Window Installation Analysis

QUAKER WINDOWS & DOORS
M600 Awning-Fixed-Awning
M600 Awn-Fix & Fix-Awn

Report Q3930.01-122-34

Rendered to:

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Scope

Architectural Testing, Inc., an Intertek company, was contracted by Quaker Windows & Doors to evaluate alternate installation methods for their M600 Fixed over Awning with Roto-Operator over Fixed windows. The evaluation is based on physical testing and product certifications.

Reference standards utilized in this project include:

Florida Building Code, Building, 8th Edition (2023). International Code Council, 2023.

ANSI/AWC NDS-2018 *National Design Specification (NDS) for Wood Construction with 2015 Supplement*. American Wood Council, 2018.

ADM1-2020 *Aluminum Design Manual*. The Aluminum Association, Inc., 2020.

AISI S100-16(2020)w/S2-20 *North American Specification for the Design of Cold-Formed Steel Structural Members, 2016 Edition(Reaffirmed 2020)*. American Iron and Steel Institute, 2020.

ICC-ES Report ESR-1976 *ITW Buildex TEKS Self-Drilling Fasteners.* ICC Evaluation Service. 07/2023.

NOA 21-0628.20 *Hilti Kwik-Con+ Concrete and Masonry Screw Anchor.* Miami-Dade County Product Control Section. 08/19/2021.

The anchorage analyses presented herein do not address the water resistance, water penetration or air infiltration performance of the installation method or the installed product. In addition, the analyses rely on the assumption that the building substrate is capable of withstanding incurred loads.

Certification of Independence

In accordance with Rule 61G20-3 Florida Administrative Code, Architectural Testing, Inc. hereby certifies the following:

- Architectural Testing does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested or labeled by the agency.

- Architectural Testing is not owned, operated or controlled by any company manufacturing or distributing products it tests or labels.

- Tanya A. Dolby, P.E. and Adam R. Kunkel do not have nor will acquire, a financial interest in any company manufacturing or distributing products for which the reports are being issued.

- Tanya A. Dolby, P.E. and Adam R. Kunkel do not have, nor will acquire, a financial interest in any other entity involved in the approval process of the product.

Analyses

Summary of Test Results

The following table summarizes the M600 Fixed over Awning with Roto-Operator over Fixed Window products and their corresponding performance levels which have been established by testing or product certification.

Table 1 Summary of Test Results

Series/Model	Test Report Number	Product Certification	Size (W x H)	Performance
M600 Fixed over Awning with Roto-Operator over Fixed Window	L5050.01-801-44 (Revision 1, 05/18/22)	NI015457-R2	60" x 144"	+/- 70 psf

L5050.01-801-44 testing was conducted by the Architectural Testing laboratory in Plano, Texas (Florida Department of Business & Professional Regulation Test Lab No. TST1910, IAS Accredited Laboratory TL-331).

As-Tested Installation Analysis

For air/water/structural testing, the test specimen was secured to a 2x Spruce-Pine-Fir wood buck with nailing fins using #8 x 1-5/8" wood screws. The as-tested installation method is evaluated on page 8 and the established design capacities are summarized in Table 2.

Table 2 As-Tested Anchorage Design Capacity

Test	Connection	Capacity
M600 Fixed over Awning with Roto-Operator over Fixed Window Air/Water/Structural Test	Nailing Fin with #8 x 1-5/8" Wood Screws Placed 3" from each corner and 15" on center	99 lb

The capacities presented in Table 2 will be used to prove acceptable alternate anchors and substrates for the windows.

Alternate Anchorages

Calculations on page 9 through page 21 determine the design capacity of alternate anchorages for the windows. The alternate anchorage capacities are summarized in Table 3.

Table 3 Alternate Anchorage Capacities

Installation	Connection	Capacity	Comments
Nailing Fin to Wood	#10 Wood Screw connecting Nailing Fin to Wood Blocking	121 lb	1. Limited by pull-over 2. 1-1/2" min penetration 3. Min Spruce-Pine-Fir wood blocking, G = 0.42
Nailing Fin to Steel	#10-16 TEKS Screw connecting Nailing Fin to Light Gauge Steel Framing	116 lb	1. Limited by pull-out 2. Full penetration +3 threads 3. Min 18 gauge 33 KSI steel
Receptor to Wood	#12 Wood Screw connecting Receptor to Wood Blocking	193 lb	1. Limited by shear 2. 1-1/2" min penetration 3. 1/4" max shim space 4. Min Spruce-Pine-Fir wood blocking, G = 0.42
Receptor to Steel	#12-14 TEKS Screw connecting Receptor to Light Gauge Steel Framing	209 lb	1. Limited by bending 2. Full penetration +3 threads 3. 1/4" max shim space 4. Min 18 gauge 33 KSI steel
Receptor to Concrete	1/4" Hilti Kwik-Con+ Anchor connecting Receptor to Concrete	183 lb	1. Limited by bending 2. 1" min embedment 3. 2-1/2" min edge distance 4. 2" min spacing 5. 1/4" max shim space 6. Min f'_c = 3,000 psi concrete
Receptor to CMU	1/4" Hilti Kwik-Con+ Anchor connecting Receptor to CMU	183 lb	1. Limited by bending 2. 1" min embedment 3. 2-1/2" min edge distance 4. 3" min spacing 5. 1/4" max shim space 6. Min ASTM C90 masonry

Table 3 Alternate Anchorage Capacities (continued)

Installation	Connection	Capacity	Comments
Trim Clip to Wood	#12 Wood Screw connecting Trim Clip to Wood Blocking	100 lb	1. Limited by connection to window frame 2. 1-1/2" min penetration 3. Min Spruce-Pine-Fir wood blocking, G = 0.42
Trim Clip to Steel	#12-14 TEKS Screw connecting Trim Clip to Light Gauge Steel Framing	100 lb	1. Limited by connection to window frame 2. Full penetration +3 threads 3. Min 18 gauge 33 KSI steel
Trim Clip to Concrete	1/4" Hilti Kwik-Con+ Anchor connecting Trim Clip to Concrete	100 lb	1. Limited by connection to window frame 2. 1" min embedment 3. 2-1/2" min edge distance 4. 2" min spacing 5. Min f'_c = 3,000 psi concrete
Trim Clip to CMU	1/4" Hilti Kwik-Con+ Anchor connecting Trim Clip to CMU	100 lb	1. Limited by connection to window frame 2. 1" min embedment 3. 2-1/2" min edge distance 4. 3" min spacing 5. Min ASTM C90 masonry

Note: A #10-16 TEKS screw is used to connect the trim clip to window frame. The capacity of this connection is 100 lb as shown on page 21. This connection governs the capacity of all trim clip installation methods.

Anchorage Requirements

Alternate anchorage conditions have anchorage capacities which are comparable to or exceed the as-tested anchorage capacities. The as tested spacings for each anchoring system will apply to alternate substrates.

Reference Drawings

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

- *M600 Awn-Fix & Fix-Awn Installation Instructions.* Sheets 1 - 7. Quaker Windows and Doors. 10/05/23. (7 pages)
- *M600 Fixed-Awning-Fixed Installation Instructions.* Sheets 1 - 7. Quaker Windows and Doors. 10/05/23. (7 pages)

As-Tested Installation – Nailing Fin to Wood Blocking

#8 x 1-5/8" Wood Screw (Non-Countersunk)
1-1/2" Minimum Penetration
1/16" thick 6063-T6 Aluminum Nailing Fin
G = 0.42 Minimum Spruce-Pine-Fir 2x Wood Blocking

Withdrawal of #8 Wood Screw

$W' = 2{,}850(G^2)(D)(C_d)(C_m{}^2)(C_t)(C_{eg})(C_{tn})(L)$

$W' = 2{,}850(0.42)^2(0.164")(1.6)(1.0)^2(1.0)(1.0)(1.0)(1.5")$

$W' = 198$ lb

Pull-Over of #8 Wood Screw

$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}\text{-}D_h)/3.0$

$P_{nov} = 1.0(0.0625")(30{,}000 \text{ psi})(0.322" – 0.164")/3.0$

$P_{nov} = 99$ lb

Capacity of Connection is 99 lb

As-Tested Installation – Trim Clip to Wood Blocking

#12 Wood Screw (Non-Countersunk)
1-1/2" Minimum Penetration
1/16" thick 6063-T6 Aluminum Trim Clip
G = 0.42 Minimum Spruce-Pine-Fir 2x Wood Blocking (Qualifies Southern Yellow Pine)
1/4" Max Shim Space

Allowable Shear of #12 Wood Screw

$Z' = 193$ lb

Bearing of #12 Screw

$V_a = 2DtF_u/n_u$

$V_a = 2(0.216")(0.0625")(30{,}000 \text{ psi})/3.0$

$V_a = 270$ lb

Bending of #12 Wood Screw

$S = \pi d^3/32 = \pi(0.216")^3/32 = 0.001 \text{ in}^3$

$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(80{,}000 \text{ psi}) = 62{,}400$ psi (1.3 factor for weak axis bending)

$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)

$V = 2SF_b/L = (2)(0.001 \text{ in}^3)(62{,}400 \text{ psi})/0.25" = 316$ lb

Capacity of Connection is 100 lb (See Page 21)

Alternate Installation – Nailing Fin to Wood Blocking

#10 Wood Screw (Non-Countersunk)

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Nailing Fin

G = 0.42 Minimum Spruce-Pine-Fir 2x Wood Blocking (Qualifies Southern Yellow Pine)

Withdrawal of #10 Wood Screw

$W' = 2{,}850(G^2)(D)(C_d)(C_m{}^2)(C_t)(C_{eg})(C_{tn})(L)$

$W' = 2{,}850(0.42)^2(0.190")(1.6)(1.0)^2(1.0)(1.0)(1.0)(1.5")$

$W' = 229$ lb

Pull-Over of #10 Wood Screw

$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}-D_h)/3.0$

$P_{nov} = 1.0(0.0625")(30{,}000 \text{ psi})(0.385" - 0.190")/3.0$

$P_{nov} = 121$ lb

Capacity of Connection is 121 lb

Alternate Installation – Nailing Fin to Steel Stud

#10-16 TEKS Screw

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Nailing Fin

Minimum 18 Gauge 33 KSI Steel Stud (Qualifies thicker and stronger steel)

Allowable Tension of #10-16 TEKS Screw

V_a = 885 lb (ESR-1976)

Pull-Over of #10-16 TEKS Screw in Nail Fin

$P_{nov} = C_{pov} t_1 F_{tu1}(D_{ws}-D_h)/3.0$

$P_{nov} = 1.0(0.0625")(30{,}000\text{ psi})(0.400" - 0.190")/3.0$

P_{nov} = 131 lb

Pull-Out of #10-16 TEKS Screw in Steel Stud

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

$P_{not} = 0.85(0.0478")(0.190")(45{,}000\text{ psi})/3.0$

P_{not} = 116 lb

Capacity of Connection is 116 lb

Alternate Installation – Receptor to Wood Blocking

#12 Wood Screw (Non-Countersunk)

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Receptor

G = 0.42 Minimum Spruce-Pine-Fir 2x Wood Blocking (Qualifies Southern Yellow Pine)

1/4" Maximum Shim Space

11/16" Maximum Bending Space

Allowable Shear of #12 Wood Screw

Z' = 193 lb

See Following Page

Bearing of #12 Screw

$V_a = 2DtF_u/n_u$

V_a = 2(0.216")(0.0625")(30,000 psi)/3.0

V_a = 270 lb

Bending of #12 Wood Screw

S = πd3/32 = π(0.216")3/32 = 0.001 in3

Fb = (1.3)(0.6Fy) = (1.3)(0.6)(80,000 psi) = 62,400 psi (1.3 factor for weak axis bending)

Fb = M/S = (VL/2)/S (L/2 for guided bending)

V = 2SFb/L = (2)(0.001 in3)(62,400 psi)/0.375" = 329 lb

Capacity of Connection is 193 lb

Alternate Installation – Receptor to Wood Blocking (continued)

Lateral Design Strength of Wood Connections

ANSI / AF&PA NDS-2018

Data

Fastener

Fastener	=	#12 Wood Screw	
Shank Dia	=	0.216 in.	
Root Dia.	=	0.171 in.	
F_{yb}	=	80,000 psi	
Fastener length	=	2.000 in.	

Main Member

Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain)
F_e	=	3,350 psi	(Table 12.3.2)
Thickness	=	1.500 in.	

Side Member

Material	=	6063 T6 Aluminum	
G	=	N/A	
θ	=	0	<= (Angle of load to grain)
F_{es}	=	37,500 psi	
Thickness	=	0.063 in.	

Calculations

Lateral Bearing Factors

D	=	0.171 in.	
ℓ_m	=	1.500 in.	
K_θ	=	1.25	(Table 12.3.1B)
K_D	=	2.21	(Table 12.3.1B)
R_e	=	0.089	(Table 12.3.1A)
R_t	=	24.00	(Table 12.3.1A)
k_1	=	0.8662	(Table 12.3.1A)
k_2	=	0.5564	(Table 12.3.1A)
k_3	=	15.53	(Table 12.3.1A)

Yield Mode	R_d	
I_m, I_s	2.21	(Table 12.3.1B)
II	2.21	(Table 12.3.1B)
III_m, III_s, IV	2.21	(Table 12.3.1B)

Lateral Design Values, Z

Mode I_m	=	389 lbf		(Eq 12.3-1)
Mode I_s	=	181 lbf		(Eq 12.3-2)
Mode II	=	157 lbf		(Eq 12.3-3)
Mode III_m	=	184 lbf		(Eq 12.3-4)
Mode III_s	=	120 lbf	<==== Min Value	(Eq 12.3-5)
Mode IV	=	169 lbf		(Eq 12.3-6)
C_D	=	1.6		(B.2)
Wet Service Factor				
Fabrication/In-Service		Dry/Dry		
C_M	=	1.0		(Table 11.3.3)
In service temperature		T≤100˚F		
C_t	=	1.0		(Table 11.3.4)
C_g	=	1.0		(11.3.6)
C_Δ	=	1.0		(12.5.1)
Installed in end grain?		No		
C_{eg}	=	1.00		(12.5.2)
Part of a diaphragm?		No		
C_{di}	=	1.0		(12.5.3)
Toe-nailed?		No		
C_{tn}	=	1.00		(12.5.4)
Z'	=	**193 lbf**		(Table 11.3.1)

Alternate Installation – Receptor to Steel Stud

#12-14 TEKS Screw

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Receptor

Minimum 18 Gauge 33 KSI Steel Stud (Qualifies thicker and stronger steel)

1/4" Maximum Shim Space

11/16" Maximum Bending Space

Allowable Shear of #12-14 TEKS Screw

V_a = 724 lb (ESR-1976)

Bearing of #12-14 TEKS Screw on Receptor

$V_a = 2DtF_u/n_u$

V_a = 2(0.216")(0.0625")(30,000 psi)/3.0

V_a = 270 lb

Bearing of #12-14 TEKS Screw on Steel Stud

$V_a = 2.7DtF_u/n_u$

V_a = 2.7(0.216")(0.0478")(45,000 psi)/3.0

V_a = 418 lb

Tilting of #12-14 TEKS Screw in Steel

$V_a = 4.2(t_2^3D)^{1/2}F_{tu}/n_s$

$V_a = 4.2(0.0478^3 \times 0.216)^{1/2}(45{,}000 \text{ psi})/3.0$

V_a = 306 lb

Bending of #12-14 TEKS Screw

$S = \pi d^3/32 = \pi(0.216")^3/32 = 0.001 \text{ in}^3$

$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(92,000 psi) = 71,760 psi (1.3 factor for weak axis bending)

$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)

$V = 2SF_b/L = (2)(0.001 \text{ in}^3)(71{,}760 \text{ psi})/0.6875" = 209 \text{ lb}$

Capacity of Connection is 209 lb

Alternate Installation – Receptor to Concrete

1/4" Hilti Kwik-Con+ Anchor

1" Minimum Embedment

2-1/2" Minimum Edge Distance

2" Minimum Spacing

1/16" thick 6063-T6 Aluminum Receptor

Minimum f'_c = 3,000 psi Concrete

1/4" Maximum Shim Space

11/16" Maximum Bending Space

Allowable Shear of 1/4" Hilti Kwik-Con+ Anchor

P_{ss}/Ω = 379 lb (NOA-No. 21-0628.20)

Bearing of 1/4" Hilti Kwik-Con+ in Receptor

$V_a = 2DtF_u/n_u$

V_a = 2(0.25")(0.0625")(30,000 psi)/3.0

V_a = 313 lb

Bending of 1/4" Hilti Kwik-Con+

$S = \pi d^3/32 = \pi(0.190")^3/32 = 0.000673\ in^3$

F_y = 120,000 psi per Miami Dade NOA 20-0427.13

$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(120,000 psi) = 93,600 psi (1.3 factor for rod bending)

$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)

$V = 2SF_b/L = (2)(0.000673\ in^3)(93,600\ psi)/0.6875" = 183$ lb

Capacity of Connection is 183 lb

Alternate Installation – Receptor to CMU

1/4" Hilti Kwik-Con+ Anchor

1" Minimum Embedment

2-1/2" Minimum Edge Distance

3" Minimum Spacing

1/16" thick 6063-T6 Aluminum Receptor

Minimum f'm = 1,500 psi ASTM C90 Concrete Masonry

1/4" Maximum Shim Space

11/16" Maximum Bending Space

Allowable Shear of 1/4" Hilti Kwik-Con+ Anchor

P_{ss}/Ω = 251 lb (NOA-No. 21-0628.20)

Bearing of 1/4" Hilti Kwik-Con+ in Receptor

$V_a = 2DtF_u/n_u$

V_a = 2(0.25")(0.0625")(30,000 psi)/3.0

V_a = 313 lb

Bending of 1/4" Hilti Kwik-Con+

$S = \pi d^3/32 = \pi(0.190")^3/32 = 0.000673\ in^3$

F_y = 120,000 psi per Miami Dade NOA 20-0427.13

$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(120,000 psi) = 93,600 psi (1.3 factor for rod bending)

$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)

$V = 2SF_b/L = (2)(0.000673\ in^3)(93,600\ psi)/0.6875" = 183$ lb

Capacity of Connection is 183 lb

Alternate Installation – Trim Clip to Wood Blocking

#12 Wood Screw (Non-Countersunk)

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Trim Clip

G = 0.42 Minimum Spruce-Pine-Fir 2x Wood Blocking (Qualifies Southern Yellow Pine)

1/4" Max Shim Space

Allowable Shear of #12 Wood Screw

Z' = 193 lb

See Following Page

Bearing of #12 Screw

$V_a = 2DtF_u/n_u$

$V_a = 2(0.216")(0.0625")(30{,}000\text{ psi})/3.0$

$V_a = 270$ lb

Bending of #12 Wood Screw

$S = \pi d^3/32 = \pi(0.216")^3/32 = 0.001\text{ in}^3$

$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(80{,}000\text{ psi}) = 62{,}400$ psi (1.3 factor for weak axis bending)

$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)

$V = 2SF_b/L = (2)(0.001\text{ in}^3)(62{,}400\text{ psi})/0.25" = 316$ lb

Capacity of Connection is 193 lb

Alternate Installation – Trim Clip to Wood Blocking (continued)

Lateral Design Strength of Wood Connections

ANSI / AF&PA NDS-2018

Data

Fastener

Fastener	=	#12 Wood Screw
Shank Dia	=	0.216 in.
Root Dia.	=	0.171 in.
F_{yb}	=	80,000 psi
Fastener length	=	2.000 in.

Main Member

Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain)
F_e	=	3,350 psi	(Table 12.3.2)
Thickness	=	1.500 in.	

Side Member

Material	=	6063 T6 Aluminum	
G	=	N/A	
θ	=	0	<= (Angle of load to grain)
F_{es}	=	37,500 psi	
Thickness	=	0.063 in.	

Calculations

Lateral Bearing Factors

D	=	0.171 in.	
ℓ_m	=	1.500 in.	
K_θ	=	1.25	(Table 12.3.1B)
K_D	=	2.21	(Table 12.3.1B)
R_e	=	0.089	(Table 12.3.1A)
R_t	=	24.00	(Table 12.3.1A)
k_1	=	0.8662	(Table 12.3.1A)
k_2	=	0.5564	(Table 12.3.1A)
k_3	=	15.53	(Table 12.3.1A)

Yield Mode	R_d	
I_m, I_s	2.21	(Table 12.3.1B)
II	2.21	(Table 12.3.1B)
III_m, III_s, IV	2.21	(Table 12.3.1B)

Lateral Design Values, Z

Mode I_m	=	389 lbf		(Eq 12.3-1)
Mode I_s	=	181 lbf		(Eq 12.3-2)
Mode II	=	157 lbf		(Eq 12.3-3)
Mode III_m	=	184 lbf		(Eq 12.3-4)
Mode III_s	=	120 lbf	<==== Min Value	(Eq 12.3-5)
Mode IV	=	169 lbf		(Eq 12.3-6)
C_D	=	1.6		(B.2)
Wet Service Factor				
Fabrication/In-Service		Dry/Dry		
C_M	=	1.0		(Table 11.3.3)
In service temperature		T≤100˚F		
C_t	=	1.0		(Table 11.3.4)
C_g	=	1.0		(11.3.6)
C_Δ	=	1.0		(12.5.1)
Installed in end grain?		No		
C_{eg}	=	1.00		(12.5.2)
Part of a diaphragm?		No		
C_{di}	=	1.0		(12.5.3)
Toe-nailed?		No		
C_{tn}	=	1.00		(12.5.4)
Z'	=	**193 lbf**		(Table 11.3.1)

Alternate Installation – Trim Clip to Steel Stud

#12-14 TEKS Screw

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Trim Clip

Minimum 18 Gauge 33 KSI Steel Stud (Qualifies thicker and stronger steel)

1/4" Maximum Shim Space

No Bending

Allowable Shear of #12-14 TEKS Screw

V_a = 724 lb (ESR-1976)

Bearing of #12-14 TEKS Screw on Trim Clip

$V_a = 2DtF_u/n_u$

V_a = 2(0.216")(0.0625")(30,000 psi)/3.0

V_a = 270 lb

Bearing of #12-14 TEKS Screw on Steel Stud

$V_a = 2.7DtF_u/n_u$

V_a = 2.7(0.216")(0.0478")(45,000 psi)/3.0

V_a = 418 lb

Tilting of #12-14 TEKS Screw in Steel

$V_a = 4.2(t_2^3D)^{1/2}F_{tu}/n_s$

$V_a = 4.2(0.0478^3 \times 0.216)^{1/2}$(45,000 psi)/3.0

V_a = 306 lb

Capacity of Connection is 270 lb

Alternate Installation – Trim Clip to Concrete

1/4" Hilti Kwik-Con+ Anchor

1" Minimum Embedment

2-1/2" Minimum Edge Distance

2" Minimum Spacing

1/16" thick 6063-T6 Aluminum Trim Clip

Minimum f'_c = 3,000 psi Concrete

1/4" Maximum Shim Space

No Bending

Allowable Shear of 1/4" Hilti Kwik-Con+ Anchor

$P_{ss}/\Omega = 379$ lb (NOA-No. 21-0628.20)

Bearing of 1/4" Hilti Kwik-Con+ in Trim Clip

$V_a = 2DtF_u/n_u$

V_a = 2(0.25")(0.0625")(30,000 psi)/3.0

V_a = 313 lb

Capacity of Connection is 313 lb

Alternate Installation – Trim Clip to CMU

1/4" Hilti Kwik-Con+ Anchor

1" Minimum Embedment

2-1/2" Minimum Edge Distance

3" Minimum Spacing

1/16" thick 6063-T6 Aluminum Trim Clip

Minimum f'm = 1,500 psi ASTM C90 Concrete Masonry

1/4" Maximum Shim Space

No Bending

Allowable Shear of 1/4" Hilti Kwik-Con+ Anchor

P_{ss}/Ω = 251 lb (NOA-No. 21-0628.20)

Bearing of 1/4" Hilti Kwik-Con+ in Receptor

$V_a = 2DtF_u/n_u$

V_a = 2(0.25")(0.0625")(30,000 psi)/3.0

V_a = 313 lb

Capacity of Connection is 251 lb

Alternate Installation – Trim Clip to Window Frame

#10-16 TEKS Screw

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Trim Clip

1/16" thick 6063-T6 Aluminum Window Frame

Allowable Tension of #10-16 TEKS Screw

V_a = 885 lb (ESR-1976)

Pull-Over of #10-16 TEKS Screw in Trim Clip

$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}-D_h)/3.0$

P_{nov} = 1.0(0.0625")(30,000 psi)(0.400" – 0.190")/3.0

P_{nov} = 131 lb

Pull-Out of #10-16 TEKS Screw in Window Frame

$P_{not} = K_sDL_eF_{ty2}/3.0$

P_{not} = 1.01(0.190")(0.0625")(25,000 psi)/3.0

P_{not} = 100 lb

Capacity of Connection is 100 lb

Tested capacity of M2078 Interior Snap Trim (1/16" thick) determined as shown below on Q3412.01-550-44-R0. Qualified for use at the design capacity of 100 lb.

Trim&Clip	70.0	psf				
Anchor Spacing	8.0	inch				Anchor Capacity for
	Width, w	Height, h			R	Specified Spacing
Window Mark	(inch)	(inch)	w/h	gamma	(lb/inch)	(lb)
Q3412.01-550-44-R0	60.00	99.00	1.65	0.494	14.40	115

Actual Tested Anchorage Capacity

Nailfin

Design Pressure	70.0	psf	
Anchor Spacing	15.0	inch	Head/Sill
Anchor Spacing	15.0	inch	Jambs

Window Mark	Width, w (inch)	Height, h (inch)	w/h	gamma	R (lb/inch)	Anchor Capacity for Specified Spacing (lb)
L5050.01-801-44-R1	60.00	144.00	2.40	0.505	14.74	221
L5050.01-801-44-R1	60.00	60.00	1.00	0.420	12.25	184

GLASS ANALYSIS

Glazing Information

Supported Edges:	Four sides simply supported
Shape:	Rectangular
Lite Width:	57.1 in.
Lite Height:	47.7 in.
Glazing Angle:	90.0 °

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (Monolithic 3/16 in.)

Single Glass Ply Properties

RCSS (Heat Treatment):	0.00 psi (Annealed)
Min Thickness:	0.180 in.
Surface Treatment:	None
Surface Parameters:	7.00 [1.36e-29 in^12/lbf^7] (ASTM)

Airspace Properties

Thickness:	0.625 in.
Sealant Width:	0.236 in.
Elevation:	0.00 ft
Initial Pressure:	14.70 psi
Initial Temperature:	70.0 °F

Interior Lite Properties (Monolithic 3/16 in.)

Single Glass Ply Properties

RCSS (Heat Treatment):	0.00 psi (Annealed)
Min Thickness:	0.180 in.
Surface Treatment:	None
Surface Parameters:	7.00 [1.36e-29 in^12/lbf^7] (ASTM)

Load Combinations

Load Combination 1 - 70.0 psf (3.00 sec)

Description	Load	Duration	Factor	Total
Short Duration	70.0 psf	3.00 sec	1.00	70.0 psf

Scenarios

Scenario 1

Load Combination 1 acting on Exterior Lite	70.0 psf (3.00 sec)
Elevation (Atmospheric Pressure):	0.00 ft (14.6 psi)
Air Space 1 Temperature:	70.0 °F

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (3/16 in. Monolithic)

Construction: 3/16 in. (AN)

Airspace Properties

Thickness: 0.625 in.

Interior Lite Properties (3/16 in. Monolithic)

Construction: 3/16 in. (AN)

Load Resistance

Short Duration (3 Sec)

Description	NFL	GTF	LSF	LR
Exterior Lite	44.0 psf	0.900	1/0.500	79.1 psf
Interior Lite	44.0 psf	0.900	1/0.500	79.1 psf

Comparisons

Scenario 1

70.0 psf 3.00 sec <= 79.1 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.56 in.
Interior Lite	0.56 in.

Notes

Load resistance values are computed in accordance with ASTM E1300-16 Section 6.2 and are based on non-factored load values calculated in a manner consistent with those presented in ASTM E1300-16.

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	09/28/23	N/A	Original report issue