



K2 Engineering, Inc.
 5549 Hunters Hill Road
 Irondale, AL 35210-3036
 Phone: (205) 951-3825 Fax: (205) 951-3825
 e-mail: rkiser@k2engineeringinc.com
 web address: www.k2engineeringinc.com

Bolted Plate Design Results Page 1

Engineer: Robert P Kiser, PE
 Printed at: Sunday, January 09, 2011 12:55:13 PM

Bolts meet design criteria? True
 Pole Vang meets design criteria? True
 Arm Connection meets design criteria? True

Pole Vang Edge Criteria Violated? False
 Arm Connection Edge Criteria Violated? False

General Data

Project Data File: C:\K2_Projects\Bolted Plate\Design Test Davit Arm 43_25 pole flat-flat.XML
 Customer Name: test customer
 Project Number: test project
 Project Description: test description
 Site Name: test site
 Job Number: J12345
 Structure Number: S123

Analysis Settings

Desired Pole Number: 1
 Connection Type: Davit Arm
 Tube index (for Flange only): 0
 Analysis Type: Redesign
 Bolt Analysis Method: ASCE 48-05
 Use plate thickness in 1/4 inch increments? False
 Bypass Minimum Edge Distance Warnings? False

Pole Data

Pole Type: Transmission
 Pole Shape: 12F - 12 Sides, Flat on Transverse Axis
 Pole Material: A572-50
 Pole Thickness: 0.2500 (in)
 Pole Flat/Flat Width: 43.2261 (in)
 Pole Weld Size: 0.2500 (in)
 Is Stealth Pole? False

Pole Vang Data

Plate Material: A572-50
 Plate Thickness: 0.50000 (in)
 Plate Depth: 14.500 (in)
 Plate Length: 49.500 (in)
 Outside/Outside Distance: 12.000 (in)
 Bolt Diameter: 1.750 (in)
 Bolt Grade: A325
 Bolt Layout: 2 Bolts
 Near End Bolt Edge Distance: 2.500 (in)
 Bolt Offset from Pole Centerline: 23.750 (in)
 Bolt Spacing - Dimension 1: 9.750 (in)
 Bolt Spacing - Dimension 2: 0.000 (in)

Arm Connection Data

Type: U-shaped Bracket
 Plate Material: A572-50
 Plate Thickness: 0.50000 (in)
 Plate Depth: 14.500 (in)
 Bolt Offset from Free Edge: 2.500 (in)
 Bolt Offset from Arm Butt: 6.000 (in)
 On Outside of Vang Plates? True
 Outer Bend Radius: 1.000 (in)
 Arm Shape: 6.000 (in)
 Arm Flat/Flat Width: 10.000 (in)

User Mandates

Pole Out-of-Roundness Tolerance: 1.0 (%)
 Plate Max OD as adder to BC: 10.00 (in)
 Min Distance Center Hole to Pole: 2.00 (in)
 Min Distance Center Pole to Edge: 2.00 (in)
 Min Bolt Edge Distance: 2.00 (in)
 Quadrant On-Center Bolt Spacing: 6.00 (in)
 Minimum Bolt Spacing: 6.00 (in)
 Maximum Bend Line Length: 0.00 (in)
 Maximum Plate Thickness: 4.00 (in)
 Rotation Angle for Eq. Spaced Bolts: 0.00 (Deg)
 Maximum Flange Bolt Spacing: 9.00 (in)



K2 Engineering, Inc.
 5549 Hunters Hill Road
 Irondale, AL 35210-3036
 Phone: (205) 951-3825 Fax: (205) 951-3825
 e-mail: rkiser@k2engineeringinc.com
 web address: www.k2engineeringinc.com

Bolted Plate Design Results Page 2

Engineer: Robert P Kiser, PE
 Printed at: Sunday, January 09, 2011 12:55:13 PM

Bolts meet design criteria? True
 Pole Vang meets design criteria? True
 Arm Connection meets design criteria? True

Pole Vang Edge Criteria Violated? False
 Arm Connection Edge Criteria Violated? False

Active Load Cases

Load Case	Load Name	Axial (kips)	Forces Axis 1 (kips)	Axis 2 (kips)	Axial (ft-k)	Moments Axis 1 (ft-k)	Axis 2 (ft-k)	Strs Inc Factor	Str Red Factor	Load Factor
1 1		-9.53	-7.58	-0.71	0.00	3.13	34.14	1.00	1.00	1.00
2 2		-4.16	-4.14	-0.58	0.00	2.55	18.63	1.00	1.00	1.00
3 3		-4.97	-2.46	-0.29	0.00	1.26	11.05	1.00	1.00	1.00
4 4		4.67	-15.86	-0.26	0.00	1.12	71.28	1.00	1.00	1.00

Pole Vang Bolt Geometry Data

Bolt Number	Axis 1 Location (in)	Axis 2 Location (in)	Radius From CL (in)
1	-6.0000	4.8750	7.7308
2	-6.0000	-4.8750	7.7308
3	6.0000	4.8750	7.7308
4	6.0000	-4.8750	7.7308

Pole Vang Bolt Loading Results Summary

Bolt Analysis Method = ASCE 48-05

Bolts meet design criteria? True

Worst Case Shear Load = 37.50 kips for Load Case # 4 at Bolt # 3

Worst Case Load Combination = 0.873 for Load Case # 4 at Bolt # 3

Pole Vang Bolt Loading Results Detail as per ASCE 48-05

Load Case	Bolt Number	Fu (ksi)	Fbr (ksi)	Axial Force (kip)	Shear Force (kip)	fv (ksi)	fbr (ksi)	Load Comb.
1	1	105.0	157.5	0.0	17.53	9.22	20.03	0.408
1	2	105.0	157.5	0.0	21.38	11.25	24.43	0.498
1	3	105.0	157.5	0.0	16.61	8.74	18.99	0.387
1	4	105.0	157.5	0.0	12.76	6.72	14.59	0.297
2	1	105.0	157.5	0.0	8.79	4.62	10.04	0.205
2	2	105.0	157.5	0.0	11.93	6.28	13.63	0.278
2	3	105.0	157.5	0.0	9.85	5.18	11.25	0.229
2	4	105.0	157.5	0.0	6.71	3.53	7.67	0.156
3	1	105.0	157.5	0.0	5.99	3.15	6.85	0.140
3	2	105.0	157.5	0.0	7.54	3.97	8.62	0.176
3	3	105.0	157.5	0.0	5.06	2.66	5.78	0.118
3	4	105.0	157.5	0.0	3.51	1.85	4.01	0.082
4	1	105.0	157.5	0.0	33.78	17.78	38.61	0.787
4	2	105.0	157.5	0.0	35.16	18.51	40.18	0.819
4	3	105.0	157.5	0.0	37.50	19.74	42.85	0.873
4	4	105.0	157.5	0.0	36.12	19.01	41.28	0.841



K2 Engineering, Inc.
 5549 Hunters Hill Road
 Irondale, AL 35210-3036
 Phone: (205) 951-3825 Fax: (205) 951-3825
 e-mail: rkiser@k2engineeringinc.com
 web address: www.k2engineeringinc.com

Bolted Plate Design Results Page 3

Engineer: Robert P Kiser, PE
 Printed at: Sunday, January 09, 2011 12:55:13 PM

Bolts meet design criteria? True
 Pole Vang meets design criteria? True
 Arm Connection meets design criteria? True

Pole Vang Edge Criteria Violated? False
 Arm Connection Edge Criteria Violated? False

Pole Vang Stress Summary

Bolt Analysis Method = ASCE 48-05
 Found excessive Bearing Stresses in the Pole Vang? False
 Found excessive Shear Stresses in the Pole Vang? False
 Found that the AISC Minimum Edge Distance was violated in the Pole Vang? False
 AISC Minimum Edge Distance = 2.1875 in
 Found that the ASCE 48-05 Minimum Edge Distance was violated in the Pole Vang? False
 Pole Vang meets design criteria? True
 Worst Case Bearing Stress = 42.85 ksi for Load Case # 4 at Bolt # 3
 Worst Case Block Shear Stress = 23.07 ksi for Load Case # 4 at Bolt # 3 in direction towards: End Edge

Pole Vang Stress Detail as per ASCE 48-05

Load Case	Bolt Number	Resultant Shear (kip)	Arm Axis Shear (kip)	Axis 2 Shear (kip)	Allow. Br Strs (ksi)	Allow. Sh Strs (ksi)	Bearing Stress (ksi)	Blk Shr End (ksi)	Blk Shr Top (ksi)	Blk Shr Bottom (ksi)
1	1	17.53	-17.53	-0.18	97.50	29.00	20.03	0.00	0.00	0.00
1	2	21.38	-21.38	-0.18	97.50	29.00	24.43	0.00	0.00	0.12
1	3	16.61	16.61	-0.18	97.50	29.00	18.99	10.22	0.00	0.00
1	4	12.76	12.76	-0.18	97.50	29.00	14.59	7.85	0.00	0.12
2	1	8.79	-8.79	-0.15	97.50	29.00	10.04	0.00	0.00	0.00
2	2	11.93	-11.92	-0.15	97.50	29.00	13.63	0.00	0.00	0.10
2	3	9.85	9.84	-0.15	97.50	29.00	11.25	6.06	0.00	0.00
2	4	6.71	6.71	-0.15	97.50	29.00	7.67	4.13	0.00	0.10
3	1	5.99	-5.99	-0.07	97.50	29.00	6.85	0.00	0.00	0.00
3	2	7.54	-7.54	-0.07	97.50	29.00	8.62	0.00	0.00	0.05
3	3	5.06	5.06	-0.07	97.50	29.00	5.78	3.11	0.00	0.00
3	4	3.51	3.51	-0.07	97.50	29.00	4.01	2.16	0.00	0.05
4	1	33.78	-33.78	-0.07	97.50	29.00	38.61	0.00	0.00	0.00
4	2	35.16	-35.16	-0.07	97.50	29.00	40.18	0.00	0.00	0.04
4	3	37.50	37.50	-0.07	97.50	29.00	42.85	23.07	0.00	0.00
4	4	36.12	36.12	-0.07	97.50	29.00	41.28	22.23	0.00	0.04

Arm Connection Stress Summary

Bolt Analysis Method = ASCE 48-05
 Found excessive Bearing Stresses in the Arm Connection? False
 Found excessive Shear Stresses in the Arm Connection? False
 Found that the AISC Minimum Edge Distance was violated in the Arm Connection? False
 AISC Minimum Edge Distance = 2.1875 in
 Found that the ASCE 48-05 Minimum Edge Distance was violated in the Arm connection? False
 Arm Connection meets design criteria? True
 Worst Case Bearing Stress = 42.85 ksi for Load Case # 4 at Bolt # 3
 Worst Case Block Shear Stress = 23.07 ksi for Load Case # 4 at Bolt # 3 in direction towards: End Edge



K2 Engineering, Inc.
 5549 Hunters Hill Road
 Irondale, AL 35210-3036
 Phone: (205) 951-3825 Fax: (205) 951-3825
 e-mail: rkiser@k2engineeringinc.com
 web address: www.k2engineeringinc.com

Bolted Plate Design Results Page 4

Engineer: Robert P Kiser, PE
 Printed at: Sunday, January 09, 2011 12:55:13 PM

Bolts meet design criteria? True
 Pole Vang meets design criteria? True
 Arm Connection meets design criteria? True

Pole Vang Edge Criteria Violated? False
 Arm Connection Edge Criteria Violated? False

Arm Connection Stress Detail as per ASCE 48-05

Load Case	Bolt Number	Resultant Shear (kip)	Arm Axis Shear (kip)	Axis 2 Shear (kip)	Allow. Br Strs (ksi)	Allow. Sh Strs (ksi)	Bearing Stress (ksi)	Blk Shr End (ksi)	Blk Shr Top (ksi)	Blk Shr Bottom (ksi)
1	1	17.53	-17.53	-0.18	97.50	29.00	20.03	0.00	0.00	0.00
1	2	21.38	-21.38	-0.18	97.50	29.00	24.43	0.00	0.00	0.12
1	3	16.61	16.61	-0.18	97.50	29.00	18.99	10.22	0.00	0.00
1	4	12.76	12.76	-0.18	97.50	29.00	14.59	7.85	0.00	0.12
2	1	8.79	-8.79	-0.15	97.50	29.00	10.04	0.00	0.00	0.00
2	2	11.93	-11.92	-0.15	97.50	29.00	13.63	0.00	0.00	0.10
2	3	9.85	9.84	-0.15	97.50	29.00	11.25	6.06	0.00	0.00
2	4	6.71	6.71	-0.15	97.50	29.00	7.67	4.13	0.00	0.10
3	1	5.99	-5.99	-0.07	97.50	29.00	6.85	0.00	0.00	0.00
3	2	7.54	-7.54	-0.07	97.50	29.00	8.62	0.00	0.00	0.05
3	3	5.06	5.06	-0.07	97.50	29.00	5.78	3.11	0.00	0.00
3	4	3.51	3.51	-0.07	97.50	29.00	4.01	2.16	0.00	0.05
4	1	33.78	-33.78	-0.07	97.50	29.00	38.61	0.00	0.00	0.00
4	2	35.16	-35.16	-0.07	97.50	29.00	40.18	0.00	0.00	0.04
4	3	37.50	37.50	-0.07	97.50	29.00	42.85	23.07	0.00	0.00
4	4	36.12	36.12	-0.07	97.50	29.00	41.28	22.23	0.00	0.04



K2 Engineering, Inc.
5549 Hunters Hill Road
Irondale, AL 35210-3036
Phone: (205) 951-3825 Fax: (205) 951-3825
e-mail: rkiser@k2engineeringinc.com
web address: www.k2engineeringinc.com

Bolted Plate Design Results Page 5

Engineer: Robert P Kiser, PE

Printed at: Sunday, January 09, 2011 12:55:13 PM

Bolts meet design criteria? True
Pole Vang meets design criteria? True
Arm Connection meets design criteria? True

Pole Vang Edge Criteria Violated? False
Arm Connection Edge Criteria Violated? False

Bolt Properties

Bolt Grade:	A325
Bolt Diameter:	1.7500 inches
Min. Tensile Strength (Fu):	105.0 ksi
Bolt Proof Load (Fp):	74.0 ksi
Bolt Yield Strength (Fy):	81.0 ksi
Stress or Net Area (An):	1.9000 in ²
Tensile Area:	1.9000 in ²
Bolt Root Area:	1.7800 in ²
Bolt Gross Area:	2.4050 in ²
Min. Edge Distance:	2.1875 inches
Min. Spacing:	4.6670 inches
Nut Point/Point Width:	3.1875 inches
Nut Height:	1.7500 inches
Bolt Threads per inch:	5.0
Standard Hole Diameter:	1.8125 inches
Oversize Hole Diameter:	2.0625 inches

Miscellaneous Results Data

Pole Cross Section Area:	34.546 (in ²)
Pole Moment of Inertia:	8119.1 (in ⁴)
Pole Perimeter:	138.989 (in)
Pole Point/Point Width:	44.751 (in)
Width of Pole Flat:	11.582 (in)
Adjusted Pole Maximum Width:	45.198 (in)
Moment at Onset of Pole Yield:	1511.9 (ft-kip)
Minimum Required Bolt Length:	3.250 (in)
Pole Vang Yield Strength:	50.00 (ksi)
Pole Vang Tensile Strength:	65.00 (ksi)
Arm Connection Yield Strength:	50.00 (ksi)
Arm Connection Tensile Strength:	65.00 (ksi)