TECHNICAL ENGINEERING BULLETIN

ASCE 41 Values - Connector and Anchor Strength Design Capacities for Retrofits Designed in Accordance with ASCE 41

SIMPSON Strong-Tie

ASCE 41 is a performance based design methodology for seismic evaluation and retrofit of existing buildings that considers both the lower bound and upper bound (expected) component strength of each individual connection and is referenced in building codes such as IBC, IEBC, Seattle Existing Building Code, and California Existing Building Code. In existing structures, because the inelastic behavior of individual components is unlikely to be consistent throughout the structure, the components must be evaluated on an individual basis to assess the seismic performance of each component. This document establishes ASCE 41 capacities for wood connectors and post-installed anchors for use in linear analysis. Unless otherwise noted, these values and provisions apply to both ASCE 41-13 and ASCE 41-17. Specific sections are referenced for the ASCE 41-17, 2017 edition, where applicable. ASCE 41-17 includes design provisions for individual building components in these chapters; Chapter 12 details design requirements for wood light frame construction and Chapter 10 covers post-installed anchors.

For ASCE 41 design help, we recommend consulting the FEMA P-2006 'Example Application Guide for ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings', a free publication. The following page explains both force controlled and deformation controlled building component assessment in more detail. The chart below is provided to show examples of common elements that would be designated as force-controlled elements and the reasons for that designation with ASCE 41-13 references.

Examples of Force-Controlled Elements (Excerpts from Table 4-2 of FEMA P-2006)

	Force-Controlled Component	Trigger	ASCE 41-13 Reference
Steel	Anchorage to concrete	If controlled by concrete failure	§ 9.3.2.4
Concrete	Anchorage to concrete	Always required by reference section	§ 10.3.6.1, § 10.3.6.2
	Concrete diaphragm connections	Always required by reference section	§ 10.10.2.4
	Existing foundation systems	Always required by reference section	§ 10.12.3
Masonry	Anchorage to masonry	Always required by reference section	11.5.2
Light Frame	Light-frame components supporting discontinuous shear walls	Flexure and shear on beams and axial compression on columns	12.3.4.1, 12.3.4.2
	Light-frame bodies of connections	Always required by reference section	12.3.3.1, 12.3.3.2
	Axial compression and connections between steel rods and wood members	Always required by reference section	12.7.13
	Light-frame components subject to axial compression	Always required by reference section	Table 12-3
	Wood connection	Actions on connection not listed in table	Table 12-3 Note 4, Table 12-4 Note 4

As per FEMA P-2006, sections and tables referenced are from ASCE 41-13, not ASCE 41-17.

ASCE 41 Values - Connector and Anchor Strength Design Capacities for Retrofits Designed in Accordance with ASCE 41

ASCE 41-17 (10.3.6.2) states that component actions on post-installed anchor systems shall be considered force controlled. For concrete connections, the lower-bound capacities of post-installed anchors used in a force-controlled assessment shall be ultimate values, as specified in ACI 318 with a reduction factor (phi) of 1.0. Alternately, for anchors into other substrates, the mean ultimate values as tested by the manufacturer and documented in an approved test report can be used minus one standard deviation. See table footnotes for more information on anchor design methodology for each substrate.

ASCE 41-17 (12.3.3.1) states that demands on connectors, including nails, screws, lags, bolts, split rings, and shear plates used to attach wood components to other wood or metal components shall be considered deformation-controlled actions. Demands on bodies of connections and bodies of connection hardware shall be considered force-controlled actions. For connection hardware, the lower-bound capacity used in a force-control assessment shall be the ultimate value, as specified in NDS-2018 with a reduction factor (phi) of 1.0, or - as provided herein - shall be taken as the mean minus one standard deviation of the maximum strengths determined experimentally (12.3.2.2.1). Q_{CE} = expected component strength per ASCE 41-17 § 12.3.2.2.1 is permitted to be calculated based on 1.5 times the load and resistance factor design procedures in ANSI/AWC NDS-2018, National Design Specification for Wood Construction (AWC, 2018) with a resistance factor, φ, taken equal to 1.0.
Therefore, the Q_{CE} capacities for the wood connection hardware are not published because the capacities are governed by the Q_{CL} check. The reason that the Q_{CL} check governs is because for the Q_{CE} check, the ASD C_D factor of 1.6 is removed. The LRFD value of K_f equals (3.32/1.6) x (permitted factor of 1.5 for fasteners per ASCE 41) which yields 3.11. This factor is higher than the typical factor of safety of 3 used to determine Allowable Stress Design capacities per the appropriate ICC-ES Acceptance Criteria from tested ultimate capacities. This determination is made before applying appropriate m-factors to the fastener checks which will further increase the capacity of the fasteners. Tested Average Ultimate Values and Standard Deviations used to determine the values provided in the tables are a result of physical tests in accordance with the appropriate Acceptance Criteria.

General Notes:

- Q_{CE}: Expected strength for deformation controlled component per ASCE 41
- Q_{CL}: Lower-bound strength for force controlled component per ASCE 41
- k = knowledge factor in accordance with ASCE 41-17 (6.2.4), 1.0 is assumed since connector material strengths are known.

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ASCE 41 - Tension & Shear Strength Design Capacities for Simpson Strong-Tie Anchors into CMU & URM

SIMPSON Strong-Tie

Tension & Shear Strength Design Capacities into Face of Grouted 8" CMU Wall (GFCMU)[1,2,3,4,5,6,7,8,9,10]

Anchor Type	Anchor Diameter (In.)	Embedment Depth (in.)	Dimensions (in.)			ASCE 41 TENSION Capacity (lbs.)	ASCE 41 SHEAR Capacity (lbs.)
			Minimum Edge	Min. End	Minimum Spacing	Q_{CL}	Q_{CL}
SET-XP Epoxy	3/8	3 3/8	12	12	8	6,815	5,420
	1/2	4 1/2	12	12	8	8,307	5,982
	5/8	5 5/8	12	12	8	8,502	5,479
	3/4	6 1/2	12	12	8	8,104	6,200
Titen HD (THD) Screw	3/8	2 3/4	12	12	6	2,141	4,122
	1/2	3 1/2	12	12	8	3,285	6,648
	5/8	4 1/2	12	12	10	4,442	9,069
	3/4	5 1/2	12	12	12	7,560	13,520
Strong-Bolt 2 (STB2) Expansion Anchor	3/8	2 5/8	12	12	8	2,016	3,020
	1/2	3 1/2	12	12	8	2,423	4,638
	5/8	4 3/8	12	12	8	4,340	8,482
	3/4	5 1/4	12	12	8	4,502	12,031
Titen Turbo (TNT) Screw	3/16	2	3 7/8	3 7/8	3	1,250	956 (Perp. to edge)
			1 1/2	3 7/8	3	1,182	998 (Parallel to edge)
	1/4	2	3 7/8	3 7/8	4	1,514	1,569 (Perp. to edge)
			1 1/2	3 7/8	4	1,425	1,151 (Parallel to edge)

See next page for footnotes.

Tension & Shear Strength Design Capacities into Face of Hollow 8" CMU Wall (HCMU)[1,2,3,4,5,6,7,8,9,10]

Anchor Type	Anchor Diameter (In.)	Embedment Depth (in.)	Dimensions (in.)			ASCE 41 TENSION Capacity (lbs.)	ASCE 41 SHEAR Capacity (lbs.)
			Minimum Edge	Min. End	Minimum Spacing	Q_{CL}	Q_{CL}
SET-XP Epoxy	3/8	1 1/4	12	12	8	821	1,584
	1/2	1 1/4	12	12	8	780	1,589
	5/8	1 1/4	12	12	8	1,074	1,873
Titen HD (THD) Screw	3/8	1 3/4	4	4 5/8	12	550	907
	1/2	1 3/4	4	4 5/8	12	550	1,000
	5/8	1 3/4	4	4 5/8	12	550	1,174
	3/4	1 3/4	4	4 5/8	12	809	1,045
Titen Turbo (TNT) Screw	3/16	1 1/4	3 7/8	3 7/8	3	518	767
	1/4	1 1/4	3 7/8	3 7/8	4	491	729

See next page for footnotes.

ASCE 41 - Tension & Shear Strength Design Capacities for Simpson Strong-Tie Anchors into CMU & URM

SIMPSON Strong-Tie

Tension & Shear Strength Design Capacities into Top of Grouted 8" CMU Wall (GFCMU)[1,2,3,4,5,6,7,8,9,10]

Anchor Type	Anchor Diameter (In.)	Embedment Depth (in.)	ASCE 41 TENSION Capacity (lbs.)	ASCE 41 SHEAR Capacity Parallel to edge (lbs.)
			Q_{CL}	Q_{CL}
SET-XP Epoxy	½	4½	7,183	4,350
		12	11,437	—
	⅝	5⅝	7,514	6,505
		12	14,112	—
Titen HD (THD) Screw	½	4½	2,623	2,401
	⅝	4½	2,209	2,593
Strong-Bolt 2 (STB2) Expansion Anchor	½	3½	1,931	3,072
	⅝	4⅜	2,850	3,511

1. CMU and Mortar requirements shall meet the requirements listed in the associated evaluation report for the listed product.
2. Q_{CL} = Is defined as the lower bound component strength which is to be evaluated as a force controlled component. Q_{CL}= Tested Average Ultimate - 1.0x Standard Deviation.
3. Tested Average Ultimate Values and Standard Deviations used to determine the values provided above are a result of physical tests in accordance with AC01, AC58 or AC106 into CMU.
4. Per ASCE 41 Section 11.5.2., Phi (Ø)=1.0.
5. Carbon Steel Titen HD (THD) and Carbon Steel Strong-Bolt 2 (STB2) models are assumed.
6. For adhesive anchors, Q_{CL} shall be the lesser of the capacity in the table above or the capacity of the steel threaded rod type used with the adhesive. See table below for steel strengths.
7. All dimensions for minimum and critical edge, minimum and critical end and minimum critical spacing shall comply with the appropriate information in Simpson's Anchor catalog C-A-2021.
8. Reduction factors for anchors located between minimum and critical edge, between minimum and critical end and between minimum and critical spacing shall comply with the appropriate information in Simpson's Anchor catalog C-A-2021.
9. In some cases, Q_{CL} for a smaller diameter will be larger than Q_{CL} for the next largest diameter due to variations in standard deviations encountered during testing.
10. For CMU Values, ASCE 41-13 Section C11.5.3 states "Judgment should be exercised in the use of lower-bound material properties for anchors. Not all manufacturers of post-installed anchors publish information on the mean and the standard deviation of the ultimate anchor capacity. Older testing for existing post-installed anchors is often reported at allowable stress design levels and may not be consistent with this standard. It is recommended that care and judgment be used to estimate pullout and shear strengths for anchors, particularly for those that are critical to satisfying the target performance level." This section is not present in ASCE 41-17. Both the ASCE 41-13 and -17 versions state in Section C11.5.2 "Anchors in masonry shall be analyzed as a force-controlled action in accordance with applicable sections of Chapter 7, Chapter 13, and TMS 402." The document 'TMS 402/602-16 Building Code Requirements and Specification for Masonry Structures' covers Strength Design requirements in Section 9.1.6. The commentary for this section states, "Due to the wide variation in configurations of post-installed anchors, designers are referred to product literature published by manufacturers for these anchors." Given the information in this footnote and the values presented in the tables above, Engineering Judgment should be used to determine if the values in the tables above are appropriate for the structure being analyzed.

ASCE 41 - Steel Strength Design Tables - For Comparison with Adhesive Anchor Strength in CMU Only[1]

Anchor Diameter (in)	A_{se} (in^2)	ASTM F1554 - Grade 36		ASTM A193 - Grade B8 & B8M 304 & 316 Stainless	
		Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)
		$A_{se} \times f_y$	$A_{se} \times f_y \times 0.6$	$A_{se} \times f_y$	$A_{se} \times f_y \times 0.6$
⅜	0.078	2,808	1,685	2,340	1,404
½	0.142	5,112	3,067	4,260	2,556
⅝	0.226	8,136	4,882	6,780	4,068
¾	0.334	12,024	7,214	10,020	6,012

1. Nominal Steel Strength Values determined in accordance with TMS 402 Section 9.1.6.3.1 and 9.1.6.3.2.

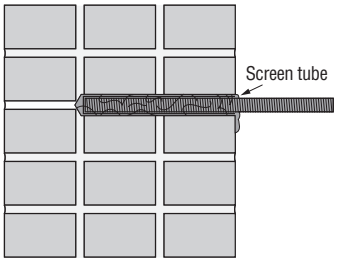
ASCE 41 - Tension & Shear Strength Design Capacities for Simpson Strong-Tie Anchors into CMU & URM

SIMPSON Strong-Tie

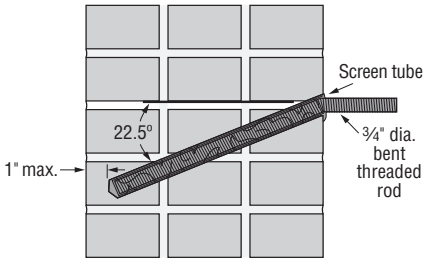
Tension & Shear Strength Design Capacities into Face of 3-Wythe Thick Unreinforced Masonry Walls (URM)[1,2,3,4,5]

Anchor Type	Anchor Diameter (In.)	Embedment Depth (in.)	Anchor Configuration	Anchor Configuration explained	Dimensions (in.)			ASCE 41 TENSION Capacity (lbs.)	ASCE 41 SHEAR Capacity (lbs.)
					Minimum Edge (In.)	Minimum. End (In.)	Minimum Spacing (In.)	Q_{CL}	Q_{CL}
ET-HP Epoxy	¾"	8	A	Straight Shear	16	16	16	—	7,920
		13	B	22.5 degree	16	16	16	6,066	6,545

1. URM and Mortar requirements shall meet the requirements listed in the associated evaluation report for ET-HP.
2. Q_{CL} = Is defined as the lower bound component strength which is to be evaluated as a force controlled component.
   Q_{CL}= Tested Average Ultimate - 1.0x Standard Deviation.
3. Tested Average Ultimate Values and Standard Deviations used to determine the values provided above are a result of physical tests in accordance with AC60 into URM.
4. All anchor installation and hole configuration information shall comply with the appropriate information in Simpson's Anchor catalog C-A-2018 for ET-HP epoxy.
5. For capacities of anchors in URM, FEMA P-2006 'Example Application Guide for ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings', suggests using published ASD values multiplied by a factor to determine design values for use in ASCE 41 analysis "given the lack of sufficient Ultimate Tested Capacities and Standard Deviation information that is typically provided by manufacturers". ASCE 41-17 table 16.1 provides "Strengths of Anchors in Unreinforced Masonry Walls." Alternately, Footnote c. states "An alternative adhesive anchor system is permitted to be used providing (a) its properties and installation conform to an ICC Evaluation Service Report or equivalent evaluation report; and (b) the report states that the system's use is in unreinforced masonry as an acceptable alternative to the International Existing Building Code's Sections A107.4 and A113.1, or TMS 402, Section 2.1.4. The report's allowable values shall be multiplied by a factor of 3 to obtain lower-bound strength values."
   Given that the information in the table above is calculated from Ultimate Tested Capacities and Standard Deviation, Engineering Judgment should be used to determine which value is appropriate for the structure being analyzed.



Configuration A
(Shear)



Configuration B
(Tension & Shear)

ASCE 41 - Guidelines to Designing Concrete Anchors

ASCE 41 capacities for anchors into concrete are evaluated differently than anchors into CMU or URM in that they are typically calculated values in accordance with ACI 318 methods using values from associated evaluation reports versus using ultimate tested values and standard deviations as tested by the manufacturer. In other words, anchor rods and their connection to concrete are evaluated as force-controlled components per ASCE 41 where the lower bound strength, Q_{CL}, equals the anchor strength calculated in accordance with ACI 318. ACI 318-11 is referenced by ASCE 41-13 and ACI 318-14 is referenced by ASCE 41-17. References below cite ACI 318-14 for consistency.

Other considerations include:

1. Phi (Ø) is assumed as = 1.0.
2. In high seismic zones, an additional 0.75 reduction factor (k) is applied to all tension concrete dependent failure modes as stated in ACI 318-14.
3. Cracked Concrete shall be assumed in high seismic zones.
4. The evaluation of the anchor and the connection for tension loads shall satisfy one of the design options stipulated in ACI 318-14 Section 17.2.3.4.3 for ductility.
5. The evaluation of the anchor and the connection for shear loads shall satisfy one of the design options stipulated in ACI 318-14 Section 17.2.3.5.3 for ductility.
6. For more specific direction regarding meeting ductility requirements for tension and shear we recommend consulting the FEMA P-2006 'Example Application Guide for ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings'.

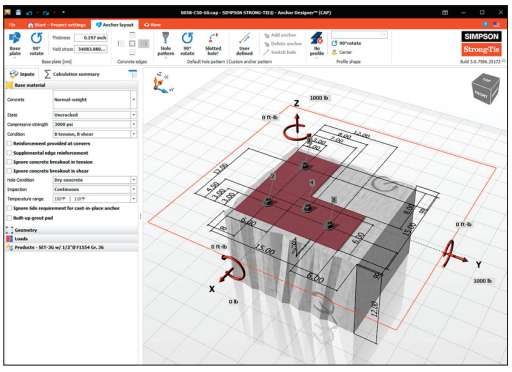
Anchor Designer™ Software is available for free download at www.strongtie.com/software/anchordesigner.html

Simpson Strong-Tie Anchor Designer Software is the latest anchorage design tool for structural engineers to satisfy the strength design provisions and methodologies. Anchor Designer will quickly and accurately analyze an existing design or suggest anchorage solutions based upon user-defined design elements in cracked and uncracked concrete conditions.

The real-time design is visually represented in a fully-interactive 3D graphic user interface, supports imperial- and metric-sized Simpson Strong-Tie mechanical and adhesive anchors, and offers cast-in-place anchor solutions. Anchor Designer can calculate single anchor solutions or with multiple anchors in a single plate. Anchor locations are fully customizable to assist engineers in complex design conditions.

Features include:

- Design standards: ACI 318-14 Chapter 17 / ACI 318-11 Appendix D, CAN / CSA A23.3 Annex D, ETAG 001 Annex C or EOTA TR029.
- Customizable anchor pattern.
- Easy-to-use menus.
- Ability to calculate single anchor model or to calculate multiple anchor models at once.
- Multi-lingual options include English, German, French, Spanish, Polish and Danish languages.
- Rectangular, circular, L-shape and T-shape base plate geometries with the option to include slotted holes.
- And much more!



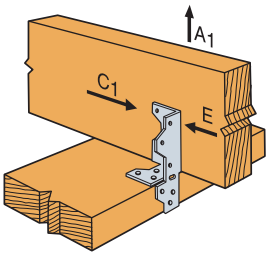
ASCE 41 - Load Tables for Wood Connection Hardware

SIMPSON Strong-Tie

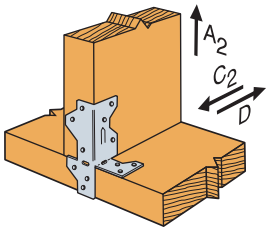
ASCE 41 Capacities for A35, LTP4 and LTP5[1,2,3,4,5,6,7]

Model No.	Type of Connection	Fasteners (in.)	Direction of Load	DF/SP ASCE 41 Capacity (lbs.)	SPF/HF ASCE 41 Capacity (lbs.)
				Q_{CL} (K = 1.0)	Q_{CL} (K = 1.0)
A35	2	(9) 0.131 x 1½	A_1	1,060	910
			E	1,330	1,145
			C_1	560	480
	3	(12) 0.131 x 1½	A_2	935	805
			C_2	1,010	870
			D	670	575
	4	(12) 0.131 x 1½	F_1	1,840	1,580
			F_2	1,980	1,705
	5	(12) PH612I	F_1	1,280	1,100
LTP4	6	(12) 0.131 x 1½	G	1,825	1,570
			H	1,500	1,290
LTP5	7	(12) 0.131 x 1½	G	1,695	1,460
			H	1,465	1,260

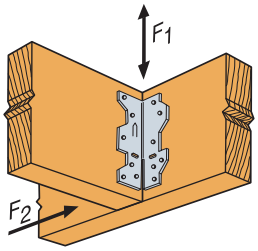
1. All loads listed assume connectors are directly attached to framing members.
2. Some illustrations show connections that could cause cross-grain tension or bending of the wood during loading if not reinforced sufficiently. In this case, mechanical reinforcement should be considered.
3. LTP4 can be installed over ⅜" wood structural panel sheathing with 0.131" x 1½" nails and achieve 0.72 of the listed load, or over ½" sheathing and achieve 0.64 of the listed load. When installed with 0.131" x 2½" nails will achieve 100% load.
4. The LTP5 may be installed over wood structural panel sheathing up to ½" thick using 0.131" x 1½" nails with no reduction in load.
5. Connectors are required on both sides to achieve F2 loads in both directions.
6. A34 and A35 installed with 0.131" x 1½" nails onto 1¼" LSL material will achieve 0.90 of the listed F_1 and F_2 loads.
7. **Fasteners:** Nail dimensions in the table are diameter by length. PH612I is a pan-head #6 x ½" screw available from Simpson Strong-Tie.



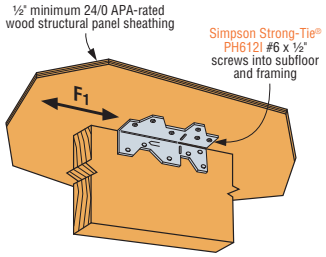
2 A35



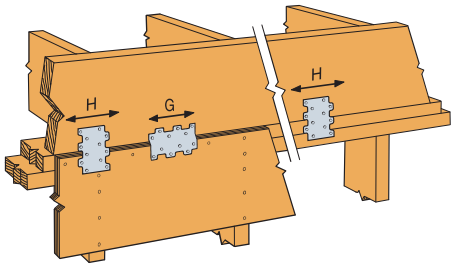
3 A35



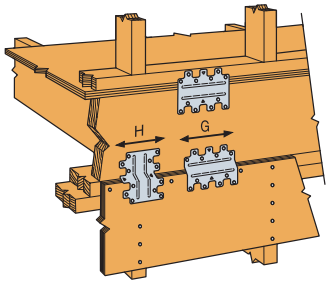
4 A35



5 A35



6 LTP4



7 LTP5

ASCE 41 - Load Tables for Wood Connection Hardware

SIMPSON Strong-Tie

ASCE 41 Tension Capacities for HDU Holdowns[1,2,3]

Model No.	Ga.	Fasteners		Minimum Wood Member Thickness (in.)	ASCE 41 Tension Capacity Q_{CL} (K = 1.0) (lbs.)
		Anchor Bolt Dia. (in.)	Post Fasteners		DF/SP
HDU2-SDS2.5	14	⅝	(6) ¼ x 2½ SDS	3 x 3½	8,300
HDU4-SDS2.5	14	⅝	(10) ¼ x 2½ SDS	3 x 3½	12,720
HDU5-SDS2.5	14	⅝	(14) ¼ x 2½ SDS	3 x 3½	17,340
HDU8-SDS2.5	10	⅞	(20) ¼ x 2½ SDS	3 x 3½	15,275
				3½ x 3½	17,665
				3½ x 4½	23,930
HDU11-SDS2.5	10	1	(30) ¼ x 2½ SDS	3½ x 5½	25,290
				3½ x 7¼	33,300
HDU14-SDS2.5	7	1	(36) ¼ x 2½ SDS	3½ x 5½	34,100
				3½ x 7¼	41,135
				5½ x 5½	44,195

1. HDU14 requires heavy-hex anchor nut to achieve tabulated loads (supplied with holdown).
2. HDU14 loads on 4x6 post are applicable to installation on either the narrow or the wide face of the post.
3. Fasteners dimensions in the table are listed diameter x length.

ASCE 41 Tension Capacities for CMST and CS Straps[1,2,3,4]

Model No.	Ga.	DF/SP		SPF/HF		ASCE 41 Tension Capacity Q_{CL} (K = 1.0) (lbs.)
		Fasteners (in.)	End Length (in.)	Fasteners (in.)	End Length (in.)	
CMST12	12	(74) 0.162 x 2½	33	(84) 0.162 x 2½	38	13,080
		(86) 0.148 x 2½	39	(98) 0.148 x 2½	44	13,080
CMST14	14	(56) 0.162 x 2½	26	(66) 0.162 x 2½	30	9,195
		(66) 0.148 x 2½	30	(76) 0.148 x 2½	34	9,195
CMSTC16	16	(50) 0.148 x 3¼	20	(58) 0.148 x 3¼	25	7,445
CS14	14	(26) 0.148 x 2½	15	(30) 0.148 x 2½	16	3,830
		(30) 0.131 x 2½	16	(36) 0.131 x 2½	19	3,830
CS16	16	(20) 0.148 x 2½	11	(22) 0.148 x 2½	13	2,480
		(22) 0.131 x 2½	13	(26) 0.131 x 2½	15	2,480
CS20	20	(12) 0.148 x 2½	7	(14) 0.148 x 2½	9	1,495
		(14) 0.131 x 2½	9	(16) 0.131 x 2½	9	1,495

1. The capacity is based on the least of the force controlled strap steel in tension check, Q_{CL} and the deformation controlled nail with steel side member check, Q_{CE}.
2. Listed Q_{CL} tension loads assume straight, non-bent straps with half of fasteners in each member being connected.
3. Calculate the connector value for a reduced number of nails as follows:

$$Q_{CL}\text{ Tension Capacity} = \frac{\text{No. of Nails Used}}{\text{No. of Nails in Table}} \times \text{Table Load}$$

4. Fasteners: Nail dimensions in the table are listed diameter x length.

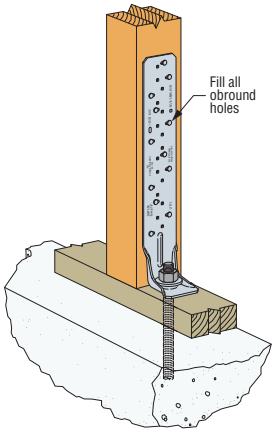
ASCE 41 - Load Tables for Wood Connection Hardware

SIMPSON Strong-Tie

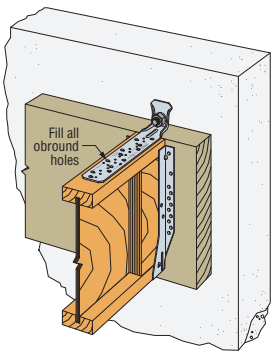
ASCE 41 Tension Capacities for HTT and LTT Holdowns[1,2]

Model No.	Ga.	Dimensions (in.)			SO (in.)	Fasteners (in.)		Minimum Wood Member Size (in.)	ASCE 41 Tension Capacity Q_{CL} (K = 1.0) (lbs.)	
		W	L	CL		Anchor Rod Diameter	Wood Fasteners		DF/SP	SPF/HF
LTTP2	10	3	15	1	7/16	1/2, 5/8, 3/4	(15) 0.148 x 2 1/2	1 1/2 x 3 1/2 (narrow edge)	3,380	2,907
						1/2	(12) 0.148 x 1 1/2	1 1/2 x 3 1/2	5,145	4,425
						5/8, 3/4			5,690	4,893
						1/2	(12) SD#9 x 1 1/2	1 1/2 x 3 1/2	6,970	5,994
						5/8, 3/4			7,740	6,656
						1/2, 5/8, 3/4	(12) 0.148 x 2 1/2	3 x 3 1/2	7,160	6,158
LTTI31	18	3 3/4	31	1 3/8	1/4	5/8	(18) 0.148 x 1 1/2	3 x 3 1/2	4,045	3,479
HTT4	11	2 1/2	12 3/8	1 5/16	7/16	5/8	(18) 0.148 x 1 1/2	1 1/2 x 3 1/2	7,285	6,265
							(18) 0.148 x 1 1/2	3 x 3 1/2	8,670	7,456
							(18) 0.162 x 2 1/2	3 x 3 1/2	11,610	9,985
							(18) SD #10 x 1 1/2	1 1/2 x 5 1/2	12,915	11,107
							(18) SD #10 x 1 1/2	3 x 3 1/2	12,915	11,107
HTT5	11	2 1/2	16	1 7/16	7/16	5/8	(26) 0.148 x 1 1/2	3 x 3 1/2	12,880	11,077
							(26) 0.148 x 3	3 x 3 1/2	12,525	10,772
							(26) 0.162 x 2 1/2	3 x 3 1/2	15,325	13,180
							(26) SD #10 x 1 1/2	1 1/2 x 5 1/2	14,670	12,616
HTT5KT	11	2 1/2	16	1 7/16	7/16	5/8	(26) SD #10 x 2 1/2	3 x 3 1/2	15,790	14,940
HTT5-3/4	11	2 1/2	16	1 7/16	7/16	3/4	(26) 0.148 x 1 1/2	1 1/2 x 5 1/2	10,965	9,430
							(26) 0.162 x 2 1/2	3 x 3 1/2	15,325	13,180
							(26) SD #10 x 1 1/2	1 1/2 x 7 1/4	14,980	12,883

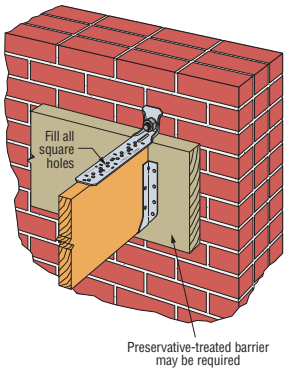
1. For LTTP2, standard cut washer is required when using 1/2" and 5/8" anchor rods.
2. Fasteners dimensions in the table are listed diameter x length.



Vertical LTTP2 Installation



Horizontal LTTP2 Installation for I-Joists



Horizontal LTTP2 Installation for solid sawn joists

ASCE 41 - Load Tables for Wood Connection Hardware

SIMPSON Strong-Tie

ASCE 41 Tension Capacities for HD and HDB Holdowns[1,2,3]

Model No.	Material		Dimensions (in.)							Fasteners (in.)		Minimum Wood Member Size (in.)	ASCE 41 Tension Capacity Q_{CL} (K = 1.0) (lbs.)
	Base (in.)	Body (ga.)	HB	SB	W	H	B	CL	SO	Anchor Bolt Dia. (in.)	Wood Member Bolts		DF/SP
HD3B	—	12	4¾	2½	2½	8⅝	2¼	1⁵⁄₁₆	⅜	⅝	(2) ⅝	1½ x 3½	5,510
												2½ x 3½	5,670
												3 x 3½	8,370
												3½ x 3½	8,370
HD5B	³⁄₁₆	10	5¼	3	2½	9⅜	2½	1¼	2	⅝	(2) ¾	1½ x 3½	6,550
												2½ x 3½	8,150
												3 x 3½	8,150
												3½ x 3½	9,390
HD7B	³⁄₁₆	10	5¼	3	2½	12⅜	2½	1¼	2	⅞	(3) ¾	3 x 3½	10,835
												3½ x 3½	10,835
												3½ x 4½	10,835
HD9B	⅜	7	6⅛	3½	2⅞	14	2½	1¼	2⅜	⅞	(3) ⅞	3½ x 3½	9,690
												3½ x 4½	14,940
												3½ x 5½	14,940
												3½ x 7¼	14,940
HD12	⅜	3	7	4	3½	20⁵⁄₁₆	4¼	2⅛	3⅝	1	(4) 1	3½ x 3½	19,000
												3½ x 4½	25,820
												5½ x 5½	32,960
										1⅛	(4) 1	3½ x 3½	19,000
												3½ x 4½	25,820
												3½ x 7¼	32,960
												5½ x 5½	32,960
HD19	⅜	3	7	4	3½	24½	4¼	2⅛	3⅝	1⅛	(5) 1	3½ x 7¼	31,980
												5½ x 5½	36,895
										1¼	(5) 1	3½ x 7¼	36,535
												5½ x 5½	38,770

1. To achieve published loads, machine bolts shall be installed with the nut on the opposite side of the holdown. If this orientation is reversed, the Designer shall reduce the loads shown per NDS requirements when bolt threads are in the shear plane.
2. Lag or carriage bolts are not permitted.
3. HD19 with 1¼" anchor rod requires No.1 post (or better) to achieve published loads.

TEB-ASCE4123 1/23 exp. 12/23

(800) 999-5099
strongtie.com