

Prepared with Cooperation from:

November 30, 2020

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

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

Window Series:
60R Aluminum Picture Window

Reference: Test report NCTL-210-3160-1

Testing Facility: National Certified Testing Laboratories

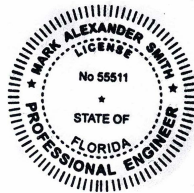
Test Standards: AAMA/WDMA/101/I.S.2-97
AAMA/WDMA/101/I.S.2/A440-08
AAMA/WDMA/101/I.S.2/A440-11

Nami #: NI006062

Specimen: 120" wide x 60" high Aluminum Picture Window

Glazing: 3/16" thick tempered glass

Design Pressure: +60 PSF/-60 PSF



Digitally
signed by
Mark Smith
Date:
2020.11.30
22:52:33[®]
-05'00'

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60R Aluminum 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 (28) #10 x 2" Phillips pan head sheet metal screws were fastened into a 2" x 6" wooden test buck. The head and sill had #10 screws starting 7" (max) from the corner and spaced 12" on center. The jambs had #10 screws 7" max from top and bottom and 12" 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=
 $(F_{by}/1.65)(D)(t) = (16,000/1.65)(.218)(.050) = 105 \text{ lbs.}$

Head & Sill

Shear:

Proof load 80 ksi
Root diameter = .171 in.
Shear=407 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=407 pounds
Allowable shear under load with aluminum in wood is 133.6 pounds
NDS min lateral load in wood for #10 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=
 $(F_{by}/1.65)(D)(t) = (16,000/1.65)(.218)(.050) = 105 \text{ lbs.}$

Head & Sill

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

Jambs

Shear:

Yield Strength = 92 ksi
Allowable shear= 300

Bending:

Root dia=.145
Allowable bending stress=73.6 ksi
Cantilever=.508" , Moment arm=.254
Allowable bending load=154 pounds

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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 = .161 in.

Allowable shear stress 20 ksi

Shear=407 pounds

Shear shall not exceed the least of:

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

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

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

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

Bending:

Allowable bending stress=64 ksi

Cantilever=.508", Moment arm=.254

Allowable bending load=130 pounds

Jamb

Shear:

Proof load 80 ksi

Root diameter = .150 in.

Shear=353 pounds

Shear shall not exceed the least of:

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

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

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

$P_{ns} / 1.25 \nu = 353 / (1.25 \times 3) = 96.8$

Bending:

Allowable bending stress=64 ksi

Cantilever=.508", Moment arm=.254

Allowable bending load=130 pounds

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Load on 120" header and sill:
Area=2700 square in=18.75 square feet
Design pressure= 60psf
Total load = 1125 pounds

Load on 60" Jambs:
Area=900 square in=6.25 square feet
Design Pressure= 60psf
Total load= 375 pounds

**Minimum Anchors required, #10 wood screw and #10 Tek & sheet metal screw,
3/16" Tapcon:**

60" x 120"

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

Head & Sill: 7.75"	15 Locations	6" End Distance	1 Anchors/Loc
Frame Jambs: 12"	5 Locations	6" End Distance	1 Anchors/Loc

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

Head & Sill:	15 Locations Required >	9 Locations Tested
Frame Jambs:	5 Locations Required >	5 Locations Tested

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#12 Wood Anchor:

Head & Sill Capacity:	1189 lbs.	>	1125 lbs.	OK
Jamb Capacity:	397 lbs.	>	375 lbs.	OK

Dade Combined Shear and bending Load:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$ $F_b = 64 \text{ ksi}$ $F_v = 20 \text{ ksi}$
Head and sill: $(.614) + (.225) = .839 < 1.0$ OK
Jambs: $(.614) + (.225) = .839 < 1.0$ OK

1/4" Tapcon:

Head & Sill Capacity:	1363 lbs.	>	1125 lbs.	OK
Jamb Capacity:	454 lbs.	>	375 lbs.	OK

Dade Combined Shear and bending Load:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$ $F_b = 64 \text{ ksi}$ $F_v = 20 \text{ ksi}$
Head and sill: $(.487) + (.250) = .737 < 1.0$ OK
Jambs: $(.487) + (.250) = .737 < 1.0$ OK

#12 Tek & Sheet Metal Screw:

Head & Sill Capacity:	1161 lbs.	>	1125 lbs.	OK
Jamb Capacity:	397 lbs.	>	375 lbs.	OK

Dade Combined Shear and bending Load:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$ $F_b = 64 \text{ ksi}$ $F_v = 20 \text{ ksi}$
 $f_b/F_b + f_v/F_v \leq 1.0$ $F_b = 64 \text{ ksi}$ $F_v = 20 \text{ ksi}$
Head and sill: $(.576) + (.184) = .760 < 1.0$ OK
Jambs: $(.576) + (.184) = .760 < 1.0$ OK

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Conclusion:

Anchor Locations Required 60R (120" X 60") :

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

Head & Sill:	7.75" 15 Locations	6" End Distance	1 Anchors/Loc
Frame Jamb:	12.00" 5 Locations	6" End Distance	1 Anchors/Loc

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