LMS GPA20 Aluminum Load Chart

6/9/2017

Factor of Safety = Aluminum Design Manual
Δ = Transverse Deflection
Designed based on ANSI/TIA-322

Pipe 4" O.D. x .313" Fy 40 ksi T6061-T6 Aluminum
Wt=Gross Load (Lifted Weight + All Rigging Wt)
Rbr=Horizontal Bridal Reation
Rba=Horizontal Basket reaction
Rv=Vertical Basket Reaction

La= Cantilever Length (ft)
Lb=Length from bridle to basket
Max Wind Load = 30 mph

Note: *1) Reactions at attachment points shall be multiplied by a 1.3 impact factor for the evaluation of the supporting structure.*
2) Not designed for lifting personnel.

4 ft Cantilever

Load Line Angle (Deg)	3	4	5	6	7	8	9	10
La (ft)	4	4	4	4	4	4	4	4
Lb (ft)	16	16	16	16	16	16	16	16
Wt (lbs)	1400.00	1330.00	1260.00	1190.00	1090.00	1000.00	920.00	880.00
Rbr (lbs)	110	140	170	200	220	240	260	290
Rba (lbs)	20	30	30	40	40	50	50	60
Rv (lbs)	3160	3110	3060	3000	2860	2740	2630	2640
Δ (in)	0.29	0.38	0.46	0.54	0.59	0.64	0.69	0.76
Max Tag Load (lbs)	146.54	185.55	219.63	248.78	265.68	278.35	287.84	305.62

6 ft Cantilever

Load Line Angle (Deg)	3	4	5	6	7	8	9	10
La (ft)	4	4	4	4	4	4	4	4
Lb (ft)	16	16	16	16	16	16	16	16
Wt (lbs)	1160.00	1110.00	1030.00	960.00	890.00	820.00	770.00	710.00
Rbr (lbs)	110	140	170	190	220	240	260	280
Rba (lbs)	30	40	50	60	70	70	80	90
Rv (lbs)	2640	2610	2520	2440	2350	2260	2220	2140
Δ (in)	0.57	0.76	0.9	1.03	1.14	1.24	1.36	1.44
Max Tag Load (lbs)	121.42	154.86	179.54	200.69	216.93	228.24	240.91	246.58

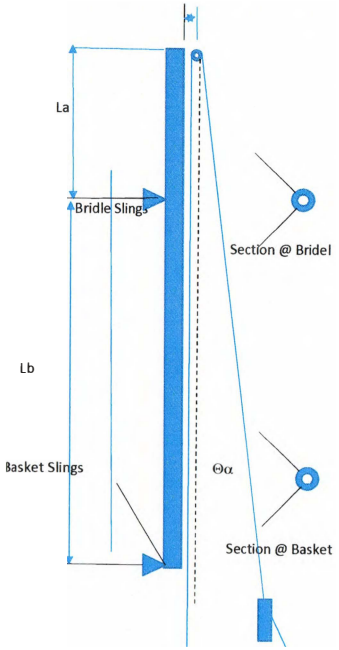
8 ft Cantilever

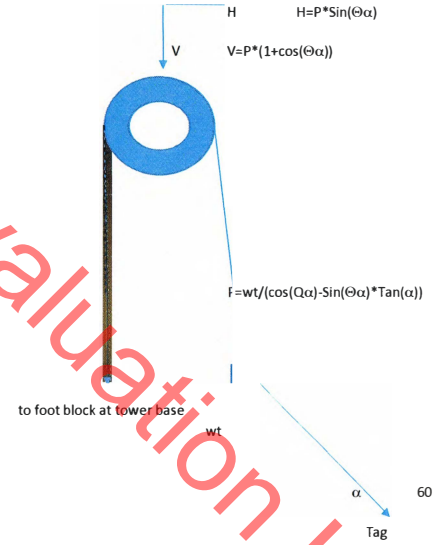
Load Line Angle (Deg)	3	4	5	6	7	8	9	10
La (ft)	4	4	4	4	4	4	4	4
Lb (ft)	16	16	16	16	16	16	16	16
Wt (lbs)	920.00	850.00	780.00	720.00	660.00	610.00	570.00	540.00
Rbr (lbs)	110	130	160	180	190	210	230	250
Rba (lbs)	40	50	60	70	80	90	100	110
Rv (lbs)	2110	2020	1930	1850	1770	1700	1660	1650
Δ (in)	0.83	1.04	1.21	1.37	1.5	1.64	1.78	1.96
Max Tag Load (lbs)	96.30	118.59	135.96	150.52	160.87	169.79	178.34	187.54

10 ft Cantilever

Load Line Angle (Deg)	3	4	5	6	7	8	9	10
La (ft)	4	4	4	4	4	4	4	4
Lb (ft)	16	16	16	16	16	16	16	16
Wt (lbs)	750.00	690.00	650.00	600.00	550.00	520.00	490.00	450.00
Rbr (lbs)	110.00	140.00	160.00	180.00	200.00	230.00		260.00
Rba (lbs)	60.00	70.00	90.00	100.00	110.00	120.00		140.00
Rv (lbs)	1,730.00	1,660.00	1,620.00	1,550.00	1,490.00	1,460.00		1,390.00
Δ (in)	1.09	1.35	1.62	1.83	2.00	2.24		2.60
Max Tag Load (lbs)	78.50	96.26	113.30	125.43	134.06	144.74	153.31	156.28

LMS GP20 (Aluminum) HD Load Calculation Diagram
Date: 6/9/17
Pipe 4" O.D. X .313" **FY = 40 ksi min** ***T6061-T6 Aluminum***





4 ft Cantilever

wt (lbs)	P (lbs)	V (lbs)	H (lbs)	Θα	Tag
1,400.00	1,541.88	3,081.65	80.70	3.00	146.54
1,330.00	1,516.98	3,030.26	105.82	4.00	185.55
1,260.00	1,490.71	2,975.74	129.92	5.00	219.63
1,190.00	1,462.86	2,917.71	152.91	6.00	248.78
1,090.00	1,394.82	2,779.25	169.99	7.00	265.68
1,000.00	1,334.73	2,656.48	185.76	8.00	278.35
920.00	1,283.60	2,551.39	200.80	9.00	287.84
880.00	1,286.47	2,553.40	223.39	10.00	305.62

6 ft Cantilever

wt (lbs)	P (lbs)	V (lbs)	H (lbs)	Θα	Tag
1,160.00	1,277.56	2,553.37	66.86	3.00	121.42
1,110.00	1,266.05	2,529.02	88.32	4.00	154.86
1,030.00	1,218.59	2,432.55	106.21	5.00	179.54
960.00	1,180.12	2,353.78	123.36	6.00	200.69
890.00	1,138.89	2,269.29	138.80	7.00	216.93
820.00	1,094.48	2,178.31	152.32	8.00	228.24
770.00	1,074.31	2,135.40	168.06	9.00	240.91
710.00	1,037.95	2,060.13	180.24	10.00	246.58

8 ft Cantilever

wt (lbs)	P (lbs)	V (lbs)	H (lbs)	Θα	Tag
920.00	1,013.24	2,025.09	53.03	3.00	96.30
850.00	969.50	1,936.63	67.63	4.00	118.59
780.00	922.82	1,842.13	80.43	5.00	135.96
720.00	885.09	1,765.34	92.52	6.00	150.52
660.00	844.57	1,682.85	102.93	7.00	160.87
610.00	814.19	1,620.45	113.31	8.00	169.79
570.00	795.27	1,580.75	124.41	9.00	178.34
540.00	789.43	1,566.86	137.08	10.00	187.54

10 ft Cantilever

wt (lbs)	P (lbs)	V (lbs)	H (lbs)	Θα	Tag
750.00	826.01	1,650.88	43.23	3.00	78.50
690.00	787.00	1,572.09	54.90	4.00	96.26
650.00	769.02	1,535.10	67.02	5.00	113.30
600.00	737.58	1,471.12	77.10	6.00	125.43
550.00	703.81	1,402.37	85.77	7.00	134.06
520.00	694.06	1,381.37	96.59	8.00	144.74
490.00	683.65	1,358.89	106.95	9.00	153.31
450.00	657.86	1,305.72	114.24	10.00	156.28

LMS GP20 (Aluminum) _HD _Design Check

4" OD x .313" T6061 T6 Aluminum Pipe

Fy (min)=	40	ksi	Ftu=	60 ksi
E=	10100	ksi		
I=	6.19	in^4		
S=	3.21	in^3		
r=	1.31	in		
Ag=	3.61	in^2		
L=	20	ft		
IMF=	1.45		Class A	
Ω=	1.65			

Design Check - 1.45 Impact Factor
4' Cantilever

Θα (deg)	Pr Kips	Mr in*k	(Pr/Pc+Mr/Mc)*IMF
3	3.11	4.44	0.988
4	3.06	5.76	0.994
5	3.00	7.08	0.998
6	2.94	8.28	0.999
7	2.81	9.12	0.974
8	2.68	9.84	0.947
9	2.58	10.56	0.929
10	2.58	11.76	0.948

Design Check - 1.45 Impact Factor
6' Cantilever

Θα (deg)	Pr Kips	Mr in*k	(Pr/Pc+Mr/Mc)*IMF
3	2.59	6.12	0.981
4	2.56	7.92	1.000
5	2.47	9.48	0.994
6	2.39	10.80	0.987
7	2.31	12.00	0.979
8	2.21	13.08	0.962
9	2.17	14.28	0.968
10	2.10	15.24	0.959

Design Check - 1.45 Impact Factor
8' Cantilever

Θα (deg)	Pr Kips	Mr in*k	(Pr/Pc+Mr/Mc)*IMF
3	2.07	6.72	0.997
4	1.98	8.40	0.985
5	1.89	9.72	0.968
6	1.81	11.04	0.954
7	1.73	12.12	0.937
8	1.66	13.20	0.924
9	1.62	14.40	0.926
10	1.61	15.84	0.945

Design Check - 1.45 Impact Factor
10' Cantilever

Θα (deg)	Pr Kips	Mr in*k	(Pr/Pc+Mr/Mc)*IMF
3	1.70	7.08	0.988
4	1.62	8.76	0.973
5	1.59	10.56	0.986
6	1.52	11.88	0.971
7	1.45	13.08	0.954
8	1.43	14.52	0.967
9	1.41	15.96	0.980
10	1.36	16.92	0.969

Axial Compression

Pn=Fc*Ag

for kL/r<= S2, Fc=.85*(Bc-Dc*kL/r)<=Fcy

for kL/r>= S2, Fc=.85*π^2*E/(kL/r)^2

S2=Cc= .41*Bc/Dc

Bc=Fcy*(1+(Fcy/2250*k)^.5
Dc=(Bc/10)*(Bc/E)^.5
Fcy=40, k=1

Bc= 45.33333
Dc= 0.303715
Cc= 61.19779

S2= 61.19779

For4' Cantilever	k=	5.3	kt based on cantilever length of gin pole				
	k*L/r=	194.1985	kL/r>S2	Fc=	2.24671726	Pn(4)=	8.110649319 kips
For 6' Cantilever	k=	3.8	kt based on cantilever length of gin pole				
	k*L/r=	208.855	kL/r>S2	Fc=	1.94245269 ksi	Pn(6)=	7.012254212 kips
For 8' Cantilever	k=	3.2	kt based on cantilever length of gin pole				
	k*L/r=	234.5038	kL/r>S2	Fc=	1.54077851 ksi	Pn(8)=	5.562210434 kips
For 10' Cantilever	k=	2.8	kt based on cantilever length of gin pole				
	k*L/r=	256.4885	kL/r>S2	Fc=	1.28796506 ksi	Pn(10)=	4.649553864 kips

Pc(4)= 4.915545
Pc(6)= 4.249851
Pc(8)= 3.371037
Pc(10)= 2.817911

Pc=Pn/Ω = 4.249851 kips

Bending Moment

Yielding & Rupture

Compressive Yielding

Mn=1.17*Fcy*S Mn= 150.228 in*k

Tensile Yielding

Mn=1.17*Fty*S Mn= 150.228 in*k

Tensile Rupture

Mn=1.24*Ftu*S/kt Mn= 238.824 in*k

Mc=Mn/Ω Mc= 91.04727 in*k