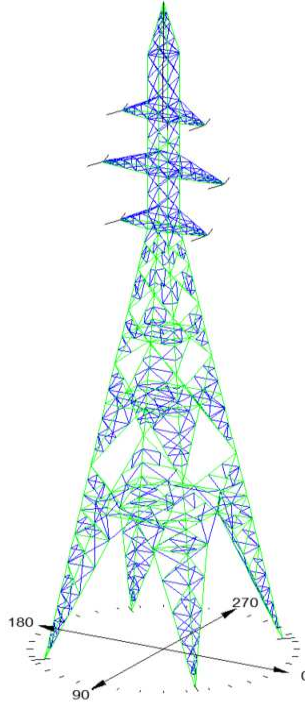


**Construction of
220 kV Loop in Loop out Paliastomi- into Ozurgeti Substation and
110 kV Double Circuit (D/C) Overhead Line from Ozurgeti Substation to Zoti HPP
Tower Design Report of Suspension Tower "12B-LA"**



2	26.08.2022	As per Comments	S.Çelebi	S.Sahin	S.Nazlı
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Tower Design Report of Suspension Tower "12B-LA"			n.a.	Page 1 of 20	

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A-GENERAL INFORMATION

1. PROJECT INFORMATION

Project : Open Programme Extension of the Transmission Network II

Tower Type : Double Circuit 110kV - 12B - LA Line Angle 0° - 30°

Extension Details : This tower includes +9, +6, +3, +0, -3 Bodies with +6, +4.5, +3, +1.5, +0, -1.5, -3 Leg Extensions.

2. DESIGN DETAILS

Software : PLS-TOWER version 17.2

Applied Specifications : EN 50341- 1:2012

Material :

Bolts : DIN 7990

Minimum yield strength of the bolt 640 MPa

Minimum tensile strength of the bolt 800 MPa

Profiles: EN10025

	Fy (Mpa)	Fu (Mpa)
S235	235	360
S355	355	470

Fy Minimum yield strength
Fu Ultimate strength

B-LOAD CASES

Load cases which applied the tower for design can be summarized as the list below.

Row #	Load Case Description	Dead Load Factor	Wind Area Factor	Wind/Ice Model	Trans. Wind Pressure (Pa)	Longit. Wind Pressure (Pa)	Ice Thickness (cm)	Ice Density (N/m3)
1	0° C1,C NA+	1.1	1	EN50341-1:2012F	568.3	0	0	0
2	0° C1-,C NA-	1.1	1	EN50341-1:2012F	-568.3	0	0	0
3	0° C2,C BI+	1.1	1	EN50341-1:2012F	401.7	401.7	0	0
4	0° C2-,C BI-	1.1	1	EN50341-1:2012F	-401.7	-401.7	0	0
5	0° ICE,C NA+	1.1	1	EN50341-1:2012F	0	0	2.5	6867
6	0° C3,C NA+	1.1	1	EN50341-1:2012F	168.3	0	2.5	6867
7	0° C3-,C NA-	1.1	1	EN50341-1:2012F	-168.3	0	2.5	6867
8	0° C4,C BI+	1.1	1	EN50341-1:2012F	119	119	2.5	6867
9	0° C4-,C BI-	1.1	1	EN50341-1:2012F	-119	-119	2.5	6867
10	0° C5,C NA+	1.1	1	EN50341-1:2012F	410.4	0	1.225	6867
11	0° C5-,C NA-	1.1	1	EN50341-1:2012F	-410.4	0	1.225	6867
12	0° C6,C BI+	1.1	1	EN50341-1:2012F	290.2	290.2	1.225	6867
13	0° C6-,C BI-	1.1	1	EN50341-1:2012F	-290.2	-290.2	1.225	6867
14	0° C7,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
15	0° C1, Min. WS,C NA+	1.1	1	EN50341-1:2012F	568.3	0	0	0
16	0° C1-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-568.3	0	0	0
17	0° C2, Min. WS,C BI+	1.1	1	EN50341-1:2012F	401.7	401.7	0	0
18	0° C2-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-401.7	-401.7	0	0
19	0° ICE, Min. WS,C NA+	1.1	1	EN50341-1:2012F	0	0	2.5	6867
20	0° C3, Min. WS,C NA+	1.1	1	EN50341-1:2012F	168.3	0	2.5	6867
21	0° C3-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-168.3	0	2.5	6867
22	0° C4, Min. WS,C BI+	1.1	1	EN50341-1:2012F	119	119	2.5	6867
23	0° C4-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-119	-119	2.5	6867
24	0° C5, Min. WS,C NA+	1.1	1	EN50341-1:2012F	410.4	0	1.225	6867
25	0° C5-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-410.4	0	1.225	6867
26	0° C6, Min. WS,C BI+	1.1	1	EN50341-1:2012F	290.2	290.2	1.225	6867
27	0° C6-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-290.2	-290.2	1.225	6867
28	0° C7, Min. WS,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
29	0° SC1+,EW<,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
30	0° SC1+,LT&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
31	0° SC1+,LT&LM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
32	0° SC1+,LM&LB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
33	0° SC1+,EW&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
34	0° SC1+,RT&RM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
35	0° SC1+,RM&RB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
36	0° SF1A,EW,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
37	0° SF1A,LT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
38	0° SF1A,RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
39	0° SF1A,LM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
40	0° SF1A,RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
41	0° SF1A,LB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
42	0° SF1A,RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
43	0° SF1A,LT&RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
44	0° SF1A,LM&RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
45	0° SF1A,LB&RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
46	SF1B,All Strung,I NA+	1.5	1	EN50341-1:2012F	157.8	0	0	0
47	SF1B,All Strung-,I NA-	1.5	1	EN50341-1:2012F	-157.8	0	0	0
48	0° SF2,C NA+	1.5	1	EN50341-1:2012F	0	0	0	0
49	30° C1,C NA+	1.1	1	EN50341-1:2012F	568.3	0	0	0
50	30° C1-,C NA-	1.1	1	EN50341-1:2012F	-568.3	0	0	0
51	30° C2,C BI+	1.1	1	EN50341-1:2012F	401.7	401.7	0	0
52	30° C2-,C BI-	1.1	1	EN50341-1:2012F	-401.7	-401.7	0	0
53	30° ICE,C NA+	1.1	1	EN50341-1:2012F	0	0	2.5	6867
54	30° C3,C NA+	1.1	1	EN50341-1:2012F	168.3	0	2.5	6867
55	30° C3-,C NA-	1.1	1	EN50341-1:2012F	-168.3	0	2.5	6867
56	30° C4,C BI+	1.1	1	EN50341-1:2012F	119	119	2.5	6867
57	30° C4-,C BI-	1.1	1	EN50341-1:2012F	-119	-119	2.5	6867

58	30° C5,C NA+	1.1	1	EN50341-1:2012F	410.4	0	1.225	6867
59	30° C5-,C NA-	1.1	1	EN50341-1:2012F	-410.4	0	1.225	6867
60	30° C6,C BI+	1.1	1	EN50341-1:2012F	290.2	290.2	1.225	6867
61	30° C6-,C BI-	1.1	1	EN50341-1:2012F	-290.2	-290.2	1.225	6867
62	30° C7,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
63	30° C1, Min. WS,C NA+	1.1	1	EN50341-1:2012F	568.3	0	0	0
64	30° C1-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-568.3	0	0	0
65	30° C2, Min. WS,C BI+	1.1	1	EN50341-1:2012F	401.7	401.7	0	0
66	30° C2-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-401.7	-401.7	0	0
67	30° ICE, Min. WS,C NA+	1.1	1	EN50341-1:2012F	0	0	2.5	6867
68	30° C3, Min. WS,C NA+	1.1	1	EN50341-1:2012F	168.3	0	2.5	6867
69	30° C3-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-168.3	0	2.5	6867
70	30° C4, Min. WS,C BI+	1.1	1	EN50341-1:2012F	119	119	2.5	6867
71	30° C4-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-119	-119	2.5	6867
72	30° C5, Min. WS,C NA+	1.1	1	EN50341-1:2012F	410.4	0	1.225	6867
73	30° C5-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-410.4	0	1.225	6867
74	30° C6, Min. WS,C BI+	1.1	1	EN50341-1:2012F	290.2	290.2	1.225	6867
75	30° C6-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-290.2	-290.2	1.225	6867
76	30° C7, Min. WS,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
77	30° SC1+,EW<,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
78	30° SC1+,LT&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
79	30° SC1+,LT&LM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
80	30° SC1+,LM&LB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
81	30° SC1+,EW&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
82	30° SC1+,RT&RM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
83	30° SC1+,RM&RB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
84	30° SF1A,EW,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
85	30° SF1A,LT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
86	30° SF1A,RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
87	30° SF1A,LM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
88	30° SF1A,RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
89	30° SF1A,LB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
90	30° SF1A,RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
91	30° SF1A,LT&RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
92	30° SF1A,LM&RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
93	30° SF1A,LB&RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
94	30° SF1B,All Strung,I NA+	1.5	1	EN50341-1:2012F	157.8	0	0	0
95	30° SF1B,All Strung-,I NA-	1.5	1	EN50341-1:2012F	-157.8	0	0	0
96	30° SF2,C NA+	1.5	1	EN50341-1:2012F	0	0	0	0

C-GROUP SUMMARY

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
1	SAE	70*70*5	355	64.63	Comp	64.63	Fg3Y	-66.661	30° SC1+,EW<,C NA+	12B_LA_-3BE_-3+6+6-3	103.149	154.416	112.8	1	1	1	102.71	1.33	1.417	1	2	M-16(8.8)	54.49	61.465	30° SC1+,EW&RT,C NA+	12B_LA_9BE_-3+6+6+6	172.246	2	1.75
5	SAE	90*90*6	355	80.6	Comp	80.6	Fg5Y	-105.064	30° SC1+,EW&RT,C NA+	12B-LA+9BE+6+6+6+6	130.352	308.831	247.515	1	1	1	115.17	1.44	2.05	5	4	M-16(8.8)	38.87	96.212	30° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	287.64	2	1.75
6	SAE	90*90*6	355	53.88	Comp	53.88	g6Y	-122.275	30° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	226.956	463.247	371.273	1	1	1	78.65	0.99	1.4	1	6	M-16(8.8)	36.68	105.495	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6+6-3	287.64	2	1.75
7	SAE	90*90*6	355	98.75	Comp	98.75	g7Y	-182.984	30° SC1+,EW<,C NA+	12B_LA_-3BE_-3-3-3+6	185.303	463.247	371.273	1	1	1	92.7	1.16	1.65	1	6	M-16(8.8)	54.65	157.196	30° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	287.64	2	1.75
8	SAE	90*90*6	355	90.34	Comp	90.34	Fg8Y	-244.389	30° SC1+,EW<,C NA+	12B_LA_-3BE_-3-3-3+6	270.527	463.247	371.273	2	1	1	59.78	0.75	0.825	1	6	M-16(8.8)	74.15	213.291	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6-3-3	287.64	2	1.75
10	SAE	130*130*10	355	41.27	Comp	41.27	g9Y	-295.618	30° SC1+,EW<,C NA+	12B_LA_-3BE_-3-3-3+6	716.228	1235.324	902.4	1	1	1	54.69	0.72	1.4	1	8	M-16(8.8)	39.57	269.159	30° C5, Min. WS,C NA+	12B_LA_9BE_-3-3+6+6	680.184	2.8	1.75
11	SAE	130*130*10	355	57.99	Comp	57.99	g10Y	-386.402	30° C5,C NA+	12B_LA_9BE_-3-3+6+6	666.306	1235.324	902.4	1	1	1	64.45	0.85	1.65	1	8	M-16(8.8)	52.54	357.357	30° C5, Min. WS,C NA+	12B_LA_9BE_-3-3+6+6	680.184	2.8	1.75
12	SAE	130*130*10	355	74.27	Comp	74.27	g11Y	-494.887	30° C5,C NA+	12B_LA_9BE_-3-3+6+6	666.306	1235.324	902.4	1	1	1	64.45	0.85	1.65	1	8	M-16(8.8)	67.76	460.912	30° C5, Min. WS,C NA+	12B_LA_9BE_-3-3+6+6	680.184	2.8	1.75
13	SAE	130*130*10	355	85.79	Comp	85.79	g12Y	-614.436	30° C5,C NA+	12B_LA_9BE_+6-3+6	716.228	772.078	1128	1	1	1	54.69	0.72	1.4	1	10	M-16(8.8)	82.99	564.482	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6+6-3	680.184	2.8	1.75
14	SAE	130*130*10	355	84.43	Tens	83.83	g13Y	-628.34	30° C5,C NA+	12B_LA_9BE_+6-3+6	749.514	772.078	1128	1	1	1	45.03	0.59	1.153	1	10	M-16(8.8)	84.43	574.252	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6+6-3	680.184	2.8	1.75
14A	SAE	130*130*10	355	92.87	Tens	91.15	g14Y	-683.181	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	749.514	1235.324	902.4	1	1	1	45.03	0.59	1.153	1	8	M-16(8.8)	92.87	631.715	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	680.184	2.8	1.75
14B	SAE	130*130*10	355	90.27	Tens	88.62	g15Y	-664.311	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	749.642	1235.324	902.4	1	1	1	44.99	0.59	1.152	1	8	M-16(8.8)	90.27	613.986	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	680.184	2.8	1.75
14C	SAE	130*130*10	355	95.85	Tens	95.53	Fg121P	-716.014	30° C5,C NA+	12B_LA_-3BE_-3-3+6+6	749.514	1235.324	902.4	1	1	1	45.03	0.59	1.153	1	8	M-16(8.8)	95.85	651.967	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3-3+6+6	680.184	2.8	1.75
14D	SAE	130*130*10	355	94.63	Comp	94.63	Fg121167Y	-709.233	30° C5,C NA+	12B_LA_-3BE_+6-3-3-3	749.514	1235.324	902.4	1	1	1	45.03	0.59	1.153	1	8	M-16(8.8)	94.46	642.469	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6-3-3-3	680.184	2.8	1.75
15	SAE	70*70*6	355	30.69	Tens	18.46	g16P	-19.176	0° C7, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	103.868	231.623	185.637	1	1	1	116.35	1.5	1.594	6	3	M-16(8.8)	30.69	45.351	0° C7,C NA+	12B-LA+9BE+6+6+6+6	147.768	2	1.75
16	SAE	70*70*6	355	53.95	Comp	53.95	g19XY	-64.553	30° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3-3+6-3	119.662	231.623	185.637	1	1	1	104.53	1.38	1.432	2	3	M-16(8.8)	24.21	35.78	30° SC1+,EW&RT,C NA+	12B_LA_9BE_-3+6+6+6	147.768	2	1.75
17	SAE	50*50*4	235	94.37	Climb	6.03	g22Y	-1.695	30° C4-,C BI-	12B_LA_9BE_+6-3-3-3	28.087	77.208	34.56	1	1	1	162.65	1.64	1.594	8	1	M-16(8.8)	0.15	0.053	30° SC1+,EW<,C NA+	12B_LA_-3BE_+6-3-3-3	38.88	1	1.75
18	SAE	45*45*4	235	4.54	Redun	4.35	g23XY	-1.502	0° C1,C NA+	12B_LA_-3BE_-3-3+6-3	50.094	77.208	34.56	1	1	1	79.55	1.07	0.7	3	1	M-16(8.8)	4.54	1.502	0° C1,C NA+	12B_LA_-3BE_-3-3+6-3	33.12	1	1.75
19	SAE	45*45*4	235	70.16	Climb	12.37	g24XY	-4.276	30° SC1+,EW<,C NA+	12B_LA_9BE_+6+6-3+6	41.817	77.208	34.56	1	1	1	102.69	1.22	0.904	3	1	M-16(8.8)	6.21	2.056	30° SC1+,EW<,C NA+	12B_LA_9BE_+6+6-3+6	33.12	1	1.75
20	DAE	45*45*5	355	2.27	Tens	1.21	g25X	-1.368	30° SC1+,EW<,C NA+	12B_LA_9BE_+6+6-3+6	220.903	154.416	112.8	1	1	1	22.16	0.9	0.299	3	1	M-16(8.8)	2.27	2.431	30° SC1+,EW<,C NA+	12B_LA_9BE_+6-3-3+6	107.16	2	1.75
21	SAE	45*45*5	235	87.69	Climb	7.35	g26Y	-2.806	30° SC1+,EW&RT,C NA+	12B_LA_3BE_-3+6+6+6	38.184	154.416	78.994	0.608	0.608	0.608	137.16	1.46	1.962	6	2	M-16(8.8)	5.47	3.623	0° SC1+,EW<,C NA+	12B_LA_3BE_+6+6-3+6	66.24	1	1.75
22	SAE	45*45*5	235	40.69	Climb	23.6	g203Y	-18.334	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6+6+6-3	77.702	154.416	78.994	1	1	1	64.09	0.81	0.558	2	2	M-16(8.8)	21.35	14.14	30° SC1+,EW&RT,C NA+	12B_LA_-3BE_-3-3+6-3	66.24	1	1.75
23	SAE	55*55*5	235	34.45	Climb	11.49	g28Y	-9.076	0° SC1+,EW&RT,C NA+	12B_LA_9BE_+6+6+6-3	90.414	154.416	78.994	0.67	0.67	0.67	73.86	0.9	1.18	2	2	M-16(8.8)	8.67	6.849	30° SC1+,EW&RT,C NA+	12B_LA_9BE_-3+6+6+6	88.416	1	1.75
24	DAE	80*80*8	355	34.78	Tens	0	g204X	0		12B-LA+9BE+6+6+6+6	684.787	154.416	330.021	1	1	1	8.26	0.78	0.2	3	2	M-16(8.8)	34.78	53.707	30° C3-,C NA+	12B_LA_-3BE_-3+6-3-3	579.04	2	1.75
24A	DAE	80*80*8	355	6.19	Tens	4.06	g336P	-6.262	30° C3, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	645.149	154.416	330.021	1	1	1	19.06	0.87	0.461	3	2	M-16(8.8)	6.19	9.557	30° C3,C NA+	12B_LA_-3BE_-3-3-3-3	579.04	2	1.75
25	SAE	45*45*5	235	87.76	Climb	5.46	g30XY	-1.944	0° SC1+,LT&RT,C NA+	12B_LA_9BE_+6+6+6-3	35.587	154.416	78.994	0.608	0.608	0.608	145.62	1.52	2.083	6	2	M-16(8.8)	4.66	3.085	30° SC1+,EW<,C NA+	12B_LA_9BE_+6-3-3+6	66.24	1	1.75
26	SAE	50*50*5	235	25.96	Climb	12.92	g202Y	-10.208	0° SC1+,LT&RT,C NA+	12B_LA_-3BE_+6+6-3+6	89.964	154.416	78.994	0.75	0.75	0.75	54.68	0.75	0.714	2	2	M-16(8.8)	22.3	17.179	0° SC1+,LT&RT,C NA+	12B_LA_-3BE_-3-3-3+6	77.04	1	1.75
27	SAE	45*45*5	235	54.09	Climb	9.79	g32Y	-6.183	30° SC1+,LT&RT,C NA+	12B_LA_-3BE_+6-3-3+6	63.141	154.416	78.994	0.659	0.659	0.659	90.74	1.05	1.198	2	2	M-16(8.8)	5.93	3.93	0° SC1+,LT&RT,C NA+	12B_LA_9BE_+6+6+6-3	66.24	1	1.75
28	DAE	80*80*8	355	16.89	Tens	0	g205X	0		12B-LA+9BE+6+6+6+6	684.787	308.831	330.021	1	1	1	8.26	0.78	0.2	3	2	M-16(8.8)	16.89	52.159	30° C3-, Min. WS,C NA-	12B_LA_-3BE_-3-3-3-3	579.04	2	1.75
28A	DAE	80*80*8	355	6.26	Tens	3.7	g337P	-5.72	30° C3, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	662.832	154.416	330.021	1	1	1	14.59	0.84	0.353	3	2	M-16(8.8)	6.26	9.669	30° C3,C NA+	12B_LA_-3BE_-3-3-3-3	579.04	2	1.75
29	SAE	65*65*6	355	55.03	Tens	23.17	g35P	-29.207	0° C7, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	126.058	231.623	185.637	1	1	1	95.02	1.28	1.207	2	3	M-16(8.8)	55.03	72.009	0° C7,C NA+	12B_LA_-3BE_-3+6+6-3	130.848	2	1.75
30	SAE	70*70*6	355	69.72	Comp	69.72	g39XY	-109.816	30° SC1+,LT&LM,C NA+	12B_LA_-3BE_+6+6-3-3	157.499	231.623	185.637	1	1	1	84.3	1.16	1.155	2	3	M-16(8.8)	41.49	61.305	30° SC1+,RT&RM,C NA+	12B_LA_9BE_+6+6+6+6	147.768	2	1.75
31	SAE	45*45*4	235	10.05	Comp	10.05	g44Y	-2.264	30° C4-,C BI-	12B_LA_9BE_+6-3+6+6	22.521	77.208	34.56	1	1	1	177.37	1.74	1.561	8	1	M-16(8.8)	0	0		12B-LA+9BE+6+6+6+6	33.12	1	1.75
32	SAE	45*45*4	235	6.86	Redun	6.57	g45XY	-2.271	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	36.125	77.208	34.56	1	1	1	119.32	1.33	1.05	3	1	M-16(8.8)	6.86	2.271	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	33.12	1	1.75
33	SAE	45*45*4	235	8.05	Comp	8.05	g46XY	-2.181	30° C3,C NA+	12B_LA_9BE_+6+6+6-3	27.099	77.208	34.56	1	1	1	153.47	1.57	1.351	8	1	M-16(8.8)	0	0		12B-LA+9BE+6+6+6+6	33.12	1	1.75
34	SAE	45*45*4	235	7.54	Redun	7.23	g47XY	-2.497	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	50.094	77.208	34.56	1	1	1	79.55	1.07	0.7	3	1	M-16(8.8)	7.54	2.497	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	33.12	1	1.75
35	SAE	45*45*4	235	94.56	Climb	13.08	g48XY	-4.055	30° SC1+,LT&LM,C NA+	12B-LA+9BE+6+6+6+6	30.996	77.208	34.56	1	1	1	137.14	1.46	1.207	8	1	M-16(8.8)	4.83	1.599	0° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3+6-3-3	33.12	1	1.75
36	SAE	45*45*4	235	7.53	Tens	3.61	g49X	-1.246	0° SC1+,LT&LM,C NA+	12B_LA_OBE_-3+6+6+6	59.842	77.208	34.56	1	1	1	39.77	0.89	0.35	3	1	M-16(8.8)	7.53	2.496	30° SC1+,LT&LM,C NA+	12B_LA_9BE_+6+6-3-3	33.12	1	1.75
37	SAE	45*45*4	235	46.17	Climb	26.54	g50XY	-9.174	30° SC1+,LT&LM,C NA+	12B_LA_-3BE_+6+6+6-3	53.219	77.208	34.56	1	1	1	67.54	1.02	0.594	3	1	M-16(8.8)	13.71	4.541	30° SC1+,LT&LM,C NA+	12B_LA_9BE_+6+6+6-3	33.12	1	1.75
38	DAE	45*45*																											

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
60	SAE	45*45*5	235	30.68	Comp	30.68	g75XY	-24.237	0° SC1+,LM&LB,C NA+	12B_LA_6BE_-3+6+6+6	81.915	154.416	78.994	0.75	0.75	0.75	47.09	0.71	0.546	2	2	M-16(8.8)	29.29	19.403	30° SC1+,RM&RB,C NA+	12B_LA_-3BE_-3-3+6-3	66.24	1	1.75
61	SAE	45*45*5	235	88.97	Climb	4.77	g76X	-1.695	30° SC1+,LT&LM,C NA+	12B_LA_OBE_+6+6-3-3	35.52	154.416	78.994	0.608	0.608	0.608	145.85	1.52	2.087	6	2	M-16(8.8)	4.98	3.296	30° SC1+,RT&RM,C NA+	12B_LA_OBE_+6-3-3+6	66.24	1	1.75
62	DAE	80*80*8	355	33.63	Tens	0	g206X	0		12B-LA+9BE+6+6+6+6	684.787	154.416	330.021	1	1	1	8.26	0.78	0.2	3	2	M-16(8.8)	33.63	51.933	30° C3-,C NA-	12B-LA+9BE+6+6+6+6	579.04	2	1.75
62A	DAE	80*80*8	355	9.15	Tens	6.29	g338P	-9.72	30° C3, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	649.858	154.416	330.021	1	1	1	17.91	0.86	0.433	3	2	M-16(8.8)	9.15	14.127	30° C3,C NA+	12B_LA_OBE_+6-3-3+6	579.04	2	1.75
63	SAE	45*45*5	235	62.57	Climb	12.98	g78X	-7.11	0° SC1+,LT&LM,C NA+	12B_LA_9BE_-3+6+6+6	54.782	154.416	78.994	0.659	0.659	0.659	104.22	1.17	1.376	2	2	M-16(8.8)	5.14	3.404	0° SC1+,LT&LM,C NA+	12B-LA+9BE+6+6+6+6	66.24	1	1.75
64	SAE	50*50*5	235	30.41	Climb	11.48	g79XY	-9.067	0° SF1A,LM,I NA+	12B_LA_OBE_+6+6+6+6	87.054	154.416	78.994	0.75	0.75	0.75	63.41	0.81	0.829	2	2	M-16(8.8)	28.3	21.8	0° SC1+,RT&RM,C NA+	12B_LA_9BE_+6-3+6+6	77.04	1	1.75
67	SAE	45*45*4	235	29.25	Climb	12.24	g85XR	-4.23	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3-3+6-3	59.598	77.208	34.56	1	1	1	40.91	0.89	0.36	3	1	M-16(8.8)	13.03	4.315	0° SC1+,EW&RT,C NA+	12B-LA+9BE+6+6+6+6	33.12	1	1.75
68	SAE	45*45*4	235	17.74	Comp	17.74	g83XY	-6.132	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6-3-3+6	39.559	77.208	34.56	1	0.667	0.667	81.32	1.26	1.073	3	1	M-16(8.8)	17.57	5.82	0° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	33.12	1	1.75
69	SAE	45*45*4	235	9.18	Comp	9.18	g80XY	-2.446	30° C5, Min. WS,C NA+	12B_LA_9BE_-3+6+6+6	26.634	77.208	34.56	1	0.636	0.636	125.57	1.59	1.708	3	1	M-16(8.8)	7.37	2.44	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_-3-3-3-3	33.12	1	1.75
70	SAE	45*45*4	235	8.08	Comp	8.08	g576Y	-1.697	30° C6,C BI+	12B_LA_9BE_+6+6+6-3	21.003	77.208	34.56	1	0.588	0.588	152.07	1.81	2.068	7	1	M-16(8.8)	4.5	1.492	30° C6, Min. WS,C BI+	12B_LA_9BE_+6+6+6-3	33.12	1	1.75
71	SAE	60*60*5	235	66.28	Climb	20.77	g86XR	-9.359	30° C3, Min. WS,C NA+	12B_LA_9BE_-3-3+6-3	45.054	154.416	78.994	1	1	1	153.85	1.57	1.8	8	2	M-16(8.8)	12.19	9.631	0° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+3	99.216	1	1.75
72	SAE	45*45*5	235	93.62	Climb	3.09	g87X	-1.095	30° SC1+,EW&RT,C NA+	12B-LA+9BE+6+6+6+6	35.39	154.416	78.994	0.5	0.5	0.5	146.3	1.52	2.546	6	2	M-16(8.8)	2.89	1.916	30° SC1+,EW&RT,C NA+	12B_LA_6BE_+6+6-3-3	66.24	1	1.75
72AT	SAE	60*60*5	235	66.28	Climb	21.7	g88P	-9.776	30° C7, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	45.054	154.416	78.994	1	1	1	153.85	1.57	1.8	8	2	M-16(8.8)	40.73	32.177	0° C7,C NA+	12B_LA_-3BE_-3-3-3-3	99.216	1	1.75
72AL	SAE	55*55*5	235	79.54	Climb	45.63	g88AX	-16.789	30° C3,C NA+	12B_LA_-3BE_-3-3+6-3	36.789	154.416	78.994	1	1	1	168.22	1.68	1.8	8	2	M-16(8.8)	15.86	12.525	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	88.416	1	1.75
73T	SAE	60*60*5	235	88.73	Comp	88.73	g89Y	-39.976	0° SC1+,LT&RT,C NA+	12B_LA_-3BE_-3-3-3-3	45.054	154.416	78.994	1	1	1	153.85	1.57	1.8	8	2	M-16(8.8)	29.13	23.007	0° SC1+,LT&RT,C NA+	12B-LA+9BE+6+6+6+6	99.216	1	1.75
73L	SAE	55*55*5	235	79.54	Climb	10.24	g89AX	-3.768	30° C3, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	36.789	154.416	78.994	1	1	1	168.22	1.68	1.8	8	2	M-16(8.8)	14.41	11.381	0° C3,C NA+	12B_LA_9BE_-3+6-3-3	88.416	1	1.75
74	SAE	45*45*5	235	93.62	Climb	52.75	g90P	-18.668	0° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3+6+6-3	35.39	154.416	78.994	0.5	0.5	0.5	146.3	1.52	2.546	6	2	M-16(8.8)	21.48	14.231	0° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3+6+6-3	66.24	1	1.75
75T	SAE	60*60*5	235	66.28	Climb	33.1	g91P	-14.912	30° C7, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	45.054	154.416	78.994	1	1	1	153.85	1.57	1.8	8	2	M-16(8.8)	64.41	50.877	0° C7,C NA+	12B_LA_-3BE_-3-3-3-3	99.216	1	1.75
75L	SAE	55*55*5	235	79.54	Climb	52.88	g91AX	-19.453	30° C3,C NA+	12B-LA+9BE+6+6+6+6	36.789	154.416	78.994	1	1	1	168.22	1.68	1.8	8	2	M-16(8.8)	18.75	14.811	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	88.416	1	1.75
76T	SAE	60*60*5	355	94.29	Comp	94.29	g92P	-49.1	0° C7,C NA+	12B-LA+9BE+6+6+6+6	52.075	154.416	103.131	1	1	1	153.85	1.82	1.8	8	2	M-16(8.8)	19.78	20.4	0° C7, Min. WS,C NA+	12B_LA_6BE_+6+6+6+6	129.532	1	1.75
76L	SAE	55*55*5	235	79.54	Climb	22.56	g92AX	-8.298	30° C3, Min. WS,C NA+	12B_LA_OBE_+6+6+6+6	36.789	154.416	78.994	1	1	1	168.22	1.68	1.8	8	2	M-16(8.8)	24.59	19.428	30° C3,C NA+	12B_LA_OBE_+6+6+6+6	88.416	1	1.75
77	SAE	45*45*5	235	93.62	Climb	82.38	g93P	-29.155	0° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3+6+6-3	35.39	154.416	78.994	0.5	0.5	0.5	146.3	1.52	2.546	6	2	M-16(8.8)	28.41	18.819	0° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3+6+6-3	66.24	1	1.75
78T	SAE	60*60*5	235	66.28	Climb	25.29	g94P	-11.394	30° C7, Min. WS,C NA+	12B_LA_9BE_+6-3+6+6	45.054	154.416	78.994	1	1	1	153.85	1.57	1.8	8	2	M-16(8.8)	46.74	36.921	0° SC1+,EW<,C NA+	12B_LA_OBE_-3-3+6+6	99.216	1	1.75
78L	SAE	55*55*5	355	91.25	Comp	91.25	g94AX	-38.396	30° C5,C NA+	12B_LA_OBE_+6+6+6+6	42.076	154.416	103.131	1	1	1	168.22	1.94	1.8	8	2	M-16(8.8)	39.58	40.82	30° C5, Min. WS,C NA+	12B_LA_OBE_+6+6+6+6	115.432	1	1.75
79T	SAE	60*60*5	355	81.92	Comp	81.92	g95P	-101.75	30° C7,C NA+	12B_LA_-3BE_+6-3-3-3	124.213	231.623	154.697	1	1	1	76.92	1.08	0.9	2	3	M-16(8.8)	57	73.836	30° C7, Min. WS,C NA+	12B_LA_-3BE_-3-3+6+6	129.532	1	1.75
79L	SAE	60*60*5	355	68.35	Comp	68.35	g95aP	-84.899	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	124.213	231.623	154.697	1	1	1	76.92	1.08	0.9	2	3	M-16(8.8)	66.1	85.62	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	129.532	1	1.75
80	SAE	50*50*5	235	67.64	Climb	44.88	g96P	-11.925	0° SC1+,C NA+	12B_LA_9BE_+6-3-3+6	26.573	154.416	78.994	0.5	1	0.25	168.58	1.89	2.546	8	2	M-16(8.8)	11.39	8.773	30° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3-3-3+6	77.04	1	1.75
80a	SAE	45*45*5	235	93.62	Climb	48.97	g148P	-20.864	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	42.603	154.416	78.994	1	0.5	0.5	94.28	1.37	1.273	3	2	M-16(8.8)	29.5	19.541	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	66.24	1	1.75
81T	SAE	45*45*5	235	55.56	Comp	55.56	g99XY	-18.065	30° C5,C NA+	12B_LA_9BE_+6+6+6-3	32.515	154.416	78.994	0.5	0.5	0.5	156.79	1.6	2.728	6	2	M-16(8.8)	26	17.223	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	66.24	1	1.75
81L	SAE	45*45*5	235	46.73	Comp	46.73	g100P	-15.195	0° SC1+,EW&RT,C NA+	12B-LA+9BE+6+6+6+6	32.515	154.416	78.994	0.5	0.5	0.5	156.79	1.6	2.728	6	2	M-16(8.8)	24.26	16.071	0° SC1+,EW<,C NA+	12B-LA+9BE+6+6+6+6	66.24	1	1.75
82T	SAE	45*45*5	235	55.6	Comp	55.6	g171X	-18.079	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	32.515	154.416	78.994	0.5	0.5	0.5	156.79	1.6	2.728	6	2	M-16(8.8)	28.36	18.784	30° C5,C NA+	12B_LA_9BE_+6-3+6+6	66.24	1	1.75
82L	SAE	45*45*5	235	50	Comp	50	g172X	-16.256	0° SC1+,EW<,C NA+	12B-LA+9BE+6+6+6+6	32.515	154.416	78.994	0.5	0.5	0.5	156.79	1.6	2.728	6	2	M-16(8.8)	22.9	15.17	30° SC1+,EW<,C NA+	12B-LA+9BE+6+6+6+6	66.24	1	1.75
83T	SAE	45*45*5	235	74.05	Comp	74.05	g101XY	-30.165	30° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	40.737	154.416	78.994	0.5	0.5	0.5	131.05	1.4	2.28	2	2	M-16(8.8)	28.84	19.104	0° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	66.24	1	1.75
83L	SAE	45*45*5	235	59.62	Cross	59.62	g102P	-14.16	30° C5,C NA+	12B-LA+9BE+6+6+6+6	23.75	154.416	78.994	0.5	1	0.5	168.91	1.89	2.28	8	2	M-16(8.8)	34.4	22.789	30° SC1+,EW<,C NA+	12B_LA_9BE_-3+6+6+6	66.24	1	1.75
84T	SAE	50*50*5	355	90.4	Comp	90.4	g103X	-51.042	30° C5,C NA+	12B_LA_9BE_+6+6-3-3	56.46	154.416	103.131	0.5	0.5	0.5	124.58	1.57	2.442	6	2	M-16(8.8)	47.15	47.425	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6-3-3	100.58	1	1.75
84L	SAE	50*50*5	355	94.25	Comp	94.25	g104P	-53.211	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6-3-3+6	56.46	154.416	103.131	0.5	0.5	0.5	124.58	1.57	2.442	6	2	M-16(8.8)	56.44	56.77	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6-3-3+6	100.58	1	1.75
85T	SAE	50*50*5	355	87.93	Comp	87.93	ig105PX	-49.647	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6-3-3	56.46	154.416	103.131	1	1	1	124.58	1.57	1.221	6	2	M-16(8.8)	52.29	52.591	30° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6+6+6-3	100.58	1	1.75
85L	SAE	55*55*5	355	82.35	Comp	82.35	g106P	-57.27	0° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6-3-3+6	69.543	154.416	103.131	0.5	0.5	0.5	114.1	1.48	2.442	6	2	M-16(8.8)	51.49	53.105	0° SC1+,EW<,C NA+	12B_LA_-3BE_-3+6+6-3	115.432	1	1.75
86T	SAE	55*55*5	355	87.82	Comp	87.82	g107XY	-66.926	30° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3-3-3+6	76.207	154.416	103.131	0.5	0.5	0.5	106.56	1.4	2.28	2	2	M-16(8.8)	43.8	45.169	30° C5,C NA+	12B_LA_9BE_-3			

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
111L	SAE	65*65*5	355	92.65	Comp	92.65	g140P	-72.225	30° C5,C NA+	12B_LA_OBE_+6+6-3+6	77.957	154.416	103.131	1.5	1	1	120.13	1.53	1.562	6	2	M-16(8.8)	69.86	72.044	30° C5, Min. WS,C NA+	12B_LA_OBE_-3+6+6+6	144.384	1	1.75
112T	SAE	60*60*5	355	81.77	Climb	42.1	g145XY	-24.782	30° SC1+,RM&RB,C NA+	12B_LA_OBE_+6-3-3+6	58.867	154.416	103.131	1	1	1	140.32	1.7	1.642	6	2	M-16(8.8)	22.05	22.74	30° SC1+,LM&LB,C NA+	12B_LA_OBE_-3+6+6-3	129.532	1	1.75
112L	SAE	60*60*5	355	81.77	Climb	46.54	g143Y	-27.398	30° SC1+,RM&RB,C NA+	12B_LA_OBE_+6+6-3-3	58.867	154.416	103.131	1	1	1	140.32	1.7	1.642	6	2	M-16(8.8)	21.39	22.056	30° SC1+,LM&LB,C NA+	12B_LA_OBE_-3-3+6+6	129.532	1	1.75
113	SAE	60*60*4	355	73.02	Comp	73.02	g146P	-15.572	30° C2-,C BI-	12B_LA_OBE_-3+6+6+6	21.326	77.208	45.12	1	1	1	196.76	2.53	2.322	5	1	M-16(8.8)	32.84	14.818	30° C2-,C BI-	12B_LA_OBE_-3+6+6+6	66.552	1	1.75
114T	SAE	60*60*5	355	70.09	Climb	56.93	g153P	-20.428	30° C2-, Min. WS,C BI-	12B_LA_OBE_-3+6+6+6	35.884	154.416	103.131	2	1	1	175.41	2.22	1.596	8	2	M-16(8.8)	20.15	20.782	0° C2,C BI+	12B_LA_OBE_-3+6+6+6	129.532	1	1.75
114L	SAE	60*60*5	355	70.09	Climb	58.45	g154XY	-20.976	30° C5, Min. WS,C NA+	12B_LA_OBE_+6+6-3-3	35.884	154.416	103.131	2	1	1	175.41	2.22	1.596	8	2	M-16(8.8)	26.65	27.48	30° C6,C BI+	12B_LA_OBE_-3+6+6+6	129.532	1	1.75
115T	SAE	55*55*4	235	80.5	Comp	80.5	g151P	-18.542	30° SC1+,LM&LB,C NA+	12B_LA_OBE_-3+6+6-3	23.034	77.208	34.56	1	1	1	178.96	1.92	1.915	7	1	M-16(8.8)	52.44	18.124	30° SC1+,LM&LB,C NA+	12B_LA_OBE_+6-3-3+6	45.216	1	1.75
115L	SAE	55*55*4	235	66.63	Comp	66.63	g152XY	-15.348	0° SC1+,RT&RM,C NA+	12B_LA_OBE_+6+6-3-3	23.034	77.208	34.56	1	1	1	178.96	1.92	1.915	7	1	M-16(8.8)	44.4	15.344	0° SC1+,RT&RM,C NA+	12B_LA_OBE_-3-3+6+6	45.216	1	1.75
116T	DAE	50*50*5	355	40.26	Comp	40.26	g149XY	-56.192	30° SC1+,RM&RB,C NA+	12B_LA_OBE_+6-3+6+6	139.577	308.831	206.263	1	1	1	105.39	1.39	1.591	1	2	M-16(8.8)	26.15	52.602	30° SC1+,LM&LB,C NA+	12B_LA_OBE_+6+6+6-3	201.16	2	1.75
116L	DAE	50*50*5	355	46.34	Comp	46.34	g150Y	-64.683	30° SC1+,RM&RB,C NA+	12B_LA_OBE_+6+6+6+6	139.577	308.831	206.263	1	1	1	105.39	1.39	1.591	1	2	M-16(8.8)	28.01	56.352	30° SC1+,LM&LB,C NA+	12B_LA_OBE_+6+6+6+6	201.16	2	1.75
117T	SAE	65*65*5	355	64.69	Climb	22.3	Fg155X	-10.299	30° C5, Min. WS,C NA+	12B_LA_OBE_-3+6+6-3	46.176	154.416	103.131	2	1	1	153.83	2.03	1.523	8	2	M-16(8.8)	7.52	7.754	0° C1-, Min. WS,C NA-	12B_LA_OBE_-3+6+6+6	144.384	1	1.75
117L	SAE	65*65*5	355	64.69	Climb	19.71	Fg156XY	-9.103	0° C2, Min. WS,C BI+	12B_LA_OBE_-3-3+6+6	46.176	154.416	103.131	2	1	1	153.83	2.03	1.523	8	2	M-16(8.8)	7.35	7.583	30° C2-, Min. WS,C BI-	12B_LA_OBE_-3-3+6+6	144.384	1	1.75
118	SAE	80*80*6	355	52.46	Climb	4.76	g157XY	-2.72	30° C5, Min. WS,C NA+	12B_LA_OBE_+6+6+6-3	57.115	154.416	123.758	2	1	1	176.54	2.22	2.154	8	2	M-16(8.8)	1.49	1.848	30° C5,C NA+	12B_LA_OBE_+6+6+6+6	221.84	1	1.75
119	SAE	70*70*5	235	59.86	Climb	18.37	g159Y	-7.074	30° C2-,C BI-	12B_LA_OBE_-3+6+6-3	38.51	154.416	78.994	0.65	0.65	0.65	174.08	1.87	3.697	5	2	M-16(8.8)	8.15	6.436	30° C2-, Min. WS,C BI-	12B_LA_OBE_-3+6+6-3	121.392	1	1.75
303	SAE	130*130*11	355	92.71	Tens	90.78	B1g148P	-784.678	30° C5,C NA+	12B_LA_3BE_-3-3+6+6	864.42	1235.324	907.557	1	1	1	30.14	0.4	0.769	1	8	M-16(8.8)	92.71	696.795	30° C5, Min. WS,C NA+	12B_LA_3BE_+6+6-3-3	751.586	2.8	1.75
313T	SAE	70*70*5	355	41.7	Comp	41.7	g145P	-29.75	30° SC1+,LM&LB,C NA+	12B_LA_3BE_+6+6-3-3	71.342	154.416	103.131	1	1	1	136.19	1.66	1.879	6	2	M-16(8.8)	26.99	27.832	30° SC1+,LM&LB,C NA+	12B_LA_3BE_+6+6-3-3	158.484	1	1.75
313L	SAE	70*70*5	355	38.51	Comp	38.51	g143X	-27.471	30° SC1+,LM&LB,C NA+	12B_LA_3BE_-3+6+6+6	71.342	154.416	103.131	1	1	1	136.19	1.66	1.879	6	2	M-16(8.8)	24.48	25.25	30° SC1+,LT&LM,C NA+	12B_LA_3BE_+6-3+6+6	158.484	1	1.75
314	SAE	65*65*5	355	90.85	Climb	67.98	ig146PX	-16.785	30° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	24.69	77.208	56.4	3	1	1	212.25	2.81	1.401	7	1	M-16(8.8)	31.06	17.518	30° C2-,C BI-	12B_LA_3BE_-3+6+6+6	92.684	1	1.75
315T	SAE	60*60*5	355	70.1	Climb	50.2	Fg153P	-18.009	30° SC1+,LM&LB,C NA+	12B_LA_3BE_-3+6+6-3	35.879	154.416	103.131	2	1	1	175.43	2.22	1.596	8	2	M-16(8.8)	19.32	19.926	0° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	129.532	1	1.75
315L	SAE	60*60*5	355	70.1	Climb	46.91	Fg154Y	-16.83	30° SC1+,LT&LM,C NA+	12B_LA_3BE_+6+6-3-3	35.879	154.416	103.131	2	1	1	175.43	2.22	1.596	8	2	M-16(8.8)	20.05	20.682	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	129.532	1	1.75
316T	SAE	55*55*4	235	11.95	Comp	11.95	g151Y	-3.156	30° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	26.409	77.208	34.56	1	1	1	166.39	1.79	1.78	7	1	M-16(8.8)	7.28	2.517	30° C2-,C BI-	12B_LA_3BE_-3+6+6+6	45.216	1	1.75
316L	SAE	55*55*4	235	11.73	Comp	11.73	g152X	-3.099	0° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	26.409	77.208	34.56	1	1	1	166.39	1.79	1.78	7	1	M-16(8.8)	7.15	2.471	30° C2-,C BI-	12B_LA_3BE_-3+6+6+6	45.216	1	1.75
317T	DAE	50*50*5	355	47.04	Comp	47.04	g149X	-43.61	30° SC1+,LM&LB,C NA+	12B_LA_3BE_+6+6+6-3	92.718	308.831	206.263	1	1	1	118.64	1.75	1.792	7	2	M-16(8.8)	21.26	42.759	30° SC1+,LM&LB,C NA+	12B_LA_3BE_+6+6+6-3	201.16	2	1.75
317L	DAE	50*50*5	355	37.1	Comp	37.1	g150XY	-42.015	0° SC1+,LM&LB,C NA+	12B_LA_3BE_+6+6+6+6	113.246	308.831	206.263	1	1	1	118.64	1.57	1.792	5	2	M-16(8.8)	20.42	41.071	0° SC1+,RM&RB,C NA+	12B_LA_3BE_+6+6+6+6	201.16	2	1.75
318	SAE	70*70*5	235	59.26	Climb	16.01	g159Y	-6.352	30° C2-,C BI-	12B_LA_3BE_-3+6+6+6	39.675	154.416	78.994	0.618	0.618	0.618	171.34	1.84	3.824	5	2	M-16(8.8)	6.91	5.46	30° C2-, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	121.392	1	1.75
319T	SAE	65*65*5	355	64.69	Climb	27.42	Fg155X	-12.659	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	46.173	154.416	103.131	2	1	1	153.84	2.03	1.523	8	2	M-16(8.8)	8.73	9.001	0° C2-,C BI-	12B_LA_3BE_-3+6+6-3	144.384	1	1.75
319L	SAE	65*65*5	355	64.69	Climb	21.73	Fg156XY	-10.033	0° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	46.173	154.416	103.131	2	1	1	153.84	2.03	1.523	8	2	M-16(8.8)	8.75	9.021	0° C2-,C BI-	12B_LA_3BE_-3+6+6+6	144.384	1	1.75
320	SAE	80*80*6	355	52.46	Climb	3.96	g157P	-2.262	30° C2-,C BI-	12B_LA_3BE_-3+6+6+6	57.111	154.416	123.758	2	1	1	176.55	2.22	2.154	8	2	M-16(8.8)	1.78	2.207	0° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6	221.84	1	1.75
602	SAE	130*130*11	355	93.58	Comp	93.58	g133P	-712.895	30° C5,C NA+	12B_LA_3BE_-3-3+6+6	761.773	1235.324	907.557	1	1	1	60.28	0.8	1.537	1	8	M-16(8.8)	84.91	638.167	30° C5, Min. WS,C NA+	12B_LA_3BE_+6+6-3-3	751.586	2.8	1.75
603	SAE	130*130*11	355	91.71	Comp	91.71	Fg139173P	-771.68	30° C5,C NA+	12B_LA_6BE_-3-3+6+6	841.42	1235.324	907.557	1	1	1	40.19	0.53	1.025	1	8	M-16(8.8)	91.3	686.236	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6-3-3	751.586	2.8	1.75
604	SAE	130*130*11	355	91.26	Tens	90.52	B1g148Y	-782.502	30° C5,C NA+	12B_LA_6BE_+6+6-3-3	864.42	1235.324	907.557	1	1	1	30.14	0.4	0.769	1	8	M-16(8.8)	91.26	685.914	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6-3-3	751.586	2.8	1.75
612T	SAE	70*70*5	235	74.31	Comp	74.31	g134Y	-43.155	30° C5,C NA+	12B_LA_3BE_+6+6-3-3	58.074	154.416	78.994	1.5	1	1	142.53	1.5	1.967	6	2	M-16(8.8)	54.91	43.376	30° C5, Min. WS,C NA+	12B_LA_6BE_-3-3+6+6	121.392	1	1.75
612L	SAE	70*70*5	235	92.73	Comp	92.73	g135Y	-53.853	30° SC1+,RM&RB,C NA+	12B_LA_3BE_+6+6-3-3	58.074	154.416	78.994	1.5	1	1	142.53	1.5	1.967	6	2	M-16(8.8)	66.14	52.243	30° C5, Min. WS,C NA+	12B_LA_3BE_-3-3+6+6	121.392	1	1.75
613T	SAE	90*90*6	235	56.53	Comp	56.53	g141Y	-31.718	30° SC1+,RM&RB,C NA+	12B_LA_6BE_-3-3-3+6	56.105	154.416	94.793	3	1	1	175.1	1.93	1.611	8	2	M-16(8.8)	33.51	31.762	30° SC1+,LM&LB,C NA+	12B_LA_6BE_-3+6+6-3	197.28	1	1.75
613L	SAE	90*90*6	235	55.4	Comp	55.4	g140Y	-31.08	30° SC1+,LT&LM,C NA+	12B_LA_6BE_-3-3-3+6	56.105	154.416	94.793	3	1	1	175.1	1.93	1.611	8	2	M-16(8.8)	31.46	29.825	30° C6, Min. WS,C BI+	12B_LA_6BE_+6+6-3-3	197.28	1	1.75
616T	SAE	70*70*5	355	38.02	Climb	30.23	g144P	-18.442	0° C2,C BI+	12B_LA_6BE_-3+6+6+6	60.998	154.416	103.131	1	1	1	153.41	1.8	2.117	6	2	M-16(8.8)	14.8	15.267	30° C2-, Min. WS,C BI-	12B_LA_6BE_-3+6+6+6	158.484	1	1.75
616L	SAE	70*70*5	355	38.02	Climb	30.83	g142P	-18.805	30° C2,C BI+	12B_LA_6BE_-3+6+6+6	60.998	154.416	103.131	1	1	1	153.41	1.8	2.117	6	2	M-16(8.8)	14.58	15.039	0° C2-, Min. WS,C BI-	12B_LA_6BE_-3+6+6+6	158.484	1	1.75
617	SAE	70*70*5	355	88.79	Climb	81.53	ig147PY	-20.192	0° C2, Min. WS,C BI+	12B_LA_6BE_-3+6+6+6	24.767	77.208	56.4	3	1	1	221.2	2.88	1.578	7	1	M-16(8.8)	36.93	20.828	30° C2-,C BI-	12B_LA_6BE_-3+6+6+6	102.084	1	1.75
618T	SAE	65*65*5	235	90.63	Climb	32.58	g153P	-12.043	30° C2-, Min. WS,C BI-	12B_LA_6BE_-3+6+6+6	36.959	154.416	78.994	2	1	1	161.25	1.84	1.596										

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
919T	SAE	55*55*4	235	79.9	Comp	79.9	g151P	-15.922	30° C5,C NA+	12B-LA+9BE+6+6+6+6	19.929	77.208	34.56	1	1	1	193.17	2.08	2.067	7	1	M-16(8.8)	41.86	14.467	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	45.216	1	1.75
919L	SAE	55*55*4	235	76.47	Comp	76.47	g152P	-15.239	30° C6,C BI+	12B_LA_9BE_-+6-3+6+6	19.929	77.208	34.56	1	1	1	193.17	2.08	2.067	7	1	M-16(8.8)	38.67	13.364	0° C2-, Min. WS,C BI-	12B_LA_9BE_+6-3+6+6	45.216	1	1.75
920T	DAE	55*55*5	355	80.24	Comp	80.24	g149X	-52.928	30° C1-,C NA-	12B-LA+9BE+6+6+6+6	65.96	308.831	206.263	1	1	1	167.3	2.21	2.777	5	2	M-16(8.8)	23.9	49.291	30° C1-, Min. WS,C NA-	12B-LA+9BE+6+6+6+6	230.864	2	1.75
920L	DAE	55*55*5	355	70.4	Comp	70.4	g150P	-46.433	30° C2,C BI+	12B-LA+9BE+6+6+6+6	65.96	308.831	206.263	1	1	1	167.3	2.21	2.777	5	2	M-16(8.8)	20.98	43.271	30° C2, Min. WS,C BI+	12B-LA+9BE+6+6+6+6	230.864	2	1.75
921	SAE	80*80*6	235	38.02	Climb	12.36	g159Y	-8.062	30° C6-,C BI-	12B_LA_9BE_-3+6+6+6	65.22	154.416	94.793	0.568	0.568	0.568	155.14	1.67	4.287	5	2	M-16(8.8)	7.17	6.795	30° C2, Min. WS,C BI+	12B_LA_9BE_-3+6+6+6	169.92	1	1.75
922T	SAE	65*65*5	355	64.69	Climb	24.31	Fg155XY	-11.224	30° C5, Min. WS,C NA+	12B_LA_9BE_-3+6+6-3	46.17	154.416	103.131	2	1	1	153.85	2.03	1.523	8	2	M-16(8.8)	7.93	8.179	30° C2-, Min. WS,C BI-	12B_LA_9BE_-3+6+6-3	144.384	1	1.75
922L	SAE	65*65*5	355	64.69	Climb	21.52	Fg156XY	-9.934	0° C2, Min. WS,C BI+	12B_LA_9BE_-3-3+6+6	46.17	154.416	103.131	2	1	1	153.85	2.03	1.523	8	2	M-16(8.8)	7.92	8.167	0° C2-, Min. WS,C BI-	12B_LA_9BE_-3-3+6+6	144.384	1	1.75
923	SAE	80*80*6	355	52.47	Climb	6.15	Fg157P	-3.512	30° C2-, Min. WS,C BI-	12B_LA_9BE_-3+6+6+6	57.108	154.416	123.758	2	1	1	176.56	2.22	2.154	8	2	M-16(8.8)	2.96	3.658	0° C2,C BI+	12B_LA_9BE_-3+6+6+6	221.84	1	1.75
501	SAE	130*130*11	355	94.55	Comp	94.55	Fg139P	-778.784	30° C5,C NA+	12B_LA_-3BE_-3-3+6+6	823.678	1235.324	907.557	1	1	1	46.22	0.61	1.178	1	8	M-16(8.8)	94.34	709.069	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3-3+6+6	751.586	2.8	1.75
511T	SAE	75*75*5	355	87.09	Comp	87.09	g141Y	-45.385	30° SC1+,RM&RB,C NA+	12B_LA_-3BE_-3-3+3+6	52.113	154.416	103.131	2	1	1	154.61	2	1.786	8	2	M-16(8.8)	42.8	44.138	30° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3+6-3-3	172.584	1	1.75
511L	SAE	75*75*5	355	95.38	Comp	95.38	g140Y	-49.707	30° SC1+,LT&LM,C NA+	12B_LA_-3BE_-3-3+3+6	52.113	154.416	103.131	2	1	1	154.61	2	1.786	8	2	M-16(8.8)	48.01	49.511	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3+6+6+6	172.584	1	1.75
512T	SAE	65*65*5	355	64.69	Climb	16.81	Fg155XY	-13.506	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3+6+6-3	80.333	154.416	103.131	1	1	1	117.16	1.51	1.523	6	2	M-16(8.8)	10.04	10.354	0° C1-,C NA-	12B_LA_-3BE_-3+6+6-3	144.384	1	1.75
512L	SAE	65*65*5	355	64.69	Climb	12.87	g128X	-5.935	30° C5, Min. WS,C NA+	12B_LA_3BE_-3-3+6+6	46.12	154.416	103.131	2	1	1	153.84	2.03	1.523	4	2	M-16(8.8)	7.61	7.847	0° C2-,C BI-	12B_LA_-3BE_-3+6+6+6	144.384	1	1.75
513	SAE	65*65*5	355	93.28	Climb	57.83	g157X	-16.89	30° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3-3+3+6	29.205	154.416	103.131	2	1	1	217.57	2.58	2.154	8	2	M-16(8.8)	21.36	12.049	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	92.684	1	1.75
514T	SAE	65*65*5	355	23.97	Climb	5.15	g246XY	-5.315	30° C5, Min. WS,C NA+	12B_LA_0BE_+6+6-3-3	120.056	154.416	103.131	1	1	1	89.44	1.18	1.163	1	2	M-16(8.8)	3.65	3.76	30° C6-,C BI-	12B_LA_9BE_+6-3-3+6	144.384	1	1.75
514L	SAE	65*65*5	355	23.97	Climb	7.17	g247XY	-7.395	30° C5, Min. WS,C NA+	12B_LA_0BE_+6+6+6-3	120.056	154.416	103.131	1	1	1	89.44	1.18	1.163	1	2	M-16(8.8)	4.34	4.473	30° C5,C NA+	12B_LA_9BE_-3-3+6+6	144.384	1	1.75
515	SAE	65*65*5	355	89.02	Comp	89.02	g480XY	-32.762	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	36.803	77.208	56.4	2	1	1	166.1	2.29	1.644	7	1	M-16(8.8)	57.36	32.353	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	92.684	1	1.75
516	SAE	45*45*4	235	95.16	Climb	2.27	g485X	-0.737	30° C6, Min. WS,C BI+	12B_LA_9BE_+6-3-3-3	32.46	77.208	34.56	1	1	1	132.13	1.42	1.163	7	1	M-16(8.8)	2.22	0.734	30° C6, Min. WS,C BI+	12B_LA_9BE_-3-3+6+6	33.12	1	1.75
517	SAE	45*45*4	355	89.47	Climb	4.62	g486P	-0.808	30° C6-,C BI-	12B_LA_9BE_-3+6+6-3	17.489	77.208	45.12	1	1	1	186.86	2.47	1.644	7	1	M-16(8.8)	1.59	0.687	30° C2-,C BI-	12B_LA_9BE_+6-3-3+6	43.24	1	1.75
517A	SAE	55*55*4	355	84.55	Climb	7.98	g293X	-1.285	30° C5, Min. WS,C NA+	12B_LA_0BE_+6+6+6+6	16.106	77.208	45.12	1	1	1	217.33	2.85	2.325	7	1	M-16(8.8)	2.41	1.087	30° C5, Min. WS,C NA+	12B_LA_0BE_-3+6+6-3	59.032	1	1.75
1001	SAE	130*130*11	355	93.87	Tens	91.07	Fg160P	-787.253	30° C5,C NA+	12B_LA_-3BE_-3-3+6+6	864.42	1235.324	992.64	1	1	1	30.14	0.4	0.769	1	8	M-16(8.8)	93.87	705.529	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	751.586	2.8	1.75
1002	SAE	130*130*11	355	84.66	Comp	84.66	LY_Fg160P	-644.881	30° C5,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	761.773	1235.324	992.64	1	1	1	60.28	0.8	1.537	1	8	M-16(8.8)	70.81	532.189	30° C5, Min. WS,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	751.586	2.8	1.75
1003	SAE	130*130*11	355	84.91	Comp	84.91	Fg160P	-646.838	30° C5,C NA+	12B_LA_9BE_+0+0+0+0	761.773	1235.324	992.64	1	1	1	60.28	0.8	1.537	1	8	M-16(8.8)	70.81	532.235	30° C5, Min. WS,C NA+	12B_LA_9BE_+0+0+0+0	751.586	2.8	1.75
1004	SAE	130*130*11	355	77.8	Comp	77.8	Fg160P	-635.482	30° C5,C NA+	12B_LA_9BE_+1.5+1.5+1.5+1.5	816.835	1235.324	992.64	1	1	1	48.22	0.64	1.23	1	8	M-16(8.8)	68.43	514.277	30° C5, Min. WS,C NA+	12B_LA_3BE_+1.5+1.5+1.5+1.5	751.586	2.8	1.75
1005	SAE	130*130*11	355	78.34	Comp	78.34	Fg160P	-634.117	30° C5,C NA+	12B_LA_9BE_+3+3+3+3	809.434	1235.324	992.64	1	1	1	50.23	0.66	1.281	1	8	M-16(8.8)	68.5	514.84	30° C5, Min. WS,C NA+	12B_LA_3BE_+3+3+3+3	751.586	2.8	1.75
1006	SAE	130*130*11	355	76.04	Comp	76.04	g160P	-628.776	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	826.908	1235.324	992.64	1	1	1	45.21	0.6	1.153	1	8	M-16(8.8)	68.87	517.644	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	751.586	2.8	1.75
1007	SAE	130*130*11	355	83.18	Comp	83.18	g160P	-677.721	30° C1,C NA+	12B_LA_3BE_+6-3+6+6	814.781	1235.324	907.557	1	1	1	48.8	0.64	1.244	1	8	M-16(8.8)	77.55	582.835	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	751.586	2.8	1.75
1011	SAE	90*90*6	355	50.24	Comp	50.24	LY_Fg161196P	-57.704	30° SC1+,RM&RB,C NA+	12B_LA_-3BE_+6+6-3-3	114.862	154.416	123.758	2	1	1	131.08	1.6	1.809	6	2	M-16(8.8)	45.47	56.276	30° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3+6+6-3	257.56	1	1.75
1012	SAE	90*90*6	355	32.89	Comp	32.89	LY_g161P	-37.938	30° SC1+,RM&RB,C NA+	12B_LA_0BE_-1.5-1.5-1.5-1.5	115.355	154.416	123.758	1	1	1	130.63	1.59	2.325	6	2	M-16(8.8)	25.65	31.738	30° SC1+,LM&LB,C NA+	12B_LA_0BE_-1.5-1.5-1.5-1.5	257.56	1	1.75
1013	SAE	90*90*6	355	38.18	Comp	38.18	LY_g161P	-47.256	30° SC1+,RM&RB,C NA+	12B_LA_0BE_+0+0+0+0	140.45	154.416	123.758	1	1	1	110.7	1.43	1.971	6	2	M-16(8.8)	32.65	40.405	30° C5, Min. WS,C NA+	12B_LA_0BE_+0+0+0+0	257.56	1	1.75
1014	SAE	90*90*6	355	55.63	Comp	55.63	LY_Fg161197P	-47.815	30° SC1+,RM&RB,C NA+	12B_LA_0BE_+1.5+1.5+1.5+1.5	85.95	154.416	123.758	1	1	1	163.43	1.87	2.909	6	2	M-16(8.8)	49.81	61.644	30° C5, Min. WS,C NA+	12B_LA_9BE_+1.5+1.5+1.5+1.5	257.56	1	1.75
1015	SAE	90*90*6	355	70.17	Comp	70.17	g162P	-86.841	30° C5,C NA+	12B_LA_9BE_+3+3+3+3	208.451	154.416	123.758	1	1	1	81.41	1.11	1.449	2	2	M-16(8.8)	64.18	79.426	30° C5, Min. WS,C NA+	12B_LA_9BE_+3+3+3+3	257.56	1	1.75
1016	SAE	90*90*6	355	94.19	Comp	94.19	LY_g162P	-116.568	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	235.301	154.416	123.758	1	1	1	71.28	1	1.269	2	2	M-16(8.8)	84.07	104.037	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	257.56	1	1.75
1017	SAE	90*90*6	355	75.79	Comp	75.79	LXY_g162189P	-72.464	0° C1-,C NA-	12B-LA+9BE+6+6+6+6	95.606	231.623	185.637	1	1	1	151.08	1.77	2.689	6	3	M-16(8.8)	70.61	131.075	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6+6-3	257.56	1	1.75
RED1A	SAE	45*45*4	235	73.49	Climb	5.76	g333XY	-1.99	30° C7, Min. WS,C NA+	12B_LA_6BE_-3+6+6+6	41.971	77.208	34.56	1	1	1	102.27	1.21	0.9	3	1	M-16(8.8)	10.4	3.444	30° SC1+,EW&RT,C NA+	12B_LA_-3BE_+6-3-3-3	33.12	1	1.75
RED1	SAE	45*45*4	235	35.55	Tens	35.49	g233XY	-12.267	30° C6, Min. WS,C NA+	12B_LA_0BE_+6+6+6+6	39.236	77.208	34.56	1	1	1	109.92	1.27	0.967	3	1	M-16(8.8)	35.55	11.775	30° C5,C NA+	12B_LA_0BE_+3-3+6+6	33.12	1	1.75
RED2	SAE	45*45*4	235	43.45	Redun	41.64	g234Y	-14.39	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	49.242	77.208	34.56	1	1	1	82.8	1.08	0.729	3	1	M-16(8.8)	43.45	14.39	0° C1,C NA+	12B_LA_-3BE_+6+6-3-3	33.12	1	1.75
RED3	SAE	45*45*4	235	57.72	Comp	57.72	g236Y	-18.886	30° C5,C NA+	12B_LA_0BE_+6+6-3+6	32.718	77.208	34.56	1	1	1	130.77	1.41	1.151	3	1	M-16(8.8)	56.39	18.675	30° C5, Min. WS,C NA+	12B_LA_0BE_+6+6+6-3	33.12	1	1.75
RED4	SAE	45*45*4	235	72.71	Climb	15.97	g239XY	-5.52	30° C5, Min. WS,C NA+	12B_LA_0BE_																			

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
RED30	SAE	55*55*4	235	86.25	Comp	86.25	g292Y	-12.244	30° C1,C NA+	12B-LA+9BE+6+6+6+6	14.196	77.208	34.56	1	1	1	230.51	2.48	2.466	7	1	M-16(8.8)	38.25	13.22	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	45.216	1	1.75
RED30A	SAE	60*60*4	355	83.67	Redun	83.67	g352Y	-20.104	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	24.028	77.208	45.12	1	1	1	184.96	2.38	2.183	7	1	M-16(8.8)	44.56	20.104	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	66.552	1	1.75
RED30B	SAE	45*45*4	235	89.26	Climb	12.56	g354P	-4.342	30° C2,C BI+	12B_LA_9BE_-3-3+6+6	34.679	77.208	34.56	1	1	1	124.01	1.37	1.091	3	1	M-16(8.8)	11.34	3.757	30° C2-, Min. WS,C BI-	12B_LA_9BE_-3+6+6-3	33.12	1	1.75
RED30C	SAE	65*65*4	355	80.97	Climb	54.46	g356P	-8.772	30° C6,C BI+	12B_LA_9BE_-3-3+6+6	16.108	77.208	45.12	1	1	1	237.43	3.01	3.087	7	1	M-16(8.8)	16.23	7.322	30° C2-, Min. WS,C BI-	12B_LA_9BE_-3+6+6-3	74.824	1	1.75
RED31	SAE	45*45*4	355	97.96	Redun	97.96	g297Y	-19.856	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	20.27	77.208	45.12	1	1	1	173.08	2.29	1.523	7	1	M-16(8.8)	45.92	19.856	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	43.24	1	1.75
RED32	SAE	45*45*4	235	47.62	Redun	47.62	g299Y	-5.833	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	12.249	77.208	34.56	1	1	1	223.04	2.4	1.963	7	1	M-16(8.8)	17.61	5.833	0° C1,C NA+	12B_LA_9BE_+6+6-3-3	33.12	1	1.75
RED33	SAE	50*50*4	235	72.97	Comp	72.97	LXY_g300P	-10.583	0° C1-,C NA-	12B_LA_9BE_-3+6+6-3	14.503	77.208	34.56	2	1	1	208.07	2.32	1.581	7	1	M-16(8.8)	48.06	16.608	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	38.88	1	1.75
RED34	SAE	45*45*4	235	97.47	Climb	26.45	g305P	-8.238	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3+6+6+6	31.145	77.208	34.56	1	1	1	135.3	1.45	1.191	7	1	M-16(8.8)	27.64	9.155	30° C5,C NA+	12B_LA_9BE_+6-3+6+6	33.12	1	1.75
RED35	SAE	45*45*4	235	55.89	Comp	55.89	LY_g306P	-7.652	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	13.692	77.208	34.56	1	1	1	210.5	2.26	1.852	7	1	M-16(8.8)	19.85	6.573	30° C5, Min. WS,C NA+	12B_LA_3BE_+6+6+6-3	33.12	1	1.75
RED36	SAE	55*55*4	355	85.89	Climb	64.09	LXY_g308P	-10.019	30° C5, Min. WS,C NA+	12B_LA_6BE_-3+6+6-3	15.633	77.208	45.12	1	1	1	220.69	2.89	2.361	7	1	M-16(8.8)	15.54	7.011	0° C1-,C NA-	12B_LA_9BE_-3+6+6-3	59.032	1	1.75
RED37	SAE	50*50*4	235	71.78	Comp	71.78	LXY_g310P	-12.843	0° C5-,C NA-	12B_LA_9BE_-3+6+6-3	17.892	77.208	34.56	2	1	1	181.96	2.08	1.383	7	1	M-16(8.8)	57.83	19.985	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	38.88	1	1.75
RED38	SAE	45*45*4	235	67.6	Climb	25.76	g314P	-8.901	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	45.062	77.208	34.56	1	1	1	94.14	1.16	0.828	3	1	M-16(8.8)	25.67	8.503	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	33.12	1	1.75
RED39	SAE	45*45*4	235	48.95	Comp	48.95	LY_g316P	-8.871	30° C5,C NA+	12B-LA+9BE+6+6+6+6	18.122	77.208	34.56	1	1	1	181.72	1.95	1.599	7	1	M-16(8.8)	27.56	9.127	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	33.12	1	1.75
RED40	SAE	45*45*4	355	90.16	Climb	55.34	g318P	-9.539	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	17.235	77.208	45.12	1	1	1	188.28	2.49	1.657	7	1	M-16(8.8)	13.52	5.848	0° C2-,C BI-	12B_LA_9BE_-3+6+6-3	43.24	1	1.75
RED41	SAE	45*45*4	235	41.94	Redun	41.94	LY_g320P	-7.117	0° C1,C NA+	12B_LA_3BE_+6+6-3+6	16.967	77.208	34.56	1	1	1	188.14	2.02	1.656	7	1	M-16(8.8)	29.78	9.862	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	33.12	1	1.75
RED42	SAE	45*45*4	235	33.36	Climb	21.51	L_L_L_g559P	-7.435	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	58.331	77.208	34.56	1	1	1	46.62	0.92	0.41	3	1	M-16(8.8)	26.8	8.878	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	33.12	1	1.75
RED43	SAE	45*45*4	355	70.77	Climb	31.19	g322P	-8.494	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3+6+6+6	27.236	77.208	45.12	1	1	1	148.25	1.96	1.305	7	1	M-16(8.8)	12.97	5.61	30° C5,C NA+	12B_LA_9BE_+6+6+6-3	43.24	1	1.75
RED44	SAE	45*45*4	235	33.8	Comp	33.8	g325P	-7.429	30° C5,C NA+	12B_LA_9BE_+6+6+6-3	21.98	77.208	34.56	1	1	1	163.95	1.76	1.443	7	1	M-16(8.8)	29.72	9.844	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6-3	33.12	1	1.75
RED45	SAE	45*45*4	235	77.8	Climb	21.57	g327P	-7.456	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	39.827	77.208	34.56	1	1	1	108.22	1.26	0.952	3	1	M-16(8.8)	19.16	6.346	30° C6,C BI+	12B-LA+9BE+6+6+6+6	33.12	1	1.75
RED46	SAE	45*45*4	235	56.79	Comp	56.79	LY_L_g329P	-15.279	30° C6,C BI+	12B-LA+9BE+6+6+6+6	26.904	77.208	34.56	1	1	1	146.87	1.58	1.292	7	1	M-16(8.8)	43.48	14.401	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	33.12	1	1.75
RED47	SAE	45*45*4	235	48.88	Climb	33.15	L_g331P	-11.458	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	53.047	77.208	34.56	1	1	1	68.2	1.02	0.6	3	1	M-16(8.8)	40.62	13.454	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	33.12	1	1.75
RED48	SAE	50*50*6	355	99.74	Comp	99.74	LY_L_g333P	-67.504	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	80.627	77.208	67.68	1	1	1	106.34	1.41	1.021	3	1	M-16(8.8)	71.42	48.339	30° C5, Min. WS,C NA+	12B_LA_3BE_-3+6+6+6	75.2	1	1.75
RED49	SAE	50*50*4	355	71.43	Tens	51.31	LX_L_g335P	-23.149	30° C6, Min. WS,C BI+	12B-LA+9BE+6+6+6+6	101.113	77.208	45.12	1	1	1	31.67	0.89	0.31	3	1	M-16(8.8)	71.43	32.227	30° C5,C NA+	12B_LA_9BE_+6+6-3+6	50.76	1	1.75
RED50	SAE	45*45*4	235	21.96	Comp	21.96	LY_L_g337P	-7.589	30° C6,C BI+	12B-LA+9BE+6+6+6+6	35.293	77.208	34.56	1	0.667	0.667	94.71	1.35	1.25	3	1	M-16(8.8)	20.7	6.855	30° C5, Min. WS,C NA+	12B-LA+9BE+6+6+6+6	33.12	1	1.75
RED51	SAE	45*45*4	235	17.03	Comp	17.03	g339P	-3.029	30° C5, Min. WS,C NA+	12B_LA_0BE_-3+6+6-3	17.78	77.208	34.56	1	0.656	0.656	172.61	1.97	2.314	7	1	M-16(8.8)	8.31	2.752	0° C1-,C NA-	12B_LA_9BE_-3+6+6-3	33.12	1	1.75
RED52	SAE	45*45*4	235	28.01	Comp	28.01	g341P	-3.761	0° C1,C NA+	12B_LA_9BE_-3+6+6-3	13.425	77.208	34.56	1	0.596	0.596	204.01	2.29	2.775	7	1	M-16(8.8)	10.96	3.63	0° C1-,C NA-	12B_LA_9BE_-3+6+6-3	33.12	1	1.75
RED53	SAE	55*55*4	235	26.36	Comp	26.36	LY_L_g342P	-3.576	30° C2,C BI+	12B_LA_9BE_-3-3+6+6	13.565	77.208	34.56	1	0.589	0.589	231.14	2.54	3.86	7	1	M-16(8.8)	9.73	3.362	30° C2-,C BI-	12B_LA_9BE_-3-3+6+6	45.216	1	1.75
RED54	SAE	65*65*4	235	25.05	Comp	25.05	LY_g347P	-3.96	30° C2,C BI+	12B_LA_9BE_-3-3+6+6	15.809	77.208	34.56	1	0.565	0.565	233.86	2.55	4.63	7	1	M-16(8.8)	11.34	3.92	30° C2-,C BI-	12B_LA_9BE_-3-3+6+6	57.312	1	1.75
RED55	SAE	45*45*4	355	82.78	Climb	2.33	g350X	-0.473	30° C2-,C BI-	12B_LA_9BE_-3-3+6+6	20.27	77.208	45.12	1	1	1	173.08	2.29	1.523	7	1	M-16(8.8)	1.24	0.538	30° C2,C BI+	12B_LA_9BE_-3-3+6+6	43.24	1	1.75
RED56	SAE	50*50*4	355	94.49	Climb	5.72	g351P	-0.814	30° C2,C BI+	12B_LA_9BE_-3-3+6+6	14.227	77.208	45.12	1	1	1	219.79	2.9	2.154	7	1	M-16(8.8)	1.51	0.68	30° C2-, Min. WS,C BI-	12B_LA_9BE_-3-3+6-3	50.76	1	1.75
RED61	SAE	50*50*4	235	17.1	Redun	17.1	g189P	-2.03	0° C1,C NA+	12B_LA_3BE_-3-3+6+6	11.871	77.208	34.56	1	1	1	239.79	2.58	2.35	7	1	M-16(8.8)	5.87	2.03	0° C1,C NA+	12B_LA_3BE_-3-3+6+6	38.88	1	1.75
RED62	SAE	50*50*4	355	88.86	Climb	27.85	g190XY	-4.454	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6+6-3	15.993	77.208	45.12	1	1	1	206.96	2.73	2.028	7	1	M-16(8.8)	4.92	2.219	30° C6,C BI+	12B_LA_6BE_+6+6-3+6	50.76	1	1.75
RED63	SAE	45*45*4	235	75.67	Comp	75.67	g193P	-12.113	30° C5,C NA+	12B_LA_6BE_+6+6-3+6	16.008	77.208	34.56	1	1	1	193.98	2.08	1.707	7	1	M-16(8.8)	37.85	12.537	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6+6-3	33.12	1	1.75
RED64	SAE	45*45*4	355	54.87	Climb	29.9	g195X	-12.973	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6+6+6	43.381	77.208	45.12	1	1	1	115.24	1.52	1.014	7	1	M-16(8.8)	31.21	13.495	30° C5,C NA+	12B_LA_6BE_+6-3-3+6	43.24	1	1.75
RED64A	SAE	65*65*4	355	9.54	Comp	9.54	g372Y	-1.672	30° C2, Min. WS,C BI+	12B_LA_3BE_+6+6-3-3	17.531	77.208	45.12	1	1	1	227.34	2.88	2.955	7	1	M-16(8.8)	2.8	1.265	30° C2,C BI+	12B_LA_3BE_-3-3+6-3	74.824	1	1.75
RED64B	SAE	50*50*4	355	94.39	Climb	7.81	g374P	-1.113	0° C2-, Min. WS,C BI-	12B_LA_3BE_-3+6+6+6	14.256	77.208	45.12	1	1	1	219.57	2.9	2.152	7	1	M-16(8.8)	2.49	1.121	0° C2,C BI+	12B_LA_6BE_+6+6+6+6	50.76	1	1.75
RED65	SAE	45*45*4	355	76.63	Climb	27.6	g197XY	-6.474	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6+6-3	23.455	77.208	45.12	1	1	1	160.38	2.12	1.411	7	1	M-16(8.8)	15.23	6.584	30° C5,C NA+	12B_LA_6BE_+6+6-3+6	43.24	1	1.75
RED68	SAE	50*50*4	355	77.52	Comp	77.52	Fg199XY	-14.634	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6+6-3	18.878	77.208	45.12	2	1	1	185.7	2.51	1.411	7	1	M-16(8.8)	33.02	14.899	30° C6,C BI+	12B_LA_6BE_+6-3+6+6	50.76	1	1.75
RED69	SAE	45*45*4	235	20.75	Comp	20.75	g208P	-7.173	30° C5,C NA+	12B_LA_6BE_+6-3+6+6	37.043	77.208	34.56	1	1	1	116.45	1.31	1.025	3	1	M-16(8.8)	17.86	5.916	30° C5, Min. WS,C NA+	12B_LA_6BE_-3+6+6+6	33.12	1	1.75
RED70	SAE	45*45*4	235	50.13	Redun	50.13	g210Y	-8.96	0° C1,C NA+	12B_LA_6BE_+6+6-3-3	17.872	77.208	34.56	1	1	1	183.06	1.97											

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
RED91A	SAE	45*45*4	355	89.33	Climb	41.39	g527Y	-7.261	30° C2,C BI+	12B_LA_0BE_-3-3+6+6	17.543	77.208	45.12	1	1	1	186.56	2.46	1.642	7	1	M-16(8.8)	15.76	6.813	0° C2-,C BI-	12B_LA_0BE_-3-3+6+6	43.24	1	1.75
RED91B	SAE	55*55*4	355	84.42	Climb	35.37	g344X	-5.714	30° C5, Min. WS,C NA+	12B_LA_9BE_-3+6-3-3	16.154	77.208	45.12	1	1	1	217	2.84	2.322	7	1	M-16(8.8)	15.32	6.914	30° C5,C NA+	12B_LA_9BE_+6-3-3+6	59.032	1	1.75
RED91C	SAE	65*65*4	355	86.36	Climb	16.26	g530X	-4.772	0° C1-, Min. WS,C NA-	12B_LA_0BE_-3+6+6-3	29.342	77.208	45.12	2	1	1	165.83	2.21	1.642	7	1	M-16(8.8)	11.11	5.012	30° C1,C NA+	12B_LA_0BE_-3+6+6-3	74.824	1	1.75
RED91D	SAE	50*50*4	235	24.13	Comp	24.13	g578X	-2.873	30° C6, Min. WS,C BI+	12B_LA_9BE_+6+6-3+6	11.909	77.208	34.56	1	1	1	239.4	2.57	2.346	7	1	M-16(8.8)	11.92	4.119	30° C6,C BI+	12B_LA_9BE_-3+6+6+6	38.88	1	1.75
RED91E	SAE	55*55*4	355	84.33	Climb	20.44	g579P	-3.309	30° C3,C NA+	12B_LA_9BE_+6-3-3+6	16.185	77.208	45.12	1	1	1	216.78	2.84	2.32	7	1	M-16(8.8)	4.93	2.223	30° C2, Min. WS,C BI+	12B_LA_9BE_-3-3+6-3	59.032	1	1.75
RED91F	SAE	45*45*4	355	89.33	Climb	2.2	g612P	-0.387	30° C1,C NA+	12B_LA_9BE_+6-3-3+6	17.54	77.208	45.12	1	1	1	186.57	2.46	1.642	7	1	M-16(8.8)	0.89	0.384	30° C1, Min. WS,C NA+	12B_LA_9BE_-3+6+6-3	43.24	1	1.75
RED92	SAE	45*45*4	355	89.7	Climb	35.74	g178Y	-5.195	30° C5,C NA+	12B_LA_0BE_+6+6-3+6	14.538	77.208	45.12	1	1	1	205.57	2.72	1.809	7	1	M-16(8.8)	8.56	3.699	30° C5, Min. WS,C NA+	12B_LA_0BE_+6+6+6-3	43.24	1	1.75
RED93	SAE	45*45*4	355	93.55	Redun	93.55	g179P	-18.966	0° C1,C NA+	12B_LA_0BE_-3-3+6+6	20.273	77.208	45.12	1	1	1	173.06	2.29	1.523	7	1	M-16(8.8)	43.86	18.966	0° C1,C NA+	12B_LA_0BE_-3-3+6+6	43.24	1	1.75
RED94	SAE	45*45*4	355	82.78	Climb	1.83	g182XY	-0.371	0° C1-,C NA-	12B_LA_0BE_-3+6+6-3	20.273	77.208	45.12	1	1	1	173.06	2.29	1.523	7	1	M-16(8.8)	0.94	0.407	30° C1, Min. WS,C NA+	12B_LA_0BE_-3+6+6-3	43.24	1	1.75
RED95	SAE	50*50*4	355	94.48	Climb	4.59	g184XY	-0.653	30° C2, Min. WS,C BI+	12B_LA_0BE_-3-3+6-3	14.23	77.208	45.12	1	1	1	219.77	2.9	2.154	7	1	M-16(8.8)	1.18	0.535	0° C2-,C BI-	12B_LA_0BE_-3-3+6-3	50.76	1	1.75
RED97	SAE	45*45*4	355	83.52	Climb	36.09	g144X	-7.195	30° C5, Min. WS,C NA+	12B_LA_-3BE_-3+6+6+6	19.935	77.208	45.12	1	1	1	174.59	2.31	1.536	7	1	M-16(8.8)	17.96	7.765	30° C5,C NA+	12B_LA_-3BE_+6-3+6+6	43.24	1	1.75
RED98	SAE	45*45*4	235	19.9	Comp	19.9	g146Y	-6.288	30° C5,C NA+	12B_LA_-3BE_+6+6-3+6	31.594	77.208	34.56	1	1	1	134.2	1.44	1.181	7	1	M-16(8.8)	16.48	5.459	0° C1,C NA+	12B_LA_-3BE_-3-3+6+6	33.12	1	1.75
RED99	SAE	45*45*4	235	60.19	Redun	60.19	g147P	-8.936	0° C1,C NA+	12B_LA_-3BE_-3-3+6+6	14.845	77.208	34.56	1	1	1	201.8	2.17	1.776	7	1	M-16(8.8)	26.98	8.936	0° C1,C NA+	12B_LA_-3BE_-3-3+6+6	33.12	1	1.75
RED100	SAE	45*45*4	355	82.78	Climb	9.27	g151P	-1.878	0° C1-, Min. WS,C NA-	12B_LA_-3BE_-3+6+6-3	20.271	77.208	45.12	1	1	1	173.07	2.29	1.523	7	1	M-16(8.8)	4.56	1.97	30° C1, Min. WS,C NA+	12B_LA_-3BE_-3+6+6-3	43.24	1	1.75
RED101	SAE	50*50*4	355	94.48	Climb	17.16	g152P	-2.441	30° C2-, Min. WS,C BI-	12B_LA_-3BE_-3-3+6+6	14.228	77.208	45.12	1	1	1	219.79	2.9	2.154	7	1	M-16(8.8)	5	2.258	30° C1-,C NA-	12B_LA_-3BE_-3+6+6-3	50.76	1	1.75
RED101A	SAE	65*65*4	355	79.87	Climb	22.61	g494P	-3.737	0° C1-, Min. WS,C NA-	12B_LA_-3BE_-3+6+6-3	16.528	77.208	45.12	1	1	1	234.32	2.97	3.046	7	1	M-16(8.8)	8.92	4.027	30° C5,C NA+	12B_LA_6BE_-3+6+6+6	74.824	1	1.75
RED102	SAE	45*45*4	355	82.78	Climb	1.8	g219X	-0.366	30° C1-,C NA-	12B_LA_3BE_-3+6+6-3	20.271	77.208	45.12	1	1	1	173.07	2.29	1.523	7	1	M-16(8.8)	0.91	0.393	30° C2,C BI+	12B_LA_3BE_-3-3+6+6	43.24	1	1.75
RED103	SAE	50*50*4	355	94.48	Climb	4.47	g221XY	-0.636	0° C2,C BI+	12B_LA_3BE_-3-3+6-3	14.228	77.208	45.12	1	1	1	219.79	2.9	2.154	7	1	M-16(8.8)	1.18	0.533	0° C2-,C BI-	12B_LA_3BE_-3-3+6-3	50.76	1	1.75
RED104	SAE	45*45*4	235	66.43	Redun	66.43	Fg301P	-7.936	0° C1,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	11.947	77.208	34.56	2	1	1	219.46	2.43	1.492	7	1	M-16(8.8)	23.96	7.936	0° C1,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED105	SAE	45*45*4	235	93.48	Climb	24.11	LX_g304P	-7.954	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	32.987	77.208	34.56	1	1	1	129.81	1.41	1.142	3	1	M-16(8.8)	28.85	9.556	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED106	SAE	45*45*4	235	51.2	Comp	51.2	LY_g306P	-7.869	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	15.369	77.208	34.56	1	1	1	198.17	2.13	1.744	7	1	M-16(8.8)	18.6	6.159	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED107	SAE	55*55*4	355	83.03	Climb	35.47	LX_g308P	-5.912	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	16.67	77.208	45.12	1	1	1	213.52	2.8	2.285	7	1	M-16(8.8)	5.82	2.624	30° C2,C BI+	12B_LA_9BE_+4.5+4.5+4.5+4.5	59.032	1	1.75
RED108	SAE	45*45*4	235	79.92	Comp	79.92	g310P	-12.178	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	15.237	77.208	34.56	2	1	1	188.2	2.14	1.28	7	1	M-16(8.8)	50.16	16.614	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED109	SAE	45*45*4	235	62.11	Climb	25.25	LX_g314P	-8.726	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	48.074	77.208	34.56	1	1	1	86.54	1.1	0.762	3	1	M-16(8.8)	28.36	9.394	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED110	SAE	45*45*4	235	46.37	Comp	46.37	LY_g316P	-9.761	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	21.05	77.208	34.56	1	1	1	167.8	1.8	1.477	7	1	M-16(8.8)	26.38	8.739	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED111	SAE	45*45*4	355	82.79	Climb	34.06	LX_g318P	-6.903	30° C5, Min. WS,C NA+	12B_LA_-3BE_+4.5+4.5+4.5+4.5	20.269	77.208	45.12	1	1	1	173.08	2.29	1.523	7	1	M-16(8.8)	8.15	3.525	30° C5,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	43.24	1	1.75
RED112	SAE	45*45*4	235	32.56	Comp	32.56	g321P	-6.72	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	20.638	77.208	34.56	1	1	1	169.58	1.82	1.492	7	1	M-16(8.8)	26.43	8.754	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED113	SAE	45*45*4	235	93.48	Climb	25.07	LXY_g323P	-8.27	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	32.987	77.208	34.56	1	1	1	129.81	1.41	1.142	3	1	M-16(8.8)	21.34	7.067	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED114	SAE	45*45*4	235	30.8	Comp	30.8	LY_g325P	-8.435	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	27.389	77.208	34.56	1	1	1	145.42	1.56	1.28	7	1	M-16(8.8)	30.13	9.979	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED115	SAE	45*45*4	235	62.11	Climb	26.49	LX_g327P	-9.156	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	48.074	77.208	34.56	1	1	1	86.54	1.1	0.762	3	1	M-16(8.8)	27.3	9.042	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED116	SAE	50*50*5	355	91.45	Comp	91.45	LY_L_g329P	-51.578	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	57.138	77.208	56.4	1	1	1	118.05	1.56	1.157	7	1	M-16(8.8)	70.7	39.872	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	62.98	1	1.75
RED117	SAE	45*45*4	235	79.97	Tens	57.73	LX_L_g331P	-19.95	30° C5, Min. WS,C NA+	12B_LA_3BE_+4.5+4.5+4.5+4.5	59.083	77.208	34.56	1	1	1	43.27	0.91	0.381	3	1	M-16(8.8)	79.97	26.486	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED118	SAE	45*45*4	235	43.83	Climb	26.25	LXY_L_g337P	-9.073	30° C5, Min. WS,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	54.831	77.208	34.56	1	1	1	61.19	0.99	0.539	3	1	M-16(8.8)	28.19	9.336	30° C5,C NA+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED119	SAE	45*45*4	235	47.64	Comp	47.64	L_g338P	-9.87	30° C2,C BI+	12B_LA_9BE_+4.5+4.5+4.5+4.5	20.717	77.208	34.56	1	0.714	0.714	169.24	1.82	2.085	7	1	M-16(8.8)	27.61	9.145	30° C2, Min. WS,C BI+	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED120	SAE	45*45*4	235	22.42	Comp	22.42	LXY_g341P	-3.429	30° C2, Min. WS,C BI+	12B_LA_9BE_+4.5+4.5+4.5+4.5	15.289	77.208	34.56	1	0.615	0.615	187.78	2.14	2.554	7	1	M-16(8.8)	9.65	3.195	30° C2-, Min. WS,C BI-	12B_LA_9BE_+4.5+4.5+4.5+4.5	33.12	1	1.75
RED121	SAE	50*50*4	235	13.78	Comp	13.78	LY_L_g342P	-1.577	30° C2,C BI+	12B_LA_0BE_+4.5+4.5+4.5+4.5	11.448	77.208	34.56	1	0.6	0.6	240.82	2.63	3.66	7	1	M-16(8.8)	4.39	1.518	30° C6,C BI+	12B_LA_3BE_+4.5+4.5+4.5+4.5	38.88	1	1.75
RED122	SAE	65*65*5	355	84.95	Climb	7.17	LY_g347P	-1.571	30° C6,C BI+	12B_LA_3BE_+4.5+4.5+4.5+4.5	21.915	77.208	56.4	1	0.571	0.571	227.88	2.99	4.512	7	1	M-16(8.8)	2.69	1.52	30° C2,C BI+	12B_LA_-3BE_+4.5+4.5+4.5+4.5	92.684	1	1.75
RED123	SAE	45*45*4	235	67.05	Comp	67.05	g300P	-7.888	30° C5,C NA+	12B_LA_9BE_+3+3+3+3	11.764	77.208	34.56	2	1	1	221.56	2.45	1.507	7	1	M-16(8.8)	38.44	12.73	30° C5, Min. WS,C NA+	12B_LA_9BE_+3+3+3+3	33.12	1	1.75
RED124	SAE	45*45*4	235	83	Climb	19.57	LX_g304P	-6.765	30° C5, Min. WS,C NA+	12B_LA_9BE_+3+3+3+3	37.391	77																	

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont- rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kN)	Comp. Control Load Case	Comp. Control Model	L/r Capacity (kN)	Comp. Connect. Shear Capacity (kN)	Comp. Connect. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (m)	Curve No.	No. Of Bolts Comp.	Bolt Type Comp.	Max Use In Tens. %	Tension Force (kN)	Tension Control Load Case	Tension Control Model	Net Section Capacity (kN)	No. Of Holes	Hole Diameter (cm)
RED145	SAE	45*45*4	235	70.28	Climb	17.89	LX_g310P	-6.182	30° C5, Min. WS,C NA+	12B_LA_OBE_+1.5+1.5+1.5+1.5	43.634	77.208	34.56	1	1	1	97.84	1.18	0.861	3	1	M-16(8.8)	20.69	6.853	30° C5,C NA+	12B_LA_OBE_+1.5+1.5+1.5+1.5	33.12	1	1.75
RED146	SAE	45*45*4	235	21.48	Comp	21.48	g312P	-5.107	30° C2,C BI+	12B_LA_9BE_+1.5+1.5+1.5+1.5	23.773	77.208	34.56	1	0.692	0.692	149.21	1.69	1.897	7	1	M-16(8.8)	13.41	4.44	30° C2, Min. WS,C BI+	12B_LA_9BE_+1.5+1.5+1.5+1.5	33.12	1	1.75
RED147	SAE	55*55*4	355	82.5	Climb	8.09	LXY_g316P	-2.285	30° C2, Min. WS,C BI+	12B_LA_9BE_+1.5+1.5+1.5+1.5	28.251	77.208	45.12	1	0.6	0.6	153.4	2.13	2.562	7	1	M-16(8.8)	4.98	2.248	30° C2-, Min. WS,C BI-	12B_LA_9BE_+1.5+1.5+1.5+1.5	59.032	1	1.75
RED148	SAE	60*60*4	235	8.66	Comp	8.66	LX_g347P	-1.192	30° C1-, Min. WS,C NA-	12B_LA_9BE_+1.5+1.5+1.5+1.5	13.762	77.208	34.56	1	0.625	0.625	241.87	2.64	4.426	7	1	M-16(8.8)	4.02	1.388	30° C6,C BI+	12B_LA_9BE_+1.5+1.5+1.5+1.5	50.976	1	1.75
RED149	SAE	45*45*4	235	11.2	Tens	3.75	L_g335P	-1.195	30° C2,C BI+	12B_LA_9BE_+0+0+0+0	31.84	77.208	34.56	0.5	0.5	0.5	133.6	1.44	2.351	5	1	M-16(8.8)	11.2	3.708	30° C5, Min. WS,C NA+	12B_LA_9BE_+0+0+0+0	33.12	1	1.75
RED150	SAE	50*50*4	355	89.08	Climb	28.23	LXY_g314P	-4.495	30° C5, Min. WS,C NA+	12B_LA_9BE_+0+0+0+0	15.919	77.208	45.12	1	1	1	207.45	2.74	2.033	7	1	M-16(8.8)	5.53	2.494	30° C5,C NA+	12B_LA_9BE_+0+0+0+0	50.76	1	1.75
RED151	SAE	45*45*4	235	61.91	Comp	61.91	LY_g321P	-9.911	30° C5,C NA+	12B_LA_9BE_+0+0+0+0	16.009	77.208	34.56	1	1	1	193.98	2.08	1.707	7	1	M-16(8.8)	32.23	10.675	30° C5, Min. WS,C NA+	12B_LA_9BE_+0+0+0+0	33.12	1	1.75
RED152	SAE	45*45*4	235	83.18	Climb	28.24	LX_g323P	-9.76	30° C5, Min. WS,C NA+	12B_LA_9BE_+0+0+0+0	37.308	77.208	34.56	1	1	1	115.64	1.31	1.018	3	1	M-16(8.8)	28.06	9.294	30° C5,C NA+	12B_LA_9BE_+0+0+0+0	33.12	1	1.75
RED153	SAE	45*45*4	355	77.99	Climb	12.79	LX_g310P	-2.903	30° C5, Min. WS,C NA+	12B_LA_OBE_+0+0+0+0	22.691	77.208	45.12	1	1	1	163.18	2.16	1.436	7	1	M-16(8.8)	6.77	2.928	0° C2,C BI+	12B_LA_9BE_+0+0+0+0	43.24	1	1.75
RED154	SAE	45*45*4	235	14.84	Comp	14.84	g312P	-1.933	0° C2, Min. WS,C BI+	12B_LA_9BE_+0+0+0+0	13.02	77.208	34.56	1	0.667	0.667	214.29	2.32	2.829	7	1	M-16(8.8)	5.29	1.753	30° C5, Min. WS,C NA+	12B_LA_OBE_+0+0+0+0	33.12	1	1.75
RED155	SAE	65*65*5	355	80.65	Climb	3.77	g316P	-0.998	30° C1-,C NA-	12B_LA_9BE_+0+0+0+0	26.469	77.208	56.4	1	0.6	0.6	203.54	2.71	4.03	7	1	M-16(8.8)	2.07	1.168	30° C1-, Min. WS,C NA-	12B_LA_9BE_+0+0+0+0	92.684	1	1.75
RED156	SAE	45*45*4	235	43.96	Comp	43.96	LY_g334P	-5.245	30° C5,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	11.931	77.208	34.56	1	1	1	226.11	2.43	1.99	7	1	M-16(8.8)	18.72	6.199	30° C5, Min. WS,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	33.12	1	1.75
RED157	SAE	45*45*4	355	82.79	Climb	35.69	LX_g315P	-7.234	30° C5, Min. WS,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	20.269	77.208	45.12	1	1	1	173.08	2.29	1.523	7	1	M-16(8.8)	16.26	7.03	30° C5,C NA+	12B_LA_9BE_-1.5-1.5-1.5-1.5	43.24	1	1.75
RED158	SAE	50*50*4	355	94.49	Climb	16.57	LXY_g294P	-2.358	30° C2, Min. WS,C BI+	12B_LA_9BE_-1.5-1.5-1.5-1.5	14.227	77.208	45.12	1	1	1	219.8	2.9	2.154	7	1	M-16(8.8)	6.4	2.889	30° C6,C BI+	12B_LA_OBE_-1.5-1.5-1.5-1.5	50.76	1	1.75
RED159	SAE	65*65*4	355	93.38	Climb	9.32	LY_g313P	-2.136	30° C5,C NA+	12B_LA_OBE_-1.5-1.5-1.5-1.5	22.924	77.208	45.12	1	0.666	0.666	196.46	2.51	3.832	7	1	M-16(8.8)	3.59	1.621	30° C5, Min. WS,C NA+	12B_LA_OBE_-1.5-1.5-1.5-1.5	74.824	1	1.75
RED161	SAE	65*65*4	355	91.36	Climb	12.43	LY_g316P	-3.234	30° C3,C NA+	12B_LA_-3BE_+6+6-3-3	26.014	77.208	45.12	1	0.666	0.666	181.64	2.35	3.543	7	1	M-16(8.8)	6.42	2.895	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	74.824	1	1.75
RED160	SAE	50*50*4	355	94.49	Climb	25.43	g294P	-3.618	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3	14.227	77.208	45.12	1	1	1	219.8	2.9	2.154	7	1	M-16(8.8)	9.34	4.215	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3	50.76	1	1.75
RED162	SAE	50*50*4	355	71.77	Redun	71.77	g325P	-19.921	0° C1,C NA+	12B_LA_3BE_-3-3+6+6	27.755	77.208	45.12	1	1	1	155.42	2.05	1.523	7	1	M-16(8.8)	44.15	19.921	0° C1,C NA+	12B_LA_3BE_-3-3+6+6	50.76	1	1.75
RED163	SAE	45*45*4	355	76.65	Climb	35.62	g334P	-6.596	30° C5,C NA+	12B_LA_9BE_-3-3+6-3	18.515	77.208	45.12	1	1	1	181.42	2.4	1.596	7	1	M-16(8.8)	15.53	6.717	30° C5, Min. WS,C NA+	12B_LA_9BE_-3-3+6-3	43.24	1	1.75

D-CROSSARM BOTTOM CHORD CALCULATION

1.1 Upper Crossarm Bottom chord

1.1.1 Loads (kN)

For Top Crossarm		Axial	FoS	Load	Load Case
	Compression	28.7	1.0	28.7	0° SF1A,LT,I NA+
	Climbing	3.0	1.5	4.5	

1.1.2 Material Properties

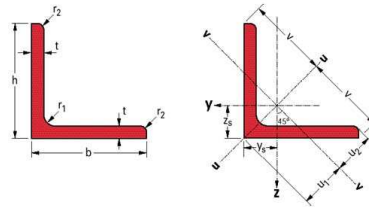
E	210000	N/mm ²	Modulus of Elasticity
F _y	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

1.1.3 Dimensiones

L =	1.432	m	Longest Field of Beam
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1.1.4 Crosssection Properties

Section	L70*70*6	Unit		
b=	70	mm	Width	
h=	70	mm	Height	
t=	6	mm	Thickness	
r _z ,r _y =	2.13	cm	Raius of Gyration z-z, y-y	
r _v =	1.37	cm	Raius of Gyration v-v	
S=	7.27	cm ³	Section Modulus z-z, y-y	
A=	8.13	cm ²	Gross cross-section area	
G=	62.57	N/m	Unit weight	
b/t=	11.7		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.64			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
A _{eff} =	8.13	cm ²	Effective cross-section area	
λ	104.53		Slenderness	J.4.2.2-EN50341-2012
λ ₁	76.41			J.4.2.3-EN50341-2012
λ'	1.37		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λ _{eff}	1.39		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection factor	J.4.1-EN50341-2012
Φ	1.54			
χ	0.45		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012



1.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
M _{z,ed} =	1.63	kN.m	Design bending moment	
M _{z,Rd} =	2.58	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	63.0 %	OK	Usage	

1.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance	
N _{ed} =	28.7	kN	Compression force	
N _{rd} =	118.6	kN	Flexural Buckling resistance	
Status	24.2 %	OK	Usage	



1.1.7 Axial Compression & Bending Check

Check	0.87	OK	$\frac{N_{ed}}{N_{rd}} + \frac{M_{z,ed}}{M_{z,Rd}} \leq 1$	Eq 6.2 6.2.1- EN1993-1-1-2005
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2.1 Middle Crossarm Bottom chord

2.1.1 Loads (kN)

For		Axial	FoS	Load	Load Case
Middle Crossarm	Compression	47.5	1.0	47.5	0° SF1A,LT,I NA+
	Climbing	3.0	1.5	4.5	

2.1.2 Material Properties

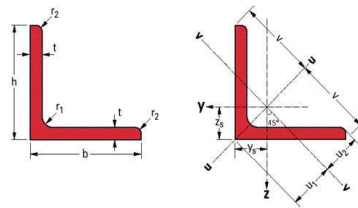
E	210000	N/mm ²	Modulus of Elasticity
F _y	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

2.1.3 Dimensions

L =	1.155	m	Longest Field of Beam
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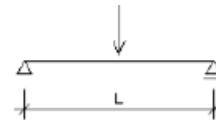
2.1.4 Crosssection Properties

Section	L70*70*6	Unit		
b=	70	mm	Width	
h=	70	mm	Height	
t=	6	mm	Thickness	
r _z ,r _y =	2.13	cm	Raius of Gyration z-z, y-y	
r _v =	1.37	cm	Raius of Gyration v-v	
S=	7.27	cm ³	Section Modulus z-z, y-y	
A=	8.13	cm ²	Gross cross-section area	
G=	62.57	N/m	Unit weight	
b/t=	11.7		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.64			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
A _{eff} =	8.13	cm ²	Effective cross-section area	
λ	84.31		Slenderness	J.4.2.2-EN50341-2012
λ ₁	76.41			J.4.2.3-EN50341-2012
λ'	1.10		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λ _{eff}	1.22		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection factor	J.4.1-EN50341-2012
Φ	1.31			
χ	0.56		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012



2.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
M _{z,ed} =	1.31	kN.m	Design bending moment	
M _{z,Rd} =	2.58	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	50.8 %	OK	Usage	



2.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance
N _{ed} =	47.5	kN	Compression force
N _{rd} =	147.2	kN	Flexural Buckling resistance
Status	32.3 %	OK	Usage

2.1.7 Axial Compression & Bending Check

Check	0.83	OK	$\frac{N_{ed}}{N_{rd}} + \frac{M_{z,ed}}{M_{z,Rd}} \leq 1$	Eq 6.2 6.2.1- EN1993-1-1-2005
-------	------	----	--	-------------------------------

3.1 Lower Crossarm Bottom chord

3.1.1 Loads (kN)

For Lower Crossarm		Axial	FoS	Load	Load Case
	Compression	36.4	1.0	36.4	0° SF1A,LM,I NA+
	Climbing	3.0	1.5	4.5	

3.1.2 Material Properties

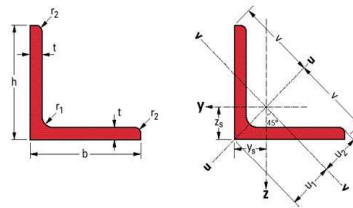
E	210000	N/mm ²	Modulus of Elasticity
F _y	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

3.1.3 Dimensiones

L =	1.419	m	Longest Field of Beam
-----	-------	---	-----------------------

3.1.4 Crosssection Properties

Section	L70*70*7	Unit		
b=	70	mm	Width	
h=	70	mm	Height	
t=	7	mm	Thickness	
r _z ,r _y =	2.12	cm	Raius of Gyration z-z, y-y	
r _v =	1.37	cm	Raius of Gyration v-v	
S=	8.41	cm ³	Section Modulus z-z, y-y	
A=	9.40	cm ²	Gross cross-section area	
G=	72.37	N/m	Unit weight	
b/t=	10.0		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.53			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
A _{eff} =	9.40	cm ²	Effective cross-section area	
λ	103.58		Slenderness	J.4.2.2-EN50341-2012
λ ₁	76.41			J.4.2.3-EN50341-2012
λ'	1.36		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λ _{eff}	1.38		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection Factor	J.4.1-EN50341-2012
Φ	1.53			
χ	0.46		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012



3.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
M _{z,ed} =	1.61	kN.m	Design bending moment	
M _{z,Rd} =	2.99	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	54.1 %	OK	Usage	

3.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance	
N _{ed} =	36.4	kN	Compression force	
N _{rd} =	138.5	kN	Flexural Buckling resistance	
Status	26.3 %	OK	Usage	



3.1.7 Axial Compression & Bending Check

Check	0.80	OK	$\frac{N_{ed}}{N_{rd}} + \frac{M_{z,ed}}{M_{z,Rd}} \leq 1$	Eq 6.2 6.2.1- EN1993-1-1-2005
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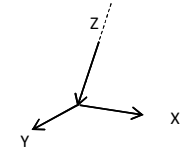
E-FOUNDATION REACTIONS

Factored Maximum Foundation Reactions

+9 Body Extension

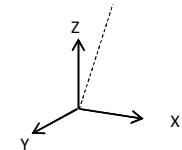
• Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	811.04	19.94	6.97	30° C5,C NA+	12B_LA_9BE_+6+6-3-3
Uplift	-692.65	15.37	5.68	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6-3-3
Max. Transverse	462.68	39.59	40.09	0° C2, Min. WS,C BI+	12B_LA_9BE_-3+6+6+6
Max. Longitudinal	463.32	38.68	40.90	30° C2, Min. WS,C BI+	12B_LA_9BE_-3+6+6+6



• Maximum Reactions in Global direction

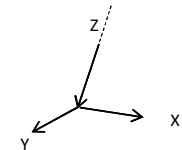
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-787.37	144.65	131.68	30° C5,C NA+	12B_LA_9BE_+6+6-3-3
Uplift	672.73	121.91	112.22	30° C5, Min. WS,C NA+	12B_LA_9BE_+6+6-3-3
Max. Transverse	-787.37	144.65	131.68	30° C5,C NA+	12B_LA_9BE_+6+6-3-3
Max. Longitudinal	-787.37	144.65	131.68	30° C5,C NA+	12B_LA_9BE_+6+6-3-3



+6 Body Extension

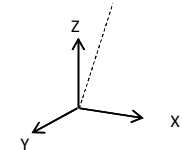
• Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	810.59	19.94	11.45	30° C5,C NA+	12B_LA_6BE_+6+6-3-3
Uplift	-701.20	13.68	9.38	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6-3-3
Max. Transverse	434.49	36.89	37.44	0° C2, Min. WS,C BI+	12B_LA_6BE_-3+6+6+6
Max. Longitudinal	435.11	36.03	38.26	30° C2, Min. WS,C BI+	12B_LA_6BE_-3+6+6+6



• Maximum Reactions in Global direction

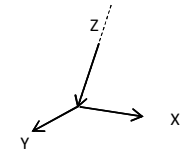
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-786.26	144.47	135.98	30° C5,C NA+	12B_LA_6BE_+6+6-3-3
Uplift	680.77	121.50	117.21	30° C5, Min. WS,C NA+	12B_LA_6BE_+6+6-3-3
Max. Transverse	-786.26	144.47	135.98	30° C5,C NA+	12B_LA_6BE_+6+6-3-3
Max. Longitudinal	-786.26	144.47	135.98	30° C5,C NA+	12B_LA_6BE_+6+6-3-3



+3 Body Extension

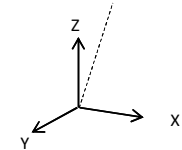
• Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	815.90	18.78	15.86	30° C5,C NA+	12B_LA_3BE_+6+6-3-3
Uplift	-715.88	15.34	12.83	30° C5, Min. WS,C NA+	12B_LA_3BE_+6+6-3-3
Max. Transverse	416.55	31.97	32.30	0° C2, Min. WS,C BI+	12B_LA_3BE_-3+6+6+6
Max. Longitudinal	434.78	31.37	33.02	30° C2,C BI+	12B_LA_3BE_-3+6+6+6



• Maximum Reactions in Global direction

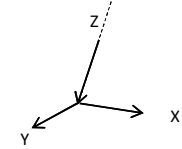
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-790.95	144.05	141.13	30° C5,C NA+	12B_LA_3BE_+6+6-3-3
Uplift	694.32	125.31	122.80	30° C5, Min. WS,C NA+	12B_LA_3BE_+6+6-3-3
Max. Transverse	-790.95	144.05	141.13	30° C5,C NA+	12B_LA_3BE_+6+6-3-3
Max. Longitudinal	-790.95	144.05	141.13	30° C5,C NA+	12B_LA_3BE_+6+6-3-3



+0 Body Extension

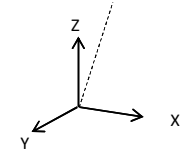
- Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	787.00	16.56	29.40	30° C5,C NA+	12B_LA_OBE_+6+6-3-3
Uplift	-696.33	12.97	26.24	30° C5, Min. WS,C NA+	12B_LA_OBE_+6+6-3-3
Max. Transverse	4.42	37.07	8.34	30° SC1+,RM&RB,C NA+	12B_LA_OBE_+6-3-3+6
Max. Longitudinal	477.71	22.30	41.27	30° C6,C BI+	12B_LA_OBE_-3+6+6+6



- Maximum Reactions in Global direction

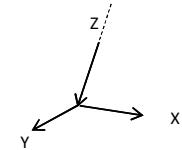
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-761.04	137.10	149.94	30° C5,C NA+	12B_LA_OBE_+6+6-3-3
Uplift	673.58	119.66	132.92	30° C5, Min. WS,C NA+	12B_LA_OBE_+6+6-3-3
Max. Transverse	-761.04	137.10	149.94	30° C5,C NA+	12B_LA_OBE_+6+6-3-3
Max. Longitudinal	-761.04	137.10	149.94	30° C5,C NA+	12B_LA_OBE_+6+6-3-3



-3 Body Extension

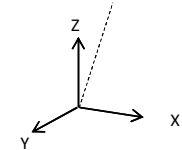
- Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	814.11	16.98	29.96	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3
Uplift	-735.43	14.05	27.18	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3
Max. Transverse	122.45	50.16	8.82	30° SC1+,LM&LB,C NA+	12B_LA_-3BE_-3+6+6-3
Max. Longitudinal	484.40	3.68	50.34	30° SC1+,RM&RB,C NA+	12B_LA_-3BE_+6+6-3-3



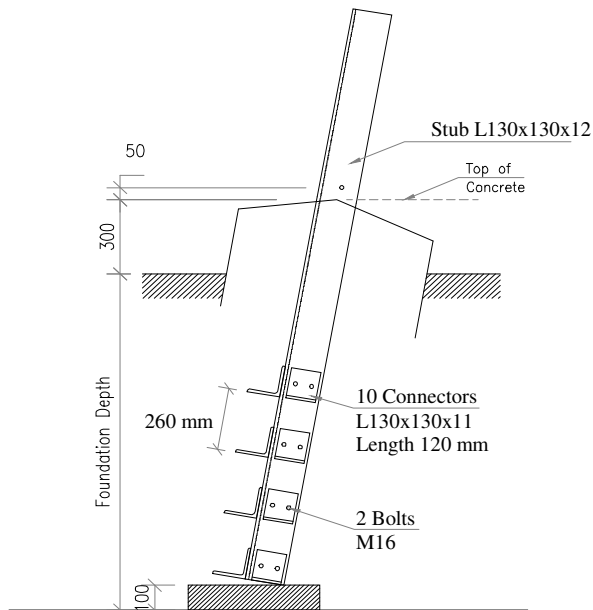
- Maximum Reactions in Global direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-787.34	141.68	154.66	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3
Uplift	711.43	126.73	139.86	30° C5, Min. WS,C NA+	12B_LA_-3BE_+6+6-3-3
Max. Transverse	-787.34	141.68	154.66	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3
Max. Longitudinal	-787.34	141.68	154.66	30° C5,C NA+	12B_LA_-3BE_+6+6-3-3

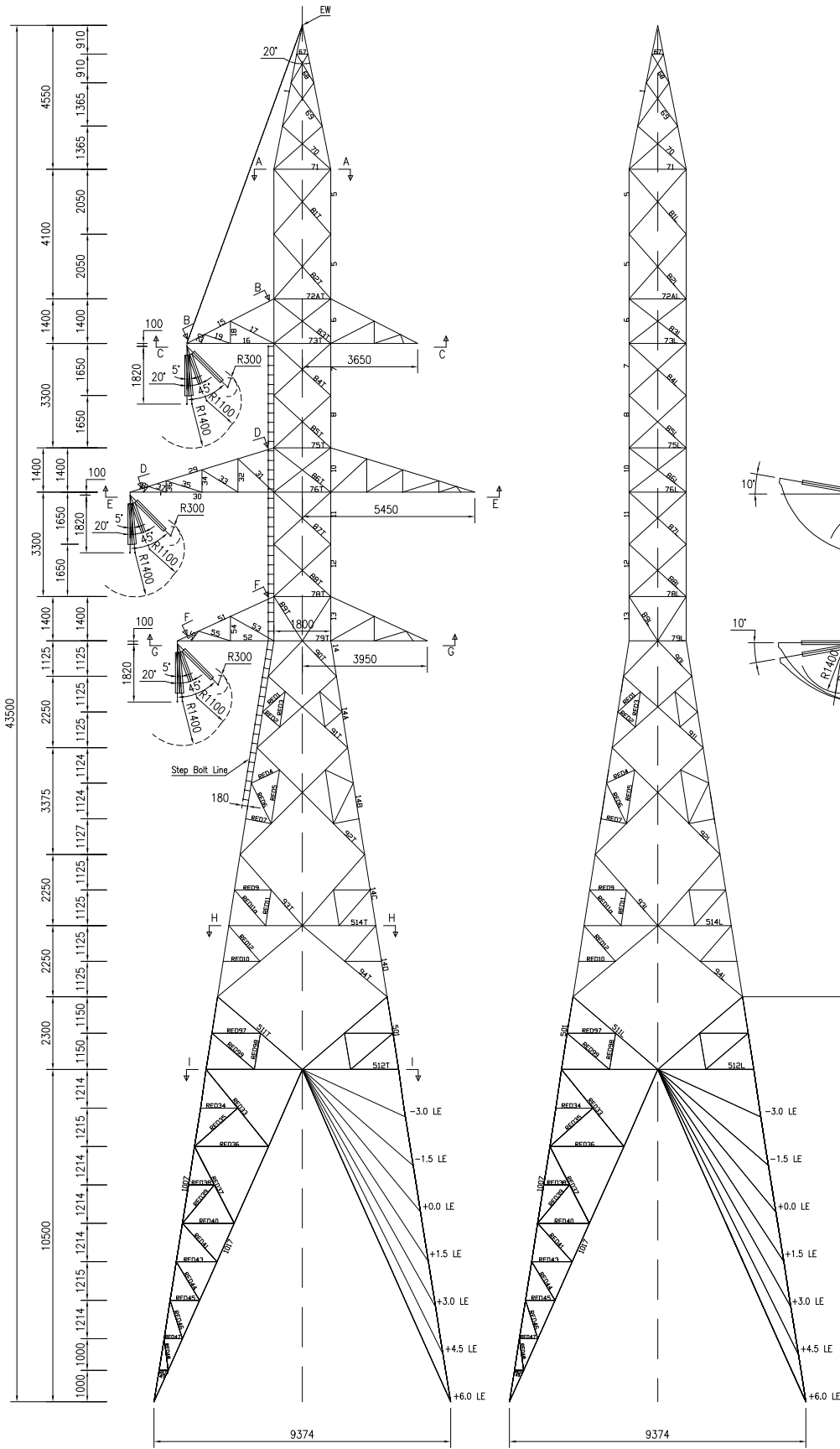


F-STUB DESIGN

MATERIAL PROPERTIES	Concrete: C20/25					$f_{cd} = f_{ck}/\gamma_c$ EN 50341-1:2012 (7.6.4) EN 1992-1-1 Eq (3.15)
	Characteristic Compressive Strength	f_{ck}	MPa	20.0		
	Partial Material Factor:	γ_c		1.5		
	Maximum Allowable Design Stress	f_{cd}	MPa	13.3		
	Steel : S355J2					
	Yield Strength	f_y	MPa	355.0		
	Bolts : ISO 898-1 Class 8.8 (Shear through unthreaded portion)					
TOWER REACTIONS ON LEG DIRECTION	Tensile Strength :		f_{ub}	MPa	800.0	
	MAX COMPRESSION	AXIAL	P	kN	897.5	Axial force for compression & uplift are increased 10 % as per B 2.5.3.4 "Employer's Requirement"
		SHEAR	V	kN	24.6	
	MAX UPLIFT	AXIAL	P	kN	809.0	
		SHEAR	V	kN	30.6	
ANGLES	STUB		Size of Ang.	L130x130x12		
			w	mm	130	w : width of stub angle
			t	mm	12	t : thickness of stub angle
			A_g	cm ²	30.00	A_g : Gross area of stub angle
			n		2.6	n: Number of holes
			$\emptyset$	mm	17.5	$\emptyset$: Diameter of Holes
			A_n	cm ²	24.54	A_n : Net area of stub angle at the plane of the intersection with concrete
			L	mm	1270	L: Minimum Stub Length in Concrete
	ANGLE SHEAR CONNECTOR	SECTION	Size of Ang.	L130x130x11		
			w	mm	130	w : width of angle shear connector leg
			t	mm	11	t : thickness of angle shear connector
			b	mm	120.0	b : length of angle shear connector
			r	mm	14.0	r : radius of fillet
		NUMBER	#		10	
MIN STUB ANGLE AREA	Compression plus Shear:		A_a	cm ²	26.20	$A_a = \frac{P}{F_y} + \frac{V}{0.75F_y}$ ASCE 10-15 Eq (7.4-1)
	Tension plus Shear:		A_a	cm ²	23.94	
SHEAR CONNECTORS	ANGLES		x	mm	52.0	$x = t \left[\frac{F_y}{1.19f_{cd}} \right]^{1/2}$ ASCE 10-15 Eq (7.6-3)
		Capacity of one Angle Shear Connector	P	kN	97.1	$P = 1.19f_{cd}b(t + r + x/2)$ ASCE 10-15 Eq (7.6-2)
		Total Capacity of Connectors	P	kN	971.3	
	BOLTS	Diameter	$\emptyset$	mm	16	
		Number	#		20	
		Shear Capacity of one Bolt	$F_{V,Rd}$	kN	77.21	$P = 0.6f_{ub}A/\gamma_{M2}$ Table J.3. EN50341-1:2012
CHECKS SUMMARY	STUB ANGLE (COMPRESSION + SHEAR)		cm ²	30.00	> 26.20	OK
	STUB ANGLE (TENSION + SHEAR)		cm ²	24.54	> 23.94	OK
	ANGLE SHEAR CONNECTOR		kN	971.3	> 897.5	OK
	CONNECTION BOLTS		kN	1544.2	> 897.5	OK



Note:
This drawing is illustrative. For more details see Assembly drawings.



-3 BE +6 LE
TRANSVERSE FACE

-3 BE +6 LE
LONGITUDINAL FACE

SECTION B-B

SECTION A-A

SECTION D-D

SECTION F-F

SECTION C-C

SECTION E-E

SECTION G-G

SECTION C-C

SECTION E-E

SECTION G-G

VIEW P

VIEW R

VIEW S

± 0 BODY EXT.

+ 3 BODY EXT.

+ 6 BODY EXT.

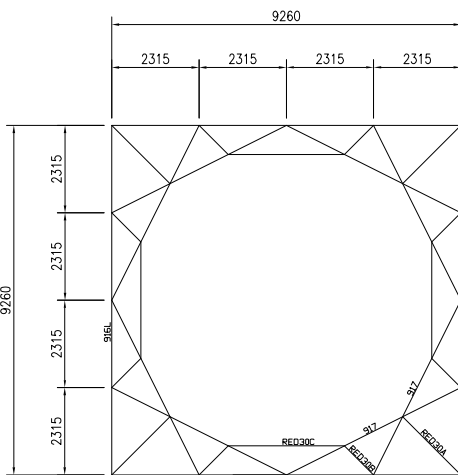
SECTION J-J

SECTION H-H

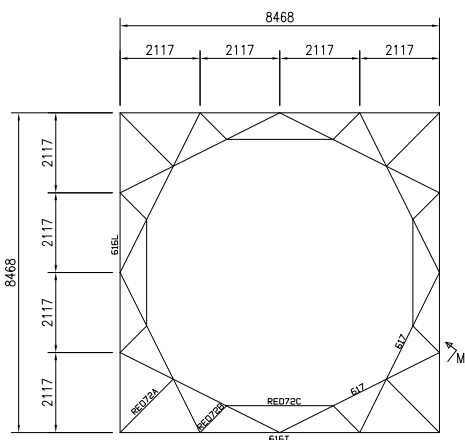
SECTION I-I

+ 9 BODY EXT.

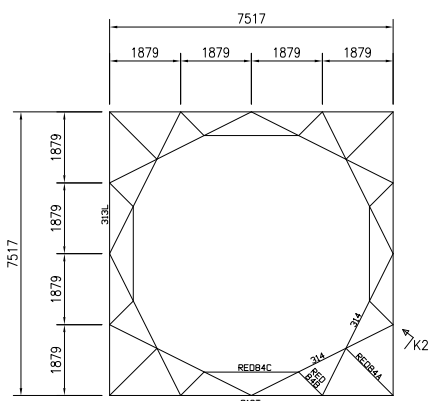
02 As per Comments		29.07.22	O.GONZALEZ
01 As per Comments		26.05.22	O.GONZALEZ
00 First Submission		11.04.22	O.GONZALEZ
REV DESCRIPTION		DATE	BY
PROJECT NAME:			
Open Programme Extension of the Transmission Network II			
BMZ No. 2015 68 286			
Contract Identification No. KW/DS/OHL-TD-Lot 2			
EMPLOYER:			
JSC Georgian State Electrosystem (GSE)			
Baratashvili Street, Tbilisi, Georgia, 0105			
ENGINEER:			
Fichtner GmbH & Co. KG			
Sarveystrasse 370191 Stuttgart / Germany			
CONTRACTOR:			
Mitas Energy and Metal Constuction Inc.			
Eski Güvercinlik Yolu No: 113 - Gazi Ankara / Turkey			
APPROVAL AREA:			
REVIEWED BY:		STATUS:	
DATE OF REVIEW:		STAMP:	
APPROVED BY:		TITLE:	
CHECKED BY:		DESIGNED BY:	
DRAWN BY:		DATE OF ISSUE:	
SCALE:		DOC NO.:	
REV.:		PAGE:	
A3		7145A07-EG-TWR-CLC-0327_02	
02		19 of 20	



SECTION O-O



SECTION M-M



SECTION K-K



SECTION J2-J2



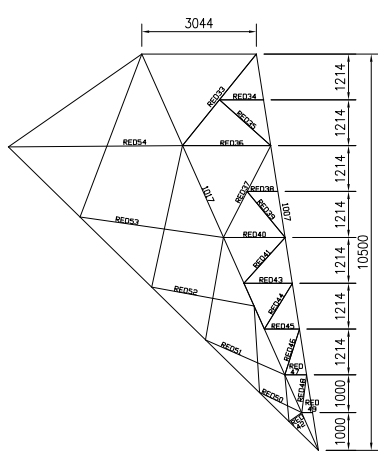
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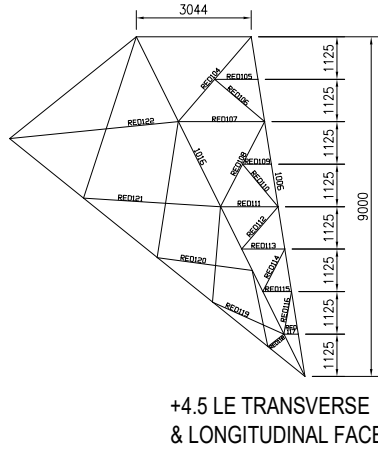
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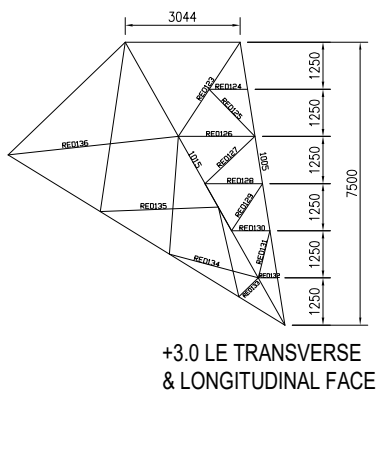
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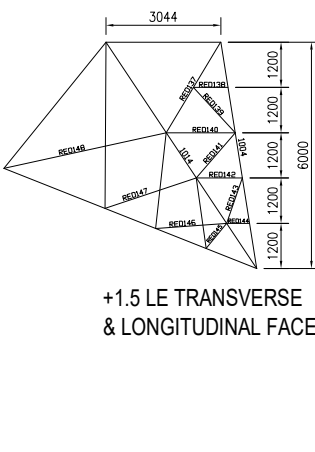
+6.0 LE TRANSVERSE & LONGITUDINAL FACE



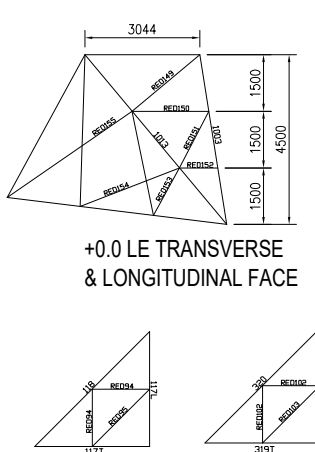
+4.5 LE TRANSVERSE & LONGITUDINAL FACE



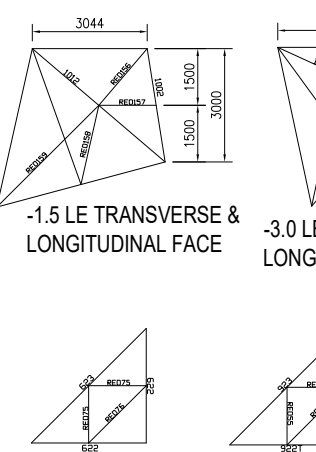
+3.0 LE TRANSVERSE & LONGITUDINAL FACE



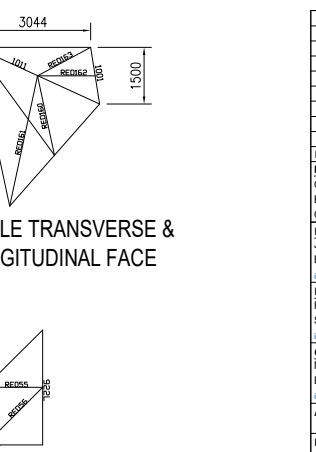
+1.5 LE TRANSVERSE & LONGITUDINAL FACE



+0.0 LE TRANSVERSE & LONGITUDINAL FACE



-1.5 LE TRANSVERSE & LONGITUDINAL FACE



-3.0 LE TRANSVERSE & LONGITUDINAL FACE

02	As per Comments	29.07.22	O.GONZALEZ
01	As per Comments	26.05.22	O.GONZALEZ
00	First Submission	11.04.22	O.GONZALEZ
REV	DESCRIPTION :	DATE	BY
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BMZ No. 2015 68 286			
Contract Identification No. KIWD/S/OHL-TD-Lot 2			
EMPLOYER :			
JSC Georgian State Electrosystem (GSE)			
Baratashvili Street, Tbilisi, Georgia, 0105			
info@gse.com.ge			
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Sarneystrasse 370191 Stuttgart / Germany			
info@fichtner.de			
CONTRACTOR :			
Mitas Energy and Metal Constuction Inc.			
Eski Güvercinlik Yolu No: 113 - Gazi Ankara / Turkey			
info@mitastower.com			
APPROVAL AREA :		STATUS :	STAMP :
REVIEWED BY :		AP	
		AC	
		NA	
DATE OF REVIEW :			
APPROVED BY :	S.SAHIN	TITLE :	
CHECKED BY :	S. SAHIN	DETAILED OUTLINE DRAWING OF TOWER TYPE 12B-LA	
DESIGNED BY :	K.KAYA		
DRAWN BY :	LOZDEMIR		
DATE OF ISSUE :	26.05.2022		
SCALE:	DOC NO.:	REV.:	PAGE:
A3	7145A07-EG-TWR-CLC-0327_02	02	20 of 20