Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

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Un-Insulated Tstud™ Structural Wall Stud and Un-Insulated Tstud™ Header

Trade Secret Report Holder:

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES Section: 06 10 00 - Rough Carpentry Section: 06 11 00 - Wood Framing

1 Innovative Products Evaluated[1]

1.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header

2 Product Description and Materials

2.1 The innovative products evaluated in this report are shown in **Figure 1** and **Figure 2**.

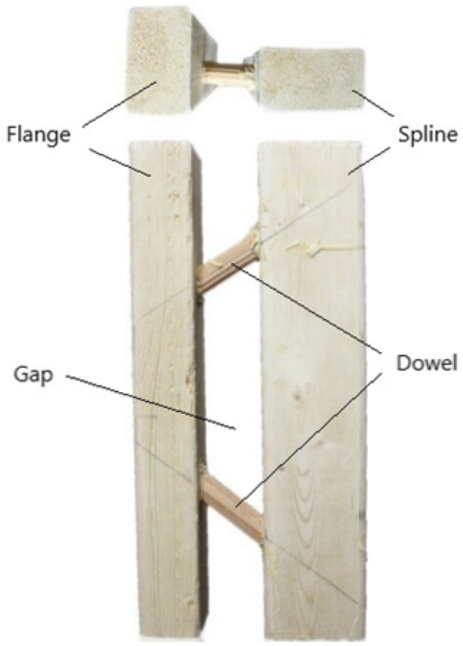


Figure 1. Un-Insulated Tstud

2.2 Un-Insulated Tstud has two available depths, $5^1/_2$" and $7^1/_4$".

2.3 Un-Insulated Tstud is made from a minimum of No. 2 Spruce Pine Fir (SPF) lumber and wooden dowels.

2.4 Un-Insulated 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" or 2" x 4".

2.5 The overall sizes of Un-Insulated Tstud are as follows:

2.5.1 $2^1/_2$" x $5^1/_2$" (2 x 3 spline and 2 x 3 flange)

2.5.2 $2^1/_2$" x $7^1/_4$" (2 x 4 spline and 2 x 3 flange)

2.5.3 $3^1/_2$" x $7^1/_4$" (2 x 4 spline and 2 x 4 flange)

2.6 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.

2.7 Dowels are spaced evenly at a distance not to exceed $6^1/_2$" on center and glued in place using an adhesive that conforms to the specifications of ASTM D2559.

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

2.9 Un-Insulated Tstud can be used as a built-up column when back-to-back Un-Insulated Tstuds are nailed together as specified in **Section 6.2.8**.

2.10 Un-Insulated Tstud Headers consist of two Un-Insulated 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 2**. In order to obtain the properties and loading from this report, the headers shall be installed as received from the manufacturer. Field gluing of Un-Insulated Tstud for use as headers is not permitted.

Figure 2. Un-Insulated Tstud Header

2.11 *Minimum Materials*

2.11.1 *Lumber:*

2.11.1.1 Grade: No. 2 SPF

2.11.1.2 Thickness: $1^1/_2$" (38 mm)

2.11.1.3 Width: $2^1/_2$" (64 mm) or $3^1/_2$" (90 mm)

2.11.1.4 Length: up to 16' (4.3 m)

2.11.2 *Dowels:*

2.11.2.1 Grade: No. 2 SPF

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

2.12 As needed, review material properties for design in **Section 6** and to regulatory evaluation in **Section 8**.

3 Definitions

3.1 New Materials[2] are defined as building materials, equipment, appliances, systems or methods of construction not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[3] The design strengths and permissible stresses shall be established by tests[4] and/or engineering analysis.[5]

3.2 Duly authenticated reports[6] and research reports[7] are test reports and related engineering evaluations, which are written by an approved agency[8] and/or an approved source.[9]

3.2.1 These reports contain intellectual property and/or trade secrets, which are protected by the Defend Trade Secrets Act (DTSA).[10]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[11]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body and/or a licensed Registered Design Professional (RDP).

3.5.1 The Center for Building Innovation (CBI) is ANAB[12] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[13] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[14] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[15]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory where recognition of certificates, validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope, shall be approved.[16] Therefore, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent.[17]

3.9 Approval equity is a fundamental commercial and legal principle.[18]

4 Applicable Standards for the Listing; Regulations for the Regulatory Evaluation[19]

4.1 *Standards*

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

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

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

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

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

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

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

4.2 *Regulations*

4.2.1 *IBC – 15, 18, 21: International Building Code®*

4.2.2 *IRC – 15, 18, 21: International Residential Code®*

4.2.3 *CBC—19, 22: California Building Code[20] (Title 24, Part 2)*

4.2.4 *CRC—19, 22: California Residential Code[20] (Title 24, Part 2.5)*

4.2.5 *LABC—20, 23: City of Los Angeles Building Code[21]*

4.2.6 *LARC—20, 23: City of Los Angeles Residential Code[21]*

5 Listed[22]

5.1 Equipment, materials, products or services included in a List published by a nationally recognized testing laboratory (i.e., CBI), approved agency (i.e., CBI and DrJ), and/or approved source (i.e., DrJ) or other organization concerned with product evaluation (i.e., DrJ) that maintains periodic inspection (i.e., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 *Prescriptive Provision*

6.1.1 Un-Insulated Tstud may be used as an alternative to solid sawn nominal 2 x 4 lumber for wall structural members.

6.1.1.1 Use as a 2 x 6, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.

6.1.1.2 In these cases, referenced design values as specified in **Table 2**, shall be used in accordance with IBC Section 2308 and IRC Section R602.

6.1.2 Un-Insulated Tstud used as structural members of a wall shall be fastened as specified in **Table 1**.

Table 1. Acceptable Fastening Schedule for Un-Insulated Tstud

Application[1]	Fastening	Number and Type of Fastener[2]	Installation[3]
Ceiling Joists to Top Plate	Toenail	3 (4" x 0.131")	Fasten two (2) toenails into interior flange/spline and one (1) toenail into exterior flange/spline per joist
Rafter or Roof Truss to Plate	Toenail	3 (3 1/2" x 0.135")	Two (2) toenails on one side and one (1) toenail on opposite side of each rafter or truss
		4 (4" x 0.131")	Fasten two (2) toenails into interior flange/spline and two (2) toenails 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 16" o.c.
	Face nail through 2 x 3 flange	2 (3 1/2" x 0.131")	
	Face nail through 2 x 4 flange	2 (4 1/2" 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 12" o.c.
	Face nail through 2 x 3 flange	(3 1/2" x 0.131")	
	Face nail through 2 x 4 flange	(4 1/2" 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 24" lap splice length each side of joint)
	Face nail in lapped area through 2 x 3 flange	12 (3 1/2" x 0.131")	
	Face nail in lapped area through 2 x 4 flange	12 (4 1/2" x 0.131")	
Stud to Plate	Toenail	4 (4" x 0.131")	Fasten two (2) toenails 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 (3 1/2" x 0.162")	Fasten two (2) nails, one (1) into each flange/spline
	End nail into stud through 2 x 3 flange	3 (3 1/2" x 0.131")	Fasten two (2) nails into the flange and one (1) nail into the spline
		2 (3 1/2" x 0.162")	Fasten two (2) nails, one (1) into each flange/spline
Plate to Stud	End nail into stud through 2 x 4 flange	3 (4 1/2" x 0.131")	Fasten two (2) nails into the flange and one (1) nail into the spline
		2 (4 1/2" x 0.162")	Fasten two (2) nails, one (1) into each flange/spline

Table 1. Acceptable Fastening Schedule for Un-Insulated Tstud

Application[1]	Fastening	Number and Type of Fastener[2]	Installation[3]
Top Plates, Laps at Corners and Intersections	Face nail through spline	2 (3 1/2" x 0.162")	Fasten two (2) face nails, one (1) into each flange/spline
Rim Joist to Sill or Top Plate	Toenail	(2 1/2" x 0.113")	4" o.c. toenail
		(2 1/2" x 0.131")	6" o.c. toenail

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 2.5**).
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. Care must be taken to avoid splitting.
4. When used as built-up column for strength, installation must be in accordance with **Section 6.2.8**.

6.1.3 Un-Insulated Tstud may be used as a single top plate in accordance with IRC Section R602.3.2 and the following:

6.1.3.1 Fasteners for Un-Insulated Tstud connections shall be distributed in each Un-Insulated Tstud flange and spline (top plate to stud connections shall be fastened as specified in **Table 1**).

6.1.3.2 Where Un-Insulated Tstud is used as a top plate, a separate means of fireblocking shall be provided in accordance with **Section 12.7**.

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

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

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

6.1.6 For trusses and rafters placed on Un-Insulated Tstud wall studs, see **Table 3** for 5 1/2" Un-Insulated Tstud and **Table 4** for 7 1/4" Un-Insulated Tstud.

6.2 *Engineered Design*

6.2.1 The design provisions for wood construction noted in IBC Section 2302.1[23] and IRC Section R301.1.3 apply to Un-Insulated Tstud for Allowable Stress Design (ASD), unless otherwise noted in this report.

6.2.2 Design of connections using Un-Insulated Tstud shall be in accordance with NDS.

6.2.3 *Material Properties:*

6.2.3.1 Reference design values for Un-Insulated Tstud are specified in **Table 2**.

6.2.3.1.1 Reference design values for Un-Insulated Tstud shall be multiplied by the adjustment factors specified in NDS Section 4.3.

Table 2. Un-Insulated Tstud Reference Design Values[1]

Reference Design Values	5½" Un-Insulated Tstud	7¼" Un-Insulated Tstud
Bending, F_bS	660 lb-ft	975 lb-ft
Compression Parallel to Grain, F_c	1,150 psi	1,150 psi
Tension Parallel to Grain, F_t	450 psi	450 psi
Compression Perpendicular to Grain, $F_{c\perp}$	425 psi	425 psi
Shear Force, V	260 lb	230 lb
Bending Stiffness, EI	19,300,000 lb-in^2	37,100,000 lb-in^2
Bending Stiffness for Beam and Column Stability, EI_{min}	8,600,000 lb-in^2	15,000,000 lb-in^2

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb-ft = 1.36 N-m, 1 psi = 0.00689 MPa

1. Un-Insulated Tstud made from No. 2 SPF

6.2.4 *Design for Compression Loads:*

6.2.4.1 The maximum allowable compression load for walls framed with 5½" and 7¼" Un-Insulated Tstud are specified in **Table 3** and **Table 4**, respectively.

6.2.4.2 The maximum allowable compression load is based on perpendicular-to-grain crushing of SPF top and bottom plates, and the compression parallel to grain of Un-Insulated Tstuds.

6.2.4.3 The allowable axial compression for Un-Insulated Tstud can be calculated using the provisions of NDS Section 3.6 and 3.7.

6.2.4.4 For computing the column stability factor (CP), 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 Un-Insulated Tstud (in^2) = (2.5" x 1.5") + ((1.5" – 0.6875") x 2.5") = 5.78 in^2

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

Table 3. Allowable Compressive Load for Walls Framed with 5 1/2" Un-Insulated Tstud

Stud Height (ft)	Allowable Compressive Load[1] (lbs)		
	Top/Bottom Plate[2]		
	Un-Insulated Tstud (SPF) (SG = 0.42)[3]	Southern Pine (SYP) (SG = 0.55)[4]	LVL or LSL[5]
8	3,665	4,875	5,930
9	3,665	4,875	5,350
10	3,665	4,750	4,750
11	3,665	4,175	4,175
12	3,660	3,660	3,660
13	3,210	3,210	3,210
14	2,825	2,825	2,825

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 Un-Insulated Tstud, 565 psi for SYP, 820 for LVL and 800 for LSL (adjusted per NDS Section 3.10.4).
3. Compression perpendicular to grain of the Un-Insulated Tstud or SPF top and bottom plates controls for walls less than or equal to 11 ft. in height.
4. Compression perpendicular to grain of the SYP top and bottom plates controls for walls less than or equal to 9 ft. in height.
5. Compression perpendicular to grain of the LVL or LSL top and bottom plates does not control.

Table 4. Allowable Compressive Load for Walls Framed with 7 1/4" Un-Insulated Tstud

Stud Height (ft)	Allowable Compressive Load[1] (lbs)		
	Top/Bottom Plate[2]		
	Un-Insulated Tstud (SPF) (SG = 0.42)	Southern Pine (SYP) (SG = 0.55)	LVL or LSL
8	4,400	5,850	7,565
9	4,400	5,850	7,155
10	4,400	5,850	6,670
11	4,400	5,850	6,135
12	4,400	5,580	5,580
13	4,400	5,040	5,040
14	4,400	4,530	4,530
15	4,075	4,075	4,075
16	3,665	3,665	3,665

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

1. Maximum stud spacing of 24".
2. Minimum compression perpendicular to grain is 425 psi for Un-Insulated Tstud, 565 psi for SYP, 820 for LVL and 800 for LSL (adjusted per NDS Section 3.10.4).

6.2.5 *Design for Bending:*

6.2.5.1 The maximum bending moment and shear forces shall not exceed the reference design values for the Un-Insulated Tstud specified in **Table 2**.

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

6.2.6.1 Un-Insulated Tstud resists bending using tension and compression stresses in the flange and spline.

6.2.6.2 The axial compressive stress due to combined bending and axial load can be computed using **Equation 2**. As an example, variables for the design of the 5½" Un-Insulated Tstud are defined below:

Equation 2. Axial Compressive Stress

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

where: P = axial load applied to Un-Insulated Tstud (lb)

A = minimum net section area of Un-Insulated Tstud (in^2)
= (2.5" x 1.5") + ((1.5" – 0.6875") x 2.5") = 5.78 in^2

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

A_m = minimum net section area of single Un-Insulated Tstud member (in^2)
= ((1.5" – 0.6875") x 2.5") = 2.03 in^2

d_{eff} = distance from center to center of Un-Insulated Tstud member (in) = 3.50 in

6.2.6.3 The axial stresses in Un-Insulated Tstud member shall be checked in accordance with NDS Section 3.6 and 3.7.

6.2.6.4 Un-Insulated Tstud shall also be checked in bending only to insure the allowable bending moment in **Table 2** is not exceeded.

6.2.6.5 Allowable wind pressures for Un-Insulated Tstud subject to axial loads are specified in the following tables:

6.2.6.5.1 *5½" Un-Insulated Tstud:*

6.2.6.5.1.1 SPF top/bottom plate: **Table 5**

6.2.6.5.1.2 SP top/bottom plate: **Table 6**

6.2.6.5.1.3 LVL or LSL top/bottom plate: **Table 7**

6.2.6.5.2 *7¼" Un-Insulated Tstud:*

6.2.6.5.2.1 SPF top/bottom plate: **Table 8**

6.2.6.5.2.2 SP top/bottom plate: **Table 9**

6.2.6.5.2.3 LVL or LSL top/bottom plate: **Table 10**

Table 5. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
($5^1/_2$" Un-Insulated Tstud and SPF Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	3,665 (L/2161)	3,665 (L/1621)	3,665 (L/1297)	3,665 (L/1081)	3,665 (L/926)	3,665 (L/810)	3,665 (L/720)	3,665 (L/648)	3,665 (L/589)	3,665 (L/540)
	9	3,665 (L/1497)	3,665 (L/1123)	3,665 (L/898)	3,665 (L/748)	3,665 (L/641)	3,665 (L/561)	3,325 (L/499)	2,980 (L/449)	2,635 (L/408)	2,290 (L/374)
	10	3,665 (L/1079)	3,665 (L/809)	3,295 (L/647)	2,865 (L/540)	2,435 (L/462)	2,010 (L/405)	1,580 (L/360)	1,155 (L/324)	725 (L/294)	295 (L/270)
	12	2,080 (L/614)	1,460 (L/461)	835 (L/368)	210 (L/307)	-	-	-	-	-	-
	14	400 (L/382)	-	-	-	-	-	-	-	-	-
16	8	3,665 (L/1621)	3,665 (L/1216)	3,665 (L/973)	3,665 (L/810)	3,665 (L/695)	3,665 (L/608)	3,665 (L/540)	3,665 (L/486)	3,610 (L/442)	3,250 (L/405)
	9	3,665 (L/1123)	3,665 (L/842)	3,665 (L/674)	3,665 (L/561)	3,210 (L/481)	2,750 (L/421)	2,290 (L/374)	1,830 (L/337)	1,370 (L/306)	910 (L/281)
	10	3,665 (L/809)	3,150 (L/607)	2,580 (L/486)	2,010 (L/405)	1,440 (L/347)	865 (L/303)	295 (L/270)	-	-	-
	12	1,460 (L/461)	625 (L/345)	-	-	-	-	-	-	-	-
24	8	3,665 (L/1081)	3,665 (L/810)	3,665 (L/648)	3,665 (L/540)	3,665 (L/463)	3,250 (L/405)	2,715 (L/360)	2,175 (L/324)	1,635 (L/295)	1,095 (L/270)
	9	3,665 (L/748)	3,665 (L/561)	2,980 (L/449)	2,290 (L/374)	1,600 (L/321)	910 (L/281)	225 (L/249)	-	-	-
	10	2,865 (L/540)	2,010 (L/405)	1,155 (L/324)	295 (L/270)	-	-	-	-	-	-
	12	210 (L/307)	-	-	-	-	-	-	-	-	-

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SPF top and bottom plates.

Table 6. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
($5^1/_2$" Un-Insulated Tstud and SP Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	4,875 (L/2161)	4,875 (L/1621)	4,875 (L/1297)	4,875 (L/1081)	4,875 (L/926)	4,875 (L/810)	4,875 (L/720)	4,870 (L/648)	4,600 (L/589)	4,330 (L/540)
	9	4,875 (L/1497)	4,875 (L/1123)	4,700 (L/898)	4,355 (L/748)	4,010 (L/641)	3,670 (L/561)	3,325 (L/499)	2,980 (L/449)	2,635 (L/408)	2,290 (L/374)
	10	4,150 (L/1079)	3,720 (L/809)	3,295 (L/647)	2,865 (L/540)	2,435 (L/462)	2,010 (L/405)	1,580 (L/360)	1,155 (L/324)	725 (L/294)	295 (L/270)
	12	2,080 (L/614)	1,460 (L/461)	835 (L/368)	210 (L/307)	--	--	--	--	--	--
	14	400 (L/382)	--	--	--	--	--	--	--	--	--
16	8	4,875 (L/1621)	4,875 (L/1216)	4,875 (L/973)	4,875 (L/810)	4,875 (L/695)	4,690 (L/608)	4,330 (L/540)	3,970 (L/486)	3,610 (L/442)	3,250 (L/405)
	9	4,875 (L/1123)	4,585 (L/842)	4,125 (L/674)	3,670 (L/561)	3,210 (L/481)	2,750 (L/421)	2,290 (L/374)	1,830 (L/337)	1,370 (L/306)	910 (L/281)
	10	3,720 (L/809)	3,150 (L/607)	2,580 (L/486)	2,010 (L/405)	1,440 (L/347)	865 (L/303)	295 (L/270)	--	--	--
	12	1,460 (L/461)	625 (L/345)	--	--	--	--	--	--	--	--
24	8	4,875 (L/1081)	4,875 (L/810)	4,870 (L/648)	4,330 (L/540)	3,790 (L/463)	3,250 (L/405)	2,715 (L/360)	2,175 (L/324)	1,635 (L/295)	1,095 (L/270)
	9	4,355 (L/748)	3,670 (L/561)	2,980 (L/449)	2,290 (L/374)	1,600 (L/321)	910 (L/281)	225 (L/249)	--	--	--
	10	2,865 (L/540)	2,010 (L/405)	1,155 (L/324)	295 (L/270)	--	--	--	--	--	--
	12	210 (L/307)	--	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and LVL or LSL (minimum compression perpendicular to grain strength to be 800 psi) top and bottom plates.

Table 7. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(5 1/2" Un-Insulated Tstud and LVL or LSL Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	5930 (L/2161)	5930 (L/1621)	5930 (L/1297)	5930 (L/1081)	5680 (L/926)	5410 (L/810)	5140 (L/720)	4870 (L/648)	4600 (L/589)	4330 (L/540)
	9	5350 (L/1497)	5045 (L/1123)	4700 (L/898)	4355 (L/748)	4010 (L/641)	3670 (L/561)	3325 (L/499)	2980 (L/449)	2635 (L/408)	2290 (L/374)
	10	4150 (L/1079)	3720 (L/809)	3295 (L/647)	2865 (L/540)	2435 (L/462)	2010 (L/405)	1580 (L/360)	1155 (L/324)	725 (L/294)	295 (L/270)
	12	2080 (L/614)	1460 (L/461)	835 (L/368)	210 (L/307)	--	--	--	--	--	--
	14	400 (L/382)	--	--	--	--	--	--	--	--	--
16	8	5930 (L/1621)	5930 (L/1216)	5770 (L/973)	5410 (L/810)	5050 (L/695)	4690 (L/608)	4330 (L/540)	3970 (L/486)	3610 (L/442)	3250 (L/405)
	9	5045 (L/1123)	4585 (L/842)	4125 (L/674)	3670 (L/561)	3210 (L/481)	2750 (L/421)	2290 (L/374)	1830 (L/337)	1370 (L/306)	910 (L/281)
	10	3720 (L/809)	3150 (L/607)	2580 (L/486)	2010 (L/405)	1440 (L/347)	865 (L/303)	295 (L/270)	--	--	--
	12	1460 (L/461)	625 (L/345)	--	--	--	--	--	--	--	--
24	8	5930 (L/1081)	5410 (L/810)	4870 (L/648)	4330 (L/540)	3790 (L/463)	3250 (L/405)	2715 (L/360)	2175 (L/324)	1635 (L/295)	1095 (L/270)
	9	4355 (L/748)	3670 (L/561)	2980 (L/449)	2290 (L/374)	1600 (L/321)	910 (L/281)	225 (L/249)	--	--	--
	10	2865 (L/540)	2010 (L/405)	1155 (L/324)	295 (L/270)	--	--	--	--	--	--
	12	210 (L/307)	--	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and LVL or LSL (minimum compression perpendicular to grain strength to be 800 psi) top and bottom plates.

Table 8. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(7 1/4" Un-Insulated Tstud and SPF Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	4400 (L/4167)	4400 (L/3126)	4400 (L/2500)	4400 (L/2084)	4400 (L/1786)	4400 (L/1563)	4400 (L/1389)	4400 (L/1250)	4400 (L/1137)	4400 (L/1042)
	9	4400 (L/2886)	4400 (L/2165)	4400 (L/1732)	4400 (L/1443)	4400 (L/1237)	4400 (L/1082)	4400 (L/962)	4400 (L/866)	4400 (L/787)	4400 (L/722)
	10	4400 (L/2081)	4400 (L/1561)	4400 (L/1248)	4400 (L/1040)	4400 (L/892)	4400 (L/780)	4400 (L/694)	4400 (L/624)	4400 (L/567)	4115 (L/520)
	12	4400 (L/1184)	4355 (L/888)	3830 (L/711)	3310 (L/592)	2785 (L/508)	2260 (L/444)	1735 (L/395)	1210 (L/355)	685 (L/323)	165 (L/296)
	14	2805 (L/737)	2090 (L/553)	1370 (L/442)	650 (L/369)	--	--	--	--	--	--
	16	1060 (L/489)	115 (L/367)	--	--	--	--	--	--	--	--
16	8	4400 (L/3126)	4400 (L/2344)	4400 (L/1875)	4400 (L/1563)	4400 (L/1340)	4400 (L/1172)	4400 (L/1042)	4400 (L/938)	4400 (L/852)	4400 (L/781)
	9	4400 (L/2165)	4400 (L/1624)	4400 (L/1299)	4400 (L/1082)	4400 (L/928)	4400 (L/812)	4400 (L/722)	4400 (L/649)	4400 (L/590)	4400 (L/541)
	10	4400 (L/1561)	4400 (L/1170)	4400 (L/936)	4400 (L/780)	4400 (L/669)	4400 (L/585)	4115 (L/520)	3635 (L/468)	3155 (L/426)	2675 (L/390)
	12	4355 (L/888)	3655 (L/666)	2960 (L/533)	2260 (L/444)	1560 (L/381)	860 (L/333)	165 (L/296)	--	--	--
	14	2090 (L/553)	1130 (L/415)	170 (L/332)	--	--	--	--	--	--	--
	16	115 (L/367)	--	--	--	--	--	--	--	--	--
24	8	4400 (L/2084)	4400 (L/1563)	4400 (L/1250)	4400 (L/1042)	4400 (L/893)	4400 (L/781)	4400 (L/695)	4400 (L/625)	4400 (L/568)	4400 (L/521)
	9	4400 (L/1443)	4400 (L/1082)	4400 (L/866)	4400 (L/722)	4400 (L/618)	4400 (L/541)	4340 (L/481)	3765 (L/433)	3185 (L/394)	2605 (L/361)
	10	4400 (L/1040)	4400 (L/780)	4400 (L/624)	4115 (L/520)	3395 (L/446)	2675 (L/390)	1955 (L/347)	1235 (L/312)	515 (L/284)	--
	12	3310 (L/592)	2260 (L/444)	1210 (L/355)	165 (L/296)	--	--	--	--	--	--
	14	650 (L/369)	--	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SPF top and bottom plates.

Table 9. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
($7^1/_4$" Un-Insulated Tstud and SP Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	5850 (L/4167)	5850 (L/3126)	5850 (L/2500)	5850 (L/2084)	5850 (L/1786)	5850 (L/1563)	5850 (L/1389)	5850 (L/1250)	5850 (L/1137)	5850 (L/1042)
	9	5850 (L/2886)	5850 (L/2165)	5850 (L/1732)	5850 (L/1443)	5850 (L/1237)	5850 (L/1082)	5850 (L/962)	5850 (L/866)	5850 (L/787)	5850 (L/722)
	10	5850 (L/2081)	5850 (L/1561)	5850 (L/1248)	5850 (L/1040)	5850 (L/892)	5555 (L/780)	5195 (L/694)	4835 (L/624)	4475 (L/567)	4115 (L/520)
	12	4880 (L/1184)	4355 (L/888)	3830 (L/711)	3310 (L/592)	2785 (L/508)	2260 (L/444)	1735 (L/395)	1210 (L/355)	685 (L/323)	165 (L/296)
	14	2805 (L/737)	2090 (L/553)	1370 (L/442)	650 (L/369)	--	--	--	--	--	--
	16	1060 (L/489)	115 (L/367)	--	--	--	--	--	--	--	--
16	8	5850 (L/3126)	5850 (L/2344)	5850 (L/1875)	5850 (L/1563)	5850 (L/1340)	5850 (L/1172)	5850 (L/1042)	5850 (L/938)	5850 (L/852)	5850 (L/781)
	9	5850 (L/2165)	5850 (L/1624)	5850 (L/1299)	5850 (L/1082)	5850 (L/928)	5850 (L/812)	5850 (L/722)	5690 (L/649)	5305 (L/590)	4920 (L/541)
	10	5850 (L/1561)	5850 (L/1170)	5850 (L/936)	5555 (L/780)	5075 (L/669)	4595 (L/585)	4115 (L/520)	3635 (L/468)	3155 (L/426)	2675 (L/390)
	12	4355 (L/888)	3655 (L/666)	2960 (L/533)	2260 (L/444)	1560 (L/381)	860 (L/333)	165 (L/296)	--	--	--
	14	2090 (L/553)	1130 (L/415)	170 (L/332)	--	--	--	--	--	--	--
	16	115 (L/367)	--	--	--	--	--	--	--	--	--
24	8	5850 (L/2084)	5850 (L/1563)	5850 (L/1250)	5850 (L/1042)	5850 (L/893)	5850 (L/781)	5850 (L/695)	5850 (L/625)	5660 (L/568)	5210 (L/521)
	9	5850 (L/1443)	5850 (L/1082)	5850 (L/866)	5850 (L/722)	5500 (L/618)	4920 (L/541)	4340 (L/481)	3765 (L/433)	3185 (L/394)	2605 (L/361)
	10	5850 (L/1040)	5555 (L/780)	4835 (L/624)	4115 (L/520)	3395 (L/446)	2675 (L/390)	1955 (L/347)	1235 (L/312)	515 (L/284)	--
	12	3310 (L/592)	2260 (L/444)	1210 (L/355)	165 (L/296)	--	--	--	--	--	--
	14	650 (L/369)	--	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SYP top and bottom plates.

Table 10. Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures
(7 1/4" Un-Insulated Tstud and LVL or LSL Top/Bottom Plate)

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	7565 (L/4167)	7565 (L/3126)	7565 (L/2500)	7565 (L/2084)	7565 (L/1786)	7565 (L/1563)	7565 (L/1389)	7565 (L/1250)	7565 (L/1137)	7565 (L/1042)
	9	7155 (L/2886)	7155 (L/2165)	7155 (L/1732)	7155 (L/1443)	7155 (L/1237)	7155 (L/1082)	6945 (L/962)	6655 (L/866)	6365 (L/787)	6080 (L/722)
	10	6670 (L/2081)	6670 (L/1561)	6635 (L/1248)	6275 (L/1040)	5915 (L/892)	5555 (L/780)	5195 (L/694)	4835 (L/624)	4475 (L/567)	4115 (L/520)
	12	4880 (L/1184)	4355 (L/888)	3830 (L/711)	3310 (L/592)	2785 (L/508)	2260 (L/444)	1735 (L/395)	1210 (L/355)	685 (L/323)	165 (L/296)
	14	2805 (L/737)	2090 (L/553)	1370 (L/442)	650 (L/369)	--	--	--	--	--	--
	16	1060 (L/489)	115 (L/367)	--	--	--	--	--	--	--	--
16	8	7565 (L/3126)	7565 (L/2344)	7565 (L/1875)	7565 (L/1563)	7565 (L/1340)	7565 (L/1172)	7565 (L/1042)	7565 (L/938)	7320 (L/852)	7020 (L/781)
	9	7155 (L/2165)	7155 (L/1624)	7155 (L/1299)	7155 (L/1082)	6850 (L/928)	6465 (L/812)	6080 (L/722)	5690 (L/649)	5305 (L/590)	4920 (L/541)
	10	6670 (L/1561)	6515 (L/1170)	6035 (L/936)	5555 (L/780)	5075 (L/669)	4595 (L/585)	4115 (L/520)	3635 (L/468)	3155 (L/426)	2675 (L/390)
	12	4355 (L/888)	3655 (L/666)	2960 (L/533)	2260 (L/444)	1560 (L/381)	860 (L/333)	165 (L/296)	--	--	--
	14	2090 (L/553)	1130 (L/415)	170 (L/332)	--	--	--	--	--	--	--
	16	115 (L/367)	--	--	--	--	--	--	--	--	--
24	8	7565 (L/2084)	7565 (L/1563)	7565 (L/1250)	7565 (L/1042)	7475 (L/893)	7020 (L/781)	6565 (L/695)	6115 (L/625)	5660 (L/568)	5210 (L/521)
	9	7155 (L/1443)	7155 (L/1082)	6655 (L/866)	6080 (L/722)	5500 (L/618)	4920 (L/541)	4340 (L/481)	3765 (L/433)	3185 (L/394)	2605 (L/361)
	10	6275 (L/1040)	5555 (L/780)	4835 (L/624)	4115 (L/520)	3395 (L/446)	2675 (L/390)	1955 (L/347)	1235 (L/312)	515 (L/284)	--
	12	3310 (L/592)	2260 (L/444)	1210 (L/355)	165 (L/296)	--	--	--	--	--	--
	14	650 (L/369)	--	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and LVL or LSL (minimum compression perpendicular to grain strength to be 800 psi) top and bottom plates.

6.2.7 *Use of Un-Insulated Tstuds in Shear Walls:*

6.2.7.1 Un-Insulated Tstuds 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 11**.

6.2.7.1.1 As shown in **Table 11**, the response modification coefficient, R; system overstrength factor, Ω_0; and deflection amplification factor, C_d, 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 11. Seismic Design Coefficients for Un-Insulated 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
Un-Insulated 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.

6.2.8 *Design for Built-Up Columns:*

6.2.8.1 Un-Insulated Tstud may be used as built-up columns per NDS Section 3.6.2.3 when installed and nailed together, as shown in **Figure 3** and **Figure 4**.

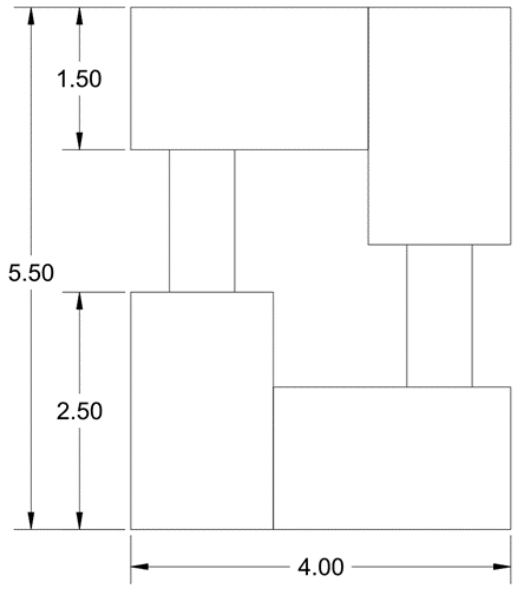


Figure 3. 5½" Un-Insulated Tstud Built-Up Column

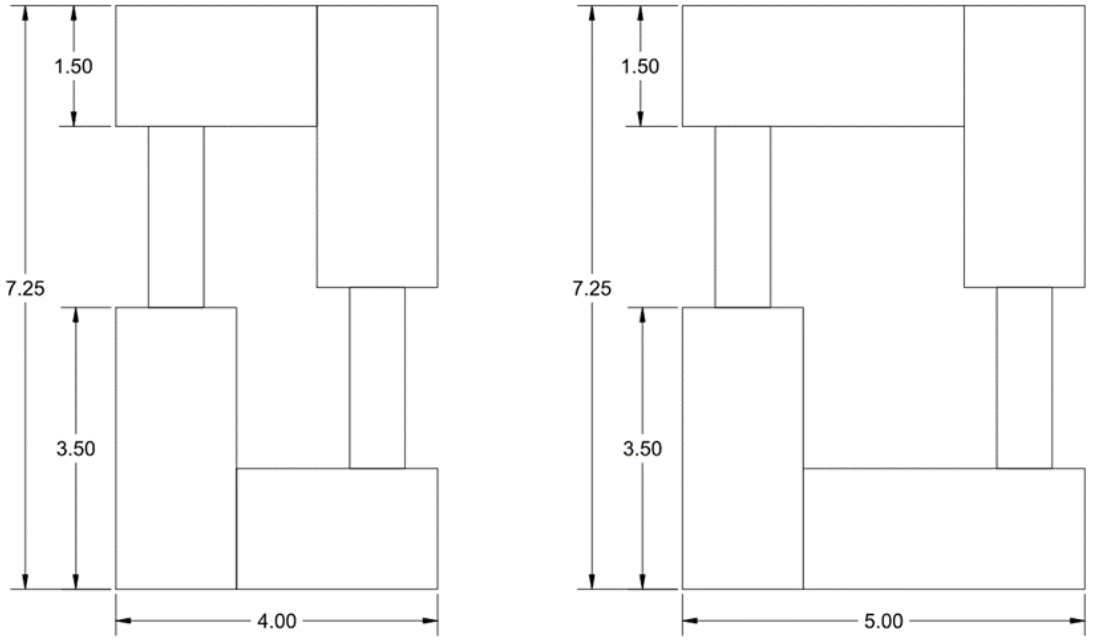


Figure 4. 7¼" Un-Insulated Tstud Built-Up Columns with 2x3 Flange and 2x4 Flange

6.2.8.2 When used as built-up columns, Un-Insulated Tstud shall be designed and installed in accordance with NDS Section 3.6.3 and Section 3.7 per NDS Section 15.3.

6.2.8.3 Un-Insulated Tstud shall be fastened together in accordance with NDS Section 15.3.3, **Figure 5** and **Figure 6** of this report, and the following provisions:

6.2.8.3.1 Nails can be driven from either side of the Un-Insulated Tstud column (**Figure 5** and **Figure 6**).

6.2.8.3.2 Minimum fastener diameter of 0.131" (8d common wire nail).

6.2.8.3.3 See **Figure 5** and **Figure 6** for minimum fastener lengths.

6.2.8.3.4 15D ≤ end distance ≤ 18D

6.2.8.3.5 20D ≤ spacing between adjacent nails in a row ≤ 8"

6.2.8.3.6 Single row of nails per spline/flange.

6.2.8.3.7 5D ≤ edge distance from exterior of Un-Insulated Tstud column ≤ 20D

6.2.8.3.8 Both flange/spline pairs of the Un-Insulated Tstud column must have a single row of nails.

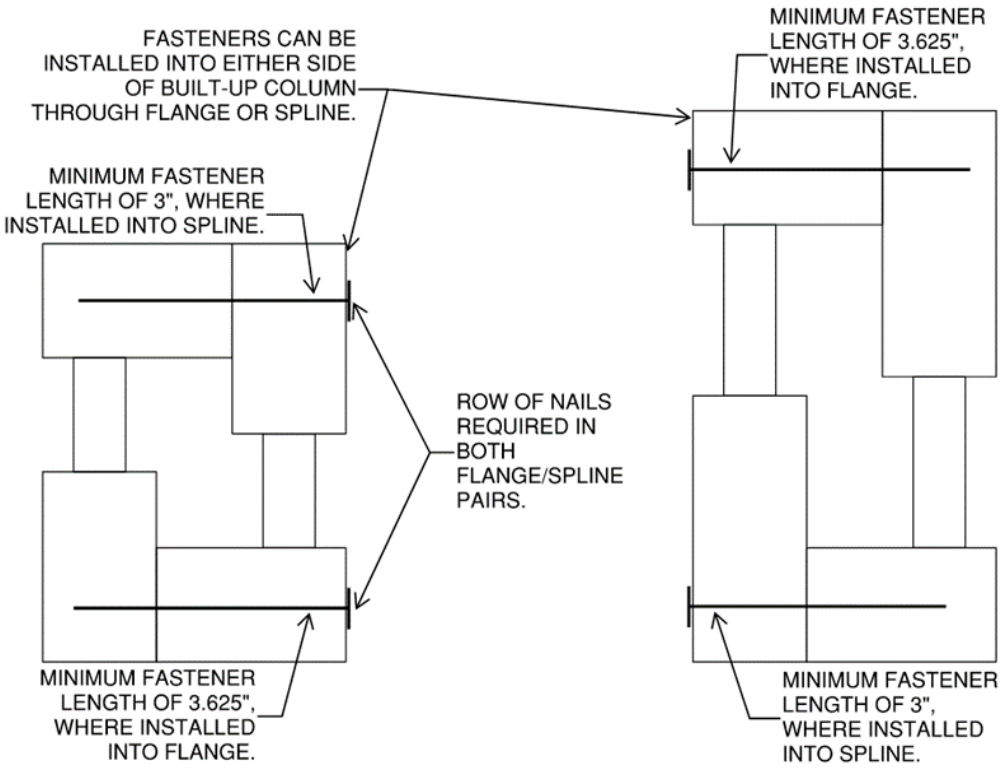


Figure 5. Fastening Requirements for Un-Insulated Tstud Built-Up Column with 2 x 3 Flange

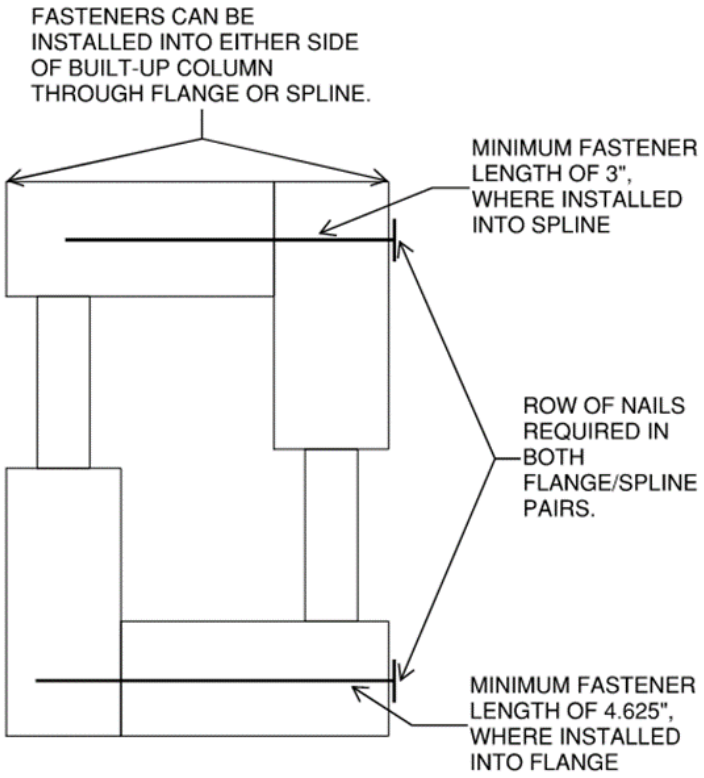


Figure 6. Fastening Requirements for Un-Insulated Tstud Built-Up Column with 2 x 4 Flange

6.2.8.4 The maximum allowable compression load for Un-Insulated Tstud columns is specified in **Table 12** for 5 1/2" Un-Insulated Tstud and **Table 13** for 7 1/4" Un-Insulated Tstud.

6.2.8.5 The maximum allowable compression load is based on perpendicular-to-grain compression of SPF, SYP, LVL or LSL top and bottom plates and compression parallel to grain of the Un-Insulated Tstud.

Table 12. Allowable Compressive Load of 5 1/2" Un-Insulated Tstud Columns

Stud Height (ft)	Allowable Compressive Load (lb)		
	Top/Bottom Plate[1]		
	Spruce Pine Fir (SPF) (SG = 0.42)	Southern Pine (SYP) (SG = 0.55)	LVL or LSL
8	7,330	9,745	11,855
9	7,330	9,745	10,700
10	7,330	9,495	9,495
11	7,330	8,350	8,350
12	7,315	7,315	7,315
13	6,420	6,420	6,420
14	5,650	5,650	5,650
15	4,995	4,995	4,995
16	4,440	4,440	4,440

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

1. Minimum compression perpendicular to grain is 425 psi for the SPF, 565 psi for SYP, 820 for LVL and 800 for LSL (adjusted per NDS Section 3.10.4).

Table 13. Allowable Compressive Load of 7 1/4" Un-Insulated Tstud Columns

Stud Height (ft)	Allowable Compressive Load (lb)		
	Top/Bottom Plate[1]		
	Spruce Pine Fir (SPF) (SG = 0.42)	Southern Pine (SYP) (SG = 0.55)	LVL or LSL
8	8,795	11,695	15,135
9	8,795	11,695	14,310
10	8,795	11,695	13,340
11	8,795	11,695	12,270
12	8,795	11,160	11,160
13	8,795	10,075	10,075
14	8,795	9,065	9,065
15	8,145	8,145	8,145
16	7,330	7,330	7,330

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

1. Minimum compression perpendicular to grain is 425 psi for the SPF, 565 psi for SYP, 820 for LVL and 800 for LSL (adjusted per NDS Section 3.10.4).

6.2.8.6 Allowable wind pressures for Un-Insulated Tstud stud columns subject to axial loads are specified in the following tables:

6.2.8.6.1 *5½" Un-Insulated Tstud Columns:*

6.2.8.6.1.1 SPF top and bottom plates: **Table 14**

6.2.8.6.1.2 SYP top and bottom plates: **Table 15**

6.2.8.6.1.3 LVL or LSL top and bottom plates: **Table 16**

6.2.8.6.2 *7¼" Un-Insulated Tstud Columns:*

6.2.8.6.2.1 SPF top and bottom plates: **Table 17**

6.2.8.6.2.2 SYP top and bottom plates: **Table 18**

6.2.8.6.2.3 LVL or LSL top and bottom plates: **Table 19**

Table 14. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (5 1/2" Un-Insulated Tstud with SPF Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	7330 (L/4322)	7330 (L/3242)	7330 (L/2593)	7330 (L/2161)	7330 (L/1852)	7330 (L/1621)	7330 (L/1441)	7330 (L/1297)	7330 (L/1179)	7330 (L/1081)
	9	7330 (L/2994)	7330 (L/2245)	7330 (L/1796)	7330 (L/1497)	7330 (L/1283)	7330 (L/1123)	7330 (L/998)	7330 (L/898)	7330 (L/816)	7330 (L/748)
	10	7330 (L/2158)	7330 (L/1619)	7330 (L/1295)	7330 (L/1079)	7330 (L/925)	7330 (L/809)	7330 (L/719)	7210 (L/647)	6840 (L/589)	6475 (L/540)
	12	6305 (L/1228)	5770 (L/921)	5240 (L/737)	4705 (L/614)	4170 (L/526)	3640 (L/461)	3105 (L/409)	2570 (L/368)	2040 (L/335)	1505 (L/307)
	14	3740 (L/764)	3005 (L/573)	2275 (L/459)	1540 (L/382)	810 (L/328)	80 (L/287)	--	--	--	--
	16	1710 (L/508)	745 (L/381)	--	--	--	--	--	--	--	--
16	8	7330 (L/3242)	7330 (L/2431)	7330 (L/1945)	7330 (L/1621)	7330 (L/1389)	7330 (L/1216)	7330 (L/1081)	7330 (L/973)	7330 (L/884)	7330 (L/810)
	9	7330 (L/2245)	7330 (L/1684)	7330 (L/1347)	7330 (L/1123)	7330 (L/962)	7330 (L/842)	7330 (L/748)	7330 (L/674)	7330 (L/612)	7330 (L/561)
	10	7330 (L/1619)	7330 (L/1214)	7330 (L/971)	7330 (L/809)	7330 (L/694)	6965 (L/607)	6475 (L/540)	5985 (L/486)	5500 (L/441)	5010 (L/405)
	12	5770 (L/921)	5060 (L/691)	4350 (L/553)	3640 (L/461)	2925 (L/395)	2215 (L/345)	1505 (L/307)	790 (L/276)	80 (L/251)	--
	14	3005 (L/573)	2030 (L/430)	1055 (L/344)	80 (L/287)	--	--	--	--	--	--
	16	745 (L/381)	--	--	--	--	--	--	--	--	--
24	8	7330 (L/2161)	7330 (L/1621)	7330 (L/1297)	7330 (L/1081)	7330 (L/926)	7330 (L/810)	7330 (L/720)	7330 (L/648)	7330 (L/589)	7330 (L/540)
	9	7330 (L/1497)	7330 (L/1123)	7330 (L/898)	7330 (L/748)	7330 (L/641)	7330 (L/561)	7330 (L/499)	6955 (L/449)	6365 (L/408)	5775 (L/374)
	10	7330 (L/1079)	7330 (L/809)	7210 (L/647)	6475 (L/540)	5745 (L/462)	5010 (L/405)	4275 (L/360)	3545 (L/324)	2810 (L/294)	2080 (L/270)
	12	4705 (L/614)	3640 (L/461)	2570 (L/368)	1505 (L/307)	435 (L/263)	--	--	--	--	--
	14	1540 (L/382)	80 (L/287)	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SPF top and bottom plates.

Table 15. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (5 1/2" Un-Insulated Tstud Column with SYP Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	9745 (L/4322)	9745 (L/3242)	9745 (L/2593)	9745 (L/2161)	9745 (L/1852)	9745 (L/1621)	9745 (L/1441)	9745 (L/1297)	9745 (L/1179)	9745 (L/1081)
	9	9745 (L/2994)	9745 (L/2245)	9745 (L/1796)	9745 (L/1497)	9745 (L/1283)	9745 (L/1123)	9745 (L/998)	9745 (L/898)	9605 (L/816)	9310 (L/748)
	10	9495 (L/2158)	9405 (L/1619)	9040 (L/1295)	8675 (L/1079)	8305 (L/925)	7940 (L/809)	7575 (L/719)	7210 (L/647)	6840 (L/589)	6475 (L/540)
	12	6305 (L/1228)	5770 (L/921)	5240 (L/737)	4705 (L/614)	4170 (L/526)	3640 (L/461)	3105 (L/409)	2570 (L/368)	2040 (L/335)	1505 (L/307)
	14	3740 (L/764)	3005 (L/573)	2275 (L/459)	1540 (L/382)	810 (L/328)	80 (L/287)	--	--	--	--
	16	1710 (L/508)	745 (L/381)	--	--	--	--	--	--	--	--
16	8	9745 (L/3242)	9745 (L/2431)	9745 (L/1945)	9745 (L/1621)	9745 (L/1389)	9745 (L/1216)	9745 (L/1081)	9745 (L/973)	9745 (L/884)	9745 (L/810)
	9	9745 (L/2245)	9745 (L/1684)	9745 (L/1347)	9745 (L/1123)	9745 (L/962)	9705 (L/842)	9310 (L/748)	8915 (L/674)	8525 (L/612)	8130 (L/561)
	10	9405 (L/1619)	8920 (L/1214)	8430 (L/971)	7940 (L/809)	7450 (L/694)	6965 (L/607)	6475 (L/540)	5985 (L/486)	5500 (L/441)	5010 (L/405)
	12	5770 (L/921)	5060 (L/691)	4350 (L/553)	3640 (L/461)	2925 (L/395)	2215 (L/345)	1505 (L/307)	790 (L/276)	80 (L/251)	--
	14	3005 (L/573)	2030 (L/430)	1055 (L/344)	80 (L/287)	--	--	--	--	--	--
	16	745 (L/381)	--	--	--	--	--	--	--	--	--
24	8	9745 (L/2161)	9745 (L/1621)	9745 (L/1297)	9745 (L/1081)	9745 (L/926)	9745 (L/810)	9745 (L/720)	9745 (L/648)	9745 (L/589)	9595 (L/540)
	9	9745 (L/1497)	9745 (L/1123)	9745 (L/898)	9310 (L/748)	8720 (L/641)	8130 (L/561)	7545 (L/499)	6955 (L/449)	6365 (L/408)	5775 (L/374)
	10	8675 (L/1079)	7940 (L/809)	7210 (L/647)	6475 (L/540)	5745 (L/462)	5010 (L/405)	4275 (L/360)	3545 (L/324)	2810 (L/294)	2080 (L/270)
	12	4705 (L/614)	3640 (L/461)	2570 (L/368)	1505 (L/307)	435 (L/263)	--	--	--	--	--
	14	1540 (L/382)	80 (L/287)	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SYP top and bottom plates.

Table 16. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (5 1/2" Un-Insulated Tstud Column with LVL or LSL Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	11855 (L/4322)	11855 (L/3242)	11855 (L/2593)	11855 (L/2161)	11855 (L/1852)	11855 (L/1621)	11855 (L/1441)	11855 (L/1297)	11855 (L/1179)	11855 (L/1081)
	9	10700 (L/2994)	10700 (L/2245)	10700 (L/1796)	10700 (L/1497)	10700 (L/1283)	10490 (L/1123)	10195 (L/998)	9900 (L/898)	9605 (L/816)	9310 (L/748)
	10	9495 (L/2158)	9405 (L/1619)	9040 (L/1295)	8675 (L/1079)	8305 (L/925)	7940 (L/809)	7575 (L/719)	7210 (L/647)	6840 (L/589)	6475 (L/540)
	12	6305 (L/1228)	5770 (L/921)	5240 (L/737)	4705 (L/614)	4170 (L/526)	3640 (L/461)	3105 (L/409)	2570 (L/368)	2040 (L/335)	1505 (L/307)
	14	3740 (L/764)	3005 (L/573)	2275 (L/459)	1540 (L/382)	810 (L/328)	80 (L/287)	--	--	--	--
	16	1710 (L/508)	745 (L/381)	--	--	--	--	--	--	--	--
16	8	11855 (L/3242)	11855 (L/2431)	11855 (L/1945)	11855 (L/1621)	11855 (L/1389)	11855 (L/1216)	11855 (L/1081)	11855 (L/973)	11750 (L/884)	11440 (L/810)
	9	10700 (L/2245)	10700 (L/1684)	10700 (L/1347)	10490 (L/1123)	10095 (L/962)	9705 (L/842)	9310 (L/748)	8915 (L/674)	8525 (L/612)	8130 (L/561)
	10	9405 (L/1619)	8920 (L/1214)	8430 (L/971)	7940 (L/809)	7450 (L/694)	6965 (L/607)	6475 (L/540)	5985 (L/486)	5500 (L/441)	5010 (L/405)
	12	5770 (L/921)	5060 (L/691)	4350 (L/553)	3640 (L/461)	2925 (L/395)	2215 (L/345)	1505 (L/307)	790 (L/276)	80 (L/251)	--
	14	3005 (L/573)	2030 (L/430)	1055 (L/344)	80 (L/287)	--	--	--	--	--	--
	16	745 (L/381)	--	--	--	--	--	--	--	--	--
24	8	11855 (L/2161)	11855 (L/1621)	11855 (L/1297)	11855 (L/1081)	11855 (L/926)	11440 (L/810)	10980 (L/720)	10520 (L/648)	10060 (L/589)	9595 (L/540)
	9	10700 (L/1497)	10490 (L/1123)	9900 (L/898)	9310 (L/748)	8720 (L/641)	8130 (L/561)	7545 (L/499)	6955 (L/449)	6365 (L/408)	5775 (L/374)
	10	8675 (L/1079)	7940 (L/809)	7210 (L/647)	6475 (L/540)	5745 (L/462)	5010 (L/405)	4275 (L/360)	3545 (L/324)	2810 (L/294)	2080 (L/270)
	12	4705 (L/614)	3640 (L/461)	2570 (L/368)	1505 (L/307)	435 (L/263)	--	--	--	--	--
	14	1540 (L/382)	80 (L/287)	--	--	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and LVL or LSL (minimum compression perpendicular to grain strength is 800 psi) top and bottom plates.

Table 17. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (7 1/4" Un-Insulated Tstud Column with SPF Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	8795 (L/8335)	8795 (L/6251)	8795 (L/5001)	8795 (L/4167)	8795 (L/3572)	8795 (L/3126)	8795 (L/2778)	8795 (L/2500)	8795 (L/2273)	8795 (L/2084)
	9	8795 (L/5773)	8795 (L/4329)	8795 (L/3464)	8795 (L/2886)	8795 (L/2474)	8795 (L/2165)	8795 (L/1924)	8795 (L/1732)	8795 (L/1574)	8795 (L/1443)
	10	8795 (L/4162)	8795 (L/3121)	8795 (L/2497)	8795 (L/2081)	8795 (L/1784)	8795 (L/1561)	8795 (L/1387)	8795 (L/1248)	8795 (L/1135)	8795 (L/1040)
	12	8795 (L/2369)	8795 (L/1776)	8795 (L/1421)	8795 (L/1184)	8795 (L/1015)	8795 (L/888)	8795 (L/790)	8795 (L/711)	8795 (L/646)	8750 (L/592)
	14	8505 (L/1474)	8030 (L/1106)	7555 (L/884)	7080 (L/737)	6605 (L/632)	6130 (L/553)	5655 (L/491)	5175 (L/442)	4705 (L/402)	4225 (L/369)
	16	5915 (L/979)	5290 (L/734)	4665 (L/587)	4045 (L/489)	3420 (L/419)	2795 (L/367)	2170 (L/326)	1545 (L/294)	920 (L/267)	295 (L/245)
16	8	8795 (L/6251)	8795 (L/4688)	8795 (L/3751)	8795 (L/3126)	8795 (L/2679)	8795 (L/2344)	8795 (L/2084)	8795 (L/1875)	8795 (L/1705)	8795 (L/1563)
	9	8795 (L/4329)	8795 (L/3247)	8795 (L/2598)	8795 (L/2165)	8795 (L/1855)	8795 (L/1624)	8795 (L/1443)	8795 (L/1299)	8795 (L/1181)	8795 (L/1082)
	10	8795 (L/3121)	8795 (L/2341)	8795 (L/1873)	8795 (L/1561)	8795 (L/1338)	8795 (L/1170)	8795 (L/1040)	8795 (L/936)	8795 (L/851)	8795 (L/780)
	12	8795 (L/1776)	8795 (L/1332)	8795 (L/1066)	8795 (L/888)	8795 (L/761)	8795 (L/666)	8750 (L/592)	8285 (L/533)	7825 (L/484)	7365 (L/444)
	14	8030 (L/1106)	7395 (L/829)	6760 (L/663)	6130 (L/553)	5495 (L/474)	4860 (L/415)	4225 (L/369)	3595 (L/332)	2960 (L/302)	2325 (L/276)
	16	5290 (L/734)	4460 (L/551)	3630 (L/440)	2795 (L/367)	1965 (L/315)	1130 (L/275)	295 (L/245)	--	--	--
24	8	8795 (L/4167)	8795 (L/3126)	8795 (L/2500)	8795 (L/2084)	8795 (L/1786)	8795 (L/1563)	8795 (L/1389)	8795 (L/1250)	8795 (L/1137)	8795 (L/1042)
	9	8795 (L/2886)	8795 (L/2165)	8795 (L/1732)	8795 (L/1443)	8795 (L/1237)	8795 (L/1082)	8795 (L/962)	8795 (L/866)	8795 (L/787)	8795 (L/722)
	10	8795 (L/2081)	8795 (L/1561)	8795 (L/1248)	8795 (L/1040)	8795 (L/892)	8795 (L/780)	8795 (L/694)	8795 (L/624)	8795 (L/567)	8795 (L/520)
	12	8795 (L/1184)	8795 (L/888)	8795 (L/711)	8750 (L/592)	8055 (L/508)	7365 (L/444)	6670 (L/395)	5980 (L/355)	5285 (L/323)	4595 (L/296)
	14	7080 (L/737)	6130 (L/553)	5175 (L/442)	4225 (L/369)	3280 (L/316)	2325 (L/276)	1375 (L/246)	425 (L/221)	--	--
	16	4045 (L/489)	2795 (L/367)	1545 (L/294)	295 (L/245)	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SPF top and bottom plates.

Table 18. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (7 1/4" Un-Insulated Tstud Column with SYP Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	11695 (L/8335)	11695 (L/6251)	11695 (L/5001)	11695 (L/4167)	11695 (L/3572)	11695 (L/3126)	11695 (L/2778)	11695 (L/2500)	11695 (L/2273)	11695 (L/2084)
	9	11695 (L/5773)	11695 (L/4329)	11695 (L/3464)	11695 (L/2886)	11695 (L/2474)	11695 (L/2165)	11695 (L/1924)	11695 (L/1732)	11695 (L/1574)	11695 (L/1443)
	10	11695 (L/4162)	11695 (L/3121)	11695 (L/2497)	11695 (L/2081)	11695 (L/1784)	11695 (L/1561)	11695 (L/1387)	11695 (L/1248)	11695 (L/1135)	11695 (L/1040)
	12	11160 (L/2369)	11160 (L/1776)	11160 (L/1421)	10830 (L/1184)	10480 (L/1015)	10135 (L/888)	9790 (L/790)	9440 (L/711)	9095 (L/646)	8750 (L/592)
	14	8505 (L/1474)	8030 (L/1106)	7555 (L/884)	7080 (L/737)	6605 (L/632)	6130 (L/553)	5655 (L/491)	5175 (L/442)	4705 (L/402)	4225 (L/369)
	16	5915 (L/979)	5290 (L/734)	4665 (L/587)	4045 (L/489)	3420 (L/419)	2795 (L/367)	2170 (L/326)	1545 (L/294)	920 (L/267)	295 (L/245)
16	8	11695 (L/6251)	11695 (L/4688)	11695 (L/3751)	11695 (L/3126)	11695 (L/2679)	11695 (L/2344)	11695 (L/2084)	11695 (L/1875)	11695 (L/1705)	11695 (L/1563)
	9	11695 (L/4329)	11695 (L/3247)	11695 (L/2598)	11695 (L/2165)	11695 (L/1855)	11695 (L/1624)	11695 (L/1443)	11695 (L/1299)	11695 (L/1181)	11695 (L/1082)
	10	11695 (L/3121)	11695 (L/2341)	11695 (L/1873)	11695 (L/1561)	11695 (L/1338)	11695 (L/1170)	11695 (L/1040)	11695 (L/936)	11695 (L/851)	11695 (L/780)
	12	11160 (L/1776)	11060 (L/1332)	10595 (L/1066)	10135 (L/888)	9675 (L/761)	9210 (L/666)	8750 (L/592)	8285 (L/533)	7825 (L/484)	7365 (L/444)
	14	8030 (L/1106)	7395 (L/829)	6760 (L/663)	6130 (L/553)	5495 (L/474)	4860 (L/415)	4225 (L/369)	3595 (L/332)	2960 (L/302)	2325 (L/276)
	16	5290 (L/734)	4460 (L/551)	3630 (L/440)	2795 (L/367)	1965 (L/315)	1130 (L/275)	295 (L/245)	--	--	--
24	8	11695 (L/4167)	11695 (L/3126)	11695 (L/2500)	11695 (L/2084)	11695 (L/1786)	11695 (L/1563)	11695 (L/1389)	11695 (L/1250)	11695 (L/1137)	11695 (L/1042)
	9	11695 (L/2886)	11695 (L/2165)	11695 (L/1732)	11695 (L/1443)	11695 (L/1237)	11695 (L/1082)	11695 (L/962)	11695 (L/866)	11695 (L/787)	11695 (L/722)
	10	11695 (L/2081)	11695 (L/1561)	11695 (L/1248)	11695 (L/1040)	11695 (L/892)	11695 (L/780)	11695 (L/694)	11695 (L/624)	11635 (L/567)	11160 (L/520)
	12	10830 (L/1184)	10135 (L/888)	9440 (L/711)	8750 (L/592)	8055 (L/508)	7365 (L/444)	6670 (L/395)	5980 (L/355)	5285 (L/323)	4595 (L/296)
	14	7080 (L/737)	6130 (L/553)	5175 (L/442)	4225 (L/369)	3280 (L/316)	2325 (L/276)	1375 (L/246)	425 (L/221)	--	--
	16	4045 (L/489)	2795 (L/367)	1545 (L/294)	295 (L/245)	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and SYP top and bottom plates.

Table 19. Built-Up Column Allowable (ASD) Compressive Load for Walls Subject to Wind Pressures (7 1/4" Un-Insulated Tstud Column with LVL or LSL Top/Bottom Plates)[1,2]

Stud Spacing (in)	Wall Height (ft)	Allowable Compression Load (lb) and (Deflection Ratio)									
		Components and Cladding Wind Pressure (psf)									
		15	20	25	30	35	40	45	50	55	60
12	8	15135 (L/8335)	15135 (L/6251)	15135 (L/5001)	15135 (L/4167)	15135 (L/3572)	15135 (L/3126)	15135 (L/2778)	15135 (L/2500)	15135 (L/2273)	15135 (L/2084)
	9	14310 (L/5773)	14310 (L/4329)	14310 (L/3464)	14310 (L/2886)	14310 (L/2474)	14310 (L/2165)	14310 (L/1924)	14310 (L/1732)	14310 (L/1574)	14310 (L/1443)
	10	13340 (L/4162)	13340 (L/3121)	13340 (L/2497)	13340 (L/2081)	13340 (L/1784)	13340 (L/1561)	13340 (L/1387)	13340 (L/1248)	13340 (L/1135)	13340 (L/1040)
	12	11160 (L/2369)	11160 (L/1776)	11160 (L/1421)	10830 (L/1184)	10480 (L/1015)	10135 (L/888)	9790 (L/790)	9440 (L/711)	9095 (L/646)	8750 (L/592)
	14	8505 (L/1474)	8030 (L/1106)	7555 (L/884)	7080 (L/737)	6605 (L/632)	6130 (L/553)	5655 (L/491)	5175 (L/442)	4705 (L/402)	4225 (L/369)
	16	5915 (L/979)	5290 (L/734)	4665 (L/587)	4045 (L/489)	3420 (L/419)	2795 (L/367)	2170 (L/326)	1545 (L/294)	920 (L/267)	295 (L/245)
16	8	15135 (L/6251)	15135 (L/4688)	15135 (L/3751)	15135 (L/3126)	15135 (L/2679)	15135 (L/2344)	15135 (L/2084)	15135 (L/1875)	15135 (L/1705)	15135 (L/1563)
	9	14310 (L/4329)	14310 (L/3247)	14310 (L/2598)	14310 (L/2165)	14310 (L/1855)	14310 (L/1624)	14310 (L/1443)	14310 (L/1299)	14310 (L/1181)	14310 (L/1082)
	10	13340 (L/3121)	13340 (L/2341)	13340 (L/1873)	13340 (L/1561)	13340 (L/1338)	13340 (L/1170)	13340 (L/1040)	13340 (L/936)	13340 (L/851)	13060 (L/780)
	12	11160 (L/1776)	11060 (L/1332)	10595 (L/1066)	10135 (L/888)	9675 (L/761)	9210 (L/666)	8750 (L/592)	8285 (L/533)	7825 (L/484)	7365 (L/444)
	14	8030 (L/1106)	7395 (L/829)	6760 (L/663)	6130 (L/553)	5495 (L/474)	4860 (L/415)	4225 (L/369)	3595 (L/332)	2960 (L/302)	2325 (L/276)
	16	5290 (L/734)	4460 (L/551)	3630 (L/440)	2795 (L/367)	1965 (L/315)	1130 (L/275)	295 (L/245)	--	--	--
24	8	15135 (L/4167)	15135 (L/3126)	15135 (L/2500)	15135 (L/2084)	15135 (L/1786)	15135 (L/1563)	15135 (L/1389)	15135 (L/1250)	15135 (L/1137)	15135 (L/1042)
	9	14310 (L/2886)	14310 (L/2165)	14310 (L/1732)	14310 (L/1443)	14310 (L/1237)	14310 (L/1082)	14310 (L/962)	14310 (L/866)	14310 (L/787)	14310 (L/722)
	10	13340 (L/2081)	13340 (L/1561)	13340 (L/1248)	13340 (L/1040)	13340 (L/892)	13060 (L/780)	12585 (L/694)	12110 (L/624)	11635 (L/567)	11160 (L/520)
	12	10830 (L/1184)	10135 (L/888)	9440 (L/711)	8750 (L/592)	8055 (L/508)	7365 (L/444)	6670 (L/395)	5980 (L/355)	5285 (L/323)	4595 (L/296)
	14	7080 (L/737)	6130 (L/553)	5175 (L/442)	4225 (L/369)	3280 (L/316)	2325 (L/276)	1375 (L/246)	425 (L/221)	--	--
	16	4045 (L/489)	2795 (L/367)	1545 (L/294)	295 (L/245)	--	--	--	--	--	--

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

1. Wind speed provided assumes Exposure Category B, Enclosed Building, Mean Roof Height 30'
2. Walls constructed with Un-Insulated Tstud studs and LVL or LSL (minimum compression perpendicular to grain strength is 800 psi) top and bottom plates.

6.2.9 *Design of Un-Insulated Tstud Headers:*

6.2.9.1 Un-Insulated Tstud headers are shown in **Figure 7** and **Figure 8**.

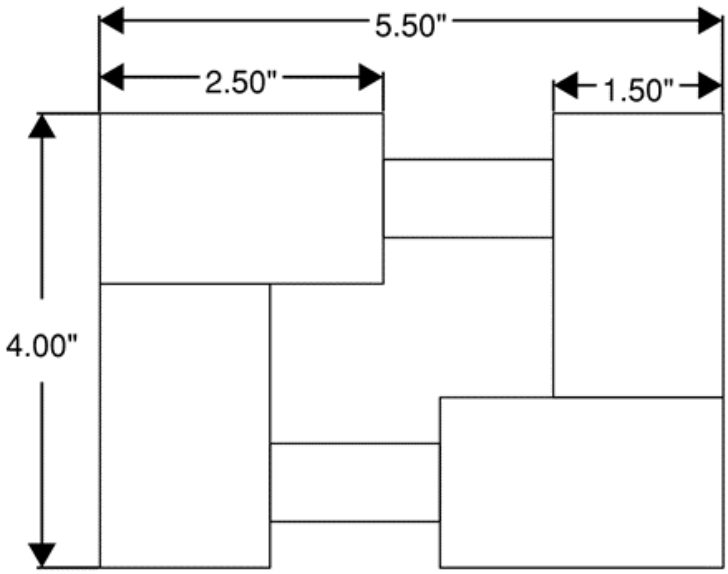


Figure 7. 5 1/2" Wide Un-Insulated Tstud Header

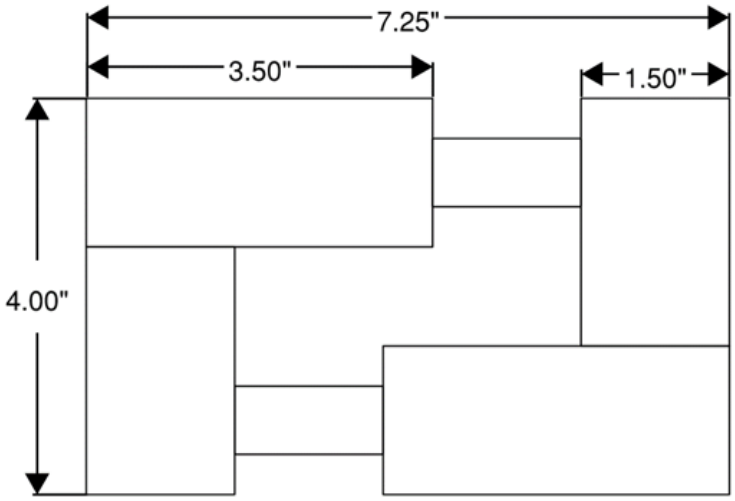


Figure 8. 7 1/4" Wide Un-Insulated Tstud Header

6.2.9.1.1 The 7 1/4" built-up section shall be limited to the 2 x 3 flange option shown in **Figure 8** when used as a header.

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

6.2.9.1.3 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.

6.2.9.2 Reference design values for Un-Insulated Tstud Headers are provided in **Table 20**.

6.2.9.2.1 Reference design values for Un-Insulated Tstud Headers shall be multiplied by the adjustment factors in NDS Section 4.3.

Table 20. Header Reference Design Values[1,2]

Reference Design Value	5½" Un-Insulated Tstud Header	7¼" Un-Insulated Tstud Header[2,3]
Bending, F_bS	1,230 lb-ft	1,005 lb-ft
Compression Parallel to Grain, F_c	1,150 psi	1,150 psi
Tension Parallel to Grain, F_t	450 psi	450 psi
Compression Perpendicular to Grain, $F_{c\perp}$	425 psi	425 psi
Shear Force, V	1,055 lb	865 lb
Bending Stiffness, EI	20,760,000 lb-in^2	23,587,000 lb-in^2
Bending Stiffness for Beam and Column Stability, EI_{min}	10,521,000 lb-in^2	10,140,000 lb-in^2

SI: 25.4 mm = 1 in, 1 N = 0.225 lb, 1 MPa = 145 psi
1. Un-Insulated Tstud Headers made from No. 2 SPF.
2. Headers are designed to be oriented with the load perpendicular to the dowels. Ensure proper orientation during installation.
3. The 7¼" Un-Insulated Tstud header referenced here uses a 2 x 3 as the flange and a 2 x 4 as the spline.

6.2.9.3 The maximum bending moment and shear forces shall not exceed the allowable design values for the corresponding Un-Insulated Tstud header specified in **Table 20**.

6.2.9.4 Allowable spans for Un-Insulated Tstud headers are specified in **Table 21** and **Table 22**.

Table 21. Allowable Loads for 5½" Un-Insulated Tstud Headers[1,2,3,4]

Number of Headers	Allowable Load (plf) and Deflection Ratio					
	Span (ft)					
	3	4	5	6	7	8
1	1093 (L/375)	615 (L/281)	369 (L/240)	214 (L/240)	134 (L/240)	90 (L/240)
2	2187 (L/375)	1230 (L/281)	738 (L/240)	427 (L/240)	269 (L/240)	180 (L/240)
3	3280 (L/375)	1845 (L/281)	1107 (L/240)	641 (L/240)	403 (L/240)	270 (L/240)

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/ft = 0.0146 kN/m
1. Table values are based on Un-Insulated 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.
4. See **Figure 7** for an illustration of the Un-Insulated Tstud cross-section.

Table 22. Allowable Loads for 7 1/4" Un-Insulated Tstud Headers[1,2,3,4]

Number of Headers	Allowable Load (plf) and Deflection Ratio					
	Span (ft)					
	3	4	5	6	7	8
1	893 (L/522)	503 (L/391)	322 (L/313)	223 (L/261)	153 (L/240)	102 (L/240)
2	1787 (L/522)	1005 (L/391)	643 (L/313)	447 (L/261)	306 (L/240)	205 (L/240)
3	2680 (L/522)	1508 (L/391)	965 (L/313)	670 (L/261)	458 (L/240)	307 (L/240)

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

1. Table values are based on Un-Insulated 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.
4. See **Figure 8** for an illustration of the Un-Insulated Tstud cross-section.

6.3 *Prescriptive Header Design*

6.3.1 Prescriptive header design values for Un-Insulated Tstud Headers are provided in **Table 23**.

Table 23. Prescriptive Header Design[1]

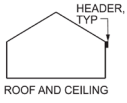
Girders and Headers Supporting	Size	Ground Snow Load (psf)																	
		30						50						70					
		Building Width (ft)																	
		14		24		36		14		24		36		14		24		36	
		Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ
Roof and ceiling 	(1) 5.5" Tstud	5' 6"	1	3' 10"	1	2' 6"	1	4' 10"	1	2 11"	1	-	1	4' 0"	1	2' 4"	1	-	1
	(1) 7.25" Tstud	5' 0"	1	3' 1"	1	2' 1"	1	4' 2"	1	2' 5"	1	-	1	3' 4"	1	-	1	-	1
	(2) 5.5" Tstud	7' 6"	1	5' 11"	1	4' 10"	1	6' 11"	1	5' 3"	1	3' 11"	1	6' 2"	1	4' 8"	1	3' 2"	1
	(2) 7.25" Tstud	7' 1"	1	5' 5"	1	4' 2"	1	6' 3"	1	4' 9"	1	3' 3"	1	5' 6"	1	3' 10"	1	2' 7"	1
	(3) 5.5" Tstud	8' 8"	1	7' 2"	1	5' 11"	1	8' 2"	1	6' 5"	1	5' 3"	2	7' 6"	1	5' 9"	2	4' 8"	2
	(3) 7.25" Tstud	8' 8"	1	6' 7"	1	5' 5"	1	7' 7"	1	5' 10"	1	4' 9"	1	6' 9"	1	5' 2"	1	3' 10"	1

Table 23. Prescriptive Header Design[1]

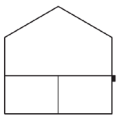
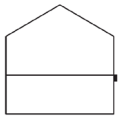
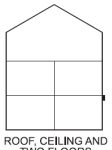
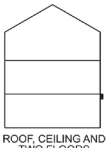
Girders and Headers Supporting	Size	Ground Snow Load (psf)																	
		30						50						70					
		Building Width (ft)																	
		14		24		36		14		24		36		14		24		36	
		Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ
Roof, ceiling and one center-bearing floor  ROOF, CEILING AND ONE FLOOR (CENTER BEARING)	(1) 5.5" Tstud	3' 9"	1	2' 4"	1	-	1	3' 2"	1	2' 0"	1	-	1	2' 10"	1	-	1	-	1
	(1) 7.25" Tstud	3' 1"	1	-	1	-	1	2' 7"	1	-	1	-	1	2' 3"	1	-	1	-	1
	(2) 5.5" Tstud	5' 5"	1	4' 8"	1	3' 3"	1	5' 3"	1	4' 0"	1	2' 9"	1	5' 1"	1	3' 6"	1	2' 4"	1
	(2) 7.25" Tstud	5' 4"	1	3' 10"	1	2' 8"	1	4' 11"	1	3' 3"	1	2' 3"	1	4' 7"	1	2' 10"	1	-	1
	(3) 5.5" Tstud	6' 3"	1	5' 4"	1	4' 9"	2	6' 1"	1	5' 2"	2	4' 2"	2	5' 11"	1	4' 11"	2	3' 7"	2
	(3) 7.25" Tstud	6' 3"	1	5' 2"	1	4' 0"	1	6' 0"	1	4' 9"	1	3' 5"	1	5' 8"	1	4' 3"	1	2' 11"	1
Roof, ceiling and one clear-span floor  ROOF, CEILING AND ONE FLOOR (CLEAR SPAN)	(1) 5.5" Tstud	2' 9"	1	-	1	-	1	2' 8"	1	-	1	-	1	2' 4"	1	-	1	-	1
	(1) 7.25" Tstud	2' 3"	1	-	1	-	1	2' 2"	1	-	1	-	1	-	1	-	1	-	1
	(2) 5.5" Tstud	4' 11"	1	3' 6"	1	2' 5"	1	4' 11"	1	3' 3"	1	2' 3"	1	4' 8"	1	2' 11"	1	2' 0"	1
	(2) 7.25" Tstud	4' 7"	1	2' 10"	1	-	1	4' 4"	1	2' 8"	1	-	1	3' 11"	1	2' 4"	1	-	1
	(3) 5.5" Tstud	5' 8"	1	4' 10"	2	3' 7"	2	5' 7"	1	4' 9"	2	3' 4"	2	5' 6"	1	4' 4"	2	3' 0"	2
	(3) 7.25" Tstud	5' 8"	1	4' 3"	1	2' 11"	1	5' 6"	1	4' 0"	1	2' 9"	1	5' 2"	1	3' 7"	1	2' 5"	1
Roof, ceiling and two center-bearing floors  ROOF, CEILING AND TWO FLOORS (CENTER BEARING)	(1) 5.5" Tstud	2' 5"	1	-	1	-	1	2' 4"	1	-	1	-	1	2' 1"	1	-	1	-	1
	(1) 7.25" Tstud	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
	(2) 5.5" Tstud	4' 8"	1	3' 2"	1	2' 3"	1	4' 8"	1	3' 0"	1	2' 1"	1	4' 3"	1	2' 8"	1	-	1
	(2) 7.25" Tstud	3' 11"	1	2' 7"	1	-	1	3' 10"	1	2' 6"	1	-	1	3' 6"	1	2' 2"	1	-	1
	(3) 5.5" Tstud	5' 5"	1	4' 8"	2	3' 4"	2	5' 4"	1	4' 6"	2	3' 2"	2	5' 3"	2	4' 1"	2	2' 10"	2
	(3) 7.25" Tstud	5' 3"	1	3' 11"	1	2' 9"	1	5' 2"	1	3' 9"	1	2' 7"	1	4' 11"	1	3' 4"	1	2' 4"	1

Table 23. Prescriptive Header Design[1]

Girders and Headers Supporting	Size	Ground Snow Load (psf)																	
		30						50						70					
		Building Width (ft)																	
		14		24		36		14		24		36		14		24		36	
		Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ	Span (ft-in)	NJ
Roof, ceiling, and two clear-span floors  ROOF, CEILING AND TWO FLOORS (CLEAR SPAN)	(1) 5.5" Tstud	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
	(1) 7.25" Tstud	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
	(2) 5.5" Tstud	3' 4"	1	2' 1"	1	-	1	3' 4"	1	2' 1"	1	-	1	3' 4"	1	2' 1"	1	-	1
	(2) 7.25" Tstud	2' 9"	1	-	1	-	1	2' 9"	1	-	1	-	1	2' 8"	1	-	1	-	1
	(3) 5.5" Tstud	4' 9"	2	3' 2"	2	2' 2"	2	4' 9"	2	3' 2"	2	2' 2"	2	4' 9"	2	3' 1"	2	2' 2"	2
	(3) 7.25" Tstud	4' 1"	1	2' 7"	1	-	1	4' 1"	1	2' 7"	1	-	1	4' 1"	1	2' 7"	1	-	1

SI: 1 in = 25.4 mm, 1 ft = 0.305 m

1. The number of jack studs is determined assuming the jack stud width matches the Un-Insulated Tstud width (i.e., 2 x 6 for 5.5 and 2 x 8 for 7.25)

6.4 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science and fire science.

7 Certified Performance[24]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[25]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[26]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 Un-Insulated Tstud complies with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 Un-Insulated Tstud was evaluated to determine its applicability for use as an alternative material where nominal 2 x 4 and 2 x 6 solid sawn lumber is specified in accordance with the IBC and IRC including use as wall studs, top and bottom wall plates, and headers.

8.1.2 Un-Insulated Tstud testing and analysis was conducted to determine its compression, flexural strengths and flexural stiffness.

8.1.3 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 ASD.

8.1.4 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.

8.1.4.1 **Table 11** 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).

8.1.4.2 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_0; and deflection amplification factor, C_d.

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

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

8.1.7 Use as an alternative material and method of construction as permitted in accordance with IBC Section 104.11 and IRC Section R104.11.

8.1.8 Use as built-up columns in accordance with NDS Section 15.3.

8.1.9 Use as a header assembly when designed in accordance with this report.

8.1.10 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 report.

8.2 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP/approved sources. DrJ is qualified[27] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise, respectively.

8.3 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which are also its areas of professional engineering competence.

8.4 Any regulation specific issues not addressed in this section are outside the scope of this report.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, the more restrictive shall govern.

9.3 *Installation Procedure*

9.3.1 Un-Insulated Tstud is pre-assembled and designed to be used as a direct replacement of nominal 2 x 4 solid sawn lumber as wall studs, top plates, bottom plates and built-up columns.

9.3.2 Install Un-Insulated Tstud in the same manner as solid sawn lumber, except as noted herein.

9.3.2.1 The Un-Insulated Tstud wall stud may be oriented in either direction (i.e., with the flange facing the interior of exterior face of the wall).

9.3.2.2 The Un-Insulated 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, treated 2" x 6" member shall be used as the bottom plate.

9.3.2.3 Where Un-Insulated Tstud is used as a top plate, a separate means of fireblocking shall be provided in accordance with **Section 12.7**.

9.3.2.4 Un-Insulated Tstud headers shall be installed such that the dowel plane is be perpendicular to the loading orientation (vertical loads only).

9.3.3 For IBC Section 2308 and the IRC, install in accordance with the provisions therein, except as noted in this report.

9.3.4 See **Section 6.1** and **Table 1** for prescriptive connection requirements.

9.3.5 See **Section 6.2.8** for built-up column requirements.

9.3.6 See **Section 6.2.9** for header requirements and limitations.

9.3.7 *Hold-Downs:*

9.3.7.1 Hold-downs shall not be attached directly to Un-Insulated Tstud members. Solid sawn nominal 2" x 6" studs shall be used where hold-downs attach to the wall.

9.3.8 *Drilling and Notching:*

9.3.8.1 Boring Un-Insulated Tstud is allowed when in accordance with IBC Section 2308.5.9, IBC Section 2308.5.10 and IRC Section R602.6 as shown in **Figure 9**.

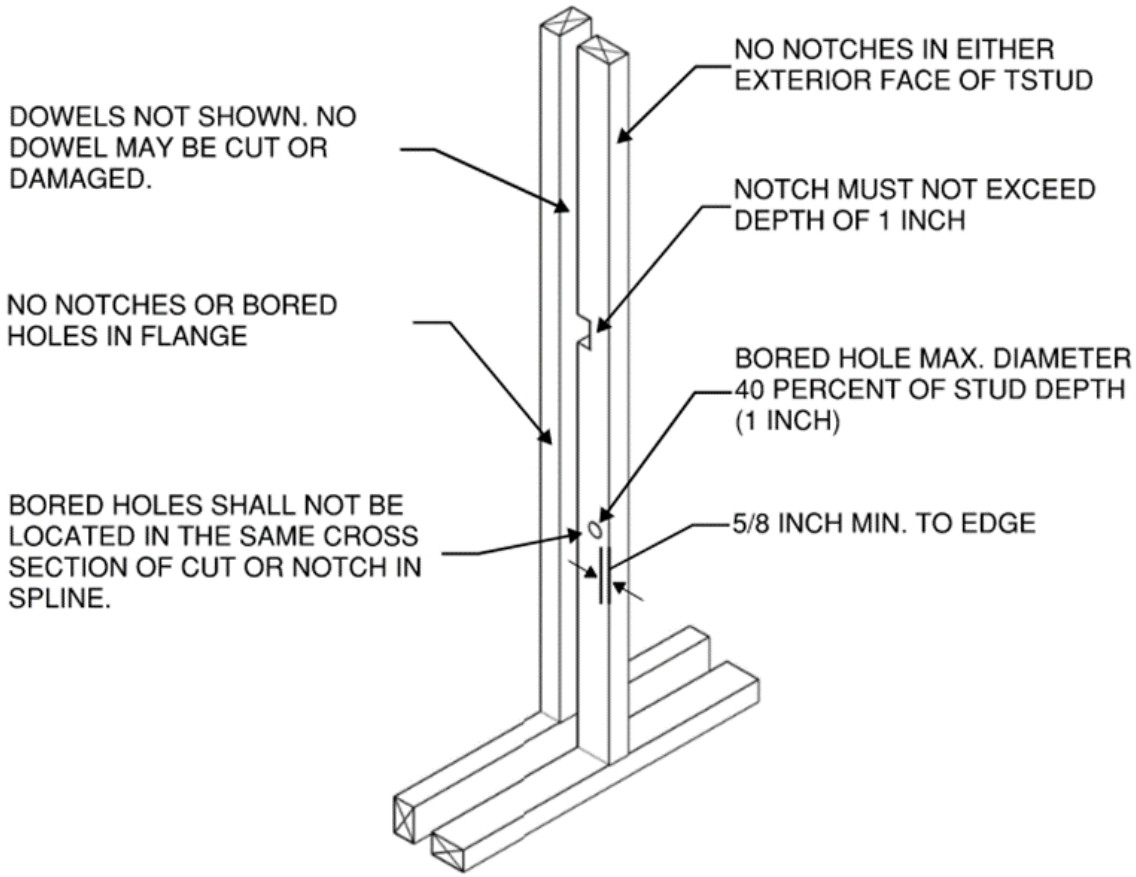


Figure 9. Drilling and Notching of Un-Insulated Tstud

9.3.8.2 No dowels may be cut or damaged.

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

9.3.9 *Ripping of Flanges for Use in Top and Bottom Plates*

9.3.9.1 Un-Insulated Tstud flanges used in top and bottom plates are permitted to be ripped to $1^1/_2$" along their length. This allows the spline and flange on the studs to be cut to the same length when constructing the wall assembly.

10 Substantiating Data

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

10.1.1 Bending tests in accordance with ASTM D198

10.1.2 Lateral load resistance in accordance with ASTM E2126

10.2 Calculations in accordance with ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction performed by DrJ Engineering, LLC.

10.3 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources and/or RDPs. Accuracy of external test data and resulting analysis is relied upon.

10.4 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability and safety.

10.5 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.6 Testing and engineering analysis: The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[28]

10.7 Where additional condition of use and/or regulatory compliance information is required, please search for Un-Insulated Tstud on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, Un-Insulated Tstud has performance characteristics that were tested and/or meet applicable regulations and is suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, Un-Insulated Tstud shall be approved for the following applications:

11.2.1 Un-Insulated Tstud wall studs installed as framing members in walls, as described in this report, are compliant with the codes listed in **Section 4** and are approved for use as an alternative to nominal 2" x 4" (38 mm x 89 mm) solid sawn lumber in all cases for wall structural members.

11.2.2 For use as a 2 x 6 (38 mm 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 IBC Section 2308 and IRC Section R602.

11.2.3 Un-Insulated Tstud installed as built-up columns, as described in this report, are compliant with the codes listed in **Section 4** and NDS Section 15.3.

11.2.4 Un-Insulated Tstud Headers, as described in this report, are compliant with the codes listed in **Section 4**.

11.3 Unless exempt by state statute, when Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header are to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Envirobon, Inc.

11.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10[29] are similar) in pertinent part 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.

11.6 **Approved**:[30] Building regulations require that the building official shall accept duly authenticated reports.[31]

11.6.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.6.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.6.3 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.7 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB-Accredited Product Certification Body – Accreditation #1131.

11.8 Through the IAF Multilateral Agreements (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[32]

12 Conditions of Use

12.1 Material properties shall not fall outside the boundaries defined in **Section 6**.

12.2 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.3 As listed herein, Un-Insulated Tstud shall not be used:

12.3.1 In walls with a wall height greater than 14' (4.3 m) for 5½" Un-Insulated Tstud.

12.3.2 In walls with a wall height greater than 16' (4.9 m) for 7¼" or larger Un-Insulated Tstud.

12.3.3 If dowels are cut or damaged.

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

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

12.6 Notches in the exterior faces of the Un-Insulated Tstud (flange and spline) are not permitted (**Figure 9**).

12.7 Where Un-Insulated 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.

12.8 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:

12.8.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.8.2 This report and the installation instructions shall be submitted at the time of permit application.

12.8.3 These innovative products have an internal quality control program and a third-party quality assurance program.

12.8.4 At a minimum, these innovative products shall be installed per **Section 9** of this report.

12.8.5 The review of this report by the AHJ shall comply with IBC Section 104 and IBC Section 105.4.

12.8.6 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.

12.8.7 The application of these innovative products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2 and any other regulatory requirements that may apply.

12.9 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, "*the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new material or assemblies as provided for in Section 104.11*," all of IBC Section 104, and IBC Section 105.4.

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

12.11 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 The innovative products listed in **Section 1.1** are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number and other information to confirm code compliance.

13.2 Additional technical information can be found at www.envirobon.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

Appendix B

Un-Insulated Tstud Example Calculation

Determine the allowable axial load for an 10' BareNaked Tstud™ of No. 2 SPF lumber spaced 16" o.c. and subject to wind speeds of 140 mph.

Material Properties of BareNaked Tstud™:

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

$F_bS := 660\ lbf \cdot ft$	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
$V_n := 260\ lbf$	Shear Force
$EI := 19252000\ lbf \cdot in^2$	Bending Stiffness
$EI_{min} := 8615000\ lbf \cdot in^2$	Bending Stiffness for Beam and Column Stability
$C_{fc} := 1.15$ $C_{ft} := 1.5$	Size factors for 2x3 lumber.

Section Properties of BareNaked 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
$d_{eff} := w - \left(\frac{d_1}{2}\right) - \left(\frac{d_2}{2}\right) = 3.5\ in$	Moment arm between members
$A_{net} := (d_1 \cdot d_2) + ((d_1 - d_{dowel}) \cdot d_2) = 5.78\ in^2$	Net section area of BareNaked Tstud™, NDS Section 3.6.3 and Section 3.1.2.1
$h := 116.125\ in = 10\ ft$	Height of BareNaked Tstud™

Compression Capacity of BareNaked 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 Cp
$A_b := 2 \cdot d_1 \cdot d_2 = 7.5\ in^2$	Net bearing area of BareNaked 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

$F_{cE} := \frac{\pi^2\ EI_{min}}{A_{net} \cdot l_e^{\ 2}} = 1091\ psi$ Critical buckling design value, TER Equation 1

$$C_P := \frac{1 + \left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c} - \sqrt{\left(\frac{1 + \left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c}\right)^2 - \frac{\left(\frac{F_{cE}}{F_{c.star}}\right)}{c}} = 0.621$$

Column stability factor, NDS Section 3.7.1.5

$F'_c := F_{c.star} \cdot C_P = 821\ psi$ < $F_{cE} = 1091\ psi$ **OK**

$P_{buckling} := F_{c.star} \cdot C_P \cdot A_b = 6160\ lbf$ 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 BareNaked Tstud™:

$C_D := 1.6$ Load Duration Factor

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

$p_{pos} := 20.2\ psf$
$p_{neg} := -26.0\ psf$ Wind pressures for a basic wind speed, Vult, of 140 mph, mean roof height of 30 ft, and Exposure B per IRC Table R301.2(2)

$S_{stud} := 16\ in$ Stud spacing

$w := (-p_{neg}) \cdot S_{stud} = 34.7\ plf$

$M_{req'd} := \frac{w \cdot h^2}{8} = 4870\ lbf \cdot in$ < $M_{all} := F_b S \cdot C_D = 12672\ lbf \cdot in$

Check shear load:

$V_{req'd} := \frac{w \cdot h}{2} = 168\ lbf$ < $V_{all} := V_n \cdot C_D = 416\ lbf$ **OK**

Combined Axial Load and Component & Cladding Wind Load on BareNaked 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 Cp

$$C_P := \frac{1+\left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c} - \sqrt{\left(\frac{1+\left(\frac{F_{cE}}{F_{c.star}}\right)}{2 \cdot c}\right)^2 - \frac{\left(\frac{F_{cE}}{F_{c.star}}\right)}{c}} = 0.444$$

Column stability factor, NDS Section 3.7.1.5

$F_c' := F_{c.star} \cdot C_P = 940\ psi$

Check combined bending and compression on the member:

$A_m := \left(d_1 - d_{dowel}\right) \cdot d_2 = 2.03\ in^2$

$M_{applied} := \frac{0.75\ w \cdot h^2}{8} = 3652\ lbf \cdot in$

A 0.75 factor is applied to the wind load in accordance with load combination 6a in ASCE 7 Section 2.4.1.

$P := 2465\ lbf$

Axial load on the BareNaked Tstud™ is selected to result in a CSI of 1.0.

$f_a := \frac{P}{A_{net}} + \frac{M_{applied}}{A_m \cdot d_{eff}} = 940\ psi$

Axial compressive stress, TER Equation 2

$f_a = 940\ psi$ < $F_{cE} = 1091\ psi$ and < $F_c' = 940\ psi$ **OK**

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

Check Deflection Limit for BareNaked Tstud™:

$$\Delta := \frac{5 \cdot \left(0.7\ w\right) \cdot h^4}{384 \cdot EI} = 0.249\ in$$

$\frac{h}{\Delta} = 467$ > 240 **OK**

Summary of Design Calculations for BareNaked Tstud™:

The BareNaked Tstud™ has a calculated axial load capacity of 2465 lbs for an 10' tall wall with a 140 mph wind load. The axial load is limited by the compression strength of the BareNaked Tstud™ member under combined axial and wind loading.

Issue Date: November 25, 2024
Subject to Renewal: April 1, 2026

CBC and CRC Supplement to Report Number 1908-02

REPORT HOLDER: Envirobon, Inc.

1 Evaluation Subject

1.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, recognized in Report Number 1908-02 have also been evaluated for compliance with the codes listed below.

2.2 *Applicable Code Editions*

2.2.1 *CBC—19, 22: California Building Code (Title 24, Part 2)*

2.2.2 *CRC—19, 22: California Residential Code (Title 24, Part 2.5)*

3 Conclusions

3.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, described in Report Number 1908-02, comply with the CBC and CRC and are subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the CBC and CRC applicable to this report, they are listed here:

3.2.1 CBC Section 104.11 replaces IBC Section 104.11.

3.2.2 CBC Section 1707.1 replaces IBC Section 1707.1.

3.2.3 CRC Section R104.11 replaces IRC Section R104.11.

3.2.4 CBC Section 718 replaces IBC Section 718.

3.2.5 CBC Section 2304 replaces IBC Section 2304.

3.2.6 CBC Section 2308 replace IBC Section 2308.

3.2.7 CRC Section R301 replaces IRC Section R301.

3.2.8 CRC Section R602 replaces IRC Section R602.

4 Conditions of Use

4.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, described in Report Number 1908-02, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 1908-02.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of CBC and CRC, as applicable.

Issue Date: November 25, 2024
Subject to Renewal: April 1, 2026

LABC and LARC Supplement to Report Number 1908-02

REPORT HOLDER: Envirobon, Inc.

1 Evaluation Subject

1.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header

2 Purpose and Scope

2.1 Purpose

2.1.1 The purpose of this Report Supplement is to show Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, recognized in Report Number 1908-02, have also been evaluated for compliance with the codes listed below as adopted by the Los Angeles Department of Building and Safety (LADBS).

2.2 *Applicable Code Editions*

2.2.1 *LABC—20, 23: Los Angeles Building Code*

2.2.2 *LARC—20, 23: Los Angeles Residential Code*

3 Conclusions

3.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, described in Report Number 1908-02, comply with the LABC and LARC and is subject to the conditions of use described in this supplement.

3.2 Where there are variations between the IBC and IRC and the LABC and LARC applicable to this report, they are listed here:

3.2.1 LABC Section 104 replaces IBC Section 104.

3.2.2 LABC Section 104.2.6 replaces IBC Section 104.11.

3.2.3 LABC Section 106.4.3 replaces IBC Section 105.4.

3.2.4 LABC Section 108.3 replaces IBC Section 110.4.

3.2.5 LABC Section 108.5 replaces IBC Section 110.3.

3.2.6 LARC Section R104.2.6 replaces IRC Section R104.11.

3.2.7 LARC Section R108.5 replaces IRC Section R104.4.

3.2.8 LARC Section R301 replaces IRC Section R301.

3.2.9 LARC Section R602 replaces IRC Section R602.

4 Conditions of Use

4.1 Un-Insulated Tstud Structural Wall Stud and Un-Insulated Tstud Header, described in Report Number 1908-02, must comply with all of the following conditions:

4.1.1 All applicable sections in Report Number 1908-02.

4.1.2 The design, installation, and inspections are in accordance with additional requirements of LABC Chapter 16 and Chapter 17, as applicable.

Notes

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

2 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1702

3 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11

4 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests%20as

5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=shall%20conform%20to%20the%20specifications%20and%20methods%20of%20design%20of%20accepted%20engineering%20practice

6 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies

7 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2

8 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_agency

9 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_source

10 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

11 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

12 https://www.cbitest.com/accreditation/

13 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104:~:text=to%20enforce%20the%20provisions%20of%20this%20code

14 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11:~:text=Where%20the%20alternative%20material%2C%20design%20or%20method%20of%20construction%20is%20not%20approved%2C%20the%20building%20official%20shall%20respond%20in%20writing%2C%20stating%20the%20reasons%20why%20the%20alternative%20was%20not%20approved AND https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#105.3.1:~:text=If%20the%20application%20or%20the%20construction%20documents%20do%20not%20conform%20to%20the%20requirements%20of%20pertinent%20laws%2C%20the%20building%20official%20shall%20reject%20such%20application%20in%20writing%2C%20stating%20the%20reasons%20therefore

15 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.11

16 https://iaf.nu/en/about-iaf-mla/#:~:text=it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

17 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

18 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

19 Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

20 All references to the CAC and CRC are the same as the 2021 IBC and 2021 IRC unless otherwise noted in the CBC and CRC Supplement at the end of this report.

21 All references to the LABC and LARC are the same as the 2021 IBC and 2021 IRC unless otherwise noted in the LABC and LARC Supplement at the end of this report.

22 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#listed AND https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#labeled

23 2015 IBC Section 2301.2

24 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1703.4

25 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

26 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

27 Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

28 See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition.

29 2018 IFC Section 104.9

30 Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[31] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1

[32] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.