BUILDING DROPS
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TBPE Firm #13734

398 East Dania Beach Blvd.
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Product Evaluation Report

of

Ventana USA

Series 2050 Garden Window

for

Texas Department of Insurance

Report No. 4847

Product:	***Series 2050 Garden Window***
Material:	**Poly Vinyl Chloride**
Product Dimensions:	***63" x 63"***

Prepared For:
Ventana USA
6001 Enterprise Drive
Export, PA 15632-8969

Prepared by:
Hermes F. Norero, P.E.
Texas Professional Engineer # 118471
Date: 05/26/217

Contents:

Digitally signed by Hermes F. Norero, P.E.
Reason: I am approving this document
Date: 2017.07.19 17:33:42 -04'00'

Manufacturer: **Ventana USA**

Product Name: **Series 2050 Garden Window**

Scope: This is a Product Evaluation Report issued by Hermes Norero, P.E. (TX # 118471) for **Ventana USA** based on the Texas Department of Insurance.

Hermes F. Norero, P.E. does not have nor will acquire financial interest in the company manufacturing or distributing the product or in any other entity involved in the approval process of the product named herein.

This product has been evaluated for use in locations adhering to the International Building Code (IBC), International Residential Code (IRC), and the Texas Revisions.

See Installation Instructions **VEN002**, signed and sealed by Hermes Norero, P.E. (TX # 118471) for specific use parameters.

Limits of Use:

1. This product has been evaluated and is in compliance with the IBC, IRC, and Texas Revisions.
2. Product anchors shall be as listed and spaced as shown on details. Anchor embedment into substrate material shall be beyond wall dressing or stucco.
3. When used in areas requiring wind borne debris protection this product does not require an impact resistant covering.
4. Site conditions that deviate from the details of **VEN002** require further engineering analysis by a licensed engineer or registered architect.
5. See Installation Instructions **VEN002** for size and design pressure limitations.

Performance Standards: The product described herein has been tested per:

- AAMA/WDMA/CSA 101/I.S.2/A440-08
- ASTM E1886-05
- ASTM E1996-12

Referenced Data:

1. Product Testing performed by **Architectural Testing**
   Report #: D4389.01-501-44, Report Date: 10/09/14
   Report #: E2513.01-501-44, Report Date: 12/11/14

Equivalence of Test Standards:

The ASTM E886 and E1996 test standards have been evaluated for differences in test methodology, if any, between tested editions of the test standard listed below and the edition referenced in the 2006 International Building Code. Ventana USA has tested their products to the following test standard edition:

1) ASTM E1886-05
2) ASTM E1996-12

Chapter 35 of the 2006 International Building Code references the following edition of the above mentioned test standard:

1) ASTM E1886-04
1) ASTM E1996-04

After review of the above mentioned referenced standard and edition, it has been found that no significant technical changes have been made to the test standard that would affect the results or compliance with the code. The referenced standard has been found to be equivalent.

Installation: 1. Approved anchor types and substrates are as follows:

A. For two by (2X) wood frame substrate (Min. S.G. = 0.42), use **#12 Wood Screw** type wood frame anchors of sufficient length to achieve minimum embedment of 1.50" into wood framing.

B. For concrete (Min f'c = 3000psi) or masonry (shall comply with ASTM C90) substrate where one by (1X), non-structural, wood bucking is employed, use **1/4" diameter ITW Tapcon** type concrete screw anchors of sufficient length to achieve minimum embedment of 1.25" into concrete or masonry.

C. For concrete (Min f'c = 3000psi) or masonry (shall comply with ASTM C90) substrate where wood bucking is NOT employed, use **1/4" diameter ITW Tapcon** type concrete screw anchors of sufficient length to achieve minimum embedment of 1.25" into concrete or masonry.

D. For Steel Stud substrate (Min 18 ga., Fy= 33 ksi) use **1/4" TEK Screws** of sufficient length to achieve a minimum of 3 threads penetration beyond steel structure.

Refer to manufacturer Installation Instructions **VEN002** for anchor spacing and more details of the installation requirements.

Design Pressure: +/- 50 PSF

APPENDIX

(INCLUDES THIRTEEN (13) PAGES OF CALCULATIONS)

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Date: 6/1/2017

#12 Wood Screw into Spruce-Pine-Fir w/ 0.5 in. of Gap Space.
2050/2051 PVC Greenhouse Window

Calculations herein are performed in accordance with the National Design Specification for Wood Construction - 2012, Chapter 11.3 and Technical Report 12 - General Dowel Equations for Calculating Lateral Connection Values, published by the American Wood Council

Wood Screw Type =	#12	Wood Screw	
Wood Screw Length =	3.25	in	
Wood Screw Embedment =	1.50	in	
Wood Screw Thread Length =	2.17	in	
D =	0.216	in	, Dowel Diameter
D_m =	0.171	in	, Dowel Diameter at max. stress in main member
D_s =	0.171	in	, Dowel Diameter at max. stress in side member
F_b =	80,000	psi	, Dowel bending strength

Wood Screw Lateral Calculations - Solid Main Member - Solid Side Member

Substrate (Main Member):	Spruce-Pine-Fir		
Frame (Side Member):	Spruce-Pine-Fir		
Cantilever Distance:	0.5	in	, Frame hollow space + shim

ℓ_m =	1.500	in	, Main member dowel bearing length
ℓ_s =	1.250	in	, Side member dowel bearing length
F_{em} =	3,364	psi	, Main member dowel bearing strength
F_{es} =	3,364	psi	, Side member dowel bearing strength
q_m =	575	lbs/in	, Main member dowel bearing resistance = $F_{em}D_m$
q_s =	575	lbs/in	, Side member dowel bearing resistance = $F_{es}D_s$
M_m =	66.67	in-lbs	, Main member dowel moment resistance = $F_b(D_m^3/6)$
M_s =	66.67	in-lbs	, Side member dowel moment resistance = $F_b(D_s^3/6)$
θ =	90	degrees	, Maximum angle of load to grain (0° ≤ θ ≤ 90°) for any member in a connection
K_θ =	1.25		
K_D =	2.210		

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#12 Wood Screw into Spruce-Pine-Fir w/ 0.5 in. of Gap Space.
2050/2051 PVC Greenhouse Window

		Single Shear		Double Shear		
Mode I_m	Z_I=	862.93	lbs	862.93	lbs	, Main Member Bearing
				2.21		, Reduction Term
Mode I_m	**Z_I=**	**390.46**	**lbs**	**390.46**	**lbs**	
Mode I_s	Z_I=	719.11	lbs	1438.21	lbs	, Side Member Bearing
				2.21		, Reduction Term
Mode I_s	**Z_I=**	**325.39**	**lbs**	**650.77**	**lbs**	
Mode II	Z_{II}=	260.89	lbs			, Side and Main Member Bearing
		A = 0.0009				
		B = 1.875				
		C = -548.32				
				2.21		, Reduction Term
Mode II	**Z_{II}=**	**118.05**	**lbs**			
Mode III_m	Z_{III}=	248.04	lbs			, Main Member Bearing and Dowel Yielding in the Side Member
		A = 0.0013				
		B = 1.250				
		C = -390.27				
				2.21		, Reduction Term
Mode III_m	**Z_{III}=**	**112.24**	**lbs**			
Mode III_s	Z_{III}=	208.59	lbs	417.18	lbs	, Side Member Bearing and Dowel Yielding in the Main Member
		A = 0.0013				
		B = 1.125				
		C = -291.39				
				2.21		, Reduction Term
Mode III_s	**Z_{III}=**	**94.39**	**lbs**	**188.77**	**lbs**	
Mode IV	Z_{IV}=	168.26	lbs	336.51	lbs	, Dowel Yielding in the Side and Main Member
		A = 0.0017				
		B = 0.500				
		C = -133.34				
				2.21		, Reduction Term
Mode IV	**Z_{IV}=**	**76.13**	**lbs**	**152.27**	**lbs**	

C_d = 1.6 , Load Duration
C_p = 1.000 , Penetration Factor

Single Lateral Allowable (Z'_s) = 121.815 lbs **<< Capacity @ Head**
Double Lateral Allowable (Z'_d) = 243.629 lbs

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#12 Wood Screw into Spruce-Pine-Fir w/ 0.25 in. of Gap Space.
2050/2051 PVC Greenhouse Window

Calculations herein are performed in accordance with the National Design Specification for Wood Construction - 2012, Chapter 11.3 and Technical Report 12 - General Dowel Equations for Calculating Lateral Connection Values, published by the American Wood Council

Wood Screw Type =	#12	Wood Screw	
Wood Screw Length =	3.00	in	
Wood Screw Embedment =	1.50	in	
Wood Screw Thread Length =	2.00	in	
D =	0.216	in	, Dowel Diameter
D_m =	0.171	in	, Dowel Diameter at max. stress in main member
D_s =	0.171	in	, Dowel Diameter at max. stress in side member
F_b =	80,000	psi	, Dowel bending strength

Wood Screw Lateral Calculations - Solid Main Member - Solid Side Member

Substrate (Main Member):	Spruce-Pine-Fir		
Frame (Side Member):	Spruce-Pine-Fir		
Cantilever Distance:	0.25	in	, Frame hollow space + shim

ℓ_m =	1.500	in	, Main member dowel bearing length
ℓ_s =	1.250	in	, Side member dowel bearing length
F_{em} =	3,364	psi	, Main member dowel bearing strength
F_{es} =	3,364	psi	, Side member dowel bearing strength
q_m =	575	lbs/in	, Main member dowel bearing resistance = $F_{em}D_m$
q_s =	575	lbs/in	, Side member dowel bearing resistance = $F_{es}D_s$
M_m =	66.67	in-lbs	, Main member dowel moment resistance = $F_b(D_m^3/6)$
M_s =	66.67	in-lbs	, Side member dowel moment resistance = $F_b(D_s^3/6)$
θ =	90	degrees	, Maximum angle of load to grain (0° ≤ θ ≤ 90°) for any member in a connection
K_θ =	1.25		
K_D =	2.210		

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#12 Wood Screw into Spruce-Pine-Fir w/ 0.25 in. of Gap Space.
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		Single Shear		Double Shear		
Mode I_m	Z_I=	862.93	lbs	862.93	lbs	, Main Member Bearing
				2.21		, Reduction Term
Mode I_m	**Z_I=**	**390.46**	**lbs**	**390.46**	**lbs**	
Mode I_s	Z_I=	719.11	lbs	1438.21	lbs	, Side Member Bearing
				2.21		, Reduction Term
Mode I_s	**Z_I=**	**325.39**	**lbs**	**650.77**	**lbs**	
Mode II	Z_{II}=	291.87	lbs			, Side and Main Member Bearing
		A = 0.0009				
		B = 1.625				
		C = -548.32				
				2.21		, Reduction Term
Mode II	**Z_{II}=**	**132.07**	**lbs**			
Mode III_m	Z_{III}=	284.64	lbs			, Main Member Bearing and Dowel Yielding in the Side Member
		A = 0.0013				
		B = 1.000				
		C = -390.27				
				2.21		, Reduction Term
Mode III_m	**Z_{III}=**	**128.80**	**lbs**			
Mode III_s	Z_{III}=	244.18	lbs	488.36	lbs	, Side Member Bearing and Dowel Yielding in the Main Member
		A = 0.0013				
		B = 0.875				
		C = -291.39				
				2.21		, Reduction Term
Mode III_s	**Z_{III}=**	**110.49**	**lbs**	**220.98**	**lbs**	
Mode IV	Z_{IV}=	214.23	lbs	428.47	lbs	, Dowel Yielding in the Side and Main Member
		A = 0.0017				
		B = 0.250				
		C = -133.34				
				2.21		, Reduction Term
Mode IV	**Z_{IV}=**	**96.94**	**lbs**	**193.88**	**lbs**	

C_d = 1.6 , Load Duration
C_p = 1.000 , Penetration Factor

Single Lateral Allowable (Z'_s) = 155.102 lbs **<< Capacity @ Jambs & Sill**
Double Lateral Allowable (Z'_d) = 310.204 lbs

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Product Evaluation Report

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2050/2051 PVC Greenhouse Window

Shear Design Value

Concrete Anchor Calculations

Fastener type:	**1/4" ITW Tapcon**			
Reference:	Manufacture Published Data			
Substrate:	3000 PSI Concrete or Greater			
Minimum embedment:	1.25	in		
Minimum Spacing:	3.00	in		
Minimum edge distance:	2.50	in		
Allowable Design Value:	**Z'=**	177 lbs	/	anchor

Masonry Anchor Calculations

Fastener type:	**1/4" ITW Tapcon**			
Reference:	Manufacture Published Data			
Substrate:	Hollow Block CMU (Per ASTM C-90)			
Minimum embedment:	1.25	in		
Minimum Spacing:	3.00	in		
Minimum edge distance:	2.50	in		
Allowable Design Value:	**Z'=**	156 lbs	/	anchor

Fastener type:	**1/4" ITW Tapcon**			
Shank Diameter:	D =	0.190	in	
Cantilever distance:		0.50	in	
Moment arm:		0.25	in	
Allowable bending stress:	F_b =	46.88	ksi	
Actual bending stress:	f_b =	40.47	ksi	
Combined bending plus shear:	**(fb/Fb)+(fv/Fv) =**	**1.0**	**≤**	**1.0**
Maximum design value in cantilever:		109	lbs /	anchor

Factor of Safety:	Ω=	2.00	
Bending Yield strength:	F_y =	100.00	ksi
Ultimate strength:	F_u =	125.00	ksi
Allowable shear stress:	Fv =	28.13	ksi
Actual shear stress:	f_v =	3.84	ksi
Elastic Modulus:	*S* =	0.0007	in^3
Area:	*A* =	0.02835287	in^2

Minimum anchor capacity: 109 lbs / anchor **<< Capacity @ Head**

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Product Evaluation Report

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2050/2051 PVC Greenhouse Window

Manufacture Published Data

PERFORMANCE TABLES

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Concrete

ANCHOR DIA. In. (mm)	MIN. DEPTH OF EMBEDMENT In. (mm)	f'c = 2000 PSI (13.8 MPa)		f'c = 3000 PSI (20.7 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 5000 PSI (34.5 MPa)	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	600 (2.7)	720 (3.2)	625 (2.8)	720 (3.2)	650 (2.9)	720 (3.2)	800 (3.6)	860 (3.8)
	1-1/4 (31.8)	845 (3.7)	720 (3.2)	858 (3.8)	720 (3.2)	870 (3.9)	720 (3.2)	1,010 (4.5)	860 (3.8)
	1-1/2 (38.1)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,220 (5.4)	860 (3.8)
	1-3/4 (44.5)	1,450 (6.5)	870 (3.9)	1,455 (6.5)	870 (3.9)	1,460 (6.5)	990 (4.4)	1,730 (7.7)	990 (4.4)
1/4 (6.4)	1 (25.4)	750 (3.3)	900 (4.0)	775 (3.4)	900 (4.0)	800 (3.6)	1,360 (6.1)	950 (4.2)	1,440 (6.4)
	1-1/4 (31.8)	1,050 (4.7)	900 (4.0)	1,160 (5.2)	900 (4.0)	1,270 (5.6)	1,360 (6.1)	1,515 (6.7)	1,440 (6.4)
	1-1/2 (38.1)	1,380 (6.1)	1,200 (5.3)	1,600 (7.2)	1,200 (5.3)	1,820 (8.1)	1,380 (6.1)	2,170 (9.7)	1,670 (7.4)
	1-3/4 (44.5)	2,020 (9.0)	1,670 (7.4)	2,200 (9.8)	1,670 (7.4)	2,380 (10.6)	1,670 (7.4)	2,770 (12.3)	1,670 (7.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Hollow Block

ANCHOR DIA. In. (mm)	ANCHOR EMBEDMENT In. (mm)	LIGHTWEIGHT BLOCK		MEDIUM WEIGHT BLOCK	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	220 (1.0)	400 (1.8)	340 (1.5)	730 (3.2)
1/4 (6.4)	1 (25.4)	250 (1.1)	620 (2.8)	500 (2.2)	1,000 (4.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.
NOTE: 3/16" Tapcon requires 5/32" bit, 1/4" Tapcon requires 3/16" bit.

Tapcon® Anchors — Allowable Edge and Spacing Distances

PARAMETER	ANCHOR DIA. In. (mm)	NORMAL WEIGHT CONCRETE			CONCRETE MASONRY UNITS (CMU)		
		FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR	FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR
Spacing Between Anchors - Tension	3/16	3	1-1/2	0.73	3	1-1/2	1.00
	1/4	4	2	0.66	4	2	0.84
Spacing Between Anchors - Shear	3/16	3	1-1/2	0.83	3	1-1/2	1.00
	1/4	4	2	0.82	4	2	0.81
Edge Distance - Tension	3/16	1-7/8	1	0.83	4	2	0.91
	1/4	2-1/2	1-1/4	0.82	4	2	0.88
Edge Distance -Shear	3/16	2-1/4	1-1/8	0.70	4	2	0.93
	1/4	3	1-1/2	0.59	4	2	0.80

For SI: 1 inch = 25.4 mm

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Shear Design Value

Concrete Anchor Calculations

Fastener type:	**1/4" ITW Tapcon**		
Reference:	Manufacture Published Data		
Substrate:	3000 PSI Concrete or Greater		
Minimum embedment:	1.25	in	
Minimum Spacing:	3.00	in	
Minimum edge distance:	2.50	in	
Allowable Design Value:	**Z'=** 177	lbs	/ anchor

Masonry Anchor Calculations

Fastener type:	**1/4" ITW Tapcon**		
Reference:	Manufacture Published Data		
Substrate:	Hollow Block CMU (Per ASTM C-90)		
Minimum embedment:	1.25	in	
Minimum Spacing:	3.00	in	
Minimum edge distance:	2.50	in	
Allowable Design Value:	**Z'=** 156	lbs	/ anchor

Fastener type:	**1/4" ITW Tapcon**					
Shank Diameter:	D =	0.190	in	Factor of Safety:	Ω=	2.00	
Cantilever distance:		0.25	in	Bending Yield strength:	F_y =	100.00	ksi
Moment arm:		0.13	in	Ultimate strength:	F_u =	125.00	ksi
Allowable bending stress:	F_b =	46.88	ksi	Allowable shear stress:	Fv =	28.13	ksi
Actual bending stress:	f_b =	35.62	ksi	Actual shear stress:	f_v =	6.76	ksi
Combined bending plus shear:	**(fb/Fb)+(fv/Fv) =**	**1.0**	**≤ 1.0**	Elastic Modulus:	*S* =	0.0007	in^3
Maximum design value in cantilever:	192	lbs / anchor		Area:	*A* =	0.02835287	in^2

Minimum anchor capacity: 156 lbs / anchor **<< Capacity @ Jambs & Sill**

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PERFORMANCE TABLES

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Concrete

ANCHOR DIA. In. (mm)	MIN. DEPTH OF EMBEDMENT In. (mm)	f'c = 2000 PSI (13.8 MPa)		f'c = 3000 PSI (20.7 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 5000 PSI (34.5 MPa)	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	600 (2.7)	720 (3.2)	625 (2.8)	720 (3.2)	650 (2.9)	720 (3.2)	800 (3.6)	860 (3.8)
	1-1/4 (31.8)	845 (3.7)	720 (3.2)	858 (3.8)	720 (3.2)	870 (3.9)	720 (3.2)	1,010 (4.5)	860 (3.8)
	1-1/2 (38.1)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,220 (5.4)	860 (3.8)
	1-3/4 (44.5)	1,450 (6.5)	870 (3.9)	1,455 (6.5)	870 (3.9)	1,460 (6.5)	990 (4.4)	1,730 (7.7)	990 (4.4)
1/4 (6.4)	1 (25.4)	750 (3.3)	900 (4.0)	775 (3.4)	900 (4.0)	800 (3.6)	1,360 (6.1)	950 (4.2)	1,440 (6.4)
	1-1/4 (31.8)	1,050 (4.7)	900 (4.0)	1,160 (5.2)	900 (4.0)	1,270 (5.6)	1,360 (6.1)	1,515 (6.7)	1,440 (6.4)
	1-1/2 (38.1)	1,380 (6.1)	1,200 (5.3)	1,600 (7.2)	1,200 (5.3)	1,820 (8.1)	1,380 (6.1)	2,170 (9.7)	1,670 (7.4)
	1-3/4 (44.5)	2,020 (9.0)	1,670 (7.4)	2,200 (9.8)	1,670 (7.4)	2,380 (10.6)	1,670 (7.4)	2,770 (12.3)	1,670 (7.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Hollow Block

ANCHOR DIA. In. (mm)	ANCHOR EMBEDMENT In. (mm)	LIGHTWEIGHT BLOCK		MEDIUM WEIGHT BLOCK	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	220 (1.0)	400 (1.8)	340 (1.5)	730 (3.2)
1/4 (6.4)	1 (25.4)	250 (1.1)	620 (2.8)	500 (2.2)	1,000 (4.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.
NOTE: 3/16" Tapcon requires 5/32" bit, 1/4" Tapcon requires 3/16" bit.

Tapcon® Anchors — Allowable Edge and Spacing Distances

PARAMETER	ANCHOR DIA. In. (mm)	NORMAL WEIGHT CONCRETE			CONCRETE MASONRY UNITS (CMU)		
		FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR	FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR
Spacing Between Anchors - Tension	3/16	3	1-1/2	0.73	3	1-1/2	1.00
	1/4	4	2	0.66	4	2	0.84
Spacing Between Anchors - Shear	3/16	3	1-1/2	0.83	3	1-1/2	1.00
	1/4	4	2	0.82	4	2	0.81
Edge Distance - Tension	3/16	1-7/8	1	0.83	4	2	0.91
	1/4	2-1/2	1-1/4	0.82	4	2	0.88
Edge Distance -Shear	3/16	2-1/4	1-1/8	0.70	4	2	0.93
	1/4	3	1-1/2	0.59	4	2	0.80

For SI: 1 inch = 25.4 mm

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Report #: 4847
Date: 6/1/2017

Product Evaluation Report

Steel Stud Anchor Calculations

Fastener type:	**1/4" Tek Screw**
Substrate:	18 Steel Gauge
Referecne:	AAMA TIR A9-14
Minimum embedment:	3 pitches of thread

Allowable Design Value: **Z'=** 441 lbs / anchor

Fastener type: **1/4" Tek Screw** **with min. engagement of** **3 pitches of thread**

Shank Diameter:	D =	0.196	in	Factor of Safety:	Ω=	2.00		
Cantilever distance:		0.50	in	Bending Yield strength:	F_y =	92.00	ksi	
Moment arm:		0.25	in	Ultimate strength:	F_u =	120.00	ksi	
Allowable bending stress:	F_b =	45	ksi	Allowable shear stress:	Fv =	27.00	ksi	
Actual bending stress:	f_b =	39	ksi	Actual shear stress:	f_v =	3.80	ksi	
Combined bending plus shear:	**(fb/Fb)+(fv/Fv) =**	**1.0**	**≤ 1.0**	Elastic Modulus:	*S* =	0.0007	in^3	
Maximum design value in cantilever:		114 lbs / anchor		Area:	*A* =	0.03017186	in^2	

Minimum anchor capacity: 114 lbs / anchor

Minimum anchor capacity per Substrate:

Steel Stud Anchor	114 lbs / anchor	**<< Capacity @ Head**

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Allowable Design Value: **Z'=** 441 lbs / anchor

Fastener type: **1/4" Tek Screw** **with min. engagement of** **3 pitches of thread**

Shank Diameter:	D =	0.196	in	Factor of Safety:	Ω=	2.00		
Cantilever distance:		0.25	in	Bending Yield strength:	F_y =	92.00	ksi	
Moment arm:		0.13	in	Ultimate strength:	F_u =	120.00	ksi	
Allowable bending stress:	F_b =	45	ksi	Allowable shear stress:	Fv =	27.00	ksi	
Actual bending stress:	f_b =	34	ksi	Actual shear stress:	f_v =	6.70	ksi	
Combined bending plus shear:	**(fb/Fb)+(fv/Fv) =**	**1.0**	**≤ 1.0**	Elastic Modulus:	*S* =	0.0007	in^3	
Maximum design value in cantilever:		200 lbs / anchor		Area:	*A* =	0.03017186	in^2	

Minimum anchor capacity: 200 lbs / anchor

Minimum anchor capacity per Substrate:

Steel Stud Anchor	200 lbs / anchor	**<< Capacity @ Jambs & Sill**

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E4.3.1 Shear Strength Limited by Tilting and Bearing:

Reference: AISI Cold Formed Steel Specifications, E4.3.1

The *nominal shear strength* [*resistance*] per screw, P_{ns}, shall be determined in accordance with this section.

For $t_2/t_1 \le 1.0$, P_{ns} shall be taken as the smallest of

$P_{ns} = 4.2\,(t_2^3 d)^{1/2} F_{u2}$ (*Eq.* E4.3.1-1)

$P_{ns} = 2.7\,t_1\,d\,F_{u1}$ (*Eq.* E4.3.1-2)

$P_{ns} = 2.7\,t_2\,d\,F_{u2}$ (*Eq.* E4.3.1-3)

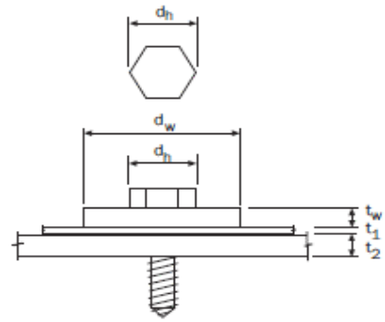
For $t_2/t_1 \ge 2.5$, P_{ns} shall be taken as the smaller of

$P_{ns} = 2.7\,t_1\,d\,F_{u1}$ (*Eq.* E4.3.1-4)

$P_{ns} = 2.7\,t_2\,d\,F_{u2}$ (*Eq.* E4.3.1-5)

For $1.0 < t_2/t_1 < 2.5$, P_{ns} shall be calculated by linear interpolation between the above two cases.

Figure 1: Typical Connection Detail



Where,

Nominal screw diameter,	d =	0.196	in.
Thickness of member in contact with screw head,	t1 =	1.25	in.
Thicness of member non in contact with screw head,	t2 =	0.0478	in.
Ratio of thickness,	t2/t1 =	0.03824	
Tensile strength of mem. in contact with screw head,	Fu1 =	750	psi
Tensile strength of mem. not in contact with screw head,	Fu2 =	33000	psi

Eq. E4.3.1-1,	Pns =	641.258	lbs
Eq. E4.3.1-2,	Pns =	496.125	lbs
Eq. E4.3.1-3,	Pns =	834.76	lbs
Eq. E4.3.1-4,	Pns =	496.125	lbs
Eq. E4.3.1-5,	Pns =	834.76	lbs

For $t2/t1 \le 1.0$,	Pns =	496.125	lbs	**Use This Value**
For $t2/t1 \ge 2.5$,	Pns =	496.125	lbs	**Not Applicable**
For $1.0 < t2/t1 < 2.5$,	Pns =	496.125	lbs	**Not Applicable**

Per ASD,	**Pns/Ω =**	**165.375**	**lbs, Ω =**	**3**	
Per LRFD,	**ΦPns =**	**248.063**	**lbs, Φ =**	**0.5**	

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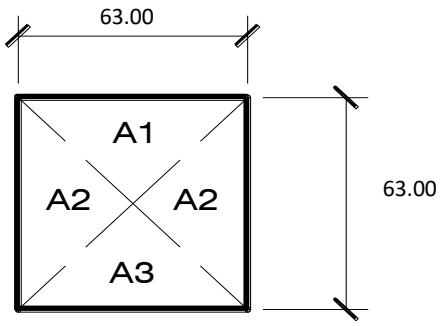
Product Evaluation Report

Ventana USA
2050/2051 PVC Greenhouse Window

Anchor Capacity Calculations: Through Frame Installation (AS TESTED)



Design pressure: 50.0 psf

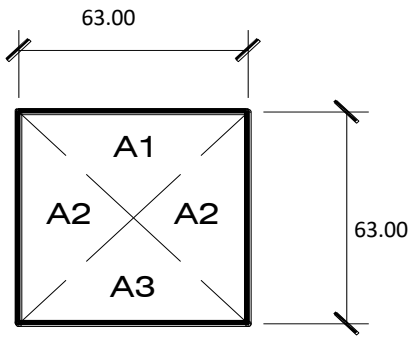
Zone	Area (ft^2)	Load (lbs)	From Corner Distance (in)	Max. O.C. (in)	Anchor	
					Cap. (lbs)	Qty
A_1	6.89	344.5	6.0	25.5	114.8	3
A_2	6.89	344.5	6.0	25.5	114.8	3
A_3	6.89	344.5	6.0	25.5	114.8	3

Window Total Area: 27.56 ft^2

Minimum anchor capacity per Substrate:

Wood	155	lbs	/ anchor	**<< Limiting @ Jambs & Sill**
Metal stud	165	lbs	/ anchor	
Masonry	156	lbs	/ anchor	
Wood Head	122	lbs	/ anchor	
Metal Head	114	lbs	/ anchor	
Masonry Head	109	lbs	/ anchor	**<< Limiting @ Head**

Anchor Capacity Calculations: Through Frame Installation



Substrate of installation: Wood

Design pressure: 50.0 psf

Zone	Area (ft^2)	Load (lbs)	From Corner Distance (in)	Max. O.C. Spacing (in)	Anchor			Result
					Cap. (lbs)	Qty	Load (lbs)	
A_1	6.89	344.5	6.0	25.5	155.1	3	114.8	**OK**
A_2	6.89	344.5	6.0	25.5	155.1	3	114.8	**OK**
A_3	6.89	344.5	6.0	25.5	155.1	3	114.8	**OK**
J	6.89	344.5	6.0	25.5	155.1	3	114.8	**OK**
H	6.89	344.5	6.0	12.8	109.0	5	68.9	**OK**
S	6.89	344.5	6.0	25.5	155.1	3	114.8	**OK**

*H=A1
*J =A2
*S=A3

Window Total Area: 27.56 ft^2

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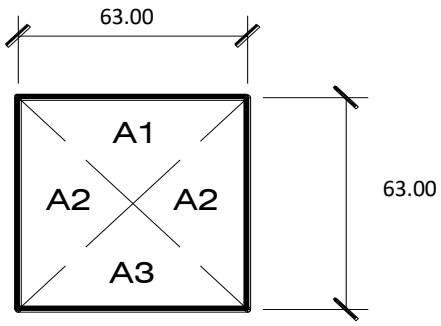
Product Evaluation Report

Ventana USA
2050/2051 PVC Greenhouse Window

Anchor Capacity Calculations: Through Frame Installation (AS TESTED) Combined Wind Load and Dead Load



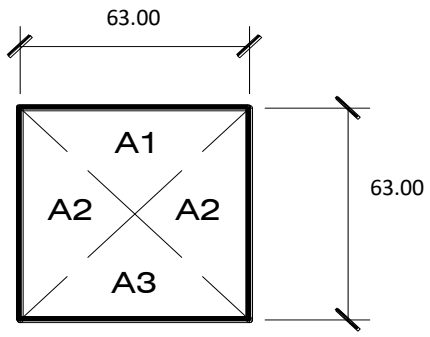
Zone	Area (ft^2)	Load (lbs)	From Corner Distance (in)	Max. O.C. (in)	Anchor	
					Cap. (lbs)	Qty
A_1	6.89	544.5	6.0	12.0	90.8	6
A_2	6.89	633.9	6.0	25.5	211.3	3
A_3	6.89	544.5	6.0	25.5	181.5	3

Window Total Area: 27.56 ft^2

Minimum anchor capacity per Substrate:

Wood	155	lbs	/ anchor	**<< Limiting @ Jambs & Sill**
Metal stud	165	lbs	/ anchor	
Masonry	156	lbs	/ anchor	
Wood Head	122	lbs	/ anchor	
Metal Head	114	lbs	/ anchor	
Masonry Head	109	lbs	/ anchor	**<< Limiting @ Head**

Anchor Capacity Calculations: Through Frame Installation



Window Total Area: 27.56 ft^2

Substrate of installation: Wood

Zone	Area (ft^2)	Load (lbs)	From Corner Distance (in)	Max. O.C. Spacing (in)	Anchor			Result
					Cap. (lbs)	Qty	Load (lbs)	
A_1	6.89	544.5	6.0	12.8	155.1	5	108.9	**OK**
A_2	6.89	633.9	6.0	10.2	155.1	6	105.6	**OK**
A_3	6.89	544.5	6.0	12.8	155.1	5	108.9	**OK**
J	6.89	633.9	6.0	10.20	155.1	6	105.6	**OK**
H	6.89	544.5	6.0	12.75	109.0	5	108.9	**OK**
S	6.89	544.5	6.0	12.75	155.1	5	108.9	**OK**

*H=A1
*J =A2
*S=A3