

Prepared with Cooperation from:
Window Craftsmen Inc.
6031 Clark Center Avenue
Sarasota, FL 34238

September 29, 2023

Anchor Calculations:
Installation of Glass Sliding Doors
In Aluminum, Wood or Concrete and Masonry Openings

Window Series:
75R Glass Sliding Doors
Aluminum By-Pass/Center Meet/Pocket

Reference: Test reports NCTL-210-3220-1A, NCTL-210-3220-1B/W-1965

Testing Facility: Certified Testing Laboratories
7252 Narcoossee Rd.
Orlando, Florida 32822

Test Standards: AAMA/WDMA/CSA 101/I.S.2/A440-08
AAMA/WDMA/CSA 101/I.S.2/A440-11
TAS 202-94

Nami #: NI006716
Specimen: 192" x 96" Sliding Glass Pocket Door, XXXX pocket door configuration.

Glazing: 1/4" thick tempered glass

Design Pressure: +75PSF/-75PSF



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Mark A Smith
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75R Glass Sliding Doors
Aluminum By-Pass/Center Meet/Pocket

Notes:

Anchor calculations are based on approved installation instructions and:

- 1) Concrete or masonry substrate where one by, non-structural, wood bucking is employed, use 1/4" ITW Tapcon anchors of sufficient length to achieve a minimum embedment of 1-1/4" into min. 2000 psi concrete or masonry.
- 2) Concrete substrate where wood bucking is not employed, use 1/4" ITW Tapcon anchors of sufficient length to achieve a minimum embedment of 1-1/4" into min. 2000 psi concrete or masonry.
- 3) Wood Frame substrate, use #12 wood screws of sufficient embedment of 1-1/2" into spruce pine, fir or equivalent strength wood framing.
- 4) Aluminum Frame substrate, #12 Tek screw of sufficient length to allow full thread engagement through aluminum. Reference Aluminum Design Manual, Allowable stress design, 5.4. Aluminum to be used is to be 6063-T5, equivalent or stronger.
- 5) Two (2) installation anchors are to be installed at each location except at hook strip. Hook Strips require one (1) installation anchor per anchor location.
- 6) Maximum allowable shim thickness shall be 1/4". A load bearing shim shall be located at each anchor.
- 7) Anchor calculations and analysis comply with the current Florida Building Code and including High Velocity Hurricane Zone.

Tested Installation Anchor Information

Fifty-eight (58) #12 x 1.75 Phillips flat head countersunk sheet metal screws, twenty-four (24) were located in the head and twenty-four (24) in the sill in two rows. Starting 6" max. from the end and spaced 16.25" on center. The Jamb had ten (10) #12 screws 6" from the top and 24.5" max. on center in two rows, and nine (9) #10 X 1.75 pan head screws on the hook strip, 6" from the end and 12.25" max. on center.

Anchors to be qualified:

1. #12 wood screws for installation in wood substrates.
2. 1/4" ITW Tapcons for installation in concrete and masonry substrates.
3. #12 Tek screws for installation into aluminum substrates.

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Anchor Calculations:

#12 wood screw

1-1/2" embedment

Allowable Bearing of 6063-T5 aluminum frame=
 $(F_{by}/1.65)(D)(t) = (16,000/1.65)(.218)(.062) = 131.6 \text{ lbs.}$

Head & Sill

Shear:

Allowable Shear stress 20 ksi

Root diameter = .171 in.

Shear=459 pounds

Allowable shear under load with aluminum in wood is 133.6 pounds

NDS min lateral load in wood for #12 wood screw is 141 pounds

Bending:

Allowable bending stress=64 ksi

Cantilever=.250" , Moment arm=.125

Allowable bending load=256 pounds

Jamb

Shear:

Allowable Shear stress 20 ksi

Root diameter = .171 in.

Shear=459 pounds

Allowable shear under load with aluminum in wood is 133.6 pounds

NDS min lateral load in wood for #12 wood screw is 141 pounds

Bending:

Allowable bending stress=64 ksi

Cantilever=.719" , Moment arm=.360

Allowable bending load=88 pounds

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Hook Strip

Shear:

Allowable Shear stress 20 ksi

Root diameter= .171 in.

Shear=459 pounds

Allowable shear under load with aluminum in wood is 133.6 pounds

NDS min lateral load in wood for #12 wood screw is 141 pounds

1/4" Tapcon

1-1/4" embedment

2000psi concrete

Allowable Bearing of 6063-T5 aluminum frame=

$(F_{by}/1.65)(D)(t) = (16,000/1.65)(.250)(.062) = 150.3 \text{ lbs.}$

Head & Sill

Shear:

Yield Strength = 92 ksi

Allowable shear= 285 pounds

Bending:

Root dia=.175

Allowable bending stress=73.6 ksi

Cantilever=.250" , Moment arm=.125

Allowable bending load= 315 pounds

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Sill

Shear:

Yield Strength = 92 ksi

Allowable Shear = 285 pounds

Bending:

Root dia=.175

Allowable bending stress=73.6 ksi

Cantilever=.336" , Moment arm=.168

Allowable bending load= 234 pounds

Jambs

Shear:

Yield Strength = 92 ksi

Allowable shear= 285

Reduction Factor @ 1.5 spacing = 132 pounds

Bending:

Root dia=.175

Allowable bending stress=73.6 ksi

Cantilever=.719" , Moment arm=.360

Allowable bending load=110 pounds

Hook Strip

Shear:

Proof Load 92 ksi

Root diameter= .175 in.

Shear=285 pounds

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#12 TEK Screw

Min .125" thick aluminum

Allowable Bearing of 6063-T5 aluminum frame=

$$(F_{by}/1.65)(D)(t)=(16,000/1.65)(.218)(.062)=131 \text{ lbs.}$$

$$\text{Pullout: } K_s \times D \times t_2 \times F_{ty2}=(1.01)(.218)(.125)(16000/1.65)=257 \text{ lbs}$$

Head & Sill

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Allowable shear stress 20 ksi

Shear=459 pounds

Shear shall not exceed the least of:

$$2 \times F_{tu1} / x D \times t_1 / n_u = (2)(22000)(.21)(.062/1.95)=293 \text{ lbs}$$

$$2 \times F_{tu2} \times D \times t_2 / n_u = (2)(22000)(.21)(.125/1.95)=593 \text{ lbs}$$

$$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / n_s \text{ for } t_2 \leq t_1 \dots 4.2(((.125^3)(.21))^{1/2})(22000/3)=618 \text{ lbs}$$

$$P_{ns}/1.25n_s=459/(1.25 \times 3)=122.4$$

Bending:

Allowable bending stress=64 ksi

Cantilever=.250" , Moment arm=.125

Allowable bending load=254 pounds

Jamb

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Shear=459 pounds

Shear shall not exceed the least of:

$$2 \times F_{tu1} / x D \times t_1 / n_u = (2)(22000)(.21)(.062/1.95)=293 \text{ lbs}$$

$$2 \times F_{tu2} \times D \times t_2 / n_u = (2)(22000)(.21)(.125/1.95)=593 \text{ lbs}$$

$$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / n_s \text{ for } t_2 \leq t_1 \dots 4.2(((.125^3)(.21))^{1/2})(22000/3)=618 \text{ lbs}$$

$$P_{ns}/1.25n_s=459/(1.25 \times 3)=122.4$$

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Bending:

Allowable bending stress=64 ksi

Cantilever=.719" , Moment arm=.360

Allowable bending load=88 pounds

Hook Strip

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Shear=459 pounds

Shear shall not exceed the least of:

$2 \times F_{tu1} / \pi \times D \times t_1 / n_u = (2)(22000)(.21)(.062/1.95) = 293 \text{ lbs}$

$2 \times F_{tu2} \times D \times t_2 / n_u = (2)(22000)(.21)(.125/1.95) = 593 \text{ lbs}$

$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / n_s \text{ for } t_2 \leq t_1 \dots 4.2(((.125^3)(.21))^{1/2})(22000/3) = 618 \text{ lbs}$

$P_{ns} / 1.25 n_s = 459 / (1.25 \times 3) = 122.4$

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75R Glass Sliding Doors Impact

Load on 192" header and sill:

Area=6,912 square in=48 square feet

Design pressure= 75psf

Total load = 3600 pounds

Load on 96" Jambs and hook strip:

Area=2304 square in=16 square feet

Design Pressure= 75psf

Total load= 1200 pounds

Minimum Anchors required:

Spacing, Locations End Distance & # of Anchors/Location:

Head:	13.84"	14 Locations	6" End Distance	2 Anchor/Loc
Frame Jambs:	12.50"	8 Locations	4.25" End Distance	2 Anchors/Loc
Hook Strip:	7.75"	13 Locations	3.875" End Distance	1 Anchor/Loc
Sill:	13.84"	14 Locations	6" End Distance	2 Anchors/Loc

Verify Anchor Locations Required exceeds # of Anchor Locations during Testing:

Head:	14 Locations Required =>	12 Locations Tested
Frame Jambs:	8 Locations Required=>	5 Locations Tested
Hook Strip:	13 Locations Required =>	9 Locations Tested
Frame Jambs:	14 Locations Required=>	12 Locations Tested

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#12 Wood Anchor:

Head Capacity:	3685 lbs.	>	3600 lbs.	OK
Jamb Capacity:	1408 lbs.	>	1200 lbs.	OK
Hook Strip Capacity:	1274 lbs.	>	1200 lbs.	OK
Sill Capacity:	3685 lbs.	>	3600 lbs.	OK

Combined Bending plus Shear:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$	Fb=64 ksi	Fv=20ksi
Head: $(.500) + (.281) = .781 < 1.0$	OK	
Jamb: $(.839) + (.160) = 0.999 < 1.0$	OK	
Sill: $(.500) + (.281) = .781 < 1.0$	OK	
Hook Strip: $(0) + (.201) = .201 < 1.0$	OK	

#1/4 Tapcon:

Head Capacity:	4200 lbs.	>	3600 lbs.	OK
Jamb Capacity:	1760 lbs.	>	1200 lbs.	OK
Hook Strip Capacity:	1222 lbs.	>	1200 lbs.	OK
Sill Capacity:	4200 lbs.	>	3600 lbs.	OK

Combined Bending plus Shear:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$	Fb=64 ksi	Fv=20ksi
Head: $(.409) + (.452) = .861 < 1.0$	OK	
Jamb: $(.685) + (.129) = .814 < 1.0$	OK	
Sill: $(.409) + (.452) = .861 < 1.0$	OK	
Hook Strip: $(0) + (.1609) = .160 < 1.0$	OK	

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#12 Tek Screw:

Head Capacity:	3685 lbs.	>	3600 lbs.	OK
Jamb Capacity:	1408 lbs.	>	1200 lbs.	OK
Hook Strip Capacity:	1274 lbs.	>	1200 lbs.	OK
Sill Capacity:	3685 lbs.	>	3600 lbs.	OK

Combined Bending plus Shear:

$$(f_b/F_b) + (f_v/F_v) \leq 1.0 \quad F_b = 64 \text{ ksi} \quad F_v = 20 \text{ ksi}$$

$$\text{Head: } (.500) + (.281) = .781 < 1.0 \quad \text{OK}$$

$$\text{Jamb: } (.839) + (.160) = 0.999 < 1.0 \quad \text{OK}$$

$$\text{Sill: } (.500) + (.281) = .781 < 1.0 \quad \text{OK}$$

$$\text{Hook Strip: } (0) + (.201) = .201 < 1.0 \quad \text{OK}$$

Conclusion:**Anchor Locations Required (192" X 96):****Spacing, Locations End Distance & # of Anchors/Location:**

Head:	13-13/16"	14 Locations	6" End Distance	2 Anchor/Loc
Frame Jambs:	12-1/2"	8 Locations	4.25" End Distance	2 Anchors/Loc
Hook Strip:	7-3/4"	13 Locations	3.875" End Distance	1 Anchor/Loc
Sill:	13-13/16"	14 Locations	6" End Distance	2 Anchors/Loc

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