

Prepared with Cooperation from:

November 30, 2020

Window Craftsmen Inc.
6031 Clark Center Avenue
Sarasota, FL 34238

**Anchor Calculations:
Installation of Aluminum Impact Picture Window
In a Wood or Concrete and Masonry Openings**

**Window Series:
60R Aluminum Impact Picture Window**

Reference: Test reports NCTL-210-3403-1 and NCTL-210-3403-1A

Testing Facility: National Certified Testing Laboratories
8350 Parkline Blvd, Suite 320
Orlando, Florida 34232

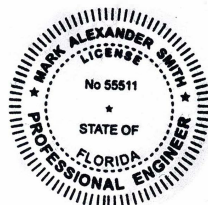
Test Standards: AAMA/WDMA/101/I.S.2/A440-08
AAMA/WDMA/101/I.S.2/A440-11
ASTM E 1886-02/13a
ASTM E 1996-02/14a
TAS 201-94
TAS 202-94
TAS 203-94

Nami #: NI009413

Specimen: 48" wide x 72" high Aluminum Picture Window.
Glazing: 9/16" thick, (2) 1/4" heat strengthened outer layers and a .090" PVB interlayer with NOA# 09-0127.13.

Design Pressure: +60 PSF/-60PSF

Mark A. Smith, P.E.
3738 Kingswood Drive
Sarasota, FL 34232
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Mark Smith
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60R Aluminum Impact Picture Window

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 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 concrete or masonry.
- 3) Wood Frame substrate, use #12 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) Tek screw will also qualify #12 sheet metal screw into steel.
- 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 including High Velocity Hurricane Zone.

Tested Installation Anchor Information

Twenty-four (24) #12 x 1.75" Phillips flat head countersunk sheet metal screws were fastened into a 2" x 6" wooden test buck. The head and sill had #12 screws starting 6" (max) from the corner and spaced 9" on center. The Jamb had #12 screws 6" (max) from the top and bottom 10" on center.

Anchors to be qualified:

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

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Anchor Calculations:

#12 wood screw

1-1/2" embedment

Allowable Bearing of 6063-T5 aluminum frame=
 $(F_{by}/1.65)(D)(t) = (12,000/1.65)(.218)(.050) = 79.3 \text{ lbs.}$

Head & Sill

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Shear=334 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=.508" , Moment arm=.254

Allowable bending load=122 pounds

Jamb

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Shear=334 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=.508" , Moment arm=.254

Allowable bending load=122 pounds

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1/4" Tapcon

1-1/4" embedment
2000psi concrete

Allowable Bearing of 6063-T5 aluminum frame=
 $(F_{by}/1.65)(D)(t) = (12,000/1.65)(.250)(.050) = 90.9 \text{ lbs.}$

Head & Sill

Shear:

Yield Strength = 92 ksi
Allowable shear= 300 pounds (Report ESR-1328)

Bending:

Root dia=.175
Allowable bending stress=73.6 ksi
Cantilever=.508" , Moment arm=.254
Allowable bending load=154 pounds
(Cantilever= .25 shim+.258 aluminum extrusion; Moment arm = Cantilever/2)

Jambs

Shear:

Yield Strength = 92 ksi
Allowable shear= 300 pounds

Bending:

Root dia=.175
Allowable bending stress=73.6 ksi
Cantilever=.508" , Moment arm=.254
Allowable bending load=154 pounds
(Cantilever= .25 shim+.258 aluminum extrusion; Moment arm = Cantilever/2)

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#12 TEK or Sheet Metal Screw

Min .040" thick aluminum or steel Note that the min ultimate strength of steel is 36,000 psi

Allowable Bearing of 6063-T5 aluminum frame=
 $(F_{by}/1.65)(D)(t) = (16,000/1.65)(.218)(.050) = 105 \text{ lbs.}$

Pullout: $K_s \times D \times t_2 \times F_{ty2} = (1.01)(.218)(.040)(16000/1.65) = 85.4 \text{ lbs}$

Head & Sill

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Allowable shear stress 20 ksi

Shear=407 pounds

Shear shall not exceed the least of:

$2 \times F_{tu1} / x D \times t_1 / nu = (2)(22000)(.21)(.050/1.95) = 237 \text{ lbs}$

$2 \times F_{tu2} \times D \times t_2 / nu = (2)(22000)(.21)(.040/1.95) = 190 \text{ lbs}$

$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / ns \text{ for } t_2 \leq t_1 \dots 4.2(((.040^3)(.21))^{1/2})(22000/3) = 113 \text{ lbs}$

$P_{ns} / 1.25ns = 407 / (1.25 \times 3) = 109$

Bending:

Allowable bending stress=64 ksi

Cantilever=.508", Moment arm=.254

Allowable bending load=130 pounds

Jamb

Shear:

Proof load 80 ksi

Root diameter = .171 in.

Shear=407 pounds

Shear shall not exceed the least of:

$2 \times F_{tu1} / x D \times t_1 / nu = (2)(22000)(.21)(.050/1.95) = 237 \text{ lbs}$

$2 \times F_{tu2} \times D \times t_2 / nu = (2)(22000)(.21)(.040/1.95) = 190 \text{ lbs}$

$4.2 \times ((t_2)^3 \times D)^{1/2} \times F_{tu2} / ns \text{ for } t_2 \leq t_1 \dots 4.2(((.040^3)(.21))^{1/2})(22000/3) = 113 \text{ lbs}$

$P_{ns} / 1.25ns = 353 / (1.25 \times 3) = 109$

Bending:

Allowable bending stress=64 ksi

Cantilever=.508", Moment arm=.254

Allowable bending load=130 pounds

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60 Series Picture Window

Load on 48" header and sill:
Area=576 square in=4 square feet
Design pressure= 60psf
Total load = 240 pounds

Load on 72" Jambs:
Area=1152 square in=8 square feet
Design Pressure= 60psf
Total load= 480 pounds

Minimum Anchors required:

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

Head & Sill:	9-1/2"	5 Locations	4-1/2" End Distance	1 Anchors/Loc
Frame Jambs:	10-1/4"	7 Locations	5-1/4" End Distance	1 Anchors/Loc

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

Head & Sill:	5 Locations Required >	5 Locations Tested
Frame Jambs:	7 Locations Required>	7 Locations Tested

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#12 Wood Anchor:

Head & Sill Capacity:	397 lbs.	>	240 lbs.	OK
Jamb Capacity:	555 lbs.	>	480 lbs.	OK

Dade combined Shear & bending Load :
Head:

Combined Bending plus Shear:

(fb/Fb)+(fv/Fv) =< 1.0	Fb=64 ksi	Fv=20ksi
Head & Sill: (.388)+(.104)=.492<1.0	OK	
Jambs: (.554)+(.149)=.703<1.0	OK	

1/4" Tapcon:

Head & Sill Capacity:	454 lbs.	>	240 lbs.	OK
Jamb Capacity:	636 lbs.	>	480 lbs.	OK

Dade combined Shear & bending Load

Combined Bending plus Shear:

(fb/Fb)+(fv/Fv) =< 1.0	Fb=73.6 ksi	Fv=24 ksi
Head: (.311)+(.100)=0.411<1.0	OK	
Jamb: (.445)+(.142)=0.587<1.0	OK	

#12 Tek Screw:

Head & Sill Capacity:	397 lbs.	>	240 lbs.	OK
Jamb Capacity:	555 lbs.	>	480 lbs.	OK

Dade combined Shear & bending Load :
Head:

Combined Bending plus Shear:

(fb/Fb)+(fv/Fv) =< 1.0	Fb=64 ksi	Fv=20ksi
Head & Sill: (.388)+(.104)=.492<1.0	OK	
Jambs: (.554)+(.149)=.703<1.0	OK	

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Conclusion:

Anchor Locations Required (48" X 72"):

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

Head & Sill:	9.500"	5 Locations	5.000" End Distance	1 Anchors/Loc
Frame Jamb:	10.250"	7 Locations	5.250" End Distance	1 Anchors/Loc

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