CITY COUNCIL AGENDA REQUEST

Meeting Type:	Mayor & Council Meeting
Meeting Date:	12/2/2024
Agenda Item:	Decorative Traffic Signal Poles, Mast Arms, and Luminaires Contract with DOT Lighting, LLC
Department:	Public Works
Requested By:	Chad Townsend
Reviewed/Approved by City Attorney?	No
Cost:	$163,415.00
Funding Source if Not in Budget	Pentz & Cuyler Street Corridor Improvements Project Account

Please Provide A Summary of Your Request, Including Background Information to Explain the Request:

This is to award the Decorative Traffic Signal Poles, Mast Arms, and Luminaires contract to the lowest bidder DOT Lighting, LLC. All materials acquired from this contract shall be used on the Pentz and Cuyler Corridor Improvements Project. Signal masts shall be delivered no later than 25 weeks, and crossarms & luminaires shall be delivered to the City no later than 14 weeks following contract award.

Request for Bids

City of Dalton Public Works Department
Decorative Traffic Signal Poles and Luminaires

Submittal: Sealed bids must be submitted to The City of Dalton Finance Department – Cindy Jackson located at 300 W Waugh Street – Dalton, GA by October 25th, 2024 at 2:00 PM. The exterior of the envelope needs to contain the words "SEALED BID – DO NOT OPEN". Bids will be opened publicly immediately following the closing of the bid. Sealed bid submissions must include all cutsheets & specifications for materials utilized in providing a cost in bid form to provide proof each element meets requirements listed within the bid specifications. Lead times provided in bid form must be valid for a period of 30 calendar days following the bid opening date.

Vendor Requirements: All parties submitting bids must be on the City of Dalton Vendors list. Vendor packets can be found on the City's website under the Finance section. For any questions regarding the vendor packet, please contact Rhonda Sissom at 706-529-2466 or by email at rsissom@daltonga.gov

Contact: For any questions pertaining to the bid submission, please contact Jackson Sheppard via email at jsheppard@daltonga.gov or by phone at 706-278-7077.

Bid Specifications

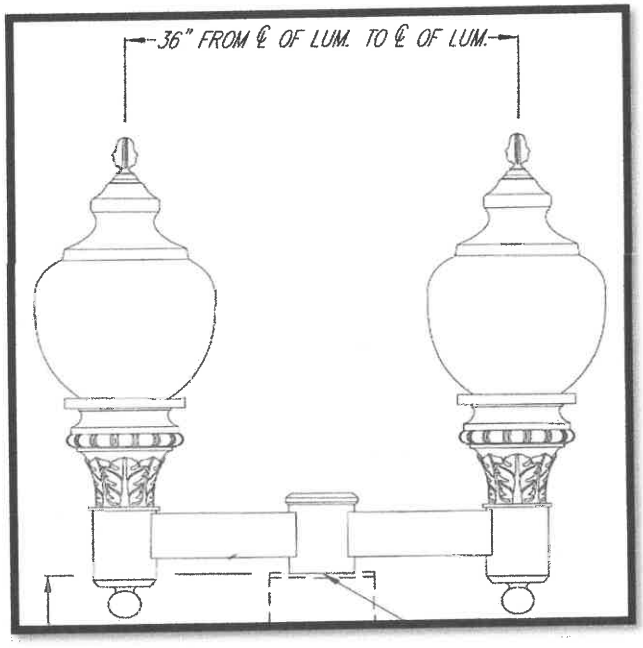
Scope: This request for bids is only for furnishing all materials required for complete installation of poles, mast arms, and associated luminaires for decorative traffic control signal poles to be used within the city right of way.

Fluted Poles & Accompanying Specifications:

TRAFFIC CONTROL DEVICES ARE NOT PART OF THE SCOPE OF THIS BID PACKAGE

1. **18-Foot Fluted Pole (15 FT-6 IN Mast Arm Mounting Height)**
    a. 35-foot fluted curved mast arm
    b. Top-Mounted Dual-Globe Cross Arm & Luminaires
    c. Octagonal Decorative base
    d. Dark Green Color
    e. Fluted Pole & Mast Arm
    f. Anchor Bolts

18-Foot Fluted Pole Example (Intended to Match)



Typical Section of Top-Mounted Dual-Globe Cross Arm & Luminaires (Intended to Match)

2. 21 Foot-6 Inch Fluted Pole (20-FT Mast Arm Mounting Height)

a. 75-foot & 45-foot round straight mast arms
b. Octagonal Decorative Base (Cast Aluminum is Accepted)
c. Dark Green Color
d. Fluted Pole & Mast Arm
e. Anchor Bolts

32-Foot Fluted Pole Example (Intended to Match)

3. 21 Foot-6 Inch Fluted Pole (20-FT Mast Arm Mounting Height)

a. 75-foot & 55-foot round straight mast arms
b. Octagonal Decorative Base
c. Dark Green Color
d. Anchor Bolts

32-Foot Fluted Pole Example (Intended to Match)

4. 8-Foot Fluted Pedestrian Crossing Control Pole

a. Dark Green Color
b. Anchor Bolts

8-Foot Fluted Pedestrian Crossing Control Pole Example (Intended to Match)

Bid Form

Please provide a price for each of the following line items. Please refer to bid specifications for a detailed description of elements pertaining to each item listed below. If an accessory essential for installation is not specifically listed, please provide a lump sum price for additional accessories, and describe additional accessories in space provided.

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	SUB TOTAL
1	18-Foot Fluted Pole (15 FT-6 IN Mast Arm Mounting Height)	EA	4	$20,115 ea = $80,460
2	21 Foot-6 Inch Fluted Pole (20-FT Mast Arm Mounting Height)	EA	1	$38,805
3	21 Foot-6 Inch Fluted Pole (20-FT Mast Arm Mounting Height)	EA	1	$40,220
4	8-Foot Fluted Pedestrian Crossing Control Pole	EA	2	$1965 ea = $3,930

SUBTOTAL	$163,415

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	SUB TOTAL
5	Additional Items Required (Not Listed in Bid Specifications)	LS	1	

TOTAL	$163,415

Description of Additional Items If Any:

Description of Lead Times for Material Delivery:

Poles: 23-25 weeks

Crossarms/Luminaires: 12-14 weeks

AWARD SHALL BE MADE TO THE LOWEST QUALIFIED BIDDER MEETING THE BID SPECIFICATIONS.

NOTE: By signing this bid form and submitting a bid, the vendor acknowledges that they have read, understand and agree to all aspects of this document presented. Conditional bids will not be accepted.

Company Name: DoT Lighting LLC

Authorized Representative Name: Tad Brandle

Authorized Representative Signature: _____

Authorized Representative Title: Sales

CONTRACT AUTHORIZATION

City of Dalton	DOT LIGHTING, LLC
Accepted By:_____	Accepted By:_____
TITLE:_____	TITLE:_____
DATE:_____	DATE:_____

Valmont Industries, Inc.
West Highway 275
P.O. Box 358
Valley, Nebraska 68064-0358 USA
(402) 359-2201

A Light & Traffic Structure Proposal
for
Cuyler St
Dalton, Georgia

Valmont Order No.: 568086-P1

Prepared By:
Nizam Qassem, P.E.
November 18, 2024

Valmont Industries, Inc.
West Highway 275
P.O. Box 358
Valley, Nebraska 68064-0358 USA
(402) 359-2201

Table Of Contents

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCRDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Design Criteria

Design Code	AASHTO-2015	Fatigue Category	2
Ultimate Wind Speed (mph)	120.0	Truck Gust	No
Mean Recurrence Interval	700	Galloping	No
Service Level Wind Speed (mph)	76.0	Natural Wind Gust	No
AASHTO Ice Included ?	Yes	HMLT Fatigue	No
Steps Included ?	No		

Design Summary - Pole

Height (ft)	Shaft Weight (lb)	Ground Line Diameter (in)	Top Dia. (in)
8.0000	52	5.62	4.500

Section Characteristics

	Section - 1
Shape	16 Sharp Flutes
Top Dia. (in)	4.500
Base Diameter (in)	5.620
Thickness (in)	0.11960
Length (ft)	8.00
Shaft Weight (lb)	52
Assembly Weight (lb)	68
Taper (in/ft)	0.14000
Yield Strength (ksi)	55.00
Material	S105 - A595

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Base Plate

Shape	Square
Material	S70 - A36
Width (in)	10.000
Thickness (in)	0.87500
Yield Strength (ksi)	36.00
Base Weld Type	SOCKET
Weight (lb)	16

Anchor Bolts

Material	S100 - F1554
Bolt diameter (in)	1.00
Bolt circle diameter (in)	9.00
Quantity	4
Yield Strength (ksi)	55.00
Tensile strength (ksi)	75

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Description of EPA Loading

Description of Load	Position of Load	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Weight (lb)	Effective Projected Area (ft2)
POST TOP	Pole	8.0000	10.0000	0.0000	37	2.19

THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED
WITHOUT CONSULTING VALMONT.
ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE
SPECIFYING AGENCY HAVE
BEEN ESTIMATED BY VALMONT.
** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR
TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

RESULTS SUMMARY - Pole

Maximum Combined Force Interaction In Each Major Component

Strength I	
Pole CFI (At 0.00 (ft))	0.00
Base Plate CFI	0.00
Anchor Bolts CFI	0.00
Deflection % (At 8.00 (ft))	0.000 %
Deflection (At 8.00 (ft))	0.00 in
Rotation (At 8.00 (ft))	0.00 deg
Extreme I	
Pole CFI (At 0.00 (ft))	0.12
Base Plate CFI	0.07
Anchor Bolts CFI	0.07
Deflection % (At 8.00 (ft))	0.330 %
Deflection (At 8.00 (ft))	0.32 in
Rotation (At 8.00 (ft))	0.31 deg
Service I	
Pole CFI (At 0.00 (ft))	0.05
Base Plate CFI	0.03
Anchor Bolts CFI	0.03
Deflection % (At 8.00 (ft))	0.132 %
Deflection (At 8.00 (ft))	0.13 in
Rotation (At 8.00 (ft))	0.12 deg

Maximum Reactions Applied To Foundation

Bending Moment	1615 ft-lb
Torsion	0 ft-lb
Shear Force	280 lb
Axial Force	167 lb
Ice	
Pole CFI (At 0.00 (ft))	0.05
Base Plate CFI	0.03
Anchor Bolts CFI	0.03
Deflection % (At 8.00 (ft))	0.133 %
Deflection (At 8.00 (ft))	0.13 in
Rotation (At 8.00 (ft))	0.12 deg

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole Properties

Height (ft)	Diameter (in)	Wall Thk. (in)	Roundness Ratio (%)	D/t	B/T	Moments of Inertia (in4)	Plastic Section Modulus (in3)	Area (in2)	Radius of Gyration (in)
8.0000	4.50	0.11960	0.0	37.63	0.00	3.57	2.18	1.65	1.47
7.2857	4.60	0.11960	0.0	38.46	0.00	3.82	2.28	1.68	1.51
6.5714	4.70	0.11960	0.0	39.30	0.00	4.08	2.38	1.72	1.54
5.8571	4.80	0.11960	0.0	40.13	0.00	4.35	2.49	1.76	1.57
5.1429	4.90	0.11960	0.0	40.97	0.00	4.64	2.59	1.80	1.61
4.4286	5.00	0.11960	0.0	41.81	0.00	4.93	2.70	1.83	1.64
3.7143	5.10	0.11960	0.0	42.64	0.00	5.24	2.82	1.87	1.67
3.0000	5.20	0.11960	0.0	43.48	0.00	5.56	2.93	1.91	1.71
2.3125	5.30	0.11960	0.0	44.28	0.00	5.88	3.04	1.95	1.74
1.6250	5.39	0.11960	0.0	45.09	0.00	6.22	3.15	1.98	1.77
0.9375	5.49	0.11960	0.0	45.89	0.00	6.56	3.27	2.02	1.80
0.2500	5.59	0.11960	0.0	46.70	0.00	6.92	3.39	2.05	1.84
0.2500	5.59	0.11960	100.0	46.70	0.00	7.66	3.57	2.05	1.93
0.0000	5.62	0.11960	100.0	46.99	0.00	7.81	3.62	2.07	1.94

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole: Forces and Moments (Strength I)

Section Height* (ft)	Forces (lb)		Moment (ft-lb)
	Axial	Shear	Total
8.00	46.25	0.00	0.00
7.29	51.75	0.00	0.00
6.57	57.37	0.00	0.00
5.86	63.11	0.00	0.00
5.14	68.97	0.00	0.00
4.43	74.96	0.00	0.00
3.71	81.06	0.00	0.00
3.00	87.29	0.00	0.00
2.31	93.39	0.00	0.00
1.63	99.61	0.00	0.00
0.94	105.94	0.00	0.00
0.25	112.38	0.00	0.00
0.25	112.38	0.00	0.00
0.00	114.70	0.00	0.00

* These heights are above the pole base plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole: Resistances (Strength I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
8.00	0.00	46.25	0.00	0.00	0.00	NA**	25,780.17	9,382.93	9,547.61
7.29	0.00	51.75	0.00	0.00	0.00	NA**	26,368.70	9,768.10	9,988.51
6.57	0.00	57.37	0.00	0.00	0.00	NA**	26,957.23	10,160.84	10,439.36
5.86	0.00	63.11	0.00	0.00	0.00	NA**	27,545.77	10,561.17	10,900.16
5.14	0.00	68.97	0.00	0.00	0.00	NA**	28,134.30	10,969.06	11,370.91
4.43	0.00	74.96	0.00	0.00	0.00	NA**	28,722.84	11,384.53	11,851.62
3.71	0.00	81.06	0.00	0.00	0.00	NA**	29,311.37	11,807.58	12,342.28
3.00	0.00	87.29	0.00	0.00	0.00	NA**	29,899.91	12,238.21	12,842.89
2.31	0.00	93.39	0.00	0.00	0.00	NA**	30,466.37	12,659.84	13,334.13
1.63	0.00	99.61	0.00	0.00	0.00	NA**	31,032.84	13,088.48	13,834.58
0.94	0.00	105.94	0.00	0.00	0.00	NA**	31,599.30	13,524.15	14,344.25
0.25	0.00	112.38	0.00	0.00	0.00	NA**	32,165.77	13,966.83	14,863.15
0.25	0.00	112.38	0.00	0.00	0.00	NA**	30,485.80	13,997.07	14,653.15
0.00	0.00	114.70	0.00	0.00	0.00	NA**	30,681.04	14,160.14	14,841.43

* These heights are above the pole base plate.
** Per 5.12.1 of the 2017 Interim Revisions.

Baseplate Analysis (Strength I) - Pole1 - Pole

Combined Force Interaction	0.00
Critical Wind Direction *	0.00 deg
Alignment of Bend Line	45.00 deg
Width of Bending Section	8.522 (in)
Failure Line Start Coordinate (in)	(5.000, -1.026)
Failure Line End Coordinate in	(-1.026, 5.000)
Applied Bending Moment	4.04 ft-lb
Factored Bending Resistance	4,404.21 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
1	29	1.69	4

Anchor Bolts Analysis (Strength I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
0.00	0.00	36.51	0.00	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole Deflection Information: (Strength I)

Critical Wind Direction: 0.00

Elevation (ft)	Rotation (deg)	Slope (in/ft)	Deflection (ft)	Deflection (in)	% of Height (%)	Angle from Vertical (deg)
8.0000	0.00	0.00	0.0000	0.00	0.000	0.00
7.2857	0.00	0.00	0.0000	0.00	0.000	0.00
6.5714	0.00	0.00	0.0000	0.00	0.000	0.00
5.8571	0.00	0.00	0.0000	0.00	0.000	0.00
5.1429	0.00	0.00	0.0000	0.00	0.000	0.00
4.4286	0.00	0.00	0.0000	0.00	0.000	0.00
3.7143	0.00	0.00	0.0000	0.00	0.000	0.00
3.0000	0.00	0.00	0.0000	0.00	0.000	0.00
2.3125	0.00	0.00	0.0000	0.00	0.000	0.00
1.6250	0.00	0.00	0.0000	0.00	0.000	0.00
0.9375	0.00	0.00	0.0000	0.00	0.000	0.00
0.2500	0.00	0.00	0.0000	0.00	0.000	0.00
0.2500	0.00	0.00	0.0000	0.00	0.000	0.00
0.0000	0.00	0.00	0.0000	0.00	0.000	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
EXTREME I LIMIT STATE

Wind Velocity	120.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Pole: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	10.0000	0.0000	2.19	1.00	0.86	0.95	38.98	85
8.0000	7.6415	0.0000	0.27	1.50	0.86	0.95	38.98	16
7.2857	6.9273	0.0000	0.28	1.50	0.86	0.95	38.98	16
6.5714	6.2130	0.0000	0.28	1.50	0.86	0.95	38.98	17
5.8571	5.4988	0.0000	0.29	1.50	0.86	0.95	38.98	17
5.1429	4.7845	0.0000	0.29	1.50	0.86	0.95	38.98	17
4.4286	4.0702	0.0000	0.30	1.50	0.86	0.95	38.98	18
3.7143	3.3560	0.0000	0.31	1.50	0.86	0.95	38.98	18
3.0000	2.6552	0.0000	0.30	1.50	0.86	0.95	38.98	18
2.3125	1.9677	0.0000	0.31	1.50	0.86	0.95	38.98	18
1.6250	1.2802	0.0000	0.31	1.50	0.86	0.95	38.98	18
0.9375	0.5928	0.0000	0.32	1.50	0.86	0.95	38.98	19
0.2500	-0.0947	0.0000	0.32	1.50	0.86	0.95	38.98	19

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole: Forces and Moments (Extreme I)

Section Height* (ft)	Forces (lb)		Moment (ft-lb)		
	Axial	Shear	Primary	Secondary	Total
8.00	40.25	85.58	170.74	0.44	171.17
7.29	45.11	101.43	237.37	0.60	237.97
6.57	50.09	117.63	315.44	0.77	316.21
5.86	55.18	134.17	405.19	0.96	406.15
5.14	60.40	151.05	506.88	1.14	508.02
4.43	65.74	168.27	620.75	1.32	622.07
3.71	71.21	185.83	747.04	1.50	748.55
3.00	76.80	203.73	886.02	1.67	887.69
2.31	82.30	221.27	1,031.99	1.81	1,033.80
1.63	87.93	239.13	1,190.16	1.92	1,192.08
0.94	93.69	257.29	1,360.74	2.00	1,362.75
0.25	99.35	275.85	1,543.97	2.04	1,546.02
0.25	99.49	275.80	1,543.97	2.04	1,546.02
0.00	101.53	279.98	1,613.44	2.05	1,615.49

* These heights are above the pole base plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole: Resistances (Extreme I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
8.00	0.02	40.25	85.58	171.17	0.00	NA**	25,780.17	9,382.93	9,547.61
7.29	0.02	45.11	101.43	237.97	0.00	NA**	26,368.70	9,768.10	9,988.51
6.57	0.03	50.09	117.63	316.21	0.00	NA**	26,957.23	10,160.84	10,439.36
5.86	0.04	55.18	134.17	406.15	0.00	NA**	27,545.77	10,561.17	10,900.16
5.14	0.05	60.40	151.05	508.02	0.00	NA**	28,134.30	10,969.06	11,370.91
4.43	0.06	65.74	168.27	622.07	0.00	NA**	28,722.84	11,384.53	11,851.62
3.71	0.06	71.21	185.83	748.55	0.00	NA**	29,311.37	11,807.58	12,342.28
3.00	0.07	76.80	203.73	887.69	0.00	NA**	29,899.91	12,238.21	12,842.89
2.31	0.08	82.30	221.27	1,033.80	0.00	NA**	30,466.37	12,659.84	13,334.13
1.63	0.09	87.93	239.13	1,192.08	0.00	NA**	31,032.84	13,088.48	13,834.58
0.94	0.10	93.69	257.29	1,362.75	0.00	NA**	31,599.30	13,524.15	14,344.25
0.25	0.11	99.35	275.85	1,546.02	0.00	NA**	32,165.77	13,966.83	14,863.15
0.25	0.11	99.49	275.80	1,546.02	0.00	NA**	30,485.80	13,997.07	14,653.15
0.00	0.12	101.53	279.98	1,615.49	0.00	NA**	30,681.04	14,160.14	14,841.43

* These heights are above the pole base plate.

** Per 5.12.1 of the 2017 Interim Revisions.

Baseplate Analysis (Extreme I) - Pole1 - Pole

Combined Force Interaction	0.07
Critical Wind Direction *	90.00 deg
Alignment of Bend Line	45.00 deg
Width of Bending Section	8.522 (in)
Failure Line Start Coordinate (in)	(5.000, -1.026)
Failure Line End Coordinate in	(-1.026, 5.000)
Applied Bending Moment	306.93 ft-lb
Factored Bending Resistance	4,404.21 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
1	-2179	1.69	-307

Anchor Bolts Analysis (Extreme I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
90.00	0.07	2,953.10	89.12	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole Deflection Information: (Extreme I)

Critical Wind Direction: 90.00

Elevation (ft)	Rotation (deg)	Slope (in/ft)	Deflection (ft)	Deflection (in)	% of Height (%)	Angle from Vertical (deg)
8.0000	0.31	0.06	0.0264	0.32	0.330	0.19
7.2857	0.30	0.06	0.0226	0.27	0.283	0.18
6.5714	0.28	0.06	0.0190	0.23	0.237	0.17
5.8571	0.27	0.06	0.0155	0.19	0.194	0.15
5.1429	0.25	0.05	0.0123	0.15	0.154	0.14
4.4286	0.22	0.05	0.0094	0.11	0.117	0.12
3.7143	0.20	0.04	0.0068	0.08	0.085	0.10
3.0000	0.16	0.03	0.0045	0.05	0.057	0.09
2.3125	0.13	0.03	0.0028	0.03	0.034	0.07
1.6250	0.10	0.02	0.0014	0.02	0.017	0.05
0.9375	0.06	0.01	0.0005	0.01	0.006	0.03
0.2500	0.01	0.00	0.0000	0.00	0.000	0.01
0.2500	0.01	0.00	0.0000	0.00	0.000	0.01
0.0000	0.00	0.00	0.0000	0.00	0.000	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
SERVICE I LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.00
Wind Load Factor	1.00
Gust Factor	1.30

Pole: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	10.0000	0.0000	2.19	1.00	0.86	0.95	15.64	34
8.0000	7.6415	0.0000	0.27	1.50	0.86	0.95	15.64	6
7.2857	6.9273	0.0000	0.28	1.50	0.86	0.95	15.64	6
6.5714	6.2130	0.0000	0.28	1.50	0.86	0.95	15.64	7
5.8571	5.4988	0.0000	0.29	1.50	0.86	0.95	15.64	7
5.1429	4.7845	0.0000	0.29	1.50	0.86	0.95	15.64	7
4.4286	4.0702	0.0000	0.30	1.50	0.86	0.95	15.64	7
3.7143	3.3560	0.0000	0.31	1.50	0.86	0.95	15.64	7
3.0000	2.6552	0.0000	0.30	1.50	0.86	0.95	15.64	7
2.3125	1.9677	0.0000	0.31	1.50	0.86	0.95	15.64	7
1.6250	1.2802	0.0000	0.31	1.50	0.86	0.95	15.64	7
0.9375	0.5928	0.0000	0.32	1.50	0.86	0.95	15.64	7
0.2500	-0.0947	0.0000	0.32	1.50	0.86	0.95	15.64	7

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole: Forces and Moments (Service I)

Section Height* (ft)	Forces (lb)		Moment (ft-lb)		
	Axial	Shear	Primary	Secondary	Total
8.00	36.93	34.32	68.48	0.16	68.64
7.29	41.33	40.68	95.21	0.22	95.43
6.57	45.83	47.17	126.53	0.28	126.81
5.86	50.43	53.81	162.53	0.35	162.88
5.14	55.13	60.58	203.31	0.42	203.73
4.43	59.93	67.49	248.99	0.49	249.47
3.71	64.83	74.53	299.65	0.55	300.20
3.00	69.83	81.71	355.39	0.61	356.00
2.31	74.73	88.75	413.94	0.66	414.60
1.63	79.73	95.91	477.39	0.70	478.09
0.94	84.83	103.20	545.81	0.73	546.54
0.25	89.98	110.64	619.30	0.75	620.05
0.25	90.00	110.63	619.30	0.75	620.05
0.00	91.86	112.63	647.21	0.75	647.96

* These heights are above the pole base plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole: Resistances (Service I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
8.00	0.01	36.93	34.32	68.64	0.00	NA**	25,780.17	9,382.93	9,547.61
7.29	0.01	41.33	40.68	95.43	0.00	NA**	26,368.70	9,768.10	9,988.51
6.57	0.01	45.83	47.17	126.81	0.00	NA**	26,957.23	10,160.84	10,439.36
5.86	0.02	50.43	53.81	162.88	0.00	NA**	27,545.77	10,561.17	10,900.16
5.14	0.02	55.13	60.58	203.73	0.00	NA**	28,134.30	10,969.06	11,370.91
4.43	0.02	59.93	67.49	249.47	0.00	NA**	28,722.84	11,384.53	11,851.62
3.71	0.03	64.83	74.53	300.20	0.00	NA**	29,311.37	11,807.58	12,342.28
3.00	0.03	69.83	81.71	356.00	0.00	NA**	29,899.91	12,238.21	12,842.89
2.31	0.03	74.73	88.75	414.60	0.00	NA**	30,466.37	12,659.84	13,334.13
1.63	0.04	79.73	95.91	478.09	0.00	NA**	31,032.84	13,088.48	13,834.58
0.94	0.04	84.83	103.20	546.54	0.00	NA**	31,599.30	13,524.15	14,344.25
0.25	0.05	89.98	110.64	620.05	0.00	NA**	32,165.77	13,966.83	14,863.15
0.25	0.05	90.00	110.63	620.05	0.00	NA**	30,485.80	13,997.07	14,653.15
0.00	0.05	91.86	112.63	647.96	0.00	NA**	30,681.04	14,160.14	14,841.43

* These heights are above the pole base plate.

** Per 5.12.1 of the 2017 Interim Revisions.

Baseplate Analysis (Service I) - Pole1 - Pole

Combined Force Interaction	0.03
Critical Wind Direction *	90.00 deg
Alignment of Bend Line	45.00 deg
Width of Bending Section	8.522 (in)
Failure Line Start Coordinate (in)	(5.000, -1.026)
Failure Line End Coordinate in	(-1.026, 5.000)
Applied Bending Moment	124.91 ft-lb
Factored Bending Resistance	4,404.21 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
1	-887	1.69	-125

Anchor Bolts Analysis (Service I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
90.00	0.03	1,200.96	35.85	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH

Folder: 568086 File: P8PTA15120

Pole Deflection Information: (Service I)

Critical Wind Direction: 90.00

Elevation (ft)	Rotation (deg)	Slope (in/ft)	Deflection (ft)	Deflection (in)	% of Height (%)	Angle from Vertical (deg)
8.0000	0.12	0.03	0.0106	0.13	0.132	0.08
7.2857	0.12	0.03	0.0091	0.11	0.113	0.07
6.5714	0.11	0.02	0.0076	0.09	0.095	0.07
5.8571	0.11	0.02	0.0062	0.07	0.078	0.06
5.1429	0.10	0.02	0.0049	0.06	0.062	0.06
4.4286	0.09	0.02	0.0038	0.05	0.047	0.05
3.7143	0.08	0.02	0.0027	0.03	0.034	0.04
3.0000	0.07	0.01	0.0018	0.02	0.023	0.03
2.3125	0.05	0.01	0.0011	0.01	0.014	0.03
1.6250	0.04	0.01	0.0006	0.01	0.007	0.02
0.9375	0.02	0.00	0.0002	0.00	0.002	0.01
0.2500	0.01	0.00	0.0000	0.00	0.000	0.00
0.2500	0.01	0.00	0.0000	0.00	0.000	0.00
0.0000	0.00	0.00	0.0000	0.00	0.000	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
ICE LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Pole: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	10.0000	0.0000	2.19	1.00	0.86	0.95	15.64	34
8.0000	7.6415	0.0000	0.27	1.50	0.86	0.95	15.64	6
7.2857	6.9273	0.0000	0.28	1.50	0.86	0.95	15.64	6
6.5714	6.2130	0.0000	0.28	1.50	0.86	0.95	15.64	7
5.8571	5.4988	0.0000	0.29	1.50	0.86	0.95	15.64	7
5.1429	4.7845	0.0000	0.29	1.50	0.86	0.95	15.64	7
4.4286	4.0702	0.0000	0.30	1.50	0.86	0.95	15.64	7
3.7143	3.3560	0.0000	0.31	1.50	0.86	0.95	15.64	7
3.0000	2.6552	0.0000	0.30	1.50	0.86	0.95	15.64	7
2.3125	1.9677	0.0000	0.31	1.50	0.86	0.95	15.64	7
1.6250	1.2802	0.0000	0.31	1.50	0.86	0.95	15.64	7
0.9375	0.5928	0.0000	0.32	1.50	0.86	0.95	15.64	7
0.2500	-0.0947	0.0000	0.32	1.50	0.86	0.95	15.64	7

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole: Forces and Moments (Ice)

Section Height* (ft)	Forces (lb)		Moment (ft-lb)		
	Axial	Shear	Primary	Secondary	Total
8.00	69.53	34.39	68.48	0.30	68.79
7.29	77.35	40.75	95.21	0.41	95.63
6.57	85.34	47.25	126.53	0.53	127.06
5.86	93.50	53.89	162.53	0.66	163.18
5.14	101.84	60.66	203.31	0.78	204.10
4.43	110.35	67.56	248.99	0.91	249.89
3.71	119.04	74.60	299.65	1.03	300.67
3.00	127.90	81.77	355.39	1.14	356.53
2.31	136.60	88.80	413.94	1.23	415.17
1.63	145.46	95.95	477.39	1.31	478.69
0.94	154.48	103.22	545.81	1.36	547.17
0.25	163.63	110.66	619.30	1.39	620.70
0.25	163.65	110.63	619.30	1.39	620.70
0.00	166.94	112.64	647.21	1.39	648.60

* These heights are above the pole base plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole: Resistances (Ice)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
8.00	0.01	69.53	34.39	68.79	0.00	NA**	25,780.17	9,382.93	9,547.61
7.29	0.01	77.35	40.75	95.63	0.00	NA**	26,368.70	9,768.10	9,988.51
6.57	0.01	85.34	47.25	127.06	0.00	NA**	26,957.23	10,160.84	10,439.36
5.86	0.02	93.50	53.89	163.18	0.00	NA**	27,545.77	10,561.17	10,900.16
5.14	0.02	101.84	60.66	204.10	0.00	NA**	28,134.30	10,969.06	11,370.91
4.43	0.02	110.35	67.56	249.89	0.00	NA**	28,722.84	11,384.53	11,851.62
3.71	0.03	119.04	74.60	300.67	0.00	NA**	29,311.37	11,807.58	12,342.28
3.00	0.03	127.90	81.77	356.53	0.00	NA**	29,899.91	12,238.21	12,842.89
2.31	0.03	136.60	88.80	415.17	0.00	NA**	30,466.37	12,659.84	13,334.13
1.63	0.04	145.46	95.95	478.69	0.00	NA**	31,032.84	13,088.48	13,834.58
0.94	0.04	154.48	103.22	547.17	0.00	NA**	31,599.30	13,524.15	14,344.25
0.25	0.05	163.63	110.66	620.70	0.00	NA**	32,165.77	13,966.83	14,863.15
0.25	0.05	163.65	110.63	620.70	0.00	NA**	30,485.80	13,997.07	14,653.15
0.00	0.05	166.94	112.64	648.60	0.00	NA**	30,681.04	14,160.14	14,841.43

* These heights are above the pole base plate.
** Per 5.12.1 of the 2017 Interim Revisions.

Baseplate Analysis (Ice) - Pole1 - Pole

Combined Force Interaction	0.03
Critical Wind Direction *	90.00 deg
Alignment of Bend Line	45.00 deg
Width of Bending Section	8.522 (in)
Failure Line Start Coordinate (in)	(5.000, -1.026)
Failure Line End Coordinate in	(-1.026, 5.000)
Applied Bending Moment	127.67 ft-lb
Factored Bending Resistance	4,404.21 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
1	-907	1.69	-128

Anchor Bolts Analysis (Ice) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
90.00	0.03	1,225.95	35.85	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-8' FL210 POST TOP DECO POLE AASHTO 2015 120MPH
Folder: 568086 File: P8PTA15120
Pole Deflection Information: (Ice)

Critical Wind Direction: 90.00

Elevation (ft)	Rotation (deg)	Slope (in/ft)	Deflection (ft)	Deflection (in)	% of Height (%)	Angle from Vertical (deg)
8.0000	0.12	0.03	0.0106	0.13	0.133	0.08
7.2857	0.12	0.03	0.0091	0.11	0.114	0.07
6.5714	0.11	0.02	0.0076	0.09	0.095	0.07
5.8571	0.11	0.02	0.0062	0.07	0.078	0.06
5.1429	0.10	0.02	0.0049	0.06	0.062	0.06
4.4286	0.09	0.02	0.0038	0.05	0.047	0.05
3.7143	0.08	0.02	0.0027	0.03	0.034	0.04
3.0000	0.07	0.01	0.0018	0.02	0.023	0.03
2.3125	0.05	0.01	0.0011	0.01	0.014	0.03
1.6250	0.04	0.01	0.0006	0.01	0.007	0.02
0.9375	0.02	0.00	0.0002	0.00	0.002	0.01
0.2500	0.01	0.00	0.0000	0.00	0.000	0.00
0.2500	0.01	0.00	0.0000	0.00	0.000	0.00
0.0000	0.00	0.00	0.0000	0.00	0.000	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Design Criteria

Design Code	AASHTO-2015	Fatigue Category	2
Ultimate Wind Speed (mph)	120.0	Truck Gust	No
Mean Recurrence Interval	700	Galloping	No
Service Level Wind Speed (mph)	76.0	Natural Wind Gust	Yes
AASHTO Ice Included ?	Yes		

Design Summary - Pole

Height (ft)	Shaft Weight (lb)	Ground Line Diameter (in)	Top Dia. (in)
18.0000	452	12.50	9.980

Section Characteristics

	Section - 1
Shape	16 Sharp Flutes
Top Dia. (in)	9.980
Base Diameter (in)	12.500
Thickness (in)	0.20920
Length (ft)	18.00
Shaft Weight (lb)	452
Assembly Weight (lb)	703
Taper (in/ft)	0.14000
Yield Strength (ksi)	55.00
Material	S105 - A595

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Base Plate

Shape	Square
Material	S70 - A36
Width (in)	19.000
Thickness (in)	2.00000
Yield Strength (ksi)	36.00
Base Weld Type	SOCKET
Weight (lb)	119

Anchor Bolts

Material	S100 - F1554
Bolt diameter (in)	1.75
Bolt circle diameter (in)	17.50
Quantity	4
Yield Strength (ksi)	55.00
Tensile strength (ksi)	75

Design Summary - Arms

Signal and Sign	Arm 1
Shape	16 Sharp Flutes
Span Length (ft)	35.0000
Taper (in/ft)	0.14000
Attachment Height (ft)	15.00
Orientation (deg)	180.00
Slope at Base (deg)	10.00
Centroid Location	
Horizontal (ft)	15.7579
Above Attachment (ft)	2.6616
Unbent Length (ft)	35.4013
Material-Base	S105 - 55 ksi
Weight (lb)	770
Base Section	
Base O.D. (in)	11.00
Thickness (in)	0.23910
Length (ft)	35.3553
Yield Strength (ksi)	55.00
Material	S105

Base Weld Type = Socket

Design Summary - Arms

Simplex Dimensions

	Arm 1
Connection Bolt Data	
Number of bolts	4
Bolt diameter (in)	1.25
ASTM Specification	A325
Horizontal Spacing (in)	14.50
Vertical Spacing (in)	14.50
Attachment Plate Data	
Horizontal Width (in)	17.75
Vertical Width (in)	17.75
Mast Arm Bracket Thickness (in)	2.00
Arm Plate Bracket Weight (lb)	132
Pole Plate Bracket Thickness (in)	2.00
Pole Plate Bracket Weight (lb)	132
Yield Strength (ksi)	36.00
Vertical Gusset Thickness (in)	0.3750
Horizontal Gusset Thickness (in)	0.3750

Attachment Type

Arm 1:	SIMPLEX - RING-STIFFENED BOX, THRU, Base Weld Type = Socket

** These heights are above bottom of base plate or transformer base.
Elliptical cross section; first diameter is horizontal.
** Arm orientations are angles from +X axis in X-Y plane.
X and Y axies are perpendicular/parallel to sides of pole base plate. See *** below.
*** If arm is attached with a clamp, height and orientation must not be changed
from values shown above without consulting Valmont.
Nice to have:
**** Assembly weight includes unfinished shaft + flange + simplex plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Description of EPA Loading

Description of Load	Position of Load	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Weight (lb)	Effective Projected Area (ft2)
POST TOP FIXTURE	Pole	18.0000	20.0000	0.0000	37	2.19

Description of Sign Loading

Position of Signal or Sign	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Sign Weight (lb)	Sign Width (ft)	Sign Depth (ft)	Sign Cd
Mast Arm 1	15.0000	20.0000	22.0000	15	2.5000	3.0000	1.19

Description of Signal Loading

Position of Signal	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Signal Weight (lb)	Vertical Plane (ft2)	Horizontal Plane (ft2)
Arm 1	15.0000	20.0000	18.0000	50	8.67	1.80
Arm 1	15.0000	20.0000	30.0000	74	13.72	3.60

THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED
WITHOUT CONSULTING VALMONT.
ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE
SPECIFYING AGENCY HAVE
BEEN ESTIMATED BY VALMONT.
** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR
TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120

RESULTS SUMMARY - Pole

Maximum Combined Force Interaction In Each Major Component	
Strength I	
Pole CFI (At 15.00 (ft))	0.25
Signal and Sign Arm 1 CFI	0.19
Base Plate CFI	0.06
Anchor Bolts CFI	0.10
S/S Arm 1 Att. Bolts CFI	0.01
S/S Arm 1 Att. Plate CFI	0.09
S/S Pole 1 Att. Plate CFI	0.09
Deflection % (At 18.00 (ft))	0.810 %
Deflection (At 18.00 (ft))	1.75 in
Rotation (At 18.00 (ft))	0.85 deg
Extreme I	
Pole CFI (At 0.00 (ft))	0.74
Signal and Sign Arm 1 CFI	0.52
Base Plate CFI	0.21
Anchor Bolts CFI	0.63
S/S Arm 1 Att. Bolts CFI	0.11
S/S Arm 1 Att. Plate CFI	0.31
S/S Pole 1 Att. Plate CFI	0.31
Deflection % (At 18.00 (ft))	1.654 %
Deflection (At 18.00 (ft))	3.57 in
Rotation (At 18.00 (ft))	1.52 deg
Service I	
Pole CFI (At 15.00 (ft))	0.27
Signal and Sign Arm 1 CFI	0.25
Base Plate CFI	0.11
Anchor Bolts CFI	0.28
S/S Arm 1 Att. Bolts CFI	0.03
S/S Arm 1 Att. Plate CFI	0.16
S/S Pole 1 Att. Plate CFI	0.16
Deflection % (At 18.00 (ft))	0.882 %
Deflection (At 18.00 (ft))	1.90 in
Rotation (At 18.00 (ft))	0.86 deg

Maximum Reactions Applied To Foundation	
Bending Moment	62203 ft-lb
Torsion	54539 ft-lb
Shear Force	3595 lb
Axial Force	2457 lb
Ice	
Pole CFI (At 15.00 (ft))	0.46
Signal and Sign Arm 1 CFI	0.36
Base Plate CFI	0.16
Anchor Bolts CFI	0.37
S/S Arm 1 Att. Bolts CFI	0.06
S/S Arm 1 Att. Plate CFI	0.23
S/S Pole 1 Att. Plate CFI	0.23
Deflection % (At 18.00 (ft))	1.424 %
Deflection (At 18.00 (ft))	3.08 in
Rotation (At 18.00 (ft))	1.46 deg
Fatigue II	
Pole (At 0.00 (ft))	0.74
Hand Hole / Opening	0.47
Signal and Sign Arm 1	
Arm Tube	0.85
Simplex Bolts	0.38
Anchor Bolts	0.27

SHAFT PROPERTIES: NUMBER OF SIDES = 16 Sharp Flutes
DIAMETER (D) = 12.500 IN
THICKNESS (T) = 0.20920 IN
YIELD STRENGTH (KSI) = 55
MOM. OF INERTIA (IX) = 137.298 IN^4
SECTION MODULUS (SX) = 21.968 IN^3

MN: ALLOWABLE SHAFT MOMENT
MB = (Fb * Sx) / 12
= (55000 * 21.968 / 12 = 100685
MB = 100685 FT-LB

Pole Properties

Height (ft)	Diameter (in)	Wall Thk. (in)	Roundness Ratio (%)	D/t	B/T	Moments of Inertia (in4)	Plastic Section Modulus (in3)	Area (in2)	Radius of Gyration (in)
18.0000	9.98	0.20920	0.0	47.71	0.00	69.05	18.93	6.42	3.28
16.5000	10.19	0.20920	0.0	48.71	0.00	73.59	19.76	6.56	3.35
15.0000	10.40	0.20920	0.0	49.71	0.00	78.33	20.59	6.70	3.42
14.0000	10.54	0.20920	0.0	50.38	0.00	81.60	21.16	6.79	3.47
13.0000	10.68	0.20920	0.0	51.05	0.00	84.95	21.74	6.88	3.51
11.3333	10.91	0.20920	0.0	52.17	0.00	90.75	22.72	7.03	3.59
9.6667	11.15	0.20920	0.0	53.28	0.00	96.81	23.72	7.19	3.67
8.0000	11.38	0.20920	0.0	54.40	0.00	103.12	24.74	7.34	3.75
6.3333	11.61	0.20920	0.0	55.51	0.00	109.71	25.78	7.50	3.83
4.6667	11.85	0.20920	0.0	56.63	0.00	116.57	26.85	7.65	3.90
3.0000	12.08	0.20920	0.0	57.74	0.00	123.72	27.93	7.80	3.98
1.6250	12.27	0.20920	0.0	58.66	0.00	129.82	28.85	7.93	4.05
0.2500	12.47	0.20920	0.0	59.58	0.00	136.13	29.77	8.05	4.11
0.2500	12.47	0.20920	100.0	59.58	0.00	151.03	31.40	8.05	4.33
0.0000	12.50	0.20920	100.0	59.75	0.00	152.32	31.57	8.08	4.34

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Forces and Moments (Strength I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	147.08	0.00	1,155.04	0.00	20,046.45	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Resistances (Strength I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.19	147	1,155	20,046	34,121	126,535	108,435

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.01	8.33	0.29	89.54	44.77

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.09	3,286.19	37,967.65	45	14.06

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Forces and Moments (Strength I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
18.00	-0.69	0.00	46.24	0.00	-1.38	0.00	0.00
15.00	-18.48	0.00	1,298.81	0.00	-20,556.35	0.00	0.00
0.25	-1.25	0.00	1,786.21	0.00	-20,703.06	0.00	0.00
0.25	-0.15	0.00	1,786.21	0.00	-20,703.06	0.00	0.00
0.00	-0.15	0.00	1,795.07	0.00	-20,703.10	0.00	0.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Pole: Resistances (Strength I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
18.00	0.00	46.24	0.69	1.38	0.00	320,659.76	100,584.85	77,767.29	83,091.70
15.00	0.25	1,298.81	18.48	20,556.35	0.00	324,325.21	104,908.51	83,958.59	90,388.67
0.25	0.18	1,786.21	1.25	20,703.06	0.00	173,360.15	126,166.51	117,798.75	130,731.65
0.25	0.18	1,786.21	0.15	20,703.06	0.00	169,008.29	119,577.55	118,054.75	128,884.58
0.00	0.18	1,795.07	0.15	20,703.10	0.00	166,247.59	119,919.04	118,678.37	129,621.77

* These heights are above the pole base plate.

Baseplate Analysis (Strength I) - Pole1 - Pole

Combined Force Interaction	0.06
Critical Wind Direction *	0.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	14.370 (in)
Failure Line Start Coordinate (in)	(0.661, 9.500)
Failure Line End Coordinate in	(-9.500, -0.661)
Applied Bending Moment	2,184.82 ft-lb
Factored Bending Resistance	38,799.16 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
2	-10487	2.50	-2185

Anchor Bolts Analysis (Strength I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
0.00	0.10	4,360.05	0.00	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole Deflection Information: (Strength I)

Critical Wind Direction: 0.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
18.0000	-1.75	0.00	-0.85	0.00
16.5000	-1.48	0.00	-0.85	0.00
15.0000	-1.21	0.00	-0.85	0.00
14.0000	-1.04	0.00	-0.78	0.00
13.0000	-0.89	0.00	-0.71	0.00
11.3333	-0.66	0.00	-0.60	0.00
9.6667	-0.47	0.00	-0.49	0.00
8.0000	-0.31	0.00	-0.39	0.00
6.3333	-0.19	0.00	-0.30	0.00
4.6667	-0.10	0.00	-0.22	0.00
3.0000	-0.04	0.00	-0.13	0.00
1.6250	-0.01	0.00	-0.07	0.00
0.2500	0.00	0.00	-0.01	0.00
0.2500	0.00	0.00	-0.01	0.00
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
EXTREME I LIMIT STATE

Wind Velocity	120.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	36.58	381	
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	36.58	326	
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	36.58	602	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Arm: Forces and Moments (Extreme I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	9.57	2,659.62	973.14	2,558.56	16,864.01	54,294.57

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Resistances (Extreme I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.52	10	2,832	56,853	405,094	126,535	108,435

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.11	29.45	0.71	89.54	44.77

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.31	11,614.39	37,967.65	45	14.06

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	36.58	381
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	36.58	326
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	36.58	602
ATTCHMT. 4	20.0000	0.0000	2.19	1.00	0.90	0.85	36.55	80
18.0000	17.2474	0.0000	1.26	1.50	0.87	0.85	35.43	67
16.5000	15.7475	0.0000	1.29	1.50	0.86	0.85	34.88	67
15.0000	14.4989	0.0000	0.87	1.50	0.86	0.85	34.88	46
14.0000	13.4989	0.0000	0.88	1.50	0.86	0.85	34.88	46
13.0000	12.1637	0.0000	1.50	1.50	0.86	0.85	34.88	78
11.3333	10.4971	0.0000	1.53	1.50	0.86	0.85	34.88	80
9.6667	8.8305	0.0000	1.56	1.50	0.86	0.85	34.88	82
8.0000	7.1638	0.0000	1.60	1.50	0.86	0.85	34.88	84
6.3333	5.4972	0.0000	1.63	1.50	0.86	0.85	34.88	85
4.6667	3.8306	0.0000	1.66	1.50	0.86	0.85	34.88	87
3.0000	2.3107	0.0000	1.40	1.50	0.86	0.85	34.88	73
1.6250	0.9357	0.0000	1.42	1.50	0.86	0.85	34.88	74
0.2500	-0.4393	0.0000	1.42	1.50	0.86	0.85	34.88	74

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Pole: Forces and Moments (Extreme I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
18.00	-4.50	-80.86	38.81	161.73	-9.00	0.00	270.00
15.00	-149.58	-2,876.22	1,080.36	10,826.68	-17,314.55	54,538.21	270.00
0.25	-9.22	-3,592.59	1,577.82	58,592.78	-18,171.19	54,538.00	270.00
0.25	-1.02	-3,589.94	1,583.87	58,600.47	-18,143.03	54,539.12	270.00
0.00	-1.02	-3,594.02	1,591.67	59,498.46	-18,143.28	54,539.12	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Pole: Resistances (Extreme I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
18.00	0.00	38.81	80.99	161.98	0.00	320,659.76	100,584.85	77,767.29	83,091.70
15.00	0.64	1,080.36	2,880.11	20,420.84	54,538.21	324,325.21	104,908.51	83,958.59	90,388.67
0.25	0.73	1,577.82	3,592.60	61,345.79	54,538.00	173,360.15	126,166.51	117,798.75	130,731.65
0.25	0.73	1,583.87	3,589.94	61,344.80	54,539.12	169,008.29	119,577.55	118,054.75	128,884.58
0.00	0.74	1,591.67	3,594.02	62,203.26	54,539.12	166,247.59	119,919.04	118,678.37	129,621.77

* These heights are above the pole base plate.

Baseplate Analysis (Extreme I) - Pole1 - Pole

Combined Force Interaction	0.21
Critical Wind Direction *	245.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	14.370 (in)
Failure Line Start Coordinate (in)	(-9.500, 0.661)
Failure Line End Coordinate in	(0.661, -9.500)
Applied Bending Moment	8,282.79 ft-lb
Factored Bending Resistance	38,799.16 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-39757	2.50	-8283

Anchor Bolts Analysis (Extreme I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.63	25,008.18	8,042.66	39,763.76	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole Deflection Information: (Extreme I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
18.0000	-1.48	-3.25	-0.75	1.32
16.5000	-1.26	-2.83	-0.75	1.32
15.0000	-1.03	-2.41	-0.75	1.32
14.0000	-0.89	-2.14	-0.68	1.28
13.0000	-0.76	-1.87	-0.62	1.22
11.3333	-0.56	-1.46	-0.52	1.12
9.6667	-0.40	-1.08	-0.43	1.00
8.0000	-0.27	-0.76	-0.35	0.86
6.3333	-0.17	-0.48	-0.27	0.70
4.6667	-0.09	-0.27	-0.19	0.53
3.0000	-0.04	-0.11	-0.12	0.35
1.6250	-0.01	-0.03	-0.06	0.19
0.2500	0.00	0.00	-0.01	0.03
0.2500	0.00	0.00	-0.01	0.03
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
SERVICE I LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.00
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	14.67	153	
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	14.67	131	
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	14.67	242	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Arm: Forces and Moments (Service I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	97.78	1,067.61	916.75	1,029.75	15,903.35	21,821.06

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Resistances (Service I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.25	98	1,407	27,001	34,121	126,535	108,435

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.03	15.63	0.35	89.54	44.77

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.16	6,166.46	37,967.65	45	14.06

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	14.67	153
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	14.67	131
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	14.67	242
ATTCHMT. 4	20.0000	0.0000	2.19	1.00	0.90	0.85	14.66	32
18.0000	17.2474	0.0000	1.26	1.50	0.87	0.85	14.21	27
16.5000	15.7475	0.0000	1.29	1.50	0.86	0.85	13.99	27
15.0000	14.4989	0.0000	0.87	1.50	0.86	0.85	13.99	18
14.0000	13.4989	0.0000	0.88	1.50	0.86	0.85	13.99	19
13.0000	12.1637	0.0000	1.50	1.50	0.86	0.85	13.99	31
11.3333	10.4971	0.0000	1.53	1.50	0.86	0.85	13.99	32
9.6667	8.8305	0.0000	1.56	1.50	0.86	0.85	13.99	33
8.0000	7.1638	0.0000	1.60	1.50	0.86	0.85	13.99	34
6.3333	5.4972	0.0000	1.63	1.50	0.86	0.85	13.99	34
4.6667	3.8306	0.0000	1.66	1.50	0.86	0.85	13.99	35
3.0000	2.3107	0.0000	1.40	1.50	0.86	0.85	13.99	29
1.6250	0.9357	0.0000	1.42	1.50	0.86	0.85	13.99	30
0.2500	-0.4393	0.0000	1.42	1.50	0.86	0.85	13.99	30

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Forces and Moments (Service I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
18.00	-1.08	-32.44	36.69	64.88	-2.16	0.00	270.00
15.00	-33.63	-1,154.37	1,029.02	4,352.13	-16,310.81	21,918.22	270.00
0.25	-2.13	-1,441.26	1,429.92	23,508.56	-16,524.37	21,918.15	270.00
0.25	-0.24	-1,440.30	1,430.90	23,511.37	-16,519.83	21,918.56	270.00
0.00	-0.24	-1,441.94	1,437.99	23,871.65	-16,519.89	21,918.56	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Pole: Resistances (Service I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
18.00	0.00	36.69	32.46	64.92	0.00	320,659.76	100,584.85	77,767.29	83,091.70
15.00	0.27	1,029.02	1,154.86	16,881.46	21,918.22	324,325.21	104,908.51	83,958.59	90,388.67
0.25	0.25	1,429.92	1,441.27	28,735.12	21,918.15	173,360.15	126,166.51	117,798.75	130,731.65
0.25	0.25	1,430.90	1,440.30	28,734.81	21,918.56	169,008.29	119,577.55	118,054.75	128,884.58
0.00	0.25	1,437.99	1,441.94	29,030.37	21,918.56	166,247.59	119,919.04	118,678.37	129,621.77

* These heights are above the pole base plate.

Baseplate Analysis (Service I) - Pole1 - Pole

Combined Force Interaction	0.11
Critical Wind Direction *	240.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	14.370 (in)
Failure Line Start Coordinate (in)	(-9.500, 0.661)
Failure Line End Coordinate in	(0.661, -9.500)
Applied Bending Moment	4,310.25 ft-lb
Factored Bending Resistance	38,799.16 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-20689	2.50	-4310

Anchor Bolts Analysis (Service I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.28	11,985.62	3,232.05	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole Deflection Information: (Service I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
18.0000	-1.39	-1.30	-0.68	0.53
16.5000	-1.18	-1.14	-0.68	0.53
15.0000	-0.96	-0.97	-0.68	0.53
14.0000	-0.83	-0.86	-0.62	0.51
13.0000	-0.71	-0.75	-0.57	0.49
11.3333	-0.52	-0.58	-0.48	0.45
9.6667	-0.37	-0.43	-0.39	0.40
8.0000	-0.25	-0.30	-0.32	0.34
6.3333	-0.15	-0.19	-0.24	0.28
4.6667	-0.08	-0.11	-0.17	0.21
3.0000	-0.03	-0.04	-0.11	0.14
1.6250	-0.01	-0.01	-0.06	0.08
0.2500	0.00	0.00	-0.01	0.01
0.2500	0.00	0.00	-0.01	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
ICE LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	14.67	153	
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	14.67	131	
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	14.67	242	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Forces and Moments (Ice)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	175.13	1,072.57	1,667.91	1,036.37	31,782.57	21,963.30

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Arm: Resistances (Ice)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.36	175	1,983	38,633	34,121	126,535	108,435

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.06	22.28	0.50	89.54	44.77

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.23	8,788.87	37,967.65	45	14.06

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	18.0000	8.67	1.20	0.90	0.85	14.67	153
ATTCHMT. 2	20.0000	22.0000	7.50	1.19	0.90	0.85	14.67	131
ATTCHMT. 3	20.0000	30.0000	13.72	1.20	0.90	0.85	14.67	242
ATTCHMT. 4	20.0000	0.0000	2.19	1.00	0.90	0.85	14.66	32
18.0000	17.2474	0.0000	1.26	1.50	0.87	0.85	14.21	27
16.5000	15.7475	0.0000	1.29	1.50	0.86	0.85	13.99	27
15.0000	14.4989	0.0000	0.87	1.50	0.86	0.85	13.99	18
14.0000	13.4989	0.0000	0.88	1.50	0.86	0.85	13.99	19
13.0000	12.1637	0.0000	1.50	1.50	0.86	0.85	13.99	31
11.3333	10.4971	0.0000	1.53	1.50	0.86	0.85	13.99	32
9.6667	8.8305	0.0000	1.56	1.50	0.86	0.85	13.99	33
8.0000	7.1638	0.0000	1.60	1.50	0.86	0.85	13.99	34
6.3333	5.4972	0.0000	1.63	1.50	0.86	0.85	13.99	34
4.6667	3.8306	0.0000	1.66	1.50	0.86	0.85	13.99	35
3.0000	2.3107	0.0000	1.40	1.50	0.86	0.85	13.99	29
1.6250	0.9357	0.0000	1.42	1.50	0.86	0.85	13.99	30
0.2500	-0.4393	0.0000	1.42	1.50	0.86	0.85	13.99	30

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole: Forces and Moments (Ice)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
18.00	-2.29	-32.74	69.28	65.47	-4.58	0.00	270.00
15.00	-64.06	-1,159.77	1,850.57	4,383.62	-32,525.53	22,059.72	270.00
0.25	-4.05	-1,440.16	2,441.69	23,644.70	-32,974.19	22,059.57	270.00
0.25	-0.46	-1,438.50	2,442.67	23,650.35	-32,969.59	22,060.38	270.00
0.00	-0.46	-1,440.14	2,453.21	24,010.18	-32,969.71	22,060.38	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH

Folder: 568086 File: P18CM35A15120

Pole: Resistances (Ice)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
18.00	0.00	69.28	32.82	65.63	0.00	320,659.76	100,584.85	77,767.29	83,091.70
15.00	0.46	1,850.57	1,161.54	32,819.61	22,059.72	324,325.21	104,908.51	83,958.59	90,388.67
0.25	0.35	2,441.69	1,440.17	40,575.47	22,059.57	173,360.15	126,166.51	117,798.75	130,731.65
0.25	0.35	2,442.67	1,438.50	40,575.03	22,060.38	169,008.29	119,577.55	118,054.75	128,884.58
0.00	0.35	2,453.21	1,440.14	40,785.91	22,060.38	166,247.59	119,919.04	118,678.37	129,621.77

* These heights are above the pole base plate.

Baseplate Analysis (Ice) - Pole1 - Pole

Combined Force Interaction	0.16
Critical Wind Direction *	245.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	14.370 (in)
Failure Line Start Coordinate (in)	(-9.500, 0.661)
Failure Line End Coordinate in	(0.661, -9.500)
Applied Bending Moment	6,026.38 ft-lb
Factored Bending Resistance	38,799.16 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-28927	2.50	-6026

Anchor Bolts Analysis (Ice) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.37	15,458.14	3,252.12	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Pole Deflection Information: (Ice)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
18.0000	-2.78	-1.32	-1.36	0.54
16.5000	-2.35	-1.15	-1.36	0.53
15.0000	-1.93	-0.98	-1.36	0.53
14.0000	-1.66	-0.87	-1.24	0.52
13.0000	-1.41	-0.76	-1.13	0.49
11.3333	-1.05	-0.59	-0.95	0.45
9.6667	-0.75	-0.44	-0.78	0.40
8.0000	-0.50	-0.31	-0.63	0.35
6.3333	-0.31	-0.20	-0.48	0.28
4.6667	-0.16	-0.11	-0.34	0.22
3.0000	-0.07	-0.05	-0.21	0.14
1.6250	-0.02	-0.01	-0.11	0.08
0.2500	0.00	0.00	-0.02	0.01
0.2500	0.00	0.00	-0.02	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
FATIGUE II LIMIT STATE

Galloping	No
Natural Wind Gust (11.2 mph)	Yes
Truck-Induced Gust (65.0 mph)	No
Importance Factor	II

Mast Arm: Fatigue Analysis (Fatigue II)

Analysis Location			Design Load	Comb. Force Inter.	Moment (ft-lb)	Shear force (lb)	Shear Stress (ksi)	Applied Bending Stress (ksi)	Allowable Stress (ksi)
Arm Type	Arm No.	Site							
MA	1	BASE	NATURAL WIND GUST	0.85	6,225.84	306	0.09	3.82	4.50

Mast Arm: Deflections (Fatigue II)

Arm Type	Arm No.	Load Case	Max Vertical Deflection (in)
MA	1	NATURAL WIND GUST	0.79

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Fatigue Analysis of Signal and Sign / Pole Connection: Arm

Arm Type	Arm No.	Component	Load	Stress Ratio	Applied Stress (ksi)	Allowable Stress (ksi)
MA	1	SIMPLEX BOLT	NATURAL WIND GUST	0.38	2.66	7.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120

Analysis of Pole (Fatigue II)

Section Height* (ft)	Design Load	Comb. Force Inter.	Moment (ft-lb)	Applied Bending Stress (ksi)	Allowable Bending Stress (ksi)	Deflection (in)
0.00	NATURAL WIND GUST	0.74	6,851.60	3.32	4.50	0.00

* These heights are above the pole base plate.

Tube to Transverse Plate CAFT Calculation Details

	Pole to Baseplate Weld	Arm M35 Shaft to Simplex Plate Weld
Weld type	Socket	Socket
Tt(in)	0.20920	0.23910
Dt(in)	12.50	11.00
Ttp(in)	2.00	2.00
Dbc(in)	17.50	20.51
CBC	1.40	1.86
Dop(in)	N/A	N/A
COP	N/A	N/A
NS	0.00	0.00
RRb(in)	N/A	N/A
Multisided Factor	N/A	N/A
Kf	2.65	2.87
Ki	5.46	6.12
CAFT (ksi)	4.50	4.50

NOTE: The maximum bolt circle is used for bolt patterns where all the bolts do not lie on a single circle, per AASHTO.

Fatigue Analysis of Anchor Bolts (NATURAL WIND GUST)

Load Case	Combined Stress Ratio	Axial (lb)
NATURAL WIND GUST	0.27	3,556.82

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: SE70 11/15/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A,B,C,D, P18' CM35' AASHTO 2015 120MPH
Folder: 568086 File: P18CM35A15120
Opening Group on the Pole

Description	Attachment Height (ft)	Clear Opening (in)			Reinforcement (in)		
		Width	Height	Inside Corner Radius	Rim Thickness	Rim Depth	Rim Projection
STD HH	2.00	4.48	7.00	2.52	0.28	2.50	0.50

Description	Location On Pole (ft)	Orientation (deg)	Tube Diam. (in)	Tube Thick. (in)	Area (in2)	X Centroid (in)	Y Centroid (in)	Ix(in4)	Ix(in4)
STD HH	2.00	0.00	12.22	0.21	8.25	0.15	0.00	149	148

		Stress at Root		Stress at Toe		
Description	Moment (ft-lb)	Actual (ksi)	Resist (ksi)	Actual (ksi)	Resist (ksi)	Max CSR
NATURAL WIND GUST	4,307.74	7.55	16.00	1.89	7.00	0.47

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Design Criteria

Design Code	AASHTO-2015	Fatigue Category	2
Ultimate Wind Speed (mph)	120.0	Truck Gust	No
Mean Recurrence Interval	700	Galloping	No
Service Level Wind Speed (mph)	76.0	Natural Wind Gust	Yes
AASHTO Ice Included ?	Yes		

Design Summary - Pole

Height (ft)	Shaft Weight (lb)	Ground Line Diameter (in)	Top Dia. (in)
22.0000	1136	17.00	13.920

Section Characteristics

	Section - 1
Shape	16 Sharp Flutes
Top Dia. (in)	13.920
Base Diameter (in)	17.000
Thickness (in)	0.31250
Length (ft)	22.00
Shaft Weight (lb)	1136
Assembly Weight (lb)	1708
Taper (in/ft)	0.14000
Yield Strength (ksi)	55.00
Material	S220 - A572

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Base Plate

Shape	Square
Material	S70 - A36
Width (in)	24.000
Thickness (in)	2.50000
Yield Strength (ksi)	36.00
Base Weld Type	SOCKET
Weight (lb)	219

Anchor Bolts

Material	S100 - F1554
Bolt diameter (in)	2.25
Bolt circle diameter (in)	23.50
Quantity	4
Yield Strength (ksi)	55.00
Tensile strength (ksi)	75

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Design Summary - Arms

Signal and Sign	Arm 1	Arm 2
Shape	Round	Round
Span Length (ft)	75.0000	45.0000
Taper (in/ft)	0.14000	0.14000
Attachment Height (ft)	20.00	20.00
Orientation (deg)	180.00	270.00
Slope at Base (deg)	0.00	0.00
Centroid Location		
Horizontal (ft)	31.5284	19.8305
Above Attachment (ft)	0.0000	0.0000
Unbent Length (ft)	75.0000	45.0000
Material-Base	S220 - 55 ksi	S105 - 55 ksi
Weight (lb)	2779	990
Base Section		
Base O.D. (in)	15.50	12.00
Thickness (in)	0.37500	0.23910
Length (ft)	45.0059	45.0000
Yield Strength (ksi)	55.00	55.00
Material	S220	S105
Joint Type	Slip Joint	
Overlap Length (ft)	2.3045	
Outer Section		
Base O.D. (in)	10.00	
Thickness (in)	0.23910	
Length (ft)	32.2986	
Yield Strength (ksi)	55.00	
Material	S105	

Base Weld Type = Socket

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Design Summary - Arms

Simplex Dimensions

	Arm 1	Arm 2
Connection Bolt Data		
Number of bolts	4	4
Bolt diameter (in)	1.50	1.50
ASTM Specification	A325	A325
Horizontal Spacing (in)	20.00	20.00
Vertical Spacing (in)	20.00	20.00
Attachment Plate Data		
Horizontal Width (in)	26.00	26.00
Vertical Width (in)	26.00	26.00
Mast Arm Bracket Thickness (in)	3.50	3.50
Arm Plate Bracket Weight (lb)	292	327
Pole Plate Bracket Thickness (in)	2.00	2.00
Pole Plate Bracket Weight (lb)	167	187
Yield Strength (ksi)	36.00	36.00
Vertical Gusset Thickness (in)	0.5000	0.5000
Horizontal Gusset Thickness (in)	0.5000	0.5000

Attachment Type

Arm 1:	SIMPLEX - THRU BOLTS, Base Weld Type = Socket
Arm 2:	SIMPLEX - THRU BOLTS, Base Weld Type = Socket

** These heights are above bottom of base plate or transformer base.
Elliptical cross section; first diameter is horizontal.
** Arm orientations are angles from +X axis in X-Y plane.
X and Y axies are perpendicular/parallel to sides of pole base plate. See *** below.
*** If arm is attached with a clamp, height and orientation must not be changed
from values shown above without consulting Valmont.
Nice to have:
**** Assembly weight includes unfinished shaft + flange + simplex plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Description of Sign Loading

Position of Signal or Sign	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Sign Weight (lb)	Sign Width (ft)	Sign Depth (ft)	Sign Cd
Mast Arm 1	20.0000	20.0000	52.0000	21	7.0000	1.5000	1.20
Mast Arm 1	20.0000	20.0000	64.0000	15	2.5000	3.0000	1.19
Mast Arm 2	20.0000	20.0000	34.0000	27	9.0000	1.5000	1.23

Description of Signal Loading

Position of Signal	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Signal Weight (lb)	Vertical Plane (ft2)	Horizontal Plane (ft2)
Arm 1	20.0000	20.0000	46.0000	62	11.20	1.80
Arm 1	20.0000	20.0000	58.0000	50	8.67	1.80
Arm 1	20.0000	20.0000	70.0000	50	8.67	1.80
Arm 2	20.0000	20.0000	28.0000	50	8.67	1.80
Arm 2	20.0000	20.0000	40.0000	50	8.67	1.80

THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED
WITHOUT CONSULTING VALMONT.
ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE
SPECIFYING AGENCY HAVE
BEEN ESTIMATED BY VALMONT.
** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR
TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

RESULTS SUMMARY - Pole

Maximum Combined Force Interaction In Each Major Component	
Strength I	
Pole CFI (At 20.00 (ft))	0.52
Signal and Sign Arm 1 CFI	0.34
Signal and Sign Arm 2 CFI	0.24
Base Plate CFI	0.21
Anchor Bolts CFI	0.34
S/S Arm 1 Att. Bolts CFI	0.07
S/S Arm 1 Att. Plate CFI	0.11
S/S Pole 1 Att. Plate CFI	0.33
S/S Arm 2 Att. Bolts CFI	0.01
S/S Arm 2 Att. Plate CFI	0.03
S/S Pole 2 Att. Plate CFI	0.10
Deflection % (At 22.00 (ft))	1.591 %
Deflection (At 22.00 (ft))	4.20 in
Rotation (At 22.00 (ft))	1.81 deg
Extreme I	
Pole CFI (At 20.00 (ft))	0.83
Signal and Sign Arm 1 CFI	0.52
Signal and Sign Arm 2 CFI	0.50
Base Plate CFI	0.35
Anchor Bolts CFI	0.82
S/S Arm 1 Att. Bolts CFI	0.34
S/S Arm 1 Att. Plate CFI	0.23
S/S Pole 1 Att. Plate CFI	0.69
S/S Arm 2 Att. Bolts CFI	0.04
S/S Arm 2 Att. Plate CFI	0.08
S/S Pole 2 Att. Plate CFI	0.26
Deflection % (At 22.00 (ft))	1.700 %
Deflection (At 22.00 (ft))	4.49 in
Rotation (At 22.00 (ft))	1.81 deg
Service I	
Pole CFI (At 20.00 (ft))	0.49
Signal and Sign Arm 1 CFI	0.33
Signal and Sign Arm 2 CFI	0.27
Base Plate CFI	0.24
Anchor Bolts CFI	0.44
S/S Arm 1 Att. Bolts CFI	0.13
S/S Arm 1 Att. Plate CFI	0.14
S/S Pole 1 Att. Plate CFI	0.43
S/S Arm 2 Att. Bolts CFI	0.01
S/S Arm 2 Att. Plate CFI	0.05
S/S Pole 2 Att. Plate CFI	0.15
Deflection % (At 22.00 (ft))	1.371 %
Deflection (At 22.00 (ft))	3.62 in
Rotation (At 22.00 (ft))	1.52 deg

Maximum Reactions Applied To Foundation		
Bending Moment		197238 ft-lb
Torsion		150183 ft-lb
Shear Force		5347 lb
Axial Force		8079 lb
Ice		
Pole CFI (At 20.00 (ft))	0.76	
Signal and Sign Arm 1 CFI	0.48	
Signal and Sign Arm 2 CFI	0.40	
Base Plate CFI	0.35	
Anchor Bolts CFI	0.63	
S/S Arm 1 Att. Bolts CFI	0.26	
S/S Arm 1 Att. Plate CFI	0.20	
S/S Pole 1 Att. Plate CFI	0.61	
S/S Arm 2 Att. Bolts CFI	0.03	
S/S Arm 2 Att. Plate CFI	0.07	
S/S Pole 2 Att. Plate CFI	0.22	
Deflection % (At 22.00 (ft))		2.216 %
Deflection (At 22.00 (ft))	5.85 in	
Rotation (At 22.00 (ft))	2.48 deg	
Fatigue II		
Pole (At 0.00 (ft))		0.56
Hand Hole / Opening		0.46
Signal and Sign Arm 1		
Arm Tube		0.90
Simplex Bolts		0.69
Signal and Sign Arm 2		
Arm Tube		0.85
Simplex Bolts		0.25
Anchor Bolts		0.26

SHAFT PROPERTIES: NUMBER OF SIDES = 16 Sharp Flutes
DIAMETER (D) = 17.000 IN
THICKNESS (T) = 0.31250 IN
YIELD STRENGTH (KSI) = 55
MOM. OF INERTIA (IX) = 513.335 IN^4
SECTION MODULUS (SX) = 60.392 IN^3

MN: ALLOWABLE SHAFT MOMENT
MB = (Fb * Sx) / 12
= (55000 * 60.392 / 12 = 276798
MB = 276798 FT-LB

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole Properties

Height (ft)	Diameter (in)	Wall Thk. (in)	Roundness Ratio (%)	D/t	B/T	Moments of Inertia (in4)	Plastic Section Modulus (in3)	Area (in2)	Radius of Gyration (in)
22.0000	13.92	0.31250	0.0	44.54	0.00	278.60	54.85	13.36	4.57
20.0000	14.20	0.31250	0.0	45.44	0.00	296.12	57.13	13.63	4.66
18.5000	14.41	0.31250	0.0	46.11	0.00	309.73	58.87	13.84	4.73
17.0000	14.62	0.31250	0.0	46.78	0.00	323.76	60.63	14.05	4.80
15.3333	14.85	0.31250	0.0	47.53	0.00	339.83	62.63	14.28	4.88
13.6667	15.09	0.31250	0.0	48.28	0.00	356.43	64.65	14.50	4.96
12.0000	15.32	0.31250	0.0	49.02	0.00	373.56	66.71	14.73	5.04
10.3333	15.55	0.31250	0.0	49.77	0.00	391.22	68.79	14.96	5.11
8.6667	15.79	0.31250	0.0	50.52	0.00	409.44	70.91	15.19	5.19
7.0000	16.02	0.31250	0.0	51.26	0.00	428.21	73.07	15.42	5.27
5.3333	16.25	0.31250	0.0	52.01	0.00	447.55	75.25	15.65	5.35
3.6667	16.49	0.31250	0.0	52.76	0.00	467.47	77.47	15.88	5.43
2.0000	16.72	0.31250	0.0	53.50	0.00	487.96	79.72	16.11	5.50
0.2500	16.97	0.31250	0.0	54.29	0.00	510.12	82.11	16.35	5.59
0.2500	16.97	0.31250	100.0	54.29	0.00	565.93	86.58	16.34	5.88
0.0000	17.00	0.31250	100.0	54.40	0.00	569.50	86.95	16.38	5.90

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Arm: Forces and Moments (Strength I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	127.57	30.69	3,791.38	0.00	116,042.72	939.27
SIGNAL	1	SPLICE-I	82.90	9.28	1,145.89	0.00	15,223.59	123.22
SIGNAL	1	SPLICE-O	71.19	7.84	968.61	0.00	12,787.04	103.50
SIGNAL	2	BASE	13.80	43.66	1,432.12	0.00	30,559.89	931.60

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Resistances (Strength I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.34	128	3,792	116,047	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.12	83	1,146	15,224	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.15	71	969	12,787	350,828	105,248	85,888
SIGNAL	2	BASE	0.24	14	1,433	30,574	437,164	131,149	127,863

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.07	35.13	0.95	128.93	64.47
2	0.01	9.45	0.36	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.11	18,628.63	175,406.64	45	21.21
2	0.03	6,395.20	204,449.26	45	24.73

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole: Forces and Moments (Strength I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-155.13	-41.19	5,344.16	31,408.21	-118,289.83	0.00	0.00
0.25	-8.70	-2.31	6,660.65	31,831.87	-119,885.43	0.00	0.00
0.25	-0.87	-0.23	6,660.65	31,831.87	-119,885.43	0.00	0.00
0.00	-0.88	-0.23	6,678.44	31,831.93	-119,885.65	0.00	0.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Resistances (Strength I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.52	5,344.16	160.50	122,388.56	0.00	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.38	6,660.65	9.00	124,039.44	0.00	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.38	6,660.65	0.90	124,039.44	0.00	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.38	6,678.44	0.91	124,039.67	0.00	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Strength I) - Pole1 - Pole

Combined Force Interaction	0.21
Critical Wind Direction *	0.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	15,288.85 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-56451	3.25	-15289

Anchor Bolts Analysis (Strength I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
0.00	0.34	14,197.70	0.00	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole Deflection Information: (Strength I)

Critical Wind Direction: 0.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-4.06	-1.08	-1.75	0.46
20.0000	-3.33	-0.88	-1.75	0.46
18.5000	-2.81	-0.75	-1.58	0.42
17.0000	-2.34	-0.62	-1.42	0.38
15.3333	-1.87	-0.50	-1.25	0.33
13.6667	-1.46	-0.39	-1.09	0.29
12.0000	-1.11	-0.29	-0.93	0.25
10.3333	-0.81	-0.22	-0.78	0.21
8.6667	-0.56	-0.15	-0.64	0.17
7.0000	-0.36	-0.10	-0.51	0.13
5.3333	-0.21	-0.05	-0.38	0.10
3.6667	-0.10	-0.03	-0.25	0.07
2.0000	-0.03	-0.01	-0.13	0.04
0.2500	0.00	0.00	-0.02	0.00
0.2500	0.00	0.00	-0.02	0.00
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
EXTREME I LIMIT STATE

Wind Velocity	120.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	36.56	491	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	36.56	461	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	36.56	380	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	36.56	326	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	36.56	380	

Mast Arm 2: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	36.56	380	
ATTCHMT. 7	20.0000	34.0000	13.50	1.23	0.90	0.85	36.56	607	
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	36.56	380	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Forces and Moments (Extreme I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	260.45	3,150.88	3,280.22	10.17	99,202.20	150,279.89
SIGNAL	1	SPLICE-I	336.88	2,341.75	960.17	0.00	12,685.61	33,618.66
SIGNAL	1	SPLICE-O	333.67	2,338.81	803.84	0.04	10,652.65	28,224.50
SIGNAL	2	BASE	53.58	2,023.33	1,191.37	0.97	24,834.34	59,486.90

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Resistances (Extreme I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.52	260	4,548	180,070	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.28	337	2,531	35,932	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.35	334	2,473	30,168	350,828	105,248	85,888
SIGNAL	2	BASE	0.50	54	2,348	64,463	437,164	131,149	127,863

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Arm Connection Analysis (Extreme I)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.34	74.91	1.14	128.93	64.47
2	0.04	25.31	0.59	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.23	39,726.88	175,406.64	45	21.21
2	0.08	17,126.54	204,449.26	45	24.73

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	36.56	491
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	36.56	461
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	36.56	326
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 7	20.0000	34.0000	0.00	1.23	0.90	0.85	36.56	0
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	36.56	380
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	36.93	130
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	36.26	97
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	35.65	97
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	34.95	107
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	34.88	109
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	34.88	110
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	34.88	112
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	34.88	114
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	34.88	116
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	34.88	117
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	34.88	119
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	34.88	121
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	34.88	128
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	34.88	128

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole: Forces and Moments (Extreme I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-302.56	-4,063.10	4,634.97	27,029.69	-101,145.12	150,162.33	270.00
0.25	-17.38	-5,345.61	5,870.29	120,703.89	-103,683.83	150,162.36	270.00
0.25	-1.50	-5,338.91	5,876.41	120,743.68	-103,631.49	150,166.49	270.00
0.00	-1.51	-5,344.47	5,892.06	122,079.10	-103,631.87	150,166.49	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Resistances (Extreme I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.83	4,634.97	4,074.35	104,694.51	150,162.33	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.69	5,870.29	5,345.64	159,121.86	150,162.36	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.69	5,876.41	5,338.91	159,117.95	150,166.49	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.69	5,892.06	5,344.47	160,133.92	150,166.49	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Extreme I) - Pole1 - Pole

Combined Force Interaction	0.35
Critical Wind Direction *	225.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	24,836.34 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-91703	3.25	-24836

Anchor Bolts Analysis (Extreme I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.82	29,652.79	9,883.22	36,312.72	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole Deflection Information: (Extreme I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-3.47	-2.85	-1.51	1.00
20.0000	-2.85	-2.42	-1.51	1.00
18.5000	-2.40	-2.10	-1.37	0.95
17.0000	-2.00	-1.80	-1.23	0.91
15.3333	-1.60	-1.49	-1.08	0.84
13.6667	-1.25	-1.20	-0.94	0.77
12.0000	-0.95	-0.94	-0.81	0.70
10.3333	-0.70	-0.70	-0.68	0.62
8.6667	-0.48	-0.50	-0.56	0.53
7.0000	-0.31	-0.33	-0.44	0.44
5.3333	-0.18	-0.19	-0.33	0.34
3.6667	-0.08	-0.09	-0.22	0.24
2.0000	-0.02	-0.03	-0.12	0.13
0.2500	0.00	0.00	-0.01	0.02
0.2500	0.00	0.00	-0.01	0.02
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
SERVICE I LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.00
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153	

Mast Arm 2: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 7	20.0000	34.0000	13.50	1.23	0.90	0.85	14.66	243	
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	14.66	153	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Forces and Moments (Service I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	111.17	1,371.81	3,018.74	3.71	92,143.95	63,851.36
SIGNAL	1	SPLICE-I	100.53	975.92	905.77	0.00	12,019.07	14,049.68
SIGNAL	1	SPLICE-O	94.06	974.50	763.80	0.02	10,095.20	11,802.18
SIGNAL	2	BASE	17.08	913.64	1,121.29	0.34	23,746.38	25,928.25

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Arm: Resistances (Service I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.33	111	3,316	112,105	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.14	101	1,331	18,489	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.18	94	1,238	15,531	350,828	105,248	85,888
SIGNAL	2	BASE	0.27	17	1,446	35,159	437,164	131,149	127,863

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm Connection Analysis (Service I)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.13	46.83	0.83	128.93	64.47
2	0.01	14.91	0.36	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.14	24,833.43	175,406.64	45	21.21
2	0.05	10,087.00	204,449.26	45	24.73

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 7	20.0000	34.0000	0.00	1.23	0.90	0.85	14.66	0
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	14.66	153
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	14.81	52
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	14.55	39
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	14.30	39
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	14.02	43
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	13.99	44
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	13.99	44
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	13.99	45
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	13.99	46
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	13.99	46
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	13.99	47
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	13.99	48
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	13.99	48
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	13.99	52
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	13.99	52

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Forces and Moments (Service I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-132.02	-1,740.98	4,258.25	24,968.31	-93,929.52	63,838.99	270.00
0.25	-7.43	-2,241.66	5,330.67	64,584.38	-95,128.92	63,839.02	270.00
0.25	-0.69	-2,238.38	5,332.05	64,599.91	-95,117.30	63,840.61	270.00
0.00	-0.69	-2,240.61	5,346.28	65,159.78	-95,117.48	63,840.61	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Pole: Resistances (Service I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.49	4,258.25	1,745.98	97,191.41	63,838.99	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.36	5,330.67	2,241.67	114,981.10	63,839.02	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.35	5,332.05	2,238.38	114,980.21	63,840.61	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.35	5,346.28	2,240.61	115,295.84	63,840.61	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Service I) - Pole1 - Pole

Combined Force Interaction	0.24
Critical Wind Direction *	225.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	16,978.79 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-62691	3.25	-16979

Anchor Bolts Analysis (Service I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.44	18,624.86	4,200.24	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole Deflection Information: (Service I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-3.21	-1.66	-1.39	0.62
20.0000	-2.64	-1.40	-1.39	0.62
18.5000	-2.22	-1.21	-1.25	0.58
17.0000	-1.85	-1.03	-1.13	0.54
15.3333	-1.48	-0.84	-0.99	0.50
13.6667	-1.16	-0.67	-0.86	0.45
12.0000	-0.88	-0.52	-0.74	0.40
10.3333	-0.64	-0.39	-0.62	0.35
8.6667	-0.44	-0.28	-0.51	0.30
7.0000	-0.29	-0.18	-0.40	0.24
5.3333	-0.16	-0.11	-0.30	0.19
3.6667	-0.08	-0.05	-0.20	0.13
2.0000	-0.02	-0.01	-0.11	0.07
0.2500	0.00	0.00	-0.01	0.01
0.2500	0.00	0.00	-0.01	0.01
0.0000	0.00	0.00	0.00	0.00

Wind Velocity	76.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153	

Mast Arm 2: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 7	20.0000	34.0000	13.50	1.23	0.90	0.85	14.66	243	
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	14.66	153	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Forces and Moments (Ice)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	231.77	1,407.15	4,523.59	4.37	152,641.31	65,020.92
SIGNAL	1	SPLICE-I	223.51	989.14	1,740.68	0.00	23,725.63	14,220.26
SIGNAL	1	SPLICE-O	208.67	986.35	1,554.29	0.02	19,928.55	11,943.74
SIGNAL	2	BASE	35.35	964.68	1,895.63	0.42	43,788.91	27,164.22

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Arm: Resistances (Ice)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.48	232	4,737	165,913	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.21	224	2,002	27,661	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.27	209	1,841	23,234	350,828	105,248	85,888
SIGNAL	2	BASE	0.40	35	2,127	51,530	437,164	131,149	127,863

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Arm Connection Analysis (Ice)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.26	65.36	1.18	128.93	64.47
2	0.03	21.29	0.53	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.20	34,660.57	175,406.64	45	21.21
2	0.07	14,409.69	204,449.26	45	24.73

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 6	20.0000	28.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 7	20.0000	34.0000	0.00	1.23	0.90	0.85	14.66	0
ATTCHMT. 8	20.0000	40.0000	8.67	1.20	0.90	0.85	14.66	153
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	14.81	52
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	14.55	39
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	14.30	39
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	14.02	43
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	13.99	44
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	13.99	44
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	13.99	45
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	13.99	46
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	13.99	46
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	13.99	47
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	13.99	48
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	13.99	48
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	13.99	52
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	13.99	52

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole: Forces and Moments (Ice)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-286.41	-1,793.80	6,585.69	45,727.20	-155,316.31	63,792.03	270.00
0.25	-15.67	-2,241.07	8,049.13	86,121.33	-157,999.59	63,792.10	270.00
0.25	-1.44	-2,234.42	8,051.00	86,147.10	-157,984.47	63,794.74	270.00
0.00	-1.45	-2,236.65	8,070.33	86,705.99	-157,984.83	63,794.74	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole: Resistances (Ice)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.76	6,585.69	1,816.52	161,907.79	63,792.03	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.56	8,049.13	2,241.13	179,946.53	63,792.10	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.55	8,051.00	2,234.42	179,945.60	63,794.74	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.55	8,070.33	2,236.65	180,214.14	63,794.74	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Ice) - Pole1 - Pole

Combined Force Interaction	0.35
Critical Wind Direction *	230.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	25,311.06 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-93456	3.25	-25311

Anchor Bolts Analysis (Ice) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.63	26,459.19	4,197.10	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Pole Deflection Information: (Ice)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-5.33	-2.40	-2.30	0.93
20.0000	-4.37	-2.01	-2.30	0.93
18.5000	-3.69	-1.72	-2.08	0.86
17.0000	-3.07	-1.45	-1.87	0.80
15.3333	-2.46	-1.18	-1.65	0.72
13.6667	-1.92	-0.94	-1.43	0.65
12.0000	-1.46	-0.72	-1.23	0.57
10.3333	-1.07	-0.54	-1.03	0.49
8.6667	-0.74	-0.38	-0.85	0.41
7.0000	-0.47	-0.25	-0.67	0.33
5.3333	-0.27	-0.14	-0.50	0.25
3.6667	-0.13	-0.07	-0.33	0.17
2.0000	-0.04	-0.02	-0.18	0.09
0.2500	0.00	0.00	-0.02	0.01
0.2500	0.00	0.00	-0.02	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
FATIGUE II LIMIT STATE

Galloping	No
Natural Wind Gust (11.2 mph)	Yes
Truck-Induced Gust (65.0 mph)	No
Importance Factor	II

Mast Arm: Fatigue Analysis (Fatigue II)

Analysis Location			Design Load	Comb. Force Inter.	Moment (ft-lb)	Shear force (lb)	Shear Stress (ksi)	Applied Bending Stress (ksi)	Allowable Stress (ksi)
Arm Type	Arm No.	Site							
MA	1	BASE	NATURAL WIND GUST	0.90	22,681.81	532	0.06	4.04	4.50
MA	1	SP-I	NATURAL WIND GUST	0.19	4,652.32	320	0.06	2.27	12.00
MA	1	SP-O	NATURAL WIND GUST	0.23	3,914.86	320	0.09	2.81	12.00
MA	2	BASE	NATURAL WIND GUST	0.85	8,303.11	308	0.07	3.84	4.50

Mast Arm: Deflections (Fatigue II)

Arm Type	Arm No.	Load Case	Max Vertical Deflection (in)
MA	1	NATURAL WIND GUST	1.08
MA	2	NATURAL WIND GUST	0.87

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Fatigue Analysis of Signal and Sign / Pole Connection: Arm

Arm Type	Arm No.	Component	Load	Stress Ratio	Applied Stress (ksi)	Allowable Stress (ksi)
MA	1	SIMPLEX BOLT	NATURAL WIND GUST	0.69	4.83	7.00
MA	2	SIMPLEX BOLT	NATURAL WIND GUST	0.25	1.77	7.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH

Folder: 568086 File: P22M7545A15120

Analysis of Pole (Fatigue II)

Section Height* (ft)	Design Load	Comb. Force Inter.	Moment (ft-lb)	Applied Bending Stress (ksi)	Allowable Bending Stress (ksi)	Deflection (in)
0.00	NATURAL WIND GUST	0.56	14,247.63	2.50	4.50	0.00

* These heights are above the pole base plate.

Tube to Transverse Plate CAFT Calculation Details

	Pole to Baseplate Weld	Arm M75 Shaft to Simplex Plate Weld	Arm 45M Shaft to Simplex Plate Weld
Weld type	Socket	Socket	Socket
Tt(in)	0.31250	0.37500	0.23910
Dt(in)	17.00	15.50	12.00
Ttp(in)	2.50	3.50	3.50
Dbc(in)	23.50	28.28	28.28
CBC	1.38	1.82	2.36
Dop(in)	N/A	N/A	N/A
COP	N/A	N/A	N/A
NS	0.00	0.00	0.00
RRb(in)	N/A	N/A	N/A
Multisided Factor	N/A	N/A	N/A
Kf	2.81	2.67	2.48
Ki	6.35	6.30	5.18
CAFT (ksi)	4.50	4.50	4.50

NOTE: The maximum bolt circle is used for bolt patterns where all the bolts do not lie on a single circle, per AASHTO.

Fatigue Analysis of Anchor Bolts (NATURAL WIND GUST)

Load Case	Combined Stress Ratio	Axial (lb)
NATURAL WIND GUST	0.26	5,969.05

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE A, P22' M75' & M45' AASHTO 2015 120MPH
Folder: 568086 File: P22M7545A15120
Opening Group on the Pole

Description	Attachment Height (ft)	Clear Opening (in)			Reinforcement (in)		
		Width	Height	Inside Corner Radius	Rim Thickness	Rim Depth	Rim Projection
STD HH	2.00	4.48	7.00	2.52	0.28	2.50	0.50

Description	Location On Pole (ft)	Orientation (deg)	Tube Diam. (in)	Tube Thick. (in)	Area (in2)	X Centroid (in)	Y Centroid (in)	Ix(in4)	Ix(in4)
STD HH	2.00	0.00	16.72	0.31	16.00	-0.13	0.00	552	525

		Stress at Root		Stress at Toe		
Description	Moment (ft-lb)	Actual (ksi)	Resist (ksi)	Actual (ksi)	Resist (ksi)	Max CSR
NATURAL WIND GUST	9,590.03	7.42	16.00	1.85	7.00	0.46

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Design Criteria

Design Code	AASHTO-2015	Fatigue Category	2
Ultimate Wind Speed (mph)	120.0	Truck Gust	No
Mean Recurrence Interval	700	Galloping	No
Service Level Wind Speed (mph)	76.0	Natural Wind Gust	Yes
AASHTO Ice Included ?	Yes		

Design Summary - Pole

Height (ft)	Shaft Weight (lb)	Ground Line Diameter (in)	Top Dia. (in)
22.0000	1136	17.00	13.920

Section Characteristics

	Section - 1
Shape	16 Sharp Flutes
Top Dia. (in)	13.920
Base Diameter (in)	17.000
Thickness (in)	0.31250
Length (ft)	22.00
Shaft Weight (lb)	1136
Assembly Weight (lb)	1703
Taper (in/ft)	0.14000
Yield Strength (ksi)	55.00
Material	S220 - A572

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Base Plate

Shape	Square
Material	S70 - A36
Width (in)	24.000
Thickness (in)	2.50000
Yield Strength (ksi)	36.00
Base Weld Type	SOCKET
Weight (lb)	219

Anchor Bolts

Material	S100 - F1554
Bolt diameter (in)	2.25
Bolt circle diameter (in)	23.50
Quantity	4
Yield Strength (ksi)	55.00
Tensile strength (ksi)	75

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Design Summary - Arms

Signal and Sign	Arm 1	Arm 2
Shape	Round	Round
Span Length (ft)	75.0000	55.0000
Taper (in/ft)	0.14000	0.14000
Attachment Height (ft)	20.00	20.00
Orientation (deg)	180.00	270.00
Slope at Base (deg)	0.00	0.00
Centroid Location		
Horizontal (ft)	31.5284	23.8110
Above Attachment (ft)	0.0000	0.0000
Unbent Length (ft)	75.0000	55.0000
Material-Base	S220 - 55 ksi	S105 - 55 ksi
Weight (lb)	2779	1235
Base Section		
Base O.D. (in)	15.50	13.00
Thickness (in)	0.37500	0.23910
Length (ft)	45.0059	50.0000
Yield Strength (ksi)	55.00	55.00
Material	S220	S105
Joint Type	Slip Joint	Slip Joint
Overlap Length (ft)	2.3045	1.8975
Outer Section		
Base O.D. (in)	10.00	6.50
Thickness (in)	0.23910	0.11960
Length (ft)	32.2986	6.8975
Yield Strength (ksi)	55.00	55.00
Material	S105	S105

Base Weld Type = Socket

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Design Summary - Arms

Simplex Dimensions

	Arm 1	Arm 2
Connection Bolt Data		
Number of bolts	4	4
Bolt diameter (in)	1.50	1.50
ASTM Specification	A325	A325
Horizontal Spacing (in)	20.00	20.00
Vertical Spacing (in)	20.00	20.00
Attachment Plate Data		
Horizontal Width (in)	26.00	26.00
Vertical Width (in)	26.00	26.00
Mast Arm Bracket Thickness (in)	3.50	3.50
Arm Plate Bracket Weight (lb)	292	318
Pole Plate Bracket Thickness (in)	2.00	2.00
Pole Plate Bracket Weight (lb)	167	182
Yield Strength (ksi)	36.00	36.00
Vertical Gusset Thickness (in)	0.5000	0.5000
Horizontal Gusset Thickness (in)	0.5000	0.5000

Attachment Type

Arm 1:	SIMPLEX - THRU BOLTS, Base Weld Type = Socket
Arm 2:	SIMPLEX - THRU BOLTS, Base Weld Type = Socket

** These heights are above bottom of base plate or transformer base.
Elliptical cross section; first diameter is horizontal.
** Arm orientations are angles from +X axis in X-Y plane.
X and Y axies are perpendicular/parallel to sides of pole base plate. See *** below.
*** If arm is attached with a clamp, height and orientation must not be changed
from values shown above without consulting Valmont.
Nice to have:
**** Assembly weight includes unfinished shaft + flange + simplex plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Description of Sign Loading

Position of Signal or Sign	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Sign Weight (lb)	Sign Width (ft)	Sign Depth (ft)	Sign Cd
Mast Arm 1	20.0000	20.0000	52.0000	21	7.0000	1.5000	1.20
Mast Arm 1	20.0000	20.0000	64.0000	15	2.5000	3.0000	1.19
Mast Arm 2	20.0000	20.0000	44.0000	27	9.0000	1.5000	1.23

Description of Signal Loading

Position of Signal	Mounting Height ** (ft)	Centroid Height ** (ft)	Distance To Centroid From Pole (ft)	Signal Weight (lb)	Vertical Plane (ft2)	Horizontal Plane (ft2)
Arm 1	20.0000	20.0000	46.0000	62	11.20	1.80
Arm 1	20.0000	20.0000	58.0000	50	8.67	1.80
Arm 1	20.0000	20.0000	70.0000	50	8.67	1.80
Arm 2	20.0000	20.0000	38.0000	50	8.67	1.80
Arm 2	20.0000	20.0000	50.0000	50	8.67	1.80

THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED
WITHOUT CONSULTING VALMONT.
ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE
SPECIFYING AGENCY HAVE
BEEN ESTIMATED BY VALMONT.
** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR
TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

RESULTS SUMMARY - Pole

Maximum Combined Force Interaction In Each Major Component	
Strength I	
Pole CFI (At 20.00 (ft))	0.54
Signal and Sign Arm 1 CFI	0.34
Signal and Sign Arm 2 CFI	0.29
Base Plate CFI	0.23
Anchor Bolts CFI	0.37
S/S Arm 1 Att. Bolts CFI	0.07
S/S Arm 1 Att. Plate CFI	0.11
S/S Pole 1 Att. Plate CFI	0.33
S/S Arm 2 Att. Bolts CFI	0.01
S/S Arm 2 Att. Plate CFI	0.04
S/S Pole 2 Att. Plate CFI	0.13
Deflection % (At 22.00 (ft))	1.646 %
Deflection (At 22.00 (ft))	4.34 in
Rotation (At 22.00 (ft))	1.87 deg
Extreme I	
Pole CFI (At 20.00 (ft))	0.84
Signal and Sign Arm 1 CFI	0.52
Signal and Sign Arm 2 CFI	0.58
Base Plate CFI	0.36
Anchor Bolts CFI	0.84
S/S Arm 1 Att. Bolts CFI	0.34
S/S Arm 1 Att. Plate CFI	0.23
S/S Pole 1 Att. Plate CFI	0.69
S/S Arm 2 Att. Bolts CFI	0.07
S/S Arm 2 Att. Plate CFI	0.11
S/S Pole 2 Att. Plate CFI	0.34
Deflection % (At 22.00 (ft))	1.791 %
Deflection (At 22.00 (ft))	4.73 in
Rotation (At 22.00 (ft))	1.90 deg
Service I	
Pole CFI (At 20.00 (ft))	0.50
Signal and Sign Arm 1 CFI	0.33
Signal and Sign Arm 2 CFI	0.33
Base Plate CFI	0.25
Anchor Bolts CFI	0.46
S/S Arm 1 Att. Bolts CFI	0.13
S/S Arm 1 Att. Plate CFI	0.14
S/S Pole 1 Att. Plate CFI	0.43
S/S Arm 2 Att. Bolts CFI	0.03
S/S Arm 2 Att. Plate CFI	0.07
S/S Pole 2 Att. Plate CFI	0.20
Deflection % (At 22.00 (ft))	1.437 %
Deflection (At 22.00 (ft))	3.79 in
Rotation (At 22.00 (ft))	1.59 deg

Maximum Reactions Applied To Foundation		
Bending Moment		204413 ft-lb
Torsion		149829 ft-lb
Shear Force		5347 lb
Axial Force		8457 lb
Ice		
Pole CFI (At 20.00 (ft))	0.79	
Signal and Sign Arm 1 CFI	0.48	
Signal and Sign Arm 2 CFI	0.48	
Base Plate CFI	0.38	
Anchor Bolts CFI	0.67	
S/S Arm 1 Att. Bolts CFI	0.26	
S/S Arm 1 Att. Plate CFI	0.20	
S/S Pole 1 Att. Plate CFI	0.61	
S/S Arm 2 Att. Bolts CFI	0.05	
S/S Arm 2 Att. Plate CFI	0.10	
S/S Pole 2 Att. Plate CFI	0.29	
Deflection % (At 22.00 (ft))		2.322 %
Deflection (At 22.00 (ft))	6.13 in	
Rotation (At 22.00 (ft))	2.59 deg	
Fatigue II		
Pole (At 0.00 (ft))		0.56
Hand Hole / Opening		0.49
Signal and Sign Arm 1		
Arm Tube		0.90
Simplex Bolts		0.69
Signal and Sign Arm 2		
Arm Tube		1.00
Simplex Bolts		0.35
Anchor Bolts		0.27

SHAFT PROPERTIES: NUMBER OF SIDES = 16 Sharp Flutes
DIAMETER (D) = 17.000 IN
THICKNESS (T) = 0.31250 IN
YIELD STRENGTH (KSI) = 55
MOM. OF INERTIA (IX) = 513.335 IN^4
SECTION MODULUS (SX) = 60.392 IN^3

MN: ALLOWABLE SHAFT MOMENT
MB = (Fb * Sx) / 12
= (55000 * 60.392 / 12 = 276798
MB = 276798 FT-LB

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole Properties

Height (ft)	Diameter (in)	Wall Thk. (in)	Roundness Ratio (%)	D/t	B/T	Moments of Inertia (in4)	Plastic Section Modulus (in3)	Area (in2)	Radius of Gyration (in)
22.0000	13.92	0.31250	0.0	44.54	0.00	278.60	54.85	13.36	4.57
20.0000	14.20	0.31250	0.0	45.44	0.00	296.12	57.13	13.63	4.66
18.5000	14.41	0.31250	0.0	46.11	0.00	309.73	58.87	13.84	4.73
17.0000	14.62	0.31250	0.0	46.78	0.00	323.76	60.63	14.05	4.80
15.3333	14.85	0.31250	0.0	47.53	0.00	339.83	62.63	14.28	4.88
13.6667	15.09	0.31250	0.0	48.28	0.00	356.43	64.65	14.50	4.96
12.0000	15.32	0.31250	0.0	49.02	0.00	373.56	66.71	14.73	5.04
10.3333	15.55	0.31250	0.0	49.77	0.00	391.22	68.79	14.96	5.11
8.6667	15.79	0.31250	0.0	50.52	0.00	409.44	70.91	15.19	5.19
7.0000	16.02	0.31250	0.0	51.26	0.00	428.21	73.07	15.42	5.27
5.3333	16.25	0.31250	0.0	52.01	0.00	447.55	75.25	15.65	5.35
3.6667	16.49	0.31250	0.0	52.76	0.00	467.47	77.47	15.88	5.43
2.0000	16.72	0.31250	0.0	53.50	0.00	487.96	79.72	16.11	5.50
0.2500	16.97	0.31250	0.0	54.29	0.00	510.12	82.11	16.35	5.59
0.2500	16.97	0.31250	100.0	54.29	0.00	565.93	86.58	16.34	5.88
0.0000	17.00	0.31250	100.0	54.40	0.00	569.50	86.95	16.38	5.90

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Forces and Moments (Strength I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	127.61	43.80	3,791.25	0.00	116,038.70	1,340.45
SIGNAL	1	SPLICE-I	82.91	13.24	1,145.85	0.00	15,223.05	175.85
SIGNAL	1	SPLICE-O	71.20	11.19	968.58	0.00	12,786.60	147.71
SIGNAL	2	BASE	25.63	53.33	1,748.59	0.00	43,766.91	1,334.82
SIGNAL	2	SPLICE-I	7.97	5.10	167.32	0.00	385.75	11.76
SIGNAL	2	SPLICE-O	2.33	1.49	48.73	0.00	121.81	3.72

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Resistances (Strength I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.34	128	3,792	116,046	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.12	83	1,146	15,224	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.15	71	969	12,787	350,828	105,248	85,888
SIGNAL	2	BASE	0.29	26	1,749	43,787	474,335	142,301	148,457
SIGNAL	2	SPLICE-I	0.01	8	167	386	224,009	67,203	35,788
SIGNAL	2	SPLICE-O	0.01	2	49	122	113,783	34,135	17,199

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm Connection Analysis (Strength I)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.07	35.25	0.95	128.93	64.47
2	0.01	13.54	0.44	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.11	18,691.82	175,406.64	45	21.21
2	0.04	8,593.93	196,148.93	45	23.72

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Forces and Moments (Strength I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-164.39	-62.27	5,660.59	44,802.92	-118,285.73	0.00	0.00
0.25	-9.12	-3.45	6,977.40	45,440.92	-119,970.16	0.00	0.00
0.25	-0.92	-0.35	6,977.40	45,440.92	-119,970.16	0.00	0.00
0.00	-0.92	-0.35	6,995.19	45,441.01	-119,970.39	0.00	0.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Pole: Resistances (Strength I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.54	5,660.59	175.79	126,486.43	0.00	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.40	6,977.40	9.75	128,287.63	0.00	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.40	6,977.40	0.98	128,287.63	0.00	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.40	6,995.19	0.98	128,287.88	0.00	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Baseplate Analysis (Strength I) - Pole1 - Pole

Combined Force Interaction	0.23
Critical Wind Direction *	0.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	16,649.44 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-61475	3.25	-16649

Anchor Bolts Analysis (Strength I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
0.00	0.37	15,461.18	0.00	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole Deflection Information: (Strength I)

Critical Wind Direction: 0.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-4.06	-1.54	-1.75	0.66
20.0000	-3.33	-1.26	-1.75	0.66
18.5000	-2.81	-1.06	-1.58	0.60
17.0000	-2.34	-0.89	-1.42	0.54
15.3333	-1.87	-0.71	-1.25	0.47
13.6667	-1.46	-0.55	-1.09	0.41
12.0000	-1.11	-0.42	-0.93	0.35
10.3333	-0.81	-0.31	-0.78	0.30
8.6667	-0.56	-0.21	-0.64	0.24
7.0000	-0.36	-0.14	-0.51	0.19
5.3333	-0.21	-0.08	-0.38	0.14
3.6667	-0.10	-0.04	-0.25	0.10
2.0000	-0.03	-0.01	-0.13	0.05
0.2500	0.00	0.00	-0.02	0.01
0.2500	0.00	0.00	-0.02	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
EXTREME I LIMIT STATE

Wind Velocity	120.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	36.56	491	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	36.56	461	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	36.56	380	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	36.56	326	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	36.56	380	

Mast Arm 2: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	36.56	380	
ATTCHMT. 7	20.0000	44.0000	13.50	1.23	0.90	0.85	36.56	607	
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	36.56	380	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Forces and Moments (Extreme I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	259.81	3,160.47	3,271.05	10.17	98,765.43	150,571.26
SIGNAL	1	SPLICE-I	336.48	2,344.60	953.37	0.00	12,588.01	33,656.34
SIGNAL	1	SPLICE-O	333.28	2,341.20	797.05	0.04	10,570.73	28,256.15
SIGNAL	2	BASE	83.44	2,156.97	1,464.68	5.43	35,732.53	78,823.95
SIGNAL	2	SPLICE-I	49.75	432.53	131.45	0.01	310.48	796.28
SIGNAL	2	SPLICE-O	1.79	1.40	42.89	0.00	107.22	3.51

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Resistances (Extreme I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.52	260	4,548	180,073	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.28	336	2,531	35,933	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.35	333	2,473	30,169	350,828	105,248	85,888
SIGNAL	2	BASE	0.58	83	2,607	86,545	474,335	142,301	148,457
SIGNAL	2	SPLICE-I	0.02	50	452	855	224,009	67,203	35,788
SIGNAL	2	SPLICE-O	0.01	2	43	107	113,783	34,135	17,199

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Arm Connection Analysis (Extreme I)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.34	74.87	1.14	128.93	64.47
2	0.07	34.39	0.65	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.23	39,703.66	175,406.64	45	21.21
2	0.11	21,831.15	196,148.93	45	23.72

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Wind and Weight Force Data (Extreme I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	36.56	491
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	36.56	461
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	36.56	326
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	36.56	380
ATTCHMT. 7	20.0000	44.0000	0.00	1.23	0.90	0.85	36.56	0
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	36.56	380
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	36.93	130
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	36.26	97
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	35.65	97
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	34.95	107
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	34.88	109
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	34.88	110
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	34.88	112
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	34.88	114
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	34.88	116
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	34.88	117
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	34.88	119
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	34.88	121
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	34.88	128
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	34.88	128

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Forces and Moments (Extreme I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-308.85	-4,081.34	4,902.68	38,305.63	-100,697.52	149,807.48	270.00
0.25	-17.61	-5,346.69	6,150.50	132,167.43	-103,192.38	149,807.50	270.00
0.25	-1.49	-5,338.98	6,157.21	132,206.94	-103,135.77	149,811.62	270.00
0.00	-1.50	-5,344.53	6,172.87	133,542.38	-103,136.15	149,811.62	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Pole: Resistances (Extreme I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.84	4,902.68	4,093.01	107,737.24	149,807.48	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.71	6,150.50	5,346.72	167,680.94	149,807.50	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.72	6,157.21	5,338.98	167,677.26	149,811.62	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.72	6,172.87	5,344.53	168,732.43	149,811.62	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Extreme I) - Pole1 - Pole

Combined Force Interaction	0.36
Critical Wind Direction *	225.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	26,005.36 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-96020	3.25	-26005

Anchor Bolts Analysis (Extreme I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.84	30,646.14	9,860.43	36,355.44	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole Deflection Information: (Extreme I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-3.45	-3.24	-1.50	1.16
20.0000	-2.83	-2.73	-1.50	1.16
18.5000	-2.39	-2.37	-1.36	1.10
17.0000	-1.99	-2.02	-1.22	1.04
15.3333	-1.59	-1.66	-1.08	0.96
13.6667	-1.25	-1.34	-0.94	0.88
12.0000	-0.95	-1.04	-0.80	0.79
10.3333	-0.69	-0.78	-0.68	0.69
8.6667	-0.48	-0.55	-0.55	0.59
7.0000	-0.31	-0.36	-0.44	0.49
5.3333	-0.18	-0.21	-0.33	0.38
3.6667	-0.08	-0.10	-0.22	0.26
2.0000	-0.02	-0.03	-0.12	0.14
0.2500	0.00	0.00	-0.01	0.02
0.2500	0.00	0.00	-0.01	0.02
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
SERVICE I LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.00
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153	

Mast Arm 2: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 7	20.0000	44.0000	13.50	1.23	0.90	0.85	14.66	243	
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	14.66	153	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Forces and Moments (Service I)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	111.05	1,380.01	3,015.01	3.71	91,970.27	64,101.82
SIGNAL	1	SPLICE-I	100.47	978.39	903.12	0.00	11,980.89	14,082.36
SIGNAL	1	SPLICE-O	94.00	976.58	761.15	0.02	10,063.14	11,829.63
SIGNAL	2	BASE	28.86	988.43	1,372.45	1.92	34,069.96	34,626.09
SIGNAL	2	SPLICE-I	12.82	183.09	128.77	0.00	299.39	334.46
SIGNAL	2	SPLICE-O	1.48	1.06	39.00	0.00	97.50	2.64

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Resistances (Service I)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.33	111	3,316	112,105	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.14	100	1,331	18,489	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.18	94	1,238	15,531	350,828	105,248	85,888
SIGNAL	2	BASE	0.33	29	1,691	48,577	474,335	142,301	148,457
SIGNAL	2	SPLICE-I	0.01	13	224	449	224,009	67,203	35,788
SIGNAL	2	SPLICE-O	0.01	1	39	98	113,783	34,135	17,199

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Arm Connection Analysis (Service I)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.13	46.85	0.83	128.93	64.47
2	0.03	20.62	0.42	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.14	24,845.63	175,406.64	45	21.21
2	0.07	13,088.12	196,148.93	45	23.72

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Wind and Weight Force Data (Service I)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 7	20.0000	44.0000	0.00	1.23	0.90	0.85	14.66	0
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	14.66	153
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	14.81	52
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	14.55	39
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	14.30	39
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	14.02	43
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	13.99	44
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	13.99	44
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	13.99	45
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	13.99	46
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	13.99	46
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	13.99	47
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	13.99	48
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	13.99	48
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	13.99	52
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	13.99	52

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Pole: Forces and Moments (Service I)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-137.73	-1,755.26	4,507.18	35,512.85	-93,751.47	63,776.09	270.00
0.25	-7.67	-2,242.47	5,584.61	75,276.36	-94,964.05	63,776.13	270.00
0.25	-0.70	-2,238.45	5,586.23	75,291.85	-94,950.70	63,777.71	270.00
0.00	-0.71	-2,240.68	5,600.46	75,851.74	-94,950.88	63,777.71	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Resistances (Service I)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.50	4,507.18	1,760.65	100,252.19	63,776.09	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.37	5,584.61	2,242.48	121,180.45	63,776.13	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.37	5,586.23	2,238.45	121,179.61	63,777.71	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.37	5,600.46	2,240.68	121,528.41	63,777.71	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Service I) - Pole1 - Pole

Combined Force Interaction	0.25
Critical Wind Direction *	225.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	18,068.86 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-66716	3.25	-18069

Anchor Bolts Analysis (Service I) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.46	19,593.06	4,196.20	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole Deflection Information: (Service I)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-3.21	-2.03	-1.38	0.78
20.0000	-2.63	-1.70	-1.38	0.78
18.5000	-2.22	-1.46	-1.25	0.72
17.0000	-1.85	-1.23	-1.13	0.67
15.3333	-1.48	-1.01	-0.99	0.61
13.6667	-1.16	-0.80	-0.86	0.55
12.0000	-0.88	-0.62	-0.74	0.48
10.3333	-0.64	-0.46	-0.62	0.42
8.6667	-0.44	-0.33	-0.51	0.35
7.0000	-0.29	-0.21	-0.40	0.29
5.3333	-0.16	-0.12	-0.30	0.22
3.6667	-0.08	-0.06	-0.20	0.15
2.0000	-0.02	-0.02	-0.11	0.08
0.2500	0.00	0.00	-0.01	0.01
0.2500	0.00	0.00	-0.01	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
ICE LIMIT STATE

Wind Velocity	76.0 mph
Dead Component Load Factor	1.10
Wind Load Factor	1.00
Gust Factor	1.30

Mast Arm 1: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197	
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185	
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131	
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153	

Mast Arm 2: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)	Notes
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	14.66	153	
ATTCHMT. 7	20.0000	44.0000	13.50	1.23	0.90	0.85	14.66	243	
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	14.66	153	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Forces and Moments (Ice)

Arm Type	Arm No.	Analysis Location	Forces (lb)			Moment (ft-lb)		
			Axial	Fy	Fz	Torsion	My	Mz
SIGNAL	1	BASE	231.52	1,428.95	4,516.77	4.37	152,326.78	65,756.65
SIGNAL	1	SPLICE-I	223.36	997.53	1,735.91	0.00	23,657.01	14,334.63
SIGNAL	1	SPLICE-O	208.52	993.85	1,549.53	0.02	19,870.92	12,039.80
SIGNAL	2	BASE	61.31	1,047.94	2,269.35	2.32	62,125.54	36,333.78
SIGNAL	2	SPLICE-I	32.08	192.94	322.82	0.00	724.40	356.58
SIGNAL	2	SPLICE-O	5.12	2.92	69.08	0.00	172.70	7.29

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm: Resistances (Ice)

Analysis Location			Comb. Force Inter.	Applied Forces			Factored Resistance Forces		
Arm Type	Arm No.	Site		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)
SIGNAL	1	BASE	0.48	232	4,737	165,914	881,757	264,527	344,399
SIGNAL	1	SPLICE-I	0.21	223	2,002	27,661	533,232	159,970	129,298
SIGNAL	1	SPLICE-O	0.27	209	1,841	23,234	350,828	105,248	85,888
SIGNAL	2	BASE	0.48	61	2,500	71,970	474,335	142,301	148,457
SIGNAL	2	SPLICE-I	0.02	32	376	807	224,009	67,203	35,788
SIGNAL	2	SPLICE-O	0.01	5	69	173	113,783	34,135	17,199

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Arm Connection Analysis (Ice)

Analysis of Signal/Sign Arm Simplex Bolts

Mast Arm	Max Bolt CFI	Applied Forces (kip)		Factored Resistance (kip)	
		Tension	Shear	Tension	Shear
1	0.26	65.48	1.18	128.93	64.47
2	0.05	29.55	0.62	128.93	64.47

Analysis of Signal/Sign Arm Simplex Plates

Member Type	Max CSR	Applied Moment (ft-lb)	Factored Resistance (ft-lb)	Angle of Failure Line (deg)	Length of Bend Line (in)
1	0.20	34,727.54	175,406.64	45	21.21
2	0.10	18,761.84	196,148.93	45	23.72

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Wind and Weight Force Data (Ice)

Elevation at Top of Section (ft)	Centroid Above Base (ft)	Ecc. From Pole Centerline (ft)	Section Projected Area (ft2)	Section Drag Coeff.	Kz	Kd	Wind Pressure (psf)	Wind Force (lb)
ATTCHMT. 1	20.0000	46.0000	11.20	1.20	0.90	0.85	14.66	197
ATTCHMT. 2	20.0000	52.0000	10.50	1.20	0.90	0.85	14.66	185
ATTCHMT. 3	20.0000	58.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 4	20.0000	64.0000	7.50	1.19	0.90	0.85	14.66	131
ATTCHMT. 5	20.0000	70.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 6	20.0000	38.0000	8.67	1.20	0.90	0.85	14.66	153
ATTCHMT. 7	20.0000	44.0000	0.00	1.23	0.90	0.85	14.66	0
ATTCHMT. 8	20.0000	50.0000	8.67	1.20	0.90	0.85	14.66	153
22.0000	20.9967	0.0000	2.34	1.50	0.91	0.85	14.81	52
20.0000	19.2482	0.0000	1.79	1.50	0.89	0.85	14.55	39
18.5000	17.7482	0.0000	1.81	1.50	0.88	0.85	14.30	39
17.0000	16.1645	0.0000	2.05	1.50	0.86	0.85	14.02	43
15.3333	14.4978	0.0000	2.08	1.50	0.86	0.85	13.99	44
13.6667	12.8312	0.0000	2.11	1.50	0.86	0.85	13.99	44
12.0000	11.1646	0.0000	2.14	1.50	0.86	0.85	13.99	45
10.3333	9.4979	0.0000	2.18	1.50	0.86	0.85	13.99	46
8.6667	7.8313	0.0000	2.21	1.50	0.86	0.85	13.99	46
7.0000	6.1647	0.0000	2.24	1.50	0.86	0.85	13.99	47
5.3333	4.4980	0.0000	2.27	1.50	0.86	0.85	13.99	48
3.6667	2.8314	0.0000	2.31	1.50	0.86	0.85	13.99	48
2.0000	1.1229	0.0000	2.46	1.50	0.86	0.85	13.99	52
0.2500	-0.6271	0.0000	2.46	1.50	0.86	0.85	13.99	52

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Forces and Moments (Ice)

Section Height* (ft)	Shear (lb)		Axial (lb)	Moment (ft-lb)		Torsion (ft-lb)	Wind Direct** (deg)
	Fx	Fy	Fz	Mx	My	Mz	
20.00	-300.55	-1,831.53	6,954.86	64,351.55	-154,993.96	63,727.43	270.00
0.25	-16.26	-2,243.13	8,427.66	105,130.56	-157,738.81	63,727.50	270.00
0.25	-1.47	-2,234.59	8,429.94	105,156.27	-157,720.60	63,730.14	270.00
0.00	-1.47	-2,236.82	8,449.28	105,715.19	-157,720.97	63,730.14	270.00

* These heights are above the pole base plate.
** These are directions toward which the wind is flowing.
They are angles from the +X axis in the X-Y plane.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole: Resistances (Ice)

Section Height* (ft)	Comb. Force Inter.	Applied Force				Factored Resistance			
		Axial (lb)	Shear (lb)	Bend. (ft-lb)	Torsion (ft-lb)	Axial ϕ=0.9 (lb)	Shear ϕ=0.9 (lb)	Bend. ϕ=0.9 (ft-lb)	Torsion ϕ=0.95 (ft-lb)
20.00	0.79	6,954.86	1,856.03	167,822.08	63,727.43	677,999.13	213,557.51	236,863.77	250,745.94
0.25	0.59	8,427.66	2,243.19	189,562.56	63,727.50	412,066.25	256,076.79	329,788.73	360,532.69
0.25	0.58	8,429.94	2,234.59	189,561.68	63,730.14	402,633.73	242,702.99	330,504.47	355,438.82
0.00	0.58	8,449.28	2,236.82	189,872.61	63,730.14	398,212.18	243,213.11	331,780.51	356,934.50

* These heights are above the pole base plate.

Baseplate Analysis (Ice) - Pole1 - Pole

Combined Force Interaction	0.38
Critical Wind Direction *	225.00 deg
Alignment of Bend Line	135.00 deg
Width of Bending Section	16.941 (in)
Failure Line Start Coordinate (in)	(-12.000, -0.021)
Failure Line End Coordinate in	(-0.021, -12.000)
Applied Bending Moment	27,210.60 ft-lb
Factored Bending Resistance	71,470.37 ft-lb

Plate Controlling Bolt Forces

Bolt Number	Axial force (lb)	Moment Arm (in)	Bending moment (ft-lb)
3	-100470	3.25	-27211

Anchor Bolts Analysis (Ice) - Pole1 - Pole

Critical Wind Direct.* (deg)	Comb. Force Inter.	Applied Stress (psi)		Factored Resistance (psi)	
		Axial	Shear	ϕ F'nt	ϕ Fv
265.00	0.67	28,181.60	4,192.95	42,187.50	22,500.00

* Per AISC Design Guide 1
* These are directions toward which the wind is flowing

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Pole Deflection Information: (Ice)

Critical Wind Direction: 270.00

Height (ft)	X-Defl. (in)	Y-Defl. (in)	Deflection Angle - X (deg)	Deflection Angle - Y (deg)
22.0000	-5.32	-3.05	-2.30	1.21
20.0000	-4.36	-2.53	-2.30	1.21
18.5000	-3.68	-2.16	-2.08	1.11
17.0000	-3.06	-1.82	-1.87	1.02
15.3333	-2.45	-1.48	-1.64	0.92
13.6667	-1.92	-1.17	-1.43	0.82
12.0000	-1.46	-0.90	-1.23	0.72
10.3333	-1.06	-0.66	-1.03	0.61
8.6667	-0.74	-0.47	-0.85	0.51
7.0000	-0.47	-0.30	-0.67	0.41
5.3333	-0.27	-0.17	-0.50	0.31
3.6667	-0.13	-0.08	-0.33	0.21
2.0000	-0.04	-0.02	-0.18	0.12
0.2500	0.00	0.00	-0.02	0.01
0.2500	0.00	0.00	-0.02	0.01
0.0000	0.00	0.00	0.00	0.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
FATIGUE II LIMIT STATE

Galloping	No
Natural Wind Gust (11.2 mph)	Yes
Truck-Induced Gust (65.0 mph)	No
Importance Factor	II

Mast Arm: Fatigue Analysis (Fatigue II)

Analysis Location			Design Load	Comb. Force Inter.	Moment (ft-lb)	Shear force (lb)	Shear Stress (ksi)	Applied Bending Stress (ksi)	Allowable Stress (ksi)
Arm Type	Arm No.	Site							
MA	1	BASE	NATURAL WIND GUST	0.90	22,681.81	532	0.06	4.04	4.50
MA	1	SP-I	NATURAL WIND GUST	0.19	4,652.32	320	0.06	2.27	12.00
MA	1	SP-O	NATURAL WIND GUST	0.23	3,914.86	320	0.09	2.81	12.00
MA	2	BASE	NATURAL WIND GUST	1.00	11,476.80	350	0.07	4.51	4.50
MA	2	SP-I	NATURAL WIND GUST	0.01	100.25	57	0.02	0.18	12.00
MA	2	SP-O	NATURAL WIND GUST	0.00	0.00	0	0.00	0.00	12.00

Mast Arm: Deflections (Fatigue II)

Arm Type	Arm No.	Load Case	Max Vertical Deflection (in)
MA	1	NATURAL WIND GUST	1.17
MA	2	NATURAL WIND GUST	1.05

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Fatigue Analysis of Signal and Sign / Pole Connection: Arm

Arm Type	Arm No.	Component	Load	Stress Ratio	Applied Stress (ksi)	Allowable Stress (ksi)
MA	1	SIMPLEX BOLT	NATURAL WIND GUST	0.69	4.83	7.00
MA	2	SIMPLEX BOLT	NATURAL WIND GUST	0.35	2.45	7.00

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)

BY: NAQ 11/18/2024 VERSION: 27.3.29.9

SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH

Folder: 568086 File: P22M7555A15120

Analysis of Pole (Fatigue II)

Section Height* (ft)	Design Load	Comb. Force Inter.	Moment (ft-lb)	Applied Bending Stress (ksi)	Allowable Bending Stress (ksi)	Deflection (in)
0.00	NATURAL WIND GUST	0.56	14,246.26	2.50	4.50	0.00

* These heights are above the pole base plate.

Tube to Transverse Plate CAFT Calculation Details

	Pole to Baseplate Weld	Arm M75 Shaft to Simplex Plate Weld	Arm 55M Shaft to Simplex Plate Weld
Weld type	Socket	Socket	Socket
Tt(in)	0.31250	0.37500	0.23910
Dt(in)	17.00	15.50	13.00
Ttp(in)	2.50	3.50	3.50
Dbc(in)	23.50	28.28	28.28
CBC	1.38	1.82	2.18
Dop(in)	N/A	N/A	N/A
COP	N/A	N/A	N/A
NS	0.00	0.00	0.00
RRb(in)	N/A	N/A	N/A
Multisided Factor	N/A	N/A	N/A
Kf	2.81	2.67	2.51
Ki	6.35	6.30	5.25
CAFT (ksi)	4.50	4.50	4.50

NOTE: The maximum bolt circle is used for bolt patterns where all the bolts do not lie on a single circle, per AASHTO.

Fatigue Analysis of Anchor Bolts (NATURAL WIND GUST)

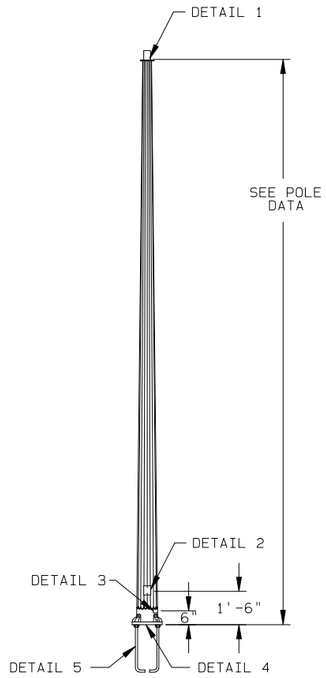
Load Case	Combined Stress Ratio	Axial (lb)
NATURAL WIND GUST	0.27	6,053.97

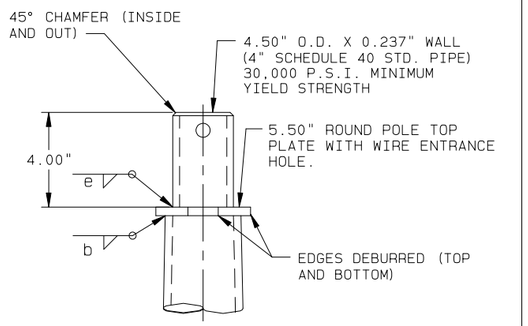
ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2015 RQMTS. (FINAL DEFLECTED POSITION)
BY: NAQ 11/18/2024 VERSION: 27.3.29.9
SUBJECT: CUYLER ST-POLE B, P22' M75' & M55' AASHTO 2015 120MPH
Folder: 568086 File: P22M7555A15120
Opening Group on the Pole

Description	Attachment Height (ft)	Clear Opening (in)			Reinforcement (in)		
		Width	Height	Inside Corner Radius	Rim Thickness	Rim Depth	Rim Projection
STD HH	2.00	4.48	7.00	2.52	0.28	2.50	0.50

Description	Location On Pole (ft)	Orientation (deg)	Tube Diam. (in)	Tube Thick. (in)	Area (in2)	X Centroid (in)	Y Centroid (in)	Ix(in4)	Ix(in4)
STD HH	2.00	0.00	16.72	0.31	16.00	-0.13	0.00	552	525

		Stress at Root		Stress at Toe		
Description	Moment (ft-lb)	Actual (ksi)	Resist (ksi)	Actual (ksi)	Resist (ksi)	Max CSR
NATURAL WIND GUST	10,044.34	7.78	16.00	1.95	7.00	0.49

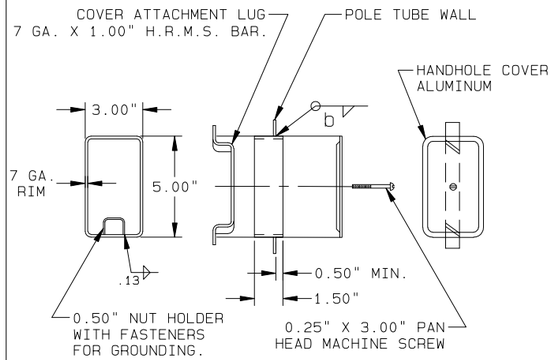




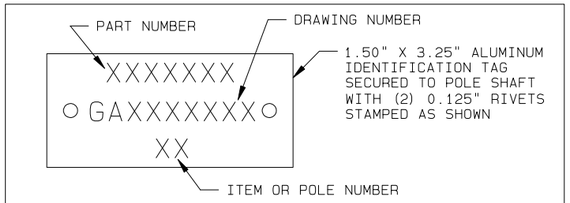
FLUTING NOT SHOWN FOR CLARITY

e	
.25	1/4"

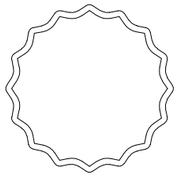
DETAIL 1 | POLE TOP TENON



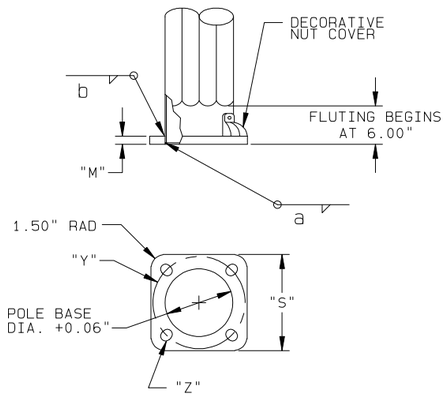
DETAIL 2 | 3" X 5" HANDHOLE



DETAIL 3 | I.D. TAG

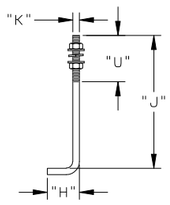


POLE CROSS SECTION DETAIL



DETAIL 4 | POLE BASE

(4)-ANCHOR BOLTS WITH (2) HEX NUTS, (2) WASHERS AND (1) LOCK WASHER PER BOLT WITH THREADED END GALVANIZED AT LEAST 12".



DETAIL 5 | ANCHOR BOLT

WELD SIZE TABLE

TUBE THICKNESS	a		b		c	
11 GA(0.1196")	.12	7/64"	.19	3/16"	.31	5/16"
7 GA (0.1793")	.18	11/64"	.25	1/4"	.44	7/16"
5 GA (0.2092")	.21	13/64"	.31	5/16"	.56	9/16"
3 GA (0.2391")	.24	15/64"	.31	5/16"	.56	9/16"
0.219"	.22	7/32"	.31	5/16"	.56	9/16"
0.250"	.25	1/4"	.31	5/16"	.56	9/16"
0.313"	.31	5/16"	.38	3/8"	.69	11/16"

THE MAST ARM TRAFFIC STRUCTURES SHOWN ON THIS DRAWING HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND THE NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1. THE WIND LOADS WERE CALCULATED FROM AN ULTIMATE WIND VELOCITY OF 120 MPH WITH A MEAN RECURRENCE INTERVAL OF 700 YEARS, AND A FATIGUE CATEGORY OF 2. THE FATIGUE LOADS WERE CALCULATED ON THE REQUIREMENTS OF SECTION 11 OF THE CODE, AND THE FOLLOWING DESIGN CONDITIONS:

- STRUCTURES ARE DESIGNED TO RESIST NATURAL WIND GUSTS BASED ON THE YEARLY MEAN WIND VELOCITY OF 11.2 MPH.
- STRUCTURES ARE NOT DESIGNED TO RESIST GALLOPING-INDUCED CYCLIC LOADS.
- TRUCK-INDUCED GUST LOADS ARE NOT INCLUDED PER THE REQUIREMENTS OF THE CODE.

AASHTO 2015 SPECIFICATIONS

MATERIAL DATA

COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
TAPERED TUBES	A595 GR.A OR A572	55
POLE BASE	A36	36
GALVANIZING-HARDWARE	HOT DIP ZINC	--

HARDWARE ≤ 0.50" IS STAINLESS STEEL

FINISH DATA

SYSTEM: FINISH PAINT/GALVANIZED (FPGV)
BASE COAT: HOT-DIP GALVANIZED TO ASTM A123
PRIME COAT: NONE
FINISH COAT: TGIC OR URETHANE POLYESTER POWDER
COLOR: DARK GREEN / RAL 6005
SPEC: F-283BQ

POLE DATA

ITEM	QTY.	POLE TUBE				POLE BASE				ANCHOR BOLT				
		BASE DIA. (IN)	TOP DIA. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	BOLT QTY
1	2	5.62	4.50	8.00	11	10.00	9.00	0.875	1.25	1.00	36.00	4.00	6.00	4

REV	DRAWN BY-DATE	CHECK BY-DATE	DESCRIPTION
—	NKL 11/19/24	NKL 11/19/24	— — — — — — — — — — — — — — — —

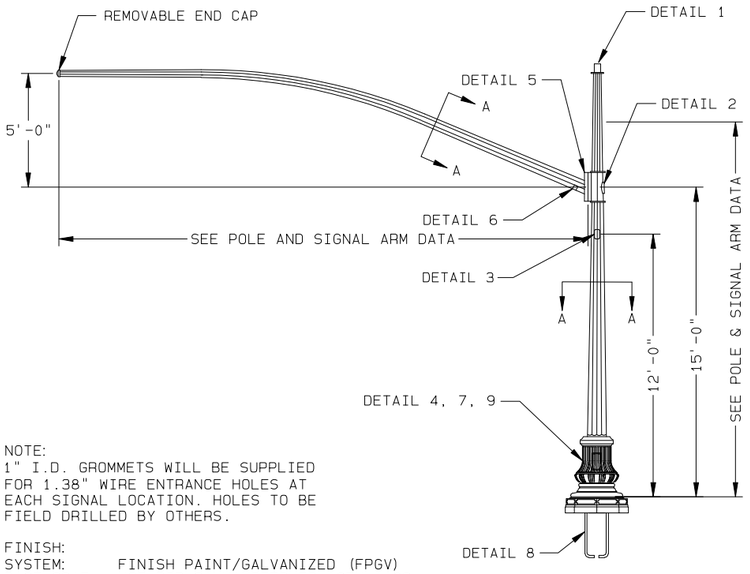
SOLD TO: DOR LIGHTING, LLC
SHIP TO: CITY OF DALTON
P.O. #: 1335
AGENT: TRAFFIC & LIGHTING CORP.

JOB: CITY OF DALTON, GEORGIA
CUYLER STREET

TITLE: TRAFFIC SIGNAL STRUCTURES

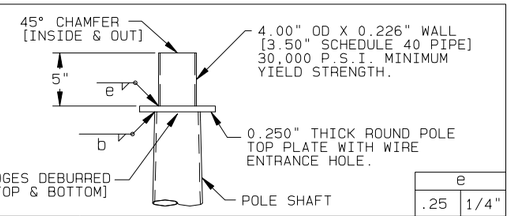
valmont
Valley,NE 68064
(402) 359-2201

ORDER NUMBER: 568086-P1
PAGE NUMBER: 1 OF 5
DRAWING NUMBER: GA568086P1
REV:



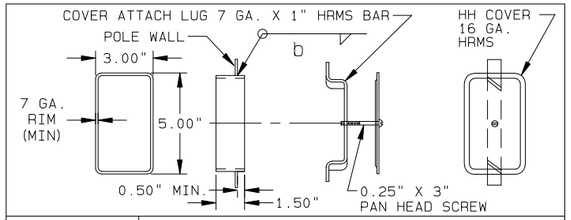
NOTE:
1" I.D. GROMMETS WILL BE SUPPLIED FOR 1.38" WIRE ENTRANCE HOLES AT EACH SIGNAL LOCATION. HOLES TO BE FIELD DRILLED BY OTHERS.

FINISH:
SYSTEM: FINISH PAINT/GALVANIZED (FPGV)
BASE COAT: HOT-DIP GALVANIZED TO ASTM A123
PRIME COAT: NONE
FINISH COAT: TGIC OR URETHANE POLYESTER POWDER
COLOR: DARK GREEN / RAL 6005
SPEC: F283BQ

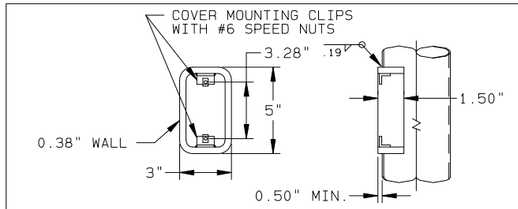


e
.25 | 1/4"

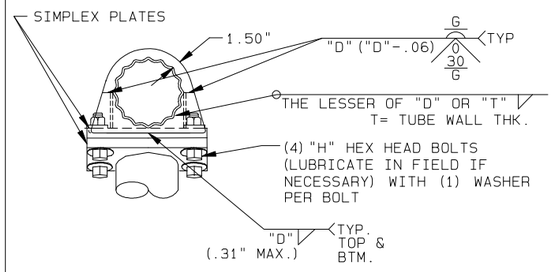
DETAIL 1 — POLE TOP



DETAIL 2 — 3 X 5 HANDHOLE

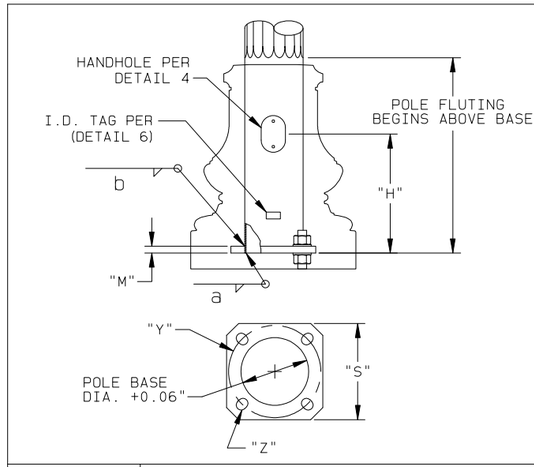


DETAIL 3 — FESTOON BOX



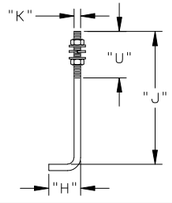
ARM-TO-PLATE WELD "E"	BEVEL "F"X"G"
(ARM THK.+.25") X ARM THK.	.19" X 30°

DETAIL 5 — SIGNAL ARM ATTACHMENT



DETAIL 7 — POLE BASE

(4) -ANCHOR BOLTS WITH (2) HEX NUTS, (2) WASHERS AND (1) LOCK WASHER PER BOLT WITH THREADED END GALVANIZED AT LEAST 12".



DETAIL 8 — ANCHOR BOLT

MATERIAL DATA

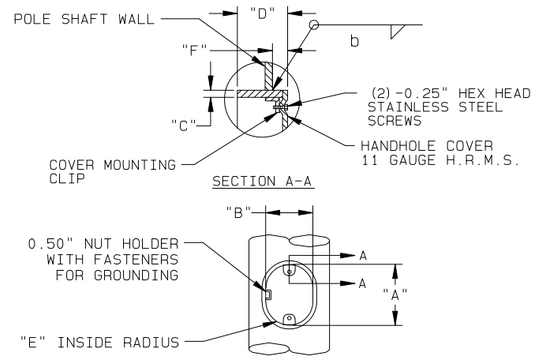
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
TAPERED TUBES	A595 GR. A OR A572	55
HARDWARE COATING	HOT DIP ZINC	
HARDWARE < 0.50" IS STAINLESS STEEL		

COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
BASE PLATE	A36	36
SIGNAL ARM ATTACHMENT	A36	36
SIG. ARM CONN. BOLTS	F3125 GR A325	
ANCHOR BOLTS	F1554 GR.55	55
NUTS AND WASHERS	A563, F436	

THE MAST ARM TRAFFIC STRUCTURES SHOWN ON THIS DRAWING HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND THE NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1. THE WIND LOADS WERE CALCULATED FROM AN ULTIMATE WIND VELOCITY OF 120 MPH WITH A MEAN RECURRENCE INTERVAL OF 700 YEARS, AND A FATIGUE CATEGORY OF 2. THE FATIGUE LOADS WERE CALCULATED ON THE REQUIREMENTS OF SECTION 11 OF THE CODE, AND THE FOLLOWING DESIGN CONDITIONS:

- STRUCTURES ARE DESIGNED TO RESIST NATURAL WIND GUSTS BASED ON THE YEARLY MEAN WIND VELOCITY OF 11.2 MPH.
- STRUCTURES ARE NOT DESIGNED TO RESIST GALLOPING-INDUCED CYCLIC LOADS.
- TRUCK-INDUCED GUST LOADS ARE NOT INCLUDED PER THE REQUIREMENTS OF THE CODE.

AASHTO 2015 SPECIFICATIONS

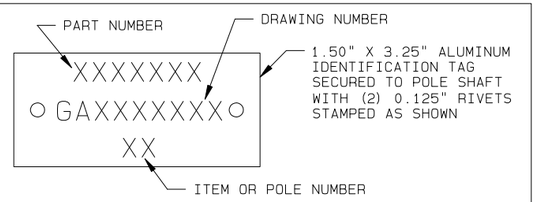


POLE	"A" I.D. (IN)	"B" I.D. (IN)	"C" THK (IN)	"D" DEPTH (IN)	"E" RADIUS (IN)	"F" PROJ (IN)	"H" MTG. HEIGHT (FT)
ALL	7.00	4.48	0.280	2.50	2.52	0.50	2.00

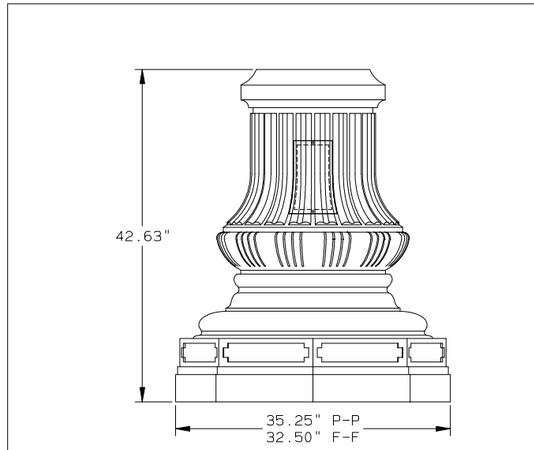
DETAIL 4 — LOWER HANDHOLE

SIGNAL ARM ATTACHMENT DATA

POLE	"A" (IN)	"B" (IN)	POLE PLATE "C" (IN)	ARM PLATE "X" (IN)	"D" (IN)	"H" (IN)
A,B,C,D	17.75	14.50	2.00	2.00	0.375	1.25 X 6.00



DETAIL 6 — I.D. TAG



DETAIL 9 — WA03AC DECORATIVE BASE

JOB: CITY OF DALTON, GEORGIA
CUYLER STREET

TITLE: TRAFFIC SIGNAL STRUCTURES

VALMONT INDUSTRIES, INC. RESERVES THE RIGHT TO INSTALL VARIOUS, ENGINEER APPROVED, MATERIAL HANGING ACCOMMODATIONS TO FACILITATE THE MANUFACTURING PROCESS.

valmont
Valley,NE 68064
(402) 359-2201

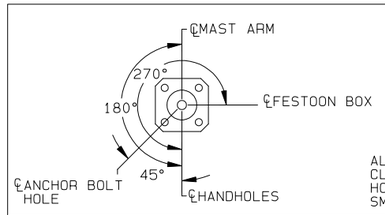
ORDER NUMBER: 568086-P1
PAGE NUMBER: 2 OF 5
DRAWING NUMBER: GA568086P1
REV:

POLE AND SIGNAL ARM DATA

POLE	QTY.	POLE TUBE				POLE BASE				ANCHOR BOLT					SIGNAL ARM TUBE			
		BASE DIA. (IN)	TOP DIA. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	BOLT QTY	FIXED END DIA. (IN)	NOMINAL FREE END DIA. (IN)	GAUGE OR THICK (IN)	SPAN (FT)
A,B,C,D	4	12.50	9.98	18.00	5	19.00	17.50	2.00	2.00	1.75	84.00	6.00	8.00	4	11.00	6.05	3	35.00

Pole Foundation

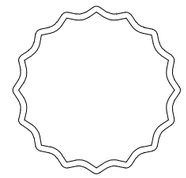
3'-0" Dia x 9'-0" Deep - (8) #8 rebar



RADIAL INDEX

WELD SIZE TABLE

TUBE THICKNESS	a	b	c
11 GA (0.1196")	0.1196"	0.1796"	0.3125"
7 GA (0.1793")	0.1793"	0.2500"	0.4375"
5 GA (0.2092")	0.2092"	0.3125"	0.5625"
3 GA (0.2391")	0.2391"	0.3125"	0.5625"
0.2188"	0.2188"	0.3125"	0.5625"
0.2500"	0.2500"	0.3125"	0.5625"
0.3125"	0.3125"	0.3750"	0.6875"



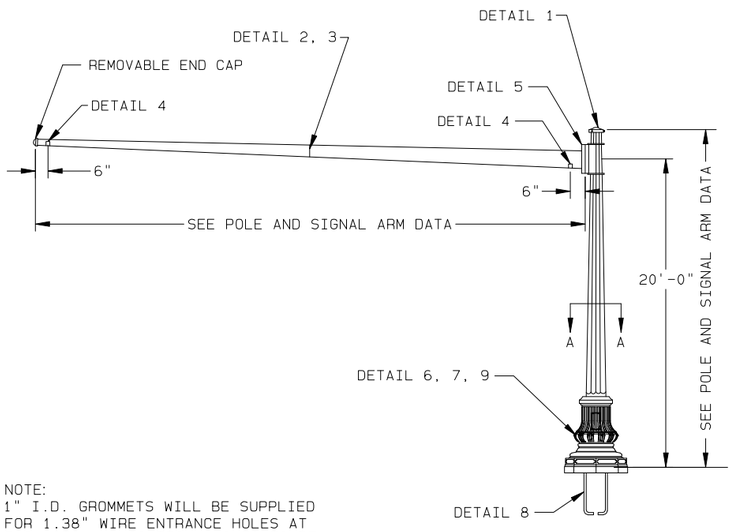
SECTION A-A

JOB CITY OF DALTON, GEORGIA
CUYLER STREET

TITLE TRAFFIC SIGNAL STRUCTURES

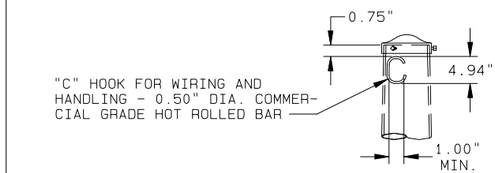
valmont
Valley,NE 68064
(402) 359-2201

ORDER NUMBER: 568086-P1
PAGE NUMBER: 3 OF 5
DRAWING NUMBER GA568086P1
REV

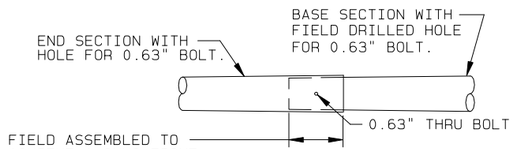


NOTE:
1" I.D. GROMMETS WILL BE SUPPLIED FOR 1.38" WIRE ENTRANCE HOLES AT EACH SIGNAL LOCATION. HOLES TO BE FIELD DRILLED BY OTHERS.

FINISH:
SYSTEM: FINISH PAINT/GALVANIZED (FPGV)
BASE COAT: HOT-DIP GALVANIZED TO ASTM A123
PRIME COAT: NONE
FINISH COAT: TGIC OR URETHANE POLYESTER POWDER
COLOR: DARK GREEN / RAL 6005
SPEC: F283BQ

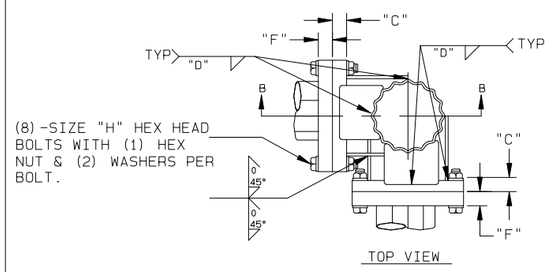


DETAIL 1 | POLE TOP



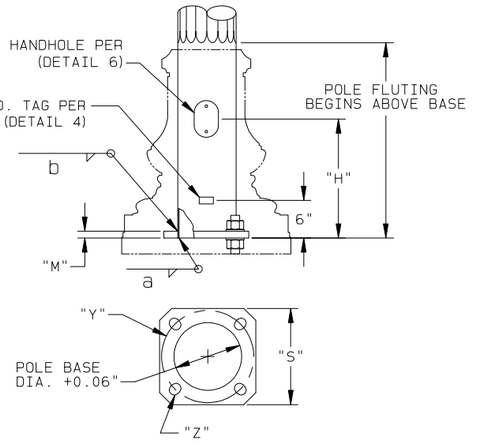
POLE	SPAN (FT)	BASE SECTION		END SECTION		
		LENGTH (FT)	GAUGE OR THK. (IN)	LARGE END O.D. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)
A	75.00	45.00	0.375	10.00	32.30	3
B	75.00	45.00	0.375	10.00	32.30	3
	55.00	50.00	3	6.50	6.90	11

DETAIL 2 | SIGNAL ARM SLIP JOINT



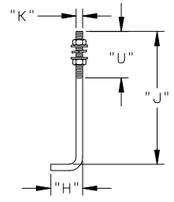
ARM-TO-PLATE WELD "E"	BEVEL "F"X"G"
(ARM THK.+.25") X ARM THK.	.19" X 30°

DETAIL 5 | SIGNAL ARM ATTACHMENT



DETAIL 7 | POLE BASE

(4)-ANCHOR BOLTS WITH (2) HEX NUTS, (2) WASHERS AND (1) LOCK WASHER PER BOLT WITH THREADED END GALVANIZED AT LEAST 12".



DETAIL 8 | ANCHOR BOLT

MATERIAL DATA

COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
TAPERED TUBES	A595 GR. A OR A572	55
HARDWARE COATING	HOT DIP ZINC	
HARDWARE < 0.50" IS STAINLESS STEEL		

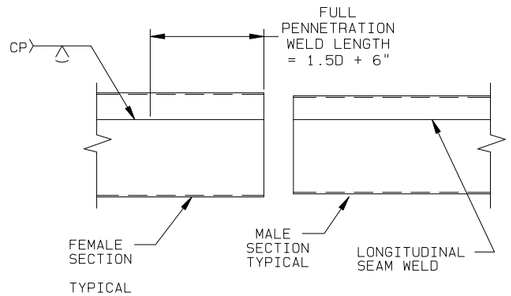
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
BASE PLATE	A36	36
SIGNAL ARM ATTACHMENT	A36	36
SIG. ARM CONN. BOLTS	F3125-GR.A325	
ANCHOR BOLTS	F1554 GR.55	55
NUTS AND WASHERS	A563, F436	

THE MAST ARM TRAFFIC STRUCTURES SHOWN ON THIS DRAWING HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND THE NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1. THE WIND LOADS WERE CALCULATED FROM AN ULTIMATE WIND VELOCITY OF 120 MPH WITH A MEAN RECURRENCE INTERVAL OF 700 YEARS, AND A FATIGUE CATEGORY OF 2. THE FATIGUE LOADS WERE CALCULATED ON THE REQUIREMENTS OF SECTION 11 OF THE CODE, AND THE FOLLOWING DESIGN CONDITIONS:

- STRUCTURES ARE DESIGNED TO RESIST NATURAL WIND GUSTS BASED ON THE YEARLY MEAN WIND VELOCITY OF 11.2 MPH.
- STRUCTURES ARE NOT DESIGNED TO RESIST GALLOPING-INDUCED CYCLIC LOADS.
- TRUCK-INDUCED GUST LOADS ARE NOT INCLUDED PER THE REQUIREMENTS OF THE CODE.

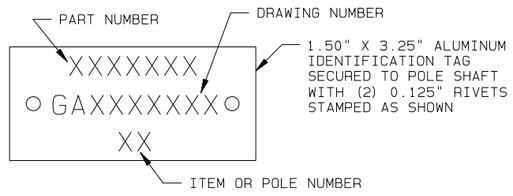
AASHTO 2015 SPECIFICATIONS

("D"= INSIDE DIAMETER OF OUTER TUBE)



75', 55' MAST ARM WELD REINFORCEMENT

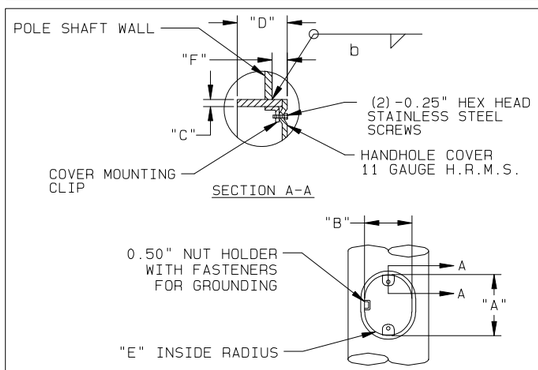
DETAIL 3 | MAST ARM WELD REINFORCEMENT



DETAIL 4 | I.D. TAG

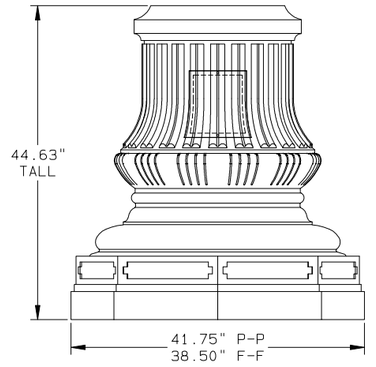
SIGNAL ARM ATTACHMENT DATA

POLE	"A" (IN)	"B" (IN)	POLE PLATE "C" (IN)	ARM PLATE "X" (IN)	"D" (IN)	"H" (IN)
A	26.00	20.00	2.00	3.50	0.500	1.50 X 7.75
B	26.00	20.00	2.00	3.50	0.500	1.50 X 7.75



POLE	"A" I.D. (IN)	"B" I.D. (IN)	"C" THK (IN)	"D" DEPTH (IN)	"E" RADIUS (IN)	"F" PROJ (IN)	"H" MTG. HEIGHT (FT)
ALL	7.00	4.48	0.280	2.50	2.52	0.50	2.00

DETAIL 6 | LOWER HANDHOLE



DETAIL 9 | WA04AC DECORATIVE BASE

JOB CITY OF DALTON, GEORGIA
CUYLER STREET

TITLE TRAFFIC SIGNAL STRUCTURES

VALMONT INDUSTRIES, INC. RESERVES THE RIGHT TO INSTALL VARIOUS, ENGINEER APPROVED, MATERIAL HANGING ACCOMMODATIONS TO FACILITATE THE MANUFACTURING PROCESS.

valmont
Valley,NE 68064
(402) 359-2201

ORDER NUMBER: 568086-P1
PAGE NUMBER: 4 OF 5
DRAWING NUMBER GA568086P1
REV

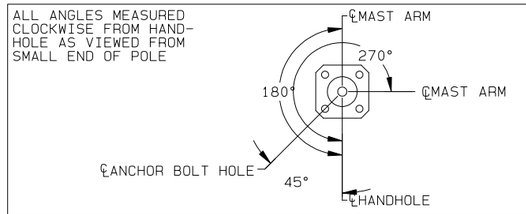
POLE AND SIGNAL ARM DATA

POLE	QTY.	POLE TUBE				POLE BASE				ANCHOR BOLT					SIGNAL ARM TUBE			
		BASE DIA. (IN)	TOP DIA. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	BOLT QTY	FIXED END DIA. (IN)	NOMINAL FREE END DIA. (IN)	GAUGE OR THICK (IN)	SPAN (FT)
A	1	17.00	13.92	22.00	0.313	24.00	23.50	2.50	2.50	2.25	89.00	7.00	12.00	4	15.50	5.48	DET.2	75.00
															12.00	5.70	3	45.00
B	1	17.00	13.92	22.00	0.313	24.00	23.50	2.50	2.50	2.25	89.00	7.00	12.00	4	15.50	5.48	DET.2	75.00
															13.00	5.53	DET.2	55.00

Pole Foundation

3'-0" Dia x 13'-6" Deep - (8) #10 rebar

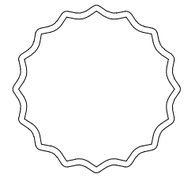
3'-0" Dia x 13'-6" Deep - (8) #10 rebar



RADIAL INDEX

WELD SIZE TABLE

TUBE THICKNESS	a	b	c
11 GA (0.1196")	0.1196"	0.1796"	0.3125"
7 GA (0.1793")	0.1793"	0.2500"	0.4375"
5 GA (0.2092")	0.2092"	0.3125"	0.5625"
3 GA (0.2391")	0.2391"	0.3125"	0.5625"
0.2188"	0.2188"	0.3125"	0.5625"
0.2500"	0.2500"	0.3125"	0.5625"
0.3125"	0.3125"	0.3750"	0.6875"



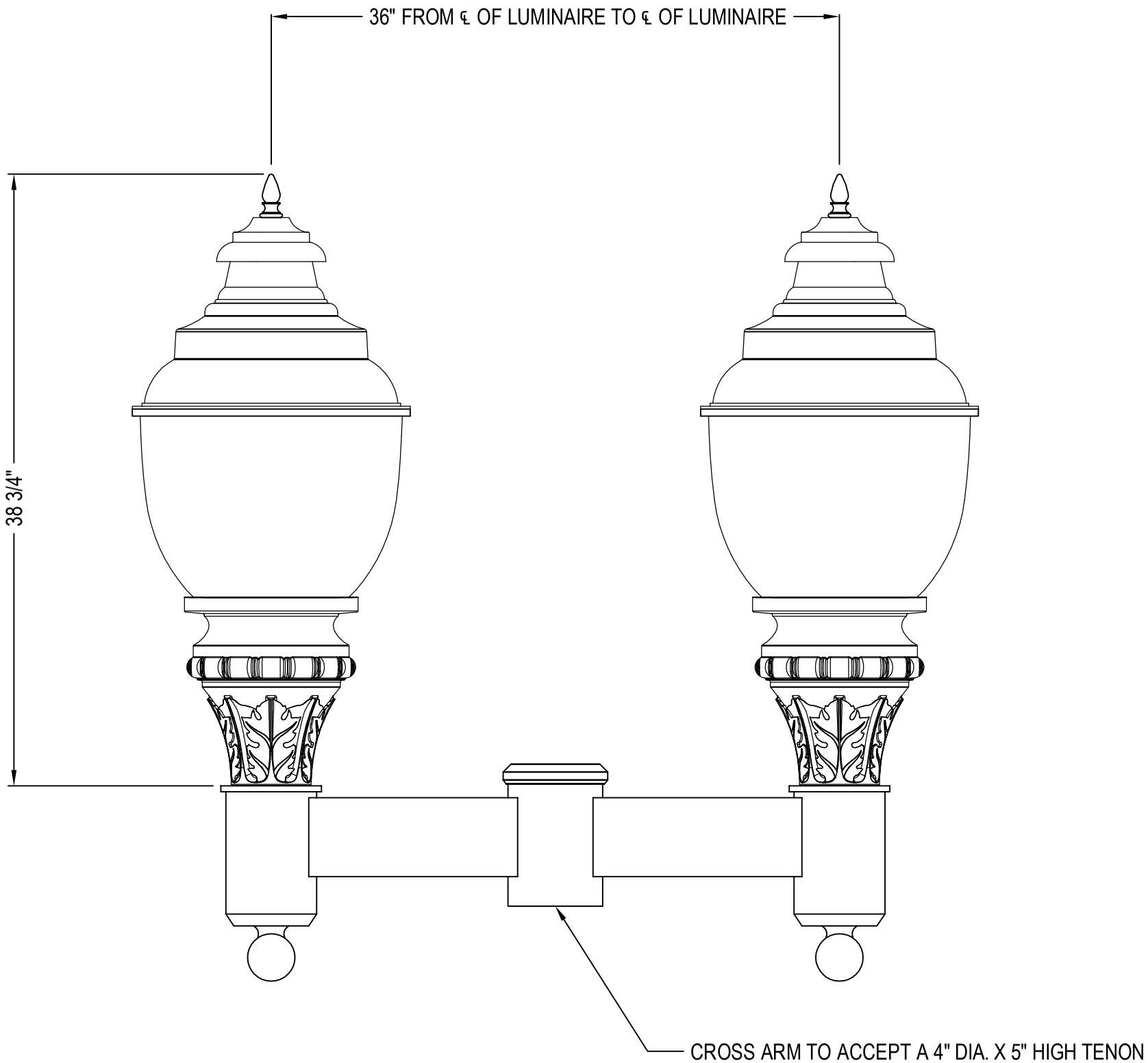
SECTION A-A

JOB CITY OF DALTON, GEORGIA
CUYLER STREET

TITLE TRAFFIC SIGNAL STRUCTURES

valmont
Valley,NE 68064
(402) 359-2201

ORDER NUMBER: 568086-P1
PAGE NUMBER: 5 OF 5
DRAWING NUMBER GA568086P1
REV



LUMINAIRE SPECIFICATIONS

STYLE:	NEW FRONTIER
HEIGHT:	38 3/4"
WIDTH:	17 5/8" DIAMETER
MATERIAL:	CAST ALUMINUM ALLOY A.N.S.I. 356, PER A.S.T.M. B26-95
GLOBE:	RIBBED GLASS - SMOOTH OUTSIDE
FINISH:	POWDER COATED - RAL #6009
LAMPING:	120 WATT LED SYSTEM
LUMEN OUTPUT:	11,610 LUMENS
VOLTAGE:	ELECTRONIC WIRED AT 120-277 VOLTS
COLOR TEMP:	4500K (NEUTRAL WHITE)
OPTICAL SYSTEM	TYPE V (SYMMETRIC DISTRIBUTION)
SURGE:	10kV
DIMMING:	0-10V DIMMING
CATALOG NO.:	ALMNWF-LE120-EVX-2G2-45-CN5-GR18-FDL-CU

CROSS ARM SPECIFICATIONS

STYLE:	DUNMORE 2-WAY
HEIGHT:	7 5/8"
WIDTH:	36" FROM ℄ OF LUMINAIRE TO ℄ OF LUMINAIRE
MATERIAL:	CAST ALUMINUM
FINISH:	POWDER COAT - RAL #6009
TENON:	4" DIA. X 3" HIGH (TO ACCEPT LUMINAIRE)
CATALOG NO.:	AARDNM-2S-18-TN4.00-3.00-CU

Spring City Electrical Mfg. Co.
HALL AND MAIN STREETS - P.O. BOX 19 - SPRING CITY, PA. 19475
PHONE (610) 948-4000 - FAX (610) 948-5577 - WWW.SPRINGCITY.COM

DESCRIPTION	THE DUNMORE 2-WAY CROSS ARM WITH THE NEW FRONTIER CAST TOP LED LUMINAIRE
OPPORTUNITY	CITY OF DALTON

SCALE	DRAWN BY:	DATE	DRAWING NO.
N.T.S.	D.B.D.	10-30-2024	SPEC-34978