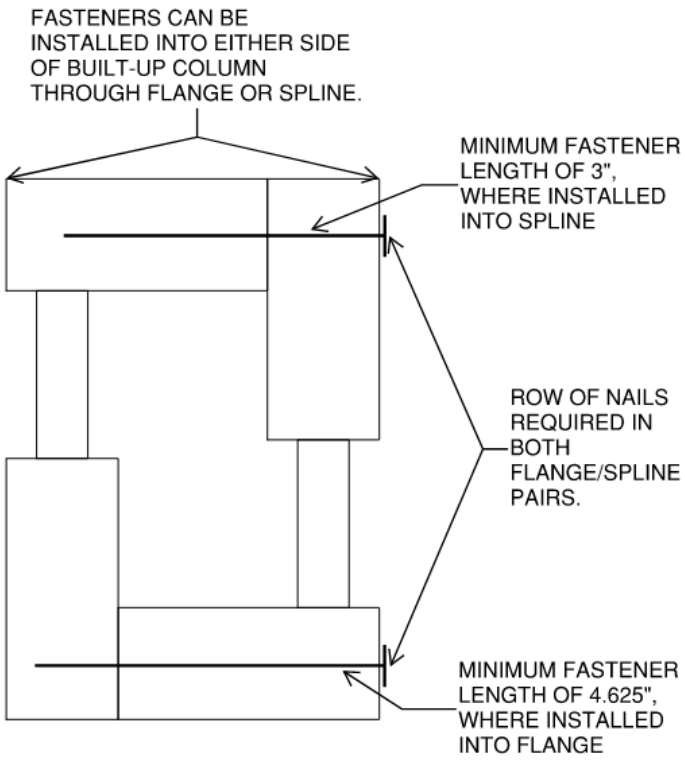

Figure 7. Fastening Requirements for BareNaked Tstud™ Built-Up Column with 2x4 Flange

5.2.9 The maximum factored compression load for BareNaked Tstud™ columns is specified in Table 14 for 5.5" BareNaked Tstud™ and Table 15 for 7.25" BareNaked Tstud™. The maximum factored compression load is based on perpendicular-to-grain crushing of SPF, MSR, LVL, or LSL top and bottom plates and compression parallel to grain of the BareNaked Tstud™.

Table 14. Maximum Factored Compressive Load of 5.5" BareNaked Tstud™ Columns

Stud Height m (ft)	Factored Compressive Load, kN (lb)			
	Top/Bottom Plate[1,2,3]			
	Spruce Pine Fir (SPF, G = 0.42)	2100F_b - 1.8E SPF	LVL	LSL
2.43 (8)	46.3 (10409)	56.8 (12770)	49.8 (11196)	48.1 (10814)
2.74 (9)	46.3 (10409)	55.0 (12365)	49.8 (11196)	48.1 (10814)
3.05 (10)	46.3 (10409)	51.1 (11488)	49.8 (11196)	48.1 (10814)
3.35 (11)	46.3 (10409)	47.0 (10567)	47.0 (10567)	47.0 (10567)
3.66 (12)	42.8 (9622)	42.8 (9622)	42.8 (9622)	42.8 (9622)
3.96 (13)	38.7 (8701)	38.7 (8701)	38.7 (8701)	38.7 (8701)
4.27 (14)	34.8 (7824)	34.8 (7824)	34.8 (7824)	34.8 (7824)
4.57 (15)	31.2 (7014)	31.2 (7014)	31.2 (7014)	31.2 (7014)
4.88 (16)	27.9 (6272)	27.9 (6272)	27.9 (6272)	27.9 (6272)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Maximum stud spacing of 610 mm (24").
2. Specified compression perpendicular-to-grain strength is 5.3 MPa for SPF (per *CSA O86* Table 6.3.1A), 6.5 MPa for 2100F_b – 1.8E SPF (per *CSA O86* Table 6.3.1A), 5.7 MPa for LVL, and 5.5 MPa for LSL.
3. For plates having a lower specified strength for compression perpendicular to grain, an engineered design is required.

Table 15. Maximum Factored Compressive Load of 7.25" BareNaked Tstud™ Columns

Stud Height m (ft)	Factored Compressive Load, kN (lb)
	Top/Bottom Plate[1,2,3]
	Spruce Pine Fir (SPF, G = 0.42), 2100F_b - 1.8E SPF, LVL, or LSL
2.43 (8)	36.1 (8116)
2.74 (9)	34.9 (7846)
3.05 (10)	33.5 (7531)
3.35 (11)	31.9 (7172)
3.66 (12)	30.2 (6790)
3.96 (13)	28.4 (6385)
4.27 (14)	26.5 (5958)
4.57 (15)	24.6 (5531)
4.88 (16)	22.8 (5126)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb

1. Maximum stud spacing of 610 mm (24").
2. Specified compression perpendicular-to-grain strength is 5.3 MPa for SPF (per *CSA O86* Table 6.3.1A), 6.5 MPa for 2100F_b – 1.8E SPF (per *CSA O86* Table 6.3.1A), 5.7 MPa for LVL, and 5.5 MPa for LSL.
3. For plates having a lower specified strength for compression perpendicular to grain, an engineered design is required.

5.2.9.1 Factored axial loads and deflection ratios for BareNaked Tstud™ columns subject to axial loads are specified in the following tables:

5.2.9.1.1 5.5" BareNaked Tstud™ columns

5.2.9.1.1.1 SPF top and bottom plates: Table 16

5.2.9.1.1.2 MSR top and bottom plates: Table 17

5.2.9.1.1.3 LVL top and bottom plates: Table 18

5.2.9.1.1.4 LSL top and bottom plates: Table 19

5.2.9.1.2 7.25" BareNaked Tstud™ columns

5.2.9.1.2.1 SPF, MSR, LVL, and LSL top and bottom plates: Table 20

Table 16. Built-Up Column LSD Factored Axial Load for Walls Subject to Wind Pressures (5.5" BareNaked Tstud™ with SPF Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	46.3 (L/9614)	46.3 (L/4973)	46.3 (L/3354)	46.3 (L/2552)	46.3 (L/2046)	46.3 (L/1707)	46.3 (L/1464)	46.3 (L/1288)	46.3 (L/1145)	46.3 (L/1030)
	2.74 (9)	46.3 (L/6659)	46.3 (L/3444)	46.3 (L/2323)	46.3 (L/1768)	46.3 (L/1417)	46.3 (L/1182)	46.3 (L/1014)	45.6 (L/892)	44.4 (L/793)	43.2 (L/713)
	3.05 (10)	46.3 (L/4800)	46.3 (L/2483)	46.3 (L/1675)	45.2 (L/1274)	43.7 (L/1021)	42.3 (L/852)	40.8 (L/731)	39.4 (L/643)	37.9 (L/571)	36.5 (L/514)
	3.66 (12)	40.5 (L/2732)	38.4 (L/1413)	36.3 (L/953)	34.2 (L/725)	32.1 (L/581)	30 (L/485)	27.8 (L/416)	25.8 (L/366)	23.6 (L/325)	21.5 (L/293)
	4.27 (14)	31.7 (L/1700)	28.8 (L/879)	25.9 (L/593)	23.1 (L/451)	20.1 (L/362)	17.2 (L/302)	14.3 (L/259)	11.5 (L/228)	8.6 (L/202)	5.6 (L/182)
	4.88 (16)	23.8 (L/1129)	19.9 (L/584)	16.1 (L/394)	12.4 (L/300)	8.6 (L/240)	4.7 (L/200)	0.9 (L/172)	--	--	--
400 (16)	2.44 (8)	46.3 (L/7211)	46.3 (L/3730)	46.3 (L/2515)	46.3 (L/1914)	46.3 (L/1534)	46.3 (L/1280)	46.3 (L/1098)	46.3 (L/966)	46.3 (L/858)	46.3 (L/773)
	2.74 (9)	46.3 (L/4994)	46.3 (L/2583)	46.3 (L/1742)	46.3 (L/1326)	46.3 (L/1063)	45.5 (L/887)	44.0 (L/761)	42.5 (L/669)	40.9 (L/595)	39.3 (L/535)
	3.05 (10)	46.3 (L/3600)	46.3 (L/1862)	45.1 (L/1256)	43.2 (L/956)	41.3 (L/766)	39.3 (L/639)	37.4 (L/548)	35.5 (L/482)	33.5 (L/429)	31.6 (L/386)
	3.66 (12)	39.8 (L/2049)	36.9 (L/1060)	34.1 (L/715)	31.3 (L/544)	28.5 (L/436)	25.7 (L/364)	22.8 (L/312)	20.1 (L/274)	17.3 (L/244)	14.4 (L/220)
	4.27 (14)	30.7 (L/1275)	26.8 (L/660)	22.9 (L/445)	19.1 (L/339)	15.2 (L/271)	11.3 (L/226)	7.4 (L/194)	3.7 (L/171)	--	--
	4.88 (16)	22.4 (L/847)	17.3 (L/438)	12.2 (L/295)	7.2 (L/225)	2.1 (L/180)	--	--	--	--	--
600 (24)	2.44 (8)	46.3 (L/4807)	46.3 (L/2486)	46.3 (L/1677)	46.3 (L/1276)	46.3 (L/1023)	46.3 (L/853)	45.6 (L/732)	43.8 (L/644)	42 (L/572)	40.2 (L/515)
	2.74 (9)	46.3 (L/3329)	46.3 (L/1722)	46.3 (L/1161)	45.5 (L/884)	43.2 (L/708)	40.8 (L/591)	38.5 (L/507)	36.2 (L/446)	33.8 (L/396)	31.5 (L/357)
	3.05 (10)	46.3 (L/2400)	45 (L/1241)	42.1 (L/837)	39.3 (L/637)	36.4 (L/511)	33.4 (L/426)	30.5 (L/366)	27.7 (L/321)	24.8 (L/286)	21.8 (L/257)
	3.66 (12)	38.2 (L/1366)	34 (L/707)	29.7 (L/477)	25.6 (L/363)	21.4 (L/291)	17.1 (L/243)	12.9 (L/208)	8.7 (L/183)	4.5 (L/163)	0.2 (L/146)
	4.27 (14)	28.6 (L/850)	22.8 (L/440)	16.9 (L/297)	11.3 (L/226)	5.4 (L/181)	--	--	--	--	--
	4.88 (16)	19.7 (L/565)	12.0 (L/292)	4.3 (L/197)	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum SPF top and bottom plates. BareNaked Tstud™ studs with a mean relative density equal to or greater than 0.42.

Table 17. Built-Up Column LSD Factored Axial Load for Walls Subject to Wind Pressures (5.5" BareNaked Tstud™ with MSR Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	56.8 (L/9614)	56.7 (L/4973)	55.7 (L/3354)	54.8 (L/2552)	53.9 (L/2046)	53 (L/1707)	52.1 (L/1464)	51.2 (L/1288)	50.3 (L/1145)	49.4 (L/1030)
	2.74 (9)	53.7 (L/6659)	52.6 (L/3444)	51.4 (L/2323)	50.2 (L/1768)	49.1 (L/1417)	47.9 (L/1182)	46.7 (L/1014)	45.6 (L/892)	44.4 (L/793)	43.2 (L/713)
	3.05 (10)	49.5 (L/4800)	48 (L/2483)	46.6 (L/1675)	45.2 (L/1274)	43.7 (L/1021)	42.3 (L/852)	40.8 (L/731)	39.4 (L/643)	37.9 (L/571)	36.5 (L/514)
	3.66 (12)	40.5 (L/2732)	38.4 (L/1413)	36.3 (L/953)	34.2 (L/725)	32.1 (L/581)	30.0 (L/485)	27.8 (L/416)	25.8 (L/366)	23.6 (L/325)	21.5 (L/293)
	4.27 (14)	31.7 (L/1700)	28.8 (L/879)	25.9 (L/593)	23.1 (L/451)	20.1 (L/362)	17.2 (L/302)	14.3 (L/259)	11.5 (L/228)	8.6 (L/202)	5.6 (L/182)
	4.88 (16)	23.8 (L/1129)	19.9 (L/584)	16.1 (L/394)	12.4 (L/300)	8.6 (L/240)	4.7 (L/200)	0.9 (L/172)	--	--	--
400 (16)	2.44 (8)	56.8 (L/7211)	56 (L/3730)	54.8 (L/2515)	53.6 (L/1914)	52.4 (L/1534)	51.2 (L/1280)	49.9 (L/1098)	48.7 (L/966)	47.5 (L/858)	46.3 (L/773)
	2.74 (9)	53.3 (L/4994)	51.7 (L/2583)	50.2 (L/1742)	48.7 (L/1326)	47.1 (L/1063)	45.5 (L/887)	44.0 (L/761)	42.5 (L/669)	40.9 (L/595)	39.3 (L/535)
	3.05 (10)	49.0 (L/3600)	47.0 (L/1862)	45.1 (L/1256)	43.2 (L/956)	41.3 (L/766)	39.3 (L/639)	37.4 (L/548)	35.5 (L/482)	33.5 (L/429)	31.6 (L/386)
	3.66 (12)	39.8 (L/2049)	36.9 (L/1060)	34.1 (L/715)	31.3 (L/544)	28.5 (L/436)	25.7 (L/364)	22.8 (L/312)	20.1 (L/274)	17.3 (L/244)	14.4 (L/220)
	4.27 (14)	30.7 (L/1275)	26.8 (L/660)	22.9 (L/445)	19.1 (L/339)	15.2 (L/271)	11.3 (L/226)	7.4 (L/194)	3.7 (L/171)	--	--
	4.88 (16)	22.4 (L/847)	17.3 (L/438)	12.2 (L/295)	7.2 (L/225)	2.1 (L/180)	--	--	--	--	--
600 (24)	2.44 (8)	56.6 (L/4807)	54.7 (L/2486)	52.9 (L/1677)	51.1 (L/1276)	49.3 (L/1023)	47.5 (L/853)	45.6 (L/732)	43.8 (L/644)	42 (L/572)	40.2 (L/515)
	2.74 (9)	52.5 (L/3329)	50.1 (L/1722)	47.8 (L/1161)	45.5 (L/884)	43.2 (L/708)	40.8 (L/591)	38.5 (L/507)	36.2 (L/446)	33.8 (L/396)	31.5 (L/357)
	3.05 (10)	47.9 (L/2400)	45 (L/1241)	42.1 (L/837)	39.3 (L/637)	36.4 (L/511)	33.4 (L/426)	30.5 (L/366)	27.7 (L/321)	24.8 (L/286)	21.8 (L/257)
	3.66 (12)	38.2 (L/1366)	34 (L/707)	29.7 (L/477)	25.6 (L/363)	21.4 (L/291)	17.1 (L/243)	12.9 (L/208)	8.7 (L/183)	4.5 (L/163)	0.2 (L/146)
	4.27 (14)	28.6 (L/850)	22.8 (L/440)	16.9 (L/297)	11.3 (L/226)	5.4 (L/181)	--	--	--	--	--
	4.88 (16)	19.7 (L/565)	12.0 (L/292)	4.3 (L/197)	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum 2100Fb - 1.8E SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

Table 18. Built-Up Column LSD Factored Axial Load for Walls Subject to Wind Pressures (5.5" BareNaked Tstud™ with LVL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	49.8 (L/9614)	49.8 (L/4973)	49.8 (L/3354)	49.8 (L/2552)	49.8 (L/2046)	49.8 (L/1707)	49.8 (L/1464)	49.8 (L/1288)	49.8 (L/1145)	49.4 (L/1030)
	2.74 (9)	49.8 (L/6659)	49.8 (L/3444)	49.8 (L/2323)	49.8 (L/1768)	49.1 (L/1417)	47.9 (L/1182)	46.7 (L/1014)	45.6 (L/892)	44.4 (L/793)	43.2 (L/713)
	3.05 (10)	49.5 (L/4800)	48.0 (L/2483)	46.6 (L/1675)	45.2 (L/1274)	43.7 (L/1021)	42.3 (L/852)	40.8 (L/731)	39.4 (L/643)	37.9 (L/571)	36.5 (L/514)
	3.66 (12)	40.5 (L/2732)	38.4 (L/1413)	36.3 (L/953)	34.2 (L/725)	32.1 (L/581)	30.0 (L/485)	27.8 (L/416)	25.8 (L/366)	23.6 (L/325)	21.5 (L/293)
	4.27 (14)	31.7 (L/1700)	28.8 (L/879)	25.9 (L/593)	23.1 (L/451)	20.1 (L/362)	17.2 (L/302)	14.3 (L/259)	11.5 (L/228)	8.6 (L/202)	5.6 (L/182)
	4.88 (16)	23.8 (L/1129)	19.9 (L/584)	16.1 (L/394)	12.4 (L/300)	8.6 (L/240)	4.7 (L/200)	0.9 (L/172)	--	--	--
400 (16)	2.44 (8)	49.8 (L/7211)	49.8 (L/3730)	49.8 (L/2515)	49.8 (L/1914)	49.8 (L/1534)	49.8 (L/1280)	49.8 (L/1098)	48.7 (L/966)	47.5 (L/858)	46.3 (L/773)
	2.74 (9)	49.8 (L/4994)	49.8 (L/2583)	49.8 (L/1742)	48.7 (L/1326)	47.1 (L/1063)	45.5 (L/887)	44.0 (L/761)	42.5 (L/669)	40.9 (L/595)	39.3 (L/535)
	3.05 (10)	49.0 (L/3600)	47.0 (L/1862)	45.1 (L/1256)	43.2 (L/956)	41.3 (L/766)	39.3 (L/639)	37.4 (L/548)	35.5 (L/482)	33.5 (L/429)	31.6 (L/386)
	3.66 (12)	39.8 (L/2049)	36.9 (L/1060)	34.1 (L/715)	31.3 (L/544)	28.5 (L/436)	25.7 (L/364)	22.8 (L/312)	20.1 (L/274)	17.3 (L/244)	14.4 (L/220)
	4.27 (14)	30.7 (L/1275)	26.8 (L/660)	22.9 (L/445)	19.1 (L/339)	15.2 (L/271)	11.3 (L/226)	7.4 (L/194)	3.7 (L/171)	--	--
	4.88 (16)	22.4 (L/847)	17.3 (L/438)	12.2 (L/295)	7.2 (L/225)	2.1 (L/180)	--	--	--	--	--
600 (24)	2.44 (8)	49.8 (L/4807)	49.8 (L/2486)	49.8 (L/1677)	49.8 (L/1276)	49.3 (L/1023)	47.5 (L/853)	45.6 (L/732)	43.8 (L/644)	42.0 (L/572)	40.2 (L/515)
	2.74 (9)	49.8 (L/3329)	49.8 (L/1722)	47.8 (L/1161)	45.5 (L/884)	43.2 (L/708)	40.8 (L/591)	38.5 (L/507)	36.2 (L/446)	33.8 (L/396)	31.5 (L/357)
	3.05 (10)	47.9 (L/2400)	45 (L/1241)	42.1 (L/837)	39.3 (L/637)	36.4 (L/511)	33.4 (L/426)	30.5 (L/366)	27.7 (L/321)	24.8 (L/286)	21.8 (L/257)
	3.66 (12)	38.2 (L/1366)	34.0 (L/707)	29.7 (L/477)	25.6 (L/363)	21.4 (L/291)	17.1 (L/243)	12.9 (L/208)	8.7 (L/183)	4.5 (L/163)	0.2 (L/146)
	4.27 (14)	28.6 (L/850)	22.8 (L/440)	16.9 (L/297)	11.3 (L/226)	5.4 (L/181)	--	--	--	--	--
	4.88 (16)	19.7 (L/565)	12.0 (L/292)	4.3 (L/197)	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LVL (compression perpendicular to grain strength is 5.7 MPa) top and bottom plates. BareNaked Tstud™ studs with a mean relative density equal to or greater than 0.42.

Table 19. Built-Up Column LSD Factored Axial Load for Walls Subject to Wind Pressures (5.5" BareNaked Tstud™ with LSL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	48.1 (L/9614)	48.1 (L/4973)	48.1 (L/3354)	48.1 (L/2552)	48.1 (L/2046)	48.1 (L/1707)	48.1 (L/1464)	48.1 (L/1288)	48.1 (L/1145)	48.1 (L/1030)
	2.74 (9)	48.1 (L/6659)	48.1 (L/3444)	48.1 (L/2323)	48.1 (L/1768)	48.1 (L/1417)	47.9 (L/1182)	46.7 (L/1014)	45.6 (L/892)	44.4 (L/793)	43.2 (L/713)
	3.05 (10)	48.1 (L/4800)	48.0 (L/2483)	46.6 (L/1675)	45.2 (L/1274)	43.7 (L/1021)	42.3 (L/852)	40.8 (L/731)	39.4 (L/643)	37.9 (L/571)	36.5 (L/514)
	3.66 (12)	40.5 (L/2732)	38.4 (L/1413)	36.3 (L/953)	34.2 (L/725)	32.1 (L/581)	30.0 (L/485)	27.8 (L/416)	25.8 (L/366)	23.6 (L/325)	21.5 (L/293)
	4.27 (14)	31.7 (L/1700)	28.8 (L/879)	25.9 (L/593)	23.1 (L/451)	20.1 (L/362)	17.2 (L/302)	14.3 (L/259)	11.5 (L/228)	8.6 (L/202)	5.6 (L/182)
	4.88 (16)	23.8 (L/1129)	19.9 (L/584)	16.1 (L/394)	12.4 (L/300)	8.6 (L/240)	4.7 (L/200)	0.9 (L/172)	--	--	--
400 (16)	2.44 (8)	48.1 (L/7211)	48.1 (L/3730)	48.1 (L/2515)	48.1 (L/1914)	48.1 (L/1534)	48.1 (L/1280)	48.1 (L/1098)	48.1 (L/966)	47.5 (L/858)	46.3 (L/773)
	2.74 (9)	48.1 (L/4994)	48.1 (L/2583)	48.1 (L/1742)	48.1 (L/1326)	47.1 (L/1063)	45.5 (L/887)	44.0 (L/761)	42.5 (L/669)	40.9 (L/595)	39.3 (L/535)
	3.05 (10)	48.1 (L/3600)	47.0 (L/1862)	45.1 (L/1256)	43.2 (L/956)	41.3 (L/766)	39.3 (L/639)	37.4 (L/548)	35.5 (L/482)	33.5 (L/429)	31.6 (L/386)
	3.66 (12)	39.8 (L/2049)	36.9 (L/1060)	34.1 (L/715)	31.3 (L/544)	28.5 (L/436)	25.7 (L/364)	22.8 (L/312)	20.1 (L/274)	17.3 (L/244)	14.4 (L/220)
	4.27 (14)	30.7 (L/1275)	26.8 (L/660)	22.9 (L/445)	19.1 (L/339)	15.2 (L/271)	11.3 (L/226)	7.4 (L/194)	3.7 (L/171)	--	--
	4.88 (16)	22.4 (L/847)	17.3 (L/438)	12.2 (L/295)	7.2 (L/225)	2.1 (L/180)	--	--	--	--	--
600 (24)	2.44 (8)	48.1 (L/4807)	48.1 (L/2486)	48.1 (L/1677)	48.1 (L/1276)	48.1 (L/1023)	47.5 (L/853)	45.6 (L/732)	43.8 (L/644)	42.0 (L/572)	40.2 (L/515)
	2.74 (9)	48.1 (L/3329)	48.1 (L/1722)	47.8 (L/1161)	45.5 (L/884)	43.2 (L/708)	40.8 (L/591)	38.5 (L/507)	36.2 (L/446)	33.8 (L/396)	31.5 (L/357)
	3.05 (10)	47.9 (L/2400)	45 (L/1241)	42.1 (L/837)	39.3 (L/637)	36.4 (L/511)	33.4 (L/426)	30.5 (L/366)	27.7 (L/321)	24.8 (L/286)	21.8 (L/257)
	3.66 (12)	38.2 (L/1366)	34.0 (L/707)	29.7 (L/477)	25.6 (L/363)	21.4 (L/291)	17.1 (L/243)	12.9 (L/208)	8.7 (L/183)	4.5 (L/163)	0.2 (L/146)
	4.27 (14)	28.6 (L/850)	22.8 (L/440)	16.9 (L/297)	11.3 (L/226)	5.4 (L/181)	--	--	--	--	--
	4.88 (16)	19.7 (L/565)	12.0 (L/292)	4.3 (L/197)	--	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum LSL (compression perpendicular to grain strength is 5.5 MPa) top and bottom plates. BareNaked Tstud™ studs with a mean relative density equal to or greater than 0.42.

Table 20. Built-Up Column LSD Factored Axial Load for Walls Subject to Wind Pressures (7.25" BareNaked Tstud™ with SPF, MSR, LVL, or LSL Top/Bottom Plates) [1,2]

Stud Spacing mm (in)	Wall Height m (ft)	Factored Axial Load (kN) & (Deflection Ratio)									
		Specified Wind Pressure, p (kPa)									
		0.30	0.58	0.86	1.13	1.41	1.69	1.97	2.24	2.52	2.80
300 (12)	2.44 (8)	35.4 (L/18617)	34.8 (L/9629)	34.2 (L/6494)	33.6 (L/4943)	33.0 (L/3961)	32.4 (L/3305)	31.7 (L/2835)	31.2 (L/2493)	30.5 (L/2216)	29.9 (L/1995)
	2.74 (9)	34 (L/12894)	33.2 (L/6669)	32.5 (L/4498)	31.7 (L/3423)	30.9 (L/2743)	30.1 (L/2289)	29.3 (L/1964)	28.6 (L/1727)	27.8 (L/1535)	27 (L/1381)
	3.05 (10)	32.4 (L/9295)	31.4 (L/4808)	30.5 (L/3243)	29.5 (L/2468)	28.6 (L/1978)	27.6 (L/1650)	26.6 (L/1416)	25.7 (L/1245)	24.7 (L/1107)	23.7 (L/996)
	3.66 (12)	28.6 (L/5290)	27.2 (L/2736)	25.8 (L/1846)	24.4 (L/1405)	23.0 (L/1126)	21.6 (L/939)	20.2 (L/806)	18.8 (L/709)	17.4 (L/630)	16.0 (L/567)
	4.27 (14)	24.4 (L/3292)	22.5 (L/1703)	20.5 (L/1149)	18.6 (L/874)	16.7 (L/701)	14.7 (L/584)	12.8 (L/501)	10.9 (L/441)	9.0 (L/392)	7.0 (L/353)
	4.88 (16)	20 (L/2186)	17.5 (L/1131)	14.9 (L/763)	12.5 (L/580)	9.9 (L/465)	7.3 (L/388)	4.8 (L/333)	2.3 (L/293)	--	--
400 (16)	2.44 (8)	35.2 (L/13963)	34.4 (L/7222)	33.5 (L/4871)	32.8 (L/3707)	31.9 (L/2971)	31.1 (L/2479)	30.3 (L/2126)	29.5 (L/1870)	28.7 (L/1662)	27.9 (L/1496)
	2.74 (9)	33.7 (L/9670)	32.7 (L/5002)	31.6 (L/3373)	30.6 (L/2567)	29.6 (L/2058)	28.6 (L/1717)	27.5 (L/1473)	26.5 (L/1295)	25.5 (L/1151)	24.4 (L/1036)
	3.05 (10)	32.1 (L/6972)	30.8 (L/3606)	29.5 (L/2432)	28.2 (L/1851)	26.9 (L/1483)	25.6 (L/1238)	24.3 (L/1062)	23.1 (L/934)	21.8 (L/830)	20.5 (L/747)
	3.66 (12)	28.1 (L/3968)	26.2 (L/2052)	24.4 (L/1384)	22.5 (L/1053)	20.6 (L/844)	18.7 (L/704)	16.9 (L/604)	15.0 (L/531)	13.1 (L/472)	11.2 (L/425)
	4.27 (14)	23.7 (L/2469)	21.1 (L/1277)	18.5 (L/861)	16.0 (L/656)	13.4 (L/525)	10.8 (L/438)	8.2 (L/376)	5.7 (L/331)	3.1 (L/294)	0.5 (L/265)
	4.88 (16)	19.1 (L/1640)	15.7 (L/848)	12.3 (L/572)	9.0 (L/435)	5.6 (L/349)	2.2 (L/291)	--	--	--	--
600 (24)	2.44 (8)	34.7 (L/9308)	33.5 (L/4815)	32.3 (L/3247)	31.1 (L/2471)	29.9 (L/1981)	28.7 (L/1652)	27.4 (L/1418)	26.2 (L/1247)	25 (L/1108)	23.8 (L/997)
	2.74 (9)	33.2 (L/6447)	31.6 (L/3335)	30.0 (L/2249)	28.5 (L/1712)	27 (L/1372)	25.4 (L/1144)	23.8 (L/982)	22.3 (L/863)	20.8 (L/767)	19.2 (L/691)
	3.05 (10)	31.4 (L/4648)	29.4 (L/2404)	27.5 (L/1621)	25.6 (L/1234)	23.6 (L/989)	21.7 (L/825)	19.7 (L/708)	17.9 (L/622)	15.9 (L/553)	14.0 (L/498)
	3.66 (12)	27.1 (L/2645)	24.3 (L/1368)	21.4 (L/923)	18.7 (L/702)	15.9 (L/563)	13.0 (L/470)	10.2 (L/403)	7.5 (L/354)	4.6 (L/315)	1.8 (L/283)
	4.27 (14)	22.3 (L/1646)	18.4 (L/851)	14.5 (L/574)	10.8 (L/437)	6.9 (L/350)	3.0 (L/292)	--	--	--	--
	4.88 (16)	17.3 (L/1093)	12.2 (L/565)	7.1 (L/381)	2.1 (L/290)	--	--	--	--	--	--

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. The specified wind pressures provided above are for ultimate limit state (ULS), which uses an importance factor of 1, and are used to determine the allowable axial load in accordance with *NBC* Division B Article 4.1.7.3. The deflection ratio is based on serviceability limit state (SLS) per *NBC* Article 4.1.3.5, which uses an importance factor of 0.75 when determining specified wind pressure.
2. Walls constructed with BareNaked Tstud™ studs and minimum SPF top and bottom plates. Studs with a mean relative density equal to or greater than 0.42.

5.2.10 *Design of BareNaked Tstud™ Headers:*

5.2.10.1 BareNaked Tstud™ Headers are shown in Figure 8 and Figure 9.

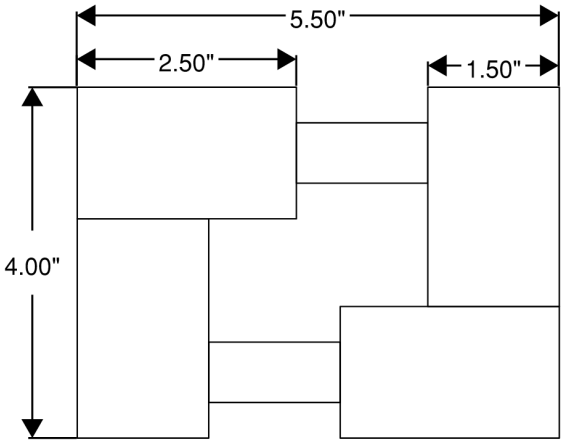

Figure 8. 5.5″ Wide BareNaked Tstud™ Header

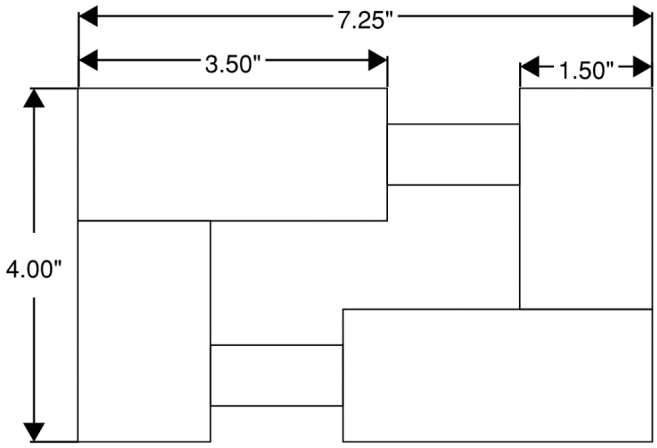

Figure 9. 7.25″ Wide BareNaked Tstud™ Header

5.2.10.1.1 The 7.25″ built-up section shall be limited to the 2x3 flange option shown in Figure 9 when used as a header.

5.2.10.1.2 Headers are designed to be loaded perpendicular to the plane of the dowels.

5.2.10.1.3 Where stacked headers are used, headers shall be fastened with 4" x 0.131" nails at 16" o.c. into each side of the header.

5.2.10.2 Specified design values for BareNaked Tstud™ are provided in Table 21.

5.2.10.2.1 Specified design values for BareNaked Tstud™ shall be multiplied by the adjustment factors in *CSA O86* Subsection 15.3.2 and Section 6.4.

Table 21. Header Specified Design Values[1,2]

Specified Design Value	5.5" Built-Up BareNaked Tstud™ Header	7.25" Built-Up BareNaked Tstud™ Header[2,3]
Bending, f_bS	2,970 N-m (2,190 lb-ft)	2,405 N-m (1,775 lb-ft)
Compression Parallel to Grain, f_c	11.5 MPa (1,665 psi)	11.5 MPa (1,665 psi)
Tension Parallel to Grain, f_t	5.5 MPa (795 psi)	5.5 MPa (795 psi)
Compression Perpendicular to Grain, $f_{c\perp}$	5.3 MPa (765 psi)	5.3 MPa (765 psi)
Shear Force, V	8,665 N (1,950 lb)	6,770 N (1,520 lb)
Bending Stiffness, EI	60,000 N-m^2 (20,907,000 lb-in^2)	68,000 N-m^2 (23,695,000 lb-in^2)
Bending Stiffness for Beam and Column Stability, EI_{05}	52,000 N-m^2 (18,120,000 lb-in^2)	59,000 N-m^2 (20,559,000 lb-in^2)

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi

1. BareNaked Tstud™ Headers made from No. 2 SPF.
2. Built-up Headers are designed to be oriented with the load perpendicular to the dowels. Ensure proper orientation during installation.
3. The 7.25" BareNaked Tstud™ header referenced here uses a 2x3 as the flange and a 2x4 as the spline.

5.2.10.3 The maximum bending moment and shear forces shall not exceed the specified design values for corresponding BareNaked Tstud™ Headers specified in Table 2.

5.2.10.4 Specified spans for BareNaked Tstud™ Headers under uniform vertical loads are specified in Table 22 and Table 23.

Table 22. Factored Loads for 5.5" Built-Up BareNaked Tstud™ Headers[1,2,4]

Number of Headers	Factored Load (kN/m) & Deflection Ratio[3]					
	Span, m (ft)					
	0.91 (3)	1.22 (4)	1.52 (5)	1.83 (6)	2.13 (7)	2.44 (8)
1	18.8 (L/322)	10.6 (L/240)	5.4 (L/240)	3.1 (L/240)	2.0 (L/240)	1.3 (L/240)
2	37.5 (L/322)	21.2 (L/240)	10.8 (L/240)	6.3 (L/240)	4.0 (L/240)	2.6 (L/240)
3	56.3 (L/322)	31.8 (L/240)	16.3 (L/240)	9.4 (L/240)	5.9 (L/240)	4.0 (L/240)

Values limited to serviceability limit state (deflection).

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/ft = 0.0146 kN/m

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, where L is equal to the header span.
4. See Figure 8 for an illustration of the Built-Up BareNaked Tstud™ cross-section.

Table 23. Factored Loads for 7.25" Built-Up BareNaked Tstud™ Headers[1,2,4]

Number of Headers	Factored Load (kN/m) & Deflection Ratio[3]					
	Span, m (ft)					
	0.91 (3)	1.22 (4)	1.52 (5)	1.83 (6)	2.13 (7)	2.44 (8)
1	12.7 (L/538)	9.5 (L/303)	6.1 (L/240)	3.6 (L/240)	2.2 (L/240)	1.5 (L/240)
2	25.4 (L/538)	19.1 (L/303)	12.3 (L/240)	7.1 (L/240)	4.5 (L/240)	3.0 (L/240)
3	38.1 (L/538)	28.6 (L/303)	18.4 (L/240)	10.7 (L/240)	6.7 (L/240)	4.5 (L/240)

Values limited to serviceability limit state (deflection).

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/ft = 0.0146 kN/m

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, where L is equal to the header span.
4. See Figure 9 for an illustration of the Built-Up BareNaked Tstud™ cross-section.

5.3 For applications outside the scope of this applicable code, consult the manufacturer installation instructions or a professional engineer registered in the province or territory of the project.

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 BareNaked Tstud™ shall be installed in accordance with the applicable code, the approved construction documents, this TER, the manufacturer installation instructions, *CSA O86*, and otherwise standard framing practices as applied to solid-sawn lumber. In the event of a conflict between the manufacturer installation instructions and this TER, the more restrictive shall govern.

6.2 *Installation Procedure*

6.2.1 BareNaked Tstud™ is pre-assembled and designed to be used as a direct replacement of 2x4 (38 x 89 mm) solid sawn lumber as wall studs, top plates, bottom plates, and built-up columns and headers.

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

6.2.2.1 The BareNaked Tstud™ wall stud may be oriented in either direction (i.e., with the flange facing the interior of exterior face of the wall).

6.2.2.2 The BareNaked Tstud™ shall be used as a bottom plate only where the wall is connected to a wood deck. For walls connected to a concrete deck, a solid sawn 2x6 (38 x 140 mm) member shall be used as the bottom plate.

6.2.2.3 Where BareNaked Tstud™ is used as a top plate, a separate means of fire-blocking shall be provided in accordance with Section 9.4.

6.2.2.4 BareNaked Tstud™ headers shall be installed such that the dowel plane is be perpendicular to the loading orientation (vertical loads only).

6.2.3 For the *NBC* Subsection 4.3.1 and Section 9.23, install in accordance with the provisions therein, except as noted in this TER.

6.2.4 See Section 5.1 and Table 1 for prescriptive connection requirements.

6.2.5 See Section 5.2.8 for built-up column requirements and limitations.

6.2.6 See Section 5.2.10 for header requirements and limitations.

6.2.7 *Hold Downs:*

6.2.7.1 Hold-downs shall not be attached directly to BareNaked Tstud™ members. Solid sawn 2x6 (38 x 140 mm) studs shall be used where hold-downs attach to the wall.

6.2.8 *Drilling and Notching:*

6.2.8.1 Drilling BareNaked Tstud™ is allowed when in accordance with *NBC* Article 9.23.5.3 and Figure 10.

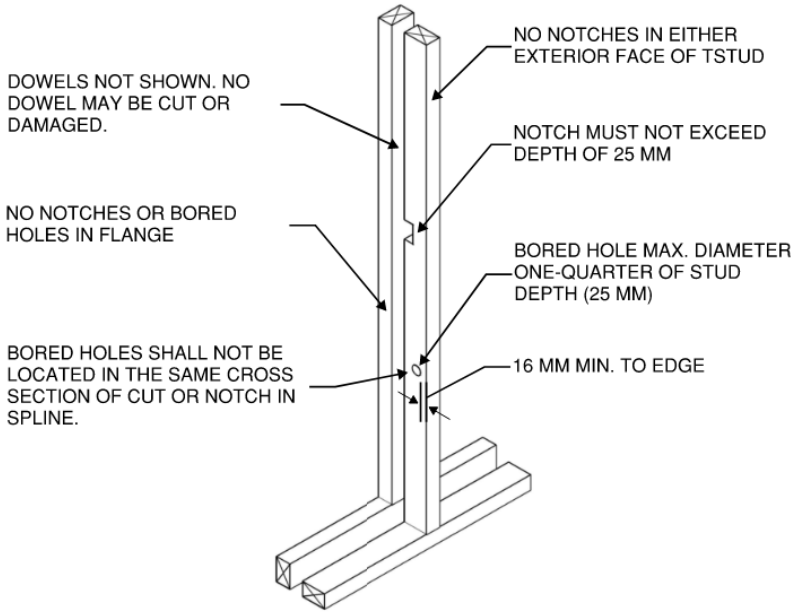

Figure 10. Drilling and Notching of BareNaked Tstud™

6.2.9 No dowels may be cut or damaged.

6.2.10 Notches on the exterior faces of the flange and spline are not permitted.

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 Bending tests in accordance with *ASTM D198*

7.1.2 Lateral load resistance in accordance with *ASTM E2126*

7.2 *CSA O86: Engineering Design in Wood*

7.3 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *NBC* Volume I commentary on Conformity Assessment and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.

7.4 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *NBC, NECB, CAN/CSA*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 Findings

8.1 When used and installed in accordance with this TER and the manufacturer installation instructions, the product(s) listed in Section 1 are approved for the following:

8.1.1 BareNaked Tstud™ 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 2x4 (38 mm x 89 mm) solid sawn lumber in all cases for wall structural members.

8.1.2 For use as a 2x6 (38 mm x 140 mm), design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment. In these cases, specified design values as provided in Table 2 shall be used in accordance with *NBC* Section 4.1 and Section 9.23.

8.1.3 BareNaked Tstud™ installed as built-up columns, as described in this TER, are compliant with the codes listed in *CSA O86* Article 6.5.5.4[14].

8.1.4 BareNaked Tstud™ Headers, as described in this TER, are compliant with the codes listed in *CSA O86* Article 6.5.3.2.4[15].

8.2 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known provincial, territorial, and local building codes. Where there are known variations in provincial, territorial, or local codes applicable to this TER, they are listed here.

8.2.1 No known variations

8.3 *NBC* Volume 1 Relationship of the NBC to Standards Development and Conformity Assessment:

> **Certification**
> Certification is the confirmation by an independent organization that a product, service, or system meets a requirement…Certification bodies publish lists of certified products and companies…Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services.
>
> **Evaluation**
> An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of the Code requirement...

8.4 ISO/IEC 17065 accreditation bodies, including but not limited to SCC and ANAB, confirm that product certification bodies have the expertise to provide *evaluation* services within their scope of accreditation. All SCC and ANAB product certification bodies meet *NBC* requirements to offer *evaluation* services for *alternative solutions*.[16]

8.4.1 DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs professional engineers.[17]

8.5 Product certification organizations, accredited by SCC and ANAB, are defined as equivalent *evaluation* services:

8.5.1 The Canada-United States-Mexico Agreement (CUSMA) Article 11.6 Conformity Assessment confirms mutual recognition by stating, "...each Party shall accord to conformity assessment bodies located in the territory of another Party treatment no less favorable than that it accords to conformity assessment bodies located in its own territory or in the territory of the other Party."

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[14] 2014 *CSA O86* Article 6.5.6.4

[15] 2014 *CSA O86* Article 6.5.4.2.2

[16] *NBC* Division A Clause A-1.2.1.1.(1)(b) provides information on code compliance via alternative solutions and defines alternative solutions as "...achiev[ing] at least the minimum level of performance required by Division B." *NBC* Division C Section 2.3 includes additional guidance for documentation of alternative solutions.

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

8.5.2 The SCC National Conformity Assessment Principles states, “SCC is a member of a number of international organizations developing voluntary conformity assessment agreements that help ensure the international acceptance of Canadian conformity assessment results. Signatories to these agreements (like SCC) recognize each other’s accreditations as being equivalent to their own.”[18]

8.6 Building official approval of a licensed professional engineer is performed by verifying the professional engineer and/or their business entity are listed by the licensing board of the relevant jurisdiction.

9 Conditions of Use

9.1 BareNaked 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 a 5½" BareNaked Tstud™ is 4.3 m (14').

9.1.2 The maximum wall height for a 7¼" or larger BareNaked Tstud™ is 4.9 m (16').

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

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

9.2 Notches in the exterior faces of the BareNaked Tstud™ (flange and spline) are not permitted (Figure 10).

9.3 No dowels may be cut or damaged (Figure 10).

9.4 Where BareNaked Tstud™ is used as a top plate, a separate means of fire-blocking shall be provided in accordance with *NBC* Subsection 3.1.11.

9.5 Where required by the *authority having jurisdiction* where the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.

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

9.7 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 *designer* (e.g., *owner*).

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

9.9 This product is manufactured under a third-party quality control program with quality control inspections established by the governing legislation of the adopting province or territory, as described in *NBC* Volume 1 commentary on Conformity Assessment.

9.10 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. Therefore, the TER shall be reviewed for code compliance by the AHJ for acceptance.

9.11 The use of this TER is dependent on the manufacturer in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer instructions, the AHJ's inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

[18] The National Conformity Assessment Principles states, “Product regulations and standards may vary from country to country. If these are set arbitrarily, they could be deemed as protectionist. The World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT Agreement) is intended to ensure that technical regulations, standards and conformity assessment procedures of member countries do not create unnecessary obstacles to trade. Under the TBT Agreement, members of the WTO agree to use international standards, including conformity assessment standards and guides, as a basis for their technical requirements.”

10 Identification

10.1 The products listed in Section 1 are identified by a label on the board or packaging material bearing the manufacturer 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 of this TER, visit drjcertification.org.

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

Appendix A: BareNaked Tstud™ Example Calculation

BareNaked TStud™ Example Calculation:

Determine the factored axial load for an 2.4 m (8 ft) BareNaked Tstud™ of No. 2 SPF lumber spaced 610 mm (24" o.c.) and subject to a specified wind pressure of 2.80 kPa (ULS) and 2.1 kPa (SLS).

$s := 610\ mm$	Stud spacing
$p_{uls} := 2.80\ kPa$	Specified wind pressure, ultimate limit state
$I_W := 0.75$	Importance factor for wind load, Normal, SLS
$p_{sls} := I_W \cdot p_{uls} = 2.1\ kPa$	Specified wind pressure, serviceability limit state
$w := 1.4 \cdot p_{uls} \cdot s = 2391\ \frac{N}{m}$	Factored wind load

Material Properties of BareNaked Tstud™:

The material properties of the No. 2 SPF BareNaked Tstud™ are given in Table 2 of the TER.

$f_bS := 1650\ N \cdot m$	Specified bending
$f_c := 11.5\ MPa$	Specified compression parallel to grain
$f_t := 5.5\ MPa$	Specified tension parallel to grain
$f_{cp} := 5.3\ MPa$	Specified compression perpendicular to grain
$V_c := 2130\ N$	Specified shear force
$EI := 55200\ N \cdot m^2$	Bending stiffness
$EI_{05} := 48100\ N \cdot m^2$	Bending stiffness for beam and column stability
$I := 25.625\ in^4 = 10665930\ mm^4$	Moment of inertia
$E_{05} := \frac{EI_{05}}{I} = 4510\ MPa$	Modulus of elasticity for design of compression members

Section Properties of BareNaked Tstud™:

$d := 5.5\ in = 140\ mm$	Effective depth of stud
$d_1 := 1.5\ in = 38\ mm$	Wide face dimension
$d_2 := 2.5\ in = 64\ mm$	Narrow face dimension
$d_{dowel} := \frac{11}{16}\ in = 17\ mm$	Dowel diameter
$A := (d_1 \cdot d_2) + ((d_1 - d_{dowel}) \cdot d_2) = 3730\ mm^2$	Net section area of BareNaked Tstud™
$h := 2340\ mm = 8\ ft$	Height of BareNaked Tstud™

Bending Moment Resistance:

$\phi := 0.90$	
$K_D := 1.15$	Load duration factor for short term
$K_H := 1.04$	System factor for load-sharing system

$K_{Sb} := 1.0$ Service condition factor for dry, bending at extreme fiber

$K_T := 1.0$ Treatment factor for untreated lumber products

$F_bS := f_bS \cdot (K_D \cdot K_H \cdot K_{Sb} \cdot K_T) = 1973\ \boldsymbol{N \cdot m}$

$K_{Zb} := 1.4$ Size factor in bending

$K_L := 1$ Lateral stability factor assuming lateral support

$M_r := \phi \cdot F_bS \cdot K_{Zb} \cdot K_L = 2486\ \boldsymbol{N \cdot m}$ Bending moment resistance, CSA O86 Section 15.3.3.1

Compressive Resistance Parallel to Grain:

$\phi := 0.80$

$K_e := 1.00$ Effective length factor

$K_D := 1.00$ Load duration factor for standard term

$K_{sc} := 1.00$ Service condition factor for dry, compression parallel to grain

$K_T := 1.0$ Treatment factor for untreated lumber products

$F_c := f_c \cdot (K_D \cdot K_{sc} \cdot K_T) = 11.5\ \boldsymbol{MPa}$

$K_{Zc} := 1.0$ Size factor for compression parallel to grain

$L_e := K_e \cdot h = 2340\ \boldsymbol{mm}$ Effective length

$C_C := \frac{L_e}{d} = 17$ Slenderness ratio

$K_{SE} := 1.0$ Service condition factor for dry, MOE

$K_C := \left(1.0 + \frac{F_c \cdot K_{Zc} \cdot {C_C}^3}{35 \cdot E_{05} \cdot K_{SE} \cdot K_T}\right)^{-1} = 0.74$ Slenderness factor

$P_r := \phi \cdot F_c \cdot A \cdot K_C \cdot K_{Zc} = 25562\ \boldsymbol{N}$ Factored compressive resistance parallel to grain, CSA O86 Section 15.3.3.4

Compressive Resistance Perpendicular to Grain:

$\phi := 0.80$

$K_D := 1.00$ Load duration factor for standard term

$K_S := 1.0$ Service condition factor for dry service

$K_T := 1.0$ Treatment factor for untreated lumber products

$F_{cp} := f_{cp} \cdot (K_D \cdot K_S \cdot K_T)$

$A_b := 2 \cdot d_1 \cdot d_2 = 4839\ \boldsymbol{mm^2}$ Bearing area

$K_B := 1.13$ Length of bearing factor

$K_{Zcp} := 1$ Size factor for bearing

$Q_r := \phi \cdot F_{cp} \cdot A_b \cdot K_B \cdot K_{Zcp} = 23183\ \boldsymbol{N}$ Compressive resistance perpendicular to grain, CSA O86 Section 15.3.3.6

Resistance to Combined Bending and Axial Load:

$P_f := 7.15\ \boldsymbol{kN} = 7150\ \boldsymbol{N}$ — Factored axial load on the BareNaked Tstud™ is selected to result in a CSI of 1.0.

$P_r := min\left(P_r, Q_r\right) = 23183\ \boldsymbol{N}$ — Check for failure in compression perpendicular to grain

$P_E := \frac{\left(\pi^2 \cdot E_{05} \cdot K_{SE} \cdot K_T \cdot I\right)}{L_e^{\,2}} = 86699\ \boldsymbol{N}$ — Euler buckling load in the plane of the applied moment

$M_f := \frac{\left(w \cdot h^2\right)}{8} = 1637\ \boldsymbol{N \cdot m}$ — Factored bending moment

$\left(\frac{P_f}{P_r}\right)^2 + \frac{M_f}{M_r} \cdot \left(\frac{1}{1 - \frac{P_f}{P_E}}\right) = 1$ **<1 OK** — Resistance to combined bending and axial load, CSA O86 Section 15.3.3.9

Deflection Limit:

$\Delta := \frac{5 \cdot \left(p_{sls} \cdot s\right) \cdot h^4}{384 \cdot EI} = 9.060\ \boldsymbol{mm}$ — Deflection

$\frac{h}{\Delta} = 258$ > 240 **OK**

Summary of Design Calculations for BareNaked Tstud™:

The BareNaked Tstud™ has a calculated axial load capacity of 7.15 kN for 2.44 m (8 ft) BareNaked Tstud™ of No. 2 SPF lumber spaced 610 mm (24" o.c.) and subject to a wind pressure of 2.80 kPa. The axial load is limited by the compression strength of the BareNaked Tstud™ member under combined axial and wind loading.

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Ontario Supplement to TER 1908-03

REPORT HOLDER: US Engineered Wood, Inc.

1 Evaluation Subject

1.1 BareNaked Tstud™ Structural Wall Stud and BareNaked TStud™ Header

2 Purpose and Scope

2.1 *Purpose*

2.1.1 The purpose of this Technical Evaluation Report (TER) supplement is to show BareNaked Tstud™ Structural Wall Stud and BareNaked TStud™ Header, recognized in TER 1908-03, has also been evaluated for compliance with the codes listed below as adopted by the Building Code Act, 1992.

2.2 *Applicable Code Editions*

2.2.1 *O Reg. 332/12: Ontario Building Code (OBC)*

3 Conclusions

3.1 BareNaked Tstud™ Structural Wall Stud and BareNaked TStud™ Header, described in TER 1908-03, comply with O Reg. 332/12 and are subject to the conditions of use described in this supplement.

3.2 Where there are variations between the *NBC and O Reg. 332/12* applicable to this TER, they are listed here.

3.2.1 No variations

4 Conditions of Use

4.1 BareNaked Tstud™ Structural Wall Stud and BareNaked TStud™ Header, described in TER 1908-03, must comply with all of the following conditions:

4.1.1 All applicable sections in TER 1908-03.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of *O Reg. 332/12*, as applicable.