

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 1 OF 40

Window Installation Calculations

M600 Fixed Window

Report Q9365.01-122-34-r1

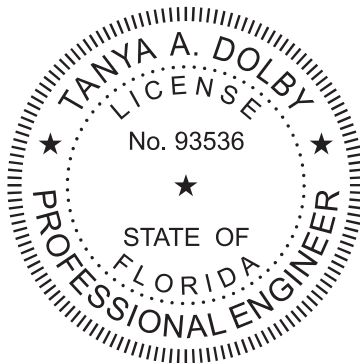
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	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
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Scope

Architectural Testing, Inc., an Intertek company, was contracted by Quaker Windows & Doors to evaluate alternate installation methods for their M600 Fixed 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 2018 Supplement. American Wood Council, 2018.

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

AISI S100-16(2020) 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. 01/2023.

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

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Analyses

Summary of Test Results

The following table summarizes the various M600 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 Window	G3080.01-801-47 (Revision 1, 11/15/17)	NI013439-R3	72" x 120"	+/- 70 psf
M600 Fixed Window	F8438.01-801-47 (Revision 1, 11/15/17)	NI013415.04	60" x 99"	+/- 50 psf test +/- 70 psf waiver
M600 Fixed Window	F8438.01-801-47 (Revision -, 07/15/16)	NI013415.01-R2	60" x 60"	+/-80 psf
M600 Fixed/Fixed Window	F8431.01-801-47 (Revision -, 07/15/16)	NI013415.03-R2	72" x 96"	+/- 65 psf

Testing documented in Table 1 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).

Glass analysis herein was conducted per ASTM E1300 to determine the glass makeup requirements. Noted below are the tested glass makeup to the required glass makeup per ASTM E1300:

- G3080.01-801-47, 72" x 120", Tested with 1" IG with 3/16" Tempered glass, analyzed with 5/16" Tempered glass
- F8438.01-801-47, 60" x 99", Tested with 1" IG with ¼" Annealed to +/- 50 psf, analyzed with ¼" Heat Strengthened glass to +/- 70 psf
- F8438.01-801-47, 60" x 60", Tested with 1" IG with ¼" Annealed glass, analyzed with ¼" Annealed glass
- F8431.01-801-47, 72" x 96", Tested with 1" IG with ¼" Annealed, analyzed with ¼" Heat Strengthened glass

Glass analysis results are shown on page 27 through 30 of 40.

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As-Tested Installation Analysis

For air/water/structural testing, the test specimen was secured to a 2x Spruce-Pine-Fir buck with #8 x 1-1/2" wood screws through a nail fin or strap anchor, located per Table 2. The as-tested installation method is evaluated on page 11 and 12 and the established design capacities summarized in Table 2.

Table 2 As-Tested Anchorage Design Capacities

Test	Connection	Capacity
Air/Water/Structural Test 72" x 120" window +/-70 psf	Nail Fin with #8 x 1-1/2" Wood Screw Placed 2" from each corner and 14" on center	86 lb
Air/Water/Structural Test 60" x 99" window +/-50 psf	Strap Anchor with #8 x 1-1/2" Wood Screw Placed 3" from each corner and 14" on center	138 lb
Air/Water/Structural Test 60" x 60" window +/-80 psf	Strap Anchor with #8 x 1-1/2" Wood Screw Placed 3" from each corner and 12" on center	138 lb
Air/Water/Structural Test 72" x 96" window +/-65 psf	Strap Anchor with #8 x 1-1/2" Wood Screw Placed 2" from each corner and 13" on center	138 lb

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

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Alternate Anchorages

Calculations on page 14 through page 18 determine the design capacity of alternate Nail Fin installation anchorages for the window. The alternate anchorage capacities are summarized in Table 3.

Table 3 Alternate Anchorage Capacities for Nail Fin Installation

Substrate	Anchor	Capacity	Comments
Wood SYP 2x	#10 x 2" Wood Screw	104 lb	1. Limited by pull-over capacity. 2. 1-1/2" Minimum penetration. 3. Qualifies installation to wood framing or installation to wood buck.
Wood SYP 2x	#12 x 2" Wood Screw	118 lb	1. Limited by pull-over capacity. 2. 1-1/2" Minimum penetration. 3. Qualifies installation to wood framing or installation to wood buck.
18 Gauge Steel Stud	#10-16 TEKS Screw	116 lb	1. Limited by pull-out capacity. 2. 33 KSI yield strength stud. 3. Full penetration +3 threads.
18 Gauge Steel Stud	#12-14 TEKS Screw	117 lb	1. Limited by pull-over capacity. 2. 33 KSI yield strength stud. 3. Full penetration +3 threads.
Concrete	3/16" Hilti Kwik Con+	112 lb	1. Minimum $f'_c = 3,000$ psi 2. 1" Minimum Embedment 3. 1-1/2" Min. Edge Distance 4. Limited by tension
CMU	3/16" Hilti Kwik Con+	116 lb	1. Minimum ASTM C90 CMU 2. 1" Minimum Embedment 3. 1-1/2" Min. Edge Distance 4. Limited by tension

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Page 19 through page 26 presents the calculation of alternate Strap Anchor installation anchorages for the window. The alternate anchorage capacities are summarized in Table 4.

Table 4 Alternate Anchorage Capacities for Strap Anchor Installation

Substrate	Anchor	Capacity	Comments
Wood SYP 2x	#10 x 1-1/2" Wood Screw	194 lb	1. 1-1/4" Minimum Penetration 2. Limited by Mode Is 3. 1/4" Maximum Shim Space 4. Southern Yellow Pine
Wood SYP 2x	#12 x 1-1/2" Wood Screw	247 lb	1. 1-1/4" Minimum Penetration 2. Limited by Mode IIIs 3. 1/4" Maximum Shim Space 4. Southern Yellow Pine
18 Gauge Steel Stud	#10-16 TEKS Screw	287 lb	1. Minimum 18 gauge 33 KSI Steel 2. Full penetration +3 threads 3. Limited by tilting 4. 1/4" Maximum Shim Space
18 Gauge Steel Stud	#12-14 TEKS Screw	306 lb	1. Minimum 18 gauge 33 KSI Steel 2. Full penetration +3 threads 3. Limited by tilting 4. 1/4" Maximum Shim Space
Concrete	3/16" Hilti Kwik Con+	215 lb	1. Minimum $f'_c = 3,000$ psi 2. 1-3/4" Minimum Embedment 3. 1-1/2" Min. Edge Distance 4. Limited by shear capacity 5. 1/4" Maximum Shim Space
CMU	3/16" Hilti Kwik Con+	150 lb	1. Minimum ASTM C90 CMU 2. 1" Minimum Embedment 3. 1-1/2" Min. Edge Distance 4. Limited by shear capacity 5. 1/4" Maximum Shim Space

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Anchorage Requirements

Although the capacities of the alternate anchorages exceed the capacity of the as-tested anchorage, it must be determined the anchorages are not overloaded for the approved window size and design pressures. Calculations presented in page 34 and 35 show required spacing for the evaluated anchorage conditions on all tested windows. Results are summarized in Table 5A to 5D.

Table 5A 60" x 99", +/- 70 psf Anchorage Requirements

Substrate		Anchor	Spacing at Jamb	Spacing at Head/Sill
Wood SYP 2x	#10 Wood Screw	Fin Installation	10"	14"
	#12 Wood Screw	Fin Installation	12"	14"
	#10 Wood Screw	Strap Installation	14"	14"
	#12 Wood Screw	Strap Installation	14"	14"
18 Gauge Steel Stud	#10 TEK Screw	Fin Installation	10"	14"
	#12 TEK Screw	Fin Installation	12"	14"
	#10 TEK Screw	Strap Installation	14"	14"
	#12 TEK Screw	Strap Installation	14"	14"
Concrete	3/16" Hilti Kwik Con+	Fin Installation	11"	14"
		Strap Installation	14"	14"
CMU	3/16" Hilti Kwik Con+	Fin Installation	11"	14"
		Strap Installation	14"	14"

The least of the as-tested spacing or the calculated spacing governs and is shown in Table 5A.

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Table 5B 72" x 96", +/- 65 psf Anchorage Requirements

Substrate		Anchor	Spacing at Jamb	Spacing at Head/Sill
Wood SYP 2x	#10 Wood Screw	Fin Installation	10"	13"
	#12 Wood Screw	Fin Installation	12"	13"
	#10 Wood Screw	Strap Installation	13"	13"
	#12 Wood Screw	Strap Installation	13"	13"
18 Gauge Steel Stud	#10 TEK Screw	Fin Installation	11"	13"
	#12 TEK Screw	Fin Installation	12"	13"
	#10 TEK Screw	Strap Installation	13"	13"
	#12 TEK Screw	Strap Installation	13"	13"
Concrete	3/16" Hilti Kwik Con+	Fin Installation	11"	13"
		Strap Installation	13"	13"
CMU	3/16" Hilti Kwik Con+	Fin Installation	11"	13"
		Strap Installation	13"	13"

The least of the as-tested spacing or the calculated spacing governs and is shown in Table 5B.

Note: Place additional anchors located 3" from the top and bottom of intermediate horizontal centerlines.

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Table 5C 72" x 120", +/- 70 psf Anchorage Requirements

Substrate		Anchor	Spacing at Jamb	Spacing at Head/Sill
Wood SYP 2x	#10 Wood Screw	Fin Installation	8"	14"
	#12 Wood Screw	Fin Installation	10"	14"
	#10 Wood Screw	Strap Installation	14"	14"
	#12 Wood Screw	Strap Installation	14"	14"
18 Gauge Steel Stud	#10 TEK Screw	Fin Installation	9"	14"
	#12 TEK Screw	Fin Installation	10"	14"
	#10 TEK Screw	Strap Installation	14"	14"
	#12 TEK Screw	Strap Installation	14"	14"
Concrete	3/16" Hilti Kwik Con+	Fin Installation	9"	14"
		Strap Installation	14"	14"
CMU	3/16" Hilti Kwik Con+	Fin Installation	9"	14"
		Strap Installation	14"	14"

The least of the as-tested spacing or the calculated spacing governs and is shown in Table 5C.

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Table 5D 60" x 60", +/- 80 psf Anchorage Requirements

Substrate		Anchor	Spacing at Jamb	Spacing at Head/Sill
Wood SYP 2x	#10 Wood Screw	Fin Installation	12"	12"
	#12 Wood Screw	Fin Installation	12"	12"
	#10 Wood Screw	Strap Installation	12"	12"
	#12 Wood Screw	Strap Installation	12"	12"
18 Gauge Steel Stud	#10 TEK Screw	Fin Installation	12"	12"
	#12 TEK Screw	Fin Installation	12"	12"
	#10 TEK Screw	Strap Installation	12"	12"
	#12 TEK Screw	Strap Installation	12"	12"
Concrete	3/16" Hilti Kwik Con+	Fin Installation	12"	12"
		Strap Installation	12"	12"
CMU	3/16" Hilti Kwik Con+	Fin Installation	12"	12"
		Strap Installation	12"	12"

The least of the as-tested spacing or the calculated spacing governs and is shown in Table 5C.

Glass Analysis

Glass analysis was conducted per ASTM E1330. Results are shown on page 27 through 30 of 40.

Member Analysis

Member analysis was conducted, and results are shown on page 31 through 33 of 40.

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As-Tested Installation – Nail Fin to Wood

#8 x 1-1/2" Pan Head Wood/Deck Screw (Non-Countersunk)

$D_{ws} = (0.322" + 0.306")/2 = 0.314"$ (Nominal Screw Head Diameter)

$D_H = 0.177"$ (Section 11.0, AAMA TIR-A9)

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Nailing Fin

G = 0.55 Minimum SYP 2x Wood Blocking

¼" maximum shim space

ASD Withdrawal

Withdrawal of #8 Wood Screw

$$W' = 2,850(G^2)(D)(Cd)(Cm)(Ct)(Ceg)(Ctn)(L)$$

$$W' = 2,850 (0.55^2)(0.164")(1.6)(0.7)(0.7)(1.00)(1.0)(1.50")$$

$$W' = 142 \text{ lb}$$

Adjustment Factors

Load Duration Factor - Ten Minutes, $C_d = 1.6$

Moisture Factor - Fabrication > 19% and In-Service > 19%, $C_m = 0.7$

Temperature Factor - $100^\circ\text{F} < T \leq 125^\circ\text{F}$, $C_t = 0.7$

End Grain Factor - No, $C_{eg} = 1.00$

Toe Nail Factor - No, $C_{tn} = 1.0$

Pull-Over of #8 PH Wood Screw

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

$$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.314" - 0.177") / 3.0$$

$$P_{nov} = 86 \text{ lb}$$

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As-Tested Installation – Strap Anchor to Wood

#8 x 1-1/2" Wood Screw

0.08" thick 6063-T6 Aluminum Strap Anchor

1/4" Maximum Shim Space

G = 0.55 Minimum SYP 2x Wood Blocking

Allowable Shear of #8 x 1-1/2" Wood Screw

$Z' = 155 \text{ lb}$ (Limited by Mode IIIs, See Following Page)

Bearing of #8 x 1-1/2" Wood Screw on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.164")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 262 \text{ lb}$$

Bending of #8 x 1-1/2" Wood Screw

$$L = 1/4" \text{ (maximum shim space)}$$

$$S = \pi d^3/32 = \pi(0.131")^3/32 = 0.000221 \text{ in}^3$$

$$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(100,000 \text{ psi}) = 78,000 \text{ psi} \text{ (1.3 factor for weak axis bending)}$$

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.000221 \text{ in}^3)(78,000 \text{ psi})/0.25" = 138 \text{ lb}$$

Capacity of Connection is 138 lb

Main Member Type	Southern Pine
Main Member Thickness	1.5 in.
Main Member: Angle of Load to Grain	90
Side Member Type	Steel
Side Member Thickness	20 gage
Side Member: Angle of Load to Grain	0
Wood Screw Number	8 (D = 0.164 in.)
Length	1.5 in.
Load Duration Factor	C _D = 1.6
Wet Service Factor	C _M = 1.0
End Grain Factor	C _{eg} = 1.0
Temperature Factor	C _t = 1.0

Calculate Connection Capacity

[Connection Yield Mode Descriptions](#)
[Limits of Use](#)
[Diaphragm Factor Help](#)
[Load Duration Factor Help](#)
[Technical Help](#)
[Show Printable View](#)

Connection Yield Modes

Im	601 lbs.
Is	212 lbs.
II	243 lbs.
IIIIm	271 lbs.
IIIIs	155 lbs.
IV	218 lbs.

Adjusted ASD Capacity	155 lbs.
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NAIL FIN ALTERNATE ANCHORAGE

Alternate Installation – Nail Fin to Wood

#10 Pan Head Wood Screw

$D_{ws} = (0.373" + 0.357")/2 = 0.365"$ (Nominal Screw Head Diameter)

$D_H = 0.201"$ (Nominal Hole Size, AAMA TIR-A9, Table 11.1)

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Nailing Fin

G = 0.55 Minimum SYP 2x Wood Blocking

¼" maximum shim space

ASD Withdrawal

Withdrawal of #10 PH Wood Screw

$$W' = 2,850(G^2)(D)(Cd)(Cm)(Ct)(Ceg)(Ctn)(L)$$

$$W' = 2,850 (0.55^2)(0.190")(1.6)(0.7)(0.7)(1.00)(1.0)(1.50")$$

$$W' = 192 \text{ lb}$$

Adjustment Factors

Load Duration Factor - Ten Minutes, $C_d = 1.6$

Moisture Factor - Fabrication > 19% and In-Service > 19%, $C_m = 0.7$

Temperature Factor - $100^\circ\text{F} < T \leq 125^\circ\text{F}$, $C_t = 0.7$

End Grain Factor - No, $C_{eg} = 1.00$

Toe Nail Factor - No, $C_{tn} = 1.0$

Pull-Over of #10 PH Wood Screw

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

$$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.365" - 0.201") / 3.0$$

$$P_{nov} = 104 \text{ lb}$$

Capacity of Connection is 104 lb

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#12 Pan Head Wood Screw

$$D_{ws} = (0.425'' + .407'')/2 = 0.416'' \text{ (Nominal Screw Head Diameter)}$$

$$D_H = 0.228'' \text{ (Nominal Hole Size, AAMA TIR-A9, Table 11.1)}$$

1-1/2" Minimum Penetration

1/16" thick 6063-T6 Aluminum Nailing Fin

G = 0.55 Minimum SYP 2x Wood Blocking

¼" maximum shim space

ASD Withdrawal

Withdrawal of #12 PH Wood Screw

$$W' = 2,850(G^2)(D)(Cd)(Cm)(Ct)(Ceg)(Ctn)(L)$$

$$W' = 2,850 (0.55^2)(0.216'')(1.6)(0.7)(0.7)(1.00)(1.0)(1.50'')$$

$$W' = 219 \text{ lb}$$

Adjustment Factors

Load Duration Factor - Ten Minutes, Cd = 1.6

Moisture Factor - Fabrication > 19% and In-Service > 19%, Cm = 0.7

Temperature Factor - 100°F < T ≤ 125°F, Ct = 0.7

End Grain Factor - No, Ceg = 1.00

Toe Nail Factor - No, Ctn = 1.0

Pull-Over of #10 PH Wood Screw

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

$$P_{nov} = 1.0(0.0625'')(30,000 \text{ psi})(0.416'' - 0.228'') / 3.0$$

$$P_{nov} = 118 \text{ lb}$$

Capacity of Connection is 118 lb

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Alternate Nail Fin Installation to Steel Stud

#10-16 HWH TEKS Screw, Nailing Fin to Steel Stud

$D_{ws} = (0.414" + 0.384")/2 = 0.399"$ (Nominal Screw Head Diameter)

$D_H = 0.201"$ (Nominal Hole Size, AAMA TIR-A9, Table 11.1)

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Nailing Fin

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

¼" maximum shim space

Allowable Tension of #10-16 TEKS Screw

$V_a = 885 \text{ lb}$ (ESR-1976)

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

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

$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.399" - 0.201") / 3.0$

$P_{nov} = 124 \text{ lb}$

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

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

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

$P_{not} = 116 \text{ lb}$

Capacity of Connection is 116 lb

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#12-14 HWH TEKS Screw, Nailing Fin to Steel Stud

$$D_{ws} = (0.432" + .398")/2 = 0.415" \text{ (Nominal Screw Head Diameter)}$$

$$D_H = 0.228" \text{ (Nominal Hole Size, AAMA TIR-A9, Table 11.1)}$$

Full Penetration +3 Threads

1/16" thick 6063-T6 Aluminum Nailing Fin

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

¼" maximum shim space

Allowable Tension of #12-16 TEKS Screw

$$V_a = 1184 \text{ lb} \quad (\text{ESR-1976})$$

Pull-Over of #12 HWH TEKS Screw in Nail Fin

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

$$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.415" - 0.228") / 3.0$$

$$P_{nov} = 117 \text{ lb}$$

Pull-Out of #12 HWH TEKS Screw in Steel Stud

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

$$P_{not} = 0.85(0.0478")(0.216")(45,000 \text{ psi}) / 3.0$$

$$P_{not} = 155 \text{ lb}$$

Capacity of Connection is 117 lb

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Alternate Installation – Nail Fin to Concrete

3/16" Hilti Kwik-Con+ Anchor

$D_{ws} = 0.433"$ (HWH Screw Head Diameter)

$D_H = 0.228"$ (Nominal Hole Size, AAMA TIR-A9, Table 11.1)

1-1/2" Minimum Edge Distance, 1" Minimum Embedment, 2" Minimum Spacing

0.062" thick 6063-T6 Aluminum Nailing Fin

Minimum $f'_c = 3,000$ psi Concrete

Allowable Tension of 3/16" Hilti Kwik-Con+ Anchor

$$P_{ss}/\Omega = 112 \text{ lb} \quad (\text{NOA-No. 21-0628.20})$$

Pull-Over of 3/16" Hilti Kwik-Con+ Anchor

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

$$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.433" - 0.201") / 3.0$$

$$P_{nov} = 145 \text{ lb}$$

Capacity of Connection is 112 lb

Alternate Installation – Nail Fin to CMU

3/16" Hilti Kwik-Con+ Anchor

1-1/2" Minimum Edge Distance, 1" Minimum Embedment, 3" Minimum Spacing

0.062" thick 6063-T6 Aluminum Nailing Fin

Minimum ASTM C90 CMU

Allowable Tension of 3/16" Hilti Kwik-Con+ Anchor

$$P_{ss}/\Omega = 116 \text{ lb} \quad (\text{NOA-No. 21-0628.20})$$

Pull-Over of 3/16" Hilti Kwik-Con+ Anchor

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

$$P_{nov} = 1.0(0.0625")(30,000 \text{ psi})(0.433" - 0.201") / 3.0$$

$$P_{nov} = 145 \text{ lb}$$

Capacity of Connection is 116 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 19 OF 40

STRAP ANCHOR ALTERNATE ANCHORAGE

Alternate Installation – Strap Anchor to Wood

#10 x 1-1/2" Wood Screw

0.08" thick 6063-T6 Aluminum Strap Anchor

1/4" Maximum Shim Space

G = 0.55 Minimum SYP 2x Wood Blocking

Allowable Shear of #10 x 1-1/2" Wood Screw

$Z' = 196 \text{ lb}$ (Limited by Mode Is, See Following Page)

Bearing of #10 x 1-1/2" Wood Screw on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.190'')(0.08'')(30,000 \text{ psi})/3.0$$

$$V_a = 304 \text{ lb}$$

Bending of #10 x 1-1/2" Wood Screw

$$L = 1/4'' \text{ (maximum shim space)}$$

$$S = \pi d^3/32 = \pi(0.152'')^3/32 = 0.000345 \text{ in}^3$$

$$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(90,000 \text{ psi}) = 70,200 \text{ psi (1.3 factor for weak axis bending)}$$

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.000345 \text{ in}^3)(70,200 \text{ psi})/0.25'' = 194 \text{ lb}$$

Capacity of Connection is 194 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 20 OF 40

Alternate Installation – Strap Anchor to Wood (Continued)

Design Method	Allowable Stress Design (ASD) ▼
Connection Type	Lateral loading ▼
Fastener Type	Wood Screw ▼
Loading Scenario	Single Shear ▼
Submit Initial Values	

Main Member Type	Southern Pine ▼
Main Member Thickness	1.5 in. ▼
Main Member: Angle of Load to Grain	90
Side Member Type	Steel ▼
Side Member Thickness	20 gage ▼
Side Member: Angle of Load to Grain	0
Wood Screw Number	10 (D = 0.19 in.) ▼
Length	1.5 in. ▼
Load Duration Factor	C _D = 1.6 ▼
Wet Service Factor	C _M = 1.0 ▼
End Grain Factor	C _{eg} = 1.0 ▼
Temperature Factor	C _t = 1.0 ▼

Calculate Connection Capacity		
Connection Yield Mode Descriptions	Limits of Use	
Diaphragm Factor Help	Load Duration Factor Help	Technical Help
Show Printable View		

Connection Yield Modes

Im	665 lbs.
Is	246 lbs.
II	269 lbs.
IIIIm	310 lbs.
IIIIs	196 lbs.
IV	277 lbs.

Adjusted ASD Capacity	196 lbs.
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	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 21 OF 40

#12 x 1-1/2" Wood Screw

0.08" thick 6063-T6 Aluminum Strap Anchor

1/4" Maximum Shim Space

G = 0.55 Minimum SYP 2x Wood Blocking

Allowable Shear of #12 x 1-1/2" Wood Screw

$Z' = 247 \text{ lb}$ (Limited by Mode IIIs, See Following Page)

Bearing of #12 x 1-1/2" Wood Screw on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.216")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 346 \text{ lb}$$

Bending of #12 x 1-1/2" Wood Screw

$$L = 1/4" \text{ (maximum shim space)}$$

$$S = \pi d^3/32 = \pi(0.171")^3/32 = 0.00049 \text{ in}^3$$

$$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(90,000 \text{ psi}) = 70,200 \text{ psi} \text{ (1.3 factor for weak axis bending)}$$

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.00049 \text{ in}^3)(70,200 \text{ psi})/0.25" = 276 \text{ lb}$$

Capacity of Connection is 247 lb

Alternate Installation – Strap Anchor to Wood (Continued)

Main Member Type	Southern Pine
Main Member Thickness	1.5 in.
Main Member: Angle of Load to Grain	90
Side Member Type	Steel
Side Member Thickness	20 gage
Side Member: Angle of Load to Grain	0
Wood Screw Number	12 (D = 0.216 in.)
Length	1.5 in.
Load Duration Factor	C _D = 1.6
Wet Service Factor	C _M = 1.0
End Grain Factor	C _{eg} = 1.0
Temperature Factor	C _t = 1.0

Calculate Connection Capacity

[Connection Yield Mode Descriptions](#)
[Limits of Use](#)
[Diaphragm Factor Help](#)
[Load Duration Factor Help](#)
[Technical Help](#)
[Show Printable View](#)

Connection Yield Modes

Im	709 lbs.
Is	276 lbs.
II	286 lbs.
IIIIm	348 lbs.
IIIIs	247 lbs.
IV	349 lbs.

Adjusted ASD Capacity	247 lbs.
-----------------------	----------

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 23 OF 40

Alternate Installation – Strap Anchor to Steel Stud

#10-16 TEKS Screw

0.08" thick 6063-T6 Aluminum Strap Anchor

1/4" Maximum Shim Space

Minimum 18 gauge 33 KSI Steel Stud

Allowable Shear of #10-16 TEKS Screw

$$P_{ss}/\Omega = 573 \text{ lb (ESR-1976)}$$

Bearing of #10-16 TEKS Screw on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.190")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 304 \text{ lb}$$

Bearing of #10-16 TEKS Screw on Steel Stud

$$V_a = 2.7DtF_{tu}/3.0$$

$$V_a = 2.7(0.190")(0.0478")(45,000 \text{ psi})/3.0$$

$$V_a = 367 \text{ lb}$$

Tilting of #10-16 TEKS Screw in Steel Stud

$$V_a = 4.2(t_2^3 D)^{1/2} F_{tu2}/n_s$$

$$V_a = 4.2(0.0478''^3 \times 0.190'')^{1/2} (45,000 \text{ psi})/3.0$$

$$V_a = 287 \text{ lb}$$

Bending of #10-16 TEKS Screw

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.190'')^3/32 = 0.00067 \text{ in}^3$$

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

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.00067 \text{ in}^3)(71,760 \text{ psi})/0.25" = 385 \text{ lb}$$

Capacity of Connection is 287 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 24 OF 40

#12-14 TEKS Screw

0.08" thick 6063-T6 Aluminum Strap Anchor

1/4" Maximum Shim Space

Minimum 18 gauge 33 KSI Steel Stud

Allowable Shear of #12-14 TEKS Screw

$$P_{ss}/\Omega = 724 \text{ lb (ESR-1976)}$$

Bearing of #12-14 TEKS Screw on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.216")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 346 \text{ lb}$$

Bearing of #12-14 TEKS Screw on Steel Stud

$$V_a = 2.7DtF_{tu}/3.0$$

$$V_a = 2.7(0.216")(0.0478")(45,000 \text{ psi})/3.0$$

$$V_a = 418 \text{ lb}$$

Tilting of #12-14 TEKS Screw in Steel Stud

$$V_a = 4.2(t_2^3 D)^{1/2} F_{tu2}/n_s$$

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

$$V_a = 306 \text{ lb}$$

Bending of #12-14 TEKS Screw

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.210'')^3/32 = 0.00091 \text{ in}^3$$

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

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.00091 \text{ in}^3)(71,760 \text{ psi})/0.25" = 521 \text{ lb}$$

Capacity of Connection is 306 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 25 OF 40

Alternate Installation – Strap Anchor to Concrete

3/16" Hilti Kwik-Con+ Anchor

1-1/2" Minimum Edge Distance, 1" Minimum Embedment, 2" Minimum Spacing

1/4" Maximum Shim Space

0.08" thick 6063-T6 Aluminum Strap Anchor

Minimum $f'_c = 3,000$ psi Concrete

Allowable Shear of 3/16" Hilti Kwik-Con+ Anchor

$$P_{ss}/\Omega = 215 \text{ lb} \quad (\text{NOA-No. 21-0628.20})$$

Bearing of 3/16" Hilti Kwik-Con+ Anchor on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.170")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 272 \text{ lb}$$

Bending of 3/16" Hilti Kwik-Con+

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482 \text{ in}^3$$

$$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 factor for weak axis bending)}$$

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.000482 \text{ in}^3)(106,860 \text{ psi})/0.25" = 412 \text{ lb}$$

Capacity of Connection is 215 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 26 OF 40

Alternate Installation – Strap Anchor to CMU

3/16" Hilti Kwik-Con+ Anchor

1-1/2" Minimum Edge Distance, 1" Minimum Embedment, 3" Minimum Spacing

1/4" Maximum Shim Space

0.08" thick 6063-T6 Aluminum Strap Anchor

Minimum ASTM C90 CMU Block

Allowable Shear of 3/16" Hilti Kwik-Con+ Anchor

$$P_{ss}/\Omega = 150 \text{ lb} \quad (\text{NOA-No. 21-0628.20})$$

Bearing of 3/16" Hilti Kwik-Con+ Anchor on Strap Anchor

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.170")(0.08")(30,000 \text{ psi})/3.0$$

$$V_a = 272 \text{ lb}$$

Bending of 3/16" Hilti Kwik-Con+

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482 \text{ in}^3$$

$$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 factor for weak axis bending)}$$

$$F_b = M/S = (VL/2)/S \text{ (L/2 for guided bending)}$$

$$V = 2SF_b/L = (2)(0.000482 \text{ in}^3)(106,860 \text{ psi})/0.25" = 412 \text{ lb}$$

Capacity of Connection is 150 lb

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 27 OF 40

Glass Analysis

72" x 120" – 5/16" FT Glass

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (5/16 in. Monolithic)

Construction: 5/16 in. (FT)

Airspace Properties

Thickness: 0.375 in.

Interior Lite Properties (5/16 in. Monolithic)

Construction: 5/16 in. (FT)

Load Resistance

Short Duration (3 Sec)

Description	NFL	GTF	LSF	LR
Exterior Lite	29.1 psf	3.60	1/0.500	210 psf
Interior Lite	29.1 psf	3.60	1/0.500	210 psf

Long Duration (30 Days)

Description	NFL	GTF	LSF	LR
Exterior Lite	29.1 psf	2.85	1/0.500	166 psf
Interior Lite	29.1 psf	2.85	1/0.500	166 psf

Comparisons

Short Duration		
70.0 psf 3.00 sec <= 210 psf		OK
Approximate center of glass deflection		
Exterior Lite		1.05 in.
Interior Lite		1.05 in.
Long Duration		
0.00 psf 30.0 day <= 166 psf		OK
Approximate center of glass deflection		
Exterior Lite		< 0.04 in.
Interior Lite		< 0.04 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.

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 28 OF 40

60" x 99" – ¼" HS Glass

Analysis 1

Load Resistance Report

March 08, 2024

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (HS)

Airspace Properties

Thickness: 0.480 in.

Interior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (HS)

Load Resistance

Short Duration (3 Sec)

Description	NFL	GTF	LSF	LR
Exterior Lite	28.0 psf	1.80	1/0.500	101 psf
Interior Lite	28.0 psf	1.80	1/0.500	101 psf

Long Duration (30 Days)

Description	NFL	GTF	LSF	LR
Exterior Lite	28.0 psf	1.25	1/0.500	69.9 psf
Interior Lite	28.0 psf	1.25	1/0.500	69.9 psf

Comparisons

Short Duration		
70.0 psf 3.00 sec <= 101 psf		OK
Approximate center of glass deflection		
Exterior Lite		1.04 in.
Interior Lite		1.04 in.
Long Duration		
0.00 psf 30.0 day <= 69.9 psf		OK
Approximate center of glass deflection		
Exterior Lite		< 0.04 in.
Interior Lite		< 0.04 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.

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 29 OF 40

60" x 60" – ¼" AN Glass

Analysis 1

Load Resistance Report

February 07, 2024

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (AN)

Airspace Properties

Thickness: 0.480 in.

Interior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (AN)

Load Resistance

Short Duration (3 Sec)

Description	NFL	GTF	LSF	LR
Exterior Lite	44.8 psf	0.900	1/0.500	80.6 psf
Interior Lite	44.8 psf	0.900	1/0.500	80.6 psf

Comparisons

Scenario 1	
80.0 psf 3.00 sec <= 80.6 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.65 in.
Interior Lite	0.65 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.

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 30 OF 40

72" x 96" Unit, 70" x 70" Glazing – ¼" HS Glass

Analysis 1

Load Resistance Report

February 07, 2024

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (HS)

Airspace Properties

Thickness: 0.480 in.

Interior Lite Properties (1/4 in. Monolithic)

Construction: 1/4 in. (HS)

Load Resistance

Short Duration (3 Sec)

<u>Description</u>	<u>NFL</u>	<u>GTF</u>	<u>LSF</u>	<u>LR</u>
Exterior Lite	35.3 psf	1.80	1/0.500	127 psf
Interior Lite	35.3 psf	1.80	1/0.500	127 psf

Comparisons

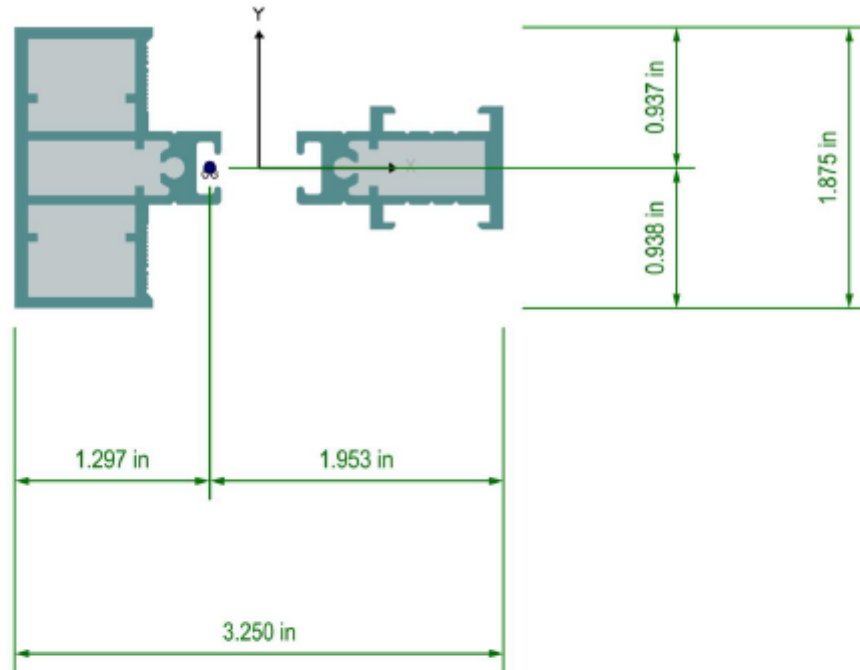
Scenario 1	
65.0 psf 3.00 sec <= 127 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.80 in.
Interior Lite	0.80 in.

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.

M600 Intermediate Horizontal Analysis

Properties



Geometric Properties

Area	1.025 in ²
Ix	0.218 in ⁴
Ixy	0.000 in ⁴
Iy	1.162 in ⁴
Sx+	0.233 in ³
Sx-	0.233 in ³
Sy+	0.595 in ³
Sy-	0.896 in ³
Xc	-0.328 in
Yc	0.000 in
rx	0.462 in
ry	1.065 in

Overall Properties

Depth	1.875 in
Perimeter	13.756 in
Weight	0.103 lb/in
Width	3.250 in

Horizontal Wind Load Analysis

Quaker

Cbeam R2
Intertek

2/16/2024 10:48 File: M600 Fixed Int Horiz 65 ps

M600 Fixed Horiz WL 65 psf

By: TAD

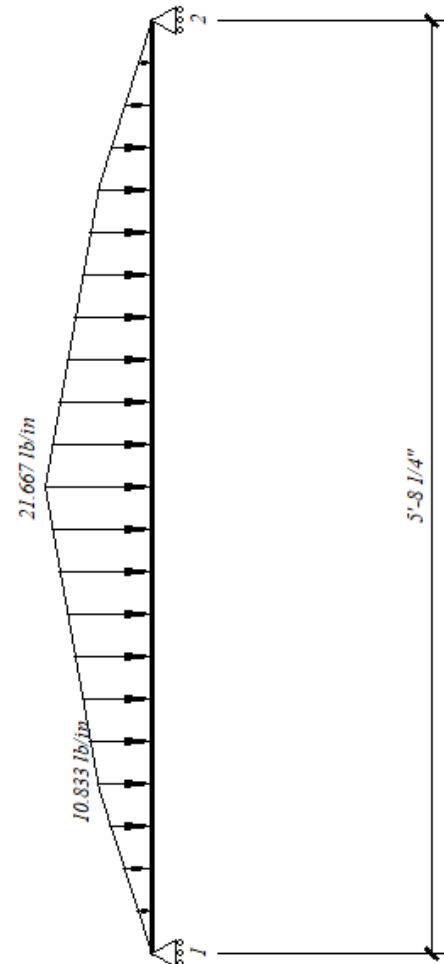
Deflection Results				
Max. Deflection =	-0.3746"	L/182	(Span 1, @	34.13")

Stress Results				
Span		M(in-lb)	fb-m(ksi)	
1	@ 34.13"	= 9254	15.552	

Member Information				
Span	Length(in)	I(in ⁴)	S(in ³)	E(psi)
1	68.250	1.162	0.595	1.0e+7

Distributed Load Information				
Span	W1(#/in)	W2(#/in)	X1(in)	X2(in)
1	0.000	10.833	0.000	12.000
	10.833	21.667	12.000	34.125
	21.667	10.833	34.125	56.250
	10.833	0.000	56.250	68.250

Support Reactions	
Joint	Pounds
1	425
2	425



Allowable Stress = 15,152 psi < 15,552 psi by 2.6%, OK
 Allowable Deflection = 68.25"/180 = 0.379" > 0.375", OK

Horizontal Dead Load Analysis

Quaker

Cbeam R2

Intertek

2/16/2024 11:01 File: M600 Fixed Int Horiz DL

M600 Fixed Horiz DL

By: TAD

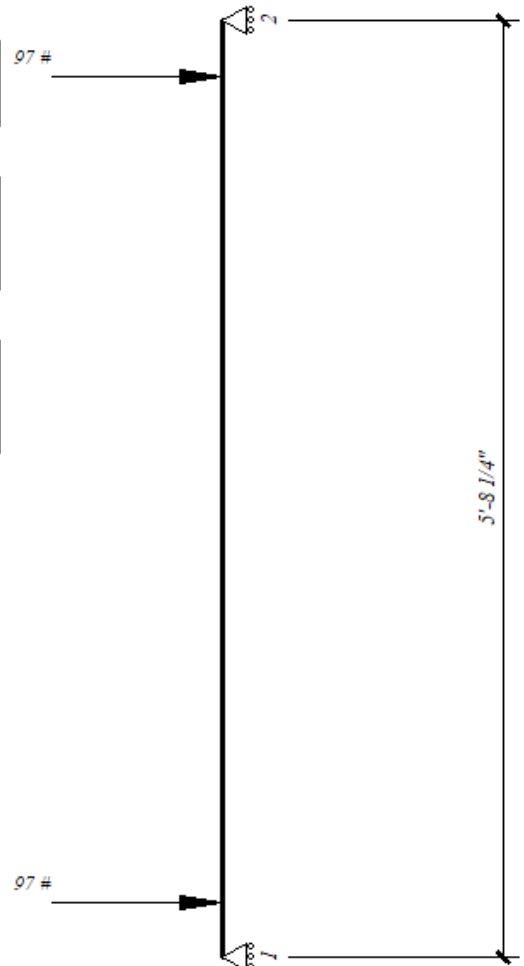
Deflection Results				
Max. Deflection =	-0.1032"	L/662	(Span 1, @	34.13")

Stress Results				
Span		M(in-lb)	fb-m(ksi)	
1	@	42.24"	=	388 1.665

Member Information				
Span	Length(in)	I(in ⁴)	S(in ³)	E(psi)
1	68.250	0.218	0.233	1.0e+7

Point Load Information		
Span	P(#)	X(in)
1	97.000	4.000
	97.000	64.250

Support Reactions	
Joint	Pounds
1	97
2	97



Allowable Stress = O.K.B.I

Allowable Deflection = 0.125" > 0.1032", OK

Locate setting blocks at 6" from the horizontal ends to meet allowable deflection

	PROJECT: Window Installation Calculations – M600 Fixed	BY: TAD DATE: 2/16/2024
	PROJECT NO.: Q9365.01-122-34-r1	CKD: ARK SHEET: 34 OF 40

NAIL FIN ALTERNATE ANCHORAGE

Punched Opening Anchor Reactions

Nail Fin Anchorage		Window Design Pressure:		70.00				
Substrate	Anchor	Anchor Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)	JAMBS	HEAD/SILL	
						Calculated Anchor Spacing	R (lb/in)	Calculated Anchor Spacing
Wood	#10 Wood Screw at Nail Fin	104 lb	60.00	99.00	10.16	10"	7.29	14"
	#12 Wood Screw at Nail Fin	118 lb	60.00	99.00	10.16	12"	7.29	16"
Steel Stud	#10-16 TEKS at Nail Fin	116 lb	60.00	99.00	10.16	11"	7.29	16"
	#12-14 TEKS at Nail Fin	117 lb	60.00	99.00	10.16	12"	7.29	16"
Concrete	3/16" Hilti Kwik-Con II+ at Nail Fin	112 lb	60.00	99.00	10.16	11"	7.29	15"
CMU	3/16" Hilti Kwik-Con II+ at Nail Fin	116 lb	60.00	99.00	10.16	11"	7.29	16"

Punched Opening Anchor Reactions

Nail Fin Anchorage		Window Design Pressure:		65.00				
Substrate	Anchor	Anchor Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)	JAMBS	HEAD/SILL	
						Calculated Anchor Spacing	R (lb/in)	Calculated Anchor Spacing
Wood	#10 Wood Screw at Nail Fin	104 lb	72.00	96.00	10.16	10"	8.75	12"
	#12 Wood Screw at Nail Fin	118 lb	72.00	96.00	10.16	12"	8.75	13"
Steel Stud	#10-16 TEKS at Nail Fin	116 lb	72.00	96.00	10.16	11"	8.75	13"
	#12-14 TEKS at Nail Fin	117 lb	72.00	96.00	10.16	12"	8.75	13"
Concrete	3/16" Hilti Kwik-Con II+ at Nail Fin	112 lb	72.00	96.00	10.16	11"	8.75	13"
CMU	3/16" Hilti Kwik-Con II+ at Nail Fin	116 lb	72.00	96.00	10.16	11"	8.75	13"

Punched Opening Anchor Reactions

Nail Fin Anchorage		Window Design Pressure:		70.00				
Substrate	Anchor	Anchor Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)	JAMBS	HEAD/SILL	
						Calculated Anchor Spacing	R (lb/in)	Calculated Anchor Spacing
Wood	#10 Wood Screw at Nail Fin	104 lb	72.00	120.00	12.25	8"	8.75	12"
	#12 Wood Screw at Nail Fin	118 lb	72.00	120.00	12.25	10"	8.75	13"
Steel Stud	#10-16 TEKS at Nail Fin	116 lb	72.00	120.00	12.25	9"	8.75	13"
	#12-14 TEKS at Nail Fin	117 lb	72.00	120.00	12.25	10"	8.75	13"
Concrete	3/16" Hilti Kwik-Con II+ at Nail Fin	112 lb	72.00	120.00	12.25	9"	8.75	13"
CMU	3/16" Hilti Kwik-Con II+ at Nail Fin	116 lb	72.00	120.00	12.25	9"	8.75	13"

Punched Opening Anchor Reactions

Nail Fin Anchorage		Window Design Pressure:		80.00				
Substrate	Anchor	Anchor Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)	JAMBS	HEAD/SILL	
						Calculated Anchor Spacing	R (lb/in)	Calculated Anchor Spacing
Wood	#10 Wood Screw at Nail Fin	104 lb	60.00	60.00	8.33	12"	7.29	14"
	#12 Wood Screw at Nail Fin	118 lb	60.00	60.00	8.33	14"	7.29	16"
Steel Stud	#10-16 TEKS at Nail Fin	116 lb	60.00	60.00	8.33	14"	7.29	16"
	#12-14 TEKS at Nail Fin	117 lb	60.00	60.00	8.33	14"	7.29	16"
Concrete	3/16" Hilti Kwik-Con II+ at Nail Fin	112 lb	60.00	60.00	8.33	13"	7.29	15"
CMU	3/16" Hilti Kwik-Con II+ at Nail Fin	116 lb	60.00	60.00	8.33	14"	7.29	16"

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STRAP ANCHOR ALTERNATE ANCHORAGE

Punched Opening Anchor Reactions

Strap Anchorage		Window Design Pressure: 70.00						JAMBS	HEAD/SILL
Substrate	Anchor	Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)			Calculated	
								Anchor	R
								Spacing	Calculated
									Anchor
									Spacing
Wood	#10 Wood Screw at Strap	194 lb	60.00	99.00	10.16	19"	7.29	27"	
	#12 Wood Screw at Strap	247 lb	60.00	99.00	10.16	24"	7.29	34"	
Steel Stud	#10-16 TEKS at Strap	287 lb	60.00	99.00	10.16	28"	7.29	39"	
	#12-14 TEKS at Strap	306 lb	60.00	99.00	10.16	30"	7.29	42"	
Concrete	3/16" Hilti Kwik-Con II+ at Strap	215 lb	60.00	99.00	10.16	21"	7.29	29"	
CMU	3/16" Hilti Kwik-Con II+ at Strap	150 lb	60.00	99.00	10.16	15"	7.29	21"	

Punched Opening Anchor Reactions

Strap Anchorage		Window Design Pressure: 65.00						JAMBS	HEAD/SILL
Substrate	Anchor	Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)			Calculated	
								Anchor	R
								Spacing	Calculated
									Anchor
									Spacing
Wood	#10 Wood Screw at Strap	194 lb	72.00	96.00	10.16	19"	8.75	22"	
	#12 Wood Screw at Strap	247 lb	72.00	96.00	10.16	24"	8.75	28"	
Steel Stud	#10-16 TEKS at Strap	287 lb	72.00	96.00	10.16	28"	8.75	33"	
	#12-14 TEKS at Strap	306 lb	72.00	96.00	10.16	30"	8.75	35"	
Concrete	3/16" Hilti Kwik-Con II+ at Strap	215 lb	72.00	96.00	10.16	21"	8.75	25"	
CMU	3/16" Hilti Kwik-Con II+ at Strap	150 lb	72.00	96.00	10.16	15"	8.75	17"	

Punched Opening Anchor Reactions

Strap Anchorage		Window Design Pressure: 70.00						JAMBS	HEAD/SILL
Substrate	Anchor	Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)			Calculated	
								Anchor	R
								Spacing	Calculated
									Anchor
									Spacing
Wood	#10 Wood Screw at Strap	194 lb	72.00	120.00	12.25	16"	8.75	22"	
	#12 Wood Screw at Strap	247 lb	72.00	120.00	12.25	20"	8.75	28"	
Steel Stud	#10-16 TEKS at Strap	287 lb	72.00	120.00	12.25	23"	8.75	33"	
	#12-14 TEKS at Strap	306 lb	72.00	120.00	12.25	25"	8.75	35"	
Concrete	3/16" Hilti Kwik-Con II+ at Strap	215 lb	72.00	120.00	12.25	18"	8.75	25"	
CMU	3/16" Hilti Kwik-Con II+ at Strap	150 lb	72.00	120.00	12.25	12"	8.75	17"	

Punched Opening Anchor Reactions

Strap Anchorage		Window Design Pressure: 80.00						JAMBS	HEAD/SILL
Substrate	Anchor	Capacity	Width, w (inch)	Height, h (inch)	R (lb/in)			Calculated	
								Anchor	R
								Spacing	Calculated
									Anchor
									Spacing
Wood	#10 Wood Screw at Strap	194 lb	60.00	60.00	8.33	23"	7.29	27"	
	#12 Wood Screw at Strap	247 lb	60.00	60.00	8.33	30"	7.29	34"	
Steel Stud	#10-16 TEKS at Strap	287 lb	60.00	60.00	8.33	34"	7.29	39"	
	#12-14 TEKS at Strap	306 lb	60.00	60.00	8.33	37"	7.29	42"	
Concrete	3/16" Hilti Kwik-Con II+ at Strap	215 lb	60.00	60.00	8.33	26"	7.29	29"	
CMU	3/16" Hilti Kwik-Con II+ at Strap	150 lb	60.00	60.00	8.33	18"	7.29	21"	

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REFERENCE MATERIAL

TEKS Screw References

TABLE 5—FASTENER STRENGTH OF SCREWS^{1, 2, 3, 4, 5}

SCREW DESIGNATION	DIAMETER (in.)	ALLOWABLE FASTENER STRENGTH		NOMINAL FASTENER STRENGTH	
		Tensile, P_{ts}/Ω (lbf)	Shear, P_{ss}/Ω (lbf)	Tensile, P_{ts} (lbf)	Shear, P_{ss} (lbf)
10-16	0.190	885	573	2654	1718
12-14	0.216	1184	724	3551	2171
12-24	0.216	1583	885	4750	2654
$\frac{1}{4}$ -14	0.250	1605	990	4816	2970
$\frac{1}{4}$ -28	0.250	1922	1308	5767	3925

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²For shear connection, the lower of the allowable shear (bearing) and the allowable fastener shear strength found in Table 4 and 5, respectively, must be used for design.

³See Section 4.1 for fastener spacing and end distance requirements.

⁴Nominal strengths are based on laboratory tests

⁵To calculate LRFD values, multiply nominal strength values by the LRFD Φ factor of 0.5.

TABLE 22.11 (Spaced Threads)

6063-T6												
Nominal Thread Diameter & Thread Per Inch	D Nominal Thread Diameter (Inch)	Aluminum Thickness (Inches)										
		0.038	0.060	0.072	0.080	0.094	0.125	0.156	0.188	0.250	0.312	0.375
		Allowable Pullout (Pounds)										
#8-18	0.1640	53	83	100	132	155	235	350	468	669	835	1004
#10-16	0.1900	61	96	116	153	180	239	372	509	775	968	1163
#12-14	0.2160	--	110	132	174	204	271	374	530	833	1100	1322
1/4-14	0.2500	--	127	152	201	236	314	433	614	964	1273	1530
5/16-12	0.3125	--	--	--	--	--	--	--	809	1334	1860	2296
3/8-12	0.3750	--	--	--	--	--	--	--	971	1601	2232	2755
6063-T6							Shading indicates transition region.					
F _U (Tensile Ultimate Strength)		30000		psi								
F _Y (Tensile Yield Strength)		25000		psi								

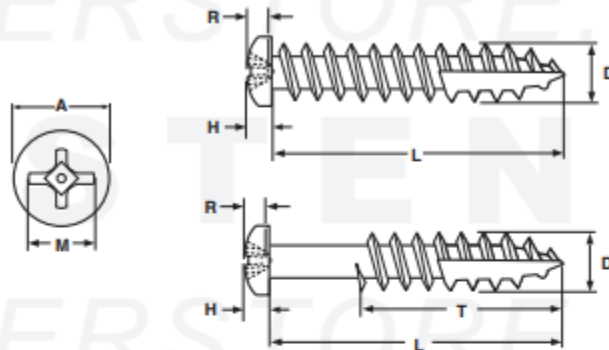
NOTE 32:

- Each table lists allowable pull-out (internal threads) values. $S_F = 3.0$ for $D \leq 0.25"$; $S_F = 2.5$ for $D \geq 0.3125"$. Fastener allowable strength (basic tension and external threads) needs to be checked separately.
- For pilot hole sizes refer to tables 21.1 to 21.7
- Fastener pullout not shown for aluminum thickness less than approximately 2 threads, unless tested at a lesser thickness.
- Multiple fastener connections and embrittlement need to be checked separately.

WOOD SCREWS

**Pan Head w/
Phillips Recess**

TYPE-17 DEEP THREAD



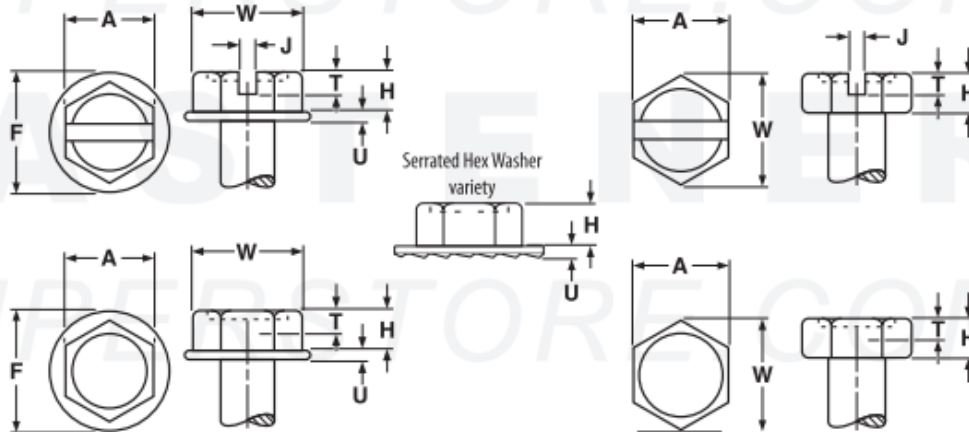
PAN PHILLIPS RECESS DEEP THREAD WOOD SCREW WITH TYPE-17 POINT													
Nominal Diameter & Threads per Inch	A		H		R		M	D		T		Torque Kg/cm (Steel screws)	Recess Size
	Head Diameter		Head Height		Recess Penetration Depth		Recess Diameter	Major Diameter		Threaded Length			
	Max	Min	Max	Min	Max	Min	Ref	Max	Min	L ≤ 1"	L > 1"	Min	
6-13	0.270	0.256	0.097	0.087	0.080	0.055	0.159	0.142	0.131	Full thread	2/3 thread	21	#2
7-12	0.296	0.281	0.106	0.096	0.089	0.064	0.170	0.158	0.147	Full thread	2/3 thread	28	#2
8-11	0.322	0.306	0.115	0.105	0.097	0.071	0.175	0.169	0.159	Full thread	2/3 thread	37	#2
10-9	0.373	0.357	0.133	0.122	0.113	0.089	0.192	0.194	0.185	Full thread	2/3 thread	55	#2
12-8	0.425	0.407	0.151	0.139	0.124	0.098	0.252	0.230	0.213	Full thread	2/3 thread	64	#3
Tolerance on Length	Up to 5/8"						± 0.03						
	Over 5/8 to 1.5"						± 0.05						
	Over 1.5 to 2.75"						± 0.06						
	Over 2.75"						± 0.09						

Description	An externally threaded fastener with a dome-shaped head, cross recess and a single lead thread. The shank has a reduced diameter and a chip cavity cut out where the final several threads end at the tip.	
Applications / Advantages	The deeper thread design offers greater resistance to pull-out forces. Popular in fastening cabinet hardware in locations that do not require the head to countersink. The chip cavity (or auger point) are designed to attach hinges to the edge of hardwood face frames.	Used in environments where corrosion resistance is necessary. The type-17 point enables the screw to more easily penetrate the material into which it's fastened. Can be used in particle board, wood and some plastics.
Material	C1018 - 1022 case-hardened steel	18-8 Stainless Steel
Surface Hardness	Vickers 450 HV minimum	-
Case Depth	0.004" - 0.009"	-
Torque	See values in above table	-
Plating	See Appendix-A for plating information	Stainless deep thread screws are usually supplied without additional finish.

SELF-TAPPING SCREWS

Hex & Hex Washer Heads

HEAD DIMENSIONS



HEX & HEX WASHER HEADS FOR SELF-TAPPING & SELF-DRILLING SCREWS												ASME B18.6.3—2013*	
Nominal Size	A		W	H		F		U		J		T	
	Width Across Flats		Width Across Corners	Height of Head		Diameter of Washer		Thickness of Washer		Width of Slot		Depth of Slot	
	Max	Min	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	.188	.181	.202	.060	.049	.243	.225	.019	.011	.039	.031	.036	.025
6	.250	.244	.272	.093	.080	.328	.302	.025	.015	.048	.039	.046	.033
7	.250	.244	.272	.093	.080	.328	.302	.029	.017	.048	.039	.054	.040
8	.250	.244	.272	.110	.096	.348	.322	.031	.019	.054	.045	.066	.052
10	.312	.305	.340	.120	.105	.414	.384	.031	.019	.060	.050	.072	.057
12	.312	.305	.340	.155	.139	.432	.398	.039	.022	.067	.056	.093	.077
14	.375	.367	.409	.190	.172	.520	.480	.050	.030	.075	.064	.101	.083
1/4 (standard)	.375	.367	.409	.190	.172	.520	.480	.050	.030	.075	.064	.101	.083
1/4 (special)	.438	.428	.484	.188	.150	.618	.574	.055	.030	.084	.072	.110	.090
5/16 (special)	.438	.428	.484	.230	.172	.676	.574	.063	.040	.084	.072	.122	.090
5/16 (standard)	.500	.489	.545	.230	.208	.676	.624	.055	.035	.084	.072	.122	.100
3/8	.562	.551	.614	.295	.270	.780	.720	.063	.037	.094	.081	.156	.131
1/2*	.750	.735	.820	.400	.367	1.040	.960	.085	.050	.106	.091	.190	.165

* Slot dimensions for 1/2-inch diameter hex washer head tapping screws are independent of ASME B18.6.3

Tap & Clearance Drill Sizes				Tap Drill				Clearance Drill			
Screw Size	Major Diameter	Threads Per Inch	Minor Diameter	75% Thread for Aluminum, Brass, & Plastics		50% Thread for Steel, Stainless, & Iron		Close Fit		Free Fit	
				Drill Size	Dec. Eq.	Drill Size	Dec. Eq.	Drill Size	Dec. Eq.	Drill Size	Dec. Eq.
0	.0600	80	.0447	3/64	.0469	55	.0520	52	.0635	50	.0700
1	.0730	64	.0538	53	.0595	1/16	.0625	48	.0760	46	.0810
		72	.0560	53	.0595	52	.0635				
2	.0860	56	.0641	50	.0700	49	.0730	43	.0890	41	.0960
		64	.0668	50	.0700	48	.0760				
3	.0990	48	.0734	47	.0785	44	.0860	37	.1040	35	.1100
		56	.0771	45	.0820	43	.0890				
4	.1120	40	.0813	43	.0890	41	.0960	32	.1160	30	.1285
		48	.0864	42	.0935	40	.0980				
5	.125	40	.0943	38	.1015	7/64	.1094	30	.1285	29	.1360
		44	.0971	37	.1040	35	.1100				
6	.138	32	.0997	36	.1065	32	.1160	27	.1440	25	.1495
		40	.1073	33	.1130	31	.1200				
8	.1640	32	.1257	29	.1360	27	.1440	18	.1695	16	.1770
		36	.1299	29	.1360	26	.1470				
10	.1900	24	.1389	25	.1495	20	.1610	9	.1960	7	.2010
		32	.1517	21	.1590	18	.1695				
12	.2160	24	.1649	16	.1770	12	.1890	2	.2210	1	.2280
		28	.1722	14	.1820	10	.1935				
		32	.1777	13	.1850	9	.1960				
1/4	.2500	20	.1887	7	.2010	7/32	.2188	F	.2570	H	.2660
		28	.2062	3	.2130	1	.2280				
		32	.2117	7/32	.2188	1	.2280				
5/16	.3125	18	.2443	F	.2570	J	.2770	P	.3230	Q	.3320
		24	.2614	I	.2720	9/32	.2812				
		32	.2742	9/32	.2812	L	.2900				
3/8	.3750	16	.2983	5/16	.3125	Q	.3320	W	.3860	X	.3970
		24	.3239	Q	.3320	S	.3480				
		32	.3367	11/32	.3438	T	.3580				
7/16	.4375	14	.3499	U	.3680	25/64	.3906	29/64	.4531	15/32	.4687
		20	.3762	25/64	.3906	13/32	.4062				
		28	.3937	Y	.4040	Z	.4130				
1/2	.5000	13	.4056	27/64	.4219	29/64	.4531	33/64	.5156	17/32	.5312
		20	.4387	29/64	.4531	15/32	.4688				
		28	.4562	15/32	.4688	15/32	.4688				
9/16	.5625	12	.4603	31/64	.4844	33/64	.5156	37/64	.5781	19/32	.5938
		18	.4943	33/64	.5156	17/32	.5312				
		24	.5114	33/64	.5156	17/32	.5312				
5/8	.6250	11	.5135	17/32	.5312	9/16	.5625	41/64	.6406	21/32	.6562
		18	.5568	37/64	.5781	19/32	.5938				
		24	.5739	37/64	.5781	19/32	.5938				
11/16	.6875	24	.6364	41/64	.6406	21/32	.6562	45/64	.7031	23/32	.7188
3/4	.7500	10	.6273	21/32	.6562	11/16	.6875	49/64	.7656	25/32	.7812
		16	.6733	11/16	.6875	45/64	.7031				
		20	.6887	45/64	.7031	23/32	.7188				
13/16	.8125	20	.7512	49/64	.7656	25/32	.7812	53/64	.8281	27/32	.8438
7/8	.8750	9	.7387	49/64	.7656	51/64	.7969	57/64	.8906	29/32	.9062
		14	.7874	13/16	.8125	53/64	.8281				
		20	.8137	53/64	.8281	27/32	.8438				
15/16	.9375	20	.8762	57/64	.8906	29/32	.9062	61/64	.9531	31/32	.9688
1	1.000	8	.8466	7/8	.8750	59/64	.9219	1-1/64	1.0156	1-1/32	1.0313
		12	.8978	15/16	.9375	61/64	.9531				
		20	.9387	61/64	.9531	31/32	.9688				

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0	02/16/24	N/A	Original report issue
1	04/03/24	3	Updated Product Certification numbers. Added glass analysis information