

Prepared with Cooperation from:

April 17, 2015

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

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

**Window Series:
70R Glass Sliding Doors, Impact
Aluminum By-Pass/Center Meet/Pocket**

Reference: Test reports NCTL-210-3220-1D, NCTL-210-3112-1, NCTL-210-3112-1A

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

Test Standards: ASTM E 330-97 AAMA/WDMA/101/I.S.2-97 and
AAMA/WDMA/CSA 101/I.S.2/A440-05,
ASTM E 1886-02, ASTM E 1996-02
TAS 201-94, TAS 202-94, TAS 203-94
ASTM F842-97

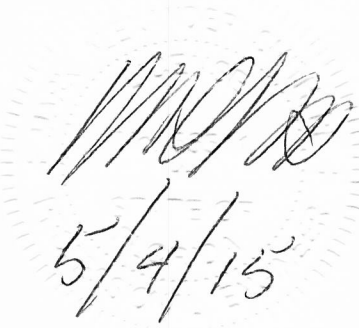
Nami #: NI005980A-R3

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

Glazing: 9/16" overall thickness, 1/4" heat strengthened glass outer layer,
.090 PVB interlayer with NOA# 09-0127.13, 1/4" heat strengthened
glass outer layer.

Design Pressure: +70PSF/-70PSF

Mark A. Smith, P.E.
Florida No. 55511
3738 Kingswood Drive
Sarasota, FL 34232

A circular stamp containing a handwritten signature and the date 5/4/15.

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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) 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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3738 Kingswood Drive
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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

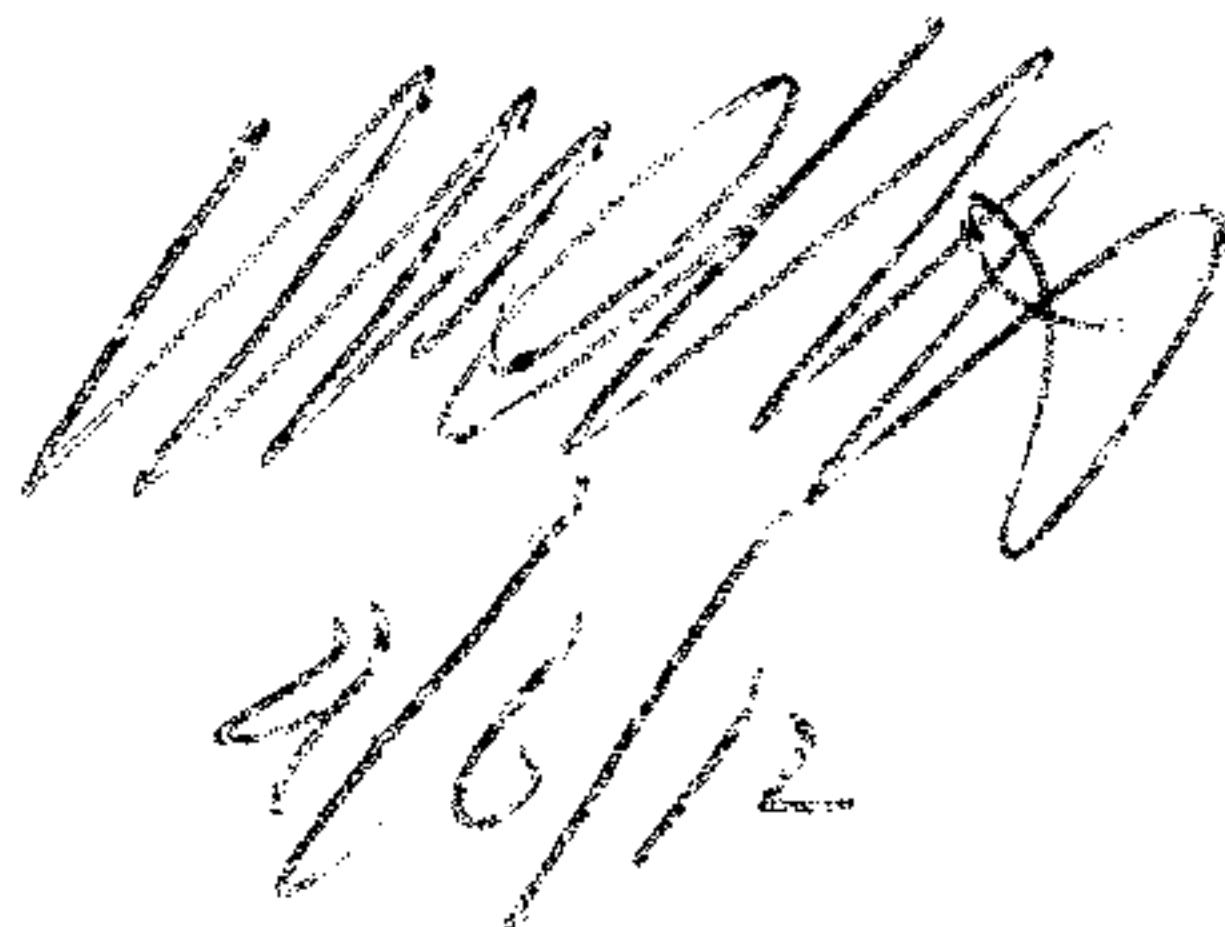
Bending:

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:

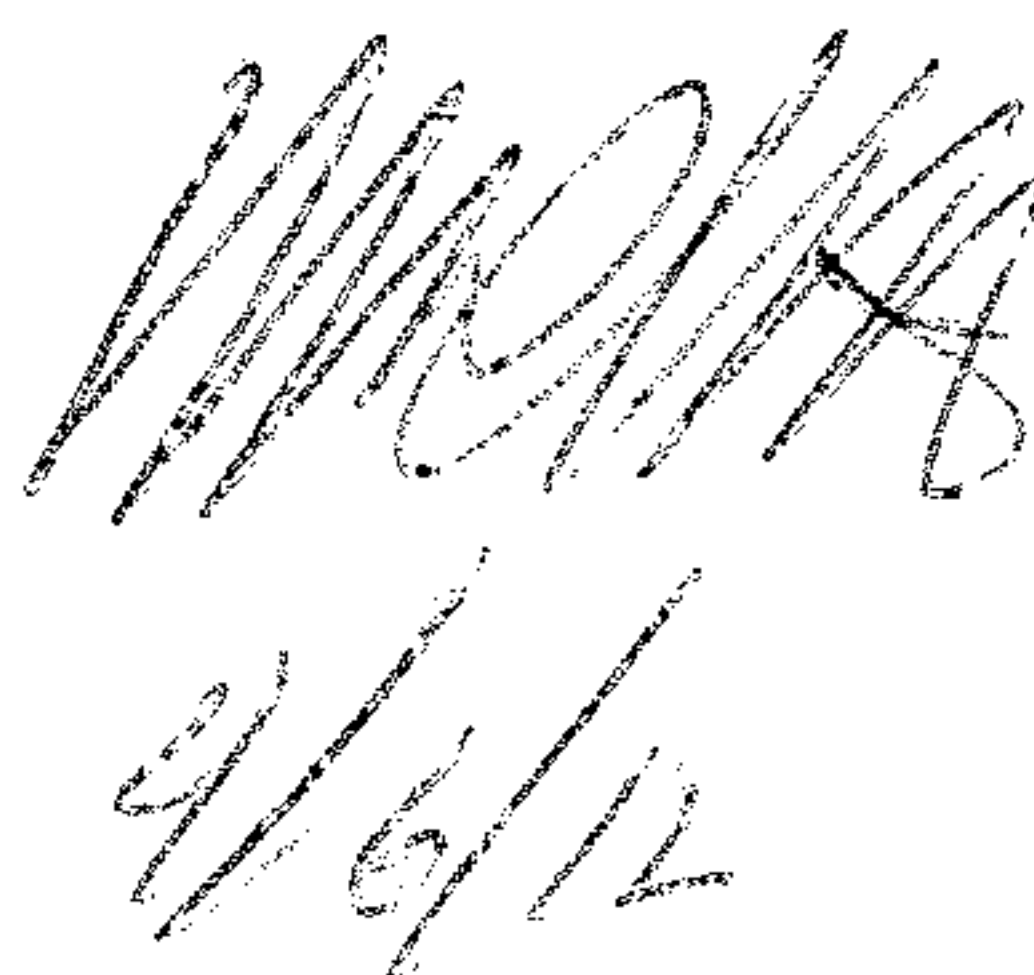
Root dia=.175

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:

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

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

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

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

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:

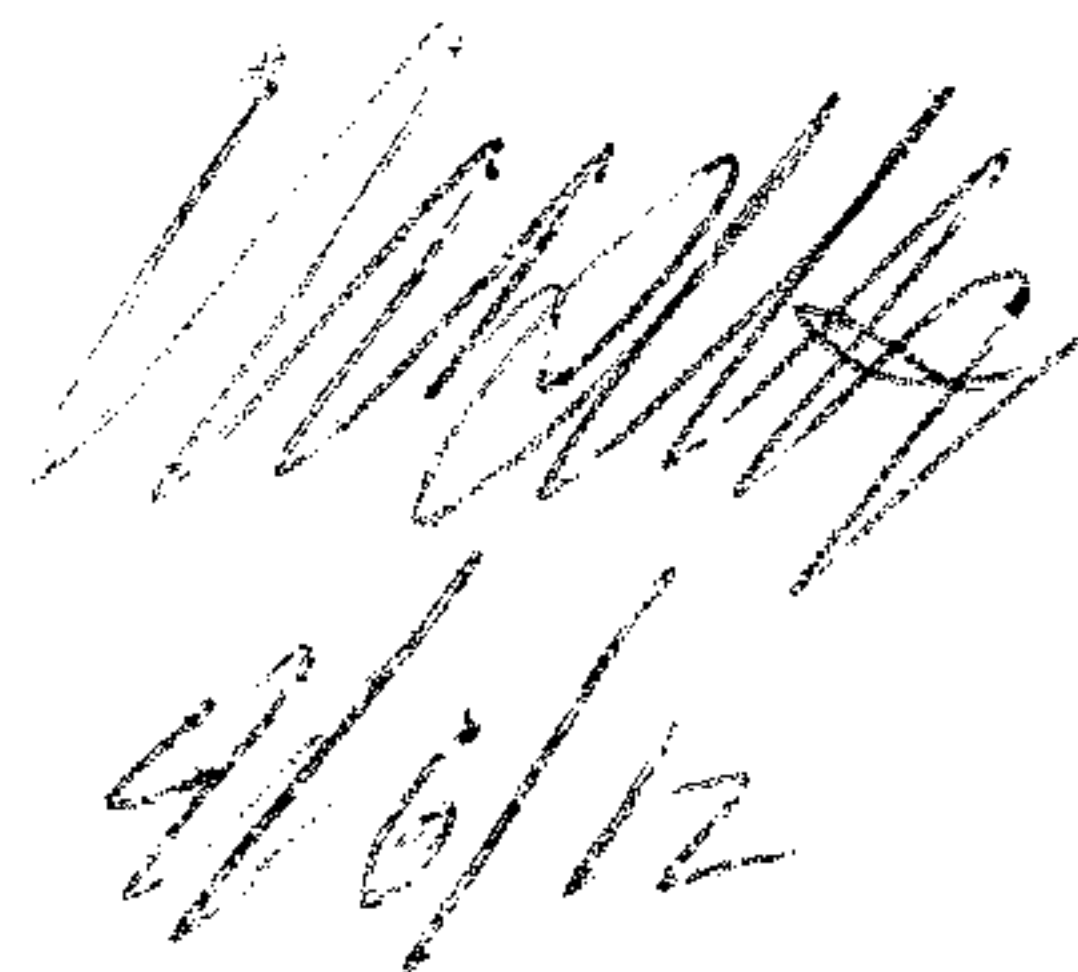
$$2 \times F_{tu1} / \pi \times D \times t_1 / n_u = (2)(22000)(.21)(.062/1.95)=293 \text{ lbs}$$

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

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

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

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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:

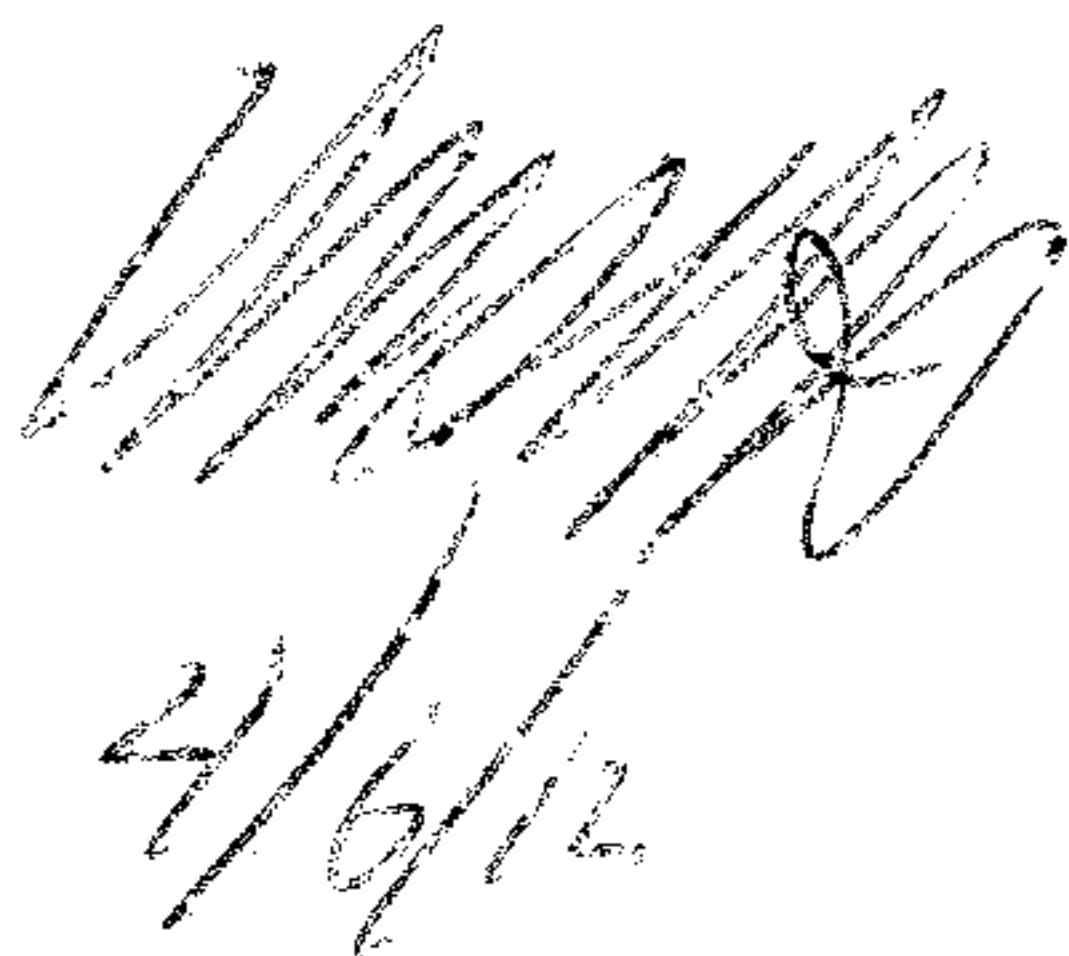
$$2 \times F_{tu1} / x D \times t1 / nu = (2)(22000)(.21)(.062/1.95) = 293 \text{ lbs}$$

$$2 \times F_{tu2} \times D \times t2 / nu = (2)(22000)(.21)(.125/1.95) = 593 \text{ lbs}$$

$$4.2 \times ((t2)^3 \times D)^{1/2} \times F_{tu2} / ns \text{ for } t2 \leq t1..4.2(((.125^3)(.21)))^{1/2}(22000/3) = 618 \text{ lbs}$$

$$Pns / 1.25ns = 459 / (1.25 \times 3) = 122.4$$

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Load on 192" header and sill:
Area=6,912 square in=48 square feet
Design pressure= 70psf
Total load = 3360 pounds

Load on 96" Jambs and hook strip:
Area=2304 square in=16 square feet
Design Pressure= 70psf
Total load= 1120 pounds

Minimum Anchors required:

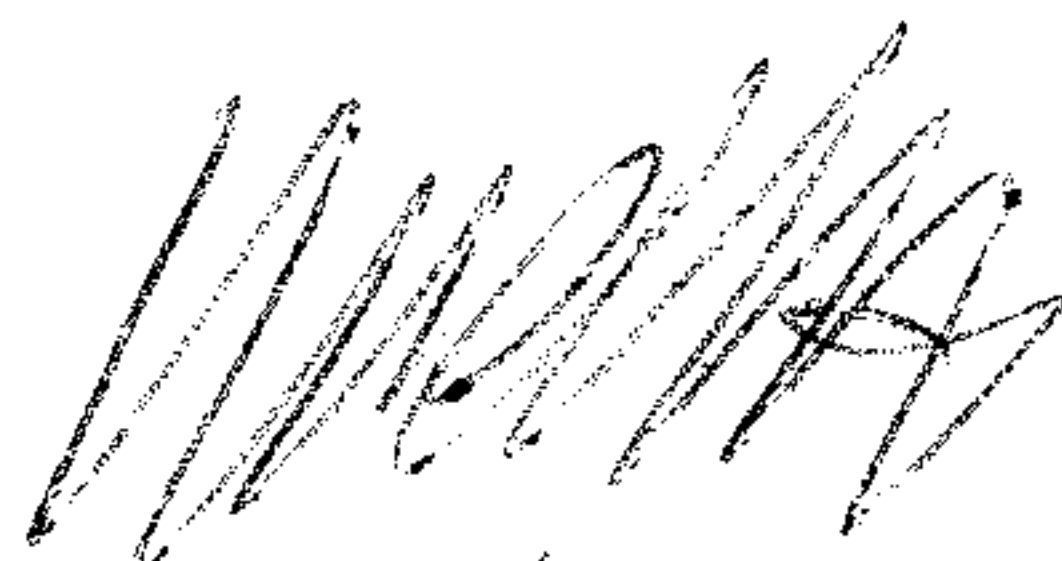
Spacing, Locations End Distance & # of Anchors/Location:

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

Mark A. Smith, P.E.
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9/6/12

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#12 Wood Anchor:

Head Capacity:	3685 lbs.	>	3360 lbs.	OK
Jamb Capacity:	1408 lbs.	>	1120 lbs.	OK
Hook Strip Capacity:	1220 lbs.	>	1120 lbs.	OK
Sill Capacity:	3685 lbs.	>	3360 lbs.	OK

Combined Bending plus Shear:

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

Head: $(.468) + (.261) = .729 < 1.0$ OK
Jamb: $(.787) + (.153) = .940 < 1.0$ OK
Sill: $(.468) + (.261) = .729 < 1.0$ OK
Hook Strip: $(0) + (.188) = .188 < 1.0$ OK

#1/4 Tapcon:

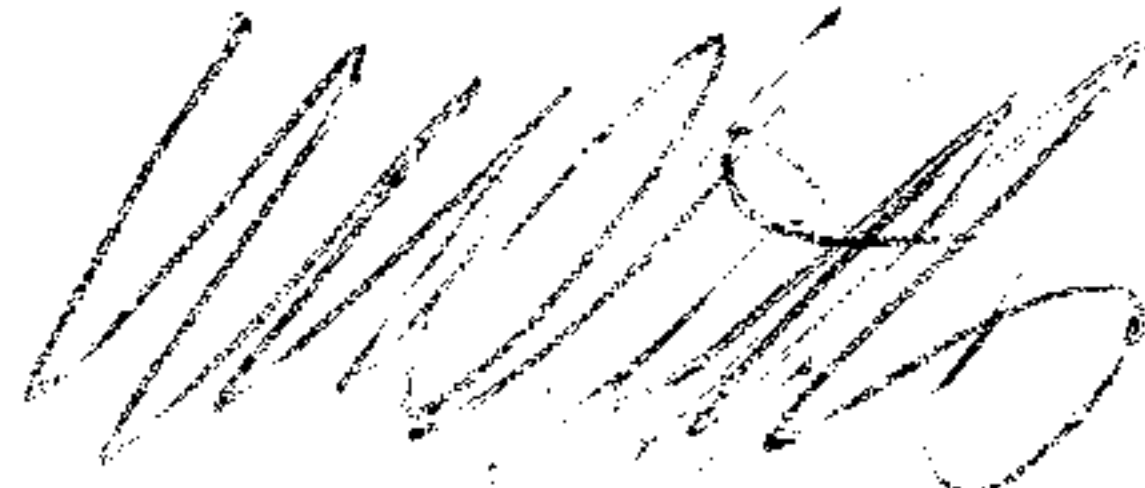
Head Capacity:	4208 lbs.	>	3360 lbs.	OK
Jamb Capacity:	1760 lbs.	>	1120 lbs.	OK
Hook Strip Capacity:	1222 lbs.	>	1120 lbs.	OK
Sill Capacity:	4208 lbs.	>	3360 lbs.	OK

Combined Bending plus Shear:

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

Head: $(.380) + (.421) = .801 < 1.0$ OK
Jamb: $(.641) + (.121) = .762 < 1.0$ OK
Sill: $(.380) + (.421) = .801 < 1.0$ OK
Hook Strip: $(0) + (.149) = .149 < 1.0$ OK

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9/6/12

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#12 Tek Screw:

Head Capacity:	3685 lbs.	>	3360 lbs.	OK
Jamb Capacity:	1408 lbs.	>	1120 lbs.	OK
Hook Strip Capacity:	1274 lbs.	>	1120 lbs.	OK
Sill Capacity:	3685 lbs.	>	3360 lbs.	OK

Combined Bending plus Shear:

$(f_b/F_b) + (f_v/F_v) \leq 1.0$ $F_b = 64 \text{ ksi}$ $F_v = 20 \text{ ksi}$
Head: $(.468) + (.261) = .729 < 1.0$ OK
Jamb: $(.787) + (.153) = .940 < 1.0$ OK
Sill: $(.468) + (.261) = .729 < 1.0$ OK
Hook Strip: $(0) + (.188) = .188 < 1.0$ OK

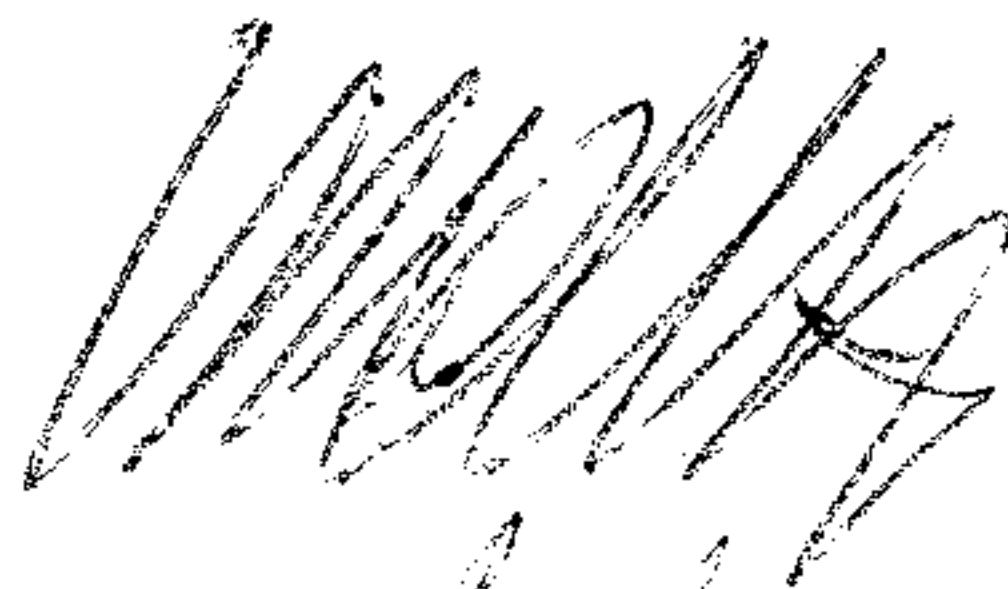
Conclusion:

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/L

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2/6/12