Window Installation Analysis

QUAKER WINDOWS & DOORS
C600/C605/W600/W605 Fixed Windows

Report P8760.01-122-34

Rendered to:

Quaker Windows & Doors
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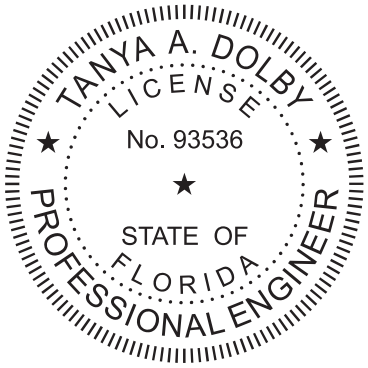

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Scope

Architectural Testing, Inc., an Intertek company, was contracted by Quaker Window & Doors to perform installation analysis for C600/C605/W600/W605 Fixed Windows on test report M3429.01-201-47-r1.

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

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

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

AAMA TIR-A9-14 *Design Guide for Metal Cladding Fasteners, Includes 2020 Addendum*. American Architectural Manufacturers Association, 2014.

AISI S100-16(2020) North American Specification for the Design of Cold-Formed Steel Structural Members, 2020. American Iron and Steel Institute, 2020.

ICC-ES Report ESR-1976 ITW Buildex TEKS Self-Drilling Fasteners. ICC Evaluation Service. 01/2023.

GANA Glazing Manual, 50th Anniversary Edition

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

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

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.

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Analyses

Summary of Test Results

The following table summarizes the C600/C605/W600/W605 Fixed Windows and the corresponding performance level established by testing.

Table 1 Summary of Test Results

Series/Model	Test Report Number	Product Certification	Size (W x H)	Performance
C600/C605/W600/W605 Fixed Windows	M3439.01-201-47-r1 (05/25/22)	NI014507.07-R1	60" x 99"	+/- 100 psf

Testing documented in Table 1 was conducted by the Intertek Testing laboratory in Fridley, Minnesota (Florida Department of Business & Professional Regulation Test Lab No. TST1795, IAS Accredited Laboratory TL-285).

As-Tested Installation Analysis

The test specimen was secured to a 2x Spruce-Pine-Fir wood buck with #8 x 1-5/8” course thread wood/deck screws. The as-tested installation method is evaluated on pages 5 and the established design capacity summarized in Table 2. Alternate anchorage is shown in Table 3 with on center spacings on pages 6 and 7.

Table 2 As-Tested Anchorage Design Capacity

Test	Connection	Capacity
Fixed Window	Nailing Fin with #8 x 1-5/8” course thread wood/deck screws, Located 3" from each corner and 15"-18” on center at head, sill, and jambs	86 lb

Anchorage Requirements

#8 x 1-5/8" PH Wood/Deck Screw actual test anchor capacity based on tested spacing:

Design Pressure	100.0 psf
Anchor Capacity	300.0 lb (Anchor to Wood)

Window Mark	Width, w (inch)	Height, h (inch)	w/h	gamma	R (lb/inch)	Anchor Spacing (in)
Test Unit	60.00	99.00	1.65	0.494	20.57	15

Calculated alternate anchors are shown for 50 psf, 70 psf, and 100 psf design pressures, #10 and #12 fasteners, wood and metal stud substrates.

The alternate anchorage conditions have design capacities which are comparable to or exceeds the design capacity of the as tested anchorage. All anchorage is installed 3" from corners and at the spacing calculated shown on page 6 of 18 for 50 psf, 70 psf, and 100 psf Design Loads. Maximum shim space between the window frame and surrounding substrate is 1/4" for all conditions. Anchors must be fully shimmed and supported.

Alternate Anchorage Capacities

Table 3 Alternate Anchorage Capacity

Installation	Connection	Capacity	Comments
Nailing Fin to Wood	#10 PH Wood Screw	114 lb	1. Limited by pull-over 2. 1 ½" minimum penetration 3. G = 0.55 Minimum SPF
Nailing Fin to Wood	#10 Round Washer Head Wood Screw	178 lb	1. Limited by pull-over 2. 1 ½" minimum penetration 3. G = 0.55 Minimum SPF
Nailing Fin to Wood	#12 PH Wood Screw	130 lb	4. Limited by pull-over 5. Full penetration +3 threads 6. G = 0.55 Minimum SPF
Nailing Fin to Steel	#10 HWH TEKS Screw	128 lb	1. Limited by pull-out 2. Full penetration +3 threads 3. Min 18 gauge 33 KSI steel
Nailing Fin to Steel	#12 HWH TEKS Screw	136 lb	1. Limited by pull-out 2. Full penetration +3 threads 3. Min 18 gauge 33 KSI steel

Required Anchor Spacing at 100 psf, 70 psf, 50 psf Design Pressure

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 14 show required spacing for the evaluated anchorage conditions. Results are summarized in the following table.

Table 5 Anchorage Requirements

Substrate	Anchor	Spacing at Jambs			Spacing at Head/Sill (in)		
		50 psf	70 psf	100 psf	50 psf	70 psf	100 psf
Nailing Fin to Wood	#10 PH Wood Screw	11"	8"	6"	13"	9"	7"
	#10 Round Washer Head Wood Screw	15"	12"	9"	15"	15"	10"
	#12 PH Wood Screw	13"	9"	6"	15"	11"	7"
Nailing Fin to Steel	#10 HWH TEKS Screw	12"	9"	6"	15"	10"	7"
	#12 HWH TEKS Screw	13"	9"	7"	15"	11"	8"

If the spacing reported in Table 5 exceeds the as-tested spacing reported in Table 2, the as-tested spacing shall govern. Spacing limited to 15” on center maximum.

Glazing analysis was conducted and shown on page 14. Glass is shown to have a Load Resistance of 174 psf design pressure, which is greater than the product design pressure rating of 100 psf.

Reference Drawings

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

- M3439.01-201-47-R1 (Test Report Drawings) - C600/C605/W600/W605, 60” x 99” Fixed Window AW100, 05-25-21
- C600/C605 Two Tone Installation Instructions, 07-10-2023
- C600/C605 One Tone Installation Instructions, 07-10-2023
- W600/W605 Two Tone Installation Instructions, 07-10-2023

As-Tested Installation – Nailing Fin to Wood Blocking

#8 x 1-5/8" Pan Head Wood/Deck Screw (Non-Countersunk)
D_{ws} = (0.322” + .0306”)/2 = 0.314” (Nominal Screw Head Diameter)
D_H = 0.177” (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 #8 PH Wood/Deck Screw

W' = 2,850(G^2)(D)(Cd)(Cm)(Ct)(Ceg)(Ctn)(L)
W' = 2,850 (0.42^2)(0.164'')(1.6)(0.7)(0.7)(1.00)(1.0)(1.50'')
W' = 166 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 #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 psi)(0.314" – 0.177")/3.0
P_{nov} = 86 lb

Calculated Capacity of Connection is 86 lb
Actual Tested Capacity is 300 lb
Safety Factor = 300/86 = 3.5
Typical Safety Factor = 3.0, Additional Capacity = 3.5/3.0 = 16.7%
Qualified 10% Increase to Alternate Anchor Capacity Based on Tested Unit

1 - Alternate Installation – #10 Pan Head Wood Screw, Nail Fin to Wood

#10 Pan Head Wood Screw
D_{ws} = (0.373” + .0357”)/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 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 psi)(0.365” – 0.199'')/3.0
P_{nov} = 104 lb

Calculated Capacity of Connection is 104 lb
Capacity of Connection at 10% Over is 114 lb (OK per Tested Capacity)

2 - Alternate Installation – #10 Round Washer Head Wood Screw, Nail Fin to Wood

#10 Round Washer Head Wood Screw
D_{ws} = (0.500” + .472”)/2 = 0.486” (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 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 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 Round Washer Head Wood Screw

$P_{nov} = C_{pov} t_1 F_{tu1} (D_{ws} - D_h)/3.0$
P_{nov} = 1.0(0.0625")(30,000 psi)(0.486" – 0.201")/3.0
P_{nov} = 178 lb

Calculated Capacity of Connection is 178 lb

3 - Alternate Installation – #12 PH Wood Screw, Nail Fin to Wood

#12 Pan Head Wood Screw

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 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 #12 PH Wood Screw

$P_{nov} = C_{pov}t_1F_{tu1}(D_{ws}-D_h)/3.0$
P_{nov} = 1.0(0.0625")(30,000 psi)(0.416" – 0.228")/3.0
P_{nov} = 118 lb

Calculated Capacity of Connection is 118 lb
Capacity of Connection at 10% Over is 130 lb (OK per Tested Capacity)

4 - Alternate Installation – #10 HWH TEKS Screw, Nailing Fin to Steel Stud

#10 HWH 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)

¼" maximum shim space

Allowable Tension of #10-16 TEKS Screw

V_a = 885 lb (ESR-1976)

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

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

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

P_{nov} = 131 lb

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

$P_{not} = 0.85t_cdF_{u2}/3.0$

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

P_{not} = 116 lb

Calculated Capacity of Connection is 116 lb
Capacity of Connection at 10% Over is 128 lb (OK per Tested Capacity)

5 - Alternate Installation – #12 HWH TEKS Screw, Nailing Fin to Steel Stud

#12 HWH 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)

¼" maximum shim space

Allowable Tension of #12 HWH TEKS Screw

V_a = 1184 lb (ESR-1976)

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

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

$P_{nov} = 1.0(0.0625")(30{,}000\ psi)(0.415" - 0.216")/3.0$

P_{nov} = 124 lb

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

$P_{not} = 0.85t_cdF_{u2}/3.0$

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

P_{not} = 131 lb

Calculated Capacity of Connection is 124 lb
Capacity of Connection at 10% Over is 136 lb (OK per Tested Capacity)

Glass Analysis

Analysis 1

Load Resistance Report

March 22, 2024

Details

Selected standard: ASTM E1300 Extended Basic

Glazing Construction (Double Glazed Insulating Unit)

Exterior Lite Properties (3/16 in. Monolithic)

Construction: 3/16 in. (FT)

Airspace Properties

Thickness: 0.625 in.

Interior Lite Properties (3/16 in. Monolithic)

Construction: 3/16 in. (FT)

Load Resistance

Short Duration (3 Sec)

Description	NFL	GTF	LSF	LR
Exterior Lite	24.1 psf	3.60	1/0.500	174 psf
Interior Lite	24.1 psf	3.60	1/0.500	174 psf

Comparisons

Scenario 1

100 psf 3.00 sec <= 174 psf	OK
Approximate center of glass deflection	
Exterior Lite	1.28 in. *
Interior Lite	1.28 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.

* Deflection value extends beyond deflection chart

Glass makeup is sufficient for 100 psf design pressure.

Anchorage Spacing Calculation

Punched Opening Anchor Reactions

Roark's Formulas for Stress & Strain (Sixth Ed.) Table 26-1a

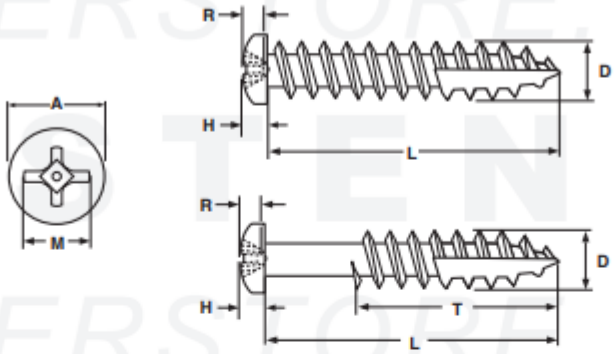
Design Pressure (psf) =	**100.0**							
Window Mark	**Description**	**Anchor Capacity**	**Width, w (inch)**	**Height, h (inch)**	**w/h**	**gamma**	**R (lb/inch)**	**Anchor Spacing (in)**
Jamb	#10 PH to to Wood	114.0	60.00	99.00	1.65	0.494	20.57	6
Head			60.00	60.00	1.00	0.420	17.50	7
Jamb	#10 Round Head w/ Washer to Wood	178.0	60.00	99.00	1.65	0.494	20.57	9
Head			60.00	60.00	1.00	0.420	17.50	10
Jamb	#12 PH to Wood	130.0	60.00	99.00	1.65	0.494	20.57	6
Head			60.00	60.00	1.00	0.420	17.50	7
Jamb	#10 TEKS to Metal Stud	128.0	60.00	99.00	1.65	0.494	20.57	6
Head			60.00	60.00	1.00	0.420	17.50	7
Jamb	#12 TEKS to Metal Stud	136.0	60.00	99.00	1.65	0.494	20.57	7
Head			60.00	60.00	1.00	0.420	17.50	8
Design Pressure (psf) =	**70.0**							
Window Mark	**Description**	**Anchor Capacity**	**Width, w (inch)**	**Height, h (inch)**	**w/h**	**gamma**	**R (lb/inch)**	**Anchor Spacing (in)**
Jamb	#10 PH to to Wood	114.0	60.00	99.00	1.65	0.494	14.40	8
Head			60.00	60.00	1.00	0.420	12.25	9
Jamb	#10 Round Head w/ Washer to Wood	178.0	60.00	99.00	1.65	0.494	14.40	12
Head			60.00	60.00	1.00	0.420	12.25	15
Jamb	#12 PH to Wood	130.0	60.00	99.00	1.65	0.494	14.40	9
Head			60.00	60.00	1.00	0.420	12.25	11
Jamb	#10 TEKS to Metal Stud	128.0	60.00	99.00	1.65	0.494	14.40	9
Head			60.00	60.00	1.00	0.420	12.25	10
Jamb	#12 TEKS to Metal Stud	136.0	60.00	99.00	1.65	0.494	14.40	9
Head			60.00	60.00	1.00	0.420	12.25	11
Design Pressure (psf) =	**50.0**							
Window Mark	**Description**	**Anchor Capacity**	**Width, w (inch)**	**Height, h (inch)**	**w/h**	**gamma**	**R (lb/inch)**	**Anchor Spacing (in)**
Jamb	#10 PH to to Wood	114.0	60.00	99.00	1.65	0.494	10.28	11
Head			60.00	60.00	1.00	0.420	8.75	13
Jamb	#10 Round Head w/ Washer to Wood	178.0	60.00	99.00	1.65	0.494	10.28	17
Head			60.00	60.00	1.00	0.420	8.75	20
Jamb	#12 PH to Wood	130.0	60.00	99.00	1.65	0.494	10.28	13
Head			60.00	60.00	1.00	0.420	8.75	15
Jamb	#10 TEKS to Metal Stud	128.0	60.00	99.00	1.65	0.494	10.28	12
Head			60.00	60.00	1.00	0.420	8.75	15
Jamb	#12 TEKS to Metal Stud	136.0	60.00	99.00	1.65	0.494	10.28	13
Head			60.00	60.00	1.00	0.420	8.75	16

Anchor Spacing is limited to the as tested spacing of 15” on center.

Appendix

WOOD SCREWS

Pan Head w/ Phillips Recess — **TYPE-17 DEEP THREAD**



PAN PHILLIPS RECESS DEEP THREAD WOOD SCREW WITH TYPE-17 POINT

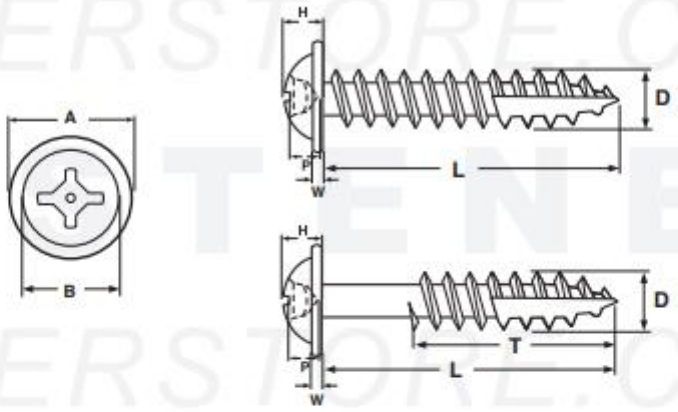
Nominal Diameter & Threads per Inch	A		H		R		M	D		T		Torque Kg/cm (Steel screws)	Recess Size
	Head Diameter		Head Height		Recess Penetration Depth		Recess Diameter	Major Diameter		Threaded Length			
	Max	Min	Max	Min	Max	Min	Ref	Max	Min	L ≤ 1"	L > 1"	Min	
6-13	0.270	0.256	0.097	0.087	0.080	0.055	0.159	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.

WOOD SCREWS

Round Washer Head w/ Square/Phillips Combo Recess — TYPE-17 DEEP THREAD



Round Washer Square/Phillips Recess Deep Thread Wood Screw w/ Type-17 Point

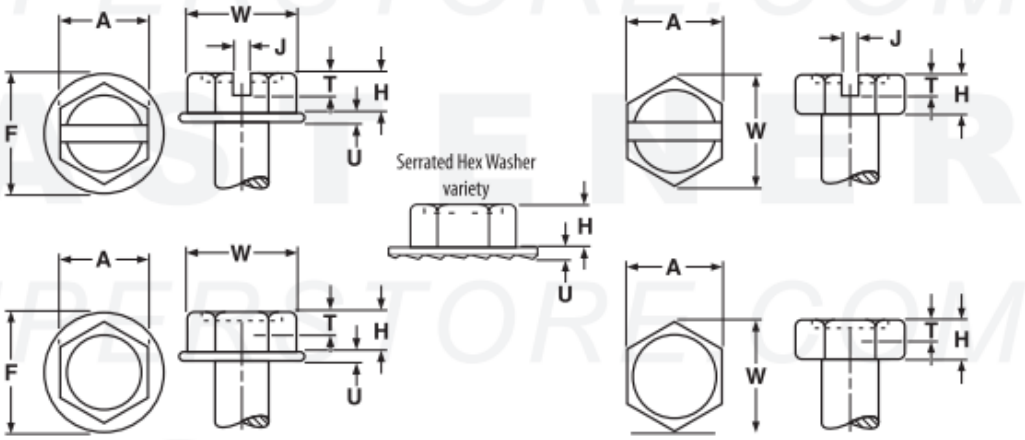
Nominal Diameter	A Washer Diameter		B Head Diameter	H Total Head Height		P Recess Depth		W Washer Thickness		D Major Diameter		T Threaded Length		Recess Size (Square & Phillips)
	Max	Min	Ref	Max	Min	Max	Min	Max	Min	Max	Min	L ≤ 1"	L > 1"	
8	0.376	0.352	0.305	0.120	0.110	0.080	0.065	0.050	0.030	0.174	0.164	Full thread	2/3 thread	#2
10	0.500	0.472	0.300	0.130	0.118	0.073	0.049	0.060	0.040	0.197	0.183	Full thread	2/3 thread	#2

Tolerance on Length	Up to 5/8"	+0 / -0.03
	Over 5/8 to 1.5"	+0 / -0.05
	Over 1.5 to 2.75"	+0 / -0.06
	Over 2.75 to 5"	+0 / -0.09

Description	An externally threaded fastener with a dome-shaped head and an integrally formed washer; a recess that can accomodate either a Phillips or Square screwdriver; and a single lead thread. The shank has a reduced diameter and a chip cavity cut out where the final several threads, ending at the tip.
Applications / Advantages	The deeper thread design offers greater resistance to pull-out forces. The chip cavity (or auger point) enables the fastener to drive—especially in denser woods—without pre-drilling a pilot hole. The head offers a greater bearing surface than a countersunk design. Used to attach surface-mounted door hinges or master lock hasps into dense woods or when attaching two pieces of wood through a pocket hole.
Material	C1022 case-hardened steel
Surface Hardness	Rockwell C 45 minimum
Case Depth	0.004" - 0.009"
Torque	#8 Diameter: 35 kg/cm minimum #10 Diameter: 50 kg/cm minimum
Plating	See Appendix-A for plating information

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

Tap & Clearance Drill Sizes

Screw Size	Major Diameter	Threads Per Inch	Minor Diameter	Tap Drill				Clearance Drill			
				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				

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	04/06/23	N/A	Original report issue
1	07/19/23	N/A	Updated to FBC 2023
2	03/25/24	All	Added glazing analysis per ASTM E1300