

Installation Analysis

Alumaboard Cladding Panel Clip Analysis

Report G8908.01-122-34

Rendered to:

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	PROJECT: Alumaboard Cladding – Panel Clip Analysis	BY: DCC DATE: 03/28/2017
	PROJECT NO.: G8908.01-122-34	CKD: JCW SHEET: 2 OF 17

Scope

Architectural Testing, Inc., an Intertek company, was contracted by Rollfab Metal Products, LLC to perform installation analysis for the panel clips to be installed on 4" and 6" Alumaboard panel system.

The analyses performed satisfy the methods and requirements of the following:

2012 International Building Code, International Code Council, Inc., 2012.

AAMA TIR-A9-14 *Metal Curtain Wall Fasteners*, American Architectural Manufacturers Association, 2015.

ESR-1976 *ITW Buildex TEKS Self-Drilling Fasteners*. ICC Evaluation Service, LLC. July 1, 2013.

The calculations presented herein are for the integrity of the panel clip installations based on wind load only. The weather tightness of the installation is not addressed by this report. The air/water/structural performance of the individual products is not proven by this report.

The building substrate is assumed to have the integrity to resist the anchor loads developed by the products. Furthermore, the results of the analyses present a solution that satisfies the scope of the project, but other feasible solutions may exist.

Analyses

Design Wind Pressure Analysis

Various design wind pressures are to be used on this project to compare to the anchorage capacities of the various fastening methods. Design pressure will range from +/-20 psf to +/-70 psf, increase in 10 psf increments.

Anchor Capacities

The panel clips are to be attached to various substrates. The capacities of the various anchorage details are calculated as shown on page 7 through page 13. These capacities are compared to reactions induced by design wind pressures. The calculated anchorage capacities are summarized in the table below.

Table 1 Various Anchor Capacities

Detail	Connection	Capacity	Comment
Screw into Wood Stud	#8x1-1/2" Pan Head Wood Screw Connecting Clip to 2x S-P-F Wood Stud	46 lb	1. Limited by withdrawal 2. Minimum 1" penetration
	#8x2" Pan Head Wood Screw Connecting Clip to 2x S-P-F Wood Stud	69 lb	1. Limited by withdrawal 2. Minimum 1-1/2" penetration
Screw into Steel Stud	#8-18 Pan Head TEKS Screw Connecting Clip to 20 ga 33 KSI Steel Stud	75 lb	1. Limited by pull out 2. Full penetration +3 threads 3. Qualifies 50 KSI steel
	#8-18 Pan Head TEKS Screw Connecting Clip to 18 ga 33 KSI Steel Stud	100 lb	1. Limited by pull out 2. Full penetration +3 threads 3. Qualifies 50 KSI steel
	#8-18 Pan Head TEKS Screw Connecting Clip to 16 ga 33 KSI Steel Stud	125 lb	1. Limited by pull out 2. Full penetration +3 threads 3. Qualifies 50 KSI steel
Screw into Sheathing	#8x1-1/2" Pan Head Wood Screw Connecting Clip to 1/2" Plywood Sheathing	21 lb	1. Limited by withdrawal
	#8x1-1/2" Pan Head Wood Screw Connecting Clip to 3/4" Plywood Sheathing	31 lb	1. Limited by withdrawal

Note(s): The building substrate is assumed to have the integrity to resist the anchor loads developed by the products.

Anchorage Requirements

Anchorage must be capable of resisting the loads caused by the various design wind pressures. The individual anchor capacities and applied loads on the products are used to calculate the anchor spacing for the products specified for the project. Calculations are presented on page 14 through page 16. Anchor requirements are summarized in the tables below for the various substrates.

Table 2 Wood Stud Clip Spacing

Connection	Design Load	Clip Spacing	
		4" Plank	6" Plank
#8x1-1/2" to Wood Stud	+/-20 psf	Every Other Stud	Every Other Stud
	+/-30 psf	Every Other Stud	Every Other Stud
	+/-40 psf	Every Other Stud	Every Stud
	+/-50 psf	Every Other Stud	Every Stud
	+/-60 psf	Every Stud	Every Stud
	+/-70 psf	Every Stud	Every Stud
#8x2" to Wood Stud	+/-20 psf	Every Other Stud	Every Other Stud
	+/-30 psf	Every Other Stud	Every Other Stud
	+/-40 psf	Every Other Stud	Every Other Stud
	+/-50 psf	Every Other Stud	Every Other Stud
	+/-60 psf	Every Other Stud	Every Stud
	+/-70 psf	Every Other Stud	Every Stud

Note(s):

1. Analysis assumes studs are placed at 16" maximum on center, therefore, spacing is limited to every other stud, or 32" on center maximum.
2. The building substrate is assumed to have the integrity to resist the anchor loads developed by the products.

Table 3 Steel Stud Clip Spacing

Connection	Design Load	Clip Spacing	
		4" Plank	6" Plank
#8-18 TEKS to 20 ga Steel Stud	+/-20 psf	Every Other Stud	Every Other Stud
	+/-30 psf	Every Other Stud	Every Other Stud
	+/-40 psf	Every Other Stud	Every Other Stud
	+/-50 psf	Every Other Stud	Every Other Stud
	+/-60 psf	Every Other Stud	Every Stud
	+/-70 psf	Every Other Stud	Every Stud
#8-18 TEKS to 18 ga and 16 ga Steel Stud	+/-20 psf	Every Other Stud	Every Other Stud
	+/-30 psf	Every Other Stud	Every Other Stud
	+/-40 psf	Every Other Stud	Every Other Stud
	+/-50 psf	Every Other Stud	Every Other Stud
	+/-60 psf	Every Other Stud	Every Other Stud
	+/-70 psf	Every Other Stud	Every Other Stud

Note(s):

1. Analysis assumes studs are placed at 16" maximum on center, therefore, spacing is limited to every other stud, or 32" on center maximum.
2. The building substrate is assumed to have the integrity to resist the anchor loads developed by the products.

Table 4 Sheathing Clip Spacing

Connection	Design Load	Clip Spacing	
		4" Plank	6" Plank
#8x1-1/2" to 1/2" Sheathing	+/-20 psf	32"	24"
	+/-30 psf	24"	16"
	+/-40 psf	16"	12"
	+/-50 psf	12"	8"
	+/-60 psf	12"	8"
	+/-70 psf	8"	4"
#8x1-1/2" to 3/4" Sheathing	+/-20 psf	32"	32"
	+/-30 psf	32"	24"
	+/-40 psf	24"	16"
	+/-50 psf	20"	12"
	+/-60 psf	16"	12"
	+/-70 psf	12"	8"

Note(s):

1. Anchor spacing is conservatively rounded to the nearest 4-inch increment.
2. The building substrate is assumed to have the integrity to resist the anchor loads developed by the products.

Referenced Drawings

The drawings referenced below are the basis of the analysis presented herein and may not reflect the requirements established by this analysis.

Alumaboard. Sheets 0 to 7. 07/24/14. (8 pages)

#8 x 1-1/2" Pan Head Wood Screw to 2x S-P-F Wood Stud

#8 x 1-1/2" Pan Head Screw

1" Penetration into Wood Blocking

20 Ga 316 Stainless Steel Clip (assumed)

2x Spruce Pine Fir (S-P-F) Wood Stud

Withdrawal of #8 Wood Screw

$$W' = C_d C_m C_t C_{eg} C_{tn} 2850 G^2 DL \quad (\text{NDS12 11.2-2})$$

$$W' = (1.6)(0.7)(0.5)(1.0)(1.0)(2850)(0.42)^2 (0.164)(1.0)$$

$$W' = 46 \text{ lb}$$

Pull-Over of #8 Pan Head Wood Screw

$$P_{nov} = 1.5 t_1 d'_w F_{u1} / 3.0$$

$$P_{nov} = 1.5(0.0359)(0.287)(45,000 \text{ psi}) / 3.0$$

$$P_{nov} = 232 \text{ lb}$$

Capacity of Connection is 46 lb

#8 x 2" Pan Head Wood Screw to 2x S-P-F Wood Stud

#8x 2" Pan Head Screw

1-1/2" Penetration into Wood Blocking

20 Ga 316 Stainless Steel Clip (assumed)

2x Spruce Pine Fir (S-P-F) Wood Stud

Withdrawal of #8 Wood Screw

$$W' = C_d C_m C_t C_{eg} C_{tn} 2850 G^2 DL \quad (\text{NDS12 11.2-2})$$

$$W' = (1.6)(0.7)(0.7)(1.0)(1.0)(2850)(0.42)^2 (0.164)(1.5")$$

$$W' = 69 \text{ lb}$$

Pull-Over of #8 Pan Head Wood Screw

$$P_{nov} = 1.5 t_1 d_w' F_{u1} / 3.0$$

$$P_{nov} = 1.5(0.0359")(0.287")(45,000 \text{ psi}) / 3.0$$

$$P_{nov} = 232 \text{ lb}$$

Capacity of Connection is 69 lb

#8-18 TEKS Screw to 20 ga 33 KSI Steel Stud

#8-18 Pan Head TEKS Screw, 316 Stainless Steel

Full Penetration of Stud + 3 Threads

20 Ga 316 Stainless Steel Clip (assumed)

20 Ga 33 KSI Steel Clip

Allowable Tension of #8-18 316 TEKS Screw

$$P_{ts}/\Omega = 315 \text{ lb (TIR-A9)}$$

Pull-Over of #8 Pan Head TEKS Screw

$$P_{nov} = 1.5t_1d'_wF_{u1}/3.0$$

$$P_{nov} = 1.5(0.0359'')(0.306'')(45,000 \text{ psi})/3.0$$

$$P_{nov} = 247 \text{ lb}$$

Pull-Out of #8 TEKS Screw

$$P_{not} = 0.85t_c d F_{u2}/3.0$$

$$P_{not} = 0.85(0.0359'')(0.164'')(45,000 \text{ psi})/3.0$$

$$P_{not} = 75 \text{ lb}$$

Capacity of Connection is 75 lb

#8-18 TEKS Screw to 18 ga 33 KSI Steel Stud

#8-18 Pan Head TEKS Screw, 316 Stainless Steel

Full Penetration of Stud + 3 Threads

20 Ga 316 Stainless Steel Clip (assumed)

18 Ga 33 KSI Steel Clip

Allowable Tension of #8-18 316 TEKS Screw

$$P_{ts}/\Omega = 315 \text{ lb (TIR-A9)}$$

Pull-Over of #8 Pan Head TEKS Screw

$$P_{nov} = 1.5t_1d'_wF_{u1}/3.0$$

$$P_{nov} = 1.5(0.0359")(0.306")(45,000 \text{ psi})/3.0$$

$$P_{nov} = 247 \text{ lb}$$

Pull-Out of #8 TEKS Screw

$$P_{not} = 0.85t_c d F_{u2}/3.0$$

$$P_{not} = 0.85(0.0478")(0.164")(45,000 \text{ psi})/3.0$$

$$P_{not} = 100 \text{ lb}$$

Capacity of Connection is 100 lb

#8-18 TEKS Screw to 20 ga 33 KSI Steel Stud

#8-18 Pan Head TEKS Screw, 316 Stainless Steel

Full Penetration of Stud + 3 Threads

20 Ga 316 Stainless Steel Clip (assumed)

16 Ga 33 KSI Steel Clip

Allowable Tension of #8-18 316 TEKS Screw

$$P_{ts}/\Omega = 315 \text{ lb (TIR-A9)}$$

Pull-Over of #8 Pan Head TEKS Screw

$$P_{nov} = 1.5t_1d_wF_{u1}/3.0$$

$$P_{nov} = 1.5(0.0359")(0.306")(45,000 \text{ psi})/3.0$$

$$P_{nov} = 247 \text{ lb}$$

Pull-Out of #8 TEKS Screw

$$P_{not} = 0.85t_c d F_{u2}/3.0$$

$$P_{not} = 0.85(0.0598")(0.164")(45,000 \text{ psi})/3.0$$

$$P_{not} = 125 \text{ lb}$$

Capacity of Connection is 125 lb

#8 x 1-1/2" Pan Head Wood Screw to 1/2" Plywood Sheathing

#8 x 1-1/2" Pan Head Screw

Full Penetration of Sheathing

20 Ga 316 Stainless Steel Clip (assumed)

1/2" Plywood Sheathing Group 1-5

Withdrawal of #8 Wood Screw

$$W' = W A_s / \Omega$$

$$W' = (240 \text{ lb})(47\%)/(6/1.10) \quad (\text{APA E830})$$

$$W' = 21 \text{ lb}$$

Pull-Over of #8 Pan Head Wood Screw

$$P_{\text{nov}} = 1.5t_1d'_wF_{u1}/3.0$$

$$P_{\text{nov}} = 1.5(0.0359'')(0.287'')(45,000 \text{ psi})/3.0$$

$$P_{\text{nov}} = 232 \text{ lb}$$

Capacity of Connection is 21 lb

#8 x 1-1/2" Pan Head Wood Screw to 1/2" Plywood Sheathing

#8 x 1-1/2" Pan Head Screw

Full Penetration of Sheathing

20 Ga 316 Stainless Steel Clip (assumed)

1/2" Plywood Sheathing Group 1-5

Withdrawal of #8 Wood Screw

$$W' = W A_s / \Omega$$

$$W' = (355 \text{ lb})(47\%)/(6/1.10) \quad (\text{APA E830})$$

$$W' = 31 \text{ lb}$$

Pull-Over of #8 Pan Head Wood Screw

$$P_{\text{nov}} = 1.5t_1d'_wF_{u1}/3.0$$

$$P_{\text{nov}} = 1.5(0.0359")(0.287")(45,000 \text{ psi})/3.0$$

$$P_{\text{nov}} = 232 \text{ lb}$$

Capacity of Connection is 31 lb

Wood Stud Spacing

#8 x 1-1/2" Pan Head Wood Screw to 2x S-P-F Wood Stud								
Design Pressure	4" Wide Plank				6" Wide Plank			
	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing
+/-20 psf	331	4"	82.8"	32"	331	6"	55.2"	32"
+/-30 psf	221	4"	55.2"	32"	221	6"	36.8"	32"
+/-40 psf	166	4"	41.4"	32"	166	6"	27.6"	27"
+/-50 psf	132	4"	33.1"	32"	132	6"	22.1"	22"
+/-60 psf	110	4"	27.6"	27"	110	6"	18.4"	18"
+/-70 psf	95	4"	23.7"	23"	95	6"	15.8"	15"

#8 x 2" Pan Head Wood Screw to 2x S-P-F Wood Stud								
Design Pressure	4" Wide Plank				6" Wide Plank			
	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing
+/-20 psf	497	4"	124.2"	32"	497	6"	82.8"	32"
+/-30 psf	331	4"	82.8"	32"	331	6"	55.2"	32"
+/-40 psf	248	4"	62.1"	32"	248	6"	41.4"	32"
+/-50 psf	199	4"	49.7"	32"	199	6"	33.1"	32"
+/-60 psf	166	4"	41.4"	32"	166	6"	27.6"	27"
+/-70 psf	142	4"	35.5"	32"	142	6"	23.7"	23"

Steel Stud Spacing

#8-18 TEKS Screw to 20 ga 33 KSI Steel Stud								
Design Pressure	4" Wide Plank				6" Wide Plank			
	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing
+/-20 psf	540	4"	135.0"	32"	540	6"	90.0"	32"
+/-30 psf	360	4"	90.0"	32"	360	6"	60.0"	32"
+/-40 psf	270	4"	67.5"	32"	270	6"	45.0"	32"
+/-50 psf	216	4"	54.0"	32"	216	6"	36.0"	32"
+/-60 psf	180	4"	45.0"	32"	180	6"	30.0"	30"
+/-70 psf	154	4"	38.6"	32"	154	6"	25.7"	25"

#8-18 TEKS Screw to 18 ga 33 KSI Steel Stud								
Design Pressure	4" Wide Plank				6" Wide Plank			
	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing
+/-20 psf	720	4"	180.0"	32"	720	6"	120.0"	32"
+/-30 psf	480	4"	120.0"	32"	480	6"	80.0"	32"
+/-40 psf	360	4"	90.0"	32"	360	6"	60.0"	32"
+/-50 psf	288	4"	72.0"	32"	288	6"	48.0"	32"
+/-60 psf	240	4"	60.0"	32"	240	6"	40.0"	32"
+/-70 psf	206	4"	51.4"	32"	206	6"	34.3"	32"



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Steel Stud Spacing (Continued)

#8-18 TEKS Screw to 16 ga 33 KSI Steel Stud								
Design Pressure	4" Wide Plank				6" Wide Plank			
	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing	Max Trib Area (in²)	Panel Width	Anchor Spacing	Specified Spacing
+/-20 psf	900	4"	225.0"	32"	900	6"	150.0"	32"
+/-30 psf	600	4"	150.0"	32"	600	6"	100.0"	32"
+/-40 psf	450	4"	112.5"	32"	450	6"	75.0"	32"
+/-50 psf	360	4"	90.0"	32"	360	6"	60.0"	32"
+/-60 psf	300	4"	75.0"	32"	300	6"	50.0"	32"
+/-70 psf	257	4"	64.3"	32"	257	6"	42.9"	32"



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Revision Log

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