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Letter of Justification - HA8 Hurricane & Seismic Clip Allowable Loads

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The Quick Connector HA8 Hurricane & Seismic Clip is an 18 gauge (minimum thickness with coating 0.0466") steel clip used to fasten joists, rafters and trusses to the wood top plates of walls. Each clip is 1¹/₄" wide and 8" long with a 90 degree twist occurring over the center 2 inches. The HA8 clip is attached to the structural framing members with 5-10dx1-1/2" (0.148x1-1/2") nails at each end. The clips are intended to resist uplift forces, as well as lateral forces applied parallel to the top of the wall. The product model number and the Quick Tie logo are stamped onto each clip. The clips are manufactured from ASTM A 653, Structural Steel, Grade 50, Class 3 ($F_u = 70$ ksi, $F_y = 50$ ksi) steel galvanized with a G90 zinc coating. The HA8 hurricane anchors are manufactured by Quick Tie™ Products, Inc., 4141 Southpoint Drive East, Suite B Jacksonville, FL 32216.

Testing of the HA8 clip is pending. In the interim, the allowable loads provided in the following table are to be used, assuming the HA8 clip is installed per the manufacturers installation instructions. The tabulated loads are less than those calculated for the fastener connection strength and the steel strength of the clip (see attached), and are no greater than the allowable loads for products manufactured to the same specifications, but with a lower grade steel. Because of this, we believe the allowable loads provided in the following table are conservative and justified.

Respectfully,

Kirk Grundahl, President
Qualtim

Harvel Crumley, C.E.O.
Quick Tie Products, Inc.

Allowable Loads

HA8 Hurricane & Seismic Clip Allowable Loads^{1,2,3} (lbs)									
Species Group (Specific Gravity)	Fasteners			Load Direction - Uplift			Load Direction - F2		
	Type	To Rafter/Truss	To Plates	Load Duration Factor			Load Duration factor		
				1.00	1.33	1.60	1.00	1.33	1.60
So Pine (0.55)	8d (0.131x1-1/2")	5	5	395	525	630	40	55	65
	10d (0.148x1-1/2")	5	5	465	620	745	45	65	75
Douglas fir-Larch (0.50)	8d (0.131x1-1/2")	5	5	395	525	630	40	55	65
	10d (0.148x1-1/2")	5	5	465	620	745	45	60	75
Spruce-Pine-Fir (0.42)	8d (0.131x1-1/2")	5	5	320	425	510	40	55	65
	10d (0.148x1-1/2")	5	5	355	470	565	45	60	75

- Notes:
1. Clips may be installed on both sides of the framing member for twice the load.
 2. The tabulated loads are valid for clips installed on the inside or the outside of the wall. However, to maintain a continuous load path for uplift connections in close proximity to one another, such as truss-to-plate and plate-to-stud should be installed on the same side of the wall.
 3. Refer also to the General Notes for Tables section provided in the Testing & Engineering Report, TER No. 0908 - *Quick Tie™* Systems and Quick Connectors for additional information.

Fastener Connection Strength

Lateral Resistance (lbs)																		
Model No.	GA	Steel Design Thickness (in)	Fasteners		Southern Pine (SG=0.55)			Douglas Fir - Larch (SG=0.50)			SPF (SG=0.42)							
					Lateral Resistance Per Nail (lb)	Total Lateral Resistance (lb)			Lateral Resistance Per Nail (lb)	Total Lateral Resistance (lb)			Lateral Resistance Per Nail (lb)	Total Lateral Resistance (lb)				
						1.00	1.33	1.60		1.00	1.33	1.60		1.00	1.33	1.60		
		Size	No.															
HA8	18	0.0451	8d (0.131x1.5")	5	106	530	705	848	98	490	652	784	84	420	559	672		
				5	106	530	705	848	98	490	652	784	84	420	559	672		
			10d (0.148x1.5")	5	126	630	838	1,008	116	580	771	928	99	495	658	792		
				5	126	630	838	1,008	116	580	771	928	99	495	658	792		
			Withdrawal Resistance (lbs)															
				GA	Steel Design Thickness (in)	Fasteners		Southern Pine (SG=0.55)			Douglas Fir - Larch (SG=0.50)			SPF (SG=0.42)				
	Withdrawal Resistance Per Nail (lb)	Total Withdrawal Resistance (lb)						Withdrawal Resistance Per Nail (lb)	Total Withdrawal Resistance (lb)			Withdrawal Resistance Per Nail (lb)	Total Withdrawal Resistance (lb)					
		1.00							1.33	1.60	1.00		1.33	1.60	1.00	1.33	1.60	
			Size	No.														
	18	0.0451	8d (0.131x1.5")	5	60	298	397	477	47	233	310	372	31	153	203	244		
5				60	298	397	477	47	233	310	372	31	153	203	244			
10d (0.148x1.5")			5	67	335	445	535	52	262	348	419	33	167	223	268			
			5	67	335	445	535	52	262	348	419	33	167	223	268			

Steel Strength of Clip

Tension Members - Section C2 of AISI Standard - North American Specification for the Design of Cold-Formed Steel Structural Members

Material: HA8 Hurricane Anchor (18 ga ASTM A653 Grade 50)

Design thickness (in), $t_s = 0.0451$

Gross width (in), $W_g = 1.12$

Hole diameter (in) = 0.1562

Total number of holes = 1

Net width (in), $W_n = 0.9638$

Gross area of cross section (in²), $A_g = 0.050512$

Net area of cross section (in²), $A_n = 0.043467$

Yield strength of member (psi), $F_y = 50,000$

$\epsilon_t = 1.67$

Tensile strength of member (psi), $F_u = 70,000$

$\epsilon_t = 2.00$

a) Yielding in the gross section

Nominal strength of member loaded in tension (lb), $T_n = 2,526$

Allowable design strength of member loaded in tension (lb), $T_a = 1,512$

b) Fracture in net section away from connections

Nominal strength of member loaded in tension (lb), $T_n = 3,043$

Allowable design strength of member loaded in tension (lb), $T_a = 1,521$

Controlling T_a (lbs) = **1,512**

Fastener Connections - Section E3 of AISI Standard - North American Specification for the Design of Cold-Formed Steel Structural Members

Section E3.1 Shear Spacing and Edge Distance

$$\begin{aligned}
 t \text{ (in)} &= 0.0451 \\
 e \text{ (in)} &= 0.3125 \\
 F_u \text{ (psi)} &= 70,000 \\
 F_y \text{ (psi)} &= 50,000 \\
 &= 2.0 \quad (\text{Since } F_u/F_y > 1.08)
 \end{aligned}
 \quad
 \begin{aligned}
 P_n \text{ (lbs)} &= 987 \\
 P_{\text{allow}} \text{ (lbs)} &= \boxed{493} \text{ per fastener}
 \end{aligned}$$

Maximum Allowable Lateral Resistance with: $t=0.0451"$, $LDF=1.6$ & $G = 0.55$		
8d	10d	16d
170	202	NA

Section E3.2 Rupture in Net Section (Shear Lag)

(b) For flat sheet connections having staggered hole patterns

$$\begin{aligned}
 W_g \text{ (in)} &= 1.12 \\
 t \text{ (in)} &= 0.0451 \\
 A_g \text{ (in}^2\text{)} &= 0.050512 \\
 n_b &= 1 \\
 d_h \text{ (in)} &= 0.1562 \\
 s' \text{ (in)} &= 1 \\
 g \text{ (in)} &= 0.25 \\
 A_n \text{ (in}^2\text{)} &= 0.07971064 \\
 F_t \text{ (psi)} &= 70,000 \\
 &= 2.2
 \end{aligned}
 \quad
 \begin{aligned}
 P_n \text{ (lbs)} &= 5,580 \\
 P_{\text{allow}} \text{ (lbs)} &= \boxed{2,536} \text{ of connected part}
 \end{aligned}$$

Section E3.3.1 Strength (Resistance) without Consideration of Bolt Hole Deformation

$$\begin{aligned}
 t \text{ (in)} &= 0.0451 \\
 d \text{ (in)} &= 0.131 \quad 0.148 \\
 m_f &= 0.75 \\
 C &= 3.0 \\
 F_u \text{ (psi)} &= 70,000 \\
 &= 2.5
 \end{aligned}
 \quad
 \begin{aligned}
 P_n \text{ (lbs)} &= \frac{0.131}{0.148} \frac{931}{1,051} \\
 P_{\text{allow}} \text{ (lbs)} &= \boxed{372} \quad \boxed{421} \quad \boxed{} \text{ per fastener}
 \end{aligned}$$

Section E3.3.2 Strength (Resistance) with Consideration of Bolt Hole Deformation

$$\begin{aligned}
 t \text{ (in)} &= 0.0451 \\
 d \text{ (in)} &= 0.131 \quad 0.148 \\
 &= 1.0 \\
 F_u \text{ (psi)} &= 70,000 \\
 &= 2.2
 \end{aligned}
 \quad
 \begin{aligned}
 P_n \text{ (lbs)} &= \frac{0.131}{0.148} \frac{719}{813} \\
 P_{\text{allow}} \text{ (lbs)} &= \boxed{327} \quad \boxed{369} \quad \boxed{} \text{ per fastener}
 \end{aligned}$$

Fastener Connections - Section E4 of AISI Standard - North American Specification for the Design of Cold-Formed Steel Structural Members

Section E4.3.1 Connection Shear Limited by Tilting and Bearing

Note - since t_2 , the thickness of the wood is considerably greater than t_1 , the thickness of the steel, only Equation E4.3.1-4 is checked

$$\begin{array}{l}
 t_1 \text{ (in)} = 0.0451 \\
 d \text{ (in)} = 0.131 \quad 0.148 \\
 F_{u1} \text{ (psi)} = 70,000 \\
 \square = 3.0
 \end{array}
 \quad
 \begin{array}{l}
 P_{ns} \text{ (lbs)} = \frac{0.131 \quad 0.148}{1,117 \quad 1,262} \\
 P_{allow} \text{ (lbs)} = \boxed{372 \quad 421 \quad } \text{ per fastener}
 \end{array}$$

Maximum Allowable Lateral Resistance with: $t=0.0451"$, $LDF=1.6$ & $G = 0.55$		
8d	10d	16d
170	202	NA

Section E4.3.2 Connection Shear Limited by End Distance

$$\begin{array}{l}
 t \text{ (in)} = 0.0451 \\
 e \text{ (in)} = 0.313 \\
 F_u \text{ (psi)} = 70,000 \\
 \square = 3.0
 \end{array}
 \quad
 \begin{array}{l}
 P_{ns} \text{ (lbs)} = 987 \\
 P_{allow} \text{ (lbs)} = \boxed{329} \text{ per fastener}
 \end{array}$$

Section E4.4.2 Tension Pull-Over

$$\begin{array}{l}
 t_1 \text{ (in)} = 0.0451 \\
 d_w \text{ (in)} = 0.262 \quad 0.296 \\
 F_{u1} \text{ (psi)} = 70,000 \\
 \square = 3.0
 \end{array}
 \quad
 \begin{array}{l}
 P_{nov} \text{ (lbs)} = \frac{0.131 \quad 0.148}{1,241 \quad 1,402} \\
 P_{allow} \text{ (lbs)} = \boxed{414 \quad 467 \quad } \text{ per fastener}
 \end{array}$$

Flexural Members - Section C3 of AISI Standard - North American Specification for the Design of Cold-Formed Steel Structural Members

Section 3.1 Bending

Section C3.1.1 Nominal Section Strength

t (in) = 0.0451		Critical Distance (in) = 3.625
h (in) = 1.120	M_n (lb-in) = 471	
S_e (in ³) = 0.00943	M_{allow} (lb-in) = 282	
F_y (psi) = 50,000	P_{allow} (lbs) = 78 per connector	
Ξ = 1.67		

Section 3.2 Shear

Section 3.2.1 Shear Strength of Member without Holes

t (in) = 0.0451		
h (in) = 1.12		
A_w (in ²) = 0.050512	V_n (lbs) = 1,515	
E (psi) = 29,500,000	V_{allow} (lbs) = 947 per connector	
K_v = 5.34		
F_y (psi) = 50,000		
$(E k_v / F_y)^{1/2}$ = 56.130		
F_v (psi) = 30,000		
Ξ = 1.60		

Drawing of HA8 Clip

