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Evaluation reports are the opinion of the engineer who prepared the report, based on the findings, and in no way constitute or imply approval by a local building authority. The engineer, in review of the data submitted, finds that, in his opinion, the product, material, system, or method of construction specifically identified in this report conforms with or is a suitable alternate to that specified in the Florida Building Code, SUBJECT TO THE LIMITATIONS IN THIS REPORT

Jeffrey P. Arneson, an employee of Jax Apex Technology, Inc. (Apex Technology), is the authorized evaluating engineer of this report. Apex Technology is the prime professional, as defined in Florida Rule 61G-30.002, authorized to sell the engineering services performed by Jeffrey P. Arneson, and is in no way acting, nor attempting to act, as an approved evaluation entity. Neither Jeffrey P. Arneson, nor any other employee of Apex Technology, has performed calculations or testing for the products listed in this report. This evaluation is based solely upon the review, under the direct supervision of Jeffrey P. Arneson, of testing and/or calculations submitted by the manufacturer.

The capacities listed in this report are based on the limiting capacities as determined from the substantiating data. We reviewed the substantiating data to a degree that allowed us to determine whether or not the work performed is consistent with the intended use of the product, and that the methods used are in compliance with, or meet the intent of, the Florida Building Code. All test reports were prepared by an approved testing laboratory.

REPORT NO.: SIM201702

CATEGORY: Structural Components

SUB CATEGORY: Metal Connectors

SUBMITTED BY:

SIMPSON STRONG-TIE COMPANY, INC.
5956 W. LAS POSITAS BOULEVARD
PLEASANTON, CA 94588

1. CERTIFICATION OF INDEPENDENCE:

Jeffrey P. Arneson, the Florida engineer who prepared this report, and Apex Technology have no financial interest in the manufacturing, sales, or distribution of the products included in this report. Jeffrey P. Arneson and Apex Technology comply with all criteria as stated in Florida Administrative Code Chapter 61G20-3.009.

2. PRODUCT NAME:

Truss to Wall Connectors
MTS24C, MTS30C, H16, H16S, H16-2, H16-2S

Stud Plate Tie
TSP

Heavy Twist Straps
HTSQ16Z, HTSQ16SS, HTSQ20Z, HTSQ20SS

Strap Ties
HRS6, HRS8, HRS12

Heavy Angles
ML24Z, ML24SS, ML26Z, ML26SS

Multiple Member Column Caps
CCCQ, CCTQ, ECCLQ

3. SCOPE OF EVALUATION:

Load Evaluation as a Structural Component using the requirements of the *6th Edition (2017) Florida Building Code, Building* and *6th Edition (2017) Florida Building Code, Residential*.

4. DESCRIPTION:

4.1 MTS24C and MTS30C Twist Strap. These twist straps are used to anchor wood trusses or rafters to wood top plates, wood top plates to studs, and other applications requiring uplift anchorage. They can be used to resist uplift from wind or other loading. The C denotes that the twist is in the center of the strap. They are installed with either 10d common nails or 10d×1½" nails. The MTS24C and MTS30C are manufactured from No. 16 gauge steel meeting ASTM A653 SS Grade 33 with a G90 galvanized finish. Allowable loads and fastener schedule are shown in Table 1. See Figure 1 for additional details.

4.2 H16, H16S, H16-2, H16-2S Hurricane Tie. The H16, H16S, H16-2, and H16-2S are used to anchor wood trusses or rafters to wood top plates or to masonry or concrete walls. These connectors wrap over the top of the rafter or truss. For wood wall applications, the straps are then wrapped under the top plate and nailed to the face of the top plate with (4) 10d×1½" nails and to the bottom of the top plate with (6) 10d×1½" nails. For masonry or concrete wall applications, the straps are fastened to a masonry wall with ¼"×2¼" Titen® or Titen® 2 screws, or a concrete wall with ¼"×1¾" Titen or Titen 2 screws. These connectors are manufactured from No. 18 gauge steel meeting ASTM A653 SS Grade 40 with a G90 galvanized finish. Allowable loads and fastener schedule are shown in Table 1 for wood framing and Table 2 for masonry or concrete walls. See Figures 2 and 3 for additional details.

4.3 TSP Stud-to-Plate Connector. The TSP is used to connect a stud to either double top plates or a single sill plate. The TSP twists to attach to the side of the stud to reduce interference with sheathing, drywall, and trim nailing. The TSP has a short flange on it that installs either over the top of the top plates or hooked under the sill plate. For sill plate application, fill all round holes. For top plate application, fill all round and triangle shaped holes. The TSP is installed with either 10d×1½" or full-length 10d common nails. The TSP is manufactured from No. 16 gauge steel meeting ASTM A653 SS Grade 40 with a G90 galvanized finish. Allowable loads and fastener schedule are shown in Table 3. See Figure 4 for additional details.

4.4 HTSQ Twist Strap. The HTSQ series of twist straps are used to provide a tension (uplift) connection between two perpendicular wood framing members. They can be

used to resist uplift from wind or other loading. They are installed with ¼"×1½" long Strong-Drive® SDS Heavy-Duty Connector Screws, which are included with the connector. All HTSQ's are manufactured from No. 14 gauge steel. The HTSQZ models are manufactured from steel meeting ASTM A653 SS Grade 40 with a G185 galvanized finish. The HTSQSS models are manufactured from AISI Type 316L stainless steel, with a minimum yield strength of 40 ksi. Allowable loads and fastener schedule are shown in Table 4. See Figure 5 for additional details.

4.5 HRS Heavy Strap Tie. The HRS strap tie models are straps used to provide a tension connection between two wood members. The HRS6, 8, and 12 are 1⅜" wide and are installed with 10d common nails. The straps are manufactured from No. 12 gauge steel meeting ASTM A653 SS Grade 33 with a G90 galvanized finish. Allowable loads and fastener schedule are shown in Table 5. See Figure 6 for additional details.

4.6 ML Angles. The ML series of heavy angles can be used to transfer shear forces between two perpendicular members. They fasten to wood members with ¼"×1½" long Simpson Strong-Tie Strong-Drive® SDS Heavy-Duty Connector Screws. The ML angles are manufactured from 12 gauge steel. The ML24Z and ML26Z models are manufactured from steel meeting ASTM A653 SS Grade 33 with a G185 galvanized finish. Products designated ML24SS and ML26SS are manufactured from AISI Type 316L stainless steel, with a minimum yield strength of 33 ksi. Stainless steel connectors require stainless steel Strong-Drive® SDS Heavy-Duty Connector Screws. Allowable loads, fastener schedule, and dimensions are shown in Table 6. See Figure 7 for additional details.

4.7 CCCQ, CCTQ, ECCLQ Multiple Member Column Caps. The CCCQ, CCTQ, and ECCLQ are used to connect multiple beams to the top of wood columns. The beams can be oriented in a "cross" configuration (CCCQ), "T" configuration (CCTQ), or an "L" configuration (ECCLQ). The Column Caps fasten to the beams with ¼"×2½" long Strong-Drive® SDS Heavy-Duty Connector Screws (provided with the part). The CCCQ, CCTQ, and ECCLQ are manufactured from 7 gauge steel meeting ASTM A1011 Grade 33 with a powder coat painted finish. Allowable loads, fastener schedule, and dimensions loads are shown in Table 7. See Figure 8 for additional details.

5. MATERIALS

5.1 Steel. Steel specifications for each product listed in this evaluation report shall be as indicated in the previous section. In addition to the standard G90 coating, some models (designated with a model number ending with Z) are available with a G185 zinc coating specification in accordance with ASTM A653. Some models (designated with a model number ending with HDG) are available with a hot-dip galvanization, also known as "batch" galvanization, in accordance with ASTM A123, with a minimum specified coating weight of 2.0 ounces of zinc per square foot of surface area, total for both sides. Some models (designated with a model number ending with SS) are available in Type 316L stainless material manufactured in accordance with ASTM A240 sheet, strip or plate and ASTM A480 (General Requirements) in the following designation: UNS designation S31603, AISI Type 316L. Model numbers in this report may not include the Z, HDG, or SS ending, but the information shown applies.

5.2 Wood. Wood members to which these connectors are fastened shall be solid sawn lumber, glued-laminated lumber, or structural composite lumber having dimensions consistent with the connector dimensions shown in Tables 1 through 7. Unless

otherwise noted, lumber shall be Southern Pine (SP) or Douglas Fir-Larch (DF) having a minimum specific gravity of 0.55 or 0.50, respectively. Where indicated by SPF, lumber shall be Spruce-Pine-Fir having a minimum specific gravity of 0.42.

5.3 **Concrete/Masonry**. Concrete and masonry design specifications shall be the stricter of the specifications by the engineer of record, the Florida Building Code minimum standards, the following, or as noted in the report:

Material	Specification	Minimum Compressive Strength
Concrete, f'_c	-	2,500 psi
Masonry, f'_m	ASTM E447	1,500 psi
Masonry Unit	ASTM C90	1,900 psi
Mortar	ASTM C270 Type S	1,800 psi (or by proportions)
Grout	ASTM C476	2,000 psi (or by proportions)

5.4 **Nails.** Unless noted otherwise, nails shall be common nails. Nails shall comply with ASTM F1667 and shall have the minimum bending yield strengths F_{yb}:

Nail Pennyweight	Nail Shank Diameter (inch)	Nail Length (inch)	F_{yb} (psi)
10d×1½	0.148	1.50	90,000
10d Common	0.148	3.00	90,000

Fasteners for galvanized connectors in pressure-preservative treated wood shall be hot-dipped zinc coated galvanized steel with coating weights in accordance with ASTM A153 or steel mechanically galvanized in accordance with ASTM B695, Class 55. Fasteners for stainless steel connectors shall be stainless steel except where otherwise permitted by the treatment manufacturer.

The allowable loads of stainless-steel connectors match those of carbon-steel connectors when installed with Simpson Strong-Tie stainless-steel, SCNR ring-shank nails, unless noted otherwise.

5.5 **Strong-Drive® SDS Heavy-Duty Connector Screws.** Fasteners used with the connectors described in Tables 4, 6, and 7 of the report must be Simpson Strong-Tie® Strong-Drive SDS Heavy-Duty Connector wood screws recognized in FL9589. Model numbers shown in this report may not include the full SDS model number after the connector model number (e.g., CCTQ-SDS2.5), but the information shown applies. SDS screws used in contact with preservative-treated or fire-retardant-treated lumber must, as a minimum, comply with FL9589. The lumber treater or Simpson Strong-Tie Company should be contacted for recommendations on minimum corrosion resistance and connection capacities of fasteners used with the specific proprietary preservative-treated or fire retardant-treated lumber.

5.6 **Titen® 2 and Titen® Concrete and Masonry Screws.** Titen® 2 screws shown in Table 2 and Figure 3 shall be Simpson Strong-Tie Titen 2 Concrete and Masonry screws as recognized in FL16230. Installation shall be as specified in FL16230. Alternately, Titen® screws of the same diameter and length may be substituted for Titen 2 screw models shown. Titen screws are recognized in FL2355. Installation shall be as specified in FL2355.

6. INSTALLATION:

Installation shall be in accordance with this report and the most recent edition of the Simpson Strong-Tie *Wood Construction Connectors* catalog. Information in this report supersedes any conflicting information between information provided in this report and the catalog.

7. SUBSTANTIATING DATA:

Test data submitted by Testing Engineers Inc. and Simpson Strong-Tie, and signed and sealed calculations performed by Bryan Wert, P.E., performed in accordance with the *6th Edition (2017) Florida Building Code, Building* and *Residential* codes.

Model No.	Test Lab	Test Number
MTSC	Testing Engineers, Inc.	F397
H16, H16S, H16-2, H16-2S	Testing Engineers, Inc.	H591, I376
TSP	Testing Engineers, Inc.	M812, M999, P089, P297, P298, P332
HTSQ16	Testing Engineers, Inc.	V980
HTSQ20	Testing Engineers, Inc.	V981
ML24Z	Testing Engineers, Inc.	P181
ML24SS	Testing Engineers, Inc.	Q851
ML26Z	Testing Engineers, Inc.	P182
MS26SS	Testing Engineers, Inc.	Q852
CCTQ	Testing Engineers, Inc.	N784, O139, O140, O412, O413
CCCQ	Testing Engineers, Inc.	N786
ECCLQ	Testing Engineers, Inc.	N782, O125, O142, O414, O415

8. FINDINGS:

The connectors listed in this evaluation report comply with the *6th Edition (2017) Florida Building Code, Building*, and *6th Edition (2017) Florida Building Code, Residential* when installed in accordance with this report.

9. LIMITATIONS:

1. Maximum allowable loads shall not exceed the allowable loads listed in this report. Allowable loads listed in this report are based on allowable stress design. The loads in this report are not applicable to Load and Resistance Factor Design.
2. Capacity of wood members is not covered by this report. Capacity of wood members must be checked by the building designer.
3. Connectors in this report having a galvanized coating thickness less than G185 shall not be installed in contact with preservative-treated wood products that are exposed to rainfall or ground moisture.

10. ALLOWABLE LOADS AND INSTALLATION ILLUSTRATIONS:

The tables that follow reference the allowable loads for the aforementioned products.

TABLE 1: MTSC and H16 Wood-to-Wood Fasteners and Allowable Loads						
Model No.	Ga.	Fasteners			Allowable Uplift Loads (lb.)	
		To Trusses/ Rafters	To Plates	To Studs[3]	DF/SP (160)	SPF/HF (160)
MTS24C[3]	16	(7) 10d×1½"	(7) 10d×1½"	–	990	850
MTS30C[3]						
H16[4]	18	(2) 10d×1½"	(10) 10d×1½"	–	1,370	1,180
H16S[4]						
H16-2[4]						
H16-2S[4]						

Notes:

1. Uplift loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. Hurricane ties are shown installed on the inside of the wall for clarity. Installation on the outside of the wall is acceptable. For a continuous load path, truss to top plate and top plate to stud connections must be on the same side of the wall.
3. MTS24C, MTS30C can be attached directly to the studs provided the (7) 10d×1½" nails are attached to the stud and not split over the stud and the top plate.
4. H16 is pre-sloped at a 5:12 pitch and can be used on pitches from 3:12 to 7:12. The minimum heel height for H16-series is 4". The maximum heel height is 13½" (Use H16 or H16-2). For H16S and H16-2S, S = short. See Figure 2 for dimensions.

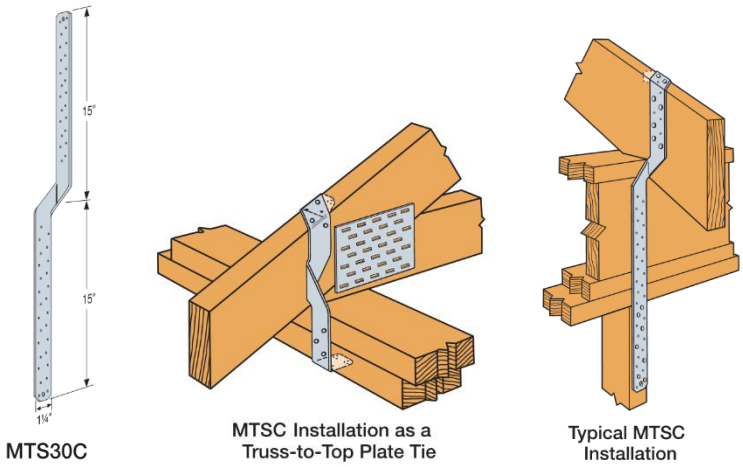


FIGURE 1: MTSC Dimensions and Typical Installations

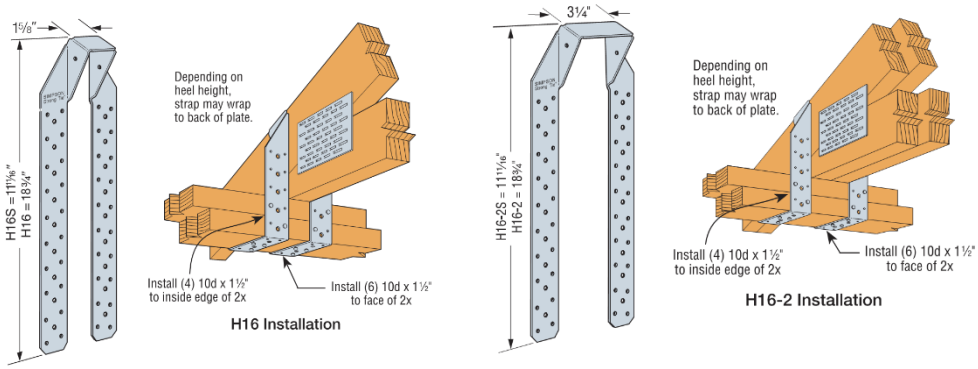


FIGURE 2: H16 and H16-2 Dimensions and Typical Installation

TABLE 2: H16 Wood-to-Masonry/Concrete Dimensions, Fasteners, and Allowable Loads							
Model No.	Ga.	Length (in.)	Fasteners			Allowable Uplift Loads (lb.)	
			Truss/Rafter	CMU (Titen 2)[3]	Concrete (Titen 2)[3]	DF/SP (160)	SPF/HF (160)
H16 H16-2	18	18 3/4	(2) 10d×1½"	(6) ¼"×2¼"	(6) ¼"×1¾"	1,470	1,265
H16S H16-2S	18	11 11/16	(2) 10d×1½"	(6) ¼"×2¼"	(6) ¼"×1¾"	1,470	1,265

Notes:
1. Uplift loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. H16 is pre-sloped at a 5:12 pitch and can be used on pitches from 3:12 to 7:12. The minimum heel height for H16 series is 4".
3. Titen screws of the same diameter and length may be substituted for the tabulated Titen 2 screw size with no change in allowable load.

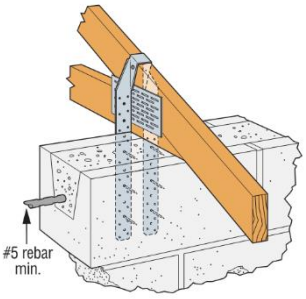


FIGURE 3: H16 Typical Installation to Masonry

TABLE 3: TSP Dimensions, Fasteners, and Allowable Loads								
Model No.	Plate Location	Fasteners		Allowable Uplift Loads (lb.)			
				Double Top Plate		Single Sill Plate	
		Stud	Top or Sill Plate	DF/SP (160)	SPF (160)	DF/SP (160)	SPF (160)
TSP	Double Top Plate	(9) 10d×1½"	(6) 10d×1½"	755	650	–	–
			(6) 10d	1,015	875		
	Single Sill Plate	(6) 10d×1½"	(3) 10d×1½"	–	–	465[4]	400

Notes:
1. Uplift loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. TSP connectors achieve different loads depending on whether full length nails or 1½" long nails are used, and whether connector is used to fasten stud to top plates or sill plate.
3. When cross grain bending or cross grain tension cannot be avoided, mechanical reinforcement to resist such forces should be considered. Large plate washers on anchor bolts can serve this purpose.
4. TSP Southern Pine stud to Southern Pine sill plate, 520 lb. uplift. TSP SPF stud to Southern Pine sill plate, 405 lb. uplift.

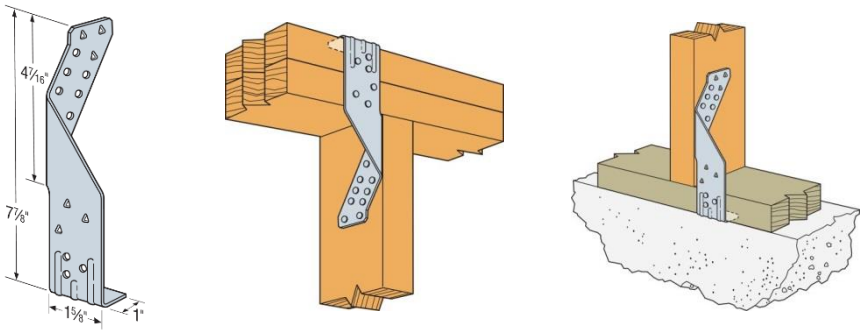


FIGURE 4: TSP Dimensions and Typical Installations

TABLE 4: HTSQ Dimensions, Fasteners, and Allowable Loads							
Model No.	Dimensions (in.)		SDS Screw Fasteners	Allowable Uplift Loads (lb.)			
				DF/SP		SPF/HF	
	W	L		(100)	(160)	(100)	(160)
HTSQ16Z	1¼	16	(8) ¼×1½"	1,000	1,145	720	800
HTSQ16SS							
HTSQ20Z	1¼	20					
HTSQ20SS							

Notes:
1. Uplift loads in the (160) column have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. Tabulated loads are for a single connector. Two identical connectors may be used when the fasteners do not interfere.
3. Install half of the tabulated fasteners in each member to achieve full loads. HTSQ20 models have two extra holes per side to allow for installation flexibility

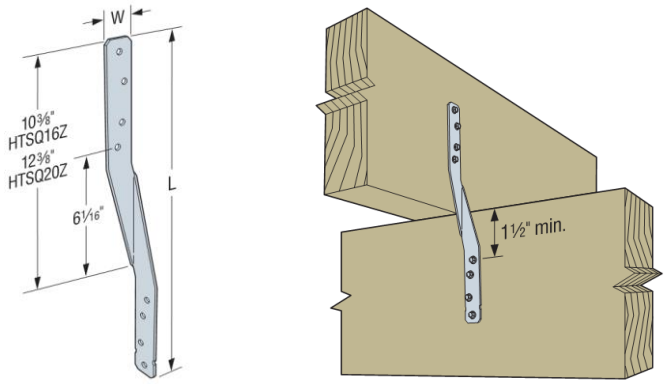


FIGURE 5: HTSQ Dimensions and Typical Installation

TABLE 5: HRS Dimensions, Fasteners, and Allowable Loads						
Model No.	W (in.)	L (in.)	Ga.	Nails	Allowable Tension Load (lb.)	
					DF/SP (160)	SPF/HF (160)
HRS6	1 3/8	6	12	(6) 10d	605	525
HRS8	1 3/8	8	12	(10) 10d	1,010	880
HRS12	1 3/8	12	12	(14) 10d	1,415	1,230

Notes:
1. Tension loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. Install half the tabulated nails in each end of the strap.

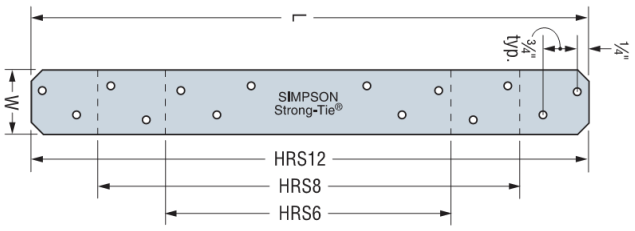


FIGURE 6: HRS Dimensions

TABLE 6: ML Dimensions, Fasteners, and Allowable Loads						
Model No.	H (in.)	SDS Screw Fasteners	DF/SP Allowable Vertical Loads (lb.)			
			(100)	(115)	(125)	(160)
ML24Z	4	(6) ¼"×1½"	515	515	515	515
ML24SS			605	605	605	605
ML26Z	6	(8) ¼"×1½"	1,000	1,090	1,090	1,090
ML26SS			1,000	1,075	1,075	1,075

Notes:
1. Uplift loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. Strong-Drive SDS Heavy-Duty Connector screws are not provided with the angle.

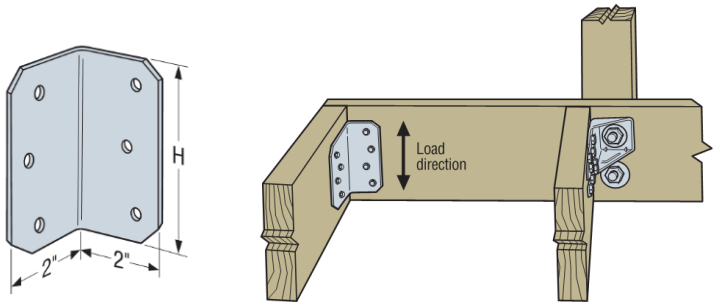
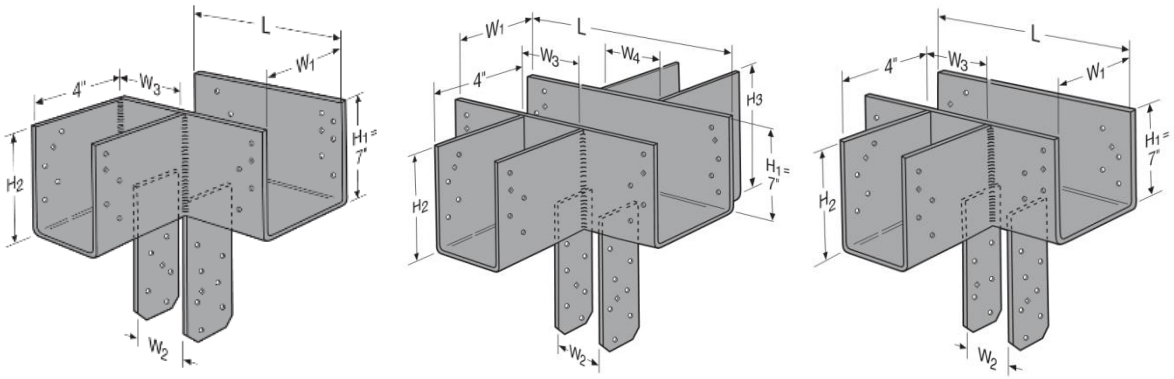


FIGURE 7: ML Dimensions and Typical Installation

TABLE 7: ECCLQ/CCCQ/CCTQ Fasteners and Allowable Loads								
Column Cap Series	Qty. of SDS ¼"×2½" Screws			DF/SP Allowable Loads (lb.)				
	Main Beam	Side Beam	Post	Uplift (160)			Download (100)	
				Main Beam	Side Beam	Total[3]	Side Beam[5]	Total
ECCLQ-SDS2.5	16	8	12	2,835	1,840	3,795	6,780	Refer to Note #4
CCCQ-SDS2.5	16	8	12	4,780	2,390[2]	4,780	7,000	
CCTQ-SDS2.5	16	8	12	4,910	2,350	5,315	7,000	

Notes:
1. Uplift loads have been increased 60% for wind loading as permitted by the code. No further increase permitted. Reduce where other loads govern.
2. Allowable load is per seat. Side beams must be loaded symmetrically for the CCCQ.
3. The combined uplift loads applied to all beams in the connector must not exceed the total allowable uplift load listed in the table.
4. The combined download for all of the carried beams shall not exceed the allowable download for the unmodified standard CCQ column cap (CCQ load for CCCQ and CCTQ, or ECCQ load for ECCLQ).
5. The download to each side beam shall not exceed the allowable load shown.



ECCLLQ-SDS2.5
(Left direction shown)
Order ECCLRQ-SDS2.5 for right direction

CCCQ-SDS2.5

CCTQ-SDS2.5

FIGURE 8: ECCLQ/CCCQ/CCTQ Dimensions

11. REFERENCES:

Florida Building Code, Building 6th Edition (2017)

Section 104.11	Alternative materials, design, and methods of construction and equipment
Chapter 19	Concrete
Chapter 21	Masonry
Chapter 22	Steel
Chapter 23	Wood

Florida Building Code, Residential 6th Edition (2017)

R101.2.1	Scope
R4405	HVHZ Concrete
R4407	HVHZ Masonry
R4408	HVHZ Steel
R4409	HVHZ Wood

Standards

AISI S100	2012
ANSI/AWC NDS	2015
ASTM D7147	2005

12. IDENTIFICATION:

Each connector covered by this report shall be stamped with the manufacturer's name and/or trademark and the product name.

DocuSigned by:
Jeffrey P Arneson
079614DB86EB432...

JEFFREY P ARNESON
LICENSE
No 58544
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

10/19/2017

Jax Apex Technology, Inc.
Jeffrey P. Arneson, P.E.
P.E. No. 58544
October 19, 2017