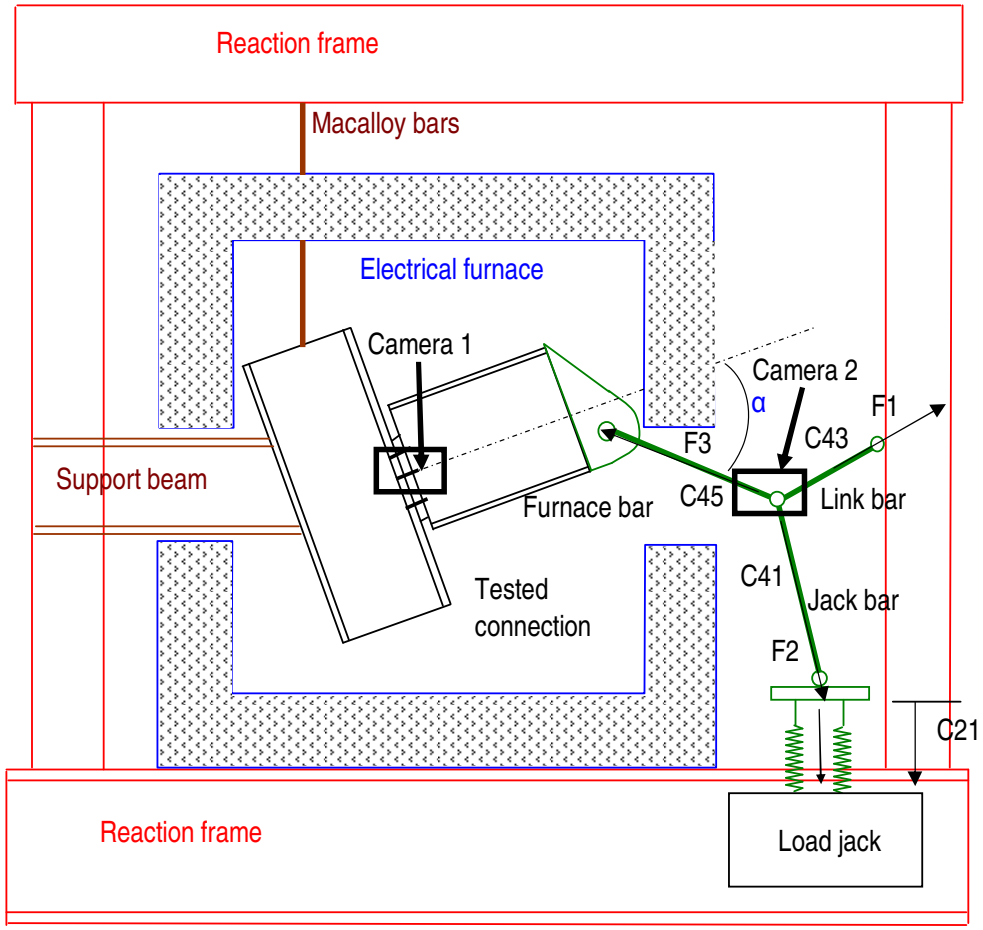
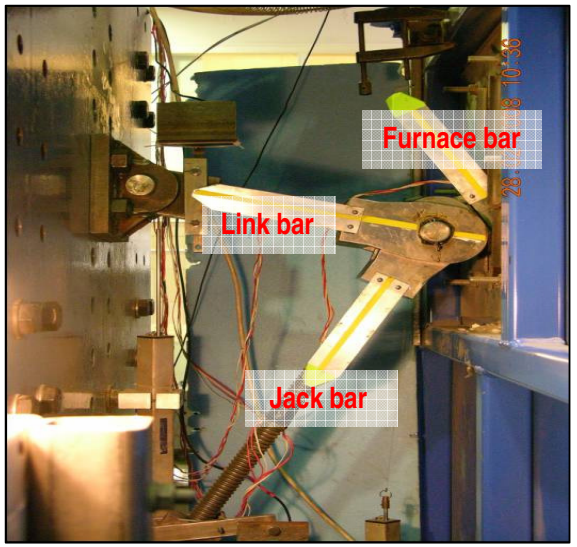
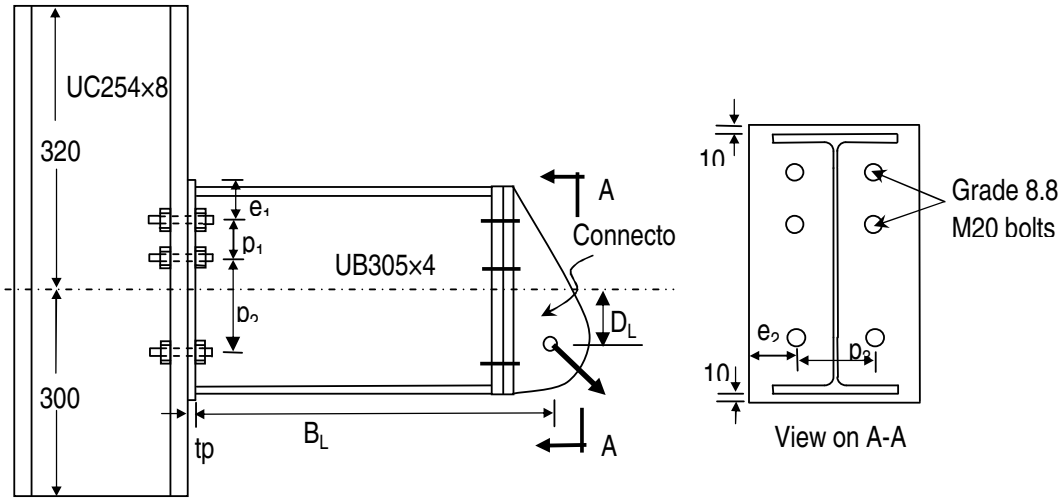

Reaction frame
Macalloy bars
Electrical furnace
Camera 1
Camera 2
α
F1
F3
C43
Support beam
Furnace bar
C45
Link bar
C41
Jack bar
Tested
connection
F2
C21
Reaction frame
Load jack


Camera 1


Furnace bar
Link bar
Jack bar



The specimen details

Diameter of bolt	d (mm)	20
Diameter of bolt hole	d_0 (mm)	22
End distance	e_1 (mm)	60
Edge distance	e_2 (mm)	55
Spacing between centres of bolts in the direction of load transfer	p_1 (mm)	70
	p_2 (mm)	133.4
Spacing between rows of bolts	p_3 (mm)	90
Thickness of end plate	t_p (mm)	8
Horizontal distance of lever arm	B_L (mm)	490
Vertical distance of lever arm	D_L (mm)	51.7

Steel Grade		S275	S355
Dimension of Members		UB305×165×40	UC254×254×89
Depth of Section	D (mm)	303.4	260.3
Width of Section	B (mm)	165	256.3
Thickness of Web	t (mm)	6	10.3
Thickness of Flange	T (mm)	10.2	17.3
Root Radius	r (mm)	8.9	12.7
Depth between Fillets	d (mm)	265.2	200.3

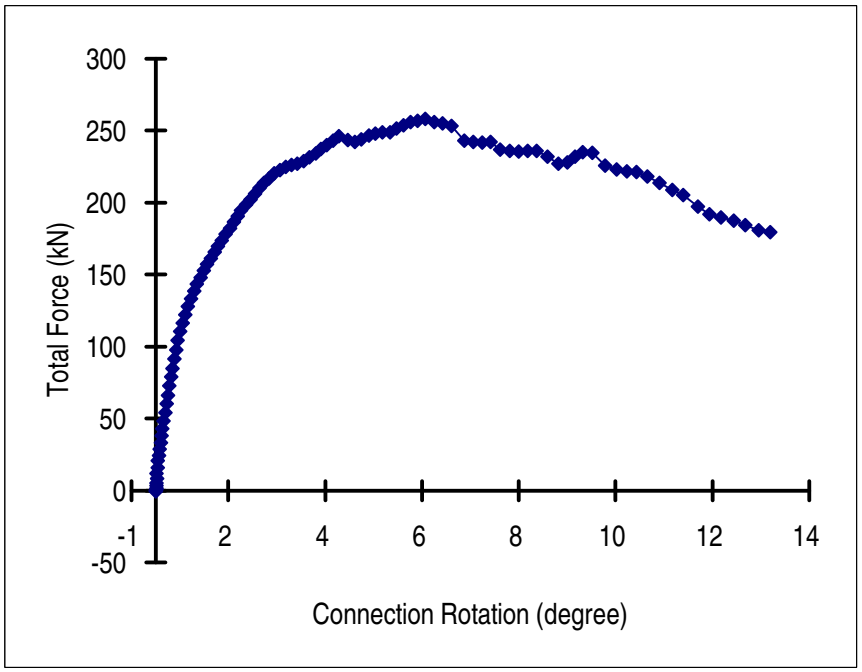
Nominal Temperature **20°C**

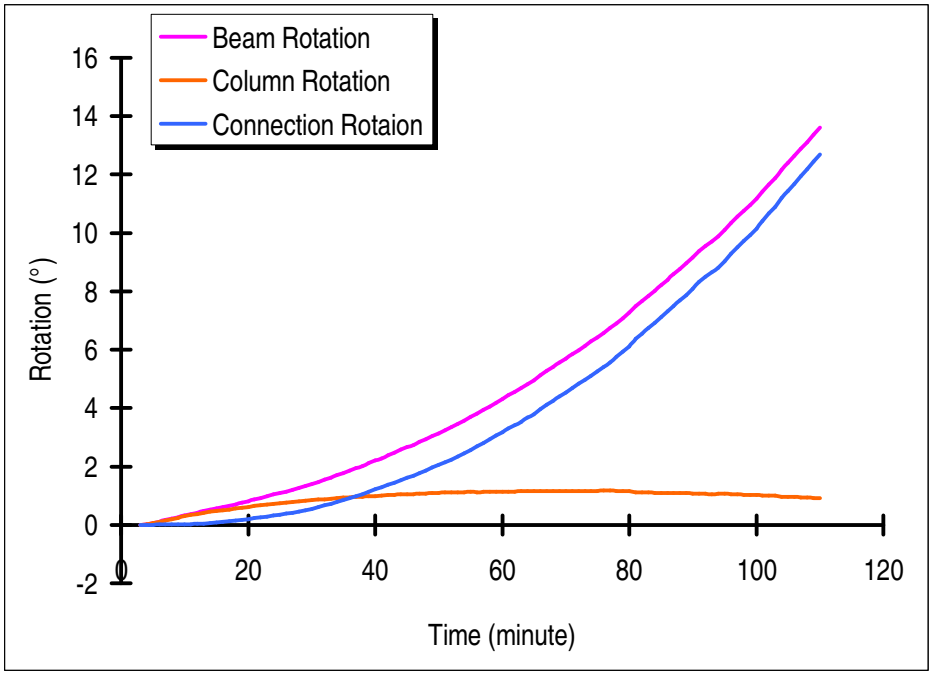
Time	Thermocouple	Jack Displacement	Load Angle	Beam Rotation	Column Rotation	Connection Rotation	Force Rotation	F3 from F1	F3 from F2	F3 from Reading	Tension	Shear	Moment
(minute)	Average(°C)	(mm)	α(°)	(°)	(°)	(°)	(°)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN*m)
0	21.287	0.028											
1	21.330	0.005											
2	21.299	0.006											
3	21.253	0.005	37.82	0.000	0.000	0.000	74.602	-0.18	-1.63	-0.76	-0.60	-0.46	-266.06
4	21.170	1.413	37.94	0.021	0.025	-0.004	74.461	0.34	-0.51	-0.38	-0.30	-0.24	-135.59
5	21.220	2.980	37.90	0.057	0.058	-0.001	74.469	0.76	-0.97	0.10	0.08	0.06	35.66
6	21.223	4.498	37.88	0.108	0.099	0.009	74.432	1.61	0.04	0.79	0.62	0.48	277.16
7	21.189	5.724	37.86	0.163	0.141	0.021	74.397	2.59	1.11	1.78	1.41	1.09	627.79
8	21.164	7.259	37.95	0.209	0.193	0.016	74.264	4.25	3.40	3.35	2.64	2.06	1181.25
9	21.161	8.725	37.91	0.267	0.247	0.020	74.251	6.33	5.05	5.33	4.21	3.28	1881.31
10	21.173	10.264	37.98	0.320	0.295	0.025	74.127	9.36	7.66	8.29	6.53	5.10	2926.93
11	21.134	11.876	38.02	0.365	0.345	0.019	74.037	13.13	12.29	11.86	9.35	7.31	4194.36
12	21.213	13.323	38.07	0.418	0.376	0.042	73.932	17.43	15.71	15.91	12.53	9.81	5630.71
13	21.152	14.790	38.20	0.468	0.420	0.047	73.753	22.18	21.07	20.49	16.10	12.67	7268.54
14	21.218	16.022	38.22	0.517	0.450	0.066	73.690	26.41	25.67	24.35	19.13	15.07	8641.07
15	21.204	17.316	38.16	0.565	0.477	0.088	73.695	30.73	29.50	28.74	22.60	17.76	10189.16
16	21.203	18.613	38.23	0.610	0.503	0.107	73.580	35.44	34.89	33.10	26.00	20.48	11748.69
17	21.205	19.927	38.23	0.657	0.530	0.127	73.538	40.40	39.76	37.98	29.84	23.50	13479.55
18	21.249	21.272	38.29	0.708	0.567	0.140	73.424	45.84	44.98	43.07	33.80	26.69	15304.81
19	21.233	22.689	38.27	0.755	0.592	0.162	73.397	51.29	50.03	48.35	37.96	29.95	17173.92
20	21.280	24.163	38.29	0.813	0.618	0.195	73.320	57.19	55.97	54.11	42.47	33.53	19226.96
21	21.268	25.660	38.31	0.875	0.644	0.231	73.243	63.53	62.20	60.17	47.21	37.29	21384.49
22	21.238	27.230	38.27	0.926	0.671	0.255	73.230	69.76	69.09	66.29	52.04	41.05	23543.65

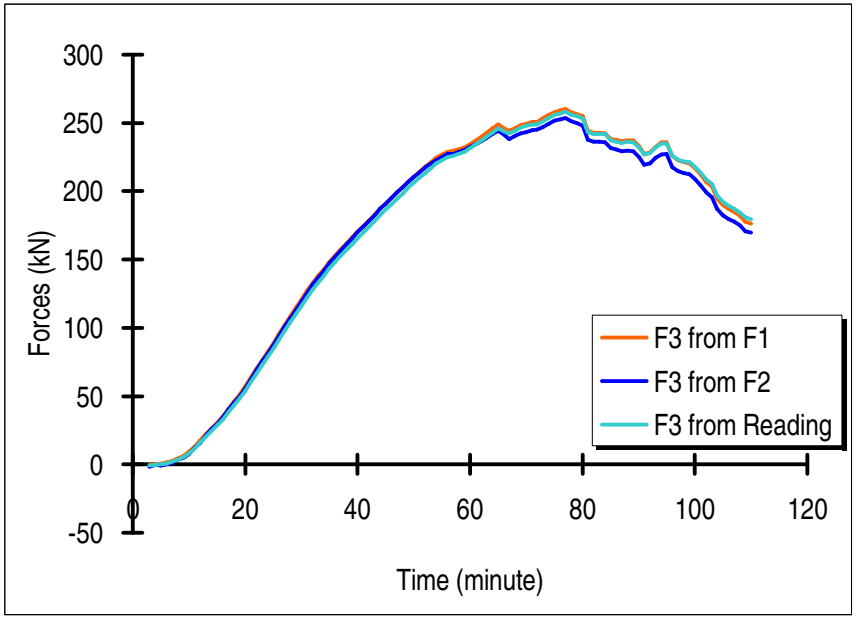
23	21.205	28.687	38.33	0.977	0.698	0.279	73.120	76.10	75.52	72.53	56.90	44.98	25789.98
24	21.198	30.138	38.33	1.042	0.720	0.321	73.055	82.46	81.36	78.75	61.78	48.84	28002.69
25	21.220	31.451	38.39	1.094	0.743	0.351	72.939	88.70	87.62	84.91	66.55	52.73	30226.68
26	21.210	32.763	38.47	1.146	0.759	0.387	72.808	95.26	93.90	91.20	71.41	56.74	32516.52
27	21.051	34.317	38.57	1.203	0.783	0.419	72.650	101.94	100.70	97.79	76.45	60.97	34929.73
28	21.004	35.830	38.51	1.266	0.811	0.454	72.646	108.36	107.10	104.13	81.48	64.84	37153.63
29	20.997	37.321	38.60	1.336	0.827	0.508	72.488	114.85	113.28	110.37	86.26	68.86	39446.47
30	21.043	38.867	38.64	1.400	0.847	0.553	72.387	121.11	119.60	116.48	90.99	72.73	41659.97
31	21.112	40.349	38.61	1.471	0.865	0.605	72.342	126.88	125.23	122.18	95.47	76.24	43675.69
32	21.114	41.933	38.58	1.544	0.878	0.666	72.302	132.63	131.64	127.83	99.93	79.71	45666.30
33	21.072	43.496	38.59	1.624	0.898	0.726	72.213	138.15	136.99	133.25	104.16	83.11	47611.22
34	21.136	44.963	38.57	1.702	0.909	0.792	72.149	143.24	141.99	138.39	108.19	86.29	49435.10
35	21.131	46.461	38.60	1.780	0.933	0.846	72.046	148.31	147.13	143.36	112.04	89.44	51234.33
36	21.112	47.981	38.55	1.866	0.944	0.922	72.013	153.05	152.04	148.07	115.81	92.27	52866.17
37	21.093	49.550	38.48	1.944	0.955	0.989	71.999	157.50	156.80	152.65	119.49	94.99	54433.70
38	21.064	51.104	38.44	2.023	0.965	1.058	71.962	161.82	161.49	157.02	122.99	97.62	55950.52
39	21.092	52.706	38.45	2.112	0.979	1.133	71.859	166.32	165.60	161.31	126.32	100.31	57492.51
40	21.132	54.204	38.36	2.208	0.985	1.222	71.852	170.31	170.01	165.48	129.75	102.71	58881.86
41	21.151	55.782	38.38	2.285	1.003	1.282	71.755	174.54	173.75	169.73	133.04	105.39	60414.75
42	21.259	57.327	38.35	2.383	1.016	1.367	71.693	178.86	178.16	173.88	136.37	107.88	61851.58
43	21.374	58.825	38.26	2.469	1.026	1.442	71.693	182.72	182.34	178.11	139.85	110.30	63252.68
44	21.448	60.387	38.18	2.572	1.039	1.533	71.669	187.13	186.86	182.32	143.31	112.71	64652.45
45	21.479	61.915	38.13	2.663	1.047	1.615	71.630	190.99	190.94	186.53	146.72	115.18	66078.37
46	21.553	63.342	38.15	2.743	1.053	1.690	71.527	195.23	195.04	190.52	149.82	117.70	67521.95
47	21.573	64.887	38.08	2.836	1.071	1.764	71.504	199.20	199.12	194.69	153.24	120.09	68906.87
48	21.630	66.352	38.00	2.935	1.071	1.863	71.491	203.00	202.99	198.50	156.42	122.20	70140.88
49	21.656	67.898	37.92	3.047	1.082	1.964	71.456	206.70	206.79	202.34	159.61	124.35	71391.35
50	21.663	69.476	37.91	3.135	1.087	2.048	71.381	210.66	210.63	206.22	162.70	126.70	72741.77
51	21.663	71.150	37.87	3.251	1.104	2.146	71.300	214.31	213.91	209.96	165.74	128.90	74013.28
52	21.687	72.632	37.87	3.349	1.109	2.240	71.203	217.98	217.38	213.52	168.55	131.08	75265.61

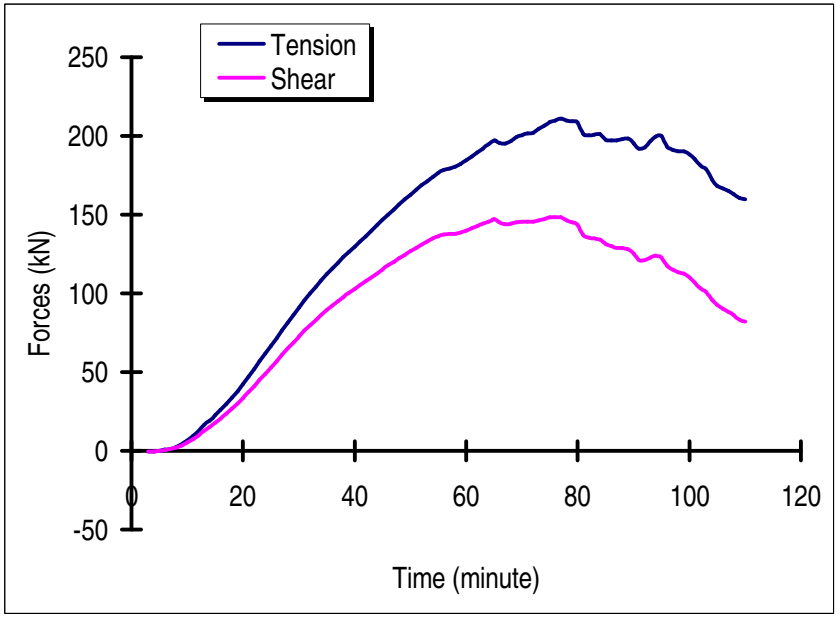
53	21.741	74.185	37.83	3.455	1.115	2.340	71.138	221.42	220.48	216.91	171.32	133.04	76402.02
54	21.792	75.778	37.80	3.565	1.121	2.443	71.061	224.61	222.72	220.25	174.03	134.99	77527.83
55	21.749	77.419	37.71	3.696	1.135	2.560	71.017	227.06	225.07	222.76	176.23	136.26	78282.25
56	21.764	78.981	37.59	3.812	1.123	2.689	71.024	228.91	227.30	225.04	178.33	137.27	78894.74
57	21.863	80.486	37.51	3.933	1.132	2.800	70.980	229.79	227.39	226.04	179.30	137.64	79127.00
58	21.829	82.121	37.35	4.059	1.136	2.922	71.017	230.47	228.64	227.24	180.65	137.86	79296.04
59	21.849	83.681	37.26	4.191	1.137	3.054	70.969	232.10	229.96	228.98	182.23	138.64	79771.09
60	21.942	85.227	37.19	4.312	1.138	3.174	70.925	234.62	232.31	231.45	184.39	139.89	80512.03
61	21.997	86.660	37.10	4.443	1.140	3.303	70.878	237.44	234.30	234.23	186.81	141.30	81342.98
62	22.017	88.213	36.95	4.562	1.145	3.416	70.915	240.03	236.95	237.28	189.63	142.62	82151.09
63	22.022	89.784	36.91	4.688	1.156	3.532	70.824	243.01	239.07	240.07	191.95	144.19	83060.51
64	22.007	91.392	36.80	4.828	1.158	3.670	70.798	245.89	241.84	243.04	194.62	145.58	83898.92
65	22.058	92.866	36.73	4.948	1.167	3.781	70.751	249.07	244.31	246.08	197.24	147.15	84824.22
66	22.028	94.490	36.57	5.120	1.151	3.968	70.735	246.31	241.35	243.60	195.64	145.13	83707.09
67	22.085	96.093	36.43	5.271	1.151	4.120	70.727	244.37	238.31	242.25	194.92	143.85	83006.42
68	22.008	97.670	36.28	5.408	1.159	4.248	70.737	246.24	240.68	244.18	196.84	144.49	83420.50
69	21.991	99.241	36.13	5.559	1.154	4.404	70.739	248.29	242.48	246.41	199.03	145.28	83922.27
70	22.004	100.827	35.98	5.694	1.154	4.540	70.754	249.40	243.08	247.88	200.60	145.61	84164.04
71	21.875	102.483	35.83	5.840	1.159	4.681	70.750	250.58	244.79	248.81	201.72	145.66	84236.52
72	21.828	104.110	35.75	5.989	1.149	4.840	70.690	251.00	244.98	248.89	202.00	145.40	84109.48
73	21.809	105.631	35.60	6.132	1.152	4.980	70.692	253.49	247.22	251.46	204.46	146.38	84726.45
74	21.749	107.105	35.50	6.277	1.164	5.113	70.649	255.79	249.35	253.66	206.51	147.29	85284.35
75	21.651	108.748	35.37	6.430	1.164	5.266	70.623	257.92	251.54	256.17	208.89	148.29	85905.25
76	21.698	110.245	35.25	6.576	1.171	5.404	70.600	259.28	252.52	257.05	209.93	148.35	85979.55
77	21.593	111.912	35.10	6.739	1.170	5.569	70.589	260.30	253.56	258.09	211.17	148.39	86052.08
78	21.634	113.376	34.89	6.912	1.158	5.754	70.618	257.89	251.19	255.98	209.95	146.44	84984.68
79	21.562	115.025	34.74	7.084	1.157	5.926	70.602	256.62	249.92	254.87	209.44	145.23	84336.84
80	21.555	116.546	34.56	7.264	1.152	6.112	70.604	254.82	247.98	253.18	208.51	143.61	83454.77
81	21.541	118.190	34.24	7.495	1.119	6.376	70.686	244.23	237.79	243.27	201.10	136.89	79651.07
82	21.493	119.702	34.06	7.673	1.118	6.554	70.688	242.86	236.22	242.00	200.48	135.55	78927.61

83	21.519	121.354	33.90	7.850	1.106	6.744	70.673	242.72	236.07	241.88	200.76	134.91	78608.50
84	21.460	123.090	33.69	8.019	1.102	6.917	70.711	242.47	235.79	242.00	201.35	134.26	78294.68
85	21.502	124.700	33.61	8.209	1.095	7.114	70.604	238.24	231.53	237.00	197.38	131.19	76535.40
86	21.491	126.360	33.43	8.403	1.090	7.313	70.589	237.79	230.64	236.11	197.04	130.09	75947.80
87	21.438	127.953	33.22	8.589	1.088	7.501	70.619	236.82	229.47	235.55	197.07	129.03	75402.86
88	21.421	129.555	33.07	8.772	1.089	7.682	70.582	237.39	229.72	236.06	197.82	128.81	75320.23
89	21.424	131.164	32.88	8.954	1.091	7.863	70.595	237.30	229.32	235.99	198.19	128.10	74964.81
90	21.440	132.750	32.63	9.169	1.076	8.093	70.626	232.81	224.88	231.88	195.29	125.03	73251.70
91	21.410	134.447	32.31	9.382	1.061	8.321	70.728	227.37	219.55	226.99	191.83	121.34	71188.53
92	21.399	135.954	32.14	9.564	1.064	8.499	70.723	228.33	220.43	227.78	192.88	121.17	71146.78
93	21.374	137.619	31.98	9.719	1.055	8.663	70.727	232.73	224.50	231.91	196.72	122.82	72169.38
94	21.389	139.213	31.85	9.890	1.075	8.815	70.686	235.77	226.97	234.87	199.51	123.93	72867.66
95	21.372	140.862	31.57	10.092	1.071	9.021	70.767	235.76	227.31	234.84	200.10	122.93	72375.38
96	21.390	142.600	31.29	10.343	1.055	9.287	70.793	226.00	217.60	225.91	193.06	117.33	69168.05
97	21.448	144.193	31.03	10.555	1.037	9.518	70.837	222.80	214.73	222.94	191.03	114.93	67839.17
98	21.410	145.844	30.79	10.761	1.033	9.728	70.872	221.21	213.31	221.68	190.43	113.48	67065.89
99	21.417	147.406	30.58	10.968	1.032	9.936	70.874	220.50	212.39	221.10	190.34	112.49	66548.32
100	21.446	149.022	30.33	11.187	1.030	10.157	70.912	217.03	209.14	218.12	188.27	110.13	65237.74
101	21.459	150.615	30.01	11.421	1.008	10.413	70.990	212.37	204.32	213.93	185.24	107.00	63490.50
102	21.463	152.306	29.65	11.662	0.996	10.666	71.111	206.89	199.24	208.85	181.50	103.32	61424.45
103	21.406	153.884	29.41	11.886	0.996	10.890	71.127	203.26	195.33	205.34	178.87	100.84	60024.75
104	21.402	155.645	29.09	12.160	0.963	11.197	71.178	194.77	187.06	197.12	172.26	95.83	57144.49
105	21.378	157.327	28.80	12.400	0.956	11.444	71.222	189.67	182.24	192.05	168.30	92.53	55266.87
106	21.353	159.058	28.45	12.636	0.954	11.682	71.334	187.10	179.77	189.61	166.70	90.34	54067.77
107	21.397	160.740	28.14	12.877	0.940	11.937	71.406	184.77	177.85	187.29	165.15	88.33	52963.95
108	21.387	162.507	27.81	13.114	0.932	12.182	71.499	181.84	175.04	184.49	163.18	86.07	51712.85
109	21.405	164.143	27.49	13.377	0.921	12.456	71.562	177.90	170.85	180.80	160.40	83.44	50234.26
110	21.426	165.800	27.19	13.606	0.911	12.695	71.631	176.46	169.67	179.39	159.57	81.96	49435.12


300
250
200
150
100
50
0
-50
-1
2
4
6
8
10
12
14
Total Force (kN)
Connection Rotation (degree)


Beam Rotation
Column Rotation
Connection Rotaion
16
14
12
10
8
6
4
2
0
-2
0
20
40
60
80
100
120
Rotation (°)
Time (minute)


300
250
200
150
100
50
0
-50
Forces (kN)
0
20
40
60
80
100
120
Time (minute)
F3 from F1
F3 from F2
F3 from Reading


250
200
150
100
50
0
-50
Forces (kN)
0
20
40
60
80
100
120
Time (minute)
Tension
Shear

Photographs after Test