



STRUCTURES

VALMONT MICROFLECT

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Reviewed by: 

COMMUNICATION POLE DESIGN CALCULATIONS

VERIZON

VALMONT ORDER# 334229

SITE NAME: PORTLAND 3, ME

POLE HEIGHT: 89FT (100 FT AGL)



STRUCTURES

7/14/16

ENGINEERING DATA

for

VERIZON

PORTLAND 3, ME

VALMONT QUOTATION 334229

- 1) STRUCTURE DESIGN CONFORMS TO EIA/TIA-222-G INCLUDING:
 100.0 MPH WIND (3 SECOND GUST, 50 YR. RETURN PERIOD)
 40.0 MPH ICE WIND (50 YR. RETURN PERIOD)
 DESIGN ICE THICKNESS = 1.00 INCHES
 EXPOSURE CATEGORY C
 STRUCTURE CLASSIFICATION II
 TOPOGRAPHIC CATEGORY 1
 60.0 MPH BASIC WIND SPEED WITH NO ICE FOR TWIST AND SWAY
- 2) FEEDLINES ARE ASSUMED TO BE PLACED INTERIOR TO THE POLE.
- 3) ALL MICROWAVE ASSUMED TO BE 6 GHz UNLESS OTHERWISE NOTED.
- 4) TOTAL POLE HEIGHT IS 90 FT AGL
- 5) 28" OD X 10' CANISTER TO 100 FT AGL
- 6) ELEVATIONS ARE MEASURED FROM TOP OF BASE PLATE (APPROX 1 FT AGL)
- 7) LOADING AS FOLLOWS:
 89.0' POLE
 1 - GOLD BALL @ 89.0
 1 - 28" X 10' CELL SILO @ 89.0
 1 - 15'x25' flag (up to 100') @ 89.0

STRUCTURE ANCHORAGE INFORMATION

POLE HEIGHT(FT):	89	NUMBER OF A.B.'s:	8
BOLT CIRCLE(IN):	44.46	DIA. OF A.B.'s(IN):	1.75
BASE VERTICAL(K):	12.76	LENGTH OF A.B.'s(IN):	66.00
BASE SHEAR(K):	8.53	PROJECTION LENGTH(IN):	8.75
BASE MOMENT(FT-K):	467	TEMPLATE OD(IN):	47.96

STRUCTURES

BY _____ DATE _____
 CHKD. BY _____ DATE _____

SHEET NO. _____

7/14/16
ENGINEERING DATA
 for
VERIZON
PORTLAND 3, ME
VALMONT QUOTATION 334229
 EIA/TIA-222-G

BASIC WIND:	100.0 MPH	DESIGN ICE THICKNESS:	1. IN.
WIND & ICE:	40.0 MPH	EXPOSURE CATEGORY:	C
TWIST & SWAY:	60.0 MPH	STRUCTURE CLASS.:	II
S _s :	N/A	TOPOGRAPHIC CATEGORY:	1
S _j :	N/A		

QTY DESCRIPTION	HEIGHT	DATA W.O. ICE		DATA W/ ICE	
		EPA	WT	EPA	WT
1 GOLD BALL	@ 89.0'	2.50	25	5.00	10
1 28" X 10' CELL SILO	@ 89.0'	14.00	2000	28.00	4000
1 15'x25' flag (up to 100')	@ 89.0'	10.70	100	10.70	100

FOR: VERIZON 100' FLAG POLE, SITE: PORTLAND 3, ME 334229

BY VALMONT INDUSTRIES

Design Code: TIA-222-G Addendum 2

*** SUMMARY ***

----- DESIGN SUMMARY -----

Height Above Base Plate (ft) 89.00 Ground Line Diameter (in) 38.242 Pole Shaft Weight (lbs) 7884

Top Diameter (in) 28.000

Pole Taper (in/ft) 0.12000 Shape: 18 Sides

Connections Between Sections

/First/

Height Above Ground (ft) 45.00

Type Slip Joint

Overlap Length (in) 66

Maximum Axial Force (lbs) 12264

Section Characteristics

/First/ /Second/

Base Diameter (in) 38.242 33.940

Top Diameter (in) 32.842 28.000

Thickness (in) 0.25000 0.21875

Length (ft) 45.000 49.500

Weight (lbs) 4288 3596

Yield Strength (ksi) 65.00 65.00

----- ANALYSIS SUMMARY -----

Pt. of Fixity Governing Level Sec.1 Governing Level Sec.2 Pole Top

	WIND		WIND	
	Governing	WIND	Governing	WIND
Height (ft)	0.00	0.00	45.00	89.00
Resultant Moment (in-kips)	5602	5602	1873	116
Shear Force (lbs)	8541	8541	5158	1513
Axial Force (lbs)	12099	12099	6333	2520
Effective Yield Strength (ksi)	71.75	71.75	71.92	76.93
Combined Interaction Value	0.31	0.31	0.16	0.01
Total Deflection (in)	0.00	0.00	4.38	14.10

Note: Diameters are outside, measured across the flats
Forces and moments are reported in the local element coordinate system

*** POLE SHAFT POINT OF FIXITY REACTIONS ***

Loading Case Identifier	Moments About X-Axis (in-kips)		Moments About Y-Axis (in-kips)		Moments Resultant (X & Y) (in-kips)		Torsional (in-kips)		Vertical Force (lbs)		Shear In X-Direction (lbs)		Shear In Y-Direction (lbs)		Shear Resultant (X & Y) (lbs)		Notes
	X-Axis	Y-Axis	X-Axis	Y-Axis	X & Y	Torsional	Vertical	X-Direction	Y-Direction	X-Direction	Y-Direction	X & Y	Notes				
WIND	4291	-3601	5602	0	12106	0	5484	6535	8531								
ICE + WIND	853	-716	1114	0	22013	0	1098	1309	1709								
T+S	862	-723	1125	0	10013	0	1104	1316	1718								

Note: Positive vertical force is downward.
Reactions are considered in the global coordinate system.

BY VALMONT INDUSTRIES FOR:

VERIZON 100' FLAG POLE, SITE: PORTLAND 3, ME 334229

DATE 07/14/2016
Fuse 1.13.0.0

Design Code TIA-222-G Addendum 2
Loading Case WIND

Basic Wind Velocity is 100.00 mph Ice Thickness 0.00
Wind Orientation is 50.0 Degrees Clockwise From +X Axis
Structure Weight Overload Factor is 1.200
Exposure C, Gust Factor 1.10
Structure Category 2, Topographic Category 1, Crest Height 0.00 ft
Orientations are Measured Clockwise From +X Axis
Positive Y Axis is 90 Degrees Clockwise From +X Axis
Foundation Rotation of 0.00 Degrees
Elevation of structure base above surrounding terrain = 1.00 ft

*** INPUT LOADS ***

Orientation of System
+***** +X-Axis
* * * * *
(Transverse)
* * * * *
* * * * *
(Longitudinal) * * * (Vertical)
+Y-Axis * * * +Z-Axis

Load Number	Mounting Height (ft)	Load Height (ft)	Load Eccentricity (ft)	Orientation in XY Plane (Degrees)	Force-X (lbs)	Force-Y (lbs)	Force-Z (lbs)	EPA (ft^2)
1	89.00	101.00	0.00	50.00	87	104	30	2.50
2	89.00	96.10	0.00	50.00	484	577	2400	14.00
3	89.00	93.00	0.00	50.00	368	438	120	10.70

1-GOLD BALL
1-28" X 10' C
1-15'x25' fla

BY VALMONT INDUSTRIES

FOR:

VERIZON 100' FLAG POLE, SITE: PORTLAND 3, ME 334229

DATE 07/14/2016
Fuse 1.13.0.0

Design Code TIA-222-G Addendum 2
Loading Case ICE + WIND

Basic Wind Velocity is 40.00 mph Ice Thickness 1.00
Wind Orientation is 50.0 Degrees Clockwise From +X Axis
Structure Weight Overload Factor is 1.200
Exposure C, Gust Factor 1.10
Structure Category 2, Topographic Category 1, Crest Height 0.00 ft
Orientations are Measured Clockwise From +X Axis
Positive Y Axis is 90 Degrees Clockwise From +X Axis
Foundation Rotation of 0.00 Degrees
Elevation of structure base above surrounding terrain = 1.00 ft

*** INPUT LOADS ***

Orientation of System
+*****+X-Axis
* * * * *
(Transverse)
* * * * *
* * * * *
(Longitudinal) * * * (Vertical)
+Y-Axis * * * +Z-Axis

Load Number	Mounting Height (ft)	Load Height (ft)	Load Eccentricity (ft)	Orientation in XY Plane (Degrees)	Force-X (lbs)	Force-Y (lbs)	Force-Z (lbs)	EPA (ft^2)
1	89.00	101.00	0.00	50.00	17	21	12	5.00
2	89.00	96.10	0.00	50.00	97	115	4800	28.00
3	89.00	93.00	0.00	50.00	37	44	120	10.70

1-GOLD BALL
1-28" X 10' C
1-15'x25' fla

BY VALMONT INDUSTRIES FOR:

VERIZON 100' FLAG POLE, SITE: PORTLAND 3, ME 334229

DATE 07/14/2016
Fuse 1.13.0.0

Design Code TIA-222-G Addendum 2
Loading Case T+S

Basic Wind Velocity is 60.00 mph Ice Thickness 0.00
Wind Orientation is 50.0 Degrees Clockwise From +X Axis
Structure Weight Overload Factor is 1.000
Exposure C, Gust Factor 1.10
Structure Category 2, Topographic Category 1, Crest Height 0.00 ft
Orientations are Measured Clockwise From +X Axis
Positive Y Axis is 90 Degrees Clockwise From +X Axis
Foundation Rotation of 0.00 Degrees
Elevation of structure base above surrounding terrain = 1.00 ft

*** INPUT LOADS ***

Orientation of System
+***** +X-Axis
* * (Transverse)
* *
* *
* *
* *
(Longitudinal) * * (Vertical)
+Y-Axis * * +Z-Axis

Load Number	Mounting Height (ft)	Load Height (ft)	Load Eccentricity (ft)	Orientation in XY Plane (Degrees)	Force-X (lbs)	Force-Y (lbs)	Force-Z (lbs)	EPA (ft^2)
1	89.00	101.00	0.00	50.00	18	21	25	2.50
2	89.00	96.10	0.00	50.00	98	116	2000	14.00
3	89.00	93.00	0.00	50.00	74	88	100	10.70

1-GOLD BALL
1-28" X 10' C
1-15'x25' fla

*** Properties ***

Connection Locations	Distance From Base (ft)	Diameter Across Flats (in)	Wall Thickness (in)	D/t Across Flats	w/t Across Flats	Moments of Inertia (in^4)	Area (in^2)
Top of Sect 2	89.00	28.000	0.2188	128.00	20.81	1880	19.29
	84.00	28.600	0.2188	130.74	21.29	2005	19.70
	79.00	29.200	0.2188	133.48	21.77	2134	20.12
	74.00	29.800	0.2188	136.23	22.26	2270	20.54
	69.00	30.400	0.2188	138.97	22.74	2411	20.95
	64.00	31.000	0.2188	141.71	23.22	2557	21.37
	59.00	31.600	0.2188	144.45	23.71	2710	21.79
	54.00	32.200	0.2188	147.20	24.19	2868	22.20
	49.00	32.800	0.2188	149.94	24.68	3033	22.62
	45.00	33.280	0.2188	152.13	25.06	3169	22.95
Top of Sect 1	45.00	32.842	0.2500	131.37	21.40	3469	25.86
	44.00	32.962	0.2500	131.85	21.49	3508	25.96
Base of Sect 2	39.50	33.502	0.2500	134.01	21.87	3685	26.38
	39.00	33.562	0.2500	134.25	21.91	3704	26.43
	34.00	34.162	0.2500	136.65	22.33	3908	26.91
	29.00	34.762	0.2500	139.05	22.75	4119	27.38
	24.00	35.362	0.2500	141.45	23.18	4338	27.86
	19.00	35.962	0.2500	143.85	23.60	4564	28.34
	14.00	36.562	0.2500	146.25	24.02	4798	28.81
	9.00	37.162	0.2500	148.65	24.45	5040	29.29
	4.00	37.762	0.2500	151.05	24.87	5290	29.76
Pt of Fixity	0.00	38.242	0.2500	152.97	25.21	5495	30.15

Forces and Moments for Pole in the Local Element Coordinate System

Loading Case WIND											
Dist. From Base (ft)	Mx (in-kips)	My (in-kips)	Resultant Mx & My (in-kips)	Torsion (in-kips)	Shear X-Dir. (lbs)	Shear Y-Dir. (lbs)	Resultant Shear (lbs)	Axial (lbs)			
89.00	89	-74	116	0	973	1159	1513	2520			
84.00	167	-141	219	0	1234	1470	1919	2918			
79.00	265	-222	346	0	1497	1784	2329	3325			
74.00	382	-320	498	0	1762	2100	2741	3742			
69.00	517	-434	675	0	2029	2418	3156	4167			
64.00	672	-564	877	0	2296	2737	3572	4601			
59.00	846	-710	1104	0	2564	3036	3989	5045			
54.00	1039	-872	1356	0	2832	3375	4406	5499			
49.00	1251	-1050	1633	0	3099	3694	4822	5961			
45.00	1435	-1204	1873	0	3316	3952	5158	6333			
45.00	1435	-1204	1873	0	3313	3949	5155	6336			
44.00	1482	-1244	1935	0	3366	4011	5236	6539			
39.50	1707	-1432	2228	0	3609	4301	5615	7450			
39.00	1733	-1454	2262	0	3632	4329	5651	7508			
34.00	2002	-1680	2613	0	3889	4634	6049	8061			
29.00	2289	-1921	2988	0	4140	4934	6441	8625			
24.00	2594	-2177	3387	0	4386	5227	6824	9200			
19.00	2917	-2448	3808	0	4624	5511	7194	9786			
14.00	3256	-2732	4251	0	4851	5761	7547	10383			
9.00	3611	-3030	4714	0	5073	6045	7892	10992			
4.00	3983	-3342	5199	0	5297	6313	8241	11609			
0.00	4291	-3601	5602	0	5490	6543	8541	12099			

Loading Case WIND

*** Deflections and Stresses ***

Distance From Base (ft)	Defl. X-Dir (in)	Defl. Y-Dir (in)	Defl. Resultant X & Y (in)	Defl. Z-Dir (in)	Rotation (deg.)	Axial Interaction Term	Flexural Interaction Term	Shear Interaction Term	Torsion Interaction Term	Combined Stress Interaction	Effective Yield Strength (ksi)
89.00	9.1	10.8	14.1	0.1	1.17	0.00	0.01	0.01	0.00	0.01	76.93
84.00	8.3	9.9	12.9	0.1	1.16	0.00	0.02	0.01	0.00	0.03	76.36
79.00	7.5	8.9	11.7	0.1	1.14	0.00	0.04	0.01	0.00	0.04	75.79
74.00	6.7	8.0	10.5	0.1	1.12	0.00	0.05	0.01	0.00	0.05	75.22
69.00	6.0	7.1	9.3	0.1	1.09	0.00	0.06	0.01	0.00	0.07	74.65
64.00	5.3	6.3	8.2	0.1	1.05	0.00	0.08	0.01	0.00	0.08	74.08
59.00	4.6	5.5	7.1	0.1	1.01	0.00	0.10	0.01	0.00	0.10	73.52
54.00	3.9	4.7	6.1	0.0	0.96	0.00	0.12	0.01	0.00	0.12	72.95
49.00	3.3	3.9	5.1	0.0	0.90	0.00	0.14	0.01	0.00	0.14	72.38
45.00	2.8	3.4	4.4	0.0	0.84	0.00	0.15	0.02	0.00	0.16	71.92
45.00	2.8	3.4	4.4	0.0	0.84	0.00	0.13	0.01	0.00	0.14	76.23
44.00	2.7	3.2	4.2	0.0	0.83	0.00	0.13	0.01	0.00	0.14	76.13
39.50	2.2	2.6	3.5	0.0	0.77	0.00	0.15	0.01	0.00	0.16	75.68
39.00	2.2	2.6	3.4	0.0	0.76	0.00	0.15	0.01	0.00	0.16	75.63
34.00	1.7	2.0	2.6	0.0	0.69	0.00	0.17	0.01	0.00	0.18	75.13
29.00	1.2	1.5	1.9	0.0	0.60	0.00	0.19	0.02	0.00	0.20	74.64
24.00	0.9	1.0	1.4	0.0	0.51	0.00	0.21	0.02	0.00	0.22	74.14
19.00	0.6	0.7	0.9	0.0	0.42	0.01	0.23	0.02	0.00	0.24	73.64
14.00	0.3	0.4	0.5	0.0	0.32	0.01	0.25	0.02	0.00	0.26	73.14
9.00	0.1	0.2	0.2	0.0	0.21	0.01	0.27	0.02	0.00	0.28	72.65
4.00	0.0	0.0	0.0	0.0	0.09	0.01	0.29	0.02	0.00	0.30	72.15
0.00	0.0	0.0	0.0	0.0	0.00	0.01	0.31	0.02	0.00	0.31	71.75

Forces and Moments for Pole in the Local Element Coordinate System

Loading Case ICE + WIND									
Dist. From Base (ft)	Mx (in-kips)	My (in-kips)	Resultant Mx & My (in-kips)		Torsion (in-kips)	Shear X-Dir. (lbs)	Shear Y-Dir. (lbs)	Resultant Shear (lbs)	Axial (lbs)
89.00	16	-14	21	0	0	164	195	255	4931
84.00	30	-25	39	0	0	221	263	344	5711
79.00	48	-40	62	0	0	278	332	433	6505
74.00	70	-59	91	0	0	336	400	522	7313
69.00	96	-80	125	0	0	393	469	612	8135
64.00	126	-106	165	0	0	450	537	701	8971
59.00	160	-135	209	0	0	507	605	789	9820
54.00	199	-167	259	0	0	564	672	877	10682
49.00	241	-202	315	0	0	620	739	965	11556
45.00	278	-233	363	0	0	666	794	1036	12264
45.00	278	-233	363	0	0	665	793	1035	12264
44.00	287	-241	375	0	0	676	805	1051	12621
39.50	333	-279	434	0	0	727	866	1131	14236
39.00	338	-284	441	0	0	731	871	1138	14332
34.00	392	-329	512	0	0	784	934	1219	15296
29.00	450	-378	588	0	0	835	995	1299	16271
24.00	512	-429	668	0	0	884	1054	1376	17256
19.00	577	-484	753	0	0	932	1110	1449	18249
14.00	645	-541	842	0	0	976	1163	1519	19248
9.00	717	-601	936	0	0	1019	1214	1585	20248
4.00	791	-664	1033	0	0	1062	1266	1653	21242
0.00	853	-716	1114	0	0	1101	1312	1712	22013

Loading Case ICE + WIND *** Deflections and Stresses ***

Distance From Base (ft)	Defl. X-Dir (in)	Defl. Y-Dir (in)	Defl. Resultant X & Y (in)	Defl. Z-Dir (in)	Rotation (deg.)	Axial Interaction Term	Flexural Interaction Term	Shear Interaction Term	Torsion Interaction Term	Combined Stress Interaction	Effective Yield Strength (ksi)
89.00	1.8	2.1	2.8	0.0	0.23	0.00	0.00	0.00	0.00	0.01	76.93
84.00	1.6	1.9	2.5	0.0	0.22	0.00	0.00	0.00	0.00	0.01	76.36
79.00	1.5	1.8	2.3	0.0	0.22	0.01	0.01	0.00	0.00	0.01	75.79
74.00	1.3	1.6	2.1	0.0	0.22	0.01	0.01	0.00	0.00	0.01	75.22
69.00	1.2	1.4	1.8	0.0	0.21	0.01	0.01	0.00	0.00	0.02	74.65
64.00	1.0	1.2	1.6	0.0	0.21	0.01	0.02	0.00	0.00	0.02	74.08
59.00	0.9	1.1	1.4	0.0	0.20	0.01	0.02	0.00	0.00	0.03	73.52
54.00	0.8	0.9	1.2	0.0	0.19	0.01	0.02	0.00	0.00	0.03	72.95
49.00	0.7	0.8	1.0	0.0	0.18	0.01	0.03	0.00	0.00	0.03	72.38
45.00	0.6	0.7	0.9	0.0	0.17	0.01	0.03	0.00	0.00	0.04	71.92
45.00	0.6	0.7	0.9	0.0	0.17	0.01	0.03	0.00	0.00	0.03	76.23
44.00	0.5	0.6	0.8	0.0	0.16	0.01	0.03	0.00	0.00	0.03	76.13
39.50	0.4	0.5	0.7	0.0	0.15	0.01	0.03	0.00	0.00	0.04	75.68
39.00	0.4	0.5	0.7	0.0	0.15	0.01	0.03	0.00	0.00	0.04	75.63
34.00	0.3	0.4	0.5	0.0	0.14	0.01	0.03	0.00	0.00	0.04	75.13
29.00	0.2	0.3	0.4	0.0	0.12	0.01	0.04	0.00	0.00	0.05	74.64
24.00	0.2	0.2	0.3	0.0	0.10	0.01	0.04	0.00	0.00	0.05	74.14
19.00	0.1	0.1	0.2	0.0	0.08	0.01	0.05	0.00	0.00	0.06	73.64
14.00	0.1	0.1	0.1	0.0	0.06	0.01	0.05	0.00	0.00	0.06	73.14
9.00	0.0	0.0	0.0	0.0	0.04	0.01	0.05	0.00	0.00	0.06	72.65
4.00	0.0	0.0	0.0	0.0	0.02	0.01	0.06	0.00	0.00	0.07	72.15
0.00	0.0	0.0	0.0	0.0	0.00	0.01	0.06	0.00	0.00	0.07	71.75

Forces and Moments for Pole in the Local Element Coordinate System

Loading Case T+S

Dist. From Base (ft)	Mx (in-kips)	My (in-kips)	Resultant Mx & My (in-kips)	Torsion (in-kips)	Shear X-Dir. (lbs)	Shear Y-Dir. (lbs)	Resultant Shear (lbs)	Axial (lbs)
89.00	18	-15	23	0	195	232	303	2124
84.00	34	-28	44	0	247	294	384	2456
79.00	53	-45	69	0	300	357	467	2794
74.00	76	-64	100	0	353	421	549	3140
69.00	104	-87	135	0	407	485	633	3493
64.00	135	-113	176	0	461	549	716	3853
59.00	170	-142	221	0	514	613	800	4221
54.00	208	-175	272	0	568	677	884	4595
49.00	251	-210	327	0	622	741	968	4977
45.00	288	-241	375	0	666	793	1035	5287
45.00	288	-241	375	0	665	793	1035	5287
44.00	297	-249	388	0	676	805	1051	5453
39.50	342	-287	447	0	725	863	1127	6210
39.00	348	-292	454	0	729	869	1134	6255
34.00	402	-337	524	0	781	931	1215	6709
29.00	459	-385	600	0	832	991	1294	7171
24.00	521	-437	680	0	881	1051	1371	7642
19.00	585	-491	764	0	930	1108	1446	8120
14.00	654	-548	853	0	976	1163	1518	8607
9.00	725	-608	946	0	1021	1216	1588	9102
4.00	800	-671	1044	0	1066	1271	1659	9605
0.00	862	-723	1125	0	1105	1317	1719	10013

*** Deflections and Stresses ***

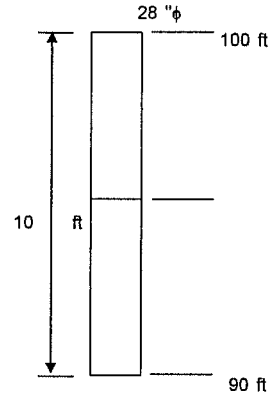
Distance From Base (ft)	Defl. X-Dir (in)	Defl. Y-Dir (in)	Defl. Resultant X & Y (in)	Defl. Z-Dir (in)	Rotation (deg.)	Axial Interaction Term	Flexural Interaction Term	Shear Interaction Term	Torsion Interaction Term	Combined Stress Interaction	Effective Yield Strength (ksi)
89.00	1.8	2.2	2.8	0.0	0.23	0.00	0.00	0.00	0.00	0.01	76.93
84.00	1.7	2.0	2.6	0.0	0.23	0.00	0.00	0.00	0.00	0.01	76.36
79.00	1.5	1.8	2.3	0.0	0.23	0.00	0.01	0.00	0.00	0.01	75.79
74.00	1.4	1.6	2.1	0.0	0.22	0.00	0.01	0.00	0.00	0.01	75.22
69.00	1.2	1.4	1.9	0.0	0.22	0.00	0.01	0.00	0.00	0.02	74.65
64.00	1.1	1.3	1.6	0.0	0.21	0.00	0.02	0.00	0.00	0.02	74.08
59.00	0.9	1.1	1.4	0.0	0.20	0.00	0.02	0.00	0.00	0.02	73.52
54.00	0.8	0.9	1.2	0.0	0.19	0.00	0.02	0.00	0.00	0.03	72.95
49.00	0.7	0.8	1.0	0.0	0.18	0.00	0.03	0.00	0.00	0.03	72.38
45.00	0.6	0.7	0.9	0.0	0.17	0.00	0.03	0.00	0.00	0.03	71.92
45.00	0.6	0.7	0.9	0.0	0.17	0.00	0.03	0.00	0.00	0.03	76.23
44.00	0.5	0.6	0.8	0.0	0.17	0.00	0.03	0.00	0.00	0.03	76.13
39.50	0.4	0.5	0.7	0.0	0.15	0.00	0.03	0.00	0.00	0.03	75.68
39.00	0.4	0.5	0.7	0.0	0.15	0.00	0.03	0.00	0.00	0.03	75.63
34.00	0.3	0.4	0.5	0.0	0.14	0.00	0.03	0.00	0.00	0.04	75.13
29.00	0.3	0.3	0.4	0.0	0.12	0.00	0.04	0.00	0.00	0.04	74.64
24.00	0.2	0.2	0.3	0.0	0.10	0.00	0.04	0.00	0.00	0.05	74.14
19.00	0.1	0.1	0.2	0.0	0.08	0.00	0.05	0.00	0.00	0.05	73.64
14.00	0.1	0.1	0.1	0.0	0.06	0.00	0.05	0.00	0.00	0.05	73.14
9.00	0.0	0.0	0.0	0.0	0.04	0.00	0.05	0.00	0.00	0.06	72.65
4.00	0.0	0.0	0.0	0.0	0.02	0.01	0.06	0.00	0.00	0.06	72.15
0.00	0.0	0.0	0.0	0.0	0.00	0.01	0.06	0.00	0.00	0.07	71.75

MINIMUM DEFLECTION RATIO // DEFLECTION LIMIT / DEFLECTION // IS

Quote/Order No.: 334229

ENGR NAR

Total flagpole height =	100 ft	Date:	7/14/2016
Height of pole =	90 ft		
Silo pipe change height =	100 ft		
Diameter of cellsilo =	28 in		
Height of cellsilo =	10 ft		
Flag dimensions =	15 ft x 25 ft		
3-sec gust windspeed= V=	100 mph		
# of Top Whip Antennas	0	default 0	
# of Antennas =	3	default # of Carriers*3	
# of Carriers =	1		
Paint Type	White	default Gray	
Weight =	2.00 k		
Topo =	1	default 1	
Topo H =	0		
Exposure =	C OK	default c	
Structure Class =	2 OK	default 2	
Windarea of silo = C _A A _A =	14.0 ft ²		
Windarea of flag = C _A A _A =	10.7 ft ²		
Windpressure per EIA-G=	33.9 psf		
Force from top part of silo =	0.00 k		
Force from entire silo =	0.76 k		
Force from flag =	0.58 k		
Δ _{silo} = PL ² /3EI =	0.7 in		
Moment at pipe change =	1.4 in-k	= 0.1 ft-k	
Moment at base of silo =	116.2 in-k	= 9.7 ft-k	



Bolts for base flange:

bolt diameter =	0.5 in
area of bolt =	0.147 in ²
number of bolts =	6
Flange bolt circle =	22 in
Max bolt force =	3.5 k
Max bolt stress =	23.9 ksi <= 90ksi = 0.75*120ksi, OK

Silo base flange:

Moment in silo flange =	25.30037571 in-k
F _b =	50 ksi
t _{required} =	0.75 in
t =	1.5 in >= 0.75 in req'd, OK

Silo lower support pipe:

Pipe Size 6.0" x 0.28"		
Silo support pipe =	6.625 "OD x	0.280 "Wall Thickness
Support pipe weight per foot =	18.99 lbs/ft	
Z =	11.28 in ³	
I =	37.36 in ⁴	
f _b = M/Z =	10	<= 41.4ksi = 0.9*46ksi, OK
Pipe to flange weld size =	0.1875 in	
Z _{weld} =	6.05 in	
Weld stress =	19.2	<= 31.5ksi = 0.75*0.6*70ksi, OK

Tapered pole flange:

Moment in pole flange =	10.56015682 in-k
F _b =	50 ksi
t _{required} =	0.48 in
t =	1.50 in >= 0.48 in req'd, OK

Flange to pole weld size =	0.1875 in	
Total weld =	66 in	
Z _{weld} =	78.72 in ³	
Weld stress =	1.5	<= 31.5ksi = 0.75*0.6*70ksi, OK

