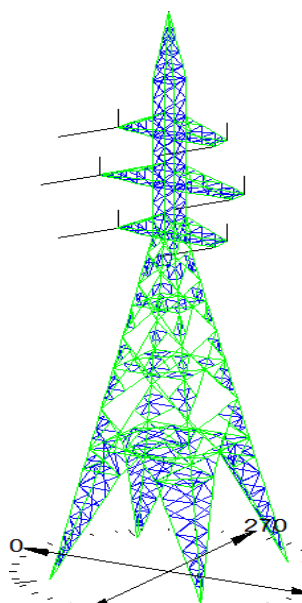


Construction of
220 kV Loop in Loop out Paliastomi- into Ozurgeti Substation and
110 kV Double Circuit (D/C) Overhead Line from Ozurgeti Substation to Zoti HPP
Tower Design Report of Medium Angle Tension Tower "12A-MA"



4	19.09.2022	As Per Assembly Drawing Revision	S.Celebi	S.Sahin	S.Nazlı
3	9.09.2022	Constrictive Members Are Add in Crossarms	S.Celebi	S.Sahin	S.Nazlı
2	24.08.2022	As Per Comments	S.Celebi	S.Sahin	S.Nazlı
1	25.07.2022	As Per Comments	S.Celebi	S.Sahin	S.Nazlı
0	13.05.2022	First Submission	S.Celebi	S.Sahin	S.Nazlı
Rev. No.	Date	Description	Prepared by	Checked by	Approved by
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Tower Design Report of Medium Angle Tension Tower "12A-MA"			n.a.	Page 1 of 22	

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A-GENERAL INFORMATION

1. PROJECT INFORMATION

Project : Open Programme Extension of the Transmission Network II

Tower Type : Double Circuit 110kV - 12A - MA Line Angle 30° - 60°

Extension Details : This tower includes +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	30° C1,C NA+	1.1	1	EN50341-1:2012F	884.9	0	0	0
2	30° C1-,C NA-	1.1	1	EN50341-1:2012F	-884.9	0	0	0
3	30° C2,C BI+	1.1	1	EN50341-1:2012F	625.7	625.7	0	0
4	30° C2-,C BI-	1.1	1	EN50341-1:2012F	-625.7	-625.7	0	0
5	30° ICE,C NA+	1.1	1	EN50341-1:2012F	0	0	3.2	6867
6	30° C3,C NA+	1.1	1	EN50341-1:2012F	262.2	0	3.2	6867
7	30° C3-,C NA-	1.1	1	EN50341-1:2012F	-262.2	0	3.2	6867
8	30° C4,C BI+	1.1	1	EN50341-1:2012F	185.4	185.4	3.2	6867
9	30° C4-,C BI-	1.1	1	EN50341-1:2012F	-185.4	-185.4	3.2	6867
10	30° C5,C NA+	1.1	1	EN50341-1:2012F	639.3	0	1.59	6867
11	30° C5-,C NA-	1.1	1	EN50341-1:2012F	-639.3	0	1.59	6867
12	30° C6,C BI+	1.1	1	EN50341-1:2012F	452.1	452.1	1.59	6867
13	30° C6-,C BI-	1.1	1	EN50341-1:2012F	-452.1	-452.1	1.59	6867
14	30° C7,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
15	30° C1, Min. WS,C NA+	1.1	1	EN50341-1:2012F	884.9	0	0	0
16	30° C1-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-884.9	0	0	0
17	30° C2, Min. WS,C BI+	1.1	1	EN50341-1:2012F	625.7	625.7	0	0
18	30° C2-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-625.7	-625.7	0	0
19	30° ICE, Min. WS,C NA+	1.1	1	EN50341-1:2012F	0	0	3.2	6867
20	30° C3, Min. WS,C NA+	1.1	1	EN50341-1:2012F	262.2	0	3.2	6867
21	30° C3-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-262.2	0	3.2	6867
22	30° C4, Min. WS,C BI+	1.1	1	EN50341-1:2012F	185.4	185.4	3.2	6867
23	30° C4-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-185.4	-185.4	3.2	6867
24	30° C5, Min. WS,C NA+	1.1	1	EN50341-1:2012F	639.3	0	1.59	6867
26	30° C6, Min. WS,C BI+	1.1	1	EN50341-1:2012F	452.1	0	1.59	6867
26	30° C6, Min. WS,C BI+	1.1	1	EN50341-1:2012F	452.1	452.1	1.59	6867
27	30° C6-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-452.1	-452.1	1.59	6867
28	30° C7, Min. WS,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
29	30° SC1,EW<,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
30	30° SC1,LT&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
31	30° SC1,LT&LM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
32	30° SC1,LM&LB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
33	30° SC1,EW&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
34	30° SC1,RT&RM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
35	30° SC1,RM&RB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
36	30° SF1A,EW,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
37	30° SF1A,LT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
38	30° SF1A,RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
39	30° SF1A,LM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
40	30° SF1A,RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
41	30° SF1A,LB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
42	30° SF1A,RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
43	30° SF1A,LT&RT,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
44	30° SF1A,LM&RM,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
45	30° SF1A,LB&RB,I NA+	1.5	1	EN50341-1:2012F	0	0	0	0
46	30° SF1B,All Strung,I NA+	1.5	1	EN50341-1:2012F	245.8	0	0	0
47	30° SF1B,All Strung-,I NA-	1.5	1	EN50341-1:2012F	-245.8	0	0	0
48	30° SF2,C NA+	1.5	1	EN50341-1:2012F	0	0	0	0
49	60° C1,C NA+	1.1	1	EN50341-1:2012F	884.9	0	0	0

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)
50	60° C1-,C NA-	1.1	1	EN50341-1:2012F	-884.9	0	0	0
51	60° C2,C BI+	1.1	1	EN50341-1:2012F	625.7	625.7	0	0
52	60° C2-,C BI-	1.1	1	EN50341-1:2012F	-625.7	-625.7	0	0
53	60° ICE,C NA+	1.1	1	EN50341-1:2012F	0	0	3.2	6867
54	60° C3,C NA+	1.1	1	EN50341-1:2012F	262.2	0	3.2	6867
55	60° C3-,C NA-	1.1	1	EN50341-1:2012F	-262.2	0	3.2	6867
56	60° C4,C BI+	1.1	1	EN50341-1:2012F	185.4	185.4	3.2	6867
57	60° C4-,C BI-	1.1	1	EN50341-1:2012F	-185.4	-185.4	3.2	6867
58	60° C5,C NA+	1.1	1	EN50341-1:2012F	639.3	0	1.59	6867
59	60° C5-,C NA-	1.1	1	EN50341-1:2012F	-639.3	0	1.59	6867
60	60° C6,C BI+	1.1	1	EN50341-1:2012F	452.1	452.1	1.59	6867
61	60° C6-,C BI-	1.1	1	EN50341-1:2012F	-452.1	-452.1	1.59	6867
62	60° C7,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
63	60° C1, Min. WS,C NA+	1.1	1	EN50341-1:2012F	884.9	0	0	0
64	60° C1-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-884.9	0	0	0
65	60° C2, Min. WS,C BI+	1.1	1	EN50341-1:2012F	625.7	625.7	0	0
66	60° C2-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-625.7	-625.7	0	0
67	60° ICE, Min. WS,C NA+	1.1	1	EN50341-1:2012F	0	0	3.2	6867
68	60° C3, Min. WS,C NA+	1.1	1	EN50341-1:2012F	262.2	0	3.2	6867
69	60° C3-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-262.2	0	3.2	6867
70	60° C4, Min. WS,C BI+	1.1	1	EN50341-1:2012F	185.4	185.4	3.2	6867
71	60° C4-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-185.4	-185.4	3.2	6867
72	60° C5, Min. WS,C NA+	1.1	1	EN50341-1:2012F	639.3	0	1.59	6867
73	60° C5-, Min. WS,C NA-	1.1	1	EN50341-1:2012F	-639.3	0	1.59	6867
74	60° C6, Min. WS,C BI+	1.1	1	EN50341-1:2012F	452.1	452.1	1.59	6867
75	60° C6-, Min. WS,C BI-	1.1	1	EN50341-1:2012F	-452.1	-452.1	1.59	6867
76	60° C7, Min. WS,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
77	60° SC1,EW<,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
78	60° SC1,LT&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
79	60° SC1,LT&LM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
80	60° SC1,LM&LB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
81	60° SC1,EW&RT,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
82	60° SC1,RT&RM,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
83	60° SC1,RM&RB,C NA+	1.1	0	EN50341-1:2012F	0	0	0	0
84	60° 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. 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)
EW1	SAE	90°90*6	355	70.84	Comp	70.84	-168.146	60° C6,C BI+	+6B +6-3+6+6	237.359	482.547	316.302	1	1	1	75.97	0.95	1.352	1	4	M-20(8.8)	60.48	164.151	60° C6, Min. WS,C BI+	+6B +6-3+6+6	271.397	2	2.15
EW2	SAE	50°50*4	355	24.85	Comp	24.85	-3.773	60° C1, Min. WS,C NA+	+6B +6-3+6+6	15.182	77.208	45.12	1	1	1	214.54	2.81	2.102	7	1	M-16(8.8)	8.36	3.773	60° C1, Min. WS,C NA+	+6B +6-3+6+6	50.76	1	1.75
EW3	SAE	45°45*4	355	78.21	Climb	11.83	-2.718	60° C5, Min. WS,C NA+	+6B +6+6+6-3	22.97	77.208	45.12	1	1	1	163.64	2.14	1.44	7	1	M-16(8.8)	5.84	2.524	60° C1,C NA+	+6B -3+6+6+6	43.24	1	1.75
EW4	SAE	45°45*4	355	23.44	Comp	23.44	-3.359	60° C1, Min. WS,C NA+	+6B -3+6+6+6	14.327	77.208	45.12	1	1	1	209.03	2.74	1.839	7	1	M-16(8.8)	7.8	3.371	60° C1, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
EW5	SAE	45°45*4	355	58.47	Climb	6.04	-2.38	60° C5, Min. WS,C NA+	+6B +6+6+6-3	39.37	77.208	45.12	1	1	1	122.73	1.61	1.08	7	1	M-16(8.8)	4.7	2.034	30° C1, Min. WS,C NA+	+6B -3+6+6+6	43.24	1	1.75
EW6	SAE	45°45*4	355	19.59	Comp	19.59	-3.614	60° C5,C NA+	+6B +6+6+6+6	18.446	77.208	45.12	1	1	1	183.44	2.4	1.614	7	1	M-16(8.8)	8.61	3.724	60° C5, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
EW7	SAE	45°45*4	355	38.86	Climb	5.1	-2.299	60° C5, Min. WS,C NA+	+6B +6+6+6-3	64.884	77.208	45.12	1	1	1	81.82	1.2	0.72	3	1	M-16(8.8)	3.93	1.699	60° C1, Min. WS,C NA+	+6B -3+6+6+6	43.24	1	1.75
EW8	SAE	45°45*4	355	9.52	Comp	9.52	-3.271	60° C5, Min. WS,C NA+	+6B -3+6+6+6	34.365	77.208	45.12	1	1	1	132.15	1.73	1.163	7	1	M-16(8.8)	7.99	3.455	60° C5, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
EW9	SAE	45°45*4	355	24.23	Climb	8.19	-3.695	60° C5, Min. WS,C NA+	+6B +6+6+6-3	82.418	77.208	45.12	1	1	1	51.14	0.99	0.45	3	1	M-16(8.8)	5.82	2.515	60° C5,C NA+	+6B -3+6+6+6	43.24	1	1.75
EW10	SAE	45°45*4	355	38.63	Tens	35.97	-16.23	60° C5,C NA+	+6B +6+6-3+6	51.952	77.208	45.12	1	1	1	102.62	1.37	0.903	3	1	M-16(8.8)	38.63	16.706	60° C5, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
EW11	SAE	45°45*4	355	12.09	Climb	10.99	-4.96	60° C5, Min. WS,C NA+	+6B +6+6+6-3	93.053	77.208	45.12	1	1	1	25.57	0.85	0.225	3	1	M-16(8.8)	7.29	3.152	60° C5,C NA+	+6B -3+6+6+6	43.24	1	1.75
3	SAE	110°110*7	355	60.84	Comp	60.84	-188.953	60° C5,C NA+	+6B +6+6+6-3	310.593	965.094	369.019	1	1	1	81.82	1	1.8	1	4	M-20(8.8)	49.6	183.044	60° C6, Min. WS,C BI+	-3B +6+6-3-3	412.51	2	2.15
4	SAE	110°110*7	355	75.88	Comp	75.88	-235.665	60° C5,C NA+	+6B +6+6+6-3	310.593	965.094	369.019	1	1	1	81.82	1	1.8	1	4	M-20(8.8)	61.65	227.514	60° C5, Min. WS,C NA+	+6B +6+6-3-3	412.51	2	2.15
5	SAE	110°110*7	355	87.36	Comp	87.36	-271.337	60° C5,C NA+	+6B +6+6-3-3	310.593	1447.642	553.528	1	1	1	81.82	1	1.8	1	6	M-20(8.8)	62.22	256.665	60° C5, Min. WS,C NA+	+6B +6+6-3-3	412.51	2	2.15
8	SAE	120°120*12	355	54.65	Tens	53.27	-387.16	60° C5,C NA+	+6B +6+6-3-3	726.759	1447.642	1015.2	1	1	1	65.96	0.86	1.55	1	6	M-20(8.8)	54.65	368.312	60° C5, Min. WS,C NA+	+6B +6+6-3-3	673.917	2.94	2.15
9	SAE	120°120*12	355	72.76	Tens	70.93	-515.515	60° C5,C NA+	+6B -3-3+6+6	726.759	1447.642	1015.2	1	1	1	65.96	0.86	1.55	1	6	M-20(8.8)	72.76	490.369	60° C5, Min. WS,C NA+	+6B -3-3+6+6	673.917	2.94	2.15
10	SAE	120°120*12	355	97.29	Comp	97.29	-624.721	60° C5,C NA+	+6B -3-3+6+6	642.106	1930.189	1353.6	1	1	1	76.6	1	1.8	1	8	M-20(8.8)	88.04	593.318	60° C5, Min. WS,C NA+	+6B -3-3+6+6	673.917	2.94	2.15
13	SAE	160°160*16	355	60.81	Tens	58.05	-838.087	60° C5,C NA+	+6B -3-3+6-3	1443.763	1930.189	1804.8	1	1	1	49.68	0.65	1.55	1	8	M-20(8.8)	60.81	800.156	60° C5, Min. WS,C NA+	+6B +6-3-3+6	1315.916	2.94	2.15
14	SAE	160°160*16	355	76.72	Tens	73.18	-1056.501	60° C5,C NA+	+3B +6+6-3-3	1443.763	1930.189	1804.8	1	1	1	49.68	0.65	1.55	1	8	M-20(8.8)	76.72	1009.589	60° C5, Min. WS,C NA+	+6B +6+6-3-3	1315.916	2.94	2.15
15	SAE	160°160*16	355	92.63	Tens	89.22	-1291.641	60° C5,C NA+	+0B +6+6-3+6	1509.663	1447.642	2707.2	2	1	1	36.96	0.48	0.9	1	12	M-20(8.8)	92.63	1218.986	60° C5, Min. WS,C NA+	+0B +6+6+6-3	1315.916	2.94	2.15
16	SAE	180°180*16	355	88.25	Comp	88.25	-1277.5	60° C5,C NA+	+0B +6+6-3+6	1766.463	1447.642	2707.2	1	1	1	21.84	0.29	0.771	1	12	M-20(8.8)	83.59	1210.042	60° C5, Min. WS,C NA+	+0B +6+6-3-3	1532.492	2.94	2.15
17	SAE	180°180*16	355	87.99	Tens	81.53	-1418.767	60° C5,C NA+	-3B -3-3+6+6	1740.186	1930.189	1804.8	1	1	1	29.12	0.38	1.028	1	8	M-20(8.8)	87.99	1348.407	60° C5, Min. WS,C NA+	-3B +6+6-3-3	1532.492	2.94	2.15
19	SAE	180°180*16	355	86.56	Tens	80.76	-1405.389	60° C5,C NA+	-3B -3-3+6+6	1740.186	1930.189	1804.8	1	1	1	29.12	0.38	1.028	1	8	M-20(8.8)	86.56	1326.477	60° C5, Min. WS,C NA+	-3B +6+6-3-3	1532.492	2.94	2.15
20	SAE	180°180*16	355	79.25	Tens	74.68	-1299.577	60° C5,C NA+	-3B -3-3+6+6	1740.186	2412.736	2256	1	1	1	29.12	0.38	1.028	1	10	M-20(8.8)	79.25	1214.514	60° C5, Min. WS,C NA+	-3B +6+6-3-3	1532.492	2.94	2.15
27	SAE	65°65*6	355	39.56	Comp	39.56	-62.234	30° SC1,RT&RM,C NA+	-3B -3-3-3-3	157.328	231.623	185.637	2	1	1	70.66	1.1	0.696	2	3	M-16(8.8)	32.97	56.158	60° C5, Min. WS,C NA+	+6B +6+6-3+6	170.328	1	1.75
28	SAE	60°60*6	355	34.64	Tens	25.96	-31.85	60° C6-, Min. WS,C BI-	+6B +6+6-3+6	122.698	231.623	185.637	2	1	1	86.11	1.23	0.784	2	3	M-16(8.8)	34.64	52.878	60° C4-,C BI-	-3B +6+6-3-3	152.656	1	1.75
29	DAE	80°80*8	355	41.52	Tens	0.43	-0.669	60° C6-, Min. WS,C BI-	+6B +6+6+6+6	380.217	154.416	330.021	2	1	1	74.38	1.34	0.9	3	2	M-16(8.8)	41.52	64.106	30° C3-, Min. WS,C NA-	-3B -3-3-3-3	579.04	2	1.75
30	SAE	45°45*4	355	17.63	Comp	17.63	-2.746	60° C4-,C BI-	+0B +6-3-3-3	15.577	77.208	45.12	1	1	1	200.21	2.62	1.762	7	1	M-16(8.8)	0	0		+6B +1.5+1.5+1.5+1.5	43.24	1	1.75
31	SAE	45°45*4	355	3.69	Tens	0	0		+6B +1.5+1.5+1.5+1.5	39.37	77.208	45.12	1	1	1	122.73	1.61	1.08	7	1	M-16(8.8)	3.69	1.594	30° C4-,C BI-	+6B +6-3-3-3	43.24	1	1.75
32	SAE	45°45*5	355	55.32	Climb	32.5	-15.654	60° SC1,RT&RM,C NA+	+6B -3+6+6+6	48.164	154.416	103.131	1	1	1	130.77	1.61	1.138	6	2	M-16(8.8)	27.34	23.641	60° C6-, Min. WS,C BI-	+6B +6+6-3+6	86.48	1	1.75
33	SAE	45°45*5	355	50.53	Climb	39.58	-21.275	60° SC1,RT&RM,C NA+	+6B -3+6+6+6	53.751	154.416	103.131	0.5	0.5	0.5	119.59	1.52	2.081	6	2	M-16(8.8)	16.75	14.488	60° SC1,RT&RM,C NA+	+6B -3+6+6+6	86.48	1	1.75
34	SAE	45°45*4	355	56.57	Climb	4.87	-1.641	30° C4-,C BI-	+6B +6+6+6-3	33.694	77.208	45.12	1	1	1	133.57	1.75	1.175	7	1	M-16(8.8)	0.15	0.063	30° SC1,EW&RT,C NA+	-3B +6-3-3-3	43.24	1	1.75
35	SAE	45°45*4	355	3.15	Tens	0.69	-0.31	30° SC1,EW&RT,C NA+	-3B +6-3-3-3	77.575	77.208	45.12	1	1	1	61.36	1.05	0.54	3	1	M-16(8.8)	3.15	1.361	30° C4-,C BI-	-3B +6-3-3-3	43.24	1	1.75
36	SAE	45°45*5	355	52.07	Climb	28.85	-14.96	60° SC1,RT&RM,C NA+	+6B -3-3-3+6	51.857	154.416	103.131	1	1	1	123.19	1.55	1.072	8	2	M-16(8.8)	24.6	21.272	60° SC1,RT&RM,C NA+	+6B -3+6+6+6	86.48	1	1.75
37	SAE	45°45*5	355	55.35	Climb	29.5	-13.372	30° SC1,LT&RT,C NA+	-3B +6+6-3-3	45.328	154.416	103.131	1	1	1	137.16	1.67	1.193	6	2	M-16(8.8)	21.92	18.955	60° SC1,LT&RT,C NA+	-3B +6-3-3-3	86.48	1	1.75
38	SAE	45°45*4	355	48.65	Climb	1.23	-0.556	60° C6-,C BI-	+6B -3+6+6-3	52.141	77.208	45.12	1	1	1	102.27	1.37	0.9	3	1	M-16(8.8)	0.85	0.366	60° C6-, Min. WS,C BI-	+6B +6+6-3+6	43.24	1	1.75
39	SAE	45°45*5	355	50.55	Climb	32.56	-16.826	60° SC1,LT&RT,C NA+	-3B +6-3-3-3	51.675	154.416	103.131	0.5	0.5	0.5	123.55	1.55	2.15	6	2	M-16(8.8)	14.1	12.19	30° SC1,LT&RT,C NA+	-3B +6+6-3-3	86.48	1	1.75
40	SAE	45°45*4	355	31.38	Climb	6.98	-3.151	30° C4-,C BI-	-3B +6-3-3-3	72.301	77.208	45.12	1	1	1	71.49	1.11	0.629	3	1	M-16(8.8)	2.23	0.965	60° C7, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
40aa	DAE	45°45*5	355	2	Tens	0.81	-0.625	60° C7, Min. WS,C NA+	+6B +6+6+6-3	227.709	77.208	112.8	1	1	1	17.7	0.86	0.239	3	1	M-16(8.8)	2	1.541	30° C4-,C BI-	-3B +6-3-3-3	107.16	2	1.75
41	SAE	45°45*5	355	50.55	Climb	23.52	-12.153	30° SC1,LT&RT,C NA+	-3B +6+6-3-3	51.675	154.416	103.131	0.5	0.5	0.5	123.55	1.55	2.15	6	2	M-16(8.8)	19.31	16.703	30° SC1,LT&RT,C NA+	-3B +6-3-3-3	86.48	1	1.75
27A	SAE	70°70*6	355	79.55	Comp	79.55	-96.546	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	121.371	231.623	185.637	1	1	1	104.42	1.37	1.431	2	3	M-16(8.8)	24.29	45.094	30° SC1,LT&LM,C NA+	+6B +6+6+6+6	187.248	1	1.75
28A	SAE	70°70*6	355	34.81	Comp	34.81	-37.149	60° C6-, Min. WS,C BI-	+6B +6+6-3+6	106.726	231.623	185.637	2	1	1	112.79	1.48	1.201	5	3	M-16(8.8)	32						

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	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)
45	SAE	45*45*4	355	8.44	Redun	8.44	-2.499	30° C1,C NA+	-3B -3-3-3+6	29.589	77.208	45.12	1	1	1	143.18	1.87	1.26	7	1	M-16(8.8)	5.78	2.499	30° C1,C NA+	-3B -3-3-3+6	43.24	1	1.75
46	SAE	45*45*4	355	81.3	Climb	17.18	-3.008	30° C4-,C BI-	+6B +6-3-3-3	17.51	77.208	45.12	1	1	1	188.46	2.47	1.658	7	1	M-16(8.8)	0	0		+6B +1.5+1.5+1.5+1.5	43.24	1	1.75
47	SAE	45*45*4	355	28.78	Climb	12.81	-5.78	30° C4-,C BI-	-3B +6-3-3-3	76.51	77.208	45.12	1	1	1	63.58	1.06	0.56	3	1	M-16(8.8)	5.92	2.561	60° C7, Min. WS,C NA+	+6B +6+6+6-3	43.24	1	1.75
47aa	DAE	45*45*5	355	3.26	Tens	1.49	-1.152	60° C7, Min. WS,C NA+	+6B +6-3+6+6	234.692	77.208	112.8	1	1	1	12.37	0.82	0.167	3	1	M-16(8.8)	3.26	2.514	30° SC1,RT&RM,C NA+	-3B +6-3-3-3	107.16	2	1.75
48	SAE	45*45*4	355	4.19	Redun	4.02	-1.813	30° C1,C NA+	-3B -3-3-3+6	64.884	77.208	45.12	1	1	1	81.82	1.2	0.72	3	1	M-16(8.8)	4.19	1.813	30° C1,C NA+	-3B -3-3-3+6	43.24	1	1.75
49	SAE	45*45*4	355	53.91	Climb	7.82	-3.188	30° SC1,RT&RM,C NA+	+3B -3-3-3+6	40.793	77.208	45.12	1	1	1	120.35	1.58	1.059	7	1	M-16(8.8)	2.05	0.885	30° SC1,RT&RM,C NA+	-3B +6-3-3-3	43.24	1	1.75
50	SAE	45*45*4	355	4.99	Tens	1.67	-0.755	30° SC1,RT&RM,C NA+	-3B +6-3-3-3	87.003	77.208	45.12	1	1	1	40.91	0.94	0.36	3	1	M-16(8.8)	4.99	2.156	30° SC1,RT&RM,C NA+	+6B -3-3-3+6	43.24	1	1.75
51	SAE	45*45*5	355	56.89	Climb	44.67	-20.773	30° SC1,RT&RM,C NA+	+0B +6-3+6+6	46.508	154.416	103.131	1	1	1	134.44	1.64	1.17	6	2	M-16(8.8)	31.54	27.273	60° SC1,RT&RM,C NA+	+3B -3-3+6+6	86.48	1	1.75
52	SAE	45*45*5	355	58.05	Comp	58.05	-26.997	60° SC1,RT&RM,C NA+	+3B -3-3+6+6	46.508	154.416	103.131	0.5	0.5	0.5	134.44	1.64	2.339	6	2	M-16(8.8)	24.02	20.772	60° SC1,RT&RM,C NA+	-3B -3-3+6+6	86.48	1	1.75
53	SAE	45*45*5	355	49.95	Climb	34.19	-18.632	60° SC1,RT&RM,C NA+	-3B -3-3+6+6	54.489	154.416	103.131	0.5	0.5	0.5	118.23	1.51	2.057	6	2	M-16(8.8)	27.01	23.36	60° SC1,RT&RM,C NA+	+3B -3-3+6+6	86.48	1	1.75
54	SAE	45*45*5	355	50.83	Climb	42.58	-22.73	60° SC1,RT&RM,C NA+	-3B -3-3+6+6	53.377	154.416	103.131	1	1	1	120.29	1.52	1.046	8	2	M-16(8.8)	22.07	19.082	60° SC1,RT&RM,C NA+	-3B -3-3+6+6	86.48	1	1.75
55	DAE	80*80*8	355	46.19	Tens	1.29	-1.991	60° SC1,RT&RM,C NA+	+6B +6+6+6+6	380.217	154.416	330.021	2	1	1	74.38	1.34	0.9	3	2	M-16(8.8)	46.19	71.326	30° C3-,C NA-	-3B -3-3-3-3	579.04	2	1.75
56	SAE	45*45*5	355	56.9	Climb	27.99	-12.589	30° SC1,RM&RB,C NA+	-3B +6+6-3-3	44.985	154.416	103.131	1	1	1	137.97	1.67	1.2	6	2	M-16(8.8)	16.93	14.639	60° SC1,RM&RB,C NA+	-3B +6+6-3-3	86.48	1	1.75
57	SAE	45*45*4	355	48.65	Climb	2.35	-1.061	30° SC1,LT&LM,C NA+	+6B -3+6+6+6	52.141	77.208	45.12	1	1	1	102.27	1.37	0.9	3	1	M-16(8.8)	0.96	0.415	60° C6-, Min. WS,C BI-	+6B +6+6-3+6	43.24	1	1.75
58	SAE	45*45*5	355	56.9	Climb	31.1	-13.992	60° SC1,RM&RB,C NA+	-3B +6+6-3-3	44.985	154.416	103.131	1	1	1	137.97	1.67	1.2	6	2	M-16(8.8)	15.3	13.233	30° SC1,RT&RM,C NA+	-3B +6+6-3-3	86.48	1	1.75
60	SAE	45*45*5	355	49.96	Climb	21.56	-11.535	30° SC1,RM&RB,C NA+	-3B +6+6-3-3	53.516	154.416	103.131	0.5	0.5	0.5	120.03	1.52	2.088	6	2	M-16(8.8)	13.94	12.056	60° SC1,RM&RB,C NA+	-3B +6+6-3-3	86.48	1	1.75
62	SAE	45*45*5	355	49.96	Climb	22.1	-11.827	30° SC1,RM&RB,C NA+	-3B +6+6-3-3	53.516	154.416	103.131	0.5	0.5	0.5	120.03	1.52	2.088	6	2	M-16(8.8)	13.46	11.639	30° SC1,RM&RB,C NA+	-3B +6+6-3-3	86.48	1	1.75
42A	SAE	60*60*6	355	52.38	Tens	34.01	-40.746	60° C6-, Min. WS,C BI-	+6B +6-3-3+6	119.795	231.623	185.637	2	1	1	88.34	1.25	0.804	2	3	M-16(8.8)	52.38	79.968	60° C4-,C BI-	-3B -3-3-3+6	152.656	1	1.75
43A	SAE	80*80*7	355	84.71	Comp	84.71	-151.999	60° SC1,LT&LM,C NA+	-3B +6+6-3-3	179.445	231.623	216.576	1	1	1	96.46	1.29	1.514	2	3	M-16(8.8)	39.12	84.733	30° SC1,RT&RM,C NA+	+6B +6+6-3+6	254.74	1	1.75
44A	SAE	45*45*4	355	28.09	Comp	28.09	-3.522	60° C4, Min. WS,C BI+	+6B +6-3+6+6	12.538	77.208	45.12	1	1	1	223.86	2.93	1.97	7	1	M-16(8.8)	0.21	0.089	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	43.24	1	1.75
45A	SAE	45*45*4	355	11.28	Redun	11.28	-3.338	30° C1,C NA+	-3B +6+6-3-3	29.589	77.208	45.12	1	1	1	143.18	1.87	1.26	7	1	M-16(8.8)	7.72	3.338	30° C1,C NA+	-3B +6+6-3-3	43.24	1	1.75
46A	SAE	45*45*4	355	82.42	Climb	23.17	-3.972	60° SC1,LT&LM,C NA+	+6B +6+6+6-3	17.142	77.208	45.12	1	1	1	190.55	2.49	1.677	7	1	M-16(8.8)	4.35	1.88	60° SC1,LT&LM,C NA+	+6B +6+6-3+6	43.24	1	1.75
47A	SAE	45*45*4	355	28.85	Comp	28.85	-13.017	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	79.474	77.208	45.12	1	1	1	57.39	1.03	0.505	3	1	M-16(8.8)	20.65	8.927	60° SC1,RT&RM,C NA+	+6B +6-3+6+6	43.24	1	1.75
47B	DAE	45*45*5	355	8.61	Tens	8.56	-6.611	60° SC1,LT&LM,C NA+	+6B -3+6+6+6	235.99	77.208	112.8	1	1	1	11.3	0.81	0.153	3	1	M-16(8.8)	8.61	6.644	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	107.16	2	1.75
48A	SAE	45*45*4	355	7.9	Redun	7.57	-3.414	30° C1,C NA+	-3B +6+6-3-3	64.884	77.208	45.12	1	1	1	81.82	1.2	0.72	3	1	M-16(8.8)	7.9	3.414	30° C1,C NA+	-3B +6+6-3-3	43.24	1	1.75
49A	SAE	45*45*4	355	60.13	Climb	26.07	-9.056	60° SC1,LT&LM,C NA+	+6B +6+6-3+6	34.732	77.208	45.12	1	1	1	131.4	1.72	1.156	7	1	M-16(8.8)	14.7	6.358	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	43.24	1	1.75
50A	SAE	45*45*4	355	13.23	Tens	8.23	-3.712	60° SC1,LT&LM,C NA+	-3B +6-3-3-3	88.715	77.208	45.12	1	1	1	36.84	0.91	0.324	3	1	M-16(8.8)	13.23	5.719	60° SC1,LT&LM,C NA+	+6B +6+6-3+6	43.24	1	1.75
51A	SAE	45*45*5	355	60.83	Climb	7.36	-3.143	60° C6-,C BI-	+6B -3+6+6-3	42.689	154.416	103.131	0.58	0.58	0.58	143.64	1.72	2.155	6	2	M-16(8.8)	2.69	2.325	60° C6-, Min. WS,C BI-	+6B -3-3+6+6	86.48	1	1.75
52A	SAE	45*45*5	355	55.17	Climb	11.22	-5.42	30° SC1,LT&LM,C NA+	+0B +6+6+6+6	48.317	154.416	103.131	0.62	0.62	0.62	130.44	1.61	1.83	6	2	M-16(8.8)	7.12	6.154	60° SC1,LT&LM,C NA+	+3B +6+6-3-3	86.48	1	1.75
53A	SAE	45*45*5	355	38.53	Climb	15.7	-12.007	30° SC1,LT&LM,C NA+	-3B +6+6-3-3	76.48	154.416	103.131	0.63	0.63	0.63	91.43	1.23	1.263	2	2	M-16(8.8)	11.99	10.371	30° SC1,LT&LM,C NA+	+6B +6+6-3+6	86.48	1	1.75
54A	SAE	55*55*5	355	38.57	Comp	38.57	-39.773	60° SC1,LT&LM,C NA+	+6B +6+6+6+6	156.163	154.416	103.131	0.66	0.66	0.66	29.35	0.66	0.476	2	2	M-16(8.8)	20.52	21.167	60° SC1,LT&LM,C NA+	+6B +6+6+6+6	115.432	1	1.75
55A	DAE	80*80*8	355	44.93	Tens	0.73	-1.124	30° C5-, Min. WS,C NA-	+0B -3+6+6-3	672.704	154.416	330.021	1	1	1	11.98	0.81	0.29	3	2	M-16(8.8)	44.93	69.378	30° C3-,C NA-	-3B -3-3-3-3	579.04	2	1.75
56A	SAE	45*45*5	355	63	Climb	7.34	-2.876	60° C6-, Min. WS,C BI-	+6B -3-3+6+6	39.182	154.416	103.131	1.035	1.035	1.035	153.19	1.8	1.288	6	2	M-16(8.8)	4.12	3.565	30° C6-,C BI-	+6B +6+6-3+6	86.48	1	1.75
57A	SAE	45*45*4	355	42.41	Climb	2.78	-1.256	60° C4-,C BI-	+6B -3-3+6-3	76.456	77.208	45.12	1	1	1	63.69	1.06	0.56	3	1	M-16(8.8)	1.5	0.65	60° C6-, Min. WS,C BI-	+6B +6+6+6+6	43.24	1	1.75
58A	SAE	45*45*5	355	55.21	Climb	6.84	-3.132	60° C6-,C BI-	+6B +6-3-3-3	45.817	154.416	103.131	1.005	1.005	1.005	136.02	1.66	1.178	6	2	M-16(8.8)	4.2	3.63	60° C6-, Min. WS,C BI-	+6B +6-3-3+6	86.48	1	1.75
60A	SAE	45*45*5	355	39.78	Climb	5.71	-3.951	60° C6-, Min. WS,C BI-	+0B +6-3-3+6	69.164	154.416	103.131	0.65	0.65	0.65	98.86	1.31	1.323	2	2	M-16(8.8)	7.24	6.26	30° SC1,RT&RM,C NA+	-3B -3-3-3+6	86.48	1	1.75
62A	SAE	45*45*5	355	22.96	Tens	9.48	-9.779	60° C6, Min. WS,C BI+	-3B -3-3+6+6	123.96	154.416	103.131	0.66	0.66	0.66	37.91	0.71	0.5	2	2	M-16(8.8)	22.96	19.857	30° SC1,RT&RM,C NA+	-3B -3-3-3+6	86.48	1	1.75
63	SAE	60*60*6	355	45.94	Tens	24.79	-30.413	60° C6-, Min. WS,C BI-	+3B +6+6+6+6	122.698	231.623	185.637	2	1	1	86.11	1.23	0.784	2	3	M-16(8.8)	45.94	70.137	30° SC1,RT&RM,C NA+	+0B +6-3-3+6	152.656	1	1.75
64	SAE	65*65*6	355	50.63	Comp	50.63	-79.649	30° SC1,RM&RB,C NA+	+0B -3-3-3+6	157.328	231.623	185.637	2	1	1	70.66	1.1	0.696	2	3	M-16(8.8)	34.82	59.304	60° SC1,RM&RB,C NA+	+0B -3-3-3+6	170.328	1	1.75
65	SAE	45*45*4	355	16.74	Comp	16.74	-2.607	30° C4-,C BI-	+6B +6-3-3+6	15.577	77.208	45.12	1	1	1	200.21	2.62	1.762	7	1	M-16(8.8)	0	0		+6B +1.5+1.5+1.5+1.5	43.24	1	1.75
66	SAE	45*45*4	355	4.24	Redun	4.24	-1.668	30° C1,C NA+	+0B -3-3-3+6	39.37	77.208	45.12	1	1	1	122.73	1.61	1.08	7	1	M-16(8.8)	3.86	1.668	30° C1,C NA+	+0B -3-3-3+6	43.24	1	1.75
67	SAE	45*45*4	355	56.57	Climb	5.19	-1.747	30° C4-,C BI-	+0B +6+6+6+6	33.694	77.208	45.12	1	1	1	133.57	1.75	1.175	7	1	M-16(8.8)	0.32	0.14	30° SC1,RM&RB,C NA+	+0B +			

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	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)
68B	SAE	45*45*4	355	35.38	Climb	26.88	-12.13	60° SC1,LM&LB,C NA+	+6B +6-3-3-3	67.4	77.208	45.12	1	1	1	78.24	1.17	0.688	3	1	M-16(8.8)	19.28	8.337	60° SC1,LM&LB,C NA+	+0B -3+6+6+6	43.24	1	1.75
68BB	DAE	45*45*5	355	8.21	Tens	6.63	-5.117	60° SC1,LM&LB,C NA+	+6B -3+6+6+6	230.624	77.208	112.8	1	1	1	15.56	0.84	0.21	3	1	M-16(8.8)	8.21	6.337	60° SC1,LM&LB,C NA+	-3B +6-3-3-3	107.16	2	1.75
69A	SAE	45*45*5	355	64.1	Climb	8.04	-3.204	30° SC1,LM&LB,C NA+	+0B +6+6+6-3	39.858	154.416	103.131	0.65	0.65	0.65	151.26	1.79	2.024	6	2	M-16(8.8)	4.21	3.64	60° SC1,LM&LB,C NA+	+3B +6+6+6-3	86.48	1	1.75
70A	SAE	45*45*5	355	45.31	Climb	11.22	-6.929	60° SC1,LM&LB,C NA+	+6B +6-3-3-3	61.748	154.416	103.131	0.68	0.68	0.68	107.35	1.4	1.373	2	2	M-16(8.8)	7.81	6.752	30° SC1,LM&LB,C NA+	+0B -3+6+6+6	86.48	1	1.75
71A	SAE	45*45*5	355	33.64	Comp	33.64	-34.694	60° SC1,LM&LB,C NA+	+6B +6+6+6-3	123.401	154.416	103.131	0.73	0.73	0.73	39.84	0.72	0.475	2	2	M-16(8.8)	23.53	20.348	30° SC1,LM&LB,C NA+	+0B +6+6+6+6	86.48	1	1.75
72A	DAE	80*80*8	355	44.95	Tens	0.64	-0.984	30° C3-, Min. WS,C NA-	-3B -3-3-3-3	688.729	154.416	330.021	1	1	1	7.08	0.77	0.171	3	2	M-16(8.8)	44.95	69.411	30° C3-,C NA-	+3B +6+6+6+6	579.04	2	1.75
73A	SAE	65*65*5	355	25.96	Climb	3.39	-3.289	60° SC1,LT&LM,C NA+	-3B -3-3-3+6	97.093	154.416	103.131	1.013	1.013	1.013	102.51	1.35	1.316	2	2	M-16(8.8)	4.32	4.453	30° SC1,LT&LM,C NA+	+0B -3+6+6+6	144.384	1	1.75
73B	SAE	45*45*4	355	40.57	Climb	2.94	-1.327	30° SC1,LT&LM,C NA+	+0B +6-3+6+6	62.122	77.208	45.12	1	1	1	85.88	1.23	0.756	3	1	M-16(8.8)	1.38	0.596	60° SC1,LT&LM,C NA+	+0B -3-3-3+6	43.24	1	1.75
75A	SAE	45*45*5	355	42.65	Climb	7.42	-4.461	30° SC1,LT&LM,C NA+	+0B -3+6+6+6	60.146	154.416	103.131	0.64	0.64	0.64	108.57	1.42	1.476	6	2	M-16(8.8)	5.89	5.094	60° SC1,LT&LM,C NA+	+3B +6+6+6-3	86.48	1	1.75
77A	SAE	45*45*5	355	26.94	Tens	11.79	-12.161	30° SC1,LT&LM,C NA+	+0B -3+6+6+6	122.823	154.416	103.131	0.7	0.7	0.7	41.78	0.73	0.519	2	2	M-16(8.8)	26.94	23.301	30° SC1,LT&LM,C NA+	+0B -3+6+6+6	86.48	1	1.75
78	SAE	55*55*5	355	52.65	Climb	47.82	-20.382	60° C5,C NA+	+6B -3-3-3+6	42.621	154.416	103.131	1	1	1	168.22	1.93	1.8	8	2	M-16(8.8)	19.64	20.254	60° C5,C NA+	+6B +6+6+6+6	115.432	1	1.75
78A	SAE	45*45*5	355	61.97	Climb	5.34	-2.226	60° SC1,EW&RT,C NA+	-3B -3-3+6+6	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	3.87	3.346	30° SC1,LT&LM,C NA+	-3B +6+6-3-3	86.48	1	1.75
81	SAE	45*45*5	355	84.59	Comp	84.59	-35.249	60° C5,C NA+	+6B -3-3+6+6	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	39.15	33.86	60° C5, Min. WS,C NA+	+6B +6+6-3-3	86.48	1	1.75
82	SAE	45*45*5	355	85.06	Comp	85.06	-35.442	60° C5, Min. WS,C NA+	+6B +6+6-3-3	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	42.08	36.39	60° C5,C NA+	+6B -3-3+6+6	86.48	1	1.75
81A	SAE	45*45*5	355	47.06	Comp	47.06	-19.609	60° C6-, Min. WS,C BI-	+6B +6+6+6-3	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	22.97	19.864	60° C6-,C BI-	+6B -3-3-3+6	86.48	1	1.75
82A	SAE	45*45*5	355	51.67	Comp	51.67	-21.531	60° C6-,C BI-	+6B -3-3-3+6	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	24.39	21.092	60° C6-, Min. WS,C BI-	+6B +6+6+6-3	86.48	1	1.75
83	SAE	55*55*5	355	71.54	Comp	71.54	-30.49	60° C3,C NA+	+6B -3+6-3-3	42.621	154.416	103.131	1	1	1	168.22	1.93	1.8	8	2	M-16(8.8)	39.61	40.852	30° SC1,LT&RT,C NA+	-3B +6-3-3-3	115.432	1	1.75
84	SAE	50*50*5	355	89.27	Comp	89.27	-48.413	60° SC1,EW<,C NA+	-3B -3-3+6+6	54.23	154.416	103.131	0.5	0.5	0.5	129.88	1.6	2.546	6	2	M-16(8.8)	40.87	41.108	60° C6, Min. WS,C BI+	+6B +6+6-3-3	100.58	1	1.75
84A	SAE	55*55*5	355	93.77	Cross	93.77	-36.971	60° C5,C NA+	+6B -3-3+6-3	39.427	154.416	103.131	0.5	1	0.5	153.35	2.01	2.546	8	2	M-16(8.8)	45.44	46.861	60° C6-, Min. WS,C BI-	+6B +6+6+6-3	115.432	1	1.75
85	SAE	65*65*5	355	79.26	Comp	79.26	-52.334	30° SC1,LT&RT,C NA+	-3B +6-3-3-3	66.026	154.416	103.131	1	1	1	138.46	1.68	1.8	8	2	M-16(8.8)	32.6	33.619	30° SC1,LT&RT,C NA+	+6B +6+6-3+6	144.384	1	1.75
86	SAE	45*45*5	355	61.97	Climb	59.09	-24.622	30° SC1,LT&LM,C NA+	-3B -3+6-3-3	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	23.56	20.373	60° SC1,LT&LM,C NA+	-3B +6+6-3-3	86.48	1	1.75
89	SAE	65*65*5	355	88.18	Comp	88.18	-99.522	60° C5,C NA+	+6B -3-3+6+6	112.868	231.623	154.697	0.5	0.5	0.5	91.36	1.23	2.375	2	3	M-16(8.8)	65.66	94.799	60° C5, Min. WS,C NA+	+6B -3-3+6+6	144.384	1	1.75
90	SAE	65*65*5	355	85.5	Comp	85.5	-96.498	60° C5, Min. WS,C NA+	+6B -3-3+6+6	112.868	231.623	154.697	0.5	0.5	0.5	91.36	1.23	2.375	2	3	M-16(8.8)	69.56	100.433	60° SC1,LT&LM,C NA+	+6B -3-3+6+6	144.384	1	1.75
89A	SAE	55*55*5	355	88.47	Comp	88.47	-64.201	60° SC1,EW<,C NA+	-3B +6+6-3-3	72.565	154.416	103.131	0.5	0.5	0.5	111	1.44	2.375	6	2	M-16(8.8)	64.5	66.524	30° SC1,EW<,C NA+	-3B -3+6-3-3	115.432	1	1.75
90A	SAE	55*55*5	355	92.26	Comp	92.26	-66.949	30° SC1,EW<,C NA+	-3B -3+6-3-3	72.565	154.416	103.131	0.5	0.5	0.5	111	1.44	2.375	6	2	M-16(8.8)	62.67	64.636	60° SC1,EW<,C NA+	-3B +6+6-3-3	115.432	1	1.75
91	SAE	55*55*5	355	92.25	Comp	92.25	-39.32	60° C5,C NA+	+6B -3+6-3-3	42.621	231.623	154.697	1	1	1	168.22	1.93	1.8	8	3	M-16(8.8)	45.7	52.747	30° SC1,EW&RT,C NA+	-3B -3-3-3-3	115.432	1	1.75
92	SAE	70*70*5	355	91.62	Comp	91.62	-109.458	60° SC1,LT&LM,C NA+	-3B -3-3+6+6	119.475	231.623	154.697	0.5	0.5	0.5	92.23	1.23	2.546	2	3	M-16(8.8)	67.88	105.005	60° C5,C NA+	+6B +6+6-3-3	158.484	1	1.75
92A	SAE	65*65*5	355	90.77	Cross	90.77	-52.416	60° C5,C NA+	+0B +6+6+6+6	57.744	154.416	103.131	0.5	1	0.5	128.56	1.8	2.546	8	2	M-16(8.8)	88.01	90.77	60° SC1,LT&LM,C NA+	+0B +6+6+6+6	144.384	1	1.75
93	SAE	65*65*5	355	79.58	Comp	79.58	-52.541	60° C4-,C BI-	+0B -3-3+6+6	66.026	154.416	103.131	1	1	1	138.46	1.68	1.8	8	2	M-16(8.8)	33.71	34.766	60° C3,C NA+	+3B +6+6+6+6	144.384	1	1.75
94	SAE	45*45*5	355	79.94	Comp	79.94	-33.311	60° SC1,LM&LB,C NA+	-3B -3-3+6+6	41.669	154.416	103.131	0.5	0.5	0.5	146.3	1.74	2.546	6	2	M-16(8.8)	29.37	25.402	60° SC1,LM&LB,C NA+	-3B -3-3+6+6	86.48	1	1.75
97	SAE	75*75*7	355	93.45	Comp	93.45	-190.66	60° SC1,LT&LM,C NA+	-3B +6+6-3-3	204.028	231.623	216.576	0.5	0.5	0.5	81.91	1.13	2.375	2	3	M-16(8.8)	75.69	163.925	60° SC1,LT&LM,C NA+	-3B +6+6-3-3	235	1	1.75
98	SAE	75*75*7	355	91.71	Tens	85.24	-173.916	60° C5, Min. WS,C NA+	-3B -3-3+6+6	204.028	231.623	216.576	0.5	0.5	0.5	81.91	1.13	2.375	2	3	M-16(8.8)	91.71	198.614	60° SC1,LT&LM,C NA+	-3B +6+6-3-3	235	1	1.75
97A	SAE	70*70*5	355	83.49	Comp	83.49	-108.289	60° SC1,LT&LM,C NA+	-3B -3-3+6+6	129.71	231.623	154.697	0.5	0.5	0.5	86.07	1.16	2.375	2	3	M-16(8.8)	70.43	108.951	30° SC1,LT&LM,C NA+	-3B -3-3-3+6	158.484	1	1.75
98A	SAE	70*70*5	355	84.76	Comp	84.76	-109.941	30° SC1,LT&LM,C NA+	-3B -3-3-3+6	129.71	231.623	154.697	0.5	0.5	0.5	86.07	1.16	2.375	2	3	M-16(8.8)	71.11	110.009	60° SC1,LT&LM,C NA+	-3B -3-3+6+6	158.484	1	1.75
99	SAE	65*65*5	355	87.74	Comp	87.74	-57.929	60° C5,C NA+	+3B +6+6+6+6	66.026	231.623	154.697	1	1	1	138.46	1.68	1.8	8	3	M-16(8.8)	39.18	56.563	60° C5,C NA+	+3B +6+6+6+6	144.384	1	1.75
100	SAE	110*110*7	355	96.23	Comp	96.23	-255.25	60° C5,C NA+	+6B +6-3+6+6	265.247	308.831	288.768	2	1	1	58.84	1.19	1.006	3	4	M-16(8.8)	85.67	247.385	60° C5, Min. WS,C NA+	-3B +6-3+6+6	380.7	1	1.75
100A	SAE	110*110*7	355	86.65	Comp	86.65	-213.458	60° SC1,RT&RM,C NA+	+3B +6+6-3+6	246.341	308.831	288.768	1	1	1	91.48	1.25	2.012	3	4	M-16(8.8)	76.14	219.861	60° SC1,LT&LM,C NA+	+3B -3+6+6+6	380.7	1	1.75
101	SAE	75*75*7	355	90.73	Comp	90.73	-196.496	60° C6-,C BI-	+0B +6+6+6-3	256.021	231.623	216.576	1	1	1	62.07	0.92	0.9	2	3	M-16(8.8)	85.06	184.219	60° C5,C NA+	+3B +6+6-3-3	235	1	1.75
102	SAE	55*55*5	355	90.25	Comp	90.25	-60.402	60° SC1,LM&LB,C NA+	-3B -3-3+6+6	66.926	154.416	103.131	1	1	1	118.95	1.51	1.273	8	2	M-16(8.8)	54.58	56.291	60° SC1,LM&LB,C NA+	-3B -3-3+6+6	115.432	1	1.75
103	SAE	100*100*7	355	77.31	Comp	77.31	-182.816	60° SC1,LM&LB,C NA+	-3B +6+6-3-3	236.461	308.831	288.768	2	1	1	62.37	1.23	0.954	3	4	M-16(8.8)	65.69	189.691	60° SC1,LM&LB,C NA+	-3B +6+6-3-3	337.46	1	1.75
104	SAE	90*90*6	355	79.68	Comp	79.68	-142.409	60° SC1,LM&LB,C NA+	-3B +6-3-3-3	178.716	231.623	185.637	2.88	1.44	1.44	88.62	1.24	0.849	2	3	M-16(8.8)	77.45	143.783	60° SC1,LM&LB,C NA+	+0B -3+6-3-3	257.56	1	1

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont- rol	Max Use In Comp. %	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)
124A	SAE	120°120°10	355	94.81	Comp	94.81	-173.467	60° C5, C NA+	+0B +6+6-3+6	182.97	231.623	309.394	5	1	1	145.43	1.95	1.067	8	3	M-16(8.8)	73.61	170.494	60° C5, Min. WS, C NA+	+0B -3+6+6+6	580.92	1	1.75
125	DAE	45°45°5	355	84.32	Comp	84.32	-116.021	60° C6, C BI+	+0B +6-3+6+6	137.59	154.416	206.263	1	2	1	100.49	1.32	1.045	1	2	M-16(8.8)	63.83	98.567	60° C6-, Min. WS, C BI-	+0B +6+6+6-3	172.96	2	1.75
126	SAE	90°90°6	355	17.12	Comp	17.12	-21.183	60° C5, Min. WS, C NA+	+0B -3+6+6-3	194.922	154.416	123.758	1	1	1	87.5	1.17	1.558	2	2	M-16(8.8)	10.73	13.274	30° C2-, C BI-	+0B -3-3+6+6	257.56	1	1.75
127	SAE	90°90°6	355	42.7	Climb	3.85	-2.825	60° C2, Min. WS, C BI+	+0B -1.5-1.5-1.5-1.5	73.28	154.416	123.758	2	1	1	159.61	2.04	2.203	8	2	M-16(8.8)	2.56	3.167	30° C2, C BI+	+0B -1.5-1.5-1.5-1.5	257.56	1	1.75
128	SAE	65°65°5	355	16.71	Comp	16.71	-7.786	60° C2, Min. WS, C BI+	+0B -3+6+6+6	46.585	154.416	103.131	1	1	1	178.83	2.02	2.325	8	2	M-16(8.8)	6.72	6.926	60° C2-, C BI-	+0B -3+6+6+6	144.384	1	1.75
129	SAE	75°75°5	355	23.57	Comp	23.57	-13.038	60° C2-, C BI-	+0B -3+6+6+6	55.317	154.416	103.131	0.66	0.66	0.66	173.97	1.95	3.954	6	2	M-16(8.8)	12.02	12.393	60° C2, Min. WS, C BI+	+0B -3+6+6+6	172.584	1	1.75
130	SAE	75°75°6	355	79.8	Comp	79.8	-52.679	60° C6-, Min. WS, C BI-	+0B -3+6+6-3	66.012	154.416	123.758	2	1	1	150.86	1.99	1.72	8	2	M-16(8.8)	52.81	65.363	60° C6, C BI+	+0B -3-3+6+6	204.92	1	1.75
2000	SAE	180°180°16	355	93.25	Tens	87.1	-1538.557	60° C5, C NA+	-3B -3-3+6+6	1766.463	2412.736	2256	1	1	1	21.84	0.29	0.771	1	10	M-20(8.8)	93.25	1429.091	60° C5, Min. WS, C NA+	-3B +6+6-3-3	1532.492	2.94	2.15
2001	SAE	180°180°16	355	72.01	Comp	72.01	-1203.738	60° C5, C NA+	+6B -1.5-1.5-1.5-1.5	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	69.75	1068.972	60° C5, Min. WS, C NA+	-3B -1.5-1.5-1.5-1.5	1532.492	2.94	2.15
2002	SAE	180°180°16	355	71.49	Comp	71.49	-1195.022	60° C5, C NA+	+6B +0+0+0+0	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	69.39	1063.345	60° C5, Min. WS, C NA+	-3B +0+0+0+0	1532.492	2.94	2.15
2003	SAE	180°180°16	355	71.19	Comp	71.19	-1190.087	60° C5, C NA+	+6B +1.5+1.5+1.5+1.5	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	69.22	1060.771	60° C5, Min. WS, C NA+	-3B +1.5+1.5+1.5+1.5	1532.492	2.94	2.15
2004	SAE	180°180°16	355	70.91	Comp	70.91	-1185.376	60° C5, C NA+	+6B +3+3+3+3	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	69.17	1060.072	60° C5, Min. WS, C NA+	-3B +3+3+3+3	1532.492	2.94	2.15
2005	SAE	180°180°16	355	70.67	Comp	70.67	-1181.242	60° C5, C NA+	+6B +4.5+4.5+4.5+4.5	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	69.05	1058.228	60° C5, Min. WS, C NA+	-3B +4.5+4.5+4.5+4.5	1532.492	2.94	2.15
2006	SAE	180°180°16	355	78.62	Tens	77.16	-1289.803	60° C5, C NA+	-3B +6-3+6+6	1671.597	2412.736	2256	1	1	1	43.68	0.57	1.542	1	10	M-20(8.8)	78.62	1204.89	60° C5, Min. WS, C NA+	-3B +6+6+6-3	1532.492	2.94	2.15
2010	SAE	100°100°6	355	73.76	Comp	73.76	-82.085	60° C6, C BI+	+6B -3+6+6+6	111.287	231.623	203.04	2	1	1	119.59	1.68	1.848	8	3	M-16(8.8)	40.59	82.42	60° SC1, LM&LB, C NA+	-3B -3+6+6-3	289.52	1	1.75
2011	SAE	100°100°6	355	39.65	Comp	39.65	-56.237	60° C6, C BI+	+6B -1.5-1.5-1.5-1.5	141.833	231.623	203.04	1	1	1	119.42	1.47	2.365	8	3	M-16(8.8)	20.85	42.343	60° C6, Min. WS, C BI+	+0B -1.5-1.5-1.5-1.5	289.52	1	1.75
2012	SAE	100°100°6	355	44.59	Comp	44.59	-76.224	60° C6, C BI+	+6B +0+0+0+0	170.928	231.623	203.04	1	1	1	100.77	1.32	1.995	3	3	M-16(8.8)	33.43	67.873	60° C5, Min. WS, C NA+	+0B +0+0+0+0	289.52	1	1.75
2013	SAE	100°100°6	355	50.87	Comp	50.87	-94.33	60° C6, C BI+	+6B +1.5+1.5+1.5+1.5	185.429	231.623	203.04	1	1	1	92.82	1.26	1.838	3	3	M-16(8.8)	44.77	90.891	60° C5, Min. WS, C NA+	+0B +1.5+1.5+1.5+1.5	289.52	1	1.75
2014	SAE	100°100°6	355	84.67	Comp	84.67	-157.186	60° C5, C NA+	+0B +3+3+3+3	246.768	231.623	185.637	1	1	1	59.1	1.02	1.17	3	3	M-16(8.8)	78.38	145.497	60° C5, Min. WS, C NA+	+0B +3+3+3+3	289.52	1	1.75
2015	SAE	100°100°6	355	96.51	Comp	96.51	-179.159	60° C5, C NA+	+6B +4.5+4.5+4.5+4.5	249.061	231.623	185.637	1	1	1	57.43	1.01	1.137	3	3	M-16(8.8)	87.3	162.059	60° C5, Min. WS, C NA+	+0B +4.5+4.5+4.5+4.5	289.52	1	1.75
2016	SAE	100°100°6	355	88.8	Comp	88.8	-219.797	60° C5, C NA+	+0B +6-3+6+6	250.549	308.831	247.515	1	1	1	56.35	1	1.116	3	4	M-16(8.8)	82.23	203.534	60° C5, Min. WS, C NA+	+0B +6+6+6-3	289.52	1	1.75
300	SAE	180°180°16	355	85.07	Tens	80.64	-1398.641	60° C5, C NA+	+3B -3-3+6+6	1734.468	2412.736	2256	1	1	1	30.58	0.4	1.079	1	10	M-20(8.8)	85.07	1303.761	60° C5, Min. WS, C NA+	+3B +6+6-3-3	1532.492	2.94	2.15
301	SAE	180°180°16	355	82.45	Tens	78.14	-1368.393	60° C5, C NA+	+3B -3-3+6+6	1751.111	2412.736	2256	1	1	1	26.21	0.34	0.925	1	10	M-20(8.8)	82.45	1263.479	60° C5, Min. WS, C NA+	+3B +6+6-3-3	1532.492	2.94	2.15
302	SAE	180°180°16	355	86.6	Tens	82.36	-1437.813	60° C5, C NA+	+3B -3-3+6+6	1745.728	2412.736	2256	1	1	1	27.67	0.36	0.977	1	10	M-20(8.8)	86.6	1327.155	60° C5, Min. WS, C NA+	+3B +6+6-3-3	1532.492	2.94	2.15
304	SAE	180°180°16	355	88.25	Tens	85.22	-1483.055	60° C5, C NA+	+3B +6+6-3-3	1740.186	2412.736	2256	1	1	1	29.12	0.38	1.028	1	10	M-20(8.8)	88.25	1352.381	60° C5, Min. WS, C NA+	+3B +6+6-3-3	1532.492	2.94	2.15
305	SAE	70°70°5	355	53.18	Comp	53.18	-38.043	60° C6, C BI+	+3B -3+6+6+6	71.532	154.416	103.131	1	1	1	137.28	1.66	1.894	6	2	M-16(8.8)	33.98	35.041	60° C5-, C NA-	+3B -3+6+6+6	158.484	1	1.75
306	SAE	75°75°5	355	87.49	Comp	87.49	-31.989	60° C6, Min. WS, C BI+	+3B -3+6+6-3	36.563	77.208	56.4	3	1	1	183.39	2.42	1.412	7	1	M-16(8.8)	56.78	32.023	60° C6-, C BI-	+3B -3-3+6+6	111.484	1	1.75
307	SAE	80°80°6	355	88.52	Comp	88.52	-71.518	60° SC1, LM&LB, C NA+	+3B -3+6-3-3	80.79	154.416	123.758	2	1	1	134.6	1.86	1.642	8	2	M-16(8.8)	57.22	70.818	60° SC1, LM&LB, C NA+	+3B +6-3-3-3	221.84	1	1.75
307A	SAE	80°80°6	355	70.13	Comp	70.13	-56.66	60° SC1, LM&LB, C NA+	+3B -3-3+6+6	80.79	154.416	123.758	2	1	1	134.6	1.86	1.642	8	2	M-16(8.8)	48.28	59.752	60° SC1, LT&LM, C NA+	+3B -3-3+6+6	221.84	1	1.75
308	DAE	50°50°5	355	62.75	Comp	62.75	-96.894	60° C6, C BI+	+3B +6-3+6+6	156.388	154.416	206.263	1	2	1	99.39	1.3	1.133	1	2	M-16(8.8)	55.39	85.523	60° C6-, Min. WS, C BI-	+3B +6+6+6-3	201.16	2	1.75
309	SAE	90°90°6	355	17.88	Comp	17.88	-22.127	60° C5, Min. WS, C NA+	+3B -3+6+6-3	194.93	154.416	123.758	1	1	1	87.5	1.17	1.557	2	2	M-16(8.8)	11.2	13.866	30° C2-, C BI-	+3B -3-3+6+6	257.56	1	1.75
310	SAE	90°90°6	355	42.7	Climb	4.06	-2.976	30° C2, Min. WS, C BI+	+3B -1.5-1.5-1.5-1.5	73.283	154.416	123.758	2	1	1	159.61	2.04	2.203	8	2	M-16(8.8)	2.76	3.414	30° C2, C BI+	+3B -1.5-1.5-1.5-1.5	257.56	1	1.75
311	SAE	65°65°5	355	13.83	Comp	13.83	-6.911	60° C2, Min. WS, C BI+	+3B -3+6+6+6	49.979	154.416	103.131	1	1	1	170.17	1.95	2.212	8	2	M-16(8.8)	5.79	5.97	60° C2-, C BI-	+3B -3+6+6+6	144.384	1	1.75
312	SAE	75°75°5	355	35.22	Climb	21.91	-12.355	60° C2-, C BI-	+3B -3+6+6+6	56.382	154.416	103.131	0.63	0.63	0.63	171.62	1.93	4.086	6	2	M-16(8.8)	11.34	11.694	60° C2, Min. WS, C BI+	+3B -3+6+6+6	172.584	1	1.75
313	SAE	70°70°5	355	83.68	Comp	83.68	-39.642	60° C5-, C NA-	+3B -3+6+6+6	47.373	154.416	103.131	2	1	1	160.73	2.06	1.72	8	2	M-16(8.8)	46.97	48.444	60° C6, C BI+	+3B -3-3+6+6	158.484	1	1.75
314	SAE	65°65°5	355	60.43	Climb	32.5	-17.252	60° C5, Min. WS, C NA+	+3B +6+6+6+6	53.078	154.416	103.131	2	1	1	144.14	1.89	1.427	4	2	M-16(8.8)	13.74	14.169	60° C5, C NA+	+3B +6+6-3+6	144.384	1	1.75
315	SAE	65°65°5	355	87.04	Climb	50.35	-19.374	60° C5, Min. WS, C NA+	+3B +6+6-3-3	38.482	77.208	56.4	2	1	1	203.85	2.23	2.018	6	1	M-16(8.8)	33.14	18.69	60° C5, Min. WS, C NA+	+3B +6+6-3-3	92.684	1	1.75
316	SAE	90°90°6	355	86	Comp	86	-65.023	60° C6-, Min. WS, C BI-	+3B -3+6+6-3	75.608	154.416	123.758	1.5	1	1	160.86	2	2.863	8	2	M-16(8.8)	48.81	60.405	60° SC1, RM&RB, C NA+	+3B -3-3+6+6	257.56	1	1.75
317	SAE	100°100°7	355	74.19	Comp	74.19	-80.512	60° C6-, C BI-	+3B +6-3-3+6	108.52	154.416	144.384	3	1	1	143.57	1.91	1.464	8	2	M-16(8.8)	61.81	89.249	60° C6-, Min. WS, C BI-	+3B -3+6+6-3	337.46	1	1.75
316A	SAE	90°90°6	355	83.15	Comp	83.15	-62.865	60° SC1, LM&LB, C NA+	+3B -3-3+6+6	75.608	154.416	123.758	1.5	1	1	160.86	2	2.863	8	2	M-16(8.8)	57.79	71.514	60° C6, C BI+	+3B -3-3+6+6	257.56	1	1.75
317A	SAE	100°100°7	355	90.5	Comp	90.5	-98.214	60° C6, C BI+	+3B -3-3+6+6	108.52	154.416	144.384	3	1														

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont- rol	Max Use In Comp. %	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)
616	SAE	180°180°16	355	85.53	Tens	82.36	-1436.614	60° C5,C NA+	+6B -3-3+6+6	1744.358	2412.736	2256	1	1	1	28.03	0.37	0.989	1	10	M-20(8.8)	85.53	1310.78	60° C5, Min. WS,C NA+	+6B +6+6-3-3	1532.492	2.94	2.15
617	SAE	110°110°8	355	75.06	Comp	75.06	-91.701	60° C6-,C BI-	+6B +6-3-3+6	122.164	154.416	165.01	4	1	1	157.11	2.04	1.335	8	2	M-16(8.8)	65.03	100.415	60° C6-, Min. WS,C BI-	+6B -3+6+6-3	424.88	1	1.75
617A	SAE	110°110°8	355	89.31	Comp	89.31	-109.105	60° C6,C BI+	+6B -3-3+6+6	122.164	154.416	165.01	4	1	1	157.11	2.04	1.335	8	2	M-16(8.8)	62.13	95.936	60° C5, Min. WS,C NA+	+6B -3+6+6+6	424.88	1	1.75
R1	SAE	55°55°4	235	90.04	Comp	90.04	-50.52	60° C5,C NA+	+0B +6-3+6+6	56.111	154.416	63.195	1	1	1	94.04	1.15	1.006	3	2	M-16(8.8)	82.87	52.371	60° C5, Min. WS,C NA+	-3B +6+6-3-3	72.288	1	1.75
R2	SAE	45°45°4	235	64.98	Comp	64.98	-37.296	60° C5, Min. WS,C NA+	-3B +6+6-3-3	57.395	154.416	63.195	1	1	1	51.14	0.94	0.45	3	2	M-16(8.8)	57.32	31.198	60° C5,C NA+	-3B -3-3+6+6	54.432	1	1.75
R3	SAE	55°55°5	235	81.09	Comp	81.09	-62.985	60° C5,C NA+	+0B +6-3+6+6	77.675	154.416	78.994	1	1	1	77.25	1.05	0.827	3	2	M-16(8.8)	67.81	53.563	60° C5, Min. WS,C NA+	+0B -3+6+6+6	88.416	1	1.75
R4	SAE	50°50°4	235	96.63	Tens	79.49	-50.232	60° C5, Min. WS,C NA+	+0B -3+6+6+6	65.341	154.416	63.195	1	1	1	45.92	0.91	0.45	3	2	M-16(8.8)	96.63	60.945	60° C5,C NA+	+0B +6-3+6+6	63.072	1	1.75
R5	SAE	45°45°4	355	78.08	Redun	74.83	-33.762	30° C1,C NA+	-3B -3-3+6+6	56	77.208	45.12	1	1	1	95.55	1.31	0.841	3	1	M-16(8.8)	78.08	33.762	30° C1,C NA+	-3B -3-3+6+6	43.24	1	1.75
R6	SAE	60°60°4	355	93.62	Comp	93.62	-42.243	60° C5,C NA+	+0B +6-3+6+6	47.18	77.208	45.12	1	1	1	130.68	1.67	1.542	7	1	M-16(8.8)	90.58	40.869	60° C5, Min. WS,C NA+	-3B +6+6-3-3	66.552	1	1.75
R7	SAE	45°45°4	235	83.97	Comp	83.97	-42.946	60° C5, Min. WS,C NA+	+3B +6+6+6-3	51.143	154.416	63.195	1	1	1	76.23	1.05	0.671	3	2	M-16(8.8)	82.69	45.011	60° C5,C NA+	+3B +6-3+6+6	54.432	1	1.75
R8	SAE	45°45°4	235	69.21	Comp	69.21	-20.587	60° C5,C NA+	+6B +6-3-3+6	29.746	77.208	34.56	1	1	1	140.15	1.49	1.233	7	1	M-16(8.8)	66.05	21.877	60° C5, Min. WS,C NA+	-3B +6-3-3+6	33.12	1	1.75
R9	SAE	45°45°4	235	81.52	Climb	46.34	-16.016	60° C5, Min. WS,C NA+	+3B -3+6+6+6	38.416	77.208	34.56	1	1	1	113.35	1.28	0.997	3	1	M-16(8.8)	56.08	18.575	60° C5,C NA+	+3B +6-3+6+6	33.12	1	1.75
R10	SAE	45°45°4	235	57.91	Comp	57.91	-20.013	60° C5,C NA+	+3B +6-3+6+6	37.272	77.208	34.56	1	1	1	116.82	1.31	1.028	3	1	M-16(8.8)	50.24	16.638	60° C5, Min. WS,C NA+	+3B -3+6+6+6	33.12	1	1.75
R11	SAE	45°45°4	235	74.99	Tens	72.87	-19.457	60° C5, Min. WS,C NA+	+3B -3+6+6+6	26.7	77.208	34.56	1	1	1	148.84	1.58	1.31	7	1	M-16(8.8)	74.99	24.838	60° C5,C NA+	+3B +6-3+6+6	33.12	1	1.75
R12	SAE	80°80°6	355	89.19	Comp	89.19	-110.381	60° C5,C NA+	+0B +6-3+6+6	130.347	154.416	123.758	2	1	1	84.2	1.43	1.027	3	2	M-16(8.8)	85.79	106.171	60° C5, Min. WS,C NA+	+0B +6+6-3-3	221.84	1	1.75
R13	SAE	50°50°5	235	91.21	Tens	85.11	-62.328	60° C5, Min. WS,C NA+	+0B +6+6+6-3	73.229	154.416	78.994	1	1	1	67.86	1.01	0.665	3	2	M-16(8.8)	91.21	70.271	60° C5,C NA+	+0B +6-3+6+6	77.04	1	1.75
R14	SAE	60°60°5	235	73.96	Comp	73.96	-54.785	60° C5,C NA+	+3B +6+6-3-3	74.077	154.416	78.994	1	1	1	96.67	1.17	1.131	3	2	M-16(8.8)	68.26	53.923	60° C5, Min. WS,C NA+	+3B +6+6-3-3	99.216	1	1.75
R15	SAE	45°45°4	235	93.79	Redun	89.88	-31.064	30° C1,C NA+	-3B -3-3+6+6	60.333	77.208	34.56	1	1	1	37.78	0.88	0.332	3	1	M-16(8.8)	93.79	31.064	30° C1,C NA+	-3B -3-3+6+6	33.12	1	1.75
R16	SAE	55°55°4	355	84.8	Redun	84.8	-36.118	30° C1,C NA+	-3B -3-3+6+6	42.592	77.208	45.12	1	1	1	131.84	1.72	1.411	7	1	M-16(8.8)	80.05	36.118	30° C1,C NA+	-3B -3-3+6+6	59.032	1	1.75
R17	SAE	60°60°4	235	91.07	Climb	15.87	-4.522	60° C5, Min. WS,C NA+	+0B +6+6+6+6	28.497	77.208	34.56	1	1	1	169.06	1.8	1.995	7	1	M-16(8.8)	12.87	4.448	60° C5, Min. WS,C NA+	+0B -3+6+6-3	50.976	1	1.75
R18	SAE	45°45°4	355	48.65	Climb	1.28	-0.577	60° C6-, Min. WS,C BI-	+6B -3+6+6-3	52.141	77.208	45.12	1	1	1	102.27	1.37	0.9	3	1	M-16(8.8)	1.77	0.767	30° SC1,LT&LM,C NA+	+0B +6+6-3+6	43.24	1	1.75
R19	SAE	45°45°4	355	48.65	Climb	2.98	-1.343	60° SC1,LT&LM,C NA+	+6B -3+6+6+6	52.141	77.208	45.12	1	1	1	102.27	1.37	0.9	3	1	M-16(8.8)	3.89	1.681	30° SC1,LT&LM,C NA+	+0B +6+6-3+6	43.24	1	1.75
R20	SAE	45°45°4	355	48.65	Climb	1.5	-0.675	60° SC1,RM&RB,C NA+	+3B +6+6+6-3	52.141	77.208	45.12	1	1	1	102.27	1.37	0.9	3	1	M-16(8.8)	1.57	0.68	30° SC1,LM&LB,C NA+	+0B +6+6-3+6	43.24	1	1.75
R6-1	SAE	65°65°5	235	92.89	Comp	92.89	-59.748	60° C5,C NA+	+6B -3-3+6+6	64.322	154.416	78.994	2	1	1	122.74	1.35	1.215	2	2	M-16(8.8)	73.74	58.25	60° C5, Min. WS,C NA+	+6B +6+6-3-3	110.592	1	1.75
R6-2	SAE	45°45°4	355	85.83	Tens	78.9	-35.553	60° C5, Min. WS,C NA+	+6B +6-3-3-3	45.058	77.208	45.12	1	1	1	113.85	1.49	1.002	7	1	M-16(8.8)	85.83	37.115	60° C5,C NA+	+6B -3-3+6-3	43.24	1	1.75
R6-3	SAE	45°45°4	235	86.79	Tens	81.05	-28.011	60° C5,C NA+	+6B -3-3+6+6	35.858	77.208	34.56	1	1	1	121.27	1.34	1.067	3	1	M-16(8.8)	86.79	28.746	60° C5, Min. WS,C NA+	+6B +6+6-3-3	33.12	1	1.75
R6-4	SAE	45°45°4	355	75.34	Redun	72.2	-32.578	30° C1,C NA+	+6B -3-3+6+6	79.696	77.208	45.12	1	1	1	56.93	1.02	0.501	3	1	M-16(8.8)	75.34	32.578	30° C1,C NA+	+6B -3-3+6+6	43.24	1	1.75
R6-5	SAE	60°60°4	235	97.17	Climb	5.7	-1.442	60° C2-,C BI-	+6B -3+6+6+6	25.304	77.208	34.56	1	1	1	180.11	1.92	2.125	7	1	M-16(8.8)	4.3	1.485	60° C2,C BI+	+6B -3+6+6+6	50.976	1	1.75
R6-6	SAE	50°50°4	235	98.95	Climb	2.72	-0.766	60° C2-,C BI-	+6B -3-3+6+6	28.188	77.208	34.56	1	1	1	153.35	1.63	1.503	7	1	M-16(8.8)	2.21	0.763	60° C2,C BI+	+6B -3+6+6-3	38.88	1	1.75
R6-7	SAE	60°60°4	355	80.34	Comp	80.34	-34.485	60° C5,C NA+	+6B +6-3+6+6	42.921	77.208	45.12	2	1	1	123.54	1.76	1.13	7	1	M-16(8.8)	76.22	34.388	60° C5, Min. WS,C NA+	+6B +6+6-3-3	66.552	1	1.75
R6-8	SAE	50°50°4	235	98.95	Climb	87.09	-24.549	60° C5, Min. WS,C NA+	+6B +6+6+6-3	28.188	77.208	34.56	1	1	1	153.35	1.63	1.503	7	1	M-16(8.8)	76.43	26.413	60° C5,C NA+	+6B +6-3+6+6	38.88	1	1.75
R6-9	SAE	45°45°4	235	96.4	Comp	96.4	-25.165	60° C5,C NA+	+6B -3-3+6+6	26.104	77.208	34.56	1	1	1	150.71	1.6	1.326	7	1	M-16(8.8)	68.85	22.802	60° C5, Min. WS,C NA+	+6B +6+6-3-3	33.12	1	1.75
R6-10	SAE	50°50°4	355	75.02	Redun	75.02	-33.849	30° C1,C NA+	+6B -3-3+6+6	76.373	77.208	45.12	1	1	1	76.68	1.15	0.751	3	1	M-16(8.8)	75.02	33.849	30° C1,C NA+	+6B -3-3+6+6	50.76	1	1.75
R6-11	SAE	60°60°4	235	83.54	Comp	83.54	-50.46	60° C5,C NA+	+6B +6-3+6+6	60.402	154.416	63.195	1	1	1	95.8	1.16	1.13	3	2	M-16(8.8)	68.56	43.33	60° C5, Min. WS,C NA+	+6B +6+6+6-3	80.928	1	1.75
R6-12	SAE	50°50°4	355	73.87	Tens	67.23	-51.347	60° C5, Min. WS,C NA+	+6B +6+6+6-3	76.373	154.416	82.505	1	1	1	76.68	1.15	0.751	3	2	M-16(8.8)	73.87	60.825	60° C5,C NA+	+6B +6-3+6+6	82.344	1	1.75
R6-13	SAE	50°50°4	235	91.31	Comp	91.31	-40.417	60° C5, Min. WS,C NA+	+6B +6+6+6-3	44.264	154.416	63.195	1	1	1	109.55	1.26	1.074	3	2	M-16(8.8)	77.84	49.098	60° C5,C NA+	+6B +6-3+6+6	63.072	1	1.75
R6-14	SAE	60°60°4	355	93.35	Comp	93.35	-42.121	60° C5,C NA+	+6B +6-3+6+6	45.389	77.208	45.12	1	1	1	133.45	1.71	1.575	7	1	M-16(8.8)	75.73	34.17	60° C5, Min. WS,C NA+	+6B +6+6+6-3	66.552	1	1.75
R6-15	SAE	60°60°4	235	98.19	Climb	91.09	-22.608	60° C5, Min. WS,C NA+	+6B +6+6+6-3	24.82	77.208	34.56	1	1	1	181.96	1.94	2.147	7	1	M-16(8.8)	74.38	25.707	60° C5,C NA+	+6B +6-3+6+6	50.976	1	1.75
R6-16	SAE	65°65°5	235	80.08	Comp	80.08	-28.993	60° C5,C NA+	+6B -3-3+6+6	36.207	77.208	43.2	2	1	1	159.06	1.86	1.575	7	1	M-16(8.8)	62.4	26.958	60° C5, Min. WS,C NA+	+6B +6+6-3-3	70.992	1	1.75
R6-17	SAE	45°45°4	235	60.09	Redun	60.09	-15.489	30° C1,C NA+	+6B -3-3+6+6	25.776	77.208	34.56	1	1	1	151.76	1.62	1.335	7	1	M-16(8.8)	46.77	15.489	30° C1,C NA+	+6B -3-3+6+6	33.12	1	1.75
R6-18	SAE	45°45°4	355	91.48	Redun	91.48	-36.408	30° C1,C NA+	+6B -3-3+6+6	39.799	77.208	45.12	1	1	1	122	1.6	1.074	7	1	M-16(8.8)	84.2	36.408	30° C1,C NA+	+6B -3-3+6+6	43.24	1	1.75
R6-19	SAE	65°65°5	235	88.17	Redun	88.17	-38.091	30° C1,C NA+	+6B -3-3+6+6	44.668	77.208	43.2	1	1	1	155.72	1.66	2.024	7	1	M-16(8.8)	88.17	38.091	30° C1,C NA+	+6B -3-3+6+6	70.992	1	1.75
R6-20	SAE	45°45°4	235	82.73	Climb	24.86	-8.591	60° C6, Min. WS,C BI+	+6B -3+6+6-3	37.86	77.208</																	

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	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)
R3-9	SAE	60°60°5	355	92.36	Comp	92.36	-52.09	60° C5,C NA+	+3B +6+6-3-3	61.436	77.208	56.4	2	1	1	137.02	1.67	1.247	6	1	M-16(8.8)	85.89	48.443	60° C5, Min. WS,C NA+	+3B +6+6-3-3	82.532	1	1.75
R3-10	SAE	50°50°5	355	82.1	Tens	78.2	-38.717	60° C5, Min. WS,C NA+	+3B +6+6+6-3	49.509	77.208	56.4	1	1	1	128.88	1.69	1.263	7	1	M-16(8.8)	82.1	46.304	60° C5,C NA+	+3B +6-3+6+6	62.98	1	1.75
R3-11	SAE	45°45°4	235	65.27	Tens	61.26	-21.17	60° C5,C NA+	+3B +6+6-3-3	35.67	77.208	34.56	1	1	1	121.88	1.34	1.073	3	1	M-16(8.8)	65.27	21.618	60° C5, Min. WS,C NA+	+3B +6+6-3-3	33.12	1	1.75
R3-12	SAE	45°45°4	355	81.75	Redun	78.35	-35.35	30° C1,C NA+	+3B -3-3+6+6	72.105	77.208	45.12	1	1	1	71.76	1.11	0.631	3	1	M-16(8.8)	81.75	35.35	30° C1,C NA+	+3B -3-3+6+6	43.24	1	1.75
R3-13	SAE	60°60°5	235	89.64	Redun	89.64	-38.114	30° C1,C NA+	+3B +6+6-3-3	42.521	77.208	43.2	1	1	1	152.66	1.63	1.786	7	1	M-16(8.8)	88.23	38.114	30° C1,C NA+	+3B +6+6-3-3	63.216	1	1.75
R3-14	SAE	45°45°4	235	72.92	Climb	24.54	-8.482	60° C2, Min. WS,C BI+	+3B -3+6+6-3	42.608	77.208	34.56	1	1	1	101.49	1.2	0.893	3	1	M-16(8.8)	22.79	7.548	60° C2-,C BI-	+3B -3-3+6+6	33.12	1	1.75
R3-15	SAE	60°60°5	235	94	Climb	42.03	-16.992	60° C2, Min. WS,C BI+	+3B -3+6+6-3	40.428	77.208	43.2	2	1	1	138.79	1.67	1.263	7	1	M-16(8.8)	34.66	14.975	60° C2-,C BI-	+3B -3-3+6+6	63.216	1	1.75
R3-16	SAE	45°45°4	235	51.44	Climb	0.89	-0.307	30° C1-,C NA-	+3B -3+6+6-3	52.296	77.208	34.56	1	1	1	71.76	1.03	0.631	3	1	M-16(8.8)	0.94	0.312	60° C1, Min. WS,C NA+	+3B -3+6+6-3	33.12	1	1.75
R3-17	SAE	55°55°4	235	94.91	Climb	57.93	-12.485	60° C5,C NA+	+3B +6+6-3-3	21.551	77.208	34.56	1	1	1	187.08	1.99	2.002	7	1	M-16(8.8)	31.39	10.849	60° C5, Min. WS,C NA+	+3B -3-3+6+6	45.216	1	1.75
R3-18	SAE	60°60°4	355	83.3	Redun	83.3	-37.584	30° C1,C NA+	+3B +6+6-3-3	46.321	77.208	45.12	1	1	1	131.99	1.69	1.557	7	1	M-16(8.8)	83.3	37.584	30° C1,C NA+	+3B +6+6-3-3	66.552	1	1.75
R3-19	SAE	45°45°4	235	15.3	Redun	15.3	-2.457	30° C1,C NA+	+3B +6-3+6+6	16.061	77.208	34.56	1	1	1	195.43	2.08	1.72	7	1	M-16(8.8)	7.42	2.457	30° C1,C NA+	+3B +6-3+6+6	33.12	1	1.75
R3-20	SAE	55°55°5	235	97.85	Climb	9.77	-2.167	60° C2,C BI+	+3B -3-3+6-3	22.172	77.208	43.2	1	1	1	205.85	2.19	2.203	7	1	M-16(8.8)	3.71	1.601	60° C2-, Min. WS,C BI-	+3B -3-3+6-3	56.016	1	1.75
R3-21	SAE	55°55°4	235	84.83	Climb	3.47	-1.19	60° C2, Min. WS,C BI+	+3B -3+6+6+6	34.331	77.208	34.56	1	1	1	145.56	1.55	1.557	7	1	M-16(8.8)	3.62	1.252	60° C2-,C BI-	+3B -3-3+6+6	45.216	1	1.75
R0-1	SAE	55°55°5	235	97.39	Tens	83.24	-65.753	60° C5, Min. WS,C NA+	+0B +6+6-3-3	83.815	154.416	78.994	1	1	1	61.38	0.98	0.657	3	2	M-16(8.8)	97.39	76.931	60° C5,C NA+	+0B +6-3+6+6	88.416	1	1.75
R0-2	SAE	65°65°6	235	94.67	Comp	94.67	-89.651	60° C5,C NA+	+0B +6-3+6+6	94.699	154.416	94.793	1	1	1	98.06	1.18	1.245	3	2	M-16(8.8)	80.84	76.634	60° C5, Min. WS,C NA+	+0B +6+6-3-3	130.464	1	1.75
R0-3	SAE	50°50°4	235	91	Tens	78.31	-27.065	60° C5, Min. WS,C NA+	+0B +6+6+6-3	35.863	77.208	34.56	1	1	1	134.03	1.43	1.313	7	1	M-16(8.8)	91	31.45	60° C5,C NA+	+0B +6-3+6+6	38.88	1	1.75
R0-4	SAE	60°60°4	235	71.18	Comp	71.18	-24.599	60° C5,C NA+	+0B +6-3+6+6	36.399	77.208	34.56	1	1	1	148.02	1.58	1.747	7	1	M-16(8.8)	59.55	20.582	60° C5, Min. WS,C NA+	+0B +6+6+6-3	50.976	1	1.75
R0-5	SAE	60°60°4	235	89.91	Climb	77.16	-22.506	60° C5, Min. WS,C NA+	+0B +6+6+6-3	29.169	77.208	34.56	1	1	1	166.96	1.78	1.97	7	1	M-16(8.8)	69.3	23.949	60° C5,C NA+	+0B +6-3+6+6	50.976	1	1.75
R0-6	SAE	65°65°5	235	86.52	Comp	86.52	-34.26	60° C5,C NA+	+0B +6+6-3-3	39.597	77.208	43.2	2	1	1	149.58	1.77	1.481	7	1	M-16(8.8)	78.03	33.71	60° C5, Min. WS,C NA+	+0B +6+6-3-3	70.992	1	1.75
R0-7	SAE	45°45°4	235	51.57	Redun	51.57	-14.864	30° C1,C NA+	+0B -3-3+6+6	28.825	77.208	34.56	1	1	1	142.65	1.52	1.255	7	1	M-16(8.8)	44.88	14.864	30° C1,C NA+	+0B -3-3+6+6	33.12	1	1.75
R0-8	SAE	45°45°4	355	82.98	Redun	79.52	-35.88	30° C1,C NA+	+0B -3-3+6+6	46.426	77.208	45.12	1	1	1	111.94	1.47	0.985	7	1	M-16(8.8)	82.98	35.88	30° C1,C NA+	+0B -3-3+6+6	43.24	1	1.75
R0-9	SAE	60°60°4	355	84.19	Redun	84.19	-37.985	30° C1,C NA+	+0B -3-3+6+6	46.848	77.208	45.12	1	1	1	131.18	1.68	1.548	7	1	M-16(8.8)	84.19	37.985	30° C1,C NA+	+0B -3-3+6+6	66.552	1	1.75
R0-10	SAE	45°45°4	235	63.13	Climb	28.14	-9.724	60° C2,C BI+	+0B -3-3+6+6	47.831	77.208	34.56	1	1	1	87.95	1.11	0.774	3	1	M-16(8.8)	25.63	8.49	60° C2-, Min. WS,C BI-	+0B -3+6+6-3	33.12	1	1.75
R0-11	SAE	55°55°5	235	97.23	Climb	50.26	-19.597	60° C2,C BI+	+0B -3-3+6+6	38.992	77.208	43.2	2	1	1	131.87	1.62	1.095	3	1	M-16(8.8)	39.14	16.91	60° C2-, Min. WS,C BI-	+0B -3+6+6-3	56.016	1	1.75
R0-12	SAE	45°45°4	235	44.55	Climb	0.81	-0.279	60° C1-,C NA-	+0B -3+6+6-3	54.723	77.208	34.56	1	1	1	62.19	0.99	0.547	3	1	M-16(8.8)	0.81	0.268	30° C1,C NA+	+0B -3+6+6-3	33.12	1	1.75
R0-13	SAE	45°45°4	235	19.5	Redun	19.5	-3.131	30° C1,C NA+	+0B +6-3+6+6	16.06	77.208	34.56	1	1	1	195.44	2.08	1.72	7	1	M-16(8.8)	9.45	3.131	30° C1,C NA+	+0B +6-3+6+6	33.12	1	1.75
R0-14	SAE	55°55°4	235	94.92	Climb	55.5	-11.96	60° C5,C NA+	+0B +6+6-3-3	21.55	77.208	34.56	1	1	1	187.09	1.99	2.002	7	1	M-16(8.8)	31.04	10.727	60° C5, Min. WS,C NA+	+0B -3-3+6+6	45.216	1	1.75
R0-15	SAE	60°60°4	355	83.02	Redun	83.02	-37.457	30° C1,C NA+	+0B -3-3+6+6	46.318	77.208	45.12	1	1	1	131.99	1.69	1.558	7	1	M-16(8.8)	83.02	37.457	30° C1,C NA+	+0B -3-3+6+6	66.552	1	1.75
R0-16	SAE	55°55°5	235	97.86	Climb	9.58	-2.125	60° C2,C BI+	+0B -3-3+6-3	22.17	77.208	43.2	1	1	1	205.86	2.19	2.203	7	1	M-16(8.8)	3.79	1.636	60° C2-, Min. WS,C BI-	+0B -3-3+6-3	56.016	1	1.75
R0-17	SAE	55°55°4	235	84.84	Climb	3.32	-1.14	60° C2, Min. WS,C BI+	+0B -3+6+6+6	34.329	77.208	34.56	1	1	1	145.56	1.55	1.558	7	1	M-16(8.8)	3.39	1.172	60° C2, Min. WS,C BI+	+0B -3+6+6-3	45.216	1	1.75
R-3-1	SAE	50°50°5	235	90.92	Tens	86.57	-59.818	60° C5, Min. WS,C NA+	-3B +6+6-3-3	69.101	154.416	78.994	1	1	1	79.47	1.07	0.779	3	2	M-16(8.8)	90.92	70.041	60° C5,C NA+	-3B +6-3+6+6	77.04	1	1.75
R-3-2	SAE	65°65°5	235	86.85	Comp	86.85	-67.479	60° C5,C NA+	-3B +6-3+6+6	77.693	154.416	78.994	1	1	1	101.06	1.2	1.314	3	2	M-16(8.8)	72.01	56.884	60° C5, Min. WS,C NA+	-3B +6+6+6-3	110.592	1	1.75
R-3-3	SAE	55°55°4	235	84.84	Climb	76.71	-26.332	60° C5, Min. WS,C NA+	-3B +6+6+6-3	34.326	77.208	34.56	1	1	1	145.57	1.55	1.558	7	1	M-16(8.8)	83.6	28.893	60° C5,C NA+	-3B +6-3+6+6	45.216	1	1.75
R-3-4	SAE	60°60°5	235	98.19	Comp	98.19	-37.553	60° C5,C NA+	-3B -3-3+6+6	38.245	77.208	43.2	2	1	1	144.36	1.72	1.314	7	1	M-16(8.8)	88.15	38.083	60° C5, Min. WS,C NA+	-3B +6+6-3-3	63.216	1	1.75
R-3-5	SAE	45°45°4	235	50.74	Tens	47.33	-16.169	60° C5,C NA+	-3B -3-3+6+6	34.164	77.208	34.56	1	1	1	126.9	1.38	1.117	3	1	M-16(8.8)	50.74	16.804	60° C5, Min. WS,C NA+	-3B +6+6-3-3	33.12	1	1.75
R-3-6	SAE	45°45°4	355	87.3	Redun	83.67	-37.75	30° C1,C NA+	-3B -3-3+6+6	60.4	77.208	45.12	1	1	1	88.5	1.25	0.779	3	1	M-16(8.8)	87.3	37.75	30° C1,C NA+	-3B -3-3+6+6	43.24	1	1.75
R-3-7	SAE	55°55°5	235	97.86	Climb	22.41	-4.968	60° C6-,C BI-	-3B -3-3+6+6	22.168	77.208	43.2	1	1	1	205.86	2.19	2.203	7	1	M-16(8.8)	12.05	5.205	60° C1-, Min. WS,C NA-	-3B -3+6+6-3	56.016	1	1.75
R-3-8	SAE	55°55°4	235	84.84	Climb	12.09	-4.151	60° C5-, Min. WS,C NA-	-3B -3+6+6-3	34.326	77.208	34.56	1	1	1	145.57	1.55	1.558	7	1	M-16(8.8)	11.29	3.903	60° C2-,C BI-	-3B -3-3+6+6	45.216	1	1.75
R-3-9	SAE	65°65°5	355	66.23	Climb	34.31	-6.843	30° C1-,C NA-	-3B -3+6+6-3	19.946	77.208	56.4	1	1	1	239.63	3.14	3.115	7	1	M-16(8.8)	13.91	7.846	60° C5, Min. WS,C NA+	-3B -3+6+6-3	92.684	1	1.75
RL6-1	SAE	55°55°4	235	78.61	Comp	78.61	-12.322	60° C5, Min. WS,C NA+	-3B -3+6+6-3	15.675	77.208	34.56	1	1	1	220.98	2.35	2.365	7	1	M-16(8.8)	24.98	8.633	30° C1,C NA+	-3B +6-3+6+6	45.216	1	1.75
RL6-2	SAE	45°45°4	235	39.28	Comp	39.28	-6.12	30° C2-,C BI-	-3B -3-3+6+6	15.582	77.208	34.56	1	1	1	198.56	2.11	1.747	7	1	M-16(8.8)	26.7	8.845	60° C5, Min. WS,C NA+	-3B -3+6+6-3	33.12	1	1.75
RL6-3	SAE	65°65°5	235	85.17	Climb	20.98	-5.568	60° C5, Min. WS,C NA+	-3B -3+6+6-3	26.534	77.208	43.2	1	1	1	205.4	2.19	2.67	7	1	M-16(8.8)	8.59	3.709	30° C2-,C BI-	-3B -3-3+6+6	70.992	1	1.75
RL6-4	SAE	55°55°4	235	78.39	Redun	78.39	-11.114	30° C1,C NA+	-3B +6-3+6+6	1																		

Group Label	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	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)
RL6-21	SAE	60°60*6	355	93.17	Comp	93.17	-112.781	60° C6,C BI+	+6B +6+6+6+6	121.055	154.416	123.758	1	1	1	87.36	1.24	1.022	3	2	M-16(8.8)	71.63	88.642	60° C6-, Min. WS,C BI-	+6B +6+6+6+6	152.656	1	1.75
RL6-22	SAE	45°45*4	235	54.45	Tens	52.2	-18.042	60° C6,C BI+	+0B +6-3+6+6	35.249	77.208	34.56	1	0.67	0.67	96.21	1.35	1.264	3	1	M-16(8.8)	54.45	18.032	60° C5, Min. WS,C NA+	+0B -3+6+6+6	33.12	1	1.75
RL4.5-1	SAE	50°50*4	235	74.41	Comp	74.41	-8.885	60° C5, Min. WS,C NA+	-3B +4.5+4.5+4.5+4.5	11.94	77.208	34.56	1	1	1	241.28	2.57	2.365	7	1	M-16(8.8)	22.31	7.71	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	38.88	1	1.75
RL4.5-2	SAE	45°45*4	235	24.32	Comp	24.32	-3.94	60° C5,C NA+	-3B +4.5+4.5+4.5+4.5	16.2	77.208	34.56	1	1	1	194.55	2.07	1.712	7	1	M-16(8.8)	18.83	6.237	60° C5, Min. WS,C NA+	-3B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-3	SAE	60°60*5	235	96.7	Climb	20.04	-4.208	60° C5, Min. WS,C NA+	-3B +4.5+4.5+4.5+4.5	21.002	77.208	43.2	1	1	1	221.88	2.36	2.596	7	1	M-16(8.8)	7.33	3.167	60° C5,C NA+	-3B +4.5+4.5+4.5+4.5	63.216	1	1.75
RL4.5-4	SAE	50°50*4	235	86.07	Redun	86.07	-10.188	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	11.837	77.208	34.56	1	1	1	242.36	2.58	2.375	7	1	M-16(8.8)	29.48	10.188	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	38.88	1	1.75
RL4.5-5	SAE	60°60*4	235	94.89	Climb	41.64	-11.004	60° C5, Min. WS,C NA+	-3B +4.5+4.5+4.5+4.5	26.429	77.208	34.56	1	1	1	176	1.87	2.077	7	1	M-16(8.8)	18.29	6.322	60° C5,C NA+	+3B +4.5+4.5+4.5+4.5	50.976	1	1.75
RL4.5-6	SAE	50°50*4	235	79.59	Redun	79.59	-13.066	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	16.416	77.208	34.56	1	1	1	204.51	2.18	2.004	7	1	M-16(8.8)	37.81	13.066	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	38.88	1	1.75
RL4.5-7	SAE	55°55*4	235	84.84	Climb	33.79	-11.599	60° C5, Min. WS,C NA+	-3B +4.5+4.5+4.5+4.5	34.326	77.208	34.56	1	1	1	145.57	1.55	1.558	7	1	M-16(8.8)	21.6	7.465	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	45.216	1	1.75
RL4.5-8	SAE	50°50*4	235	77.48	Comp	77.48	-17.149	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	22.134	77.208	34.56	1	1	1	174.7	1.86	1.712	7	1	M-16(8.8)	53.51	18.493	60° C6-, Min. WS,C BI-	+6B +4.5+4.5+4.5+4.5	38.88	1	1.75
RL4.5-9	SAE	45°45*4	235	84.89	Climb	46.99	-16.239	60° C6-, Min. WS,C BI-	+6B +4.5+4.5+4.5+4.5	36.891	77.208	34.56	1	1	1	118	1.32	1.038	3	1	M-16(8.8)	47.35	15.683	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-10	SAE	45°45*4	235	80.84	Comp	80.84	-26.965	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	33.355	77.208	34.56	1	1	1	129.7	1.4	1.141	3	1	M-16(8.8)	73.22	24.251	60° C6-, Min. WS,C BI-	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-11	SAE	60°60*6	355	89.07	Tens	71.43	-48.345	60° C6-, Min. WS,C BI-	+6B +4.5+4.5+4.5+4.5	181.468	77.208	67.68	1	1	1	29.58	0.87	0.346	3	1	M-16(8.8)	89.07	60.285	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	98.512	1	1.75
RL4.5-12	SAE	75°75*5	235	98.36	Climb	11.54	-3.442	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	29.824	77.208	43.2	1	0.58	0.58	198.87	2.22	4.594	7	1	M-16(8.8)	7.05	3.044	60° C2, Min. WS,C BI+	+0B +4.5+4.5+4.5+4.5	85.392	1	1.75
RL4.5-13	SAE	50°50*4	235	22.06	Comp	22.06	-2.499	60° C5, Min. WS,C NA+	+0B +4.5+4.5+4.5+4.5	11.326	77.208	34.56	1	0.6	0.6	244.62	2.64	3.718	7	1	M-16(8.8)	5.76	1.992	60° C1,C NA+	+6B +4.5+4.5+4.5+4.5	38.88	1	1.75
RL4.5-14	SAE	45°45*4	235	12.48	Redun	12.48	-2.026	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	16.238	77.208	34.56	1	0.6	0.6	182.26	2.07	2.479	7	1	M-16(8.8)	6.12	2.026	30° C1,C NA+	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-15	SAE	45°45*4	235	14.79	Comp	14.79	-4.107	60° C5, Min. WS,C NA+	+0B +4.5+4.5+4.5+4.5	27.764	77.208	34.56	1	0.6	0.6	121.51	1.55	1.653	3	1	M-16(8.8)	11.37	3.766	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-16	SAE	45°45*4	235	39.82	Climb	34.35	-11.873	60° C5, Min. WS,C NA+	+6B +4.5+4.5+4.5+4.5	56.332	77.208	34.56	1	1	1	55.63	0.96	0.49	3	1	M-16(8.8)	38.14	12.631	60° C5,C NA+	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-17	SAE	45°45*4	235	76.08	Tens	71.83	-24.825	30° C1,C NA+	+3B +4.5+4.5+4.5+4.5	50.512	77.208	34.56	1	1	1	78.67	1.06	0.692	3	1	M-16(8.8)	76.08	25.199	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL4.5-18	SAE	60°60*5	355	93.73	Comp	93.73	-94.926	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	101.271	154.416	103.131	1	1	1	87.99	1.25	1.03	3	2	M-16(8.8)	74.27	76.592	60° C6-, Min. WS,C BI-	+6B +4.5+4.5+4.5+4.5	129.532	1	1.75
RL4.5-19	SAE	45°45*4	235	37.88	Comp	37.88	-12.795	60° C6,C BI+	+6B +4.5+4.5+4.5+4.5	33.776	77.208	34.56	1	0.67	0.67	101.36	1.39	1.331	3	1	M-16(8.8)	34.47	11.416	60° C5, Min. WS,C NA+	+0B +4.5+4.5+4.5+4.5	33.12	1	1.75
RL3-1	SAE	50°50*4	235	71.61	Comp	71.61	-8.55	60° C5, Min. WS,C NA+	-3B +3+3+3+3	11.94	77.208	34.56	1	1	1	241.28	2.57	2.365	7	1	M-16(8.8)	21.95	7.585	30° C1,C NA+	+6B +3+3+3+3	38.88	1	1.75
RL3-2	SAE	45°45*4	235	24.41	Comp	24.41	-4.16	60° C5,C NA+	-3B +3+3+3+3	17.043	77.208	34.56	1	1	1	189.43	2.02	1.667	7	1	M-16(8.8)	17.69	5.858	60° C5, Min. WS,C NA+	-3B +3+3+3+3	33.12	1	1.75
RL3-3	SAE	60°60*5	235	92.69	Climb	17.99	-4.087	60° C5, Min. WS,C NA+	-3B +3+3+3+3	22.717	77.208	43.2	1	1	1	213	2.27	2.492	7	1	M-16(8.8)	8.49	3.666	60° C5,C NA+	-3B +3+3+3+3	63.216	1	1.75
RL3-4	SAE	50°50*4	235	76.56	Redun	76.56	-10.329	30° C1,C NA+	+6B +3+3+3+3	13.492	77.208	34.56	1	1	1	226.49	2.41	2.22	7	1	M-16(8.8)	29.89	10.329	30° C1,C NA+	+6B +3+3+3+3	38.88	1	1.75
RL3-5	SAE	60°60*4	235	85.2	Climb	36.98	-11.891	60° C5, Min. WS,C NA+	-3B +3+3+3+3	32.16	77.208	34.56	1	1	1	158.4	1.69	1.869	7	1	M-16(8.8)	23.84	8.239	60° C5,C NA+	+3B +3+3+3+3	50.976	1	1.75
RL3-6	SAE	45°45*4	235	91.19	Comp	91.19	-13.189	60° C6,C BI+	+6B +3+3+3+3	14.464	77.208	34.56	1	1	1	206.45	2.2	1.817	7	1	M-16(8.8)	45.69	15.132	60° C5, Min. WS,C NA+	-3B +3+3+3+3	33.12	1	1.75
RL3-7	SAE	50°50*4	235	81.84	Climb	42.35	-14.637	60° C6-, Min. WS,C BI-	+6B +3+3+3+3	37.997	77.208	34.56	1	1	1	127.15	1.38	1.246	3	1	M-16(8.8)	39.31	13.585	60° C6,C BI+	+6B +3+3+3+3	38.88	1	1.75
RL3-8	SAE	45°45*4	235	61.85	Comp	61.85	-18.997	60° C6,C BI+	+6B +3+3+3+3	30.713	77.208	34.56	1	1	1	137.63	1.47	1.211	7	1	M-16(8.8)	54.68	18.11	60° C6-, Min. WS,C BI-	+6B +3+3+3+3	33.12	1	1.75
RL3-9	SAE	60°60*6	355	92.51	Tens	76.14	-51.533	60° C6-, Min. WS,C BI-	+6B +3+3+3+3	176.923	77.208	67.68	1	1	1	35.5	0.9	0.415	3	1	M-16(8.8)	92.51	62.611	60° C6,C BI+	+6B +3+3+3+3	98.512	1	1.75
RL3-10	SAE	75°75*5	235	96.44	Climb	10	-3.05	60° C5, Min. WS,C NA+	+0B +3+3+3+3	30.491	77.208	43.2	1	0.6	0.6	196.08	2.2	4.53	7	1	M-16(8.8)	6.8	2.936	60° C1,C NA+	+6B +3+3+3+3	85.392	1	1.75
RL3-11	SAE	50°50*4	235	18.3	Comp	18.3	-2.271	60° C5,C NA+	+6B +3+3+3+3	12.408	77.208	34.56	1	0.64	0.64	231.35	2.52	3.517	7	1	M-16(8.8)	5.68	1.964	60° C5, Min. WS,C NA+	+0B +3+3+3+3	38.88	1	1.75
RL3-12	SAE	45°45*4	235	15.11	Comp	15.11	-3.755	30° C2, Min. WS,C BI+	+6B +3+3+3+3	24.846	77.208	34.56	1	0.6	0.6	136.37	1.65	1.855	7	1	M-16(8.8)	11.91	3.945	30° C2,C BI+	+6B +3+3+3+3	33.12	1	1.75
RL3-13	SAE	45°45*4	235	47.83	Climb	31.1	-10.75	60° C5, Min. WS,C NA+	+6B +3+3+3+3	53.576	77.208	34.56	1	1	1	66.75	1.01	0.587	3	1	M-16(8.8)	34.53	11.437	60° C5,C NA+	+6B +3+3+3+3	33.12	1	1.75
RL3-14	SAE	45°45*4	235	69.46	Redun	66.57	-23.006	30° C1,C NA+	+6B +3+3+3+3	45.296	77.208	34.56	1	1	1	94.4	1.15	0.831	3	1	M-16(8.8)	69.46	23.006	30° C1,C NA+	+6B +3+3+3+3	33.12	1	1.75
RL3-15	SAE	60°60*6	235	89.92	Comp	89.92	-84.27	60° C6,C BI+	+6B +3+3+3+3	93.715	154.416	94.793	1	1	1	89.21	1.12	1.044	3	2	M-16(8.8)	73.82	69.979	60° C6-, Min. WS,C BI-	+6B +3+3+3+3	116.928	1	1.75
RL3-16	SAE	45°45*4	235	33.96	Comp	33.96	-10.753	60° C6,C BI+	+6B +3+3+3+3	31.663	77.208	34.56	1	0.67	0.67	109.26	1.44	1.435	3	1	M-16(8.8)	28.42	9.414	60° C5, Min. WS,C NA+	+0B +3+3+3+3	33.12	1	1.75
RL1.5-1	SAE	50°50*4	235	64.86	Comp	64.86	-7.745	60° C5, Min. WS,C NA+	-3B +1.5+1.5+1.5+1.5	11.94	77.208	34.56	1	1	1	241.28	2.57	2.365	7	1	M-16(8.8)	22.22	7.678	30° C1,C NA+	+6B +1.5+1.5+1.5+1.5	38.88	1	1.75
RL1.5-2	SAE	45°45*4	235	21.46	Comp	21.46	-3.909	60° C5,C NA+	-3B +1.5+1.5+1.5+1.5	18.213	77.208	34.56	1	1	1	182.9	1.95	1.61	7	1	M-16(8.8)	14.82	4.908	60° C5, Min. WS,C NA+	-3B +1.5+1.5+1.5+1.5	33.12	1	1.75
RL1.5-3	SAE	60°60*5	235	86.71	Climb	13.1	-3.366	60° C5, Min. WS,C NA+	-3B +1.5+1.5+1.5+1.5	25.705	77.208	43.2	1	1	1	199.69	2.13	2.336	7	1	M-16(8.8)	7.61	3.288	60° C3,C NA+	-3B +1.5+1.5+1.5+1.5	63.216	1	1.75
RL1.5-4	SAE	45°45*4	235	80.07	Redun	80.07	-9.589	30° C1,C NA+	+6B +1.5+1.5+1.5+1.5	11.976	77.208	34.56	1	1	1	227.74	2.43	2.004	7	1	M-16(8.8)	28.95	9.589	30° C1,C NA+	+6B +1			

D-CROSSARM BOTTOM CHORD CALCULATION

1.1 Left Upper Crossarm Bottom chord

1.1.1 Loads (kN)

For Top Crossarm		Axial	FoS	Load	Load Case
	Compression	32.4	1.0	32.4	30° SF1A,EW,I NA+
	Climbing	3.0	1.5	4.5	

1.1.2 Material Properties

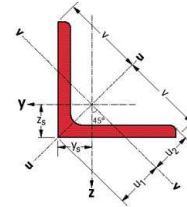
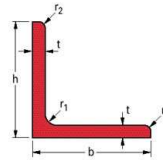
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε	0.81		7.3.6.2-EN50341-2012
kσ	0.43		7.3.6.2-EN50341-2012

1.1.3 Dimensiones

L =	1.431	m	Longest Field of Beam
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1.1.4 Crossection Properties

Section	L70*70*6	Unit		
b=	70	mm	Width	
h =	70	mm	Height	
t =	6	mm	Thickness	
rz,ry=	2.13	cm	Raius of Gyration z-z, y-y	
rv=	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			7.3.6.2-EN50341-2012
λ'p	0.64			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
Aeff=	8.13	cm ²	Effective cross-section area	
λ	104.45		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	1.37		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	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
Mz,ed=	1.63	kN.m	Design bending moment	
Mz,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	
Ned=	32.4	kN	Compression force	
Nrd=	118.7	kN	Flexural Buckling resistance	
Status	27.3 %	OK	Usage	



1.1.7 Axial Compression & Bending Check

Check	0.90	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 Left Middle Crossarm Bottom chord

2.1.1 Loads (kN)

For		Axial	FoS	Load	Load Case
Middle	Compression	49.4	1.0	49.4	30° SF1A,EW,I NA+
Crossarm	Climbing	3.0	1.5	4.5	

2.1.2 Material Properties

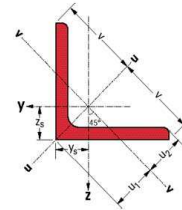
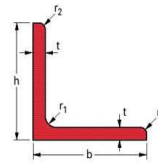
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
κσ =	0.43		7.3.6.2-EN50341-2012

2.1.3 Dimensiones

L =	1.514	m	Longest Field of Beam
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2.1.4 Crossection Properties

Section	L80*80*7	Unit		
b=	80	mm	Width	
h =	80	mm	Height	
t =	7	mm	Thickness	
rz,ry=	2.44	cm	Raius of Gyration z-z, y-y	
rv=	1.57	cm	Raius of Gyration v-v	
S =	11.10	cm ³	Section Modulus z-z, y-y	
A =	10.80	cm ²	Gross cross-section area	
G=	83.26	N/m	Unit weight	
b/t=	11.4		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.62			7.3.6.2-EN50341-2012
p	1.00			7.3.6.2-EN50341-2012
Aeff=	10.80	cm ²	Effective cross-section area	
λ	96.43		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	1.26		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	1.32		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection factor	J.4.1-EN50341-2012
Φ	1.44			
χ	0.49		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
Mz,ed=	1.73	kN.m	Design bending moment	
Mz,Rd =	3.94	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	43.8 %	OK	Usage	

2.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance
Ned=	49.4	kN	Compression force
Nrd=	171.7	kN	Flexural Buckling resistance
Status	28.8 %	OK	Usage



2.1.7 Axial Compression & Bending Check

Check	0.73	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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3.1 Left Lower Crossarm Bottom chord

3.1.1 Loads (kN)

For Lower Crossarm		Axial	FoS	Load	Load Case
	Compression	35.1	1.0	35.1	30° SF1A,EW,I NA+
	Climbing	3.0	1.5	4.5	

3.1.2 Material Properties

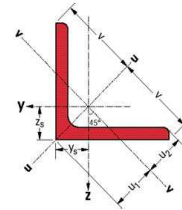
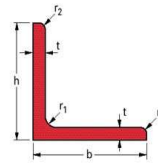
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

3.1.3 Dimensiones

L =	1.431	m	Longest Field of Beam
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3.1.4 Crossection Properties

Section	L70*70*6	Unit		
b=	70	mm	Width	
h =	70	mm	Height	
t =	6	mm	Thickness	
rz,ry=	2.13	cm	Raius of Gyration z-z, y-y	
rv=	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			7.3.6.2-EN50341-2012
Aeff=	8.13	cm ²	Effective cross-section area	
λ	104.45		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	1.37		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	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



3.1.5 Moment Capacity

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

3.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance	
Ned=	35.1	kN	Compression force	
Nrd=	118.7	kN	Flexural Buckling resistance	
Status	29.6 %	OK	Usage	



3.1.7 Axial Compression & Bending Check

Check	0.93	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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4.1 Right Upper Crossarm Bottom chord

4.1.1 Loads (kN)

For Top Crossarm		Axial	FoS	Load	Load Case
	Compression	26.5	1.0	26.5	30° SF1A,LT,I NA+
	Climbing	3.0	1.5	4.5	

4.1.2 Material Properties

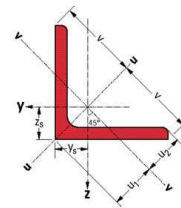
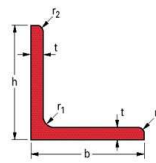
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

4.1.3 Dimensiones

L =	1.392	m	Longest Field of Beam
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4.1.4 Crossection Properties

Section	L65*65*6	Unit		
b=	65	mm	Width	
h =	65	mm	Height	
t =	6	mm	Thickness	
rz,ry=	1.97	cm	Raius of Gyration z-z, y-y	
rv=	1.27	cm	Raius of Gyration v-v	
S =	6.21	cm ³	Section Modulus z-z, y-y	
A =	7.53	cm ²	Gross cross-section area	
G=	57.96	N/m	Unit weight	
b/t=	10.8		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.58			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
Aeff=	7.53	cm ²	Effective cross-section area	
λ	109.61		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	1.43		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	1.43		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection factor	J.4.1-EN50341-2012
Φ	1.61			
χ	0.43		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012



4.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
Mz,ed=	1.58	kN.m	Design bending moment	
Mz,Rd =	2.20	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	71.7 %	OK	Usage	

4.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance	
Ned=	26.5	kN	Compression force	
Nrd=	104.2	kN	Flexural Buckling resistance	
Status	25.4 %	OK	Usage	



4.1.7 Axial Compression & Bending Check

Check	0.97	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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5.1 Right Middle Crossarm Bottom chord

4.1.1 Loads (kN)

For		Axial	FoS	Load	Load Case
Middle	Compression	43.7	1.0	43.7	30° SF1A,LT,I NA+
Crossarm	Climbing	3.0	1.5	4.5	

5.1.2 Material Properties

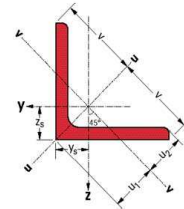
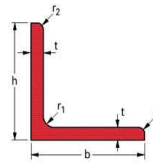
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

5.1.3 Dimensiones

L =	1.494	m	Longest Field of Beam
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5.1.4 Crosssection Properties

Section	L70*70*7	Unit		
b=	70	mm	Width	
h =	70	mm	Height	
t =	7	mm	Thickness	
rz,ry=	2.12	cm	Raius of Gyration z-z, y-y	
rv=	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
Aeff=	9.40	cm ²	Effective cross-section area	
λ	109.05		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	1.43		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	1.43		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection factor	J.4.1-EN50341-2012
Φ	1.60			
χ	0.43		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012



5.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
Mz,ed=	1.70	kN.m	Design bending moment	
Mz,Rd =	2.99	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	57.0 %	OK	Usage	

5.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance	
Ned=	43.7	kN	Compression force	
Nrd=	130.8	kN	Flexural Buckling resistance	
Status	33.4 %	OK	Usage	



5.1.7 Axial Compression & Bending Check

Check	0.90	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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6.1 Right Lower Crossarm Bottom chord

6.1.1 Loads (kN)

For Lower Crossarm		Axial	FoS	Load	Load Case
	Compression	31.3	1.0	31.3	30° SF1A,LM,I NA+
	Climbing	3.0	1.5	4.5	

6.1.2 Material Properties

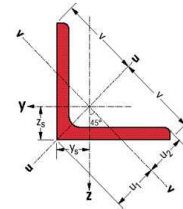
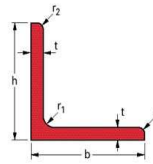
E	210000	N/mm ²	Modulus of Elasticity
Fy	355	N/mm ²	Yield Strength
ε=	0.81		7.3.6.2-EN50341-2012
kσ =	0.43		7.3.6.2-EN50341-2012

6.1.3 Dimensiones

L =	1.392	m	Longest Field of Beam
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6.1.4 Crosssection Properties

Section	L65*65*6	Unit		
b=	65	mm	Width	
h =	65	mm	Height	
t =	6	mm	Thickness	
rz,ry=	1.97	cm	Raius of Gyration z-z, y-y	
rv=	1.27	cm	Raius of Gyration v-v	
S =	6.21	cm ³	Section Modulus z-z, y-y	
A =	7.53	cm ²	Gross cross-section area	
G=	57.96	N/m	Unit weight	
b/t=	10.8		Width-Thickness ratio	
Class	3		Classification	5.5.2- EN1993-1-1-2005
λ'p	0.58			7.3.6.2-EN50341-2012
p	1.00		Reduction factor for effective area	7.3.6.2-EN50341-2012
Aeff=	7.53	cm ²	Effective cross-section area	
λ	70.66		Slenderness	J.4.2.2-EN50341-2012
λ1	76.41			J.4.2.3-EN50341-2012
λ'	0.92		Non-dimensional slenderness	J.4.2.3-EN50341-2012
λeff	1.10		Effective non-dimensional slenderness	J.4.2.4-EN50341-2012
α	0.13		Imperfection Factor	J.4.1-EN50341-2012
Φ	1.16			
χ	0.65		Reduction factor for relevant buckling mode	J.4.1-EN50341-2012

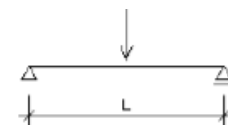


6.1.5 Moment Capacity

γM0=	1.0		Partial factor for moment resistance	6.1 -EN50341-2012
Mz,ed=	1.58	kN.m	Design bending moment	
Mz,Rd =	2.20	kN.m	Design resistance for bending about z-z axis	6.2.5-EN50341-2012
Status	71.7 %	OK	Usage	

6.1.6 Compression Capacity

γM1=	1.10		Partial factor for buckling resistance
Ned=	31.3	kN	Compression force
Nrd=	157.3	kN	Flextural Buckling resistance
Status	19.9 %	OK	Usage



6.1.7 Axial Compression & Bending Check

Check	0.92	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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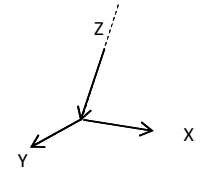
E-FOUNDATION REACTIONS

Factored Maximum Foundation Reactions

+6 Body Extension

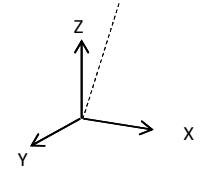
• Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	1537.97	27.30	33.87	60° C5,C NA+	+6B -3-3+6+6
Uplift	-1378.38	20.49	29.17	60° C5, Min. WS,C NA+	+6B +6+6-3-3
Max. Transverse	-378.36	68.62	34.58	60° C6-, Min. WS,C BI-	+6B -3+6+6+6
Max. Longitudinal	847.61	37.97	75.51	60° C6,C BI+	+6B -3+6+6+6



• Maximum Reactions in Global direction

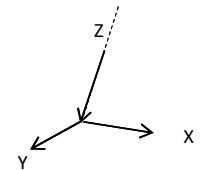
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-1486.35	277.68	284.25	60° C5,C NA+	+6B -3-3+6+6
Uplift	1332.94	245.03	253.70	60° C5, Min. WS,C NA+	+6B +6+6-3-3
Max. Transverse	-1486.34	277.68	284.25	60° C5,C NA+	+6B +6+6-3-3
Max. Longitudinal	-1486.34	277.68	284.25	60° C5,C NA+	+6B +6+6-3-3



+3 Body Extension

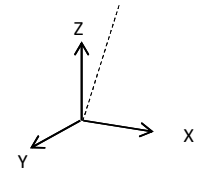
• Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	1535.68	21.63	33.59	60° C5,C NA+	+3B +6+6-3-3
Uplift	-1389.72	16.58	29.35	60° C5, Min. WS,C NA+	+3B +6+6-3-3
Max. Transverse	-450.32	59.41	9.87	60° C6-, Min. WS,C BI-	+3B -3+6+6-3
Max. Longitudinal	903.69	15.86	67.64	60° C6,C BI+	+3B -3-3+6+6



• Maximum Reactions in Global direction

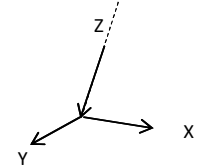
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Uplift	-1485.07	271.80	283.76	60° C5,C NA+	+3B +6+6-3-3
Uplift	1344.56	243.07	255.85	60° C5, Min. WS,C NA+	+3B +6+6-3-3
Max. Transverse	-1485.07	271.80	283.76	60° C5,C NA+	+3B +6+6-3-3
Max. Longitudinal	-1485.07	271.80	283.76	60° C5,C NA+	+3B +6+6-3-3



+0 Body Extension

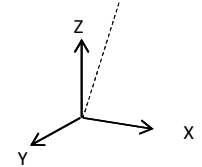
- Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	1529.69	16.64	37.43	60° C5,C NA+	+0B -3-3+6+6
Uplift	-1391.81	11.12	35.60	60° C5, Min. WS,C NA+	+0B +6+6-3-3
Max. Transverse	-426.84	59.84	3.97	60° C6-, Min. WS,C BI-	+0B -3+6+6-3
Max. Longitudinal	874.20	11.39	69.71	60° C6,C BI+	+0B -3-3+6+6



- Maximum Reactions in Global direction

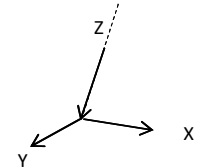
Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-1479.42	265.86	286.64	60° C5,C NA+	+0B +6+6-3-3
Uplift	1346.47	237.94	262.41	60° C5, Min. WS,C NA+	+0B +6+6-3-3
Max. Transverse	-1479.42	265.86	286.64	60° C5,C NA+	+0B +6+6-3-3
Max. Longitudinal	-1479.42	265.86	286.64	60° C5,C NA+	+0B +6+6-3-3



-3 Body Extension

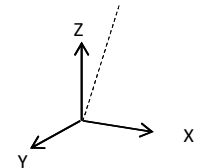
- Maximum Reactions in Leg Direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	1573.33	14.62	36.92	60° C5,C NA+	-3B -3-3+6+6
Uplift	-1453.93	5.55	35.34	60° C5, Min. WS,C NA+	-3B +6+6-3-3
Max. Transverse	468.91	77.73	13.02	60° SC1,LM&LB,C NA+	-3B -3+6+6-3
Max. Longitudinal	729.76	23.21	75.51	60° C6,C BI+	-3B -3+6+6+6



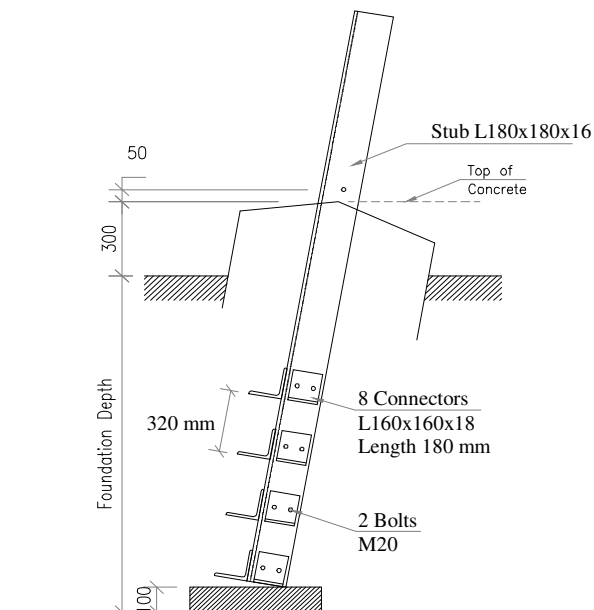
- Maximum Reactions in Global direction

Case	Axial (kN)	Transversal (kN)	Longitudinal (kN)	Load Case	Model
Compression	-1522.28	271.05	293.35	60° C5,C NA+	-3B +6+6-3-3
Uplift	1407.83	242.70	272.50	60° C5, Min. WS,C NA+	-3B +6+6-3-3
Max. Transverse	-1522.28	271.05	293.35	60° C5,C NA+	-3B +6+6-3-3
Max. Longitudinal	-1522.28	271.05	293.35	60° C5,C NA+	-3B +6+6-3-3



F-STUB DESIGN

MATERIAL PROPERTIES	Concrete: C20/25					
	Characteristic Compressive Strength	f_{ck}	MPa	20.0		
	Partial Material Factor:	γ_c		1.5		EN 50341-1:2012 (7.6.4)
	Maximum Allowable Design Stress	f_{cd}	MPa	13.3	$f_{cd} = f_{ck}/\gamma_c$	EN 1992-1-1 Eq (3.15)
	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	1730.7	Axial force for compression & uplift are increased 10 % as per B 2.5.3.4 "Employer's Requirement"
		SHEAR	V	kN	39.7	
	MAX UPLIFT	AXIAL	P	kN	1599.3	
		SHEAR	V	kN	35.8	
ANGLES	STUB		Size of Ang.	L180x180x16		
			w	mm	180	w : width of stub angle
			t	mm	16	t : thickness of stub angle
			A_g	cm ²	55.40	A_g : Gross area of stub angle
			n		2.6	n: Number of holes
			$\emptyset$	mm	21.5	$\emptyset$: Diameter of Holes
			A_n	cm ²	46.46	A_n : Net area of stub angle at the plane of the intersection with concrete
			L	mm	1220	L: Minimum Stub Length in Concrete
	ANGLE SHEAR CONNECTOR	SECTION	Size of Ang.	L160x160x18		
			w	mm	160	w : width of angle shear connector leg
			t	mm	18	t : thickness of angle shear connector
			b	mm	180.0	b : length of angle shear connector
			r	mm	17.0	r : radius of fillet
		NUMBER	#		8	
MIN STUB ANGLE AREA	Compression plus Shear:		A_a	cm ²	50.24	$A_a = \frac{P}{F_y} + \frac{V}{0.75F_y}$ ASCE 10-15 Eq (7.4-1)
	Tension plus Shear:		A_a	cm ²	46.39	
SHEAR CONNECTORS	ANGLES		x	mm	85.1	$x = t \left[\frac{F_y}{1.19f_{cd}} \right]^{1/2}$ ASCE 10-15 Eq (7.6-3)
		Capacity of one Angle Shear Connector	P	kN	221.5	$P = 1.19f_{cd}b(t + r + x/2)$ ASCE 10-15 Eq (7.6-2)
		Total Capacity of Connectors	P	kN	1772.3	
	BOLTS	Diameter	$\emptyset$	mm	20	
		Number	#		16	
		Shear Capacity of one Bolt	$F_{V,Rd}$	kN	120.64	$P = 0.6f_{ub}A/\gamma_{M2}$ Table J.3. EN50341-1:2012
CHECKS SUMMARY	STUB ANGLE (COMPRESSION + SHEAR)		cm ²	55.40	> 50.24	OK
	STUB ANGLE (TENSION + SHEAR)		cm ²	46.46	> 46.39	OK
	ANGLE SHEAR CONNECTOR		kN	1772.3	> 1730.7	OK
	CONNECTION BOLTS		kN	1930.2	> 1730.7	OK



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

