



Project Number: U2716-0231-201

January 26, 2021

Sunmodo  
14800 NE 65<sup>th</sup> Street  
Vancouver, WA 98682

**REFERENCE: Sunmodo Sunturf Ground Mount A5a  
Ground Mount PV Array Installation**

To Whom It May Concern:

Per request of Sunmodo, we have been asked to prepare the structural design of a ground-mounted PV solar array system with several foundation options as shown in the attached calculations. The adopted building code in this jurisdiction is the International Building Code, 2018 Edition. Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed. The following design parameters are used in our analysis:

- Minimum Design Loads for Buildings and Other Structures (ASCE 7-16)
- Design wind speed for risk category I structures: 140 mph
- Wind exposure: B
- Ground snow load: 70 psf
- The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below. A minimum of one ground screw or helical pier must be tested.

Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2320	1.5	3480
LATERAL	1690	2	3380

Foundation concrete shall have a minimum compressive strength of 2500 psi at 28 days. Cement for all concrete shall be Type I or II with a minimum of 6% entrained air with a water/cement ratio of 0.50. Maximum aggregate size shall be 3/4". No special inspection of concrete strength is required.

Footings are designed based on an allowable soil bearing pressure of 1500 psf an allowable skin friction of 250 psf, an allowable lateral bearing pressure of 150 pcf, and a coefficient of friction of 0.3. Vector Structural Engineering strongly recommends independent soils testing be performed by a licensed geotechnical engineer to verify the assumed soil parameters.

All ground mounts are to be installed per manufacturer’s recommendations. The use of solar panel support span tables provided by the manufacturer is allowed only where the site conditions and solar panel configuration match the description of the span tables. Electrical engineering is beyond our scope. All work performed must be in accordance with accepted industry-wide methods and applicable safety standards. Vector Structural Engineering assumes no responsibility for improper installation of the solar panels.

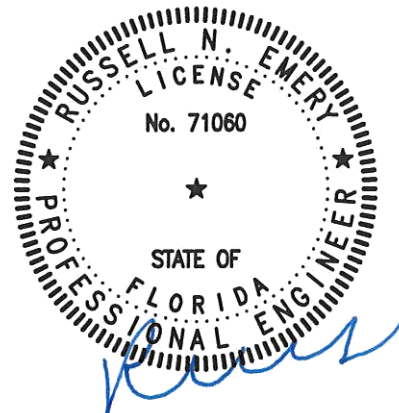
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC  
FL Firm License Number: COA 26626

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Russell Emery, P.E.  
License: 71060 - Expires: 02/28/2023  
Project Engineer

Enclosures

RNE/stb

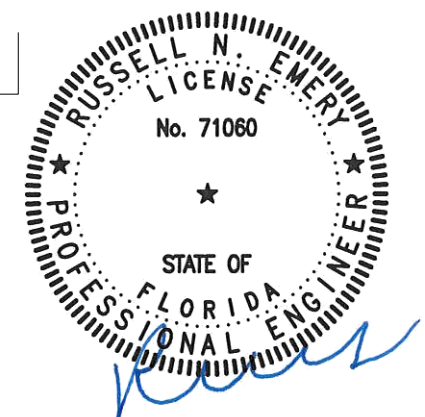
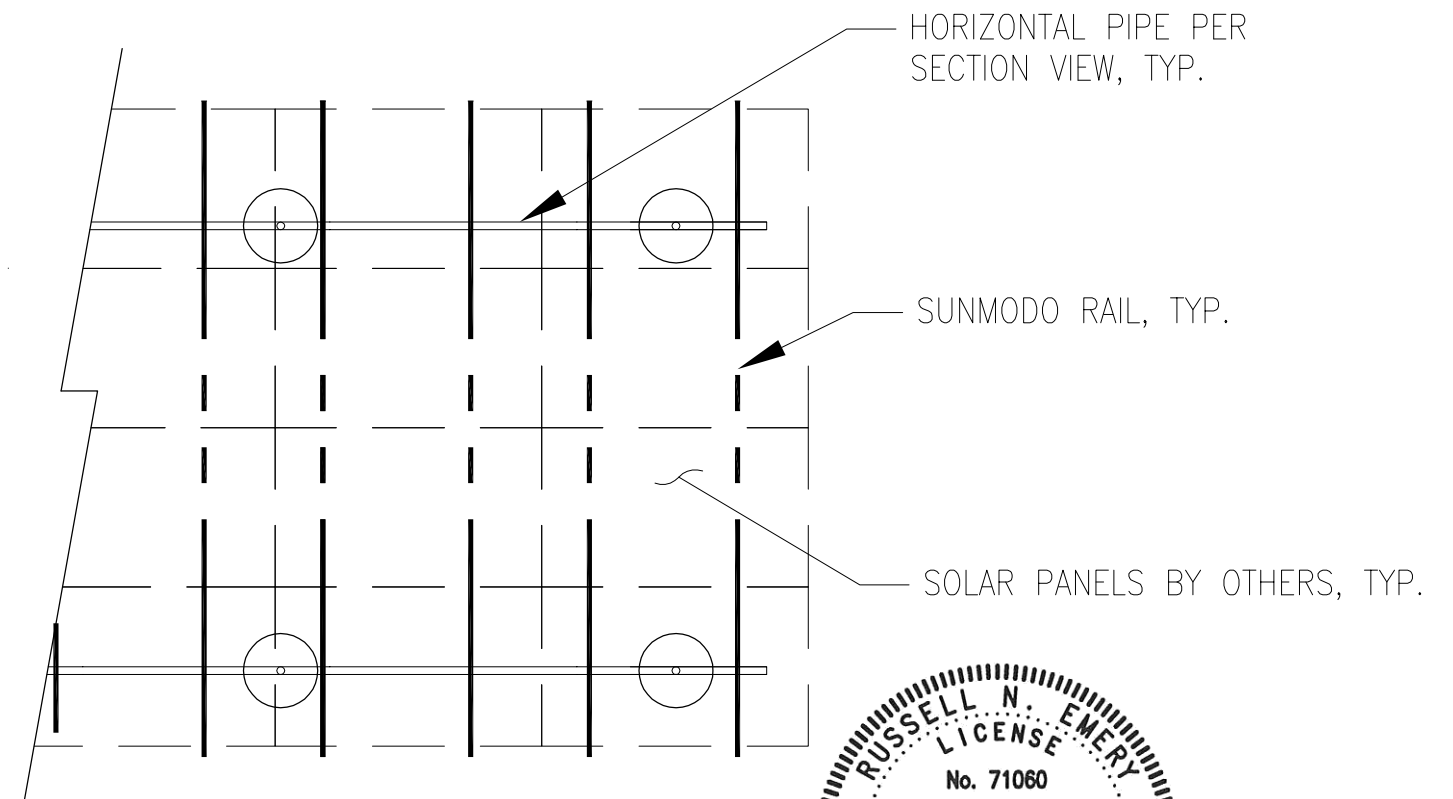
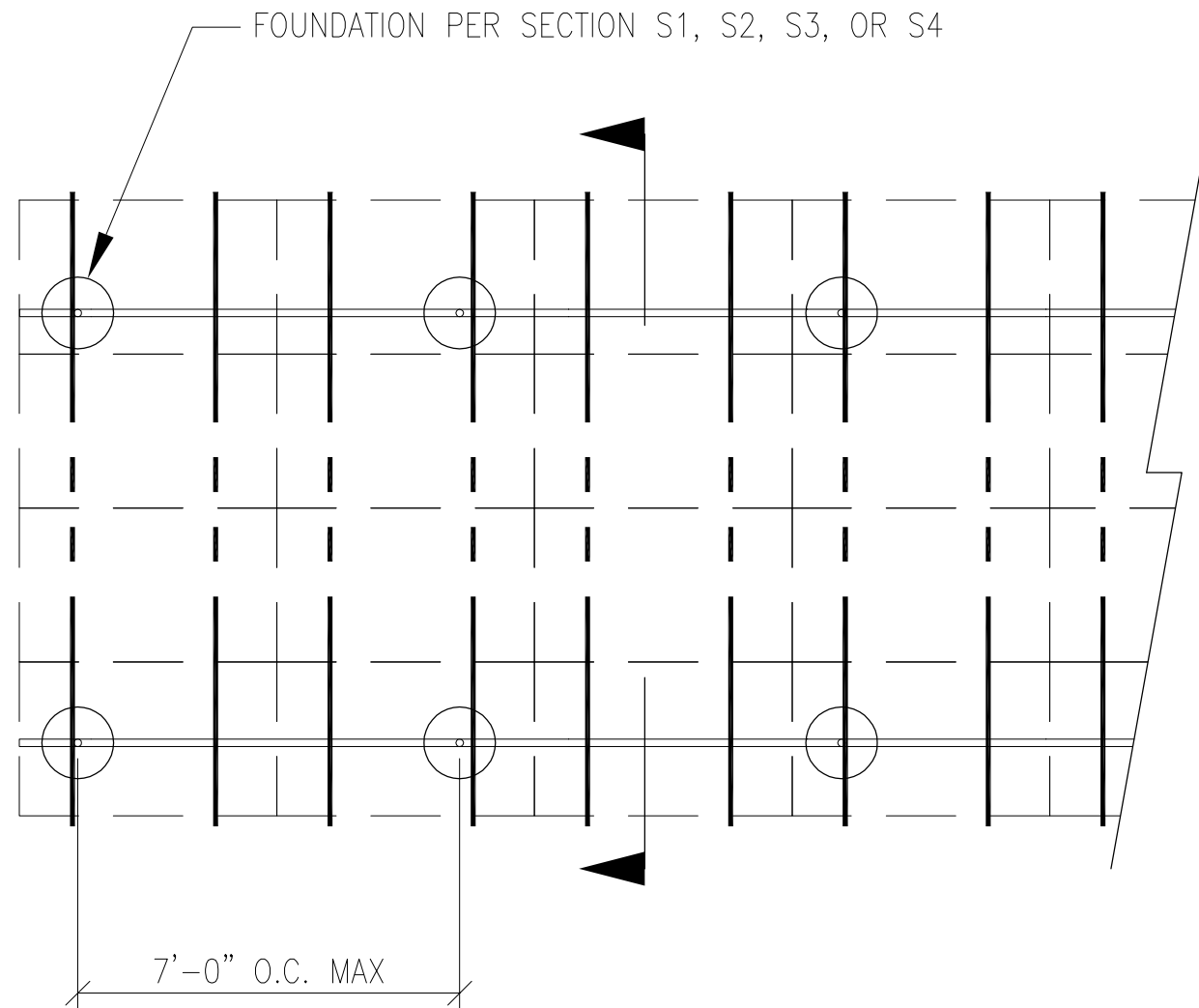


01/26/2021



JOB NO. U2716-0231-201  
 PROJECT SUNMODO SUNTURF GROUND MOUNTS A5a  
 SUBJECT ALL OPTIONS

651 W GALENA PARK BLVD. #101 (801) 990-1775  
 DRAPER, UTAH 84020 (801) 990-1776 FAX



**PV ARRAY PLAN**

N.T.S.

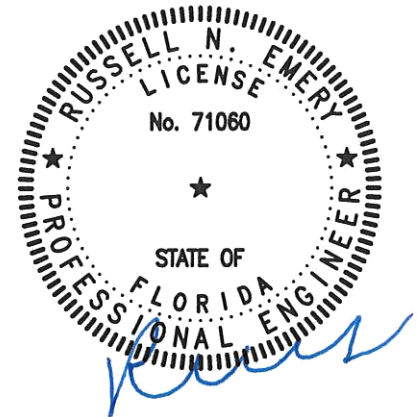
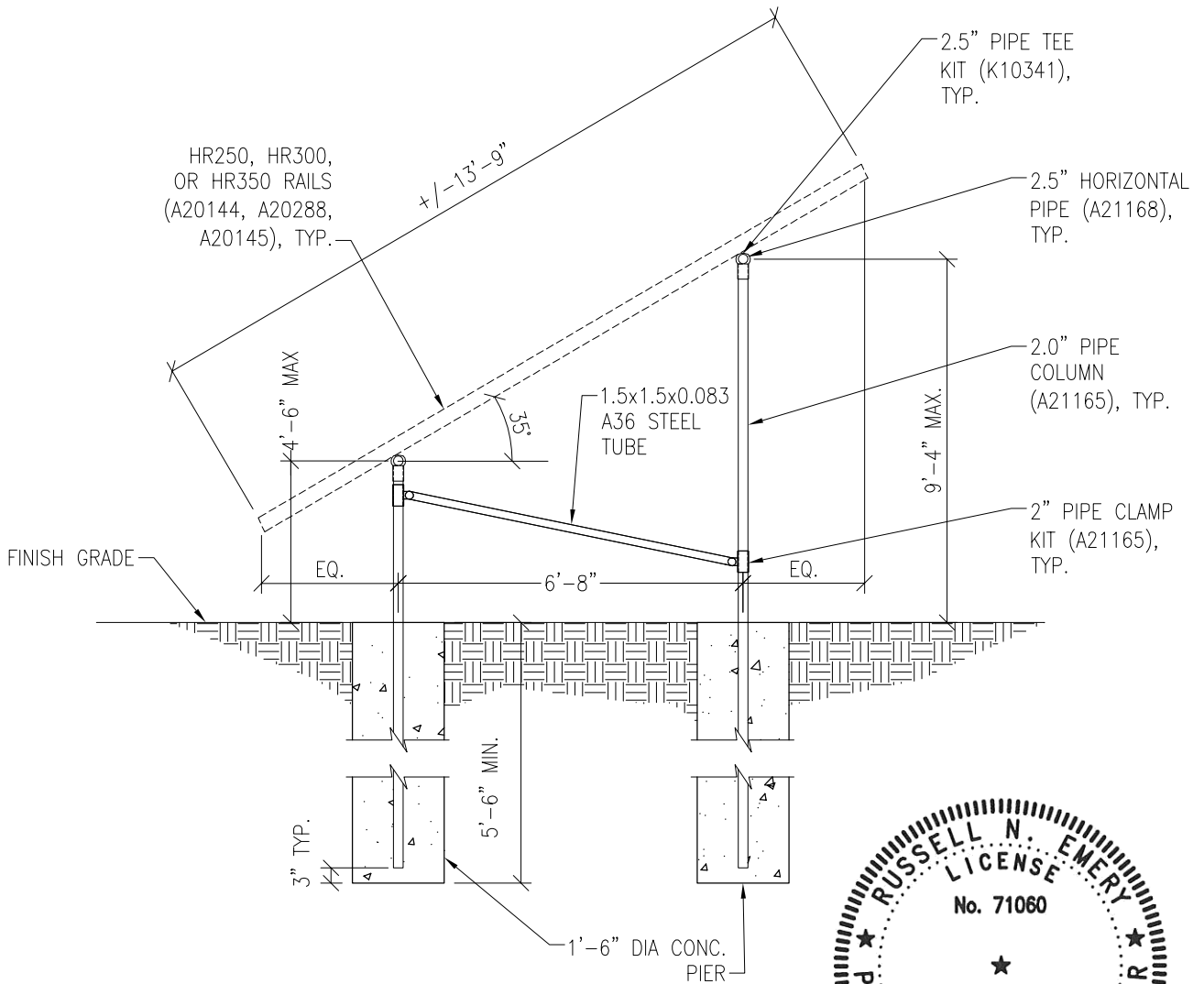
01/26/2021

**P1**

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PROJECT SUNMODO SUNTURF GROUND MOUNTS A5a

SUBJECT DRILLED PIER OPTION



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**PV ARRAY SECTION**

01/26/2021

N.T.S.

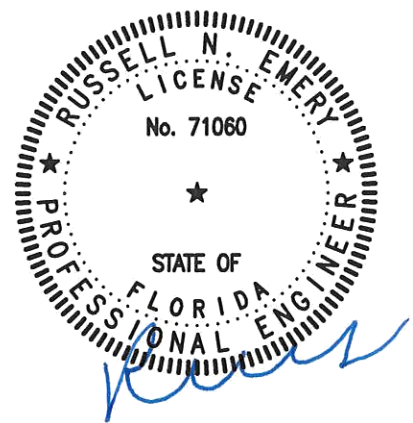
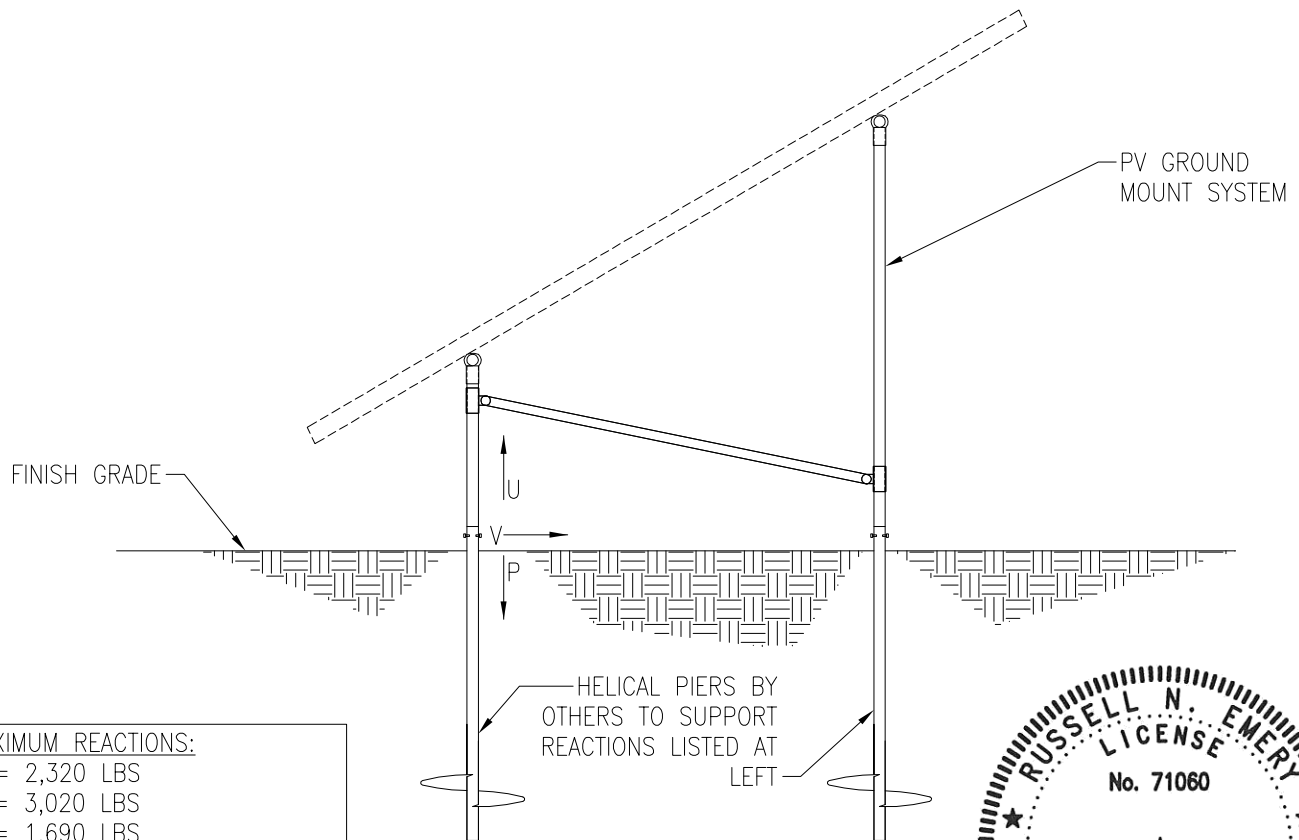
**S1**

PROJECT SUNMODO SUNTURF GROUND MOUNTS A5a

SUBJECT HELICAL PIER OPTION

**NOTES:**

1. For ground mount components see Section S1.
2. A minimum of (1) helical pier must be load-tested as follows:
  - 2.1. Safety factor for uplift = 1.5,
  - 2.2. Safety factor for lateral loads = 2.0
  - 2.3. Upward deflection limit = 1/2"
  - 2.4. Lateral deflection limit = 1"
  - 2.5. The load tests must be performed by an approved contractor.

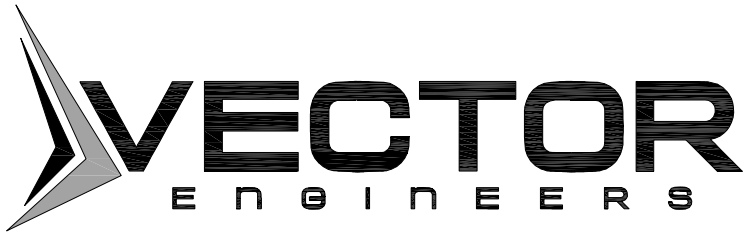


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**PV ARRAY SECTION**

N.T.S.

**S2**



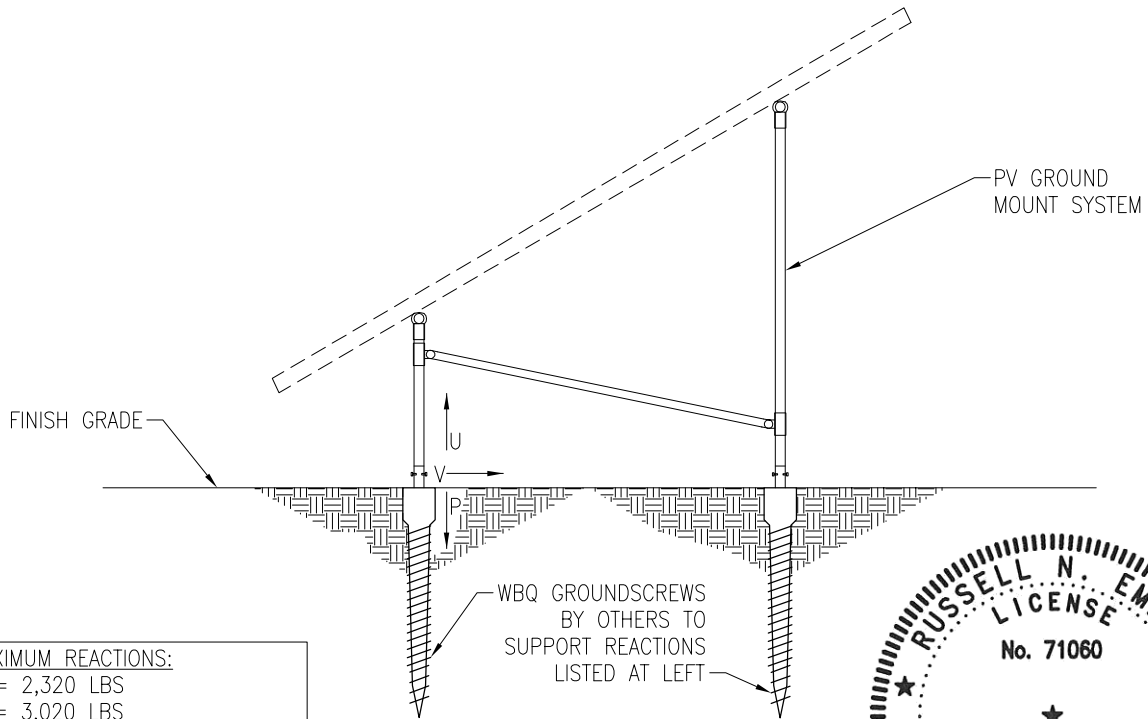
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PROJECT SUNMODO SUNTURF GROUND MOUNTS A5a

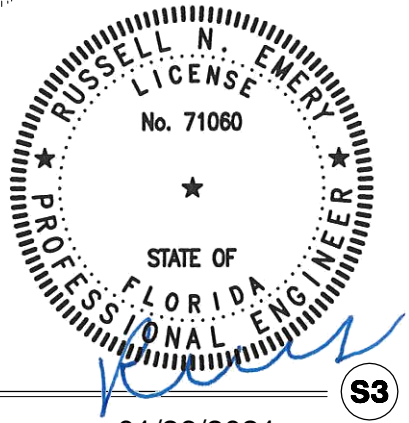
SUBJECT GROUND SCREW OPTION

NOTES:

- 1. For ground mount components see Section S1.
- 2. A minimum of (1) ground screw must be load-tested as follows:
  - 2.1. Safety factor for uplift = 1.5,
  - 2.2. Safety factor for lateral loads = 2.0
  - 2.3. Upward deflection limit = 1/2"
  - 2.4. Lateral deflection limit = 1"
  - 2.5. The load tests must be performed by an approved contractor.



**MAXIMUM REACTIONS:**  
 U = 2,320 LBS  
 P = 3,020 LBS  
 V = 1,690 LBS



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PV ARRAY SECTION  
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S3

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DRAPER, UTAH 84020

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(801) 990-1776 FAX

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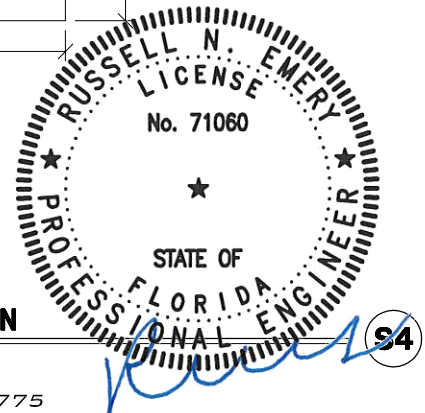
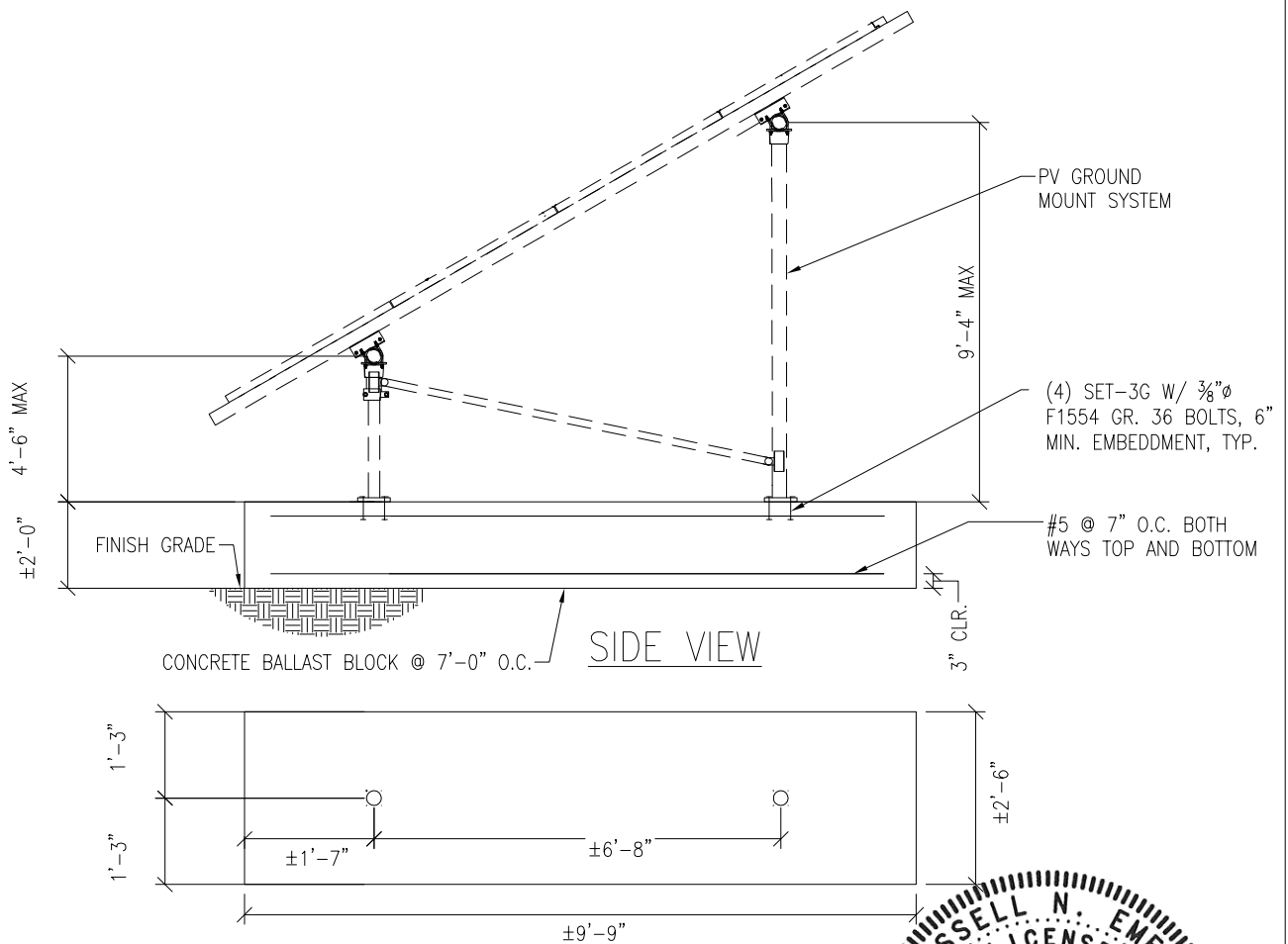
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PROJECT SUNMOD0 SUNTURF GROUND MOUNTS A5a

SUBJECT BALLASTED BLOCK OPTION

NOTES:

1. For ground mount components see Section S1.



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**PROJECT:** Sunturf Package A5A Ground Mount

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**SNOW LOADS**

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Calculations Per:	ASCE 7-16	
Snow Ground Load, $p_g$ [psf]:	70.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, $I_s$ :	0.8	(Table 1.5-2)
Terrain Category:	B	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-3.1)
Exposure Factor, $C_e$ :	0.9	(Table 7-3.1)
Thermal Factor, $C_t$ :	1.2	(Table 7-3.2)
Flat Roof Snow Load, $p_f$ [psf]:	42	(Equation 7.3-1)
Min. Roof Snow Load, $p_m$ [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	35.0	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(of Figure 7.4-1 - See Section 7.4)
Roof Slope Factor, $C_s$ :	0.64	
Sloped Roof Snow Load, $p_s$ [psf]:	27	(Equation 7.4-1)
Design Snow Load, $S$ [psf]:	27	(1.0 Snow)



**PROJECT:** Sunturf Package A5A Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-16	
Design Wind Speed, V [mph]:	140	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	B	(Section 26.7)
Ground Elevation Factor, $K_e$ :	1.0	(Table 26.9-1)
$\alpha$ :	7.0	(Table 26.11-1)
$z_g$ [ft]:	1200	(Table 26.11-1)
Velocity Pressure Exposure Coefficient, $K_h$ :	0.57	(Table 26.10-1)
Topographic Factor, $K_{ht}$ :	1.00	(Section 26.8)
Wind Directionality Factor, $K_d$ :	0.85	(Table 26.6-1)
Internal Pressure Coefficient, $GC_{pi}$ :	0.0	(Figure 26.13-1)
Velocity Pressure, $q_h$ [psf]:	24.31	(Equation 26.10-1)
Gust Effect Factor, G:	0.85	(Section 26.11.4)
Panel Slope [degrees]:	35.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.3-4

Clear Wind Flow	$C_{NW}$	$C_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-1.8	-1.8
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-2.4	-0.6
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	2.1	2.1
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	2.7	1.1

Design Wind Pressures per Equation 27.3-2 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-37.2	-37.2
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-49.6	-12.4
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	43.4	43.4
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	55.8	22.7
Case 5 ( $\gamma = 0^\circ$ , 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ( $\gamma = 180^\circ$ , 16 psf Min. Horiz.)	16.0	16.0

Wind Pressures in Longitudinal (E-W) Direction





PROJECT: Sunturf Package A5A Ground Mount

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**WIND PRESSURES**

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Net Pressure Coefficients per Figure 27.3-7

Clear Wind Flow	$C_N$
Case 1 ( $\gamma = 90^\circ$ , $d < h$ , Load Case A)	-0.80
Case 2 ( $\gamma = 90^\circ$ , $h < d < 2h$ , Load Case A)	-0.60
Case 3 ( $\gamma = 90^\circ$ , $d > 2h$ , Load Case A)	-0.30
Case 4 ( $\gamma = 90^\circ$ , $d < h$ , Load Case B)	0.80
Case 5 ( $\gamma = 90^\circ$ , $h < d < 2h$ , Load Case B)	0.50
Case 6 ( $\gamma = 90^\circ$ , $d > 2h$ , Load Case B)	0.30

Design Wind Pressures per Equation 27.3-2 [psf]

Clear Wind Flow	$q_h GC_N$
Case 1 ( $\gamma = 90^\circ$ , $d < h$ , Load Case A)	-16.5
Case 2 ( $\gamma = 90^\circ$ , $h < d < 2h$ , Load Case A)	-12.4
Case 3 ( $\gamma = 90^\circ$ , $d > 2h$ , Load Case A)	-6.2
Case 4 ( $\gamma = 90^\circ$ , $d < h$ , Load Case B)	16.5
Case 5 ( $\gamma = 90^\circ$ , $h < d < 2h$ , Load Case B)	10.3
Case 6 ( $\gamma = 90^\circ$ , $d > 2h$ , Load Case B)	6.2

*Notation:*

$h$  = mean roof height, ft

$d$  = horizontal distance from windward edge



JOB NO.: U2716-0231-201

DESIGNED: STB

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# Foundation Option 1: Drilled Concrete Pier



PROJECT: Sunturf Package A5A Ground Mount

**DRILLED CONCRETE PIER DESIGN**

**Column Reactions:**

Max. Shear, V [k]:	1.7	Max. Down, P <sub>d</sub> [k]:	3.0
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P <sub>u</sub> [k]:	2.3

**Pier Properties:**

Pier Shape:	Round	Volume of Concrete [ft <sup>3</sup> ]:	10
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd <sup>3</sup> ]:	0.4
Top of Pier Elevation [ft]:	0.00	Weight of Concrete [k]:	1.5
Pier Depth, d [ft]:	5.5		

**Soil Properties:**

Allow. Bearing Pressure [psf]:	1,500	<u>Optional Parameters for Uplift:</u>	
1/3 increase for short term loads?	No		
Lateral Bearing, S [pcf]:	150	Skin Friction* [psf]:	250
Max. Lateral Bearing (opt'l) [psf]:		Top Length to Ignore [ft]:	0
Top Depth to Ignore [ft]:	0	1/3 increase for short term loads?	No
1/3 increase for short term loads?	No	Combine w/ Bearing:	No
1/2" deflection at t/o pier allowed:	Yes		

\*per IBC Section 1810.3.3.1.4

**Check Bearing:**

Bearing Capacity [k]:	6.5
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**Bearing capacity OK.**

**Check Uplift:**

Uplift Capacity [k]:	7.8
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**Uplift capacity OK.**

**Check Lateral Bearing:**

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	1,690
Point of Application, h [ft]:	0.0
S <sub>max</sub> [psf]:	
S [psf]:	550
A = 2.34*P/(Sb):	4.79
Required Pier Depth, d <sub>reqd</sub> [ft]:	4.80

IBC Section 1807.3.2.1

IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**

# Foundation Option 2: Helical Pier

The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below.

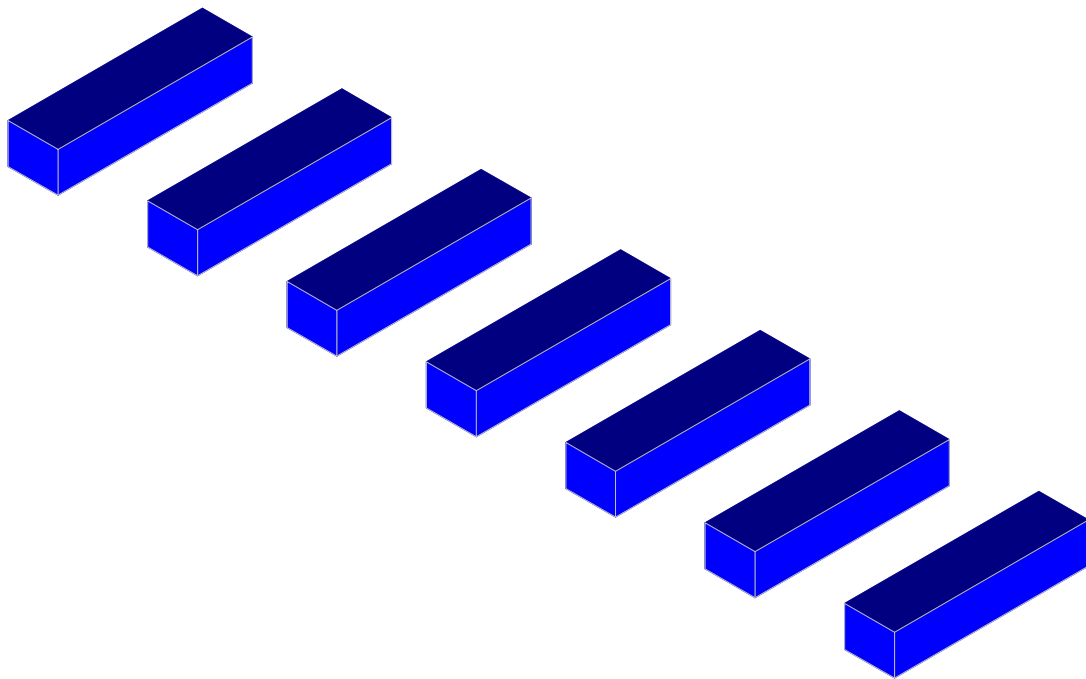
Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2320	1.5	3480
LATERAL	1690	2	3380

# Foundation Option 3: Ground Screw

The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below.

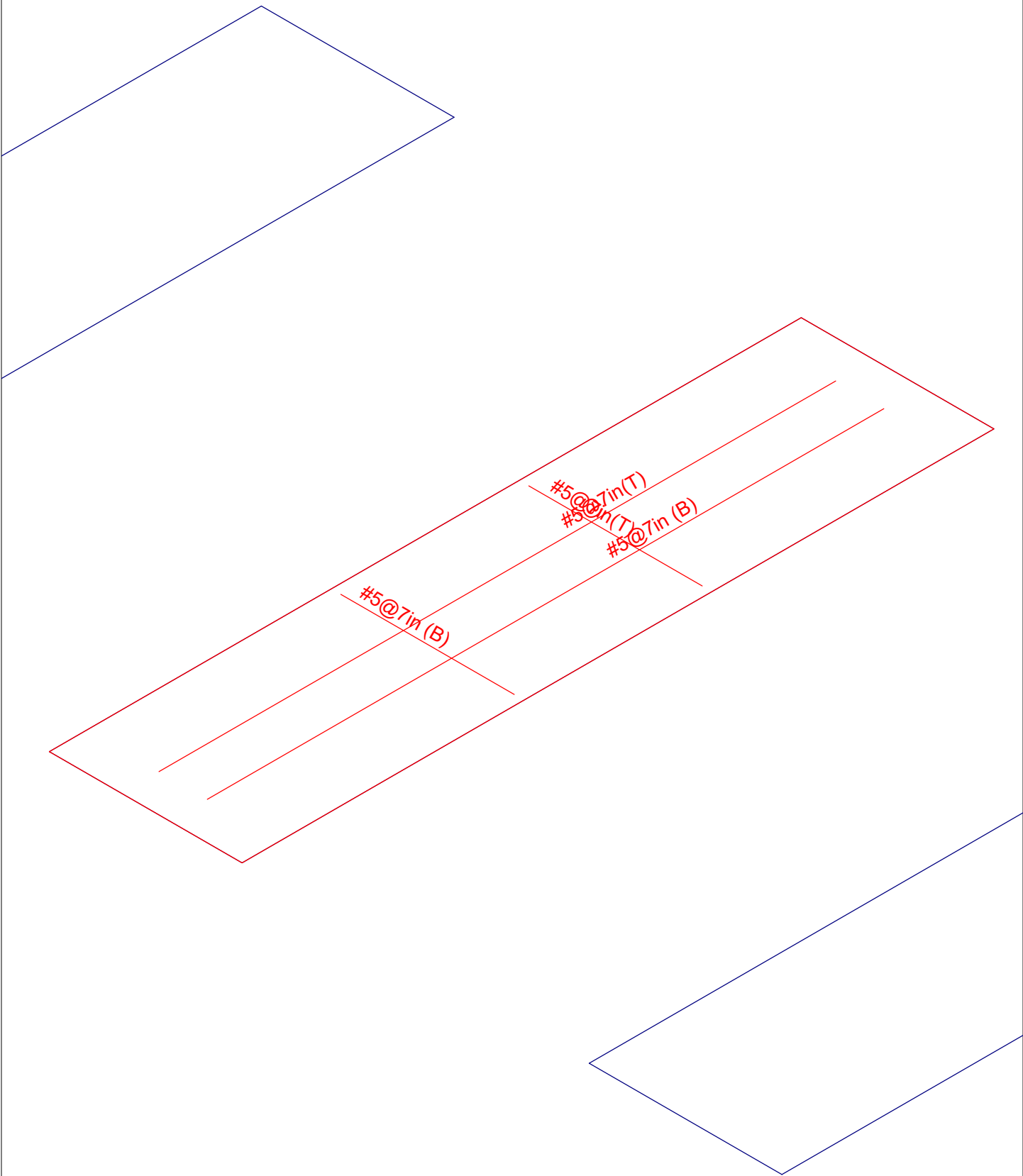
Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2320	1.5	3480
LATERAL	1690	2	3380

# Foundation Option 4: Ballasted Block



Results for LC 1, 1.0 D

Vector Structural Engineeri..	Ground Mount	SK - 2
STB		July 22, 2020 at 10:33 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d



Results for LC 1, 1.0 D

Vector Structural Engineeri...	Ground Mount	SK - 1
STB		July 22, 2020 at 10:33 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d





**(Global) Model Settings**

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	100
Mesh Size (in)	12
Max Iterations	10
Merge Tolerance (in)	.12
Solver	Sparse Accelerated
Coefficient of Friction	.3
No. of Shear Regions	4
Shear Region Spacing Increment (in)	4
Min 1 Bar Dia Spacing for Beams?	No
Optimize footings for OTM / Sliding?	Yes
Parame Beta Factor	.65
Pile Safety Factor	3
Concrete Stress Block	0
Concrete Rebar Set	Rectangular
Concrete Code	ASTM A615
HR Steel Pile Code	ACI 318-14
Wood Pile Code	AISC 14th (360-10): ASD AWC NDS-15: ASD

**Concrete Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm (/...	Density[lb/ft^3]	fc[psi]	Lambda	Flex Stee...	Shear St...
1	Conc3000NW	3156	1372	.15	.6	145	3000	1	60000	60000
2	Conc3500NW	3409	1482	.15	.6	145	3500	1	60000	60000
3	Conc4000NW	3644	1584	.15	.6	145	4000	1	60000	60000
4	Conc3000LW	2085	907	.15	.6	109.999	3000	.75	60000	60000
5	Conc3500LW	2252	979	.15	.6	109.999	3500	.75	60000	60000
6	Conc4000LW	2408	1047	.15	.6	109.999	4000	.75	60000	60000
7	Conc2500NW	3156	1372	.15	.6	145	2500	1	60000	60000

**General Design Parameters**

	Label	Max Bending Chk	Max Shear Chk	Top Cover[in]	Bottom Cover[in]
1	Typical	1	1	3	3

**Slab Rebar Parameters**

	Label	Top Bar	Bottom Bar	Max Top Bar Sp...	Min Top Bar Sp...	Max Bot Bar Sp...	Min Bot Bar Sp...	Spacing Incr...	Rebar Options
1	Typical	#5	#5	18	3	18	3	1	Optimize

**Soil Definitions**

	Label	Subgrade Modulus[lb/ft^3]	Allowable Bearing[psf]	Depth Properties	Default?
1	Default	1e+5	1500	None	Yes

**Point Loads and Moments (Cat 1 : DL)**

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-11.981
2	R3D_N1_1	Y	216.315
3	R3D_N2	Y	183.998
4	R3D_N132_2	Y	210.689
5	R3D_N133_1	X	-1.035
6	R3D_N133_1	Y	201.84
7	R3D_N109_1	Y	194.866
8	R3D_N110A_1	Y	206.883

**Point Loads and Moments (Cat 1 : DL) (Continued)**

	Label	Direction	Magnitude[lb,lb-ft]
9	R3D_N121_1	Y	213.292
10	R3D_N122_1	Y	204.065
11	R3D_N133B	Y	210.369
12	R3D_N134B_1	X	-1.088
13	R3D_N134B_1	Y	204.722
14	R3D_N151_1	Y	208.076
15	R3D_N152_1	X	-2.806
16	R3D_N152_1	Y	216.842
17	R3D_N143A	X	13.773
18	R3D_N143A	Y	172.004
19	R3D_N144A	X	6.043
20	R3D_N144A	Y	138.199

**Point Loads and Moments (Cat 6 : RLL)**

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-67.331
2	R3D_N1_1	Y	1031.223
3	R3D_N2	X	-2.839
4	R3D_N2	Y	965.955
5	R3D_N132_2	X	-2.393
6	R3D_N132_2	Y	1044.539
7	R3D_N133_1	X	-6.442
8	R3D_N133_1	Y	1072.806
9	R3D_N109_1	X	-2.92
10	R3D_N109_1	Y	942.536
11	R3D_N109_1	Z	-1.733
12	R3D_N110A_1	Y	1106.213
13	R3D_N121_1	Y	1059.791
14	R3D_N121_1	Z	2.094
15	R3D_N122_1	X	-3.297
16	R3D_N122_1	Y	1086.093
17	R3D_N133B	X	-2.058
18	R3D_N133B	Y	1040.863
19	R3D_N133B	Z	-1.423
20	R3D_N134B_1	X	-6.539
21	R3D_N134B_1	Y	1090.394
22	R3D_N151_1	X	-2.829
23	R3D_N151_1	Y	1020.851
24	R3D_N152_1	X	-17.111
25	R3D_N152_1	Y	1164.394
26	R3D_N143A	X	78.066
27	R3D_N143A	Y	772.29
28	R3D_N144A	X	35.641
29	R3D_N144A	Y	694.667

**Point Loads and Moments (Cat 16 : OL1)**

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	121.18
2	R3D_N1_1	Y	-3361.819
3	R3D_N1_1	Z	1910.216
4	R3D_N2	X	12.423
5	R3D_N2	Y	568.067
6	R3D_N2	Z	-95.762
7	R3D_N132_2	X	3.763
8	R3D_N132_2	Y	-3551.734
9	R3D_N132_2	Z	2117.481























**Slab Sliding Safety Factors (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
39	6	S4	0	7.208	2788.486	1272.106	2788.486	9.999+	2.192
40	6	S5	0	6.291	2782.937	1240.934	2782.937	9.999+	2.243
41	6	S6	0	22.483	2811.705	1404.448	2811.705	9.999+	2.002
42	6	S7	0	113.451	2581.841	787.807	2581.841	9.999+	3.277
43	7	S1	0	38.813	2455.427	475.203	2455.427	9.999+	5.167
44	7	S2	0	1.177	2427.735	466.144	2427.735	9.999+	5.208
45	7	S3	0	4.575	2367.966	281.054	2367.966	9.999+	8.425
46	7	S4	0	2.741	2330.159	199.3	2330.159	9.999+	9.999+
47	7	S5	0	1.687	2333.292	201.903	2333.292	9.999+	9.999+
48	7	S6	0	4.115	2333.902	227.226	2333.902	9.999+	9.999+
49	7	S7	0	43.098	2278.467	128.257	2278.467	9.999+	9.999+
50	8	S1	0	13.888	2027.095	473.083	2027.095	9.999+	4.285
51	8	S2	0	3.064	2079.907	407.252	2079.907	9.999+	5.107
52	8	S3	0	1.541	2136.662	249.795	2136.662	9.999+	8.554
53	8	S4	0	.082	2158.361	203.517	2158.361	9.999+	9.999+
54	8	S5	0	.352	2155.885	201.442	2155.885	9.999+	9.999+
55	8	S6	0	1.493	2162.028	227.283	2162.028	9.999+	9.512
56	8	S7	0	3.12	2149.109	128.254	2149.109	9.999+	9.999+
57	9	S1	0	4.487	2312.931	816.504	2312.931	9.999+	2.833
58	9	S2	0	1.862	2327.74	947.452	2327.74	9.999+	2.457
59	9	S3	0	.741	2328.715	919.63	2328.715	9.999+	2.532
60	9	S4	0	4.737	2328.871	927.361	2328.871	9.999+	2.511
61	9	S5	0	5.325	2326.029	906.636	2326.029	9.999+	2.566
62	9	S6	0	8.781	2338.298	1023.229	2338.298	9.999+	2.285
63	9	S7	0	25.454	2266.063	576.663	2266.063	9.999+	3.93
64	10	S1	0	7.45	2359.905	690.85	2359.905	9.999+	3.416
65	10	S2	0	4.933	2400.208	797.015	2400.208	9.999+	3.011
66	10	S3	0	2.473	2388.979	776.275	2388.979	9.999+	3.077
67	10	S4	0	7.174	2391.711	782	2391.711	9.999+	3.058
68	10	S5	0	7.487	2385.788	765.836	2385.788	9.999+	3.115
69	10	S6	0	16.635	2412.96	860.884	2412.96	9.999+	2.803
70	10	S7	0	24.377	2298.752	488.407	2298.752	9.999+	4.707
71	11	S1	0	136.677	3137.777	968.331	3137.777	9.999+	3.24
72	11	S2	0	7.13	3145.58	1126.308	3145.58	9.999+	2.793
73	11	S3	0	4.484	3203.019	1087.123	3203.019	9.999+	2.946
74	11	S4	0	10.783	3194.037	1102.044	3194.037	9.999+	2.898
75	11	S5	0	10.368	3188.992	1075.176	3188.992	9.999+	2.966
76	11	S6	0	28.177	3215.459	1213.318	3215.459	9.999+	2.65
77	11	S7	0	200.03	2873.447	683.91	2873.447	9.999+	4.202
78	12	S1	0	108.082	3067.309	837.192	3067.309	9.999+	3.664
79	12	S2	0	2.831	3098.727	977.889	3098.727	9.999+	3.169
80	12	S3	0	5.25	3137.635	941.526	3137.635	9.999+	3.333
81	12	S4	0	12.126	3132.187	955.147	3132.187	9.999+	3.279
82	12	S5	0	11.604	3124.702	930.701	3124.702	9.999+	3.357
83	12	S6	0	32.52	3162.485	1053.336	3162.485	9.999+	3.002
84	12	S7	0	175.322	2819.868	590.855	2819.868	9.999+	4.773
85	13	S1	0	84.732	2851.116	356.402	2851.116	9.999+	8
86	13	S2	0	1.307	2842.058	350.908	2842.058	9.999+	8.099
87	13	S3	0	.958	2820.257	209.22	2820.257	9.999+	9.999+
88	13	S4	0	8.776	2788.441	150.543	2788.441	9.999+	9.999+
89	13	S5	0	8.151	2787.469	151.427	2787.469	9.999+	9.999+
90	13	S6	0	18.744	2804.133	170.42	2804.133	9.999+	9.999+
91	13	S7	0	122.558	2592.338	96.193	2592.338	9.999+	9.999+
92	14	S1	0	45.207	2529.867	354.812	2529.867	9.999+	7.13
93	14	S2	0	4.488	2581.187	304.139	2581.187	9.999+	8.487
94	14	S3	0	3.629	2646.779	188.917	2646.779	9.999+	9.999+
95	14	S4	0	6.658	2659.593	151.57	2659.593	9.999+	9.999+





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**1. Project information**

Customer company:  
Customer contact name:  
Customer e-mail:  
Comment:

Project description:  
Location:  
Fastening description:

**2. Input Data & Anchor Parameters**

**General**

Design method: ACI 318-14  
Units: Imperial units

**Anchor Information:**

Anchor type: Bonded anchor  
Material: F1554 Grade 36  
Diameter (inch): 0.375  
Effective Embedment depth,  $h_{ef}$  (inch): 6.000  
Code report: ICC-ES ESR-4057  
Anchor category: -  
Anchor ductility: Yes  
 $h_{min}$  (inch): 7.25  
 $c_{ac}$  (inch): 10.99  
 $c_{min}$  (inch): 1.75  
 $s_{min}$  (inch): 3.00

**Base Material**

Concrete: Normal-weight  
Concrete thickness,  $h$  (inch): 30.00  
State: Cracked  
Compressive strength,  $f'_c$  (psi): 2500  
 $\Psi_{c,v}$ : 1.0  
Reinforcement condition: B tension, B shear  
Supplemental reinforcement: Not applicable  
Reinforcement provided at corners: No  
Ignore concrete breakout in tension: No  
Ignore concrete breakout in shear: No  
Hole condition: Dry concrete  
Inspection: Periodic  
Temperature range, Short/Long: 150/110°F  
Ignore 6do requirement: Not applicable  
Build-up grout pad: No

**Base Plate**

Length x Width x Thickness (inch): 4.75 x 4.75 x 0.31

**Recommended Anchor**

Anchor Name: SET-3G - SET-3G w/ 3/8"Ø F1554 Gr. 36  
Code Report: ICC-ES ESR-4057





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**Load and Geometry**

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

$N_{ua}$  [lb]: 3870

$V_{uax}$  [lb]: 175

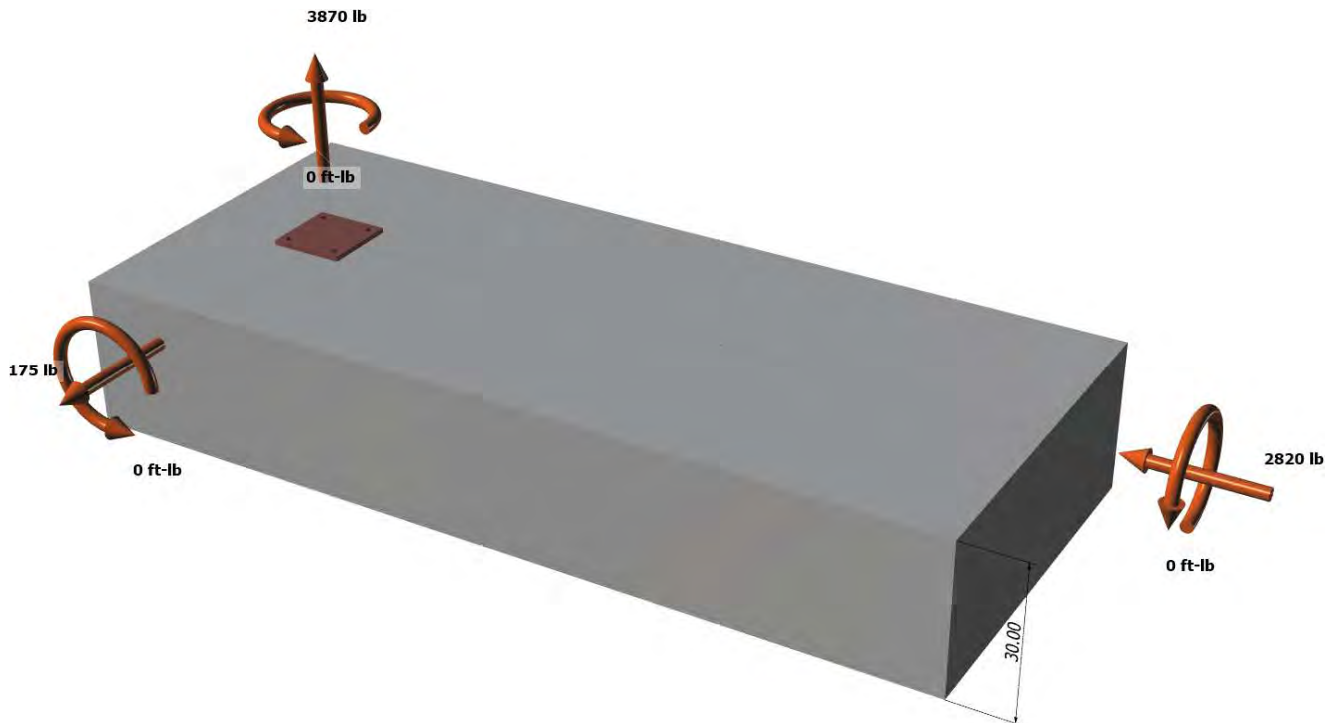
$V_{uay}$  [lb]: -2820

$M_{ux}$  [ft-lb]: 0

$M_{uy}$  [ft-lb]: 0

$M_{uz}$  [ft-lb]: 0

<Figure 1>





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<Figure 2>







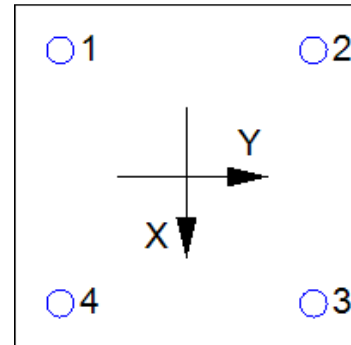
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### 3. Resulting Anchor Forces

Anchor	Tension load, N <sub>ua</sub> (lb)	Shear load x, V <sub>uax</sub> (lb)	Shear load y, V <sub>uay</sub> (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	967.5	43.8	-705.0	706.4
2	967.5	43.8	-705.0	706.4
3	967.5	43.8	-705.0	706.4
4	967.5	43.8	-705.0	706.4
Sum	3870.0	175.0	-2820.0	2825.4

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 3870  
 Resultant compression force (lb): 0  
 Eccentricity of resultant tension forces in x-axis, e'<sub>Nx</sub> (inch): 0.00  
 Eccentricity of resultant tension forces in y-axis, e'<sub>Ny</sub> (inch): 0.00  
 Eccentricity of resultant shear forces in x-axis, e'<sub>Vx</sub> (inch): 0.00  
 Eccentricity of resultant shear forces in y-axis, e'<sub>Vy</sub> (inch): 0.00

<Figure 3>



### 4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N <sub>sa</sub> (lb)	φ	φN <sub>sa</sub> (lb)
4525	0.75	3394

### 5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = K_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

K <sub>c</sub>	λ <sub>a</sub>	f <sub>c</sub> (psi)	h <sub>ef</sub> (in)	N <sub>b</sub> (lb)
17.0	1.00	2500	6.000	12492

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1b)}$$

A <sub>Nc</sub> (in <sup>2</sup> )	A <sub>Nco</sub> (in <sup>2</sup> )	c <sub>a,min</sub> (in)	ψ <sub>ec,N</sub>	ψ <sub>ed,N</sub>	ψ <sub>c,N</sub>	ψ <sub>cp,N</sub>	N <sub>b</sub> (lb)	φ	φN <sub>cbg</sub> (lb)
424.63	324.00	7.25	1.000	0.942	1.00	1.000	12492	0.65	10021

### 6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$$\tau_{k,cr} = \tau_{k,cr,short-term} K_{sat} (f_c / 2,500)^n$$

τ <sub>k,cr</sub> (psi)	f <sub>short-term</sub>	K <sub>sat</sub>	f <sub>c</sub> (psi)	n	τ <sub>k,cr</sub> (psi)
1346	1.00	1.00	2500	0.24	1346

$$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \text{ (Eq. 17.4.5.2)}$$

λ <sub>a</sub>	τ <sub>cr</sub> (psi)	d <sub>a</sub> (in)	h <sub>ef</sub> (in)	N <sub>ba</sub> (lb)
1.00	1346	0.38	6.000	9514

$$\phi N_{ag} = \phi (A_{Na} / A_{Na0}) \psi_{ec,Na} \psi_{ed,Na} \psi_{cp,Na} N_{ba} \text{ (Sec. 17.3.1 \& Eq. 17.4.5.1b)}$$

A <sub>Na</sub> (in <sup>2</sup> )	A <sub>Na0</sub> (in <sup>2</sup> )	c <sub>Na</sub> (in)	c <sub>a,min</sub> (in)	ψ <sub>ec,Na</sub>	ψ <sub>ed,Na</sub>	ψ <sub>cp,Na</sub>	N <sub>ba</sub> (lb)	φ	φN <sub>ag</sub> (lb)
198.45	112.09	5.29	7.25	1.000	1.000	1.000	9514	0.55	9265



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**8. Steel Strength of Anchor in Shear (Sec. 17.5.1)**

$V_{sa}$ (lb)	$\phi_{grout}$	$\phi$	$\phi_{grout}\phi V_{sa}$ (lb)
2715	1.0	0.65	1765

**9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)**

**Shear perpendicular to edge in x-direction:**

$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{bx}$ (lb)
3.00	0.375	1.00	2500	13.75	16564

$\phi V_{cbgx} = \phi (A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx}$  (Sec. 17.3.1 & Eq. 17.5.2.1b)

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{bx}$ (lb)	$\phi$	$\phi V_{cbgx}$ (lb)
647.11	850.78	1.000	0.805	1.000	1.000	16564	0.70	7103

**Shear perpendicular to edge in y-direction:**

$V_{by} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{by}$ (lb)
3.00	0.375	1.00	2500	10.75	11450

$\phi V_{cbgy} = \phi (A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by}$  (Sec. 17.3.1 & Eq. 17.5.2.1b)

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{by}$ (lb)	$\phi$	$\phi V_{cbgy}$ (lb)
387.00	520.03	1.000	0.891	1.000	1.000	11450	0.70	5313

**Shear parallel to edge in x-direction:**

$V_{by} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{by}$ (lb)
3.00	0.375	1.00	2500	7.25	6342

$\phi V_{cbgx} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by}$  (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{by}$ (lb)	$\phi$	$\phi V_{cbgx}$ (lb)
261.00	236.53	1.000	1.000	1.000	1.000	6342	0.70	9797

**Shear parallel to edge in y-direction:**

$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{bx}$ (lb)
3.00	0.375	1.00	2500	10.25	10661

$\phi V_{cbgy} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx}$  (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{bx}$ (lb)	$\phi$	$\phi V_{cbgy}$ (lb)
401.67	472.78	1.000	1.000	1.000	1.000	10661	0.70	12680

**10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)**

$\phi V_{cp} = \phi \min|k_{cp} N_{ag}; k_{cp} N_{cbg}| = \phi \min|k_{cp} (A_{Na} / A_{Na0}) \psi_{ec,Na} \psi_{ed,Na} \psi_{cp,Na} N_{ba}; k_{cp} (A_{Nc} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b|$  (Sec. 17.3.1 & Eq. 17.5.3.1b)

$k_{cp}$	$A_{Na}$ (in <sup>2</sup> )	$A_{Na0}$ (in <sup>2</sup> )	$\psi_{ed,Na}$	$\psi_{ec,Na}$	$\psi_{cp,Na}$	$N_{ba}$ (lb)	$N_a$ (lb)
2.0	198.45	112.09	1.000	1.000	1.000	9514	16845

$A_{Nc}$ (in <sup>2</sup> )	$A_{Nco}$ (in <sup>2</sup> )	$\psi_{ec,N}$	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	$N_b$ (lb)	$N_{cb}$ (lb)	$\phi$
424.63	324.00	1.000	0.942	1.000	1.000	12492	15417	0.70

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



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$\phi V_{cpq}$  (lb)  
21584

## 11. Results

### Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, $N_{ua}$ (lb)	Design Strength, $\phi N_n$ (lb)	Ratio	Status	
Steel	968	3394	0.29	Pass	
Concrete breakout	3870	10021	0.39	Pass	
<b>Adhesive</b>	<b>3870</b>	<b>9265</b>	<b>0.42</b>	<b>Pass (Governs)</b>	
Shear	Factored Load, $V_{ua}$ (lb)	Design Strength, $\phi V_n$ (lb)	Ratio	Status	
Steel	706	1765	0.40	Pass	
T Concrete breakout x+	175	7103	0.02	Pass	
T Concrete breakout y-	2820	5313	0.53	Pass	
Concrete breakout y-	88	9797	0.01	Pass	
Concrete breakout x-	1410	12680	0.11	Pass	
<b>Concrete breakout, combined</b>	<b>-</b>	<b>-</b>	<b>0.53</b>	<b>Pass (Governs)</b>	
Pryout	2825	21584	0.13	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.23	0.35	58.2%	1.0	Pass

**SET-3G w/ 3/8"Ø F1554 Gr. 36 with hef = 6.000 inch meets the selected design criteria.**

## 12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

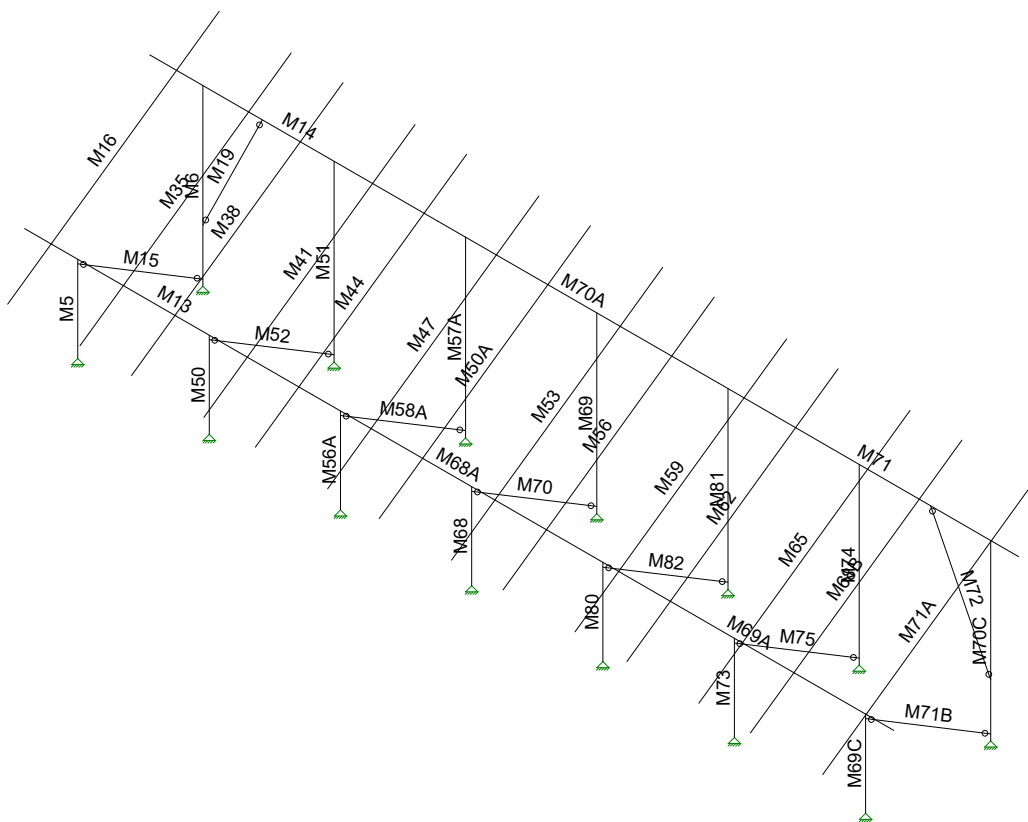


JOB NO.: U2716-0231-201

DESIGNED: STB

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# Framing Analysis



Vector Structural Engineeri...

STB

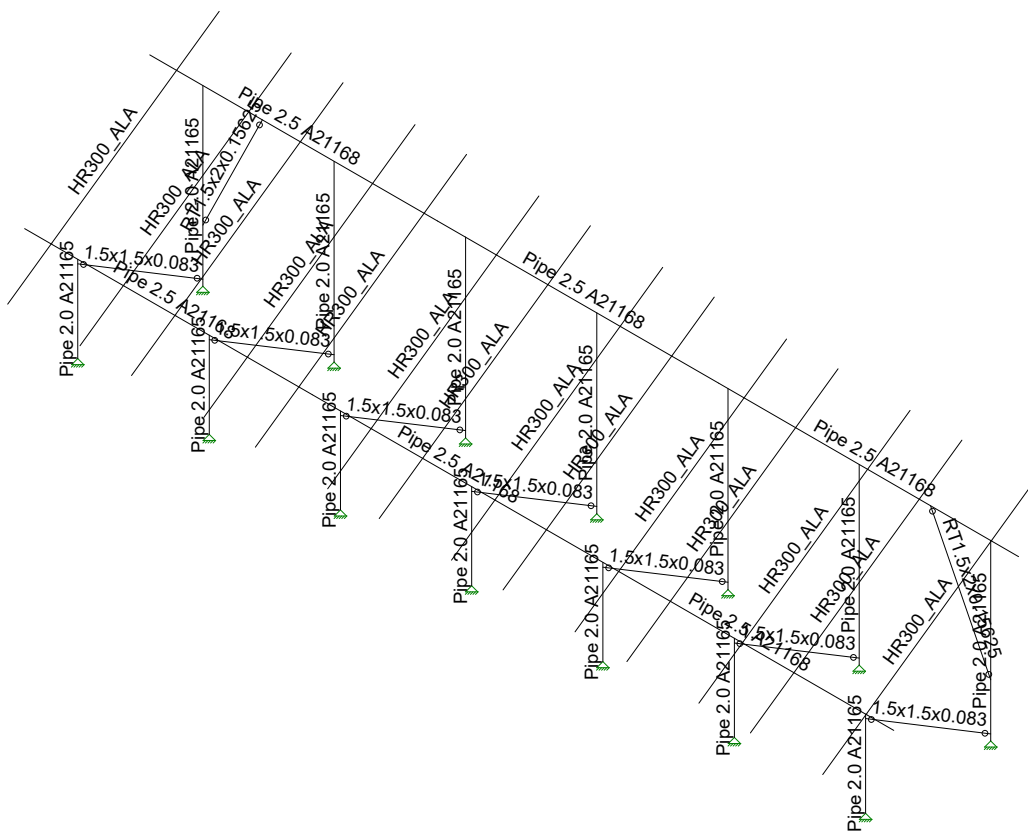
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Ground Mount

SK - 3

July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d



Vector Structural Engineeri...

STB

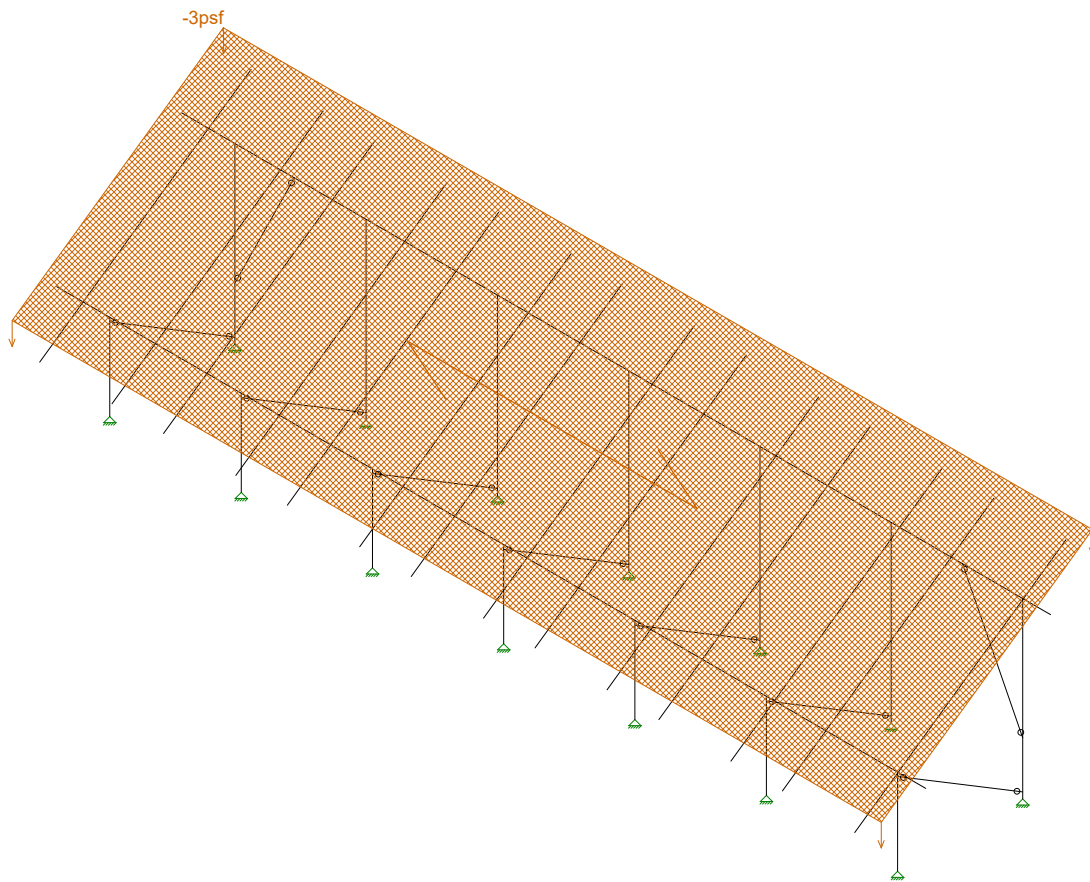
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Ground Mount

SK - 4

July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d



Loads: BLC 2, Solar Panel Weight

Vector Structural Engineeri...

STB

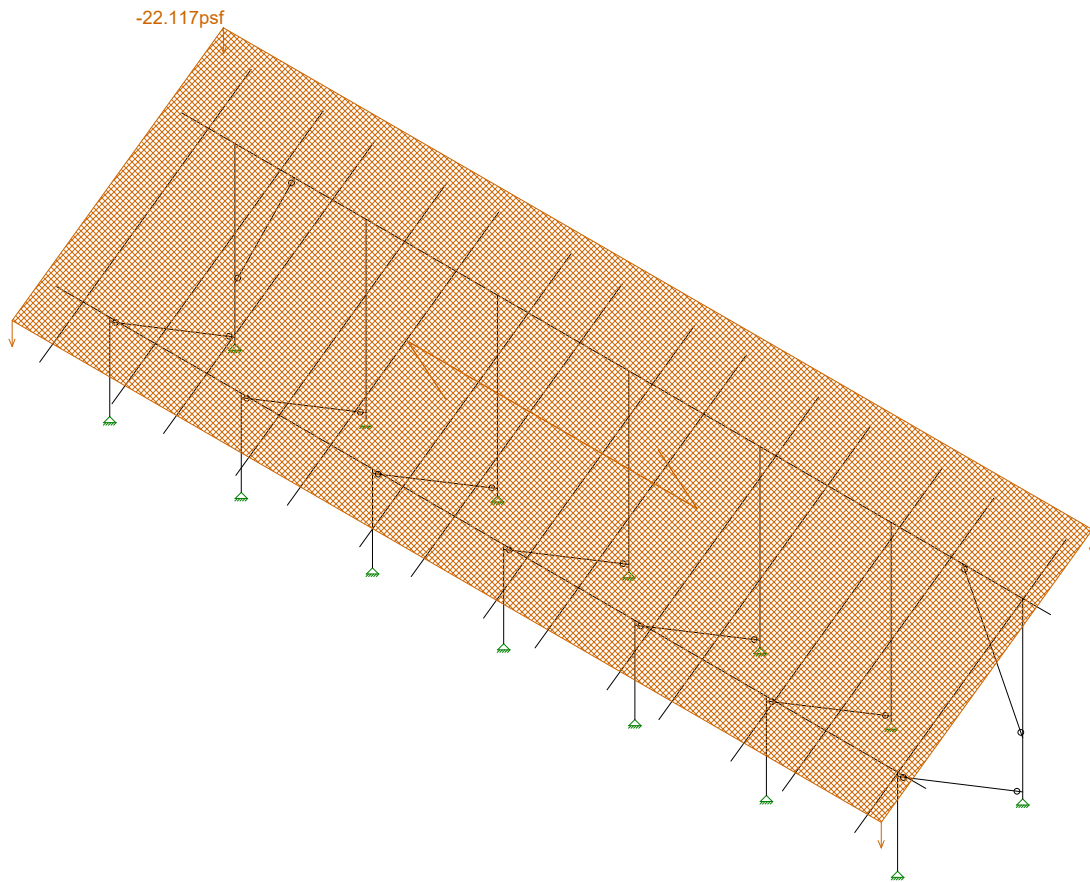
U2716.0231.201

Ground Mount

SK - 5

July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d



Loads: BLC 3, Roof Live/Snow

Vector Structural Engineeri...

STB

U2716.0231.201

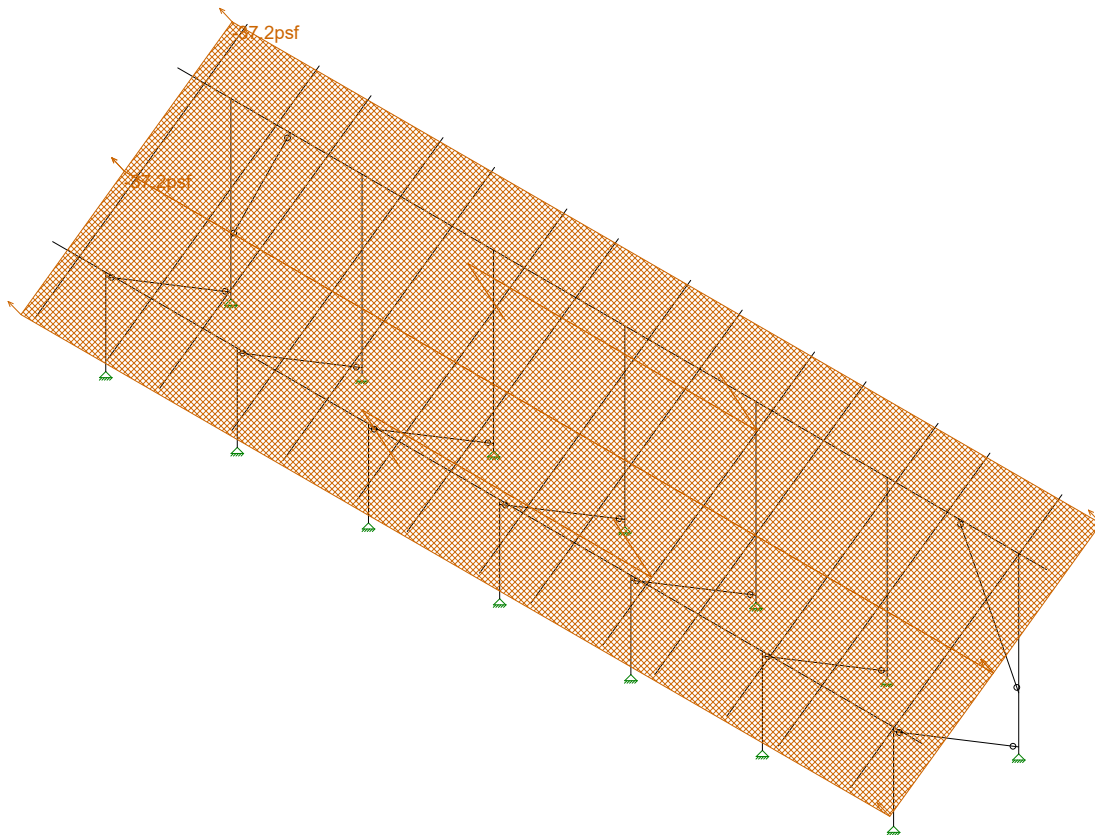
Ground Mount

SK - 6

July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d





Loads: BLC 4, Wind A 0 deg

Vector Structural Engineeri..

STB

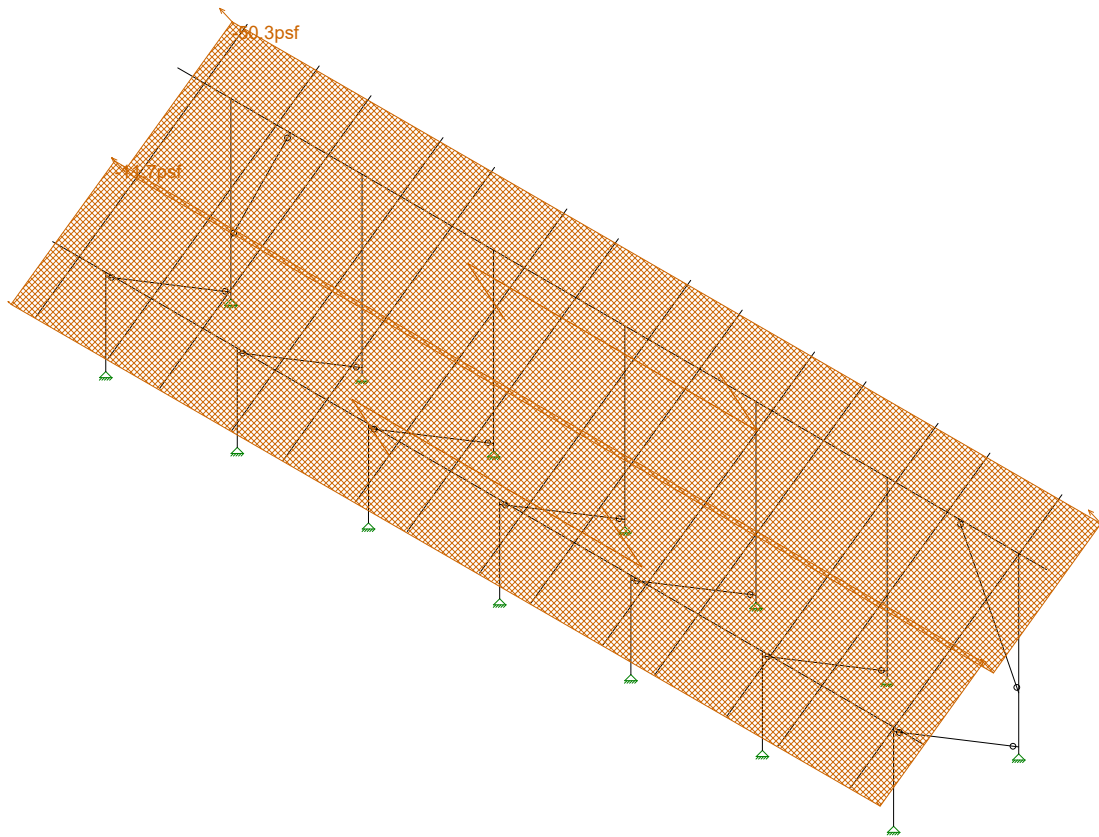
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Ground Mount

SK - 7

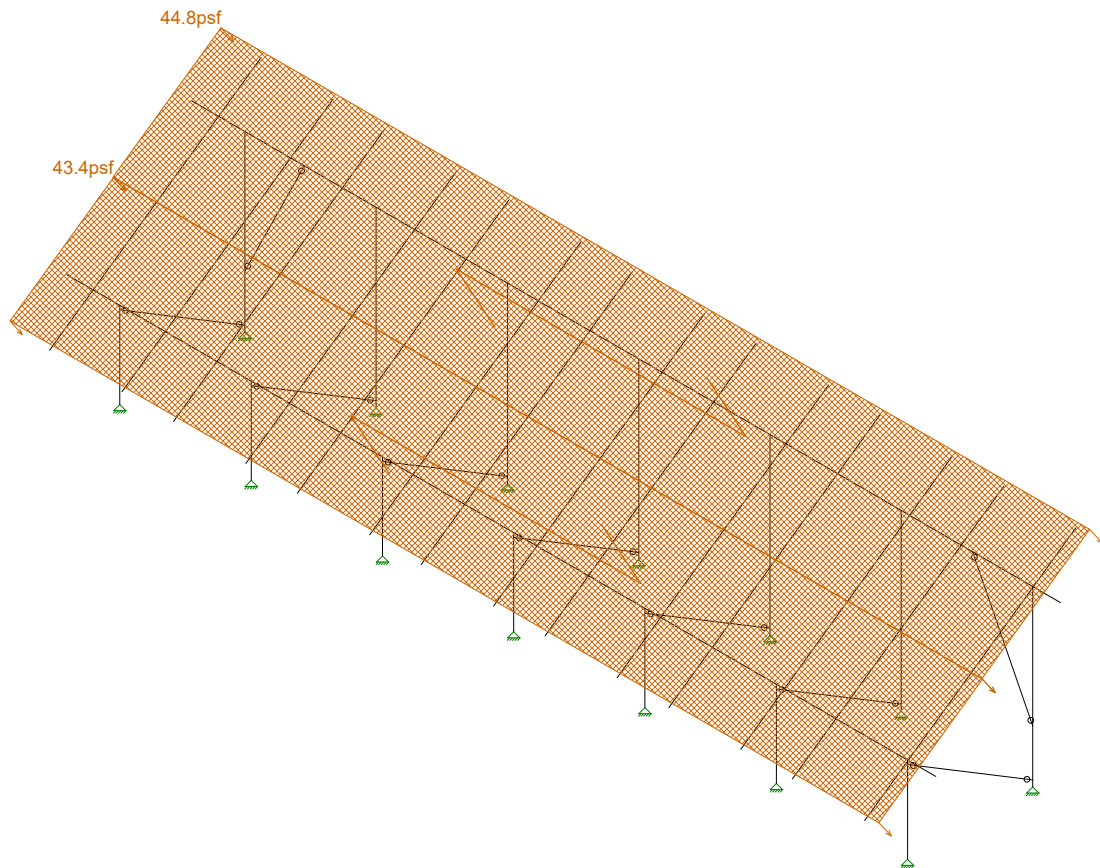
July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d



Loads: BLC 5, Wind B 0 deg

Vector Structural Engineeri..	Ground Mount	SK - 8
STB		July 22, 2020 at 10:29 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d



Loads: BLC 6, Wind A 180 deg

Vector Structural Engineeri...

STB

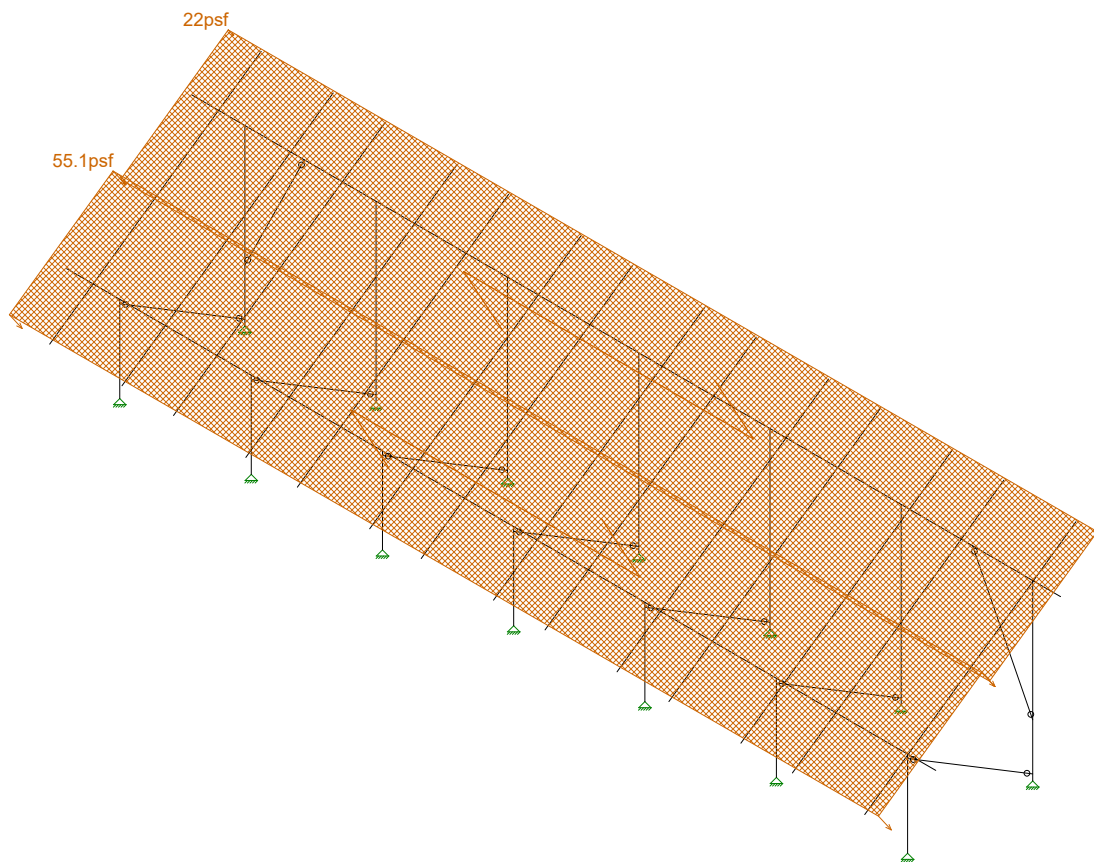
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Ground Mount

SK - 9

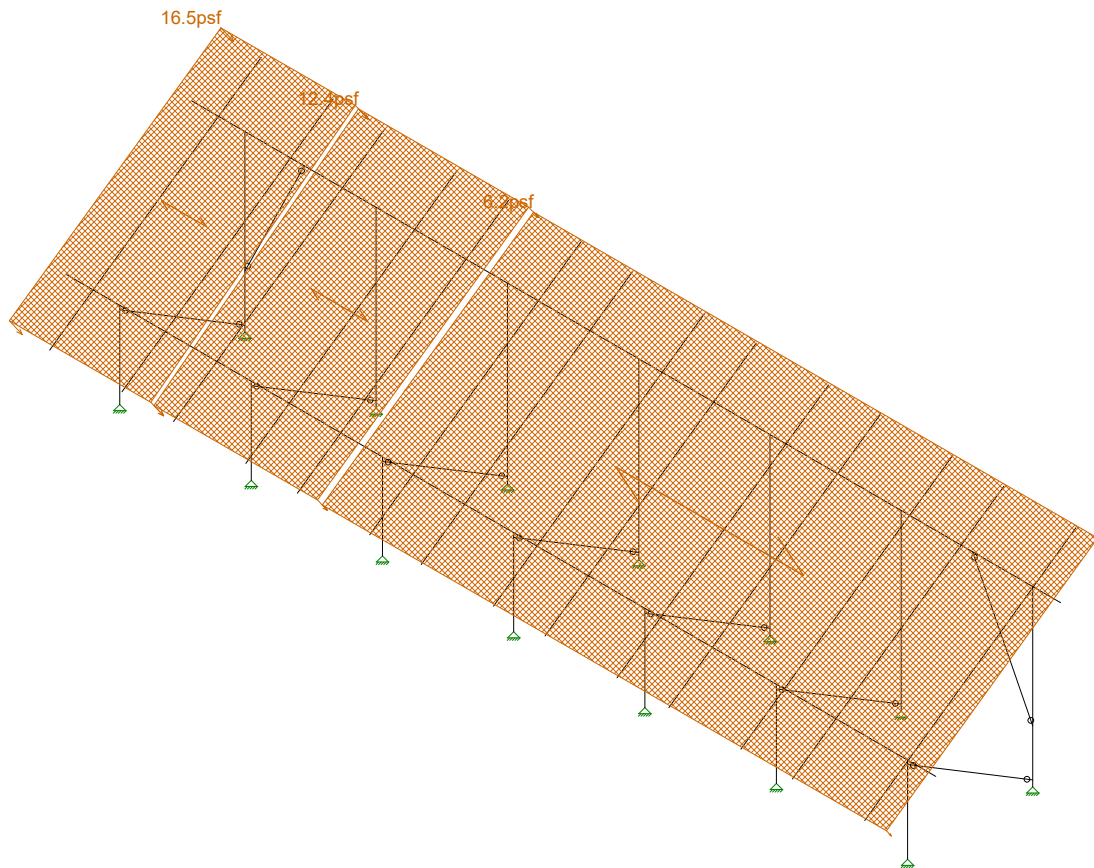
July 22, 2020 at 10:29 AM

Sunmodo Sunturf A5a.r3d



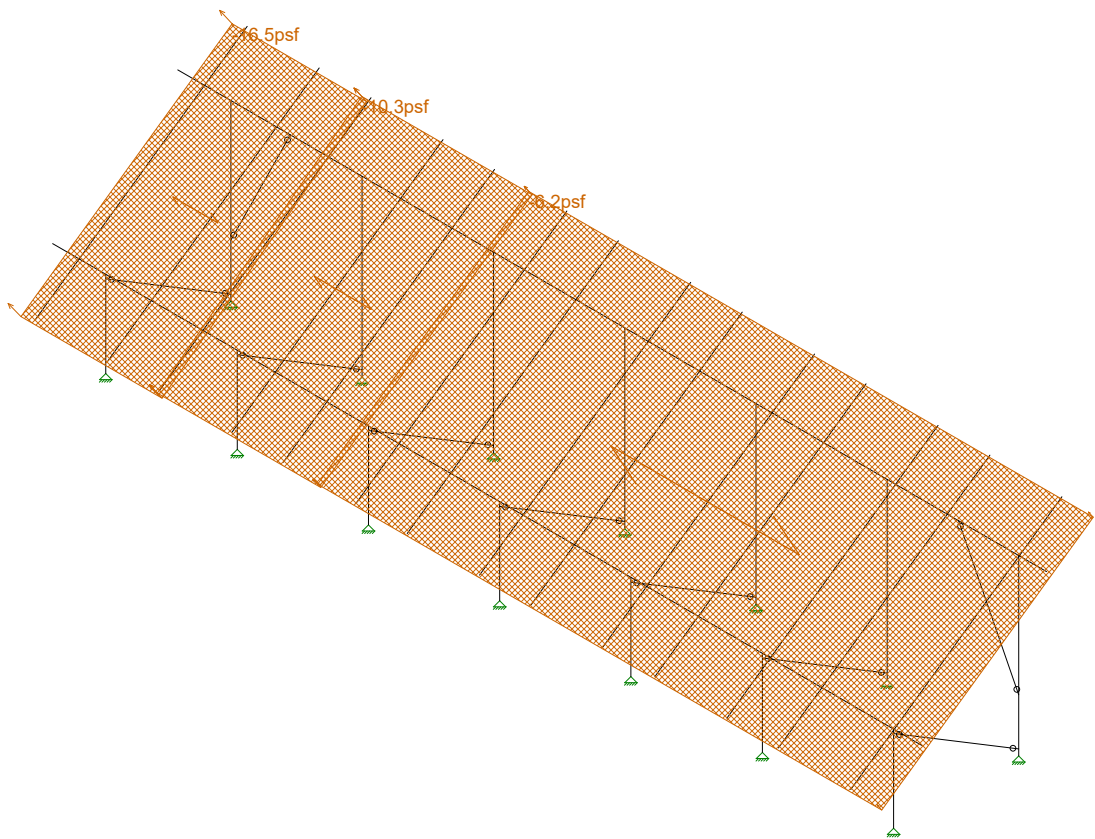
Loads: BLC 7, Wind B 180 deg

Vector Structural Engineeri..	Ground Mount	SK - 10
STB		July 22, 2020 at 10:30 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d



Loads: BLC 8, Wind A 90

Vector Structural Engineeri...	Ground Mount	SK - 11
STB		July 22, 2020 at 10:30 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d



Loads: BLC 9, Wind B 90

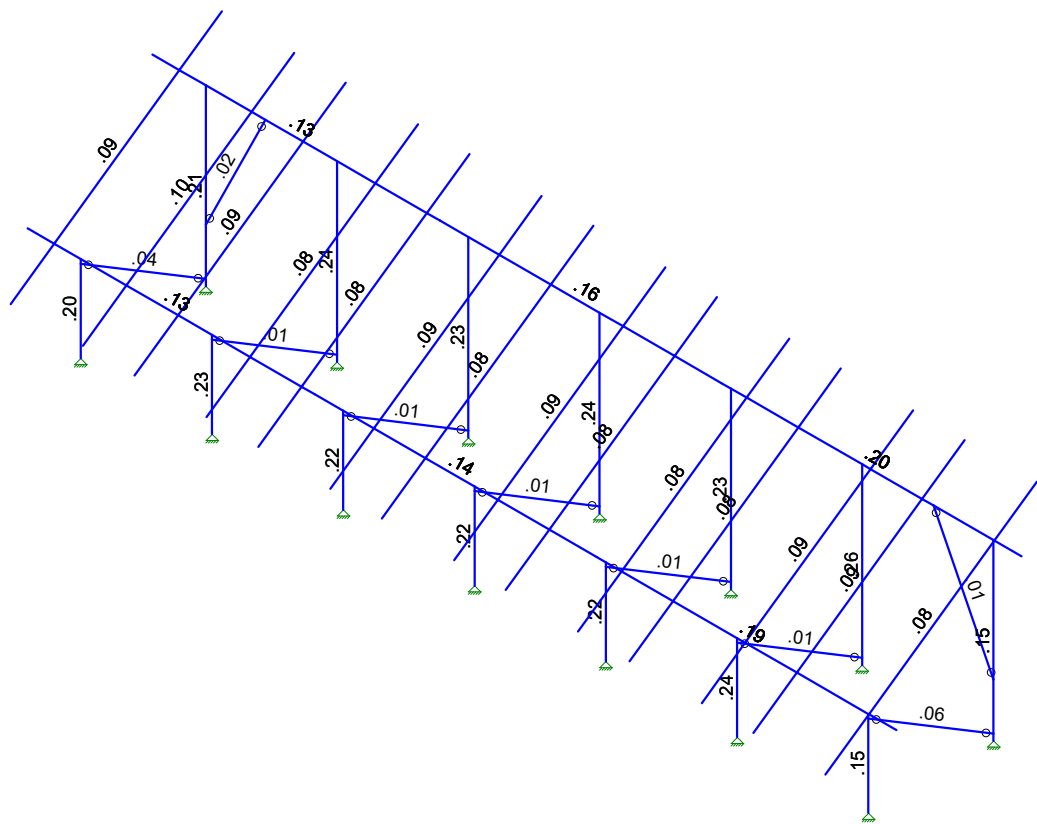
Vector Structural Engineeri...	Ground Mount	SK - 12
STB		July 22, 2020 at 10:30 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d





Shear Check  
(Elev.)

Black	No Calc
Red	> 1.0
Yellow	40-1.0
Green	75-90
Blue	50-75
Light Blue	0-.50



Member Shear Checks Displayed (Enveloped)  
Envelope Only Solution

Vector Structural Engineeri...	Ground Mount	SK - 2
STB		July 22, 2020 at 10:28 AM
U2716.0231.201		Sunmodo Sunturf A5a.r3d





**(Global) Model Settings, Continued**

Seismic Code	ASCE 7-16
Seismic Base Elevation (in)	15600
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

**Hot Rolled Steel Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[lb/ft^3]	Yield[psi]	Ry	Fu[psi]	Rt
1	A992	29000	11154	.3	.65	490	50000	1.1	65000	1.1
2	A36 Gr.36	29000	11154	.3	.65	490	36000	1.5	58000	1.2
3	A572 Gr.50	29000	11154	.3	.65	490	50000	1.1	65000	1.1
4	A500 Gr.B R...	29000	11154	.3	.65	527	42000	1.4	58000	1.3
5	A500 Gr.B Re...	29000	11154	.3	.65	527	46000	1.4	58000	1.3
6	A53 Gr.B	29000	11154	.3	.65	490	35000	1.6	60000	1.2
7	A1085	29000	11154	.3	.65	490	50000	1.4	65000	1.3

**Aluminum Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm (...Density[... Table B.4	kt	Ftu[psi]	Fty[psi]	Fcy[psi]	Fsu[psi]	Ct
1	3003-H14	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	.33	1.3 172.8 Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	38000	35000	35000	24000	141

**Hot Rolled Steel Section Sets**

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Post	Pipe 2.0 A21165	Column	Pipe	A572 Gr.50	Typical	.776	.499	.499	.998
2	Cross Beam	Pipe 2.5 A21168	Beam	Wide Flange	A572 Gr.50	Typical	.947	.907	.907	1.814
3	Diagonal Brace	1.5x1.5x0.083	HBrace	SquareTube	A572 Gr.50	Typical	.47	.158	.158	.236



Company : Vector Structural Engineering  
 Designer : STB  
 Job Number : U2716.0231.201  
 Model Name : Ground Mount

July 22, 2020  
 10:30 AM  
 Checked By: \_\_\_\_\_

**Aluminum Section Sets**

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	AL Posts	2.375ODX0.188	Column	Pipe	6005-T5	Typical	1.29	.778	.778	1.54
2	AL Brace	RT1.5x2x0.15625	VBrace	Rectangular Tubes	6005-T5	Typical	.996	.327	.524	.602
3	AL Rails	HR300 ALA	Beam	Rectangular Tubes	6005-T5	Typical	.736	.214	.727	.614
4	AL Cross Beam	Cross Rail	Beam	Rectangular Tubes	6005-T5	Typical	1.909	1.97	4.366	4.017

**Member Area Loads (BLC 2 : Solar Panel Weight)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N199	N196	Y	A-B	-3

**Member Area Loads (BLC 3 : Roof Live/Snow)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N199	N196	PY	A-B	-27

**Member Area Loads (BLC 4 : Wind A 0 deg)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	-37.2
2	N198	N201	N199	N196	Perp	A-B	-37.2

**Member Area Loads (BLC 5 : Wind B 0 deg)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	-50.3
2	N198	N201	N199	N196	Perp	A-B	-11.7

**Member Area Loads (BLC 6 : Wind A 180 deg)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	44.8
2	N198	N201	N199	N196	Perp	A-B	43.4

**Member Area Loads (BLC 7 : Wind B 180 deg)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	22
2	N198	N201	N199	N196	Perp	A-B	55.1

**Member Area Loads (BLC 8 : Wind A 90)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N203	N202	N196	Perp	A-B	16.5
2	N203	N209	N208	N202	Perp	A-B	12.4
3	N209	N200	N199	N208	Perp	A-B	6.2

**Member Area Loads (BLC 9 : Wind B 90)**

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N203	N202	N196	Perp	A-B	-16.5
2	N203	N209	N208	N202	Perp	A-B	-10.3
3	N209	N200	N199	N208	Perp	A-B	-6.2

**Basic Load Cases**

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(M...Surface...
1	Self Weight	DL		-1.05					
2	Solar Panel Weight	DL							1





Company : Vector Structural Engineering  
 Designer : STB  
 Job Number : U2716.0231.201  
 Model Name : Ground Mount

July 22, 2020  
 10:30 AM  
 Checked By: \_\_\_\_\_

**Envelope Joint Reactions (Continued)**

Joint	X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
14	min	-1.945	19	-2274.39	16	-1287....	3	0	1	0	1	0
15	N122	max	6.223	12	1691.661	10	63.102	3	0	20	0	20
16	min	-2.133	15	-360.184	17	-73.405	5	0	1	0	1	0
17	N133B	max	2.832	11	2928.258	11	1541.6...	5	0	20	0	20
18	min	-1.436	16	-2254.267	16	-1301....	3	0	1	0	1	0
19	N134B	max	10.194	12	1703.534	10	63.325	3	0	20	0	20
20	min	-1.721	15	-368.173	17	-73.541	5	0	1	0	1	0
21	N151	max	4.182	11	3013.052	11	1689	5	0	20	0	20
22	min	-1.189	16	-2319.256	16	-1426....	3	0	1	0	1	0
23	N152	max	30.296	12	1845.549	10	62.377	3	0	20	0	20
24	min	-8.746	15	-437.71	17	-71.617	5	0	1	0	1	0
25	N143A	max	98.796	16	2049.977	11	968.029	5	0	20	0	20
26	min	-130.72	11	-1545.649	16	-816.1...	3	0	1	0	1	0
27	N144A	max	23.183	15	1076.121	10	47.422	3	0	20	0	20
28	min	-64.677	12	-210.865	17	-55.787	5	0	1	0	1	0
29	Totals:	max	.021	19	23713.032	11	9673.8...	5				
30	min	-.042	14	-9980.659	15	-8157....	15					

**Envelope AISC 15th(360-16): ASD Steel Code Checks**

Member	Shape	Code Check	Loc[in]	LC	Shear	...	Loc[in]	Dir	LC	Pnc/om	[..Pnt/om	[lb]	Mnyy/om..	Mnzz/om..	Cb	Eqn
1	M5	Pipe 2.0 A2...	.222	52.073	17	.201	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
2	M6	Pipe 2.0 A2...	.703	3.477	5	.210	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
3	M13	Pipe 2.5 A2...	.656	118....	12	.128	116....	12	11641.036	28358.413	2081.747	2081.747	2...	H1-1b		
4	M14	Pipe 2.5 A2...	.639	118....	11	.127	116....	11	11641.036	28358.413	2081.747	2081.747	2...	H1-1b		
5	M15	1.5x1.5x0.083	.626	48.694	5	.039	93.493	y	11	2716.455	14085.15	624.421	624.421	1...	H1-1a	
6	M80	Pipe 2.0 A2...	.237	52.073	17	.217	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
7	M81	Pipe 2.0 A2...	.752	3.477	5	.230	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
8	M82	1.5x1.5x0.083	.691	48.694	5	.010	93.493	y	10	2716.455	14085.15	624.421	624.421	1...	H1-1a	
9	M50	Pipe 2.0 A2...	.239	52.073	17	.227	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
10	M51	Pipe 2.0 A2...	.754	3.477	5	.241	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
11	M52	1.5x1.5x0.083	.722	48.694	5	.007	93.493	y	14	2716.455	14085.15	624.421	624.421	1...	H1-1a	
12	M56A	Pipe 2.0 A2...	.239	52.073	17	.220	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
13	M57A	Pipe 2.0 A2...	.762	3.477	5	.234	0	5	6062.107	23232.186	1397.505	1397.505	2...	H1-1a		
14	M58A	1.5x1.5x0.083	.699	48.694	5	.007	93.493	y	4	2716.455	14085.15	624.421	624.421	1...	H1-1a	
15	M68	Pipe 2.0 A2...	.239	52.073	17	.222	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
16	M69	Pipe 2.0 A2...	.763	3.477	5	.236	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
17	M70	1.5x1.5x0.083	.707	48.694	5	.009	0	y	10	2716.455	14085.15	624.421	624.421	1...	H1-1a	
18	M68A	Pipe 2.5 A2...	.635	18.75	12	.138	103....	12	11641.036	28358.413	2081.747	2081.747	2...	H1-1b		
19	M69A	Pipe 2.5 A2...	.652	90	12	.193	90	12	11641.036	28358.413	2081.747	2081.747	1...	H1-1b		
20	M70A	Pipe 2.5 A2...	.707	18.75	11	.161	103....	11	11641.036	28358.413	2081.747	2081.747	2...	H1-1b		
21	M71	Pipe 2.5 A2...	.632	6	11	.196	90	11	11641.036	28358.413	2081.747	2081.747	2...	H1-1b		
22	M73	Pipe 2.0 A2...	.240	52.073	17	.245	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
23	M74	Pipe 2.0 A2...	.811	3.477	5	.258	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
24	M75	1.5x1.5x0.083	.774	48.694	5	.011	0	y	10	2716.455	14085.15	624.421	624.421	1...	H1-1a	
25	M69C	Pipe 2.0 A2...	.274	52.645	12	.146	52.645	5	16486.797	23232.186	1397.505	1397.505	1...	H1-1b		
26	M70C	Pipe 2.0 A2...	.561	33.608	11	.147	0	5	6062.107	23232.186	1397.505	1397.505	1...	H1-1a		
27	M71B	1.5x1.5x0.083	.448	48.694	5	.063	0	y	11	2716.455	14085.15	624.421	624.421	1...	H1-1a	

**Envelope AA ADM1-15: ASD - Building Aluminum Code Checks**

Member	Shape	Code C...	Loc[in]	LC	Shear	...	Loc[in]	Dir	LC	Pnc/O...	Pnt/Om...	Mny/O...	Mnz/O...	Vny/O...	Vnz/O...	Cb	Eqn
1	M19	RT1.5x2x...	.222	52.977	11	.023	0	z	5	2260.001	19411....	770.742	927.083	5889.423	3966.346	1...	H.1-1
2	M16	HR300_A...	.615	82.515	11	.085	36.1	y	11	3887.213	14342....	494.953	934.619	6030.769	2749.538	1	H.1-1
3	M35	HR300_A...	.635	80.796	11	.095	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1	H.1-1
4	M38	HR300_A...	.615	84.234	11	.089	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1	H.1-1



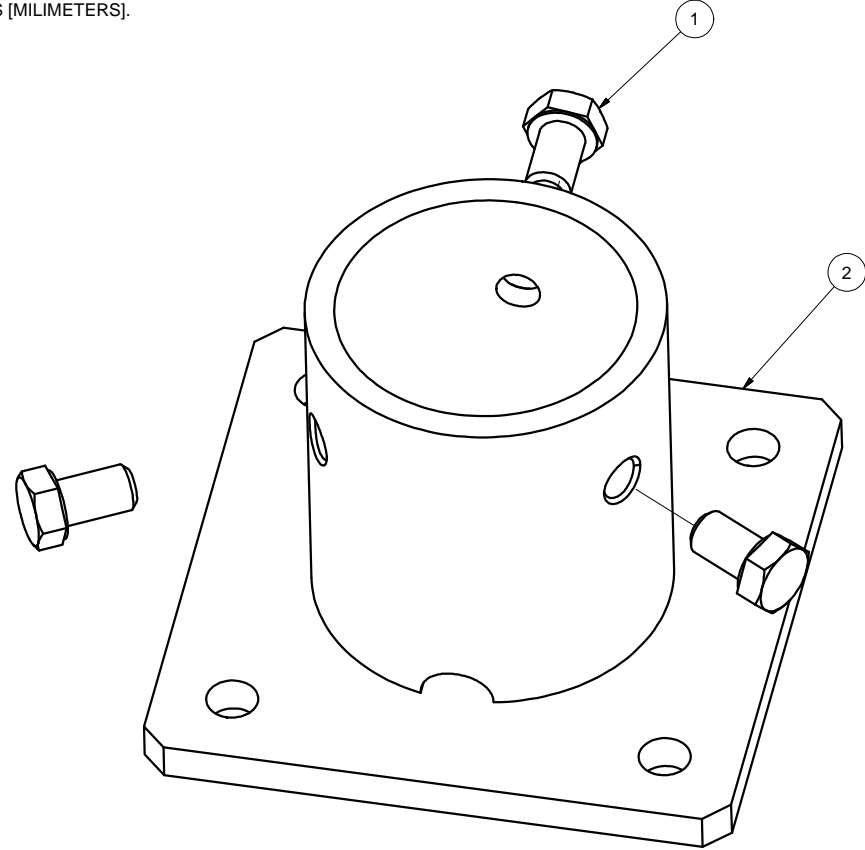
Company : Vector Structural Engineering  
 Designer : STB  
 Job Number : U2716.0231.201  
 Model Name : Ground Mount

July 22, 2020  
 10:30 AM  
 Checked By: \_\_\_\_\_

**Envelope AA ADM1-15: ASD - Building Aluminum Code Checks (Continued)**

Member	Shape	Code C...	Loc[in]	LC	Shear ...	Loc[in]	Dir	LC	Pnc/O...	Pnt/Om...	Mny/O...	Mnz/O...	Vny/O...	Vnz/O...	Cb	Eqn
5	M41	HR300_A...	.604	84.234	11	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
6	M44	HR300_A...	.606	84.234	11	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
7	M47	HR300_A...	.619	84.234	11	.085	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
8	M50A	HR300_A...	.597	34.381	12	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
9	M53	HR300_A...	.630	84.234	11	.085	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
10	M56	HR300_A...	.597	34.381	12	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
11	M59	HR300_A...	.638	84.234	11	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
12	M62	HR300_A...	.597	34.381	12	.084	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
13	M65	HR300_A...	.646	84.234	11	.089	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
14	M68B	HR300_A...	.611	80.796	11	.094	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
15	M71A	HR300_A...	.607	84.234	11	.083	36.1	y	12	3887.213	14342....	494.953	934.619	6030.769	2749.538	1 H.1-1
16	M72	RT1.5x2x...	.208	53.045	11	.012	0	z	5	2254.199	19411....	770.742	927.083	5889.423	3966.346	1... H.1-1

NOTES: UNLESS OTHERWISE SPECIFIED  
 1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].



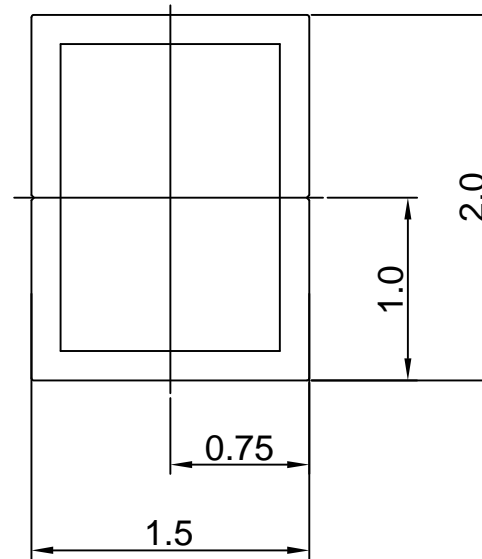
REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	10/20/2016

2	A21120-001	2" PIPE BASE	1
1	B15018-011	HEX CAP SCREW 3/8-16 X 5/8	3
ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<b>Sunmodo Corp.</b> 1905 E 5TH STREET, STE A, VANCOUVER, WA 98661	
Tolerances		TITLE	
X.XXX ±0.01 [0.25mm]		2" PIPE BASE KIT	
X.XX ±0.02 [0.50mm]		DRAWING NUMBER	
X.X ±0.039 [1.0mm]		B K10268-001	
Unless otherwise spec'd		SCALE: NONE	
DRAWN BY		SHEET 1 of 1	
LWF		DATE	
CHECKED BY		10/20/2016	
APPROVALS			

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NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERAIL: ALUMINUM 6005-T5.  
FINISH: CLEAR ANODIZED 10  $\mu$ m THICK.
3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.



## Section properties:

Weight: 1.156 lbs/ft

Area: 0.992 in<sup>2</sup>

Perimeter: 12.601 in

Bounding Box: X: -1.000,1.000

Y: -0.750, 0.750

Centroid:(0.000,0.000)

Moments of Inertia(in<sup>4</sup>): I<sub>x</sub>=0.506,I<sub>y</sub>=0.322

Section modulus in bending(in<sup>3</sup>): W<sub>x</sub>=0.675,W<sub>y</sub>=0.322

Radii of Gyration: X: 0.714, Y: 0.570

MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS			
All Dimensions in inches [millimeters]			
Tolerances			
X.XXX ± 0.01 [0.25mm]		Break all sharp edges	
X.XX ± 0.02 [0.50mm]		.010-.020 unless	
X.X ± 0.039 [1.0mm]		otherwise specified.	
Unless otherwise specd			
DRAWN BY	DATE	TITLE	
zcg	03/12/2014	1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
CHECKED BY		B	DRAWING NUMBER
			A20164
APPROVALS		SCALE:	SHEET 1 of 1
		NONE	

**Sunmodo Corp.**

1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661

TITLE  
1.5X2 AL TUBE BRACE EXTRUSION

DRAWING NUMBER  
A20164

SCALE: NONE SHEET 1 of 1

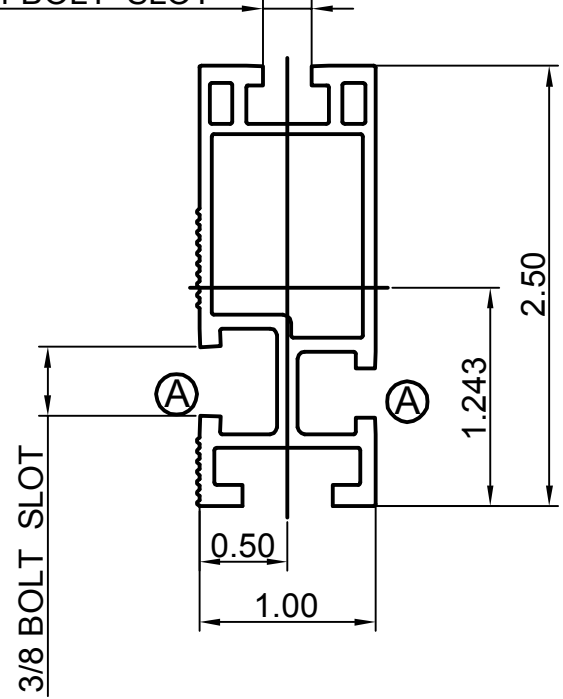


REVISIONS			
REV	DESCRIPTION	BY	DATE
A	ADDED BOTTOM CHANNEL & CHANGED ONE 3/8 CHANNEL TO 1/4	zcg	02/21/2013

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERAIL: ALUMINUM 6005-T5.  
FINISH: CLEAR ANODIZED 15  $\mu$ m THICK.
3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.

2X 1/4 BOLT SLOT



### Section properties:

Weight: 0.850 lbs/ft  
 Area: 0.723 in<sup>2</sup>  
 Perimeter: 17.325 in  
 Bounding Box: X: -0.500,0.500  
 Y: -1.243,1.257

Centroid:(0.000,0.000)  
 Moments of Incertia(in<sup>4</sup>): Ix=0.486,Iy=0.095  
 Section modulus in bending(in<sup>3</sup>): Wx=0.387,Wy=0.190  
 Radii of Gyration: X: 0.820, Y: 0.363

MATERIAL <b>SEE NOTES</b>		<b>Sunmodo Corp.</b>	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters]		1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
Tolerances: X.XXX ± 0.01 [0.25mm] X.XX ± 0.02 [0.50mm] X.X ± 0.039 [1.0mm] Unless otherwise spec'd		TITLE HELIO STANDARD RAIL	
DRAWN BY zcg	DATE 02/21/2013	DRAWING NUMBER A20144	
CHECKED BY		SCALE: NONE SHEET 1 of 1	
APPROVALS			

4

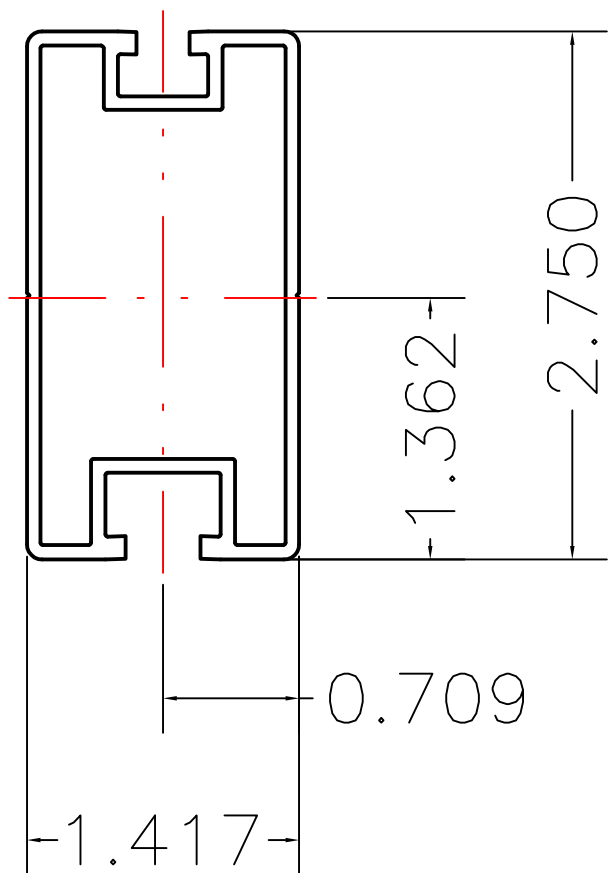
3

2

1

NOTES: UNLESS OTHERWISE SPECIFIED

- 1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
- 2. MATERIAL: 6005-T5.  
FINISH: CLEAR ANODIZED 10um THICK.
- 3. THE UNSPECIFIED RADII ARE .02" MAX.
- 4. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.



### Section properties:

Weight: 0.862 lbs/ft  
 Area: 0.736 in<sup>2</sup>  
 Perimeter: 19.824 in  
 Bounding Box: X: -0.709,0.709  
                   Y: -1.362,1.388  
 Centroid:(0.000,0.000)  
 Moments of Inertia(in<sup>4</sup>): I<sub>x</sub>=0.727,I<sub>y</sub>=0.214  
 Section modulus in bending(in<sup>3</sup>): W<sub>x</sub>=0.524,W<sub>y</sub>=0.302  
 Radii of Gyration: X: 994, Y: 0.539

MATERIAL SEE NOTES	
Third Angle Projection:	
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters]	
Tolerances	
X.XXX ±0.01 [0.25mm]	Break all sharp edges .010-.020 unless otherwise specified.
X.XX ±0.02 [0.50mm]	
X.X ±0.039 [1.0mm]	
Unless otherwise spec'd	
DRAWN BY KYY	DATE 01/18/2018
CHECKED BY	
APPROVALS	

<b>SunModo Corp.</b>	
14800 NE 65TH STREET, VANCOUVER WA 98682	
TITLE RAIL, HR300 (SUNRAY), EXTRUSION	
B	DRAWING NUMBER A20288
SCALE: NONE	SHEET 1 of 1

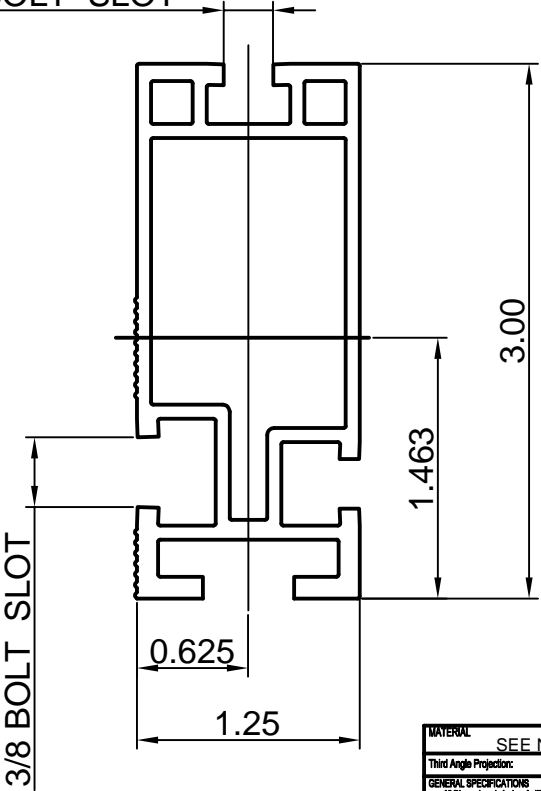
THIS DRAWING IS CONFIDENTIAL PROPERTY OF SUNMODO AND ITS CONTENTS MAY NOT BE DISCLOSED WITHOUT THE PRIOR WRITTEN CONSENT OF SUNMODO CORP.

REV	DESCRIPTON	BY	DATE
A	0.44 WAS 0.41, 0.44 WAS 0.33	LWF	11/30/2015

NOTES: UNLESS OTHERWISE SPECIFIED

- 1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
- 2. MATERIAL: ALUMINUM 6005-T5.  
FINISH: CLEAR ANODIZED 15 μm THICK.
- 3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.

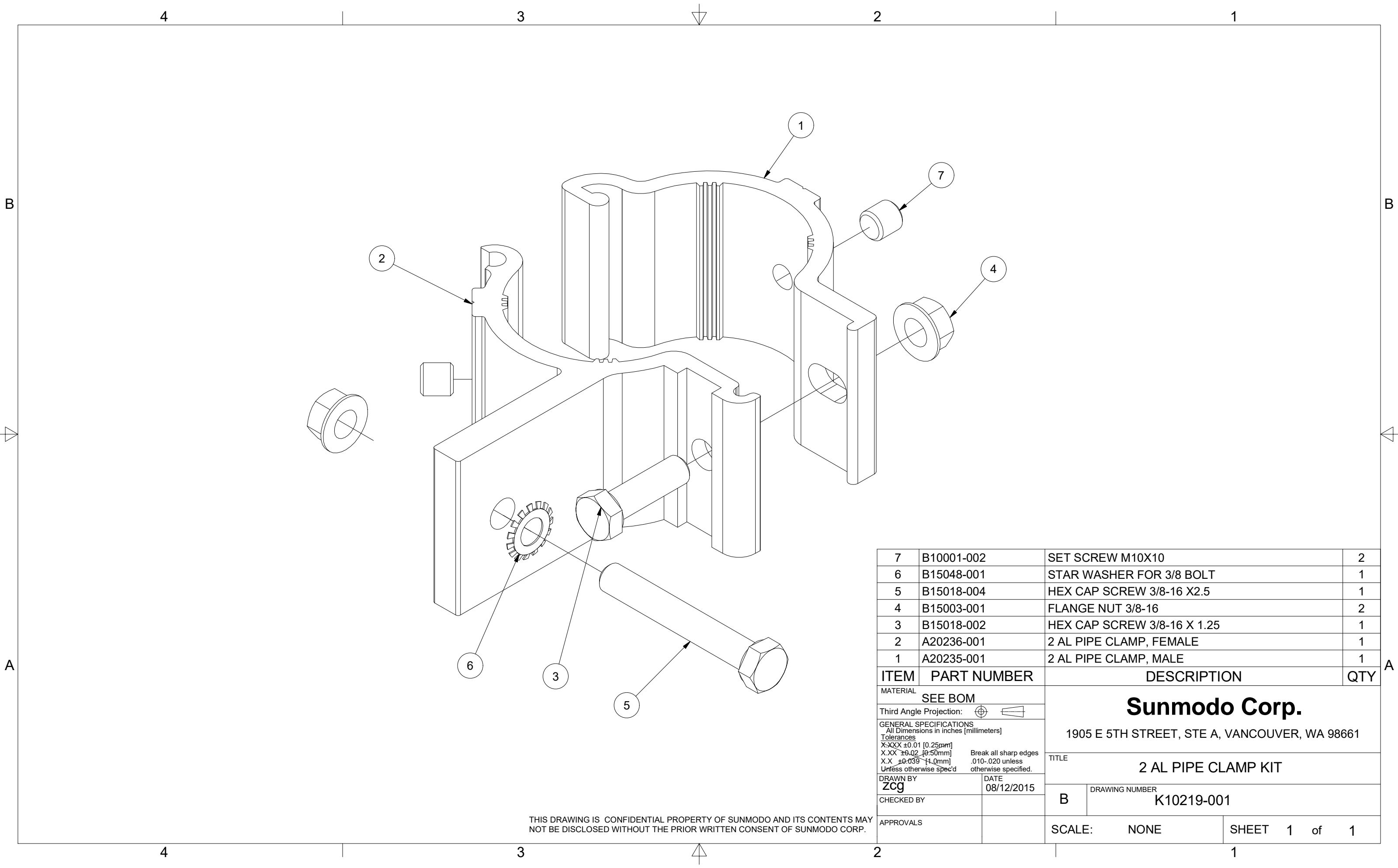
2X 1/4 BOLT SLOT



**Section properties:**

Weight: 1.151 lbs/ft  
 Area: 0.980 in<sup>2</sup>  
 Perimeter: 22.104 in  
 Bounding Box: X: -0.625,0.625  
                   Y: -1.463,1.537  
 Centroid:(0.000,0.000)  
 Moments of Inertia(in<sup>4</sup>): Ix=1.047,Iy=0.207  
 Section modulus in bending(in<sup>3</sup>): Wx=0.681,Wy=0.331  
 Radii of Gyration: X: 1.034, Y: 0.460

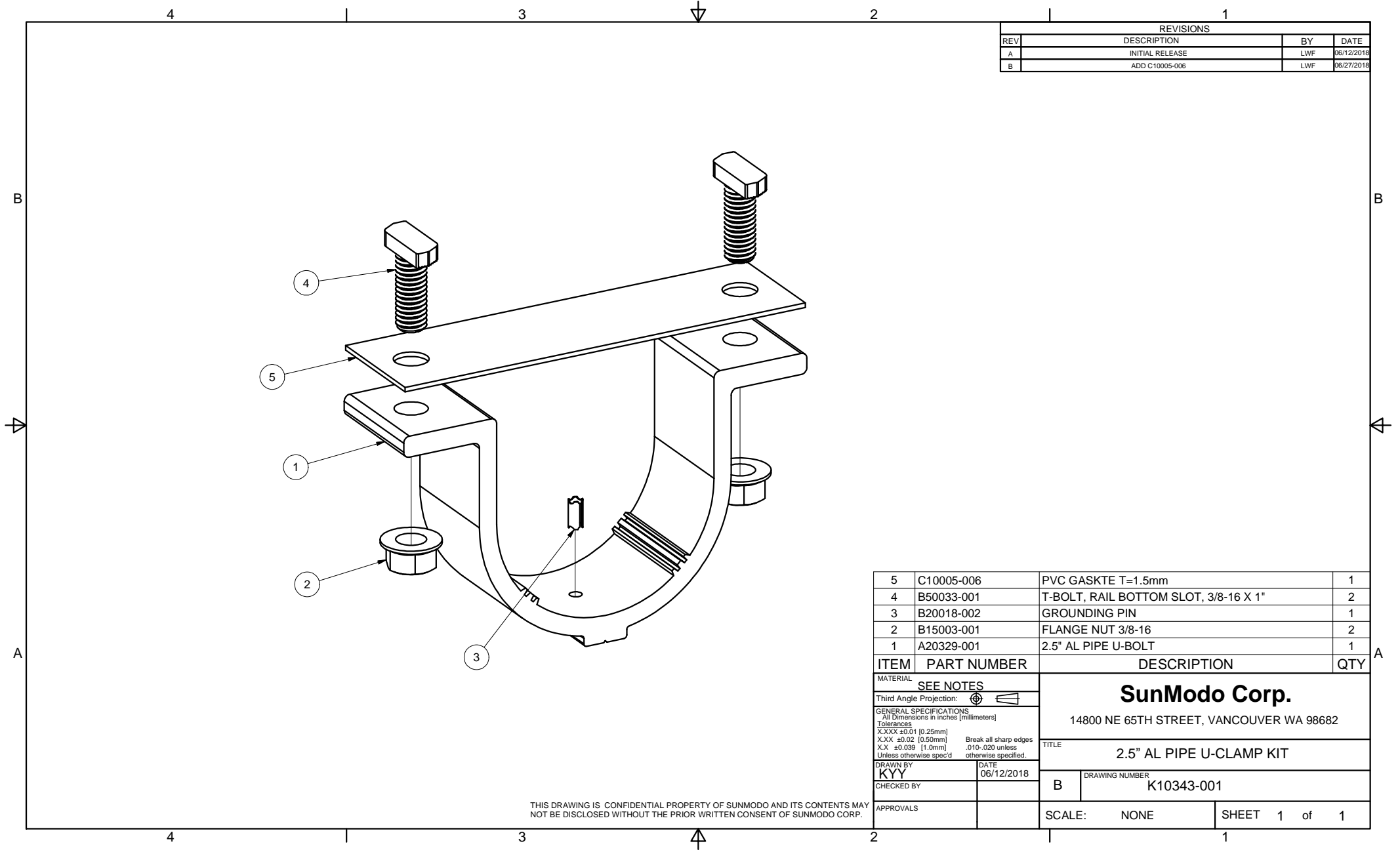
MATERIAL		SEE NOTES	
Third Angle Projection			
GENERAL SPECIFICATIONS			
All Dimensions in Inches [millimeters]			
Tolerances			
XXX ±0.01 (0.25mm)			
XX ±0.02 (0.50mm)			
X ±0.03 (1.0mm)			
Unless otherwise specified.			
Break all sharp edges 0.10-0.25 unless otherwise specified.			
DRAWN BY		DATE	
ZCJ		02/21/2013	
CHECKED BY		APPROVALS	
TITLE		1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
HELIO HEAVY RAIL		DRAWING NUMBER	
B		A20145	
SCALE:		SHEET	
NONE		1 of 1	



7	B10001-002	SET SCREW M10X10	2
6	B15048-001	STAR WASHER FOR 3/8 BOLT	1
5	B15018-004	HEX CAP SCREW 3/8-16 X2.5	1
4	B15003-001	FLANGE NUT 3/8-16	2
3	B15018-002	HEX CAP SCREW 3/8-16 X 1.25	1
2	A20236-001	2 AL PIPE CLAMP, FEMALE	1
1	A20235-001	2 AL PIPE CLAMP, MALE	1

ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE BOM	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches (millimeters)			
Tolerances			
X.XXX ±0.01 [0.25mm]		Break all sharp edges	
X.XX ±0.02 [0.50mm]		.010-.020 unless	
X.X ±0.039 [1.0mm]		otherwise specified.	
DRAWN BY		DATE	
zcg		08/12/2015	
CHECKED BY		TITLE	
		2 AL PIPE CLAMP KIT	
APPROVALS		DRAWING NUMBER	
		B K10219-001	
SCALE:		NONE	SHEET 1 of 1

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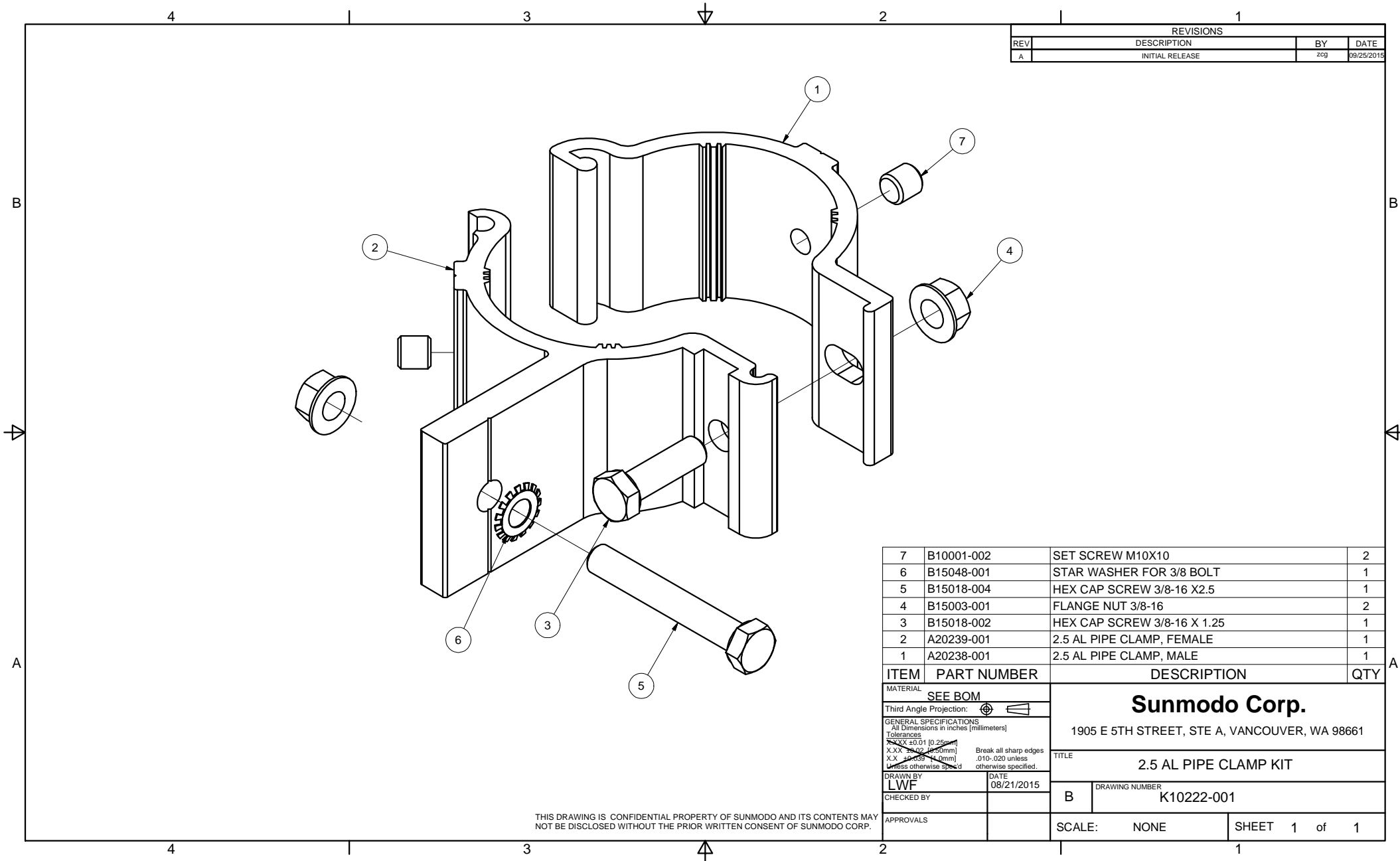


REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018
B	ADD C10005-006	LWF	08/27/2018

ITEM	PART NUMBER	DESCRIPTION	QTY
5	C10005-006	PVC GASKTE T=1.5mm	1
4	B50033-001	T-BOLT, RAIL BOTTOM SLOT, 3/8-16 X 1"	2
3	B20018-002	GROUNDING PIN	1
2	B15003-001	FLANGE NUT 3/8-16	2
1	A20329-001	2.5" AL PIPE U-BOLT	1

MATERIAL		<b>SEE NOTES</b>	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<p style="text-align: center;"><b>SunModo Corp.</b></p> <p style="text-align: center;">14800 NE 65TH STREET, VANCOUVER WA 98682</p>	
Tolerances		TITLE	
X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd		2.5" AL PIPE U-CLAMP KIT	
DRAWN BY	DATE	DRAWING NUMBER	
KYY	06/12/2018	B K10343-001	
CHECKED BY		SCALE: NONE SHEET 1 of 1	
APPROVALS			

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REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	zcg	09/25/2015

ITEM	PART NUMBER	DESCRIPTION	QTY
7	B10001-002	SET SCREW M10X10	2
6	B15048-001	STAR WASHER FOR 3/8 BOLT	1
5	B15018-004	HEX CAP SCREW 3/8-16 X2.5	1
4	B15003-001	FLANGE NUT 3/8-16	2
3	B15018-002	HEX CAP SCREW 3/8-16 X 1.25	1
2	A20239-001	2.5 AL PIPE CLAMP, FEMALE	1
1	A20238-001	2.5 AL PIPE CLAMP, MALE	1

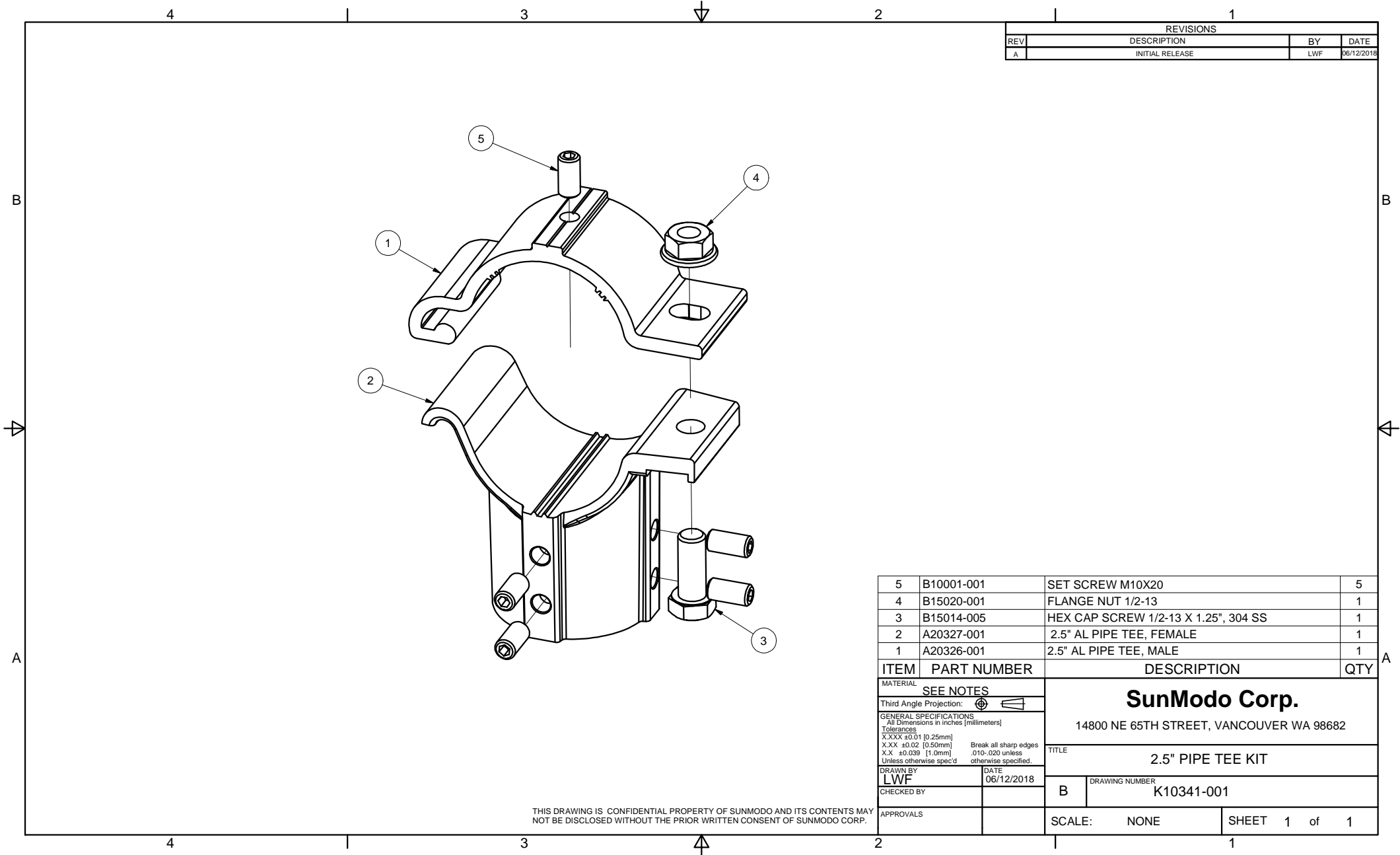
MATERIAL		<b>SEE BOM</b>	
Third Angle Projection:			
<b>GENERAL SPECIFICATIONS</b> All Dimensions in inches [millimeters] <b>Tolerances</b> X.XX ±0.01 [0.25mm] X.X ±0.02 [0.5mm] X.X ±0.03 [0.75mm] Unless otherwise specified.			
DRAWN BY		DATE	
LWF		08/21/2015	
CHECKED BY		B	
APPROVALS		SCALE: NONE	
		SHEET 1 of 1	

**Sunmodo Corp.**  
 1905 E 5TH STREET, STE A, VANCOUVER, WA 98661

TITLE  
**2.5 AL PIPE CLAMP KIT**

DRAWING NUMBER  
**K10222-001**

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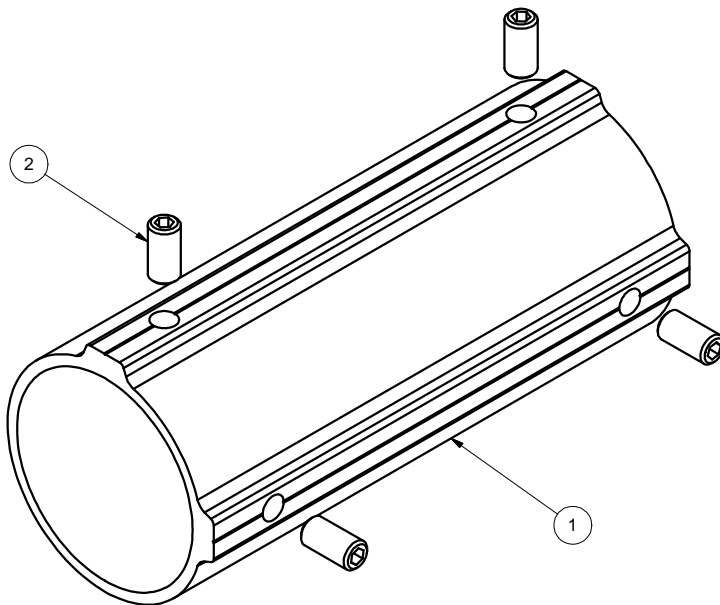
REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018

ITEM	PART NUMBER	DESCRIPTION	QTY
5	B10001-001	SET SCREW M10X20	5
4	B15020-001	FLANGE NUT 1/2-13	1
3	B15014-005	HEX CAP SCREW 1/2-13 X 1.25", 304 SS	1
2	A20327-001	2.5" AL PIPE TEE, FEMALE	1
1	A20326-001	2.5" AL PIPE TEE, MALE	1

MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<b>SunModo Corp.</b> 14800 NE 65TH STREET, VANCOUVER WA 98682	
Tolerances		TITLE	
X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd		2.5" PIPE TEE KIT	
DRAWN BY		DATE	
LWF		06/12/2018	
CHECKED BY		DRAWING NUMBER	
		B K10341-001	
APPROVALS		SCALE: NONE SHEET 1 of 1	

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REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018



2	B10001-001	SET SCREW M10X20	4
1	A20328-001	2.5" PIPE SPLICE	1
ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<b>SunModo Corp.</b> 14800 NE 65TH STREET, VANCOUVER WA 98682	
All Dimensions in inches [millimeters] Tolerances X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd		Break all sharp edges .010-.020 unless otherwise specified.	
DRAWN BY		TITLE	
LWF		2.5" PIPE SPLICE KIT	
CHECKED BY		DRAWING NUMBER	
		B K10342-001	
APPROVALS		SCALE: NONE SHEET 1 of 1	

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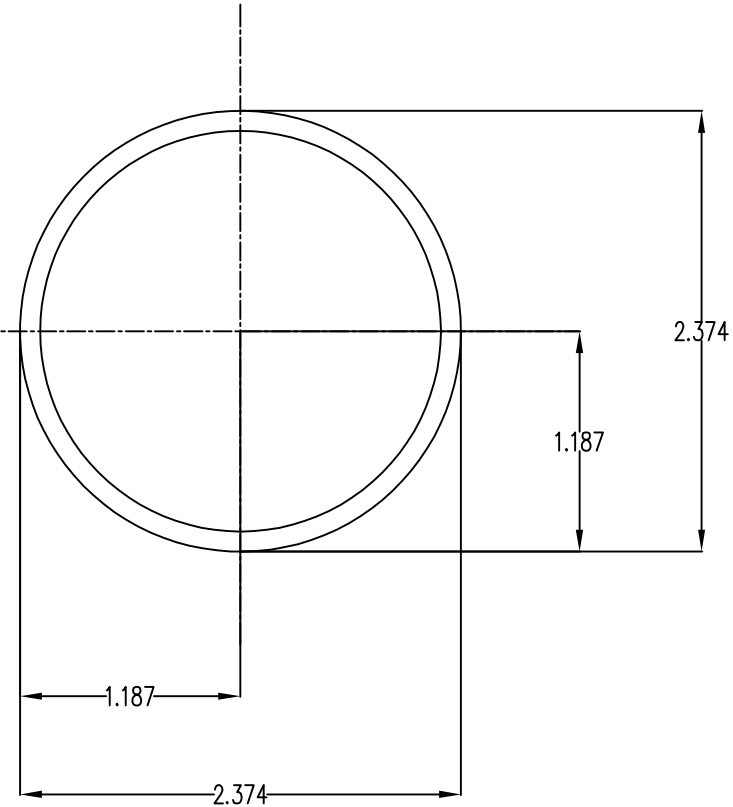
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERIAL:HIGH STRENGTH STEEL PIPE OR TUBE.
3. FINISH: HOT DIP GALVANIZE PER ASTM A123 / A123M - 02.

MINIMUM 50 KSI YIELD STRESS.

4. BREAK ALL BURRS AND SHARP EDGES.

5. ALL WELDING MUST BE IN COMPLIANCE WITH AWS CODE D1;1.



## Section properties:

Weight: 2.641 lbs/ft

Area: 0.776 in<sup>2</sup>

Perimeter: 14.238 in

Bounding Box: X: -1.187,1.187

Y: -1.187,1.187

Centroid:(0.000,0.000)

Moments of Inertia(in<sup>4</sup>): Ix=0.499,Iy=0.499

Section modulus in bending(in<sup>3</sup>): Wx=0.420,Wy=0.420

Radii of Gyration: X: 0.802, Y: 0.802

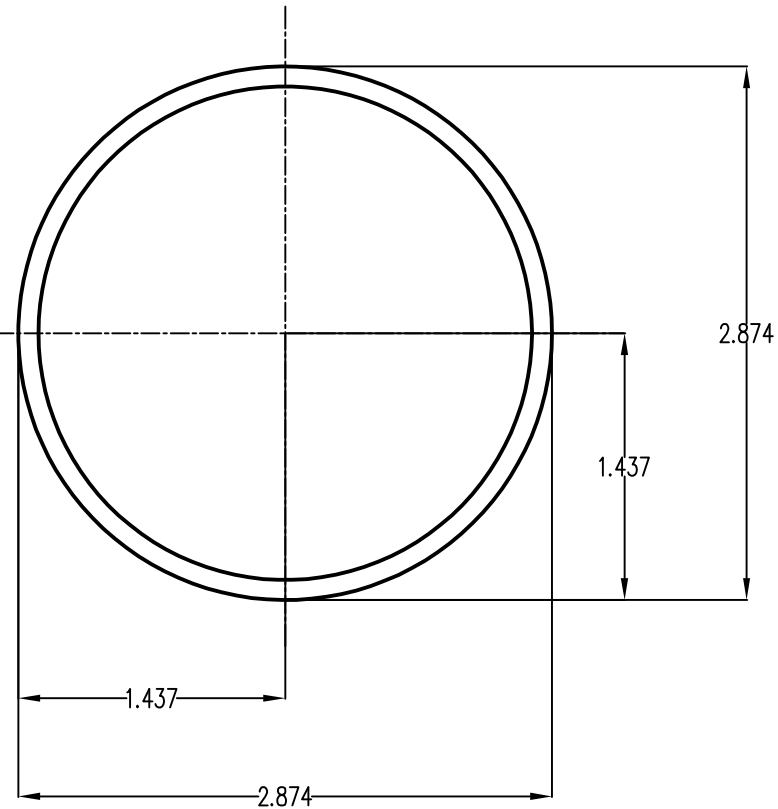
MATERIAL		SEE NOTES		<b>Sunmodo Corp.</b> 14800 NE 85TH STREET, VANCOUVER WA 98682	
Third Angle Projection:					
GENERAL SPECIFICATIONS				TITLE	
All Dimensions in Inches (millimeters)				PIPE, HSS, 2.375" OD X 12 GAUGE,L=XXX	
Tolerances				Break all sharp edges .010-.020 unless otherwise specified.	
XXX ±0.01 (0.25mm)					
XX ±0.02 (0.50mm)					
X ±0.050 (1.27mm)					
Unless otherwise specified					
DRAWN BY	DATE	B		DRAWING NUMBER	
LWF	04/03/2019			A21165	
CHECKED BY					
APPROVALS				SCALE: NONE SHEET 1 of 1	

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERAIL:HIGH STRENGTH STEEL PIPE OR TUBE.
3. FINISH: HOT DIP GALVANIZE PER ASTM A123 / A123M - 02.

MINIMUM 50 KSI YIELD STRESS.

4. BREAK ALL BURRS AND SHARP EDGES.
5. ALL WELDING MUST BE IN COMPLIANCE WITH AWS CODE D1;1.



### Section properties:

Weight: 3.201 lbs/ft

Area: 0.941 in<sup>2</sup>

Perimeter: 17.378 in

Bounding Box: X: -1.437,1.437

Y: -1.437,1.437

Centroid:(0.000,0.000)

Moments of Inertia(in<sup>4</sup>): Ix=0.901,Iy=0.901

Section modulus in bending(in<sup>3</sup>): Wx=0.627,Wy=0.627

Radii of Gyration: X: 0.979, Y: 0.979

MATERIAL		SEE NOTES		<b>Sunmodo Corp.</b> 14800 NE 85TH STREET, VANCOUVER WA 98682	
Third Angle Projection:					
GENERAL SPECIFICATIONS All Dimensions in Inches (millimeters)				TITLE	
Tolerances XXX ±0.01 (0.25mm) XX ±0.02 (0.50mm) X ±0.030 (1.0mm) Unless otherwise specified				PIPE, HSS, 2.875" OD X 12 GAUGE,L=XXX	
DRAWN BY LWF		DATE 04/03/2019		DRAWING NUMBER A21168	
CHECKED BY				B	
APPROVALS				SCALE: NONE SHEET 1 of 1	