

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 1 OF 19

Door Installation Calculations

M700 Sliding Glass Door, Impact

Report R4178.01-122-34-R0

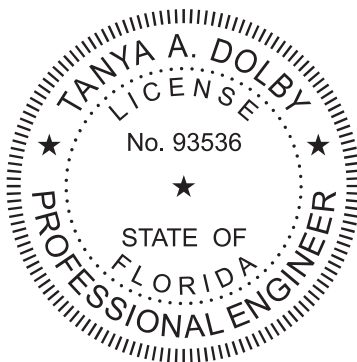
Rendered to:

QUAKER WINDOWS & DOORS
P.O. Box 128
Freeburg, Missouri 65035

Prepared by:

Tanya A. Dolby, P.E.
Adam Kunkel

Architectural Testing, Inc.
130 Derry Court
York, Pennsylvania 17406
(717) 764-7700
Florida COA: 29274



May 24, 2024

Digitally Signed by: Tanya Dolby

Tanya Dolby, P.E.
Manager, Engineering Services
2024.05.31 08:19:20 -04'00'

Adam R. Kunkel
Project Engineer

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 2 OF 19

Scope

Architectural Testing, Inc., an Intertek company, was contracted by Quaker Windows & Doors to evaluate alternate installation methods for their M700 Sliding Glass Door, Impact. 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.

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 3 OF 19

Analyses

Summary of Test Results

The following table summarizes the various M700 Sliding Glass Door 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
M700 Sliding Glass Door (XO)	H4941.01-801-44 (Revision 2, 09/03/19)	NI013987.01-R2	123" x 96"	+/- 50 psf Missile D Wind Zone 4

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:

- H4941.01-801-44, 57" x 87 1/4" Laminated IG Glass

Glass analysis results are shown on page 13 of 19.

As-Tested Installation Analysis

For impact/cycle testing, the test specimen was secured to a 2x Spruce-Pine-Fir buck with #8 x 1-1/2" wood screws through the nail fin. The as-tested installation method is evaluated on page 5 and the established design capacity summarized in Table 2.

Table 2 As-tested Anchorage Design Capacities.

Test	Connection	Capacity
Impact/cycle	#8 x 1-1/2" Wood Screw Through Nail Fin Placed 2" from each corner and 8" on center	86 lb Tension (Head & Jambs) 138 lbs Shear (Sill)

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

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 4 OF 19

Alternate Anchorages

Calculations on pages 8 to 12 of 19 determine the design capacity of alternate installation anchorages for the door. The alternate anchorage capacities are summarized in Table 3.

Table 3 Alternate Anchorage Capacities for Fin Installation

Substrate	Anchor	Capacity	Comments
Wood SYP 2x	#10 x 1-1/2" Wood Screw	104 lb (Tension) 194 lb (Shear)	1. Limited by pull-over
18 Gauge Steel Stud	#10-16 TEKS Screw	116 lb	1. Limited by pull-over
3,000 psi Concrete	3/16" Hilti Kwik-Con+ Anchor	215 lb	1. Limited by shear

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 door size and design pressures. Calculations presented on page 14 show required spacing for the evaluated anchorage conditions. Results are summarized in the following table.

Table 4 Anchorage Requirements

Substrate	Anchor	Spacing at Jambs	Spacing at Head/Sill
Wood SYP 2x	#10 x 1-1/2" Wood Screw	10"	12"
18 Gauge Steel Stud	#10-16 TEKS Screw	11"	14"
3,000 psi Concrete	3/16" Hilti Kwik-Con+ Anchor	N/A	26" (Sill)

The spacings reported in Table 4 exceed the as-tested spacing reported in Table 2. Thus, the as-tested spacing of 8" on center shall govern.

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 5 OF 19

As-Tested Installation – Nail Fin to Wood Head and Jambs

#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

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

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

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

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 6 OF 19

As-Tested Installation – Sill Flashing to Wood

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

0.075" thick 6063-T6 Aluminum Sill Flashing

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 Sill Flashing

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.164")(0.075")(30,000 \text{ psi})/3.0$$

$$V_a = 246 \text{ lb}$$

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.
-----------------------	----------

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 8 OF 19

Alternate Installation – Nail Fin to Wood Head/Jambs

#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

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 9 OF 19

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

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 10 OF 19

Alternate Installation – Sill Flashing to Wood

#10 x 1-1/2" Wood Screw

0.075" 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

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.190")(0.075")(30,000 \text{ psi})/3.0$$

$$V_a = 285 \text{ lb}$$

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

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

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

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

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

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

Capacity of Connection is 194 lb

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 11 OF 19

Alternate Installation – Sill Flashing 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.
-----------------------	----------

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 12 OF 19

Alternate Installation – Sill Flashing 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

0.075" thick 6063-T6 Aluminum Sill Flashing

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

$$V_a = 2DtF_u/n_u$$

$$V_a = 2(0.170")(0.075")(30,000 \text{ psi})/3.0$$

$$V_a = 255 \text{ lb}$$

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: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 13 OF 19

Glass Analysis

57" x 87 1/4" Laminated IG Glass

Analysis 1

Load Resistance Report

May 14, 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. (FT)

Airspace Properties

Thickness: 0.480 in.

Interior Lite Properties (1/4 in. Laminated)

Construction: 1/8 in. (AN) | 0.090 in. (Ionomer) | 1/8 in. (AN)

Load Resistance

Short Duration (3 Sec)

<u>Description</u>	<u>NFL</u>	<u>GTF</u>	<u>LSF</u>	<u>LR</u>
Exterior Lite	32.7 psf	3.80	1/0.500	249 psf
Interior Lite	32.2 psf	1.00	1/0.500	64.4 psf

Comparisons

Scenario 1	
50.0 psf 3.00 sec <= 64.4 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.73 in.
Interior Lite	0.68 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.

NAIL FIN ALTERNATE ANCHORAGE

Punched Opening Anchor Reactions

		Door Design Pressure: 50.00													
Substrate	Anchor	Capacity	Width, w (inch)	Height, h (inch)	R	JAMBS		R	HEAD/SILL		Calculated Anchor	Spacing (lb/in)	R	Calculated Anchor	Spacing
						Calculated	Anchor		Calculated	Anchor					
Wood (Head/Jambs)	#10 Wood Screw at Nailing Fin	104 lb	123.00	96.00	10.16	10"	10"	8.33	12"	12"	8.33	12"	8.33	12"	12"
Steel Stud (Head/Jambs)	#10-16 TEKS at Nailing Fin	116 lb	123.00	96.00	10.16	11"	11"	8.33	14"	14"	8.33	14"	8.33	14"	14"
Concrete (Sill)	3/16" Hilti Kwik-Con+ Anchor	215 lb	123.00	96.00	10.16	21"	21"	8.33	26"	26"	8.33	26"	8.33	26"	26"

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 15 OF 19

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								

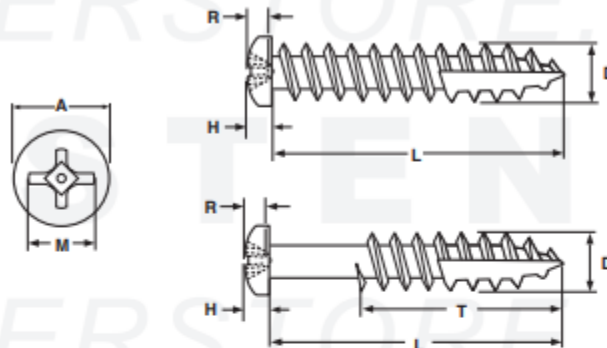
NOTE 32:

- 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



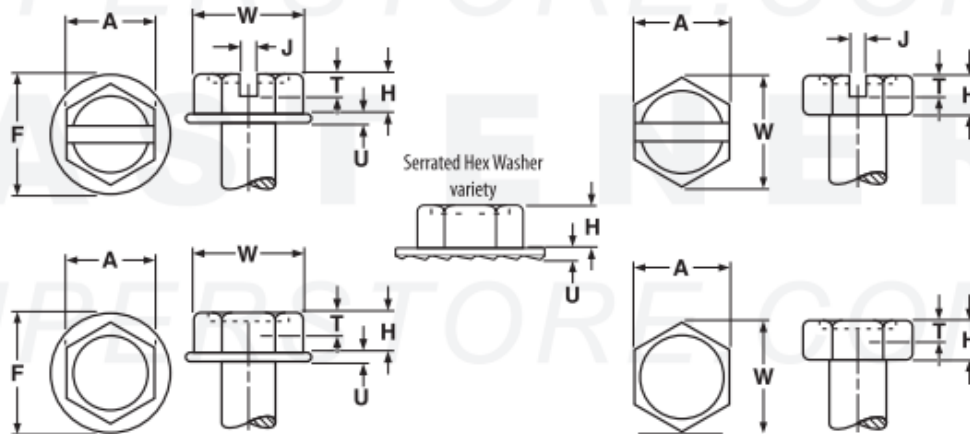
PAN PHILLIPS RECESS DEEP THREAD WOOD SCREW WITH TYPE-17 POINT													
Nominal Diameter & Threads per Inch	A		H		R		M	D		T		Torque Kg/cm (Steel screws)	Recess Size
	Head Diameter		Head Height		Recess Penetration Depth		Recess Diameter	Major Diameter		Threaded Length			
	Max	Min	Max	Min	Max	Min	Ref	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				

	PROJECT: Installation Calculations – M700 SGD, Impact	BY: TAD DATE: 5/24/2024
	PROJECT NO.: R4178.01-122-34-r0	CKD: ARK SHEET: 19 OF 19

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	05/24/24	N/A	Original report issue