

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

September 17, 2020

Anchor Calculations:
Installation of Double Hung Window
In Aluminum, Wood or Concrete and Masonry Openings

Window Series: **DH-200, 400, 500**
Double Hung Window insulated and insulated impact window

Reference: Test report NCTL-110-14497-2 Report Date: 07/29/11
Reference: Test report NCTL-110-14498-1, 2, 3 & 4 Report Date: 07/30/10

Testing Facility: NCTL
5 Leigh Drive
York, PA, 17406

Reference: Test report AL-02982-A Report Date: 05/30/07

Testing Facility: AIR-INS inc.
1320, boul. Lionel-Boulet,
Varenes Quebec, Canada J3X 1P7

Test Standards: ASTM E 330-04, TAS 201-94, TAS 202-94, TAS 203-94
AAMA/WDMA/CSA 101/I.S. 2/A440-05

Specimen: 52" x 75", 53" x 75" and 44" x 77" Vinyl Double Hung,
Glazing: 7/8" overall thickness, 1 lite of 1/8" DS annealed glass
and 1 lite of Laminated glass which included 2 lites of 1/8" DS
annealed glass with a .090 PVB interlayer
7/8" overall thickness, 2 lites of 1/8" annealed glass

Design Pressure: +70PSF/-70PSF

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Florida No. 55511
3738 Kingswood Drive
Sarasota, FL 34232



Digitally
signed by
Mark Smith
Date:
2020.10.06
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-04'00'

Window Craftsmen, Inc.
DH-200, DH-400, DH-500 Vinyl Double Hung

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 3/16" ITW Tapcon anchors of sufficient length to achieve a minimum embedment of 1-1/4" into concrete or masonry.
- 2) Concrete substrate where wood bucking is not employed, use 3/16" ITW Tapcon anchors of sufficient length to achieve a minimum embedment of 1-1/4" into concrete or masonry.
- 3) Wood Frame substrate, use #10 wood screws of sufficient embedment of 1-1/2" into 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.
- 5) Maximum allowable shim thickness shall be 1/4". A load bearing shim shall be located at each anchor.
- 6) Anchor calculations and analysis comply with the current Florida Building Code.

Tested Installation Anchor Information

Four (4) #8 x 1.5" Phillips flat head counter-sunk sheet metal screws were used to fasten the head and sill into a wooden test buck. Four (4) in the frame head and sill located at 6.00", 19.5", 32.5", 46" measuring from right frame jamb to left frame jamb. The Jambs each had six (6) #8 Phillips flat head counter-sunk sheet metal screws located at 6", 18.5", 31", 44", 56.5", 69".

Anchors to be qualified:

1. #10 wood screws for installation in wood substrates.
2. 3/16" ITW Tapcons for installation in concrete and masonry substrates.
3. #12 Tek screws for installation into aluminum substrates.

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Anchor Calculations:

#10 wood screw
1-1/2" embedment

Head & Sill

Shear:

Proof load 80 ksi
Root diameter = .150 in.
Allowable Shear=353 pounds
NDS min lateral load in wood with metal for #10 wood screw is 121 pounds

Bending:

Allowable bending stress=64 ksi
Cantilever=.209", Moment arm=.105
Allowable bending load=206 pounds

Jamb

Shear:

Proof load 80 ksi
Root diameter = .150 in.
Shear=353 pounds
NDS min lateral load in wood with metal for #10 wood screw is 121 pounds

Bending:

Allowable bending stress=64 ksi
Cantilever=.209", Moment arm=.105
Allowable bending load=206 pounds

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3/16" Tapcon

1-1/4" embedment
2000psi concrete

Head & Sill

Shear:

Yield Strength = 92 ksi
Allowable shear stress 23 ksi
Allowable shear load = 406 pounds
Allowable lateral load = 170 pounds

Bending:

Root dia=.150
Allowable bending stress=73.6 ksi
Cantilever=.209" , Moment arm=.105
Allowable bending load=232 pounds

Jambs

Shear:

Yield Strength = 92 ksi
Allowable shear stress 23 ksi
Allowable shear load = 406 pounds
Allowable shear= 170 pounds

Bending:

Root dia=.150
Allowable bending stress=73.6 ksi
Cantilever=.209" , Moment arm=.105
Allowable bending load=232 pounds

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#12 TEK Screw

Min .045" thick aluminum

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:

$$2 \times F_{tu1} / x D \times t_1 / \nu = (2)(22000)(.206)(.045/1.95) = 209 \text{ lbs}$$

$$2 \times F_{tu2} \times D \times t_2 / \nu = (2)(22000)(.206)(.045/1.95) = 209 \text{ lbs}$$

$$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / \nu \text{ for } t_2 \leq t_1. 4.2(((.045^3)(.206))^{1/2})(22000/3) = 127 \text{ lbs}$$

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

Bending:

Allowable bending stress=64 ksi

Cantilever=.209" , Moment arm=.105

Allowable bending load=523 pounds

Jamb

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Allowable shear stress 20 ksi

Shear=459 pounds

Shear shall not exceed the least of:

$$2 \times F_{tu1} / x D \times t_1 / \nu = (2)(22000)(.206)(.045/1.95) = 209 \text{ lbs}$$

$$2 \times F_{tu2} \times D \times t_2 / \nu = (2)(22000)(.206)(.045/1.95) = 209 \text{ lbs}$$

$$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / \nu \text{ for } t_2 \leq t_1. 4.2(((.045^3)(.206))^{1/2})(22000/3) = 127 \text{ lbs}$$

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

Bending:

Allowable bending stress=64 ksi

Cantilever=.209" , Moment arm=.105

Allowable bending load=523 pounds

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DH-200, DH-400, DH-500 Vinyl Double Hung

70R Series Vinyl Double Hung

Load on 52" header or sill:
Area=676 square in=4.694 square feet
Design pressure= 70psf
Total load = 329 pounds

Load on 75" Jambs:
Area=1612 square in=11.194 square feet
Design Pressure= 70psf
Total load= 784 pounds

Minimum Anchors required, #10 wood screw:

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

Head or Sill: 13.3"	4 Locations	6" End Distance	1 Anchor/Loc
Frame Jambs: 12.5"	7 Locations	6" End Distance	1 Anchors/Loc

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

Head or Sill:	4 Locations Required >	4 Locations Tested
Frame Jambs:	7 Locations Required >	6 Locations Tested

#10 Wood Anchor:

Head or Sill Capacity:	484 lbs.	>	329 lbs.	OK
Jamb Capacity:	847 lbs.	>	784 lbs.	OK

#12 Tek Screw:

Head or Sill:	488 lbs.	>	329 lbs.	OK
Jamb Capacity:	854lbs .	<	784 lbs.	OK

Dade Shear and Bending Load on lesser screw

$(f_b/F_b) + (f_v/F_v)^2 \leq 1.0$
Head or Sill: $(0.453) + (0.233)^2 = (0.734) < 1.0$
Jambs: $(0.543) + (0.317)^2 = (0.644) < 1.0$

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Minimum Anchors required, 3/16 Tapcon:

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

Head or Sill: 13-3/8"	4 Locations	6" End Distance	1 Anchors/Loc
Frame Jambs: 10-1/2"	7 Locations	6" End Distance	1 Anchors/Loc

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

Head or Sill:	4 Locations Required >	4 Locations Tested
Frame Jambs:	7 Locations Required >	6 Locations Tested

3/16" Tapcon:

Head or Sill Capacity:	680 lbs.	>	329 lbs	OK
Jamb Capacity:	1190 lbs.	>	784 lbs.	OK

Dade Shear and Bending Load on screw

$$(fb/Fb)+(fv/Fv)^2 \leq 1.0$$

$$\text{Head or Sill: } (0.354)+(0.202)^2=(0.395)<1.0$$

$$\text{Jambs: } (0.483)+(0.277)^2=(0.560)<1.0$$

Anchor Locations Required (52" X 75") # 10 wood screw, 3/16" Tapcon and #12

Tek Screw:

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

Head or Sill: 13-3/8"	4 Locations	6" End Distance	1 Anchors/Loc
Frame Jamb: 12-1/2"	7 Locations	6" End Distance	1 Anchors/Loc

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