



Project Number: U2716-096-191

April 8, 2021

Sunmodo
14800 NE 65th Street
Vancouver, WA 98682

**REFERENCE: Sunmodo Sunturf Ground Mount B2a (85x45)
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 2006 International Building Code. 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 7-05)
- Design wind speed for occupancy category I structures: 110 mph
- Importance Factor: 0.77
- Wind exposure: C
- Ground snow load: 5 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	3288	1.5	4932
LATERAL	2008	2	4016

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,

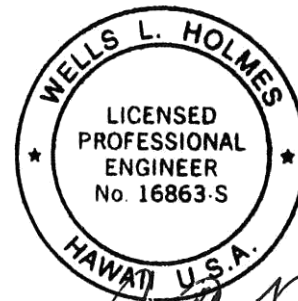
VECTOR STRUCTURAL ENGINEERING, LLC

Wells Holmes, P.E.
License: 16863 S - Expires: 04/30/2022
Project Engineer

Enclosures

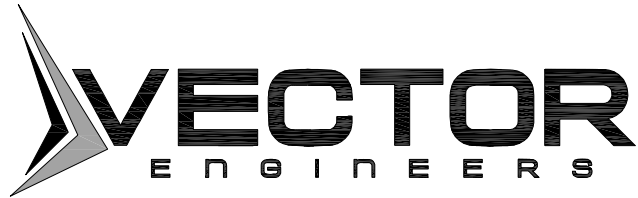
WLH/stb

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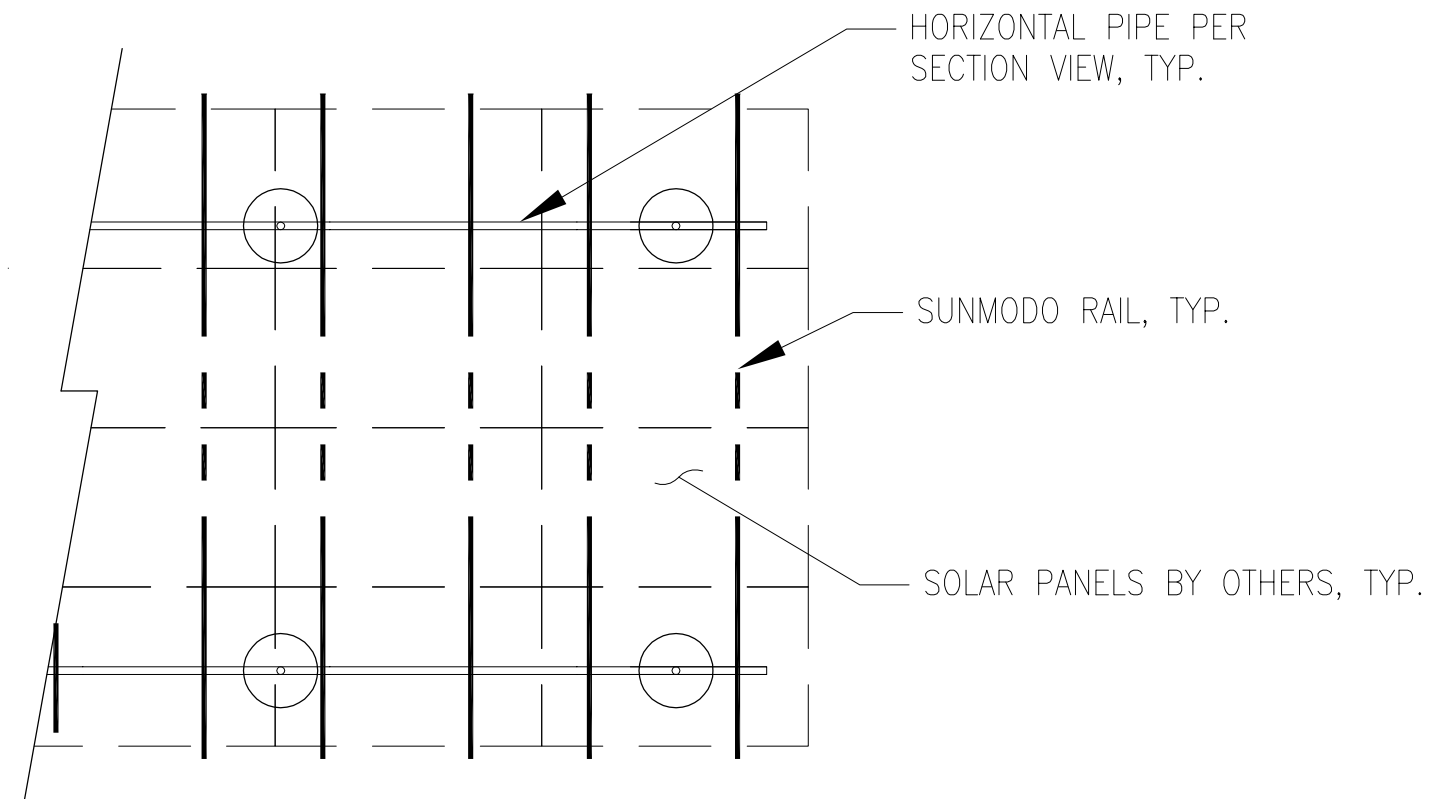
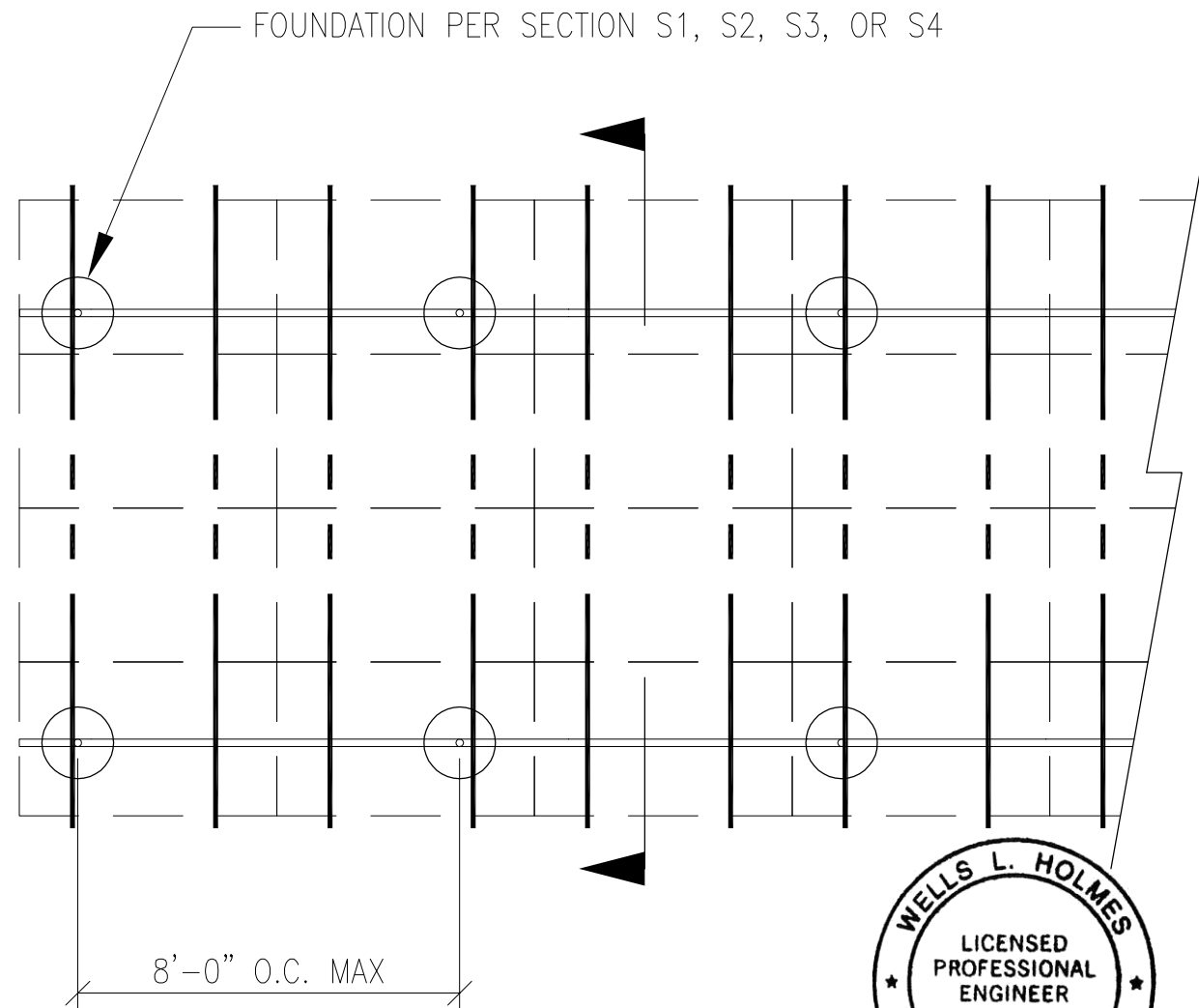
Wells L. Holmes
04/08/2021

EXPIRES: 4-30-2022



JOB NO. U2716-096-191
 PROJECT SUNMODO SUNTURF GROUND MOUNTS B2A
 SUBJECT ALL OPTIONS

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



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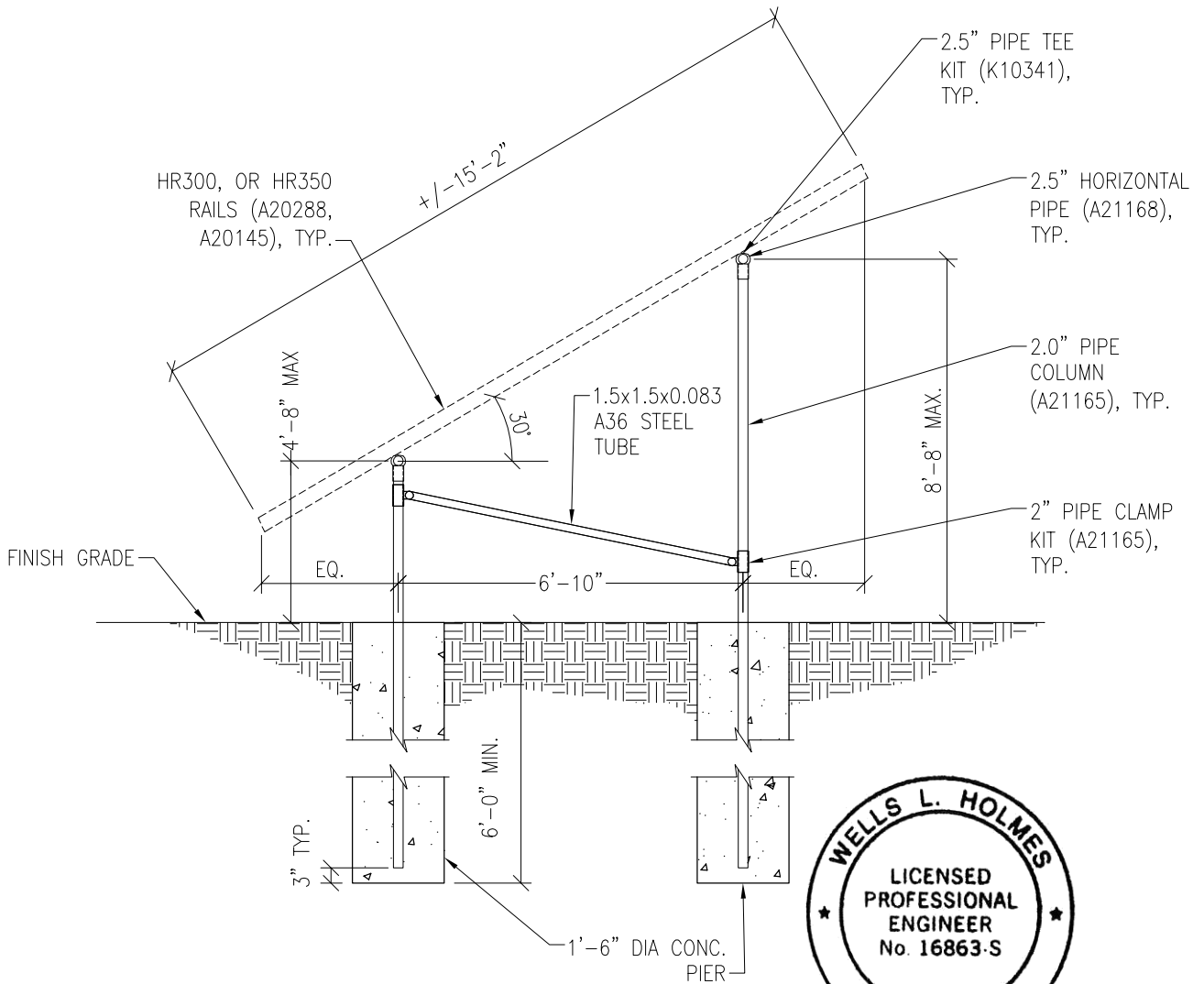
PV ARRAY PLAN

N.T.S.

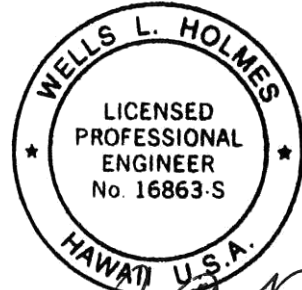
P1

PROJECT SUNMODO SUNTURF GROUND MOUNTS B2A

SUBJECT DRILLED PIER OPTION



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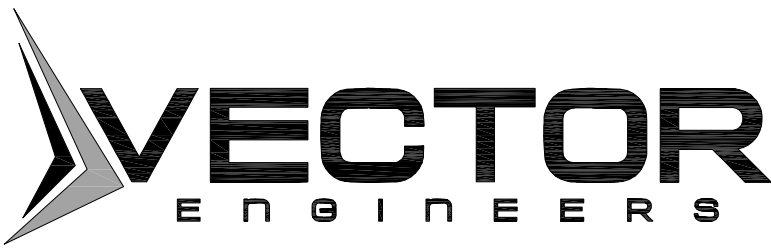
EXPIRES: 4-30-2022

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PV ARRAY SECTION

N.T.S.





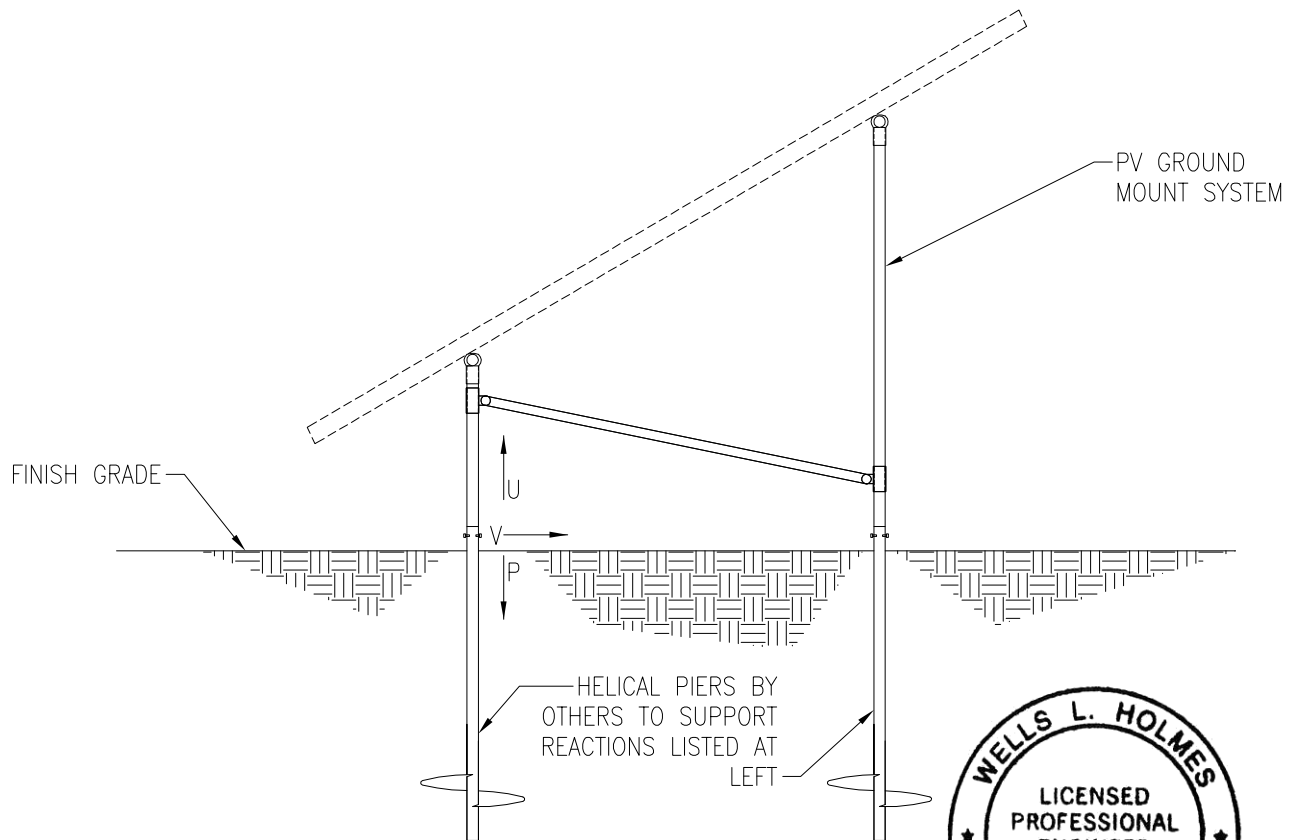
JOB NO. U2716-096-191

PROJECT SUNMODO SUNTURF GROUND MOUNTS B2A

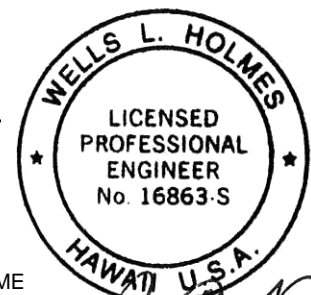
SUBJECT HELICAL PIER OPTION

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.



MAXIMUM REACTIONS:	
U	= 3,288 LBS
P	= 3,746 LBS
V	= 2,008 LBS



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PV ARRAY SECTION

S2

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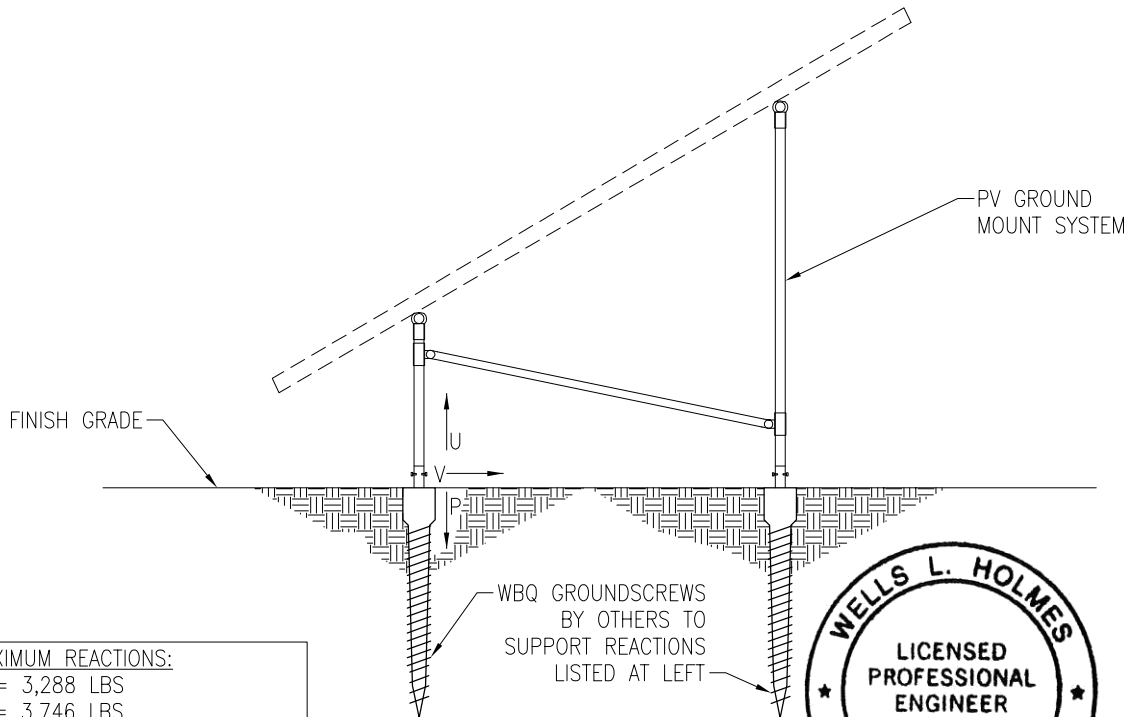
JOB NO. U2716-096-191

PROJECT SUNMODO SUNTURF GROUND MOUNTS B2A

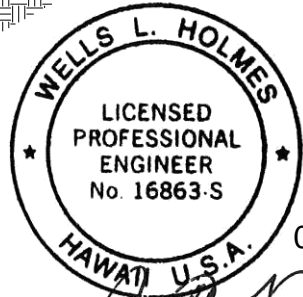
SUBJECT GROUND SCREW OPTION

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 = 3,288 LBS
 P = 3,746 LBS
 V = 2,008 LBS



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EXPIRES: 4-30-2022

S3

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JOB NO. U2716-096-191

PROJECT SUNMODO SUNTURF GROUND MOUNTS B2A

SUBJECT BALLASTED BLOCK OPTION

NOTES:

1. For ground mount components see Section S1.

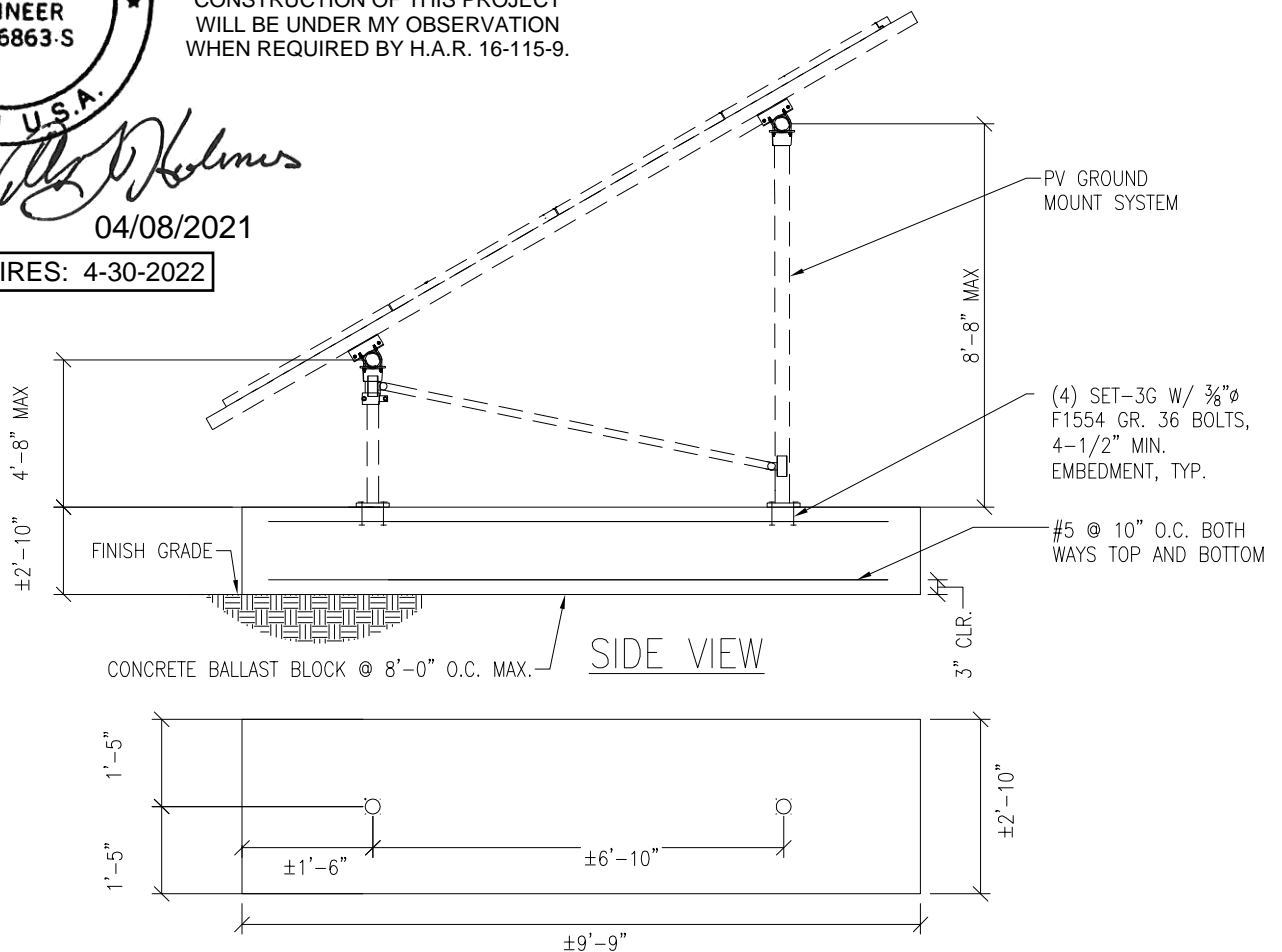


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PV ARRAY SECTION

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S4

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JOB NO.: U2716-096-191

DESIGNED: STB

DATE: 07/29/19

PROJECT: B2a – Sunmodo Sunturf GM

SUBJECT: Snow Load

SNOW LOAD (S):

ASCE 7 Standard:	05	
Panel Slope from Horizontal [°]:	30.0	
Snow Ground Load, p_g [psf]:	5.0	(Section 7.2)
Terrain Category:	C	(Table 7-2)
Exposure of Roof:	Fully Exposed	(Table 7-2)
Exposure Factor, C_e :	0.9	(Table 7-2)
Thermal Factor, C_t :	1.2	(Table 7-3)
Occupancy Category:	1	(Table 1-1)
Importance Factor, I_s :	0.8	(Table 7-4)
Flat Roof Snow Load, p_f [psf]:	3	(Equation 7-1)
Minimum Roof Snow Load, p_m [psf]:	0	(Section 7.3.4)
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(Section 7.4)
Roof Slope Factor, C_s :	0.727	(Figure 7-2)
Sloped Roof Snow Load, p_s [psf]:	2	(Equation 7-2)
Design Snow Load, S [psf]:	2	
Tributary Transverse Length [ft]:	5.9	
Tributary Longitudinal Length [ft]:	8	
Tributary Area per Column [ft ²]:	47.6	
Snow Load per Column (1.0 S) [lb]:	104.6	



PROJECT: B2a – Sunmodo Sunturf GM

SUBJECT: Wind Pressure

Design Wind Load:

ASCE 7 Standard:	05	
Basic Wind Speed, V [mph]:	110	
Occupancy Category:	I	
Importance, I _w :	0.77	
Exposure Category	C	(Section 6.5.6.3)
Velocity Pressure Exposure Coefficient, K _z :	0.85	(Table 6-3)
Topographic Factor, K _{zt} :	1.0	(Section 6.5.7.2)
Wind Directionality Factor, K _d :	0.85	(Table 6-4)
Internal Pressure Coefficient, GC _{pi} :	0.00	(Figure 6-5)
Velocity Pressure, q _h [psf]:	17.2	(Equation 6-15)
Gust Effect Factor, G:	0.85	(Section 6.5.8)
Panel Slope [degrees]:	30.0	

Net Pressure Coefficients (C_N) per: (Figure 6-18A)

Clear Wind Flow	C _{NW}	C _{NL}
Case 1 (γ = 0°, Load Case A)	-1.80	-1.80
Case 2 (γ = 0°, Load Case B)	-2.50	-0.50
Case 3 (γ = 180°, Load Case A)	2.10	2.10
Case 4 (γ = 180°, Load Case B)	2.60	1.00

Design Wind Pressures (p) [psf] per: (Equation 6-25)

Clear Wind Flow	q _h GC _{NW}	q _h GC _{NL}
Case 1 (γ = 0°, Load Case A)	-26.4	-26.4
Case 2 (γ = 0°, Load Case B)	-36.6	-7.3
Case 3 (γ = 180°, Load Case A)	30.8	30.8
Case 4 (γ = 180°, Load Case B)	38.1	14.6

Wind Pressure on Each Side of Panels [psf]

Clear Wind Flow	Short Col. Pressure	Long Col. Pressure
Case 1 (γ = 0°, Load Case A)	-26.4	-26.4
Case 2 (γ = 0°, Load Case B)	-7.3	-36.6
Case 3 (γ = 180°, Load Case A)	30.8	30.8
Case 4 (γ = 180°, Load Case B)	38.1	14.6



JOB NO.: U2716-096-191

PROJECT: B2a – Sunmodo Sunturf GM

SUBJECT: Open Building Wind Loads

Design Wind Load Per ASCE 7-05

$$p = q_h G C_n$$

Velocity Pressure Exposure Coefficient, K_{zt} :	0.85	(Table 6-3)
Topographic Factor, K_{ht} :	1.0	(Section 6.5.7.2)
Wind Directionality Factor, K_d :	0.85	(Table 6-4)
Ultimate Wind Speed, V [mph]:	110	

Velocity Pressure, q_h [psf]:	17.2	(Equation 6-15)
Gust Effect Factor, G :	0.85	(Section 6.5.8)

$\gamma = 90^\circ$ or 270°

Force Coefficient, C_N :

Horizontal Distance from Winward Edge	Roof angle			Obstructed Wind Flow
	30	A	CN	
$\leq h$	30	A	-0.8	
		B	0.8	
$> h, \leq 2h$	30	A	-0.6	
		B	0.5	
$> 2h$	30	A	-0.3	
		B	0.3	

Design Wind Pressure, p [psf]:

	Roof angle			Obstructed Wind Flow
	30	A		
$\leq h$	30	A	-11.7	
		B	11.7	
$> h, \leq 2h$	30	A	-8.8	
		B	7.3	
$> 2h$	30	A	-4.4	
		B	4.4	



JOB NO.: U2716-096-191

DESIGNED: STB

Foundation Option 1: Drilled Concrete Pier



PROJECT: Links Not Updated Ground Mount

DRILLED CONCRETE PIER DESIGN

Column Reactions:

Max. Shear, V [k]:	2.0	Max. Down, P_d [k]:	3.7
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P_u [k]:	3.3

Pier Properties:

Pier Shape:	Round	Volume of Concrete [ft ³]:	11
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd ³]:	0.4
Top of Pier Elevation [ft]:	0.00	Weight of Concrete [k]:	1.6
Pier Depth, d [ft]:	6.0		

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]:	7.1
-----------------------	-----

Bearing capacity OK.

Check Uplift:

Uplift Capacity [k]:	8.5
----------------------	-----

Uplift capacity OK.

Check Lateral Bearing:

Top of Pier Constrained?:	No	IBC Section 1807.3.2.1
Applied Lateral Force, P [lb]:	2,008	
Point of Application, h [ft]:	0.0	
S_{max} [psf]:		
S [psf]:	600	
$A = 2.34 * P / (S_b)$:	5.22	
Required Pier Depth, d_{reqd} [ft]:	5.20	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	3288	1.5	4932
LATERAL	2008	2	4016

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.

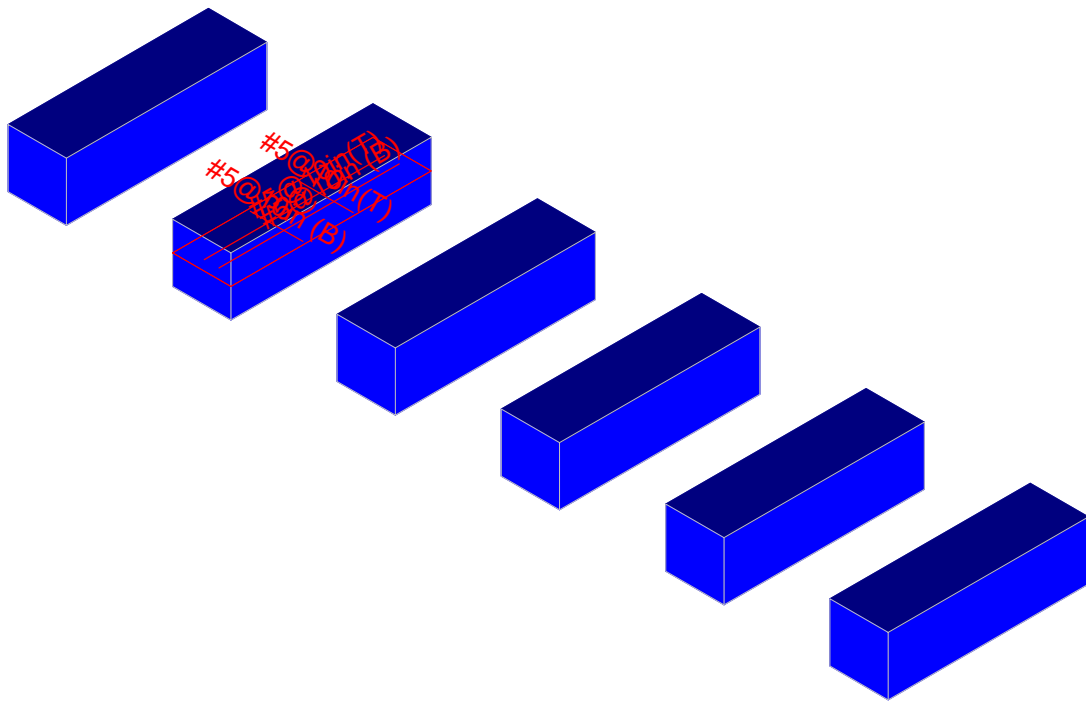
Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	3288	1.5	4932
LATERAL	2008	2	4016



JOB NO.: U2716-096-191

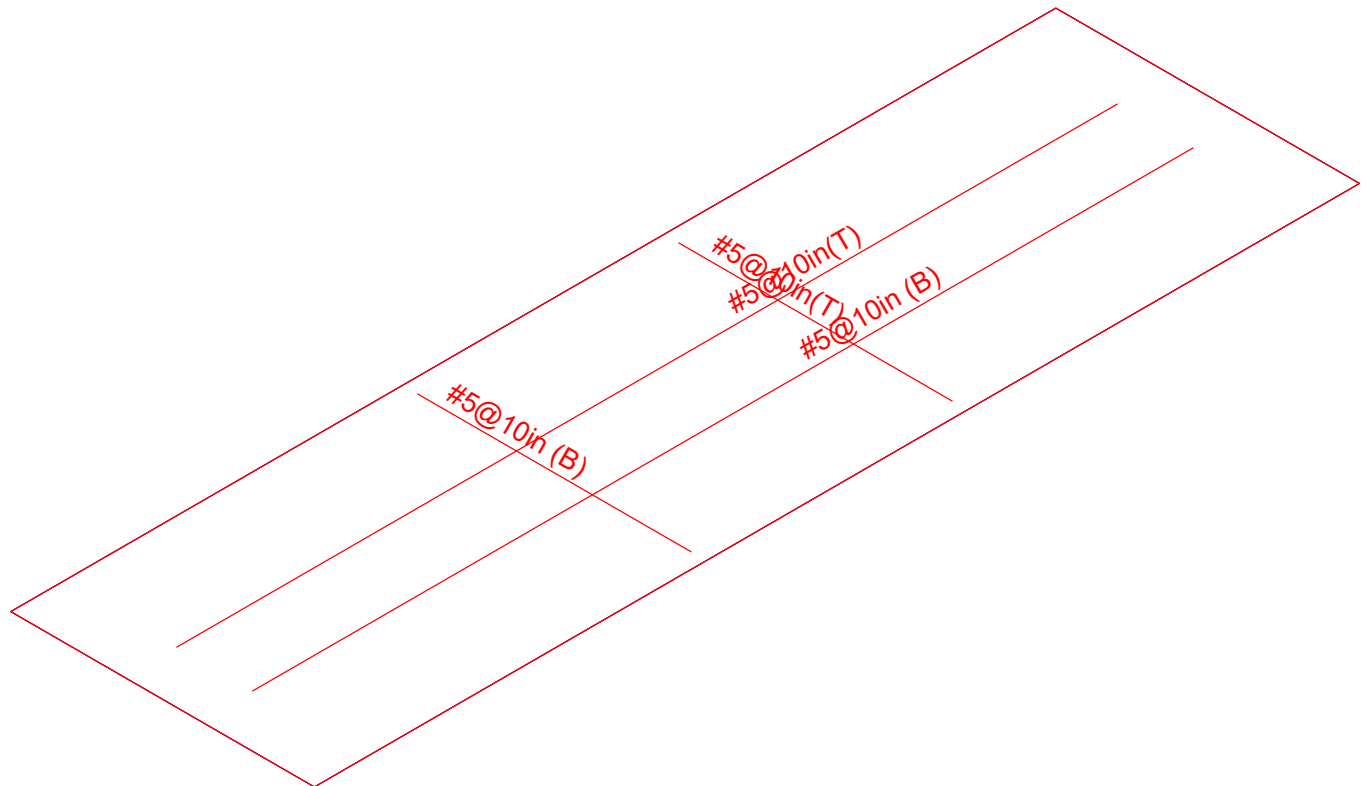
DESIGNED: STB

Foundation Option 4: Ballasted Block



Results for LC 1, 1.0 D

Vector Structural Engineeri...	Ground Mount	SK - 2
STB		Apr 8, 2021 at 10:52 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



Results for LC 1, 1.0 D

Vector Structural Engineeri..	Ground Mount	SK - 1
STB		Apr 8, 2021 at 10:52 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



(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 318-08
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	10	10	10	10	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.-ft]
1	R3D_N1_1	X	-17.538
2	R3D_N1_1	Y	240.173
3	R3D_N2	X	-3.693
4	R3D_N2	Y	199.542
5	R3D_N132_1	Y	245.538
6	R3D_N133_2	Y	250.328
7	R3D_N109_1	Y	247.007
8	R3D_N110A	X	1.265

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

	Label	Direction	Magnitude[lb,lb-ft]
9	R3D_N110A	Y	253.777
10	R3D_N121_1	Y	260.692
11	R3D_N122	Y	244.218
12	R3D_N133B_1	Y	260.703
13	R3D_N134B	Y	243.857
14	R3D_N132	X	16.973
15	R3D_N132	Y	243.125
16	R3D_N138B	X	4.62
17	R3D_N138B	Y	204.148

Point Loads and Moments (Cat 6 : RLL)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-7.877
2	R3D_N1_1	Y	93.172
3	R3D_N2	X	-1.721
4	R3D_N2	Y	82.504
5	R3D_N132_1	Y	98.726
6	R3D_N133_2	Y	106.419
7	R3D_N109_1	Y	99.437
8	R3D_N110A	Y	108.166
9	R3D_N121_1	Y	106.16
10	R3D_N122	Y	103.424
11	R3D_N133B_1	Y	106.146
12	R3D_N134B	Y	103.223
13	R3D_N132	X	7.592
14	R3D_N132	Y	93.785
15	R3D_N138B	X	2.263
16	R3D_N138B	Y	84.015

Point Loads and Moments (Cat 16 : OL1)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	120.39
2	R3D_N1_1	Y	-2479.179
3	R3D_N1_1	Z	1300.109
4	R3D_N2	X	24.871
5	R3D_N2	Y	128.938
6	R3D_N2	Z	-39.315
7	R3D_N132_1	X	-7.67
8	R3D_N132_1	Y	-2921.357
9	R3D_N132_1	Z	1707.586
10	R3D_N133_2	X	6.864
11	R3D_N133_2	Y	238.701
12	R3D_N133_2	Z	-45.555
13	R3D_N109_1	X	1.246
14	R3D_N109_1	Y	-2935.844
15	R3D_N109_1	Z	1720.315
16	R3D_N110A	X	-7.27
17	R3D_N110A	Y	233.963
18	R3D_N110A	Z	-45.527
19	R3D_N121_1	Y	-2968.489
20	R3D_N121_1	Z	1620.005
21	R3D_N122	X	1.115
22	R3D_N122	Y	196.971
23	R3D_N122	Z	-45.715
24	R3D_N133B_1	X	1.592
25	R3D_N133B_1	Y	-2984.281

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

	Label	Direction	Magnitude[lb,lb-ft]
26	R3D_N133B_1	Z	1637.923
27	R3D_N134B	X	2.378
28	R3D_N134B	Y	215.004
29	R3D_N134B	Z	-46.043
30	R3D_N132	X	-115.438
31	R3D_N132	Y	-2493.067
32	R3D_N132	Z	1307.997
33	R3D_N138B	X	-27.957
34	R3D_N138B	Y	124.303
35	R3D_N138B	Z	-39.375

Point Loads and Moments (Cat 17 : OL2)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	163.337
2	R3D_N1_1	Y	-2884.234
3	R3D_N1_1	Z	1072.556
4	R3D_N2	X	4.847
5	R3D_N2	Y	873.255
6	R3D_N2	Z	-32.439
7	R3D_N132_1	X	-10.061
8	R3D_N132_1	Y	-3331.438
9	R3D_N132_1	Z	1402.899
10	R3D_N133_2	X	2.275
11	R3D_N133_2	Y	1198.975
12	R3D_N133_2	Z	-37.474
13	R3D_N109_1	X	1.339
14	R3D_N109_1	Y	-3350.116
15	R3D_N109_1	Z	1413.301
16	R3D_N110A	X	1.836
17	R3D_N110A	Y	1215.122
18	R3D_N110A	Z	-37.361
19	R3D_N121_1	Y	-3426.044
20	R3D_N121_1	Z	1332.694
21	R3D_N122	X	-6.269
22	R3D_N122	Y	1132.349
23	R3D_N122	Z	-37.615
24	R3D_N133B_1	X	1.914
25	R3D_N133B_1	Y	-3445.036
26	R3D_N133B_1	Z	1354.244
27	R3D_N134B	X	-1.229
28	R3D_N134B	Y	1152.712
29	R3D_N134B	Z	-38.039
30	R3D_N132	X	-156.343
31	R3D_N132	Y	-2901.739
32	R3D_N132	Z	1077.664
33	R3D_N138B	X	-1.459
34	R3D_N138B	Y	883.506
35	R3D_N138B	Z	-32.436

Point Loads and Moments (Cat 18 : OL3)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-140.455
2	R3D_N1_1	Y	2892.375
3	R3D_N1_1	Z	-1516.793
4	R3D_N2	X	-29.016
5	R3D_N2	Y	-150.427

Point Loads and Moments (Cat 18 : OL3) (Continued)

	Label	Direction	Magnitude[lb.-lb-ft]
6	R3D_N2	Z	45.867
7	R3D_N132_1	X	8.949
8	R3D_N132_1	Y	3408.249
9	R3D_N132_1	Z	-1992.184
10	R3D_N133_2	X	-8.008
11	R3D_N133_2	Y	-278.484
12	R3D_N133_2	Z	53.147
13	R3D_N109_1	X	-1.454
14	R3D_N109_1	Y	3425.151
15	R3D_N109_1	Z	-2007.034
16	R3D_N110A	X	8.481
17	R3D_N110A	Y	-272.957
18	R3D_N110A	Z	53.115
19	R3D_N121_1	Y	3463.237
20	R3D_N121_1	Z	-1890.006
21	R3D_N122	X	-1.301
22	R3D_N122	Y	-229.8
23	R3D_N122	Z	53.334
24	R3D_N133B_1	X	-1.857
25	R3D_N133B_1	Y	3481.661
26	R3D_N133B_1	Z	-1910.91
27	R3D_N134B	X	-2.774
28	R3D_N134B	Y	-250.839
29	R3D_N134B	Z	53.717
30	R3D_N132	X	134.678
31	R3D_N132	Y	2908.578
32	R3D_N132	Z	-1525.996
33	R3D_N138B	X	32.617
34	R3D_N138B	Y	-145.02
35	R3D_N138B	Z	45.937

Point Loads and Moments (Cat 19 : OL4)

	Label	Direction	Magnitude[lb.-lb-ft]
1	R3D_N1_1	X	-69.44
2	R3D_N1_1	Y	1814.441
3	R3D_N1_1	Z	-1304.388
4	R3D_N2	X	-37.522
5	R3D_N2	Y	485.716
6	R3D_N2	Z	39.44
7	R3D_N132_1	X	4.701
8	R3D_N132_1	Y	2191.97
9	R3D_N132_1	Z	-1717.871
10	R3D_N133_2	X	-9.603
11	R3D_N133_2	Y	564.208
12	R3D_N133_2	Z	45.791
13	R3D_N109_1	X	-1.001
14	R3D_N109_1	Y	2201.11
15	R3D_N109_1	Z	-1730.72
16	R3D_N110A	X	13.576
17	R3D_N110A	Y	585.046
18	R3D_N110A	Z	45.836
19	R3D_N121_1	Y	2194.566
20	R3D_N121_1	Z	-1628.359
21	R3D_N122	X	-6.884
22	R3D_N122	Y	580.248
23	R3D_N122	Z	45.944

Point Loads and Moments (Cat 19 : OL4) (Continued)

	Label	Direction	Magnitude[lb.lb-ft]
24	R3D_N133B_1	X	-1.116
25	R3D_N133B_1	Y	2205.625
26	R3D_N133B_1	Z	-1640.908
27	R3D_N134B	X	-4.945
28	R3D_N134B	Y	566.556
29	R3D_N134B	Z	46.151
30	R3D_N132	X	66.806
31	R3D_N132	Y	1823.524
32	R3D_N132	Z	-1313.425
33	R3D_N138B	X	45.378
34	R3D_N138B	Y	501.654
35	R3D_N138B	Z	39.543

Point Loads and Moments (Cat 20 : OL5)

	Label	Direction	Magnitude[lb.lb-ft]
1	R3D_N1_1	X	-41.08
2	R3D_N1_1	Y	1110.246
3	R3D_N1_1	Z	-575.556
4	R3D_N2	X	-8.579
5	R3D_N2	Y	-84.049
6	R3D_N2	Z	15.888
7	R3D_N132_1	X	3.961
8	R3D_N132_1	Y	478.857
9	R3D_N132_1	Z	-288.529
10	R3D_N133_2	X	-1.141
11	R3D_N133_2	Y	-41.735
12	R3D_N133_2	Z	7.739
13	R3D_N109_1	X	1.511
14	R3D_N109_1	Y	1000.119
15	R3D_N109_1	Z	-588.495
16	R3D_N110A	X	1.353
17	R3D_N110A	Y	-79.171
18	R3D_N110A	Z	14.965
19	R3D_N121_1	X	5.072
20	R3D_N121_1	Y	620.565
21	R3D_N121_1	Z	-338.063
22	R3D_N122	X	7.195
23	R3D_N122	Y	-41.621
24	R3D_N122	Z	10.466
25	R3D_N133B_1	Y	472.798
26	R3D_N133B_1	Z	-257.816
27	R3D_N134B	X	-2.603
28	R3D_N134B	Y	-30.357
29	R3D_N134B	Z	8.11
30	R3D_N132	X	29.708
31	R3D_N132	Y	433.051
32	R3D_N132	Z	-217.18
33	R3D_N138B	X	3.775
34	R3D_N138B	Y	-25.02
35	R3D_N138B	Z	6.586

Point Loads and Moments (Cat 21 : OL6)

	Label	Direction	Magnitude[lb.lb-ft]
1	R3D_N1_1	X	39.6
2	R3D_N1_1	Y	-1102.35
3	R3D_N1_1	Z	571.89

Load Combinations (Continued)

Label	Solve	Service	A...	SF	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...
13	1.0 D + 0...	Yes	Yes	1.5	DL	1	RLL	.75	OL5	.75								
14	1.0 D + 0...	Yes	Yes	1.5	DL	1	RLL	.75	OL6	.75								
15	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL1	1								
16	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL2	1								
17	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL3	1								
18	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL4	1								
19	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL5	1								
20	0.9 D + 0...	Yes	Yes		DL	.9	RLL		OL6	1								
21																		
22	1.4D	Yes			DL	1.4												
23	1.2D+1.6SL	Yes			DL	1.2	RLL	1.6										
24	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL1	.8								
25	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL2	.8								
26	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL3	.8								
27	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL4	.8								
28	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL5	.8								
29	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL6	.8								
30	1.2D+1.6...	Yes			DL	1.2	RLL	.5	OL1	1.6								
31	1.2D-1.6...	Yes			DL	1.2	RLL	.5	OL2	1.6								
32	1.2D+1.6...	Yes			DL	1.2	RLL	.5	OL3	1.6								
33	1.2D-1.6...	Yes			DL	1.2	RLL	.5	OL4	1.6								
34	1.2D+1.6...	Yes			DL	1.2	RLL	.5	OL5	1.6								
35	1.2D-1.6...	Yes			DL	1.2	RLL	.5	OL6	1.6								
36	1.0D+1.6...	Yes			DL	1			OL1	1.6								
37	1.0D-1.6Wx	Yes			DL	1			OL2	1.6								
38	1.0D+1.6...	Yes			DL	1			OL3	1.6								
39	1.0D-1.6Wz	Yes			DL	1			OL4	1.6								
40	1.0D+1.6...	Yes			DL	1			OL5	1.6								
41	1.0D-1.6...	Yes			DL	1			OL6	1.6								

Design Strips

Label	Rebar Angle from Pl...	No. of Design Cuts	Design Rule	
1	DS1	0	50	Typical
2	DS2	90	50	Typical

Load Categories

Category	Point Loads	Line Loads	Area Loads
1	DL	17	
2	RLL	16	
3	OL1	35	
4	OL2	35	
5	OL3	35	
6	OL4	35	
7	OL5	35	
8	OL6	35	

Strip Reinforcing

Label	UC Top	LC	Top Bars	Governing ...	UC Bot	LC	Bot B...	Gover...	UC Shear	LC	Governing De...
1	DS1	.013	33	#5@10in	DS1-X26	.011	37	#5@1...DS1-...	.029	37	DS1-X15
2	DS2	.003	36	#5@10in	DS2-X26	.004	32	#5@1...DS2-...	.005	32	DS2-X50



Company : Vector Structural Engineering
 Designer : STB
 Job Number : U2716.096.191
 Model Name : Ground Mount

Apr 8, 2021
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 Checked By: JSP

Slab Overturning Safety Factors (By Combination)

LC	Slab	Angle[deg]	Mo-xx[lb-ft]	Ms-xx[lb-ft]	Mo-zz[lb-ft]	Ms-zz[lb-ft]	Ms-xx/Mo-xx	Ms-zz/Mo-zz
1	1	S1	0	0	57460.924	0	16761.247	9.999+
2	1	S2	0	0	57938.398	0	16784.02	9.999+
3	1	S3	0	0	57880.298	0	16793.45	9.999+
4	1	S4	0	0	57877.22	0	16792.955	9.999+
5	1	S5	0	0	57906.22	0	16780.637	9.999+
6	1	S6	0	0	57505.619	0	16650.617	9.999+
7	2	S1	0	0	58332.138	0	17037.315	9.999+
8	2	S2	0	0	59040.836	0	17078.124	9.999+
9	2	S3	0	0	58953.803	0	17090.362	9.999+
10	2	S4	0	0	58948.974	0	17089.562	9.999+
11	2	S5	0	0	58992.414	0	17071.258	9.999+
12	2	S6	0	0	58390.871	0	16874.577	9.999+
13	3	S1	0	23255.302	57482.075	3741.08	16761.247	2.472
14	3	S2	0	27959.079	57600.023	3844.731	16791.19	2.06
15	3	S3	0	27978.66	57698.351	3929.476	16793.45	2.062
16	3	S4	0	28133.791	57698.022	3934.388	16792.955	2.051
17	3	S5	0	27801.512	57584.247	3802.713	16780.637	2.071
18	3	S6	0	23393.995	57511.069	3762.037	16772.979	2.458
19	4	S1	0	25002.114	57482.075	3325.408	16761.247	2.299
20	4	S2	0	29281.824	57600.023	3033.571	16784.02	1.967
21	4	S3	0	29756.714	57698.351	3267.164	16793.45	1.939
22	4	S4	0	29944.754	57698.022	3249.399	16792.955	1.927
23	4	S5	0	29121.446	57584.247	3043.049	16780.637	1.977
24	4	S6	0	25144.675	57511.069	3306.267	16772.979	2.287
25	5	S1	0	397.145	57460.924	0	21125.841	9.999+
26	5	S2	0	1884.982	57938.398	0	21229.717	9.999+
27	5	S3	0	1115.701	57880.298	0	21377.838	9.999+
28	5	S4	0	1322.185	57877.22	0	21383.075	9.999+
29	5	S5	0	1919.839	57906.22	0	21211.805	9.999+
30	5	S6	0	348.256	57505.619	0	20091.656	9.999+
31	6	S1	0	0	61221.233	0	20322.861	9.999+
32	6	S2	0	0	62038.137	0	20695.444	9.999+
33	6	S3	0	0	62217.733	0	20743.943	9.999+
34	6	S4	0	0	62081.512	0	20737.382	9.999+
35	6	S5	0	0	61847.378	0	20699.112	9.999+
36	6	S6	0	0	61393.311	0	19626.766	9.999+
37	7	S1	0	364.216	57460.924	0	18355.727	9.999+
38	7	S2	0	554.343	57938.398	0	18080.586	9.999+
39	7	S3	0	199.448	57880.298	0	17578.866	9.999+
40	7	S4	0	140.671	57877.22	0	17427.121	9.999+
41	7	S5	0	315.802	57906.22	0	17391.903	9.999+
42	7	S6	0	53.603	57505.619	0	17133.792	9.999+
43	8	S1	0	10298.007	57482.075	1577.591	16761.247	5.582
44	8	S2	0	8197.647	57600.023	1130.431	16791.19	7.026
45	8	S3	0	5386.118	57698.351	782.89	16793.45	9.999+
46	8	S4	0	4532.835	57698.022	641.692	16792.955	9.999+
47	8	S5	0	4568.611	57584.247	625.88	16780.637	9.999+
48	8	S6	0	4027.011	57511.069	670.241	16772.979	9.999+
49	9	S1	0	17441.477	58113.302	2805.81	16968.298	3.332
50	9	S2	0	20969.31	58291.291	2883.548	17011.768	2.78
51	9	S3	0	20983.995	58425.812	2947.107	17016.134	2.784
52	9	S4	0	21100.344	58425.225	2950.791	17015.41	2.769
53	9	S5	0	20851.134	58269.719	2852.035	16998.603	2.795
54	9	S6	0	17545.497	58147.292	2821.528	16982.833	3.314
55	10	S1	0	18751.586	58113.302	2494.056	16968.298	3.099
56	10	S2	0	21961.368	58291.291	2275.178	17004.598	2.654
57	10	S3	0	22317.535	58425.812	2450.373	17016.134	2.618



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Slab Overturning Safety Factors (By Combination) (Continued)

LC	Slab	Angle[deg]	Mo-xx[lb-ft]	Ms-xx[lb-ft]	Mo-zz[lb-ft]	Ms-zz[lb-ft]	Ms-xx/Mo-xx	Ms-zz/Mo-zz	
58	10	S4	0	22458.565	58425.225	2437.049	17015.41	2.601	6.982
59	10	S5	0	21841.084	58269.719	2282.287	16998.603	2.668	7.448
60	10	S6	0	18858.506	58147.292	2479.7	16982.833	3.083	6.849
61	11	S1	0	297.859	58114.335	0	20241.743	9.999+	9.999+
62	11	S2	0	1413.737	58765.227	0	20338.87	9.999+	9.999+
63	11	S3	0	836.775	58685.426	0	20454.425	9.999+	9.999+
64	11	S4	0	991.639	58681.036	0	20458	9.999+	9.999+
65	11	S5	0	1439.879	58720.866	0	20321.979	9.999+	9.999+
66	11	S6	0	261.192	58169.558	0	19399.366	9.999+	9.999+
67	12	S1	0	0	60934.566	0	19639.508	9.999+	9.999+
68	12	S2	0	0	61840.031	0	19938.166	9.999+	9.999+
69	12	S3	0	0	61938.503	0	19979.003	9.999+	9.999+
70	12	S4	0	0	61834.254	0	19973.731	9.999+	9.999+
71	12	S5	0	0	61676.734	0	19937.459	9.999+	9.999+
72	12	S6	0	0	61085.328	0	19050.699	9.999+	9.999+
73	13	S1	0	273.162	58114.335	0	18164.158	9.999+	9.999+
74	13	S2	0	415.757	58765.227	0	17977.022	9.999+	9.999+
75	13	S3	0	149.586	58685.426	0	17605.195	9.999+	9.999+
76	13	S4	0	105.503	58681.036	0	17491.035	9.999+	9.999+
77	13	S5	0	236.851	58720.866	0	17457.052	9.999+	9.999+
78	13	S6	0	40.203	58169.558	0	17180.969	9.999+	9.999+
79	14	S1	0	7723.505	58113.302	1183.193	16968.298	7.524	9.999+
80	14	S2	0	6148.235	58291.291	847.823	17011.768	9.481	9.999+
81	14	S3	0	4039.589	58425.812	587.168	17016.134	9.999+	9.999+
82	14	S4	0	3399.626	58425.225	481.269	17015.41	9.999+	9.999+
83	14	S5	0	3426.458	58269.719	469.41	16998.603	9.999+	9.999+
84	14	S6	0	3020.258	58147.292	502.681	16982.833	9.999+	9.999+
85	15	S1	0	23255.302	51733.868	3741.08	15085.122	2.225	4.032
86	15	S2	0	27959.079	51840.02	3844.731	15112.071	1.854	3.931
87	15	S3	0	27978.66	51928.516	3929.476	15114.105	1.856	3.846
88	15	S4	0	28133.791	51928.22	3934.388	15113.66	1.846	3.841
89	15	S5	0	27801.512	51825.822	3802.713	15102.574	1.864	3.972
90	15	S6	0	23393.995	51759.962	3762.037	15095.681	2.213	4.013
91	16	S1	0	25002.114	51733.868	3325.408	15085.122	2.069	4.536
92	16	S2	0	29281.824	51840.02	3033.571	15105.618	1.77	4.979
93	16	S3	0	29756.714	51928.516	3267.164	15114.105	1.745	4.626
94	16	S4	0	29944.754	51928.22	3249.399	15113.66	1.734	4.651
95	16	S5	0	29121.446	51825.822	3043.049	15102.574	1.78	4.963
96	16	S6	0	25144.675	51759.962	3306.267	15095.681	2.058	4.566
97	17	S1	0	397.145	51714.832	0	19449.716	9.999+	9.999+
98	17	S2	0	1884.982	52144.558	0	19551.315	9.999+	9.999+
99	17	S3	0	1115.701	52092.268	0	19698.493	9.999+	9.999+
100	17	S4	0	1322.185	52089.498	0	19703.78	9.999+	9.999+
101	17	S5	0	1919.839	52115.598	0	19533.742	9.999+	9.999+
102	17	S6	0	348.256	51755.057	0	18426.594	9.999+	9.999+
103	18	S1	0	0	55475.14	0	18646.736	9.999+	9.999+
104	18	S2	0	0	56244.297	0	19017.042	9.999+	9.999+
105	18	S3	0	0	56429.703	0	19064.598	9.999+	9.999+
106	18	S4	0	0	56293.79	0	19058.087	9.999+	9.999+
107	18	S5	0	0	56056.756	0	19021.048	9.999+	9.999+
108	18	S6	0	0	55642.749	0	17961.704	9.999+	9.999+
109	19	S1	0	364.216	51714.832	0	16679.603	9.999+	9.999+
110	19	S2	0	554.343	52144.558	0	16402.184	9.999+	9.999+
111	19	S3	0	199.448	52092.268	0	15899.521	9.999+	9.999+
112	19	S4	0	140.671	52089.498	0	15747.825	9.999+	9.999+
113	19	S5	0	315.802	52115.598	0	15713.839	9.999+	9.999+
114	19	S6	0	53.603	51755.057	0	15468.731	9.999+	9.999+



Slab Overturning Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Mo-xx[lb-ft]	Ms-xx[lb-ft]	Mo-zz[lb-ft]	Ms-zz[lb-ft]	Ms-xx/Mo-xx	Ms-zz/Mo-zz
115	20	S1	0	10298.007	51733.868	1577.591	15085.122	5.024	9.562
116	20	S2	0	8197.647	51840.02	1130.431	15112.071	6.324	9.999+
117	20	S3	0	5386.118	51928.516	782.89	15114.105	9.641	9.999+
118	20	S4	0	4532.835	51928.22	641.692	15113.66	9.999+	9.999+
119	20	S5	0	4568.611	51825.822	625.88	15102.574	9.999+	9.999+
120	20	S6	0	4027.011	51759.962	670.241	15095.681	9.999+	9.999+

Slab Sliding Safety Factors (By Combination)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
1	1	S1	0	21.231	3536.702	0	3536.702	9.999+	9.999+
2	1	S2	0	1.265	3555.022	0	3555.022	9.999+	9.999+
3	1	S3	0	0	3556.26	0	3556.26	9.999+	9.999+
4	1	S4	0	0	3556.155	0	3556.155	9.999+	9.999+
5	1	S5	0	0	3553.547	0	3553.547	9.999+	9.999+
6	1	S6	0	21.593	3538.969	0	3538.969	9.999+	9.999+
7	2	S1	0	30.829	3589.405	0	3589.405	9.999+	9.999+
8	2	S2	0	1.265	3617.303	0	3617.303	9.999+	9.999+
9	2	S3	0	0	3619.135	0	3619.135	9.999+	9.999+
10	2	S4	0	0	3618.966	0	3618.966	9.999+	9.999+
11	2	S5	0	0	3615.09	0	3615.09	9.999+	9.999+
12	2	S6	0	31.448	3592.309	0	3592.309	9.999+	9.999+
13	3	S1	0	124.029	2831.629	1260.794	2831.629	9.999+	2.246
14	3	S2	0	4.758	2744.458	1674.787	2744.458	9.999+	1.639
15	3	S3	0	1.115	2724.805	1574.29	2724.805	9.999+	1.731
16	3	S4	0	3.97	2725.372	1591.88	2725.372	9.999+	1.712
17	3	S5	0	.806	2748.75	1662.031	2748.75	9.999+	1.654
18	3	S6	0	121.803	2828.34	1268.622	2828.34	9.999+	2.229
19	4	S1	0	146.952	2933.408	1040.117	2933.408	9.999+	2.82
20	4	S2	0	4.44	2914.524	1375.94	2914.524	9.999+	2.118
21	4	S3	0	6.269	2868.152	1295.079	2868.152	9.999+	2.215
22	4	S4	0	.684	2868.458	1316.205	2868.458	9.999+	2.179
23	4	S5	0	7.786	2913.808	1365.425	2913.808	9.999+	2.134
24	4	S6	0	136.208	2933.499	1045.228	2933.499	9.999+	2.807
25	5	S1	0	190.702	4359.286	1470.926	4359.286	9.999+	2.964
26	5	S2	0	8.293	4500.68	1953.919	4500.68	9.999+	2.303
27	5	S3	0	1.301	4526.291	1836.672	4526.291	9.999+	2.464
28	5	S4	0	4.631	4525.402	1857.193	4525.402	9.999+	2.437
29	5	S5	0	.941	4492.476	1939.037	4492.476	9.999+	2.317
30	5	S6	0	188.888	4368.036	1480.059	4368.036	9.999+	2.951
31	6	S1	0	128.193	4226.749	1264.948	4226.749	9.999+	3.341
32	6	S2	0	13.841	4390.869	1684.885	4390.869	9.999+	2.606
33	6	S3	0	6.884	4388.704	1582.415	4388.704	9.999+	2.773
34	6	S4	0	6.06	4387.81	1594.757	4387.81	9.999+	2.751
35	6	S5	0	4.902	4380.4	1672.08	4380.4	9.999+	2.62
36	6	S6	0	133.777	4236.523	1273.882	4236.523	9.999+	3.326
37	7	S1	0	70.89	3844.561	559.668	3844.561	9.999+	6.869
38	7	S2	0	4.128	3831.307	573.53	3831.307	9.999+	6.68
39	7	S3	0	12.267	3729.943	327.596	3729.943	9.999+	9.999+
40	7	S4	0	2.603	3688.887	249.706	3688.887	9.999+	9.999+
41	7	S5	0	2.82	3684.683	280.79	3684.683	9.999+	9.999+
42	7	S6	0	55.076	3661.378	210.594	3661.378	9.999+	9.999+
43	8	S1	0	26.242	3231.107	556.532	3231.107	9.999+	5.806
44	8	S2	0	3.343	3318.402	496.16	3318.402	9.999+	6.688
45	8	S3	0	8.634	3395.652	301.131	3395.652	9.999+	9.999+
46	8	S4	0	2.094	3421.524	254.75	3421.524	9.999+	9.999+
47	8	S5	0	2.513	3422.515	279.717	3422.515	9.999+	9.999+



Slab Sliding Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
48	8	S6	0	11.313	3416.779	210.762	3416.779	9.999+	9.999+
49	9	S1	0	80.516	3047.425	945.595	3047.425	9.999+	3.223
50	9	S2	0	3.252	2993.81	1256.091	2993.81	9.999+	2.383
51	9	S3	0	.836	2979.825	1180.718	2979.825	9.999+	2.524
52	9	S4	0	2.977	2980.176	1193.91	2980.176	9.999+	2.496
53	9	S5	0	.605	2996.107	1246.524	2996.107	9.999+	2.404
54	9	S6	0	78.562	3046.002	951.466	3046.002	9.999+	3.201
55	10	S1	0	97.708	3123.759	780.088	3123.759	9.999+	4.004
56	10	S2	0	3.647	3121.359	1031.955	3121.359	9.999+	3.025
57	10	S3	0	4.702	3087.335	971.309	3087.335	9.999+	3.179
58	10	S4	0	.513	3087.49	987.154	3087.49	9.999+	3.128
59	10	S5	0	5.839	3119.9	1024.068	3119.9	9.999+	3.047
60	10	S6	0	89.367	3124.871	783.921	3124.871	9.999+	3.986
61	11	S1	0	155.533	4193.167	1103.195	4193.167	9.999+	3.801
62	11	S2	0	6.536	4310.976	1465.439	4310.976	9.999+	2.942
63	11	S3	0	.975	4330.94	1377.504	4330.94	9.999+	3.144
64	11	S4	0	3.473	4330.198	1392.895	4330.198	9.999+	3.109
65	11	S5	0	.706	4303.901	1454.277	4303.901	9.999+	2.959
66	11	S6	0	154.456	4200.774	1110.044	4200.774	9.999+	3.784
67	12	S1	0	108.651	4093.764	948.711	4093.764	9.999+	4.315
68	12	S2	0	10.697	4228.618	1263.663	4228.618	9.999+	3.346
69	12	S3	0	5.163	4227.75	1186.811	4227.75	9.999+	3.562
70	12	S4	0	4.545	4227.004	1196.068	4227.004	9.999+	3.534
71	12	S5	0	3.677	4219.844	1254.06	4219.844	9.999+	3.365
72	12	S6	0	113.122	4102.139	955.412	4102.139	9.999+	4.294
73	13	S1	0	65.674	3807.123	419.751	3807.123	9.999+	9.07
74	13	S2	0	3.413	3808.946	430.147	3808.946	9.999+	8.855
75	13	S3	0	9.2	3733.679	245.697	3733.679	9.999+	9.999+
76	13	S4	0	1.952	3702.813	187.279	3702.813	9.999+	9.999+
77	13	S5	0	2.115	3698.057	210.592	3698.057	9.999+	9.999+
78	13	S6	0	54.097	3670.781	157.945	3670.781	9.999+	9.999+
79	14	S1	0	7.175	3347.033	417.399	3347.033	9.999+	8.019
80	14	S2	0	2.191	3424.267	372.12	3424.267	9.999+	9.202
81	14	S3	0	6.476	3482.96	225.849	3482.96	9.999+	9.999+
82	14	S4	0	1.57	3502.29	191.062	3502.29	9.999+	9.999+
83	14	S5	0	1.885	3501.431	209.788	3501.431	9.999+	9.999+
84	14	S6	0	4.305	3487.331	158.071	3487.331	9.999+	9.999+
85	15	S1	0	126.152	2477.959	1260.794	2477.959	9.999+	1.965
86	15	S2	0	4.885	2388.956	1674.787	2388.956	9.999+	1.426
87	15	S3	0	1.115	2369.179	1574.29	2369.179	9.999+	1.505
88	15	S4	0	3.97	2369.757	1591.88	2369.757	9.999+	1.489
89	15	S5	0	.806	2393.395	1662.031	2393.395	9.999+	1.44
90	15	S6	0	123.962	2474.443	1268.622	2474.443	9.999+	1.95
91	16	S1	0	149.076	2579.738	1040.117	2579.738	9.999+	2.48
92	16	S2	0	4.314	2559.022	1375.94	2559.022	9.999+	1.86
93	16	S3	0	6.269	2512.526	1295.079	2512.526	9.999+	1.94
94	16	S4	0	.684	2512.842	1316.205	2512.842	9.999+	1.909
95	16	S5	0	7.786	2558.453	1365.425	2558.453	9.999+	1.874
96	16	S6	0	138.367	2579.602	1045.228	2579.602	9.999+	2.468
97	17	S1	0	188.579	4005.616	1470.926	4005.616	9.999+	2.723
98	17	S2	0	8.166	4145.178	1953.919	4145.178	9.999+	2.121
99	17	S3	0	1.301	4170.665	1836.672	4170.665	9.999+	2.271
100	17	S4	0	4.631	4169.786	1857.193	4169.786	9.999+	2.245
101	17	S5	0	.941	4137.122	1939.037	4137.122	9.999+	2.134
102	17	S6	0	186.729	4014.14	1480.059	4014.14	9.999+	2.712
103	18	S1	0	126.07	3873.079	1264.948	3873.079	9.999+	3.062
104	18	S2	0	13.714	4035.367	1684.885	4035.367	9.999+	2.395



Slab Sliding Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
105	18	S3	0	6.884	4033.078	1582.415	4033.078	9.999+	2.549
106	18	S4	0	6.06	4032.194	1594.757	4032.194	9.999+	2.528
107	18	S5	0	4.902	4025.045	1672.08	4025.045	9.999+	2.407
108	18	S6	0	131.618	3882.626	1273.882	3882.626	9.999+	3.048
109	19	S1	0	68.767	3490.891	559.668	3490.891	9.999+	6.237
110	19	S2	0	4.002	3475.805	573.53	3475.805	9.999+	6.06
111	19	S3	0	12.267	3374.317	327.596	3374.317	9.999+	9.999+
112	19	S4	0	2.603	3333.272	249.706	3333.272	9.999+	9.999+
113	19	S5	0	2.82	3329.329	280.79	3329.329	9.999+	9.999+
114	19	S6	0	52.917	3307.481	210.594	3307.481	9.999+	9.999+
115	20	S1	0	28.365	2877.437	556.532	2877.437	9.999+	5.17
116	20	S2	0	3.469	2962.899	496.16	2962.899	9.999+	5.972
117	20	S3	0	8.634	3040.026	301.131	3040.026	9.999+	9.999+
118	20	S4	0	2.094	3065.908	254.75	3065.908	9.999+	9.999+
119	20	S5	0	2.513	3067.161	279.717	3067.161	9.999+	9.999+
120	20	S6	0	13.472	3062.882	210.762	3062.882	9.999+	9.999+

Envelope Slab Soil Pressures

	Label	UC	LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
1	S1	.491	5	735.94	1500	N170
2	S2	.53	5	795.368	1500	N177
3	S3	.533	5	799.278	1500	N184
4	S4	.535	5	802.159	1500	N191
5	S5	.529	5	793.85	1500	N198
6	S6	.492	5	737.495	1500	N205



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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 318-08
Units: Imperial units

Anchor Information:

Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.375
Effective Embedment depth, h_{ef} (inch): 4.500
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 5.75
 c_{ac} (inch): 8.20
 C_{min} (inch): 1.75
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 27.00
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 9.2

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]: 5277

V_{uax} [lb]: 375

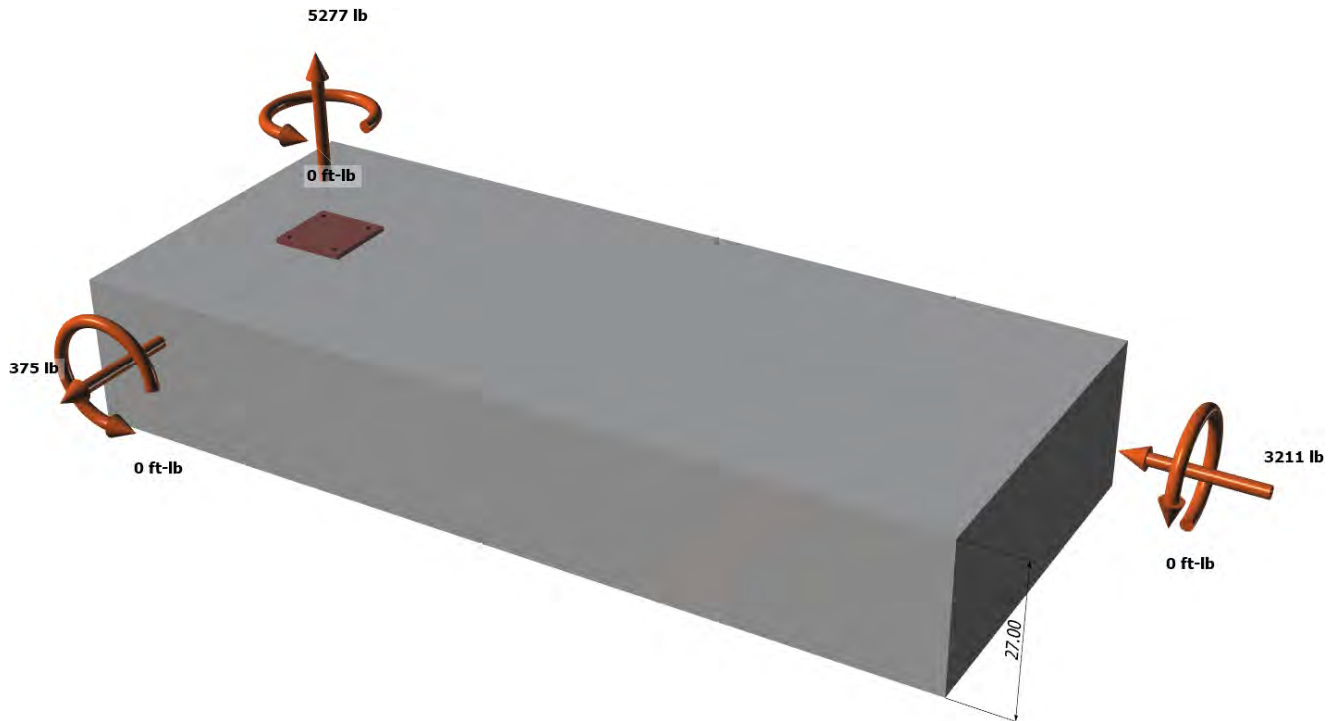
V_{uay} [lb]: -3211

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

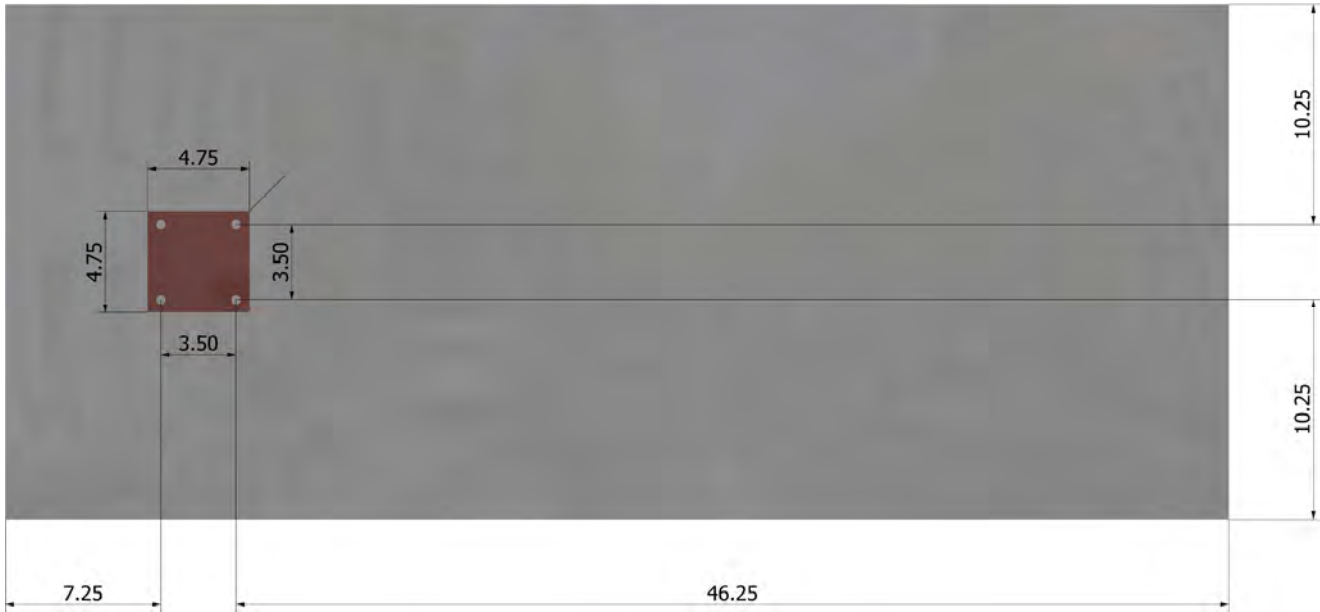
<Figure 1>





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<Figure 2>





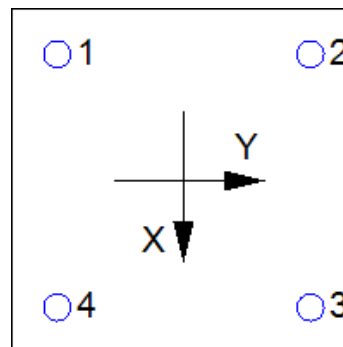
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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	1319.3	93.8	-802.8	808.2
2	1319.3	93.8	-802.8	808.2
3	1319.3	93.8	-802.8	808.2
4	1319.3	93.8	-802.8	808.2
Sum	5277.0	375.0	-3211.0	3232.8

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 5277
 Resultant compression force (lb): 0
 Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
 Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
 Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
 Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. D.5.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
4525	0.75	3394

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$$N_b = k_c \lambda \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. D-7)}$$

k _c	λ	f _c (psi)	h _{ef} (in)	N _b (lb)
17.0	1.00	2500	4.500	8114

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. D.4.1 \& Eq. D-5)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	c _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
289.00	182.25	7.25	1.000	1.000	1.00	1.000	8114	0.65	8363

6. Adhesive Strength of Anchor in Tension (AC308 Sec. 3.3)

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

τ _{k,cr} (psi)	f _{short-term}	K _{sat}	f _c (psi)	n	τ _{k,cr} (psi)
1346	1.00	1.00	2500	0.24	1346

$$N_{a0} = \tau_{k,cr} \pi d_a h_{ef} \text{ (Eq. D-16f)}$$

τ _{k,cr} (psi)	d _a (in)	h _{ef} (in)	N _{a0} (lb)
1346	0.38	4.500	7136

$$\phi N_{ag} = \phi (A_{Na} / A_{Na0}) \Psi_{ed,Na} \Psi_{g,Na} \Psi_{ec,Na} \Psi_{p,Na} N_{a0} \text{ (Sec. D.4.1 \& Eq. D-16b)}$$

A _{Na} (in ²)	A _{Na0} (in ²)	Ψ _{ed,Na}	Ψ _{g,Na}	Ψ _{ec,Na}	Ψ _{p,Na}	N _{a0} (lb)	φ	φN _{ag} (lb)
161.83	85.03	1.000	1.067	1.000	1.000	7136	0.55	7972

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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8. Steel Strength of Anchor in Shear (Sec. D.6.1)

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

9. Concrete Breakout Strength of Anchor in Shear (Sec. D.6.2)

Shear perpendicular to edge in x-direction:

$$V_{bx} = 7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda \sqrt{f_c} c_{a1}^{1.5} \text{ (Eq. D-24)}$$

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

$$\phi V_{cbgx} = \phi (A_{Vc} / A_{Vco}) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} V_{bx} \text{ (Sec. D.4.1 \& Eq. D-22)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{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:

$$V_{by} = 7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda \sqrt{f_c} c_{a1}^{1.5} \text{ (Eq. D-24)}$$

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

$$\phi V_{cbgy} = \phi (A_{Vc} / A_{Vco}) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} V_{by} \text{ (Sec. D.4.1 \& Eq. D-22)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{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:

$$V_{by} = 7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda \sqrt{f_c} c_{a1}^{1.5} \text{ (Eq. D-24)}$$

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

$$\phi V_{cbgx} = \phi (2)(A_{Vc} / A_{Vco}) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} V_{by} \text{ (Sec. D.4.1, D.6.2.1(c) \& Eq. D-22)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{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:

$$V_{bx} = 7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda \sqrt{f_c} c_{a1}^{1.5} \text{ (Eq. D-24)}$$

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

$$\phi V_{cbgy} = \phi (2)(A_{Vc} / A_{Vco}) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} V_{bx} \text{ (Sec. D.4.1, D.6.2.1(c) \& Eq. D-22)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{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. D.6.3)

$$\phi V_{cp} = \phi \min[K_{cp} N_{ag}; K_{cp} N_{cbg}] = \phi \min[K_{cp}(A_{Na} / A_{Na0}) \Psi_{ed,Na} \Psi_{g,Na} \Psi_{ec,Na} \Psi_{p,Na} N_{a0}; K_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b] \text{ (Eq. D-30b)}$$

K_{cp}	A_{Na} (in ²)	A_{Na0} (in ²)	$\Psi_{ed,Na}$	$\Psi_{g,Na}$	$\Psi_{ec,Na}$	$\Psi_{p,Na}$	N_{a0} (lb)	N_a (lb)
2.0	161.83	85.03	1.000	1.067	1.000	1.000	7136	14494

A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
289.00	182.25	1.000	1.000	1.000	1.000	8114	12867	0.70

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



Company:		Date:	5/14/2018
Engineer:		Page:	6/6
Project:			
Address:			
Phone:			
E-mail:			

$$\frac{\phi V_{cpq} \text{ (lb)}}{18013}$$

11. Results

Interaction of Tensile and Shear Forces (Sec. RD.7)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	1319	3394	0.39	Pass	
Concrete breakout	5277	8363	0.63	Pass	
Adhesive	5277	7972	0.66	Pass (Governs)	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	808	1765	0.46	Pass	
T Concrete breakout x+	375	7103	0.05	Pass	
T Concrete breakout y-	3211	5313	0.60	Pass	
Concrete breakout y-	188	9797	0.02	Pass	
Concrete breakout x-	1606	12680	0.13	Pass	
Concrete breakout, combined	-	-	0.61	Pass (Governs)	
Pryout	3233	18013	0.18	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. RD.7	0.50	0.43	93.8%	1.0	Pass

SET-3G w/ 3/8"Ø F1554 Gr. 36 with hef = 4.500 inch meets the selected design criteria.

12. Warnings

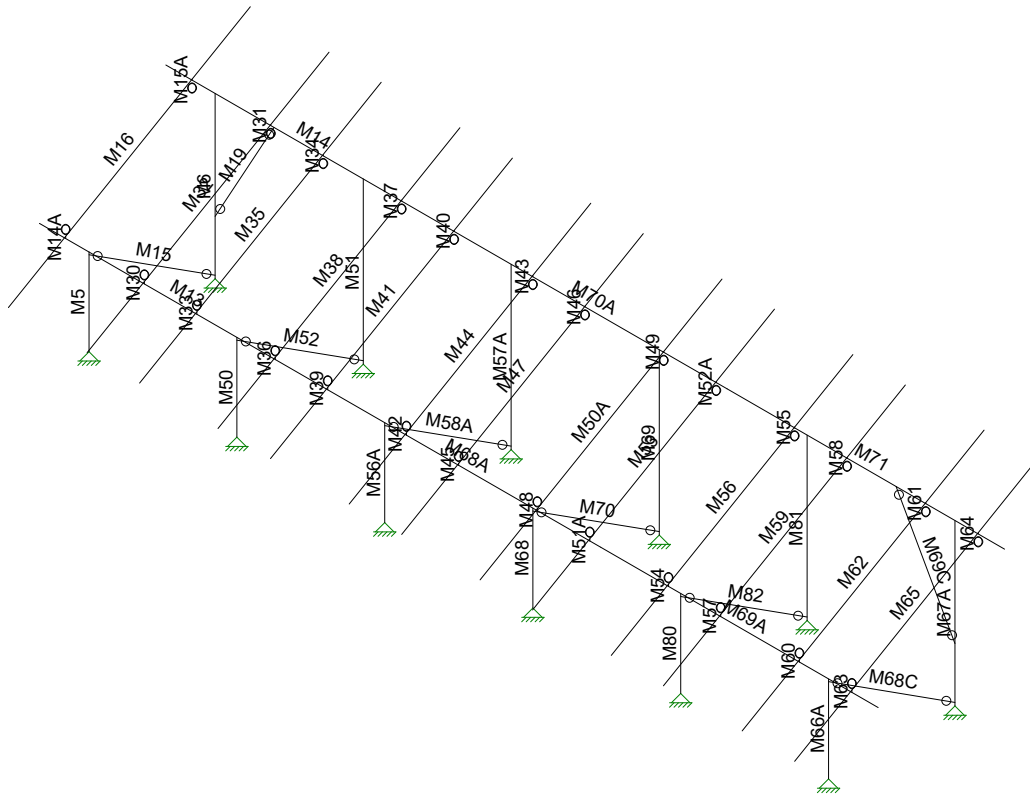
- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.



JOB NO.: U2716-096-191

DESIGNED: STB

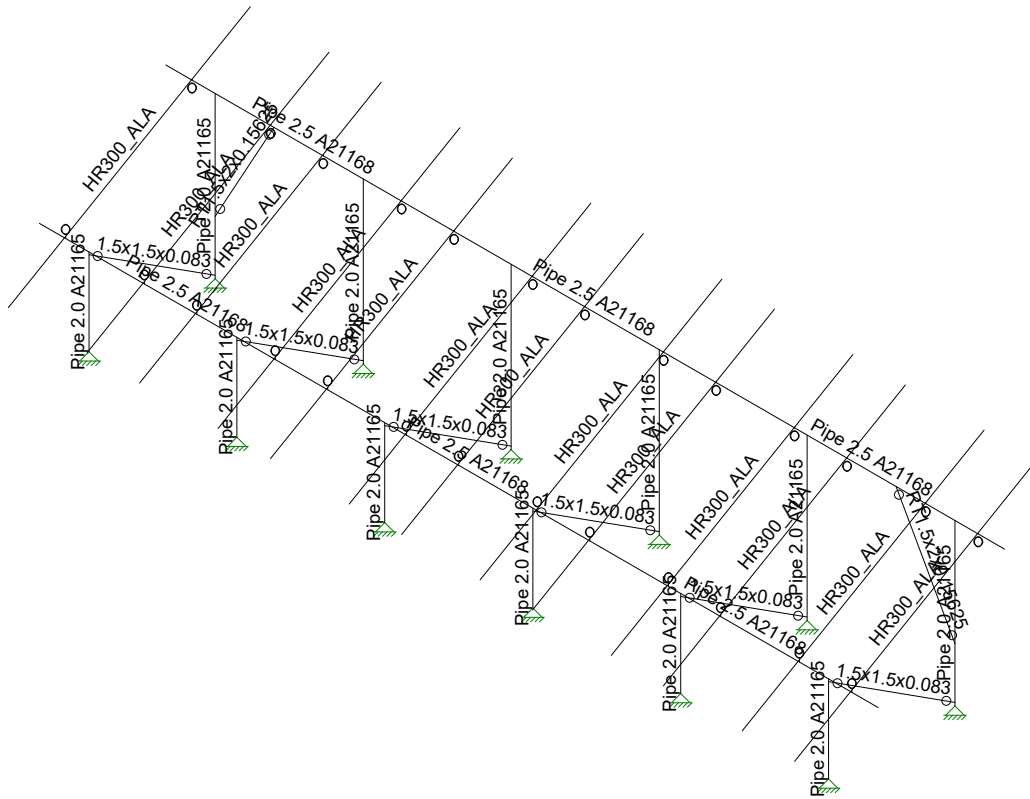
Framing Analysis



Vector Structural Engineeri...
STB
U2716.096.191

Ground Mount

SK - 3
Apr 8, 2021 at 10:39 AM
Sunmodo Sunturf B2a GM v6 85x4...

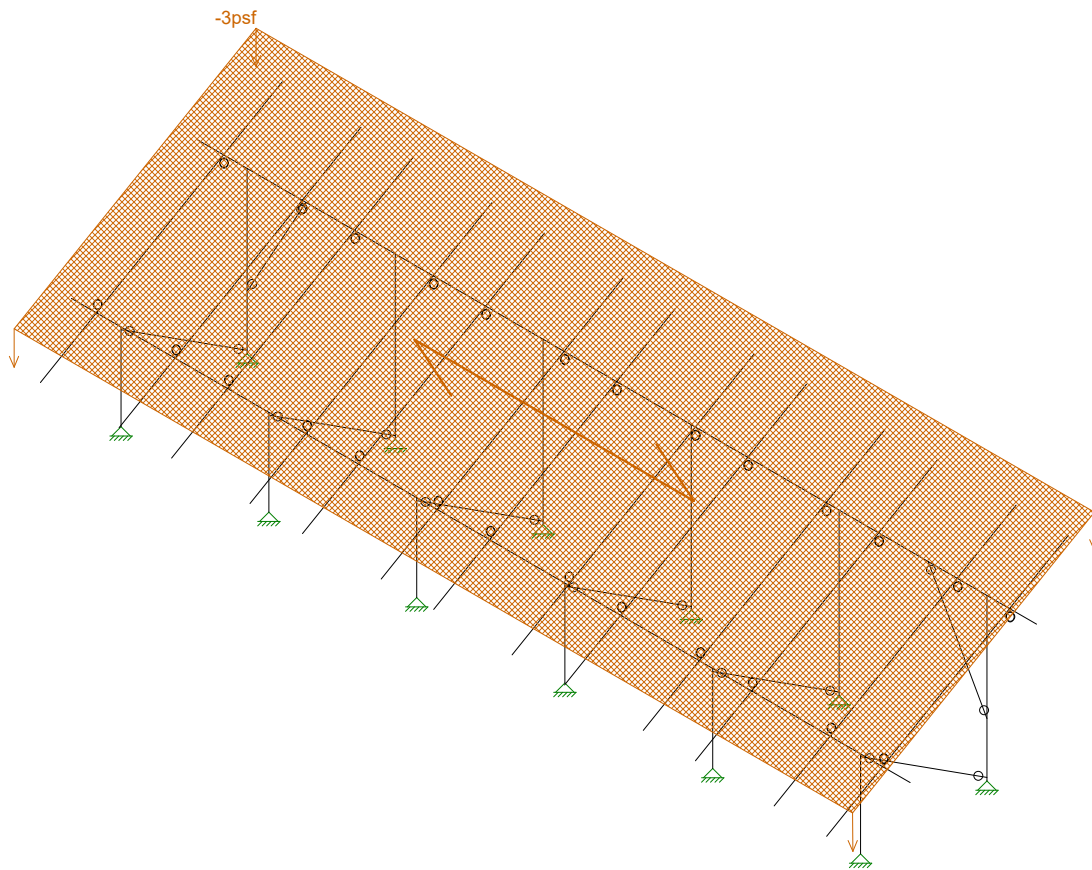


Vector Structural Engineeri...
STB
U2716.096.191

Ground Mount

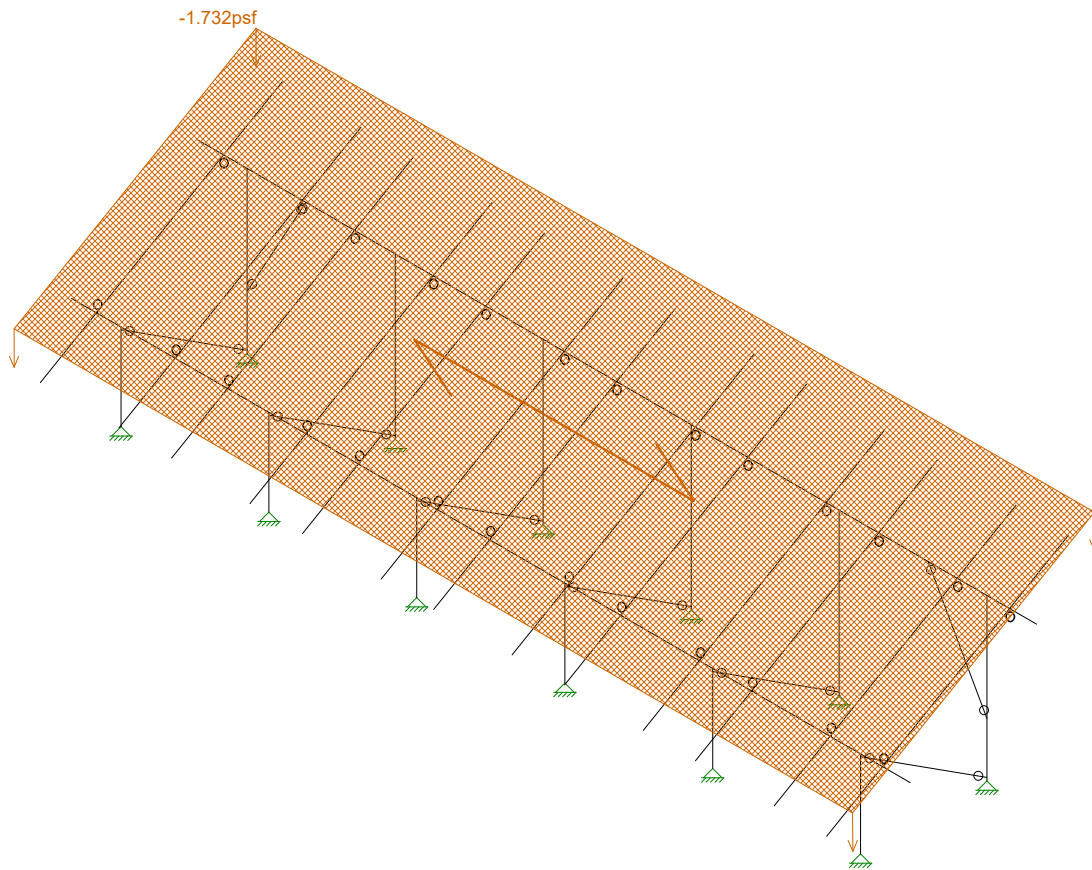
SK - 4

Apr 8, 2021 at 10:39 AM
Sunmodo Sunturf B2a GM v6 85x4...



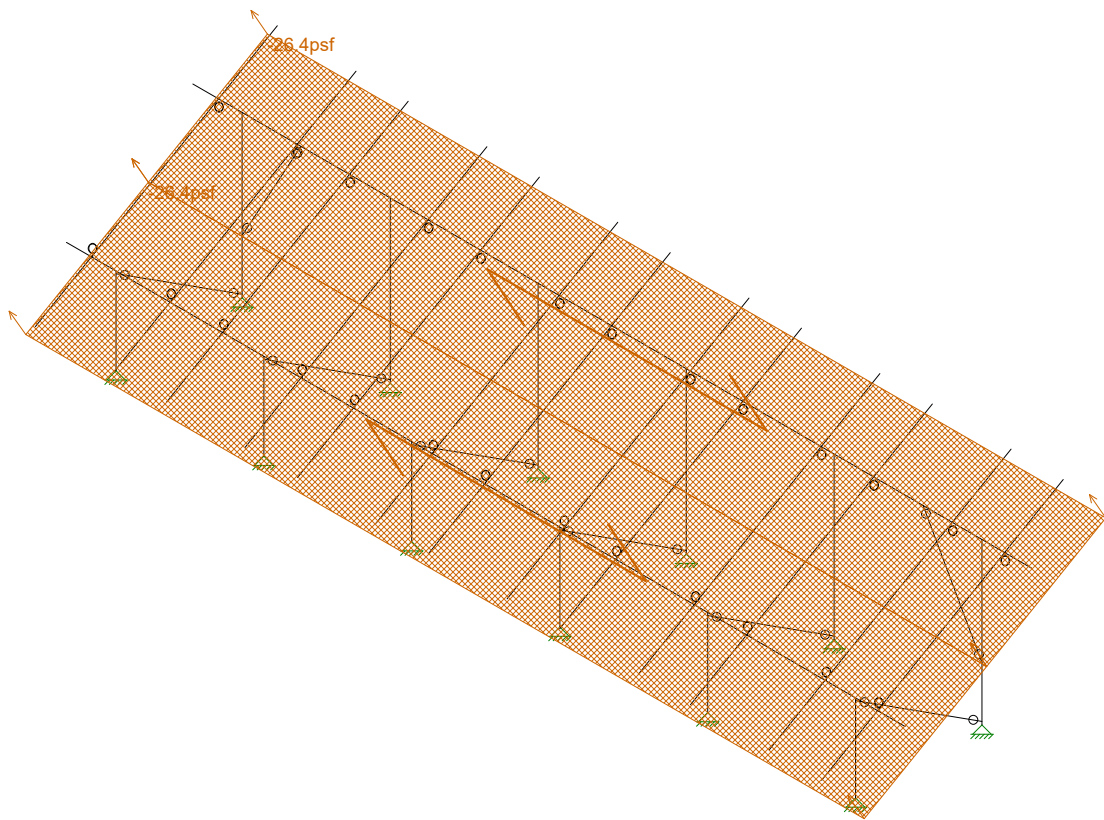
Loads: BLC 2, Solar Panel Weight

Vector Structural Engineeri...	Ground Mount	SK - 5
STB		Apr 8, 2021 at 10:39 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



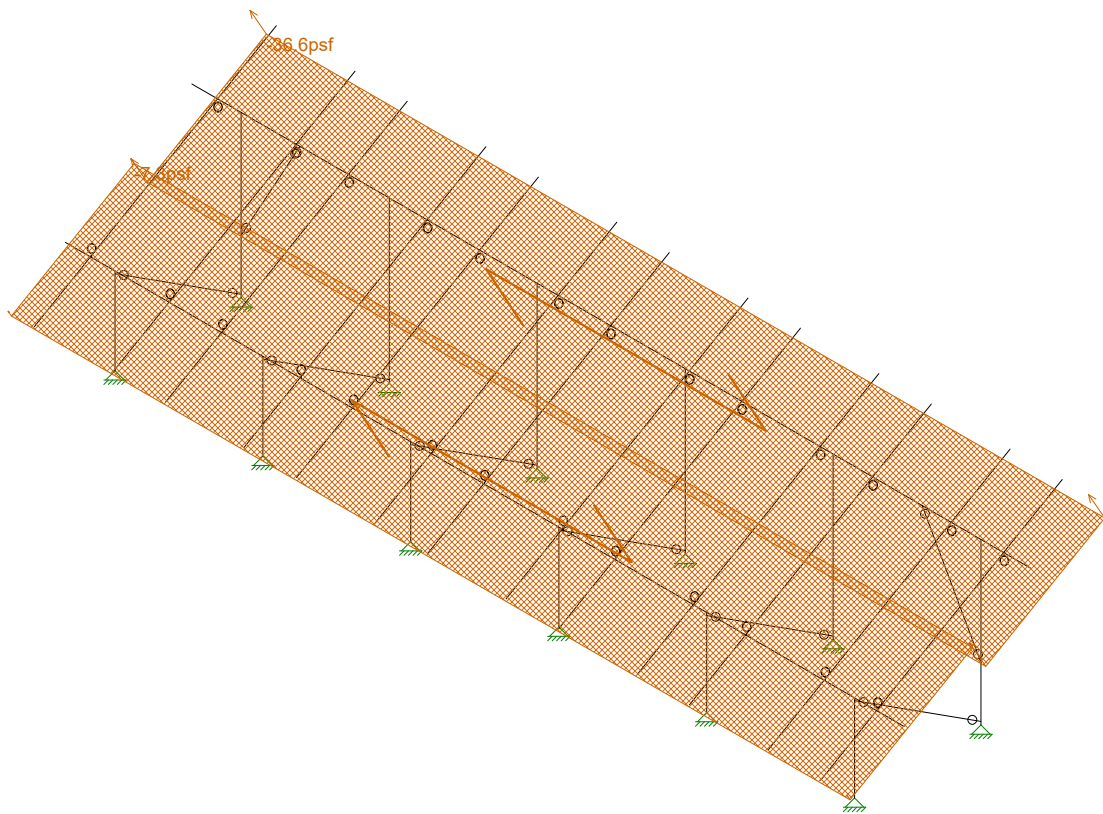
Loads: BLC 3, Roof Live/Snow

Vector Structural Engineeri...	Ground Mount	SK - 6
STB		Apr 8, 2021 at 10:39 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



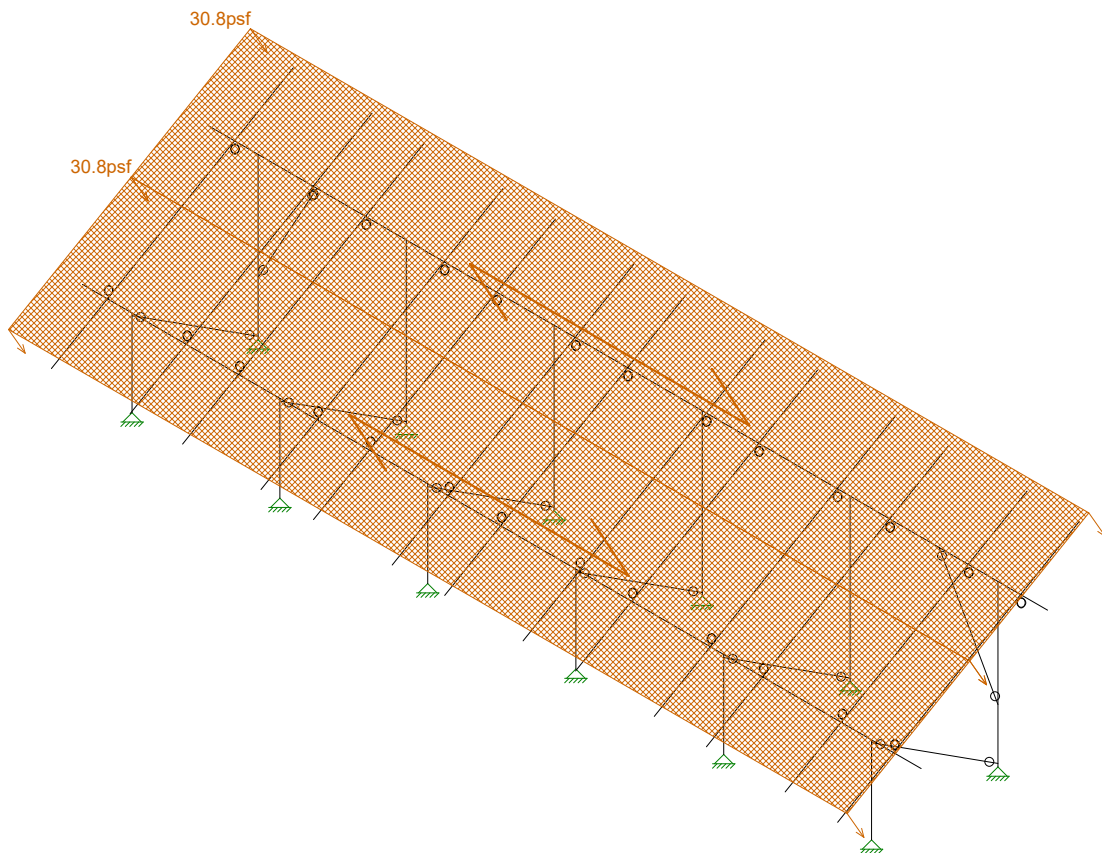
Loads: BLC 4, Wind A 0 deg

Vector Structural Engineeri..	Ground Mount	SK - 7
STB		Apr 8, 2021 at 10:39 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



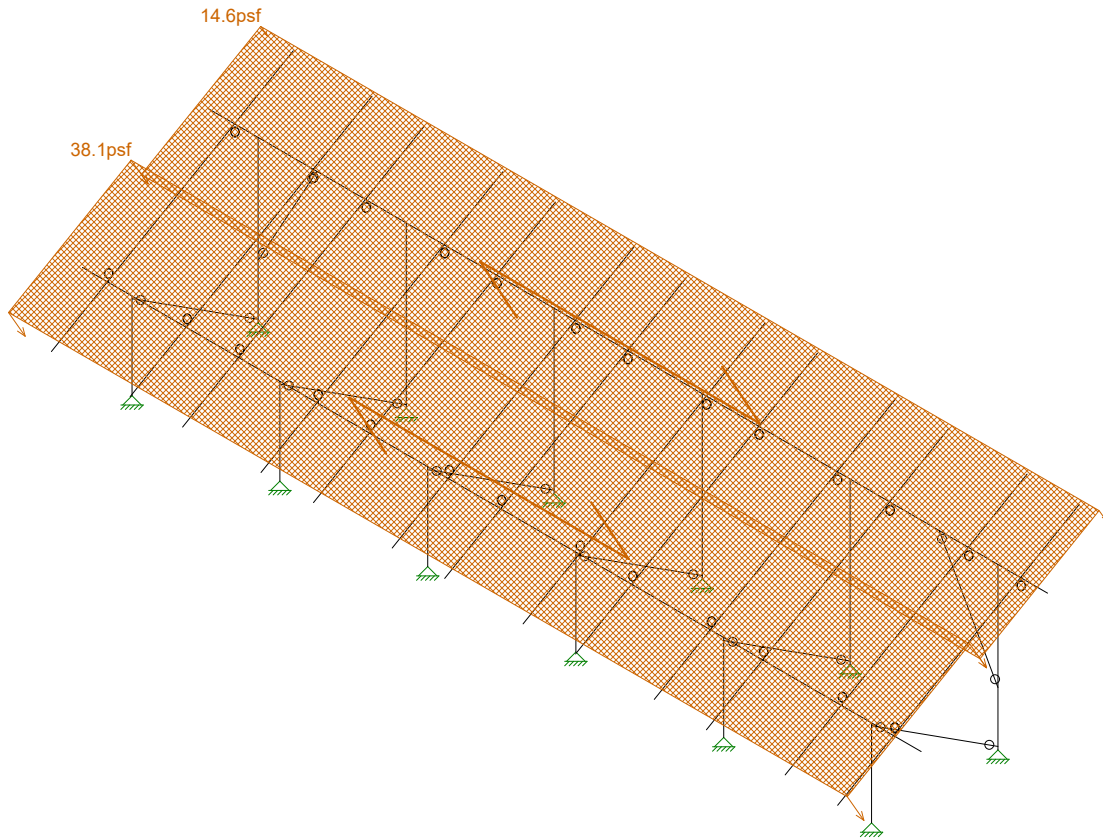
Loads: BLC 5, Wind B 0 deg

Vector Structural Engineeri...	Ground Mount	SK - 8
STB		Apr 8, 2021 at 10:40 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



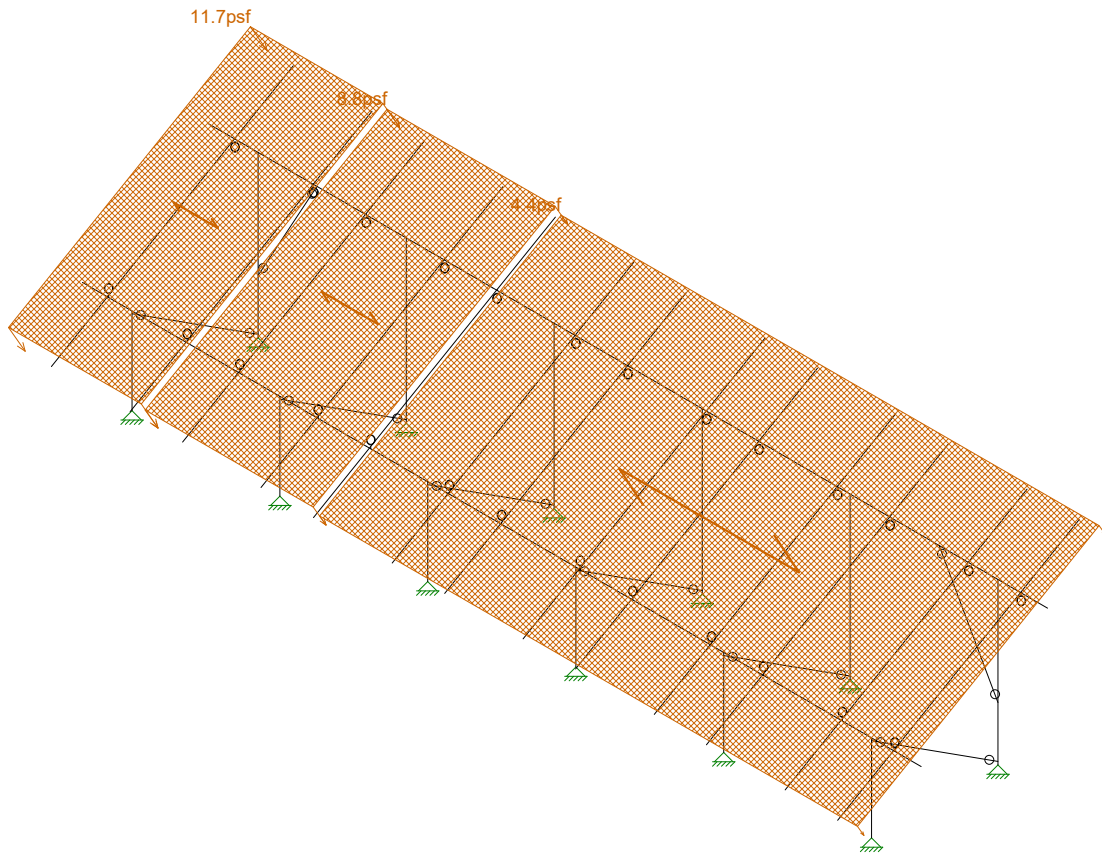
Loads: BLC 6, Wind A 180 deg

Vector Structural Engineeri...	Ground Mount	SK - 9
STB		Apr 8, 2021 at 10:40 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



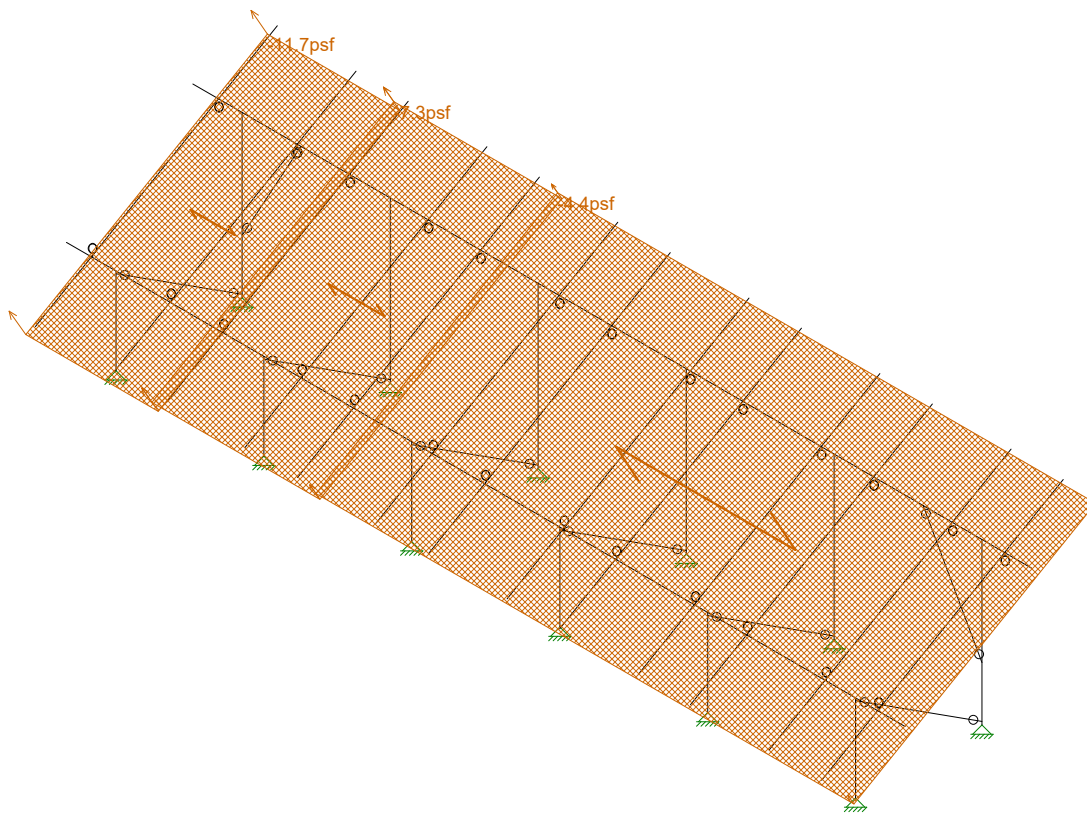
Loads: BLC 7, Wind B 180 deg

Vector Structural Engineeri...	Ground Mount	SK - 10
STB		Apr 8, 2021 at 10:40 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



Loads: BLC 8, Wind A 90

Vector Structural Engineeri...	Ground Mount	SK - 11
STB		Apr 8, 2021 at 10:40 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



Loads: BLC 9, Wind B 90

Vector Structural Engineeri...	Ground Mount	SK - 12
STB		Apr 8, 2021 at 10:40 AM
U2716.096.191		Sunmodo Sunturf B2a GM v6 85x4...



(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (in/sec^2)	386.4
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 13th(360-05): ASD
Adjust Stiffness?	Yes(Iterative)
RISACONNECTION CODE	AISC 13th(360-05): ASD
Cold Formed Steel Code	AISI S100-07: ASD
Wood Code	AWC NDS-15: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-08
Masonry Code	ACI 530-08: ASD
Aluminum Code	AA ADM1-05: ASD - Building
Stainless Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parame Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR SET ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	ASCE 7-10
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 3.3	kt	Ftu[psi]	Fty[psi]	Fcy[psi]	Fsu[psi]	Ct
1	3003-H14	10100	3787.5	.33	1.3 172.8 Table 3.3-3	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	.33	1.3 172.8 Table 3.3-4	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	.33	1.3 172.8 Table 3.3-4	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	.33	1.3 172.8 Table 3.3-4	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	.33	1.3 172.8 Table 3.3-3	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	.33	1.3 172.8 Table 3.3-3	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	.33	1.3 172.8 Table 3.3-3	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	Beam	Wide Flange	A572 Gr.50	Typical	.47	.158	.158	.236

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	.861	.288	.834	.659
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	-2

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	-26.4
2	N198	N201	N199	N196	Perp	A-B	-26.4

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	-36.6
2	N198	N201	N199	N196	Perp	A-B	-7.3

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	30.8
2	N198	N201	N199	N196	Perp	A-B	30.8

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	14.6
2	N198	N201	N199	N196	Perp	A-B	38.1

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	11.7
2	N203	N209	N208	N202	Perp	A-B	8.8
3	N209	N200	N199	N208	Perp	A-B	4.4

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	-11.7
2	N203	N209	N208	N202	Perp	A-B	-7.3
3	N209	N200	N199	N208	Perp	A-B	-4.4

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



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 -4.43	19	-3268.832	16	-1620...	3	0	1	0	1	0	1
15	N122 max 6.123	6	1372.83	4	45.947	3	0	20	0	20	0	20
16	min -6.991	19	-91.353	17	-53.898	5	0	1	0	1	0	1
17	N133B max 9.444	5	3746.481	5	1910.9...	5	0	20	0	20	0	20
18	min -.234	19	-3287.795	16	-1638...	3	0	1	0	1	0	1
19	N134B max 3.817	6	1394.892	4	46.322	3	0	20	0	20	0	20
20	min -3.403	15	-108.183	17	-54.179	5	0	1	0	1	0	1
21	N137C max 156.665	16	3155.006	5	1526.8...	5	0	20	0	20	0	20
22	min -139.66	5	-2762.041	16	-1308...	3	0	1	0	1	0	1
23	N138B max 23.795	15	1087.021	4	39.507	3	0	20	0	20	0	20
24	min -51.559	6	-26.713	17	-46.302	5	0	1	0	1	0	1
25	Totals: max .033	16	21144.814	5	10537...	17						
26	min -.057	5	-13908.477	15	-9032...	3						

Envelope AISC 13th(360-05): 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...	.217	54.984	6	.228	54.984	5	16234.792	23232.186	1397.505	1397.505	1...	H1-1b			
2	M6	Pipe 2.0 A2...	.627	34.725	5	.229	0	5	6914.112	23232.186	1397.505	1397.505	1...	H1-1a			
3	M13	Pipe 2.5 A2...	.984	128...	6	.163	126.5	6	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
4	M14	Pipe 2.5 A2...	.860	128...	5	.148	128...	5	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
5	M15	1.5x1.5x0.083	.755	50.741	5	.049	0	y 5	2501.75	14085.15	624.421	624.421	1...	H1-1a			
6	M80	Pipe 2.0 A2...	.178	54.399	17	.288	54.984	5	16234.792	23232.186	1397.505	1397.505	1...	H1-1b			
7	M81	Pipe 2.0 A2...	.650	1.085	5	.297	0	5	6914.112	23232.186	1397.505	1397.505	1...	H1-1a			
8	M82	1.5x1.5x0.083	.984	50.741	5	.008	97.423	y 5	2501.75	14085.15	624.421	624.421	1...	H1-1a			
9	M50	Pipe 2.0 A2...	.187	54.399	6	.291	54.984	5	16234.792	23232.186	1397.505	1397.505	1...	H1-1b			
10	M51	Pipe 2.0 A2...	.659	1.085	5	.301	0	5	6914.112	23232.186	1397.505	1397.505	1...	H1-1a			
11	M52	1.5x1.5x0.083	.993	50.741	5	.009	0	y 5	2501.75	14085.15	624.421	624.421	1...	H1-1a			
12	M56A	Pipe 2.0 A2...	.177	54.399	17	.275	54.984	5	16234.792	23232.186	1397.505	1397.505	2...	H1-1b			
13	M57A	Pipe 2.0 A2...	.652	1.085	5	.283	0	5	6914.112	23232.186	1397.505	1397.505	2...	H1-1a			
14	M58A	1.5x1.5x0.083	.935	50.741	5	.017	97.423	y 4	2501.75	14085.15	624.421	624.421	1...	H1-1a			
15	M68	Pipe 2.0 A2...	.178	54.399	17	.276	54.984	5	16234.792	23232.186	1397.505	1397.505	2...	H1-1b			
16	M69	Pipe 2.0 A2...	.656	1.085	5	.285	0	5	6914.112	23232.186	1397.505	1397.505	1...	H1-1a			
17	M70	1.5x1.5x0.083	.944	50.741	5	.009	0	y 5	2501.75	14085.15	624.421	624.421	1...	H1-1a			
18	M68A	Pipe 2.5 A2...	.842	39.375	6	.216	136...	6	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
19	M69A	Pipe 2.5 A2...	.757	52.5	6	.178	50.625	6	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
20	M70A	Pipe 2.5 A2...	.811	39.375	5	.240	136...	5	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
21	M71	Pipe 2.5 A2...	.569	52.5	5	.190	45	16	14032.946	28358.413	2081.747	2081.747	1	H1-1b			
22	M66A	Pipe 2.0 A2...	.255	54.984	6	.231	54.984	5	16234.792	23232.186	1397.505	1397.505	1...	H1-1b			
23	M67A	Pipe 2.0 A2...	.664	34.725	5	.230	0	5	6914.112	23232.186	1397.505	1397.505	1...	H1-1a			
24	M68C	1.5x1.5x0.083	.758	50.741	5	.061	0	y 5	2501.75	14085.15	624.421	624.421	1...	H1-1a			

Envelope AA ADM1-05: ASD - Building Aluminum Code Checks

Member	Shape	Code	...	Loc[in]	LC	Shear	...	Loc[in]	Dir	LC	Fc [psi]	Ft [psi]	Fb y-y	Fb z-z	Fs y-y	Fs z-z	Cb	Cmy	cmz	Eqn
1	M19	RT1.5x2...	.210	50.153	5	.004	0	y 6	2693.8...	19487...	21212...	21124...	12246...	12246...	1...	.6	.6	.6	4.1.1-1	
2	M16	HR300...	.812	41.509	6	.076	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
3	M69C	RT1.5x2...	.209	50.23	5	.008	0	y 5	2685.6...	19487...	21212...	21121...	12246...	12246...	1...	.6	.6	.6	4.1.1-1	
4	M32	HR300...	.947	137...	16	.085	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
5	M35	HR300...	.880	41.509	6	.089	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
6	M38	HR300...	.880	41.509	6	.087	135...	y 16	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
7	M41	HR300...	.880	41.509	6	.080	135...	y 16	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
8	M44	HR300...	.880	41.509	6	.083	135...	y 16	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
9	M47	HR300...	.880	41.509	6	.075	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
10	M50A	HR300...	.880	41.509	6	.076	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	
11	M53	HR300...	.880	41.509	6	.077	43.396	y 6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	.6	4.1.2-1	



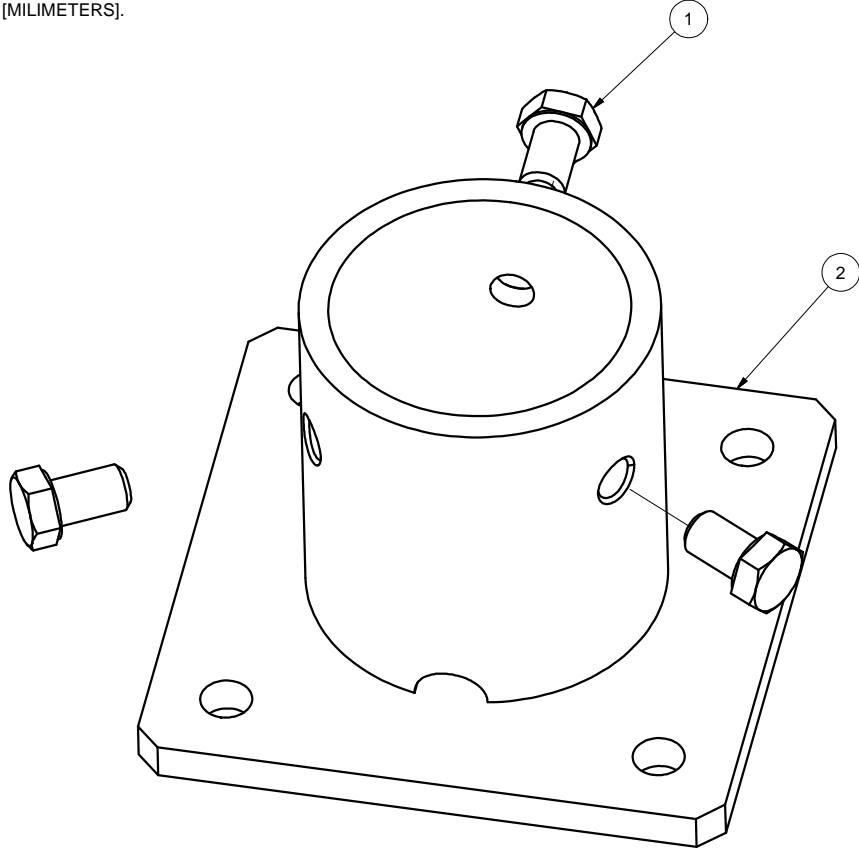
Company : Vector Structural Engineering
 Designer : STB
 Job Number : U2716.096.191
 Model Name : Ground Mount

Apr 8, 2021
 10:40 AM
 Checked By: _____

Envelope AA ADM1-05: ASD - Building Aluminum Code Checks (Continued)

Member	Shape	Code	Loc[in]	LC	Shear	Loc[in]	Dir	LC	Fc [psi]	Ft [psi]	Fb y-y	Fb z-z	Fs y-y	Fs z-z	Cb	Cmy	Cmz	Eqn	
12	M56	HR300_...	.880	41.509	6	.075	135...	y	16	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	4.1.2-1
13	M59	HR300_...	.880	41.509	6	.087	43.396	y	6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	4.1.2-1
14	M62	HR300_...	.933	137...	16	.090	43.396	y	6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	4.1.2-1
15	M65	HR300_...	.647	41.509	6	.062	43.396	y	6	8292.3...	19487...	19487...	19487...	12246...	12246...	2...	.6	.6	4.1.2-1

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



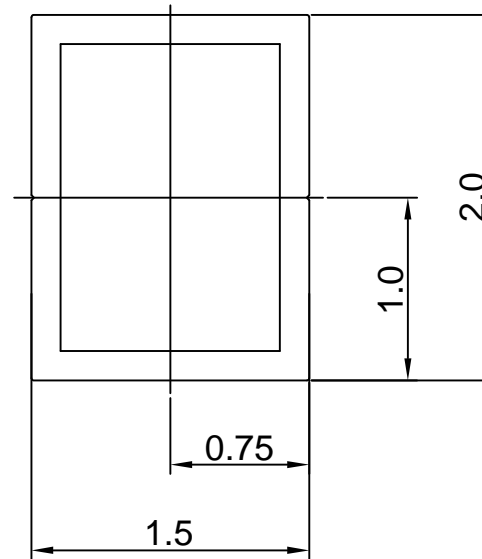
REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	10/20/2016

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		Sunmodo Corp. 1905 E 5TH STREET, STE A, VANCOUVER, WA 98661	
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" PIPE BASE KIT	
DRAWN BY		DATE	
LWF		10/20/2016	
CHECKED BY		DRAWING NUMBER	
		B K10268-001	
APPROVALS		SCALE: NONE SHEET 1 of 1	

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NOTES: UNLESS OTHERWISE SPECIFIED

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



Section properties:

Weight: 1.156 lbs/ft

Area: 0.992 in²

Perimeter: 12.601 in

Bounding Box: X: -1.000,1.000

Y: -0.750, 0.750

Centroid:(0.000,0.000)

Moments of Inertia(in⁴): I_x=0.506,I_y=0.322

Section modulus in bending(in³): W_x=0.675,W_y=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 specified			
DRAWN BY	DATE		
zcg	03/12/2014		
CHECKED BY		B	DRAWING NUMBER
			A20164
APPROVALS		SCALE:	NONE
		SHEET	1 of 1

Sunmodo Corp.

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

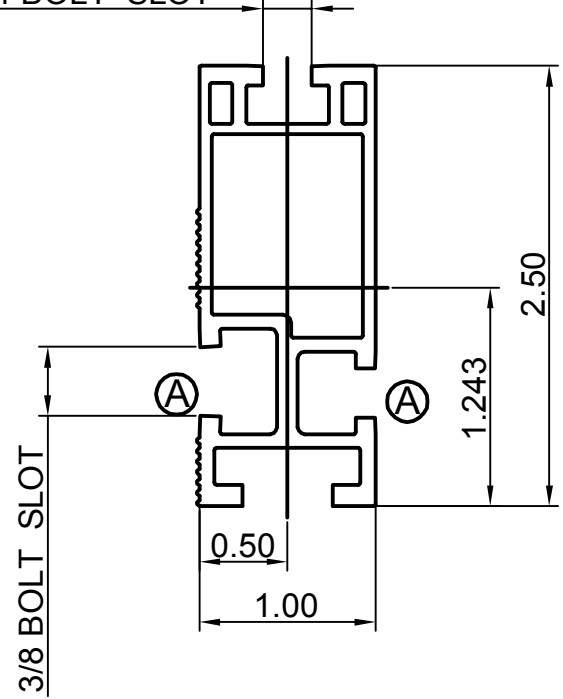
TITLE
1.5X2 AL TUBE BRACE EXTRUSION

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 μ 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 in²
 Perimeter: 17.325 in
 Bounding Box: X: -0.500,0.500
 Y: -1.243,1.257

Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): I_x=0.486,I_y=0.095
 Section modulus in bending(in³): W_x=0.387,W_y=0.190
 Radii of Gyration: X: 0.820, Y: 0.363

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 spec'd	
DRAWN BY zcg	DATE 02/21/2013
CHECKED BY	
APPROVALS	

Sunmodo Corp.	
1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
TITLE HELIO STANDARD RAIL	
DRAWING NUMBER B A20144	
SCALE: NONE	SHEET 1 of 1

4

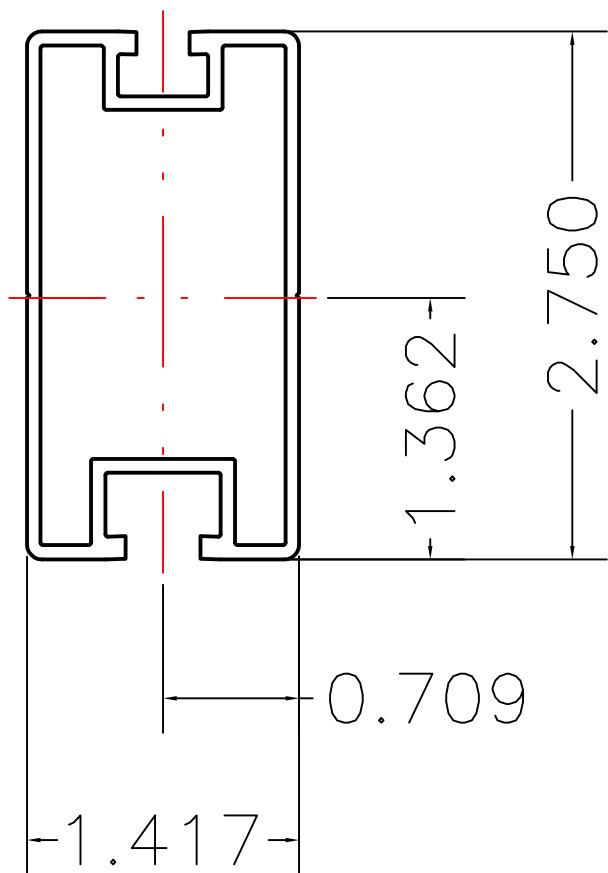
3

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 in²
 Perimeter: 19.824 in
 Bounding Box: X: -0.709,0.709
 Y: -1.362,1.388
 Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): I_x=0.727,I_y=0.214
 Section modulus in bending(in³): W_x=0.524,W_y=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
X.XX ±0.02 [0.50mm]	.010-.020 unless
X.X ±0.039 [1.0mm]	otherwise specified.
Unless otherwise spec'd	
DRAWN BY KYY	DATE 01/18/2018
CHECKED BY	
APPROVALS	

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

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4

3

2

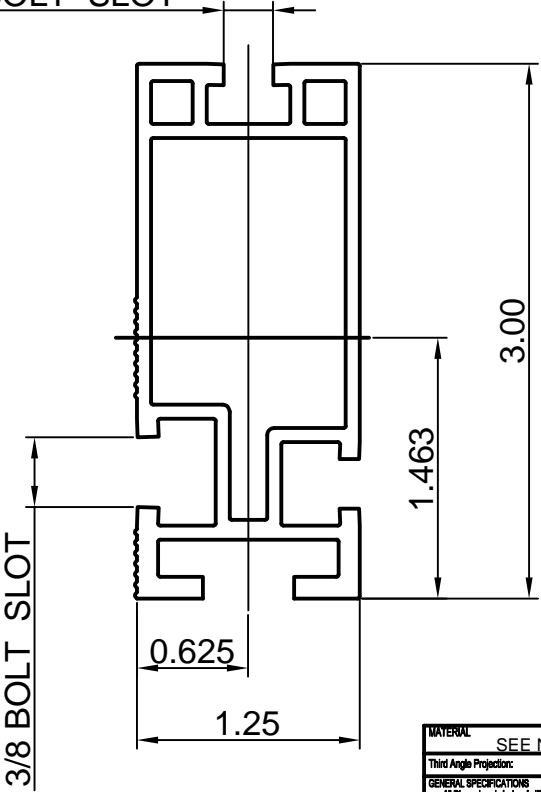
1

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 μ m THICK.
3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.

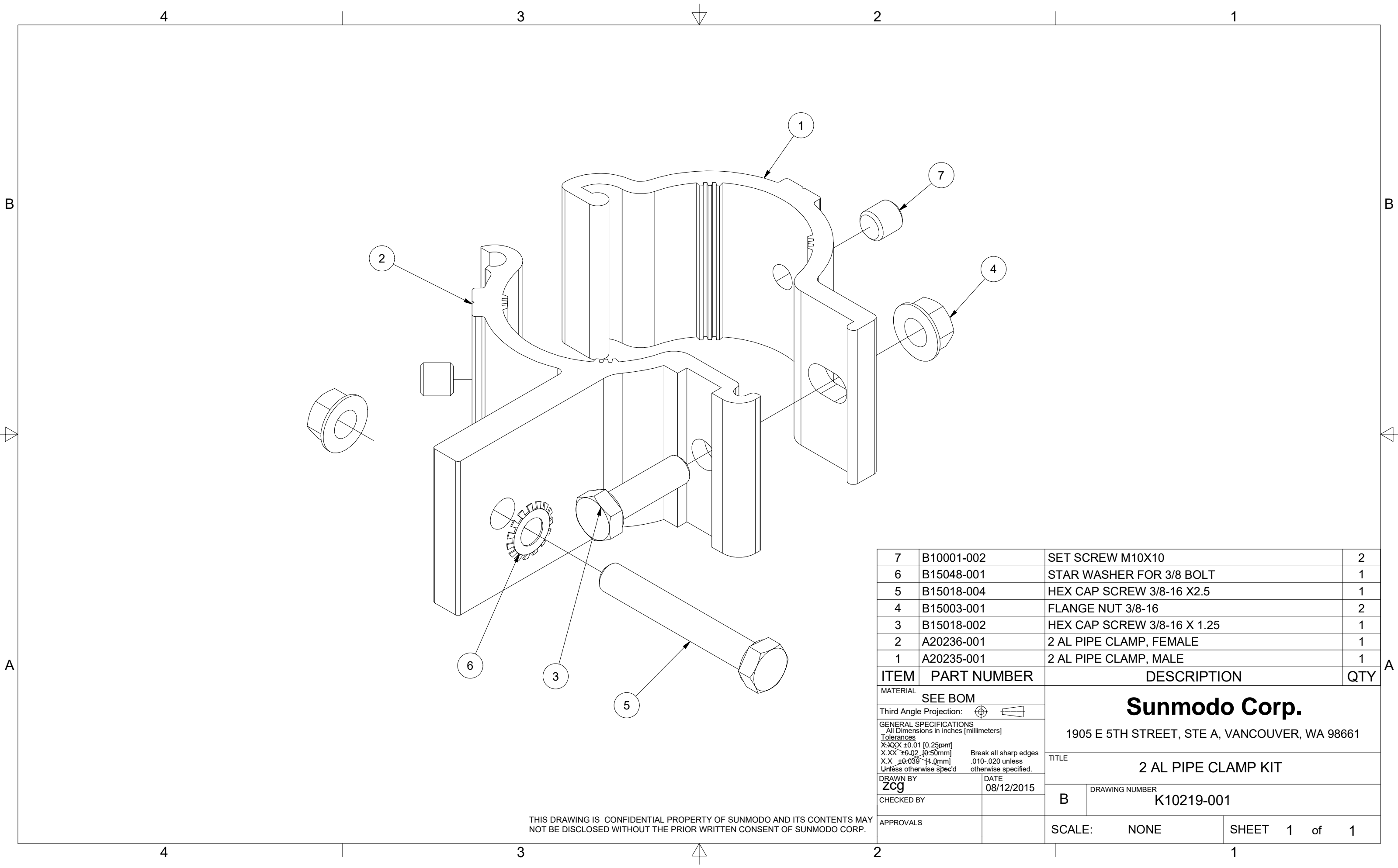
2X 1/4 BOLT SLOT



Section properties:

Weight: 1.151 lbs/ft
 Area: 0.980 in²
 Perimeter: 22.104 in
 Bounding Box: X: -0.625,0.625
 Y: -1.463,1.537
 Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): Ix=1.047,Iy=0.207
 Section modulus in bending(in³): 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			
XXXX ±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		DATE	
APPROVALS		DATE	
Sunmodo Corp.		1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
TITLE		HELIO HEAVY RAIL	
DRAWING NUMBER		A20145	
SCALE:		NONE	
SHEET		1 of 1	



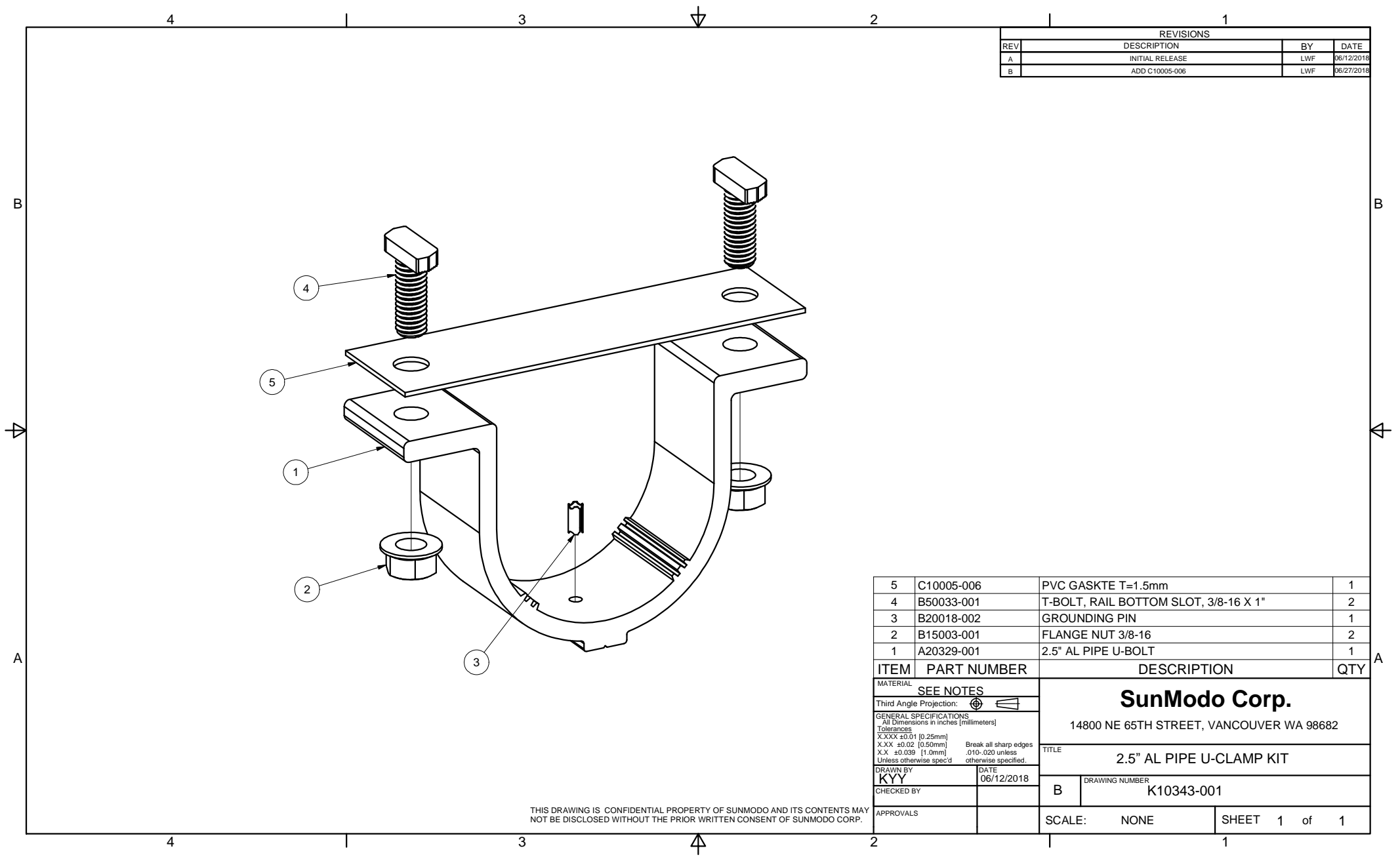
7	B10001-002	SET SCREW M10X10	2
6	B15048-001	STAR WASHER FOR 3/8 BOLT	1
5	B15018-004	HEX CAP SCREW 3/8-16 X2.5	1
4	B15003-001	FLANGE NUT 3/8-16	2
3	B15018-002	HEX CAP SCREW 3/8-16 X 1.25	1
2	A20236-001	2 AL PIPE CLAMP, FEMALE	1
1	A20235-001	2 AL PIPE CLAMP, MALE	1

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		B	
APPROVALS		DRAWING NUMBER	
		K10219-001	
SCALE:		NONE	SHEET 1 of 1

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

TITLE
2 AL PIPE CLAMP KIT

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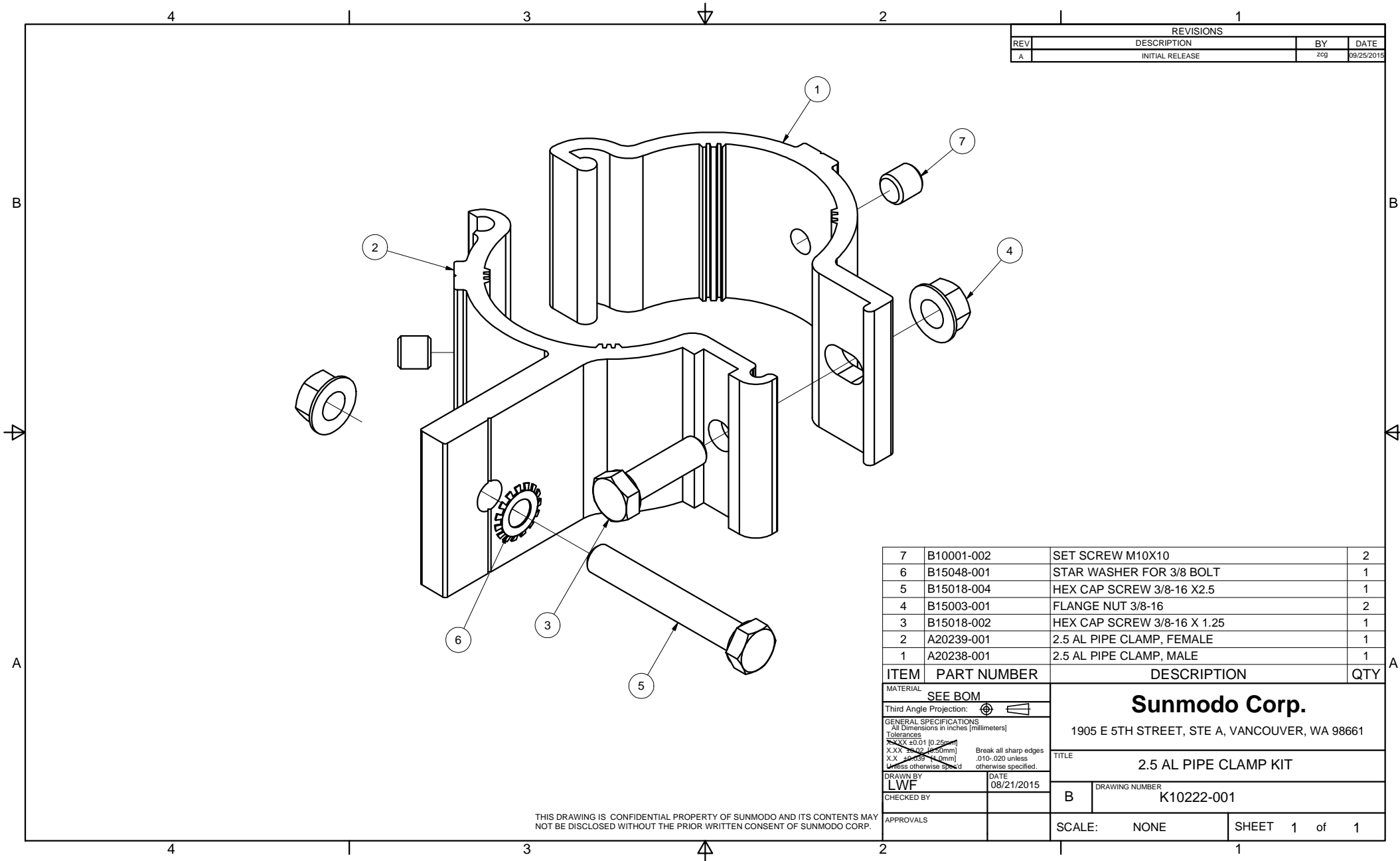


REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018
B	ADD C10005-006	LWF	06/27/2018

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

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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

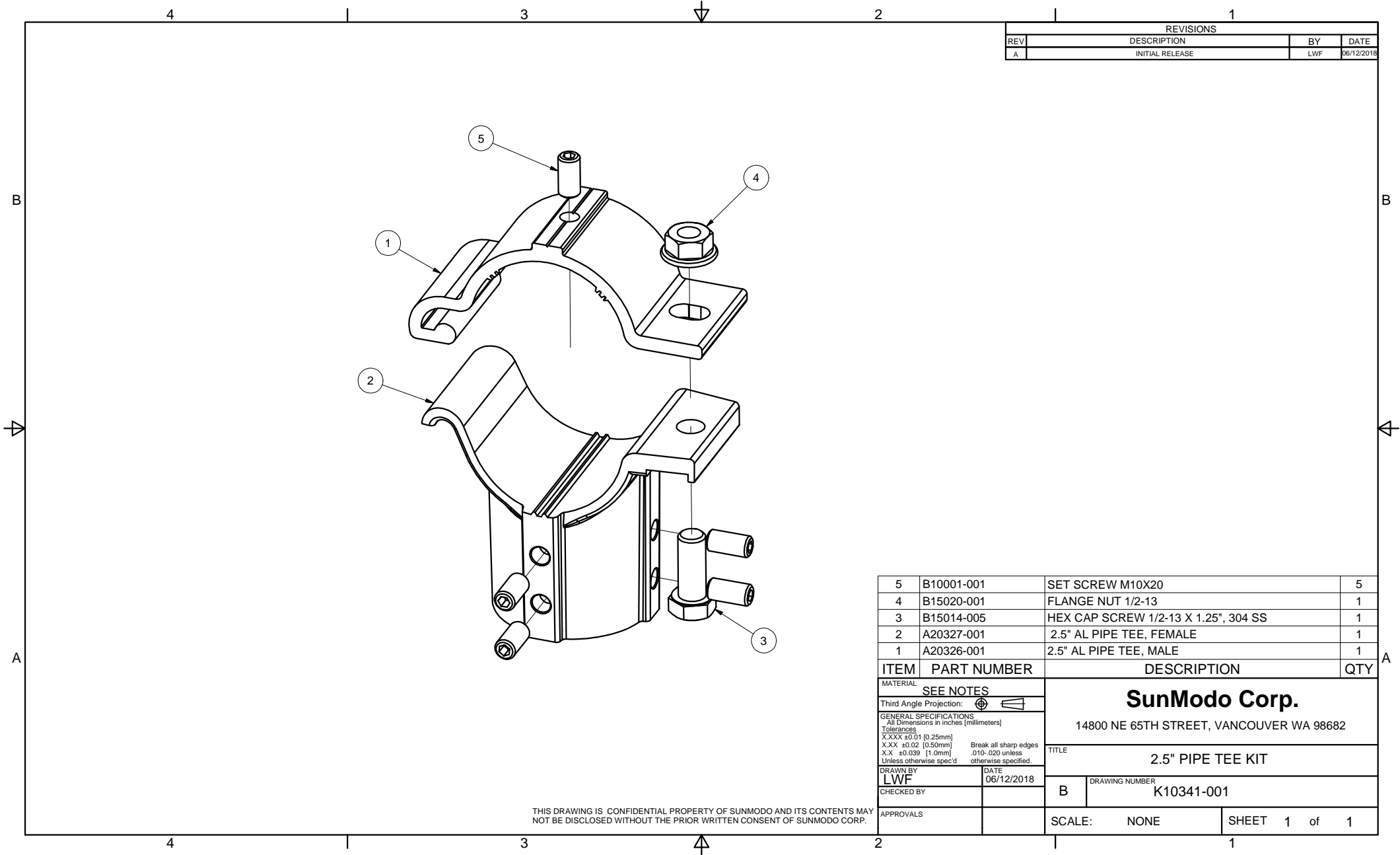
MATERIAL		SEE BOM	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters] Tolerances X.XX ±0.01 (0.25mm) X.XX ±0.02 (0.50mm) X.X ±0.03 (0.75mm) Unless otherwise specified.			
DRAWN BY		DATE	
LWF		08/21/2015	
CHECKED BY		B	
APPROVALS		SCALE: NONE	
		SHEET 1 of 1	

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 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			
DRAWN BY		DATE	
LWF		06/12/2018	
CHECKED BY		B	
APPROVALS		SCALE: NONE	
		SHEET 1 of 1	

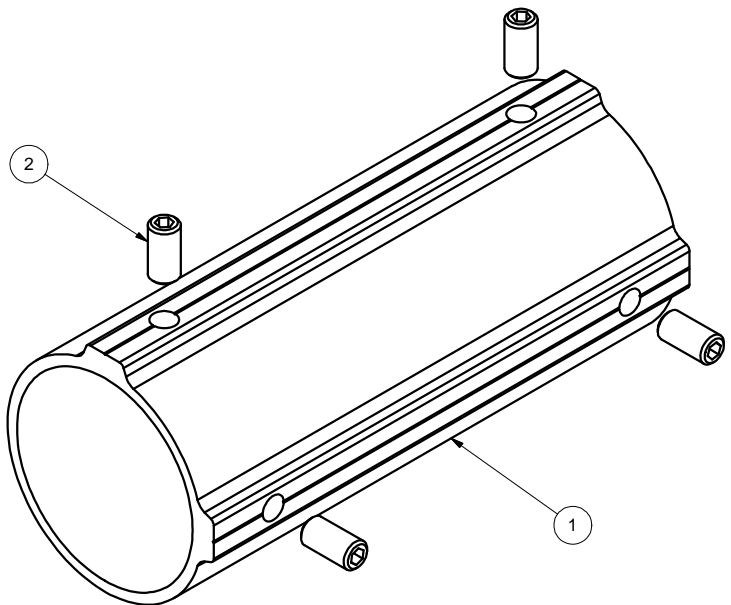
SunModo Corp.
 14800 NE 65TH STREET, VANCOUVER WA 98682

TITLE
2.5" PIPE TEE KIT

DRAWING NUMBER
K10341-001

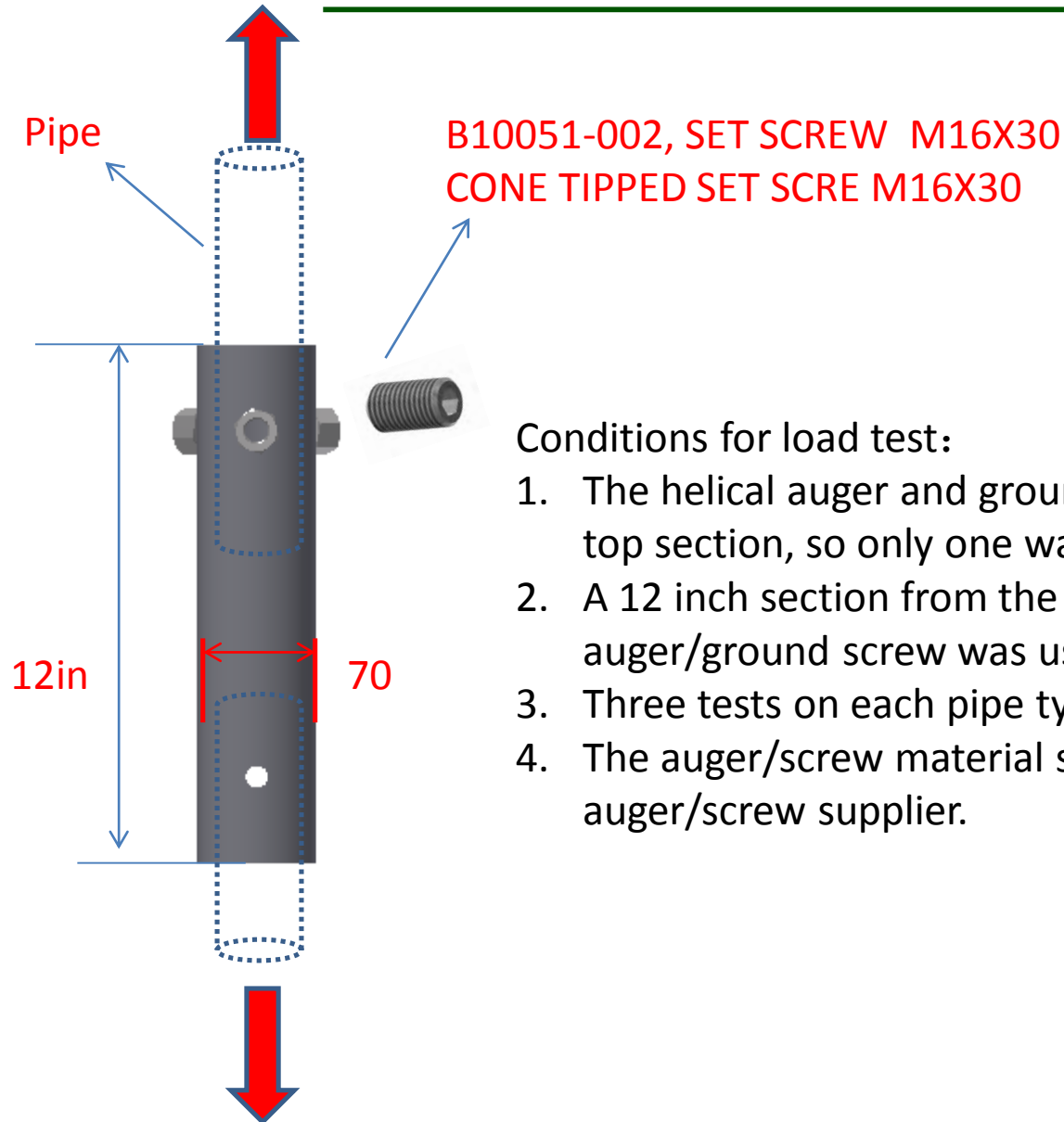
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REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018



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		SunModo Corp. 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		TITLE 2.5" PIPE SPLICE KIT	
DRAWN BY	DATE	DRAWING NUMBER	
LWF	06/12/2018	B K10342-001	
CHECKED BY			
APPROVALS		SCALE: NONE	SHEET 1 of 1

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Conditions for load test:

1. The helical auger and ground screw use the same top section, so only one was used for testing
2. A 12 inch section from the top of the auger/ground screw was used
3. Three tests on each pipe type was used
4. The auger/screw material supplied by the auger/screw supplier.