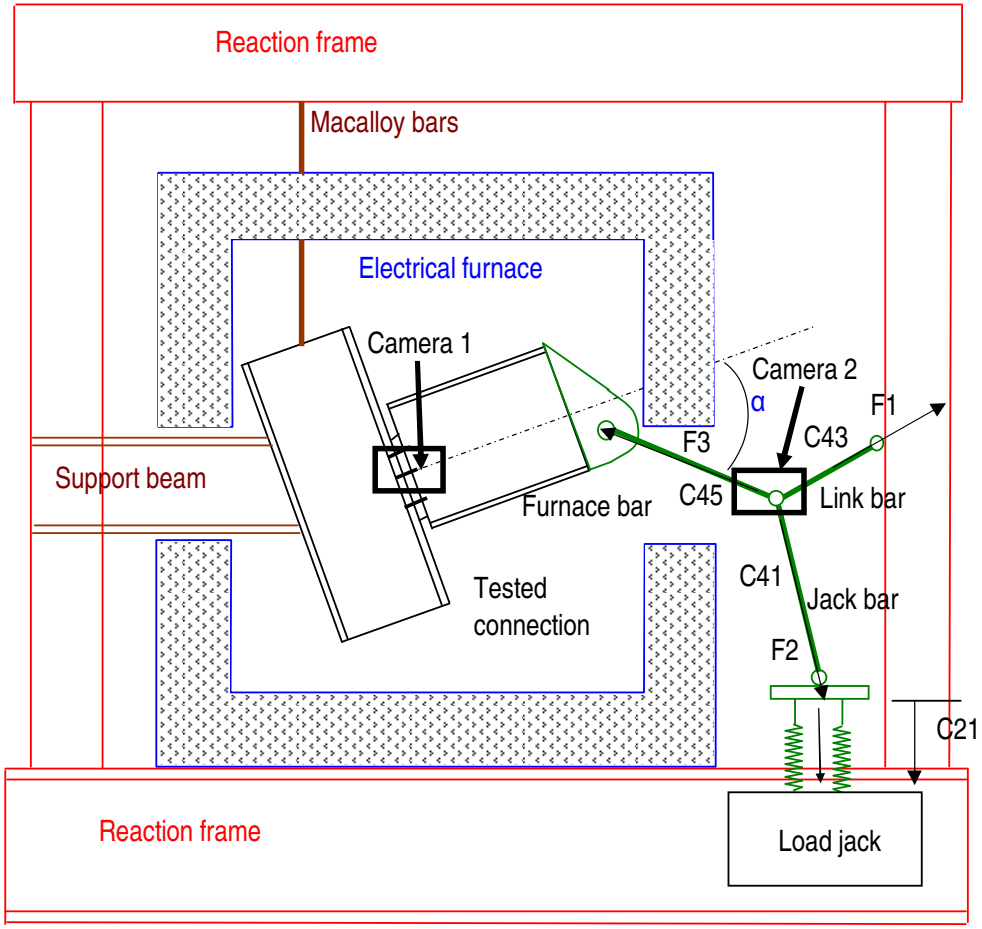
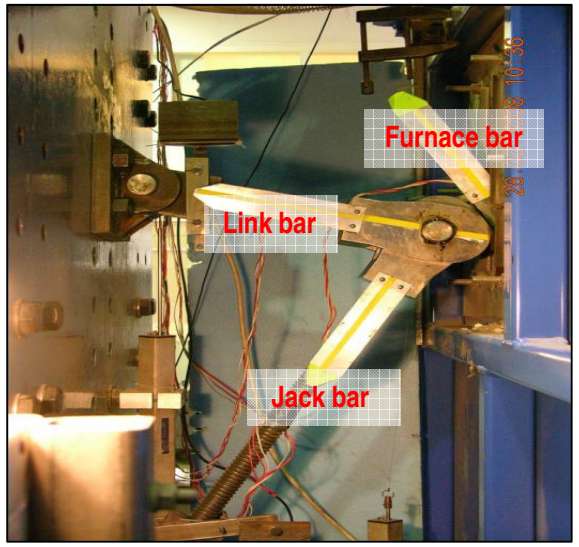
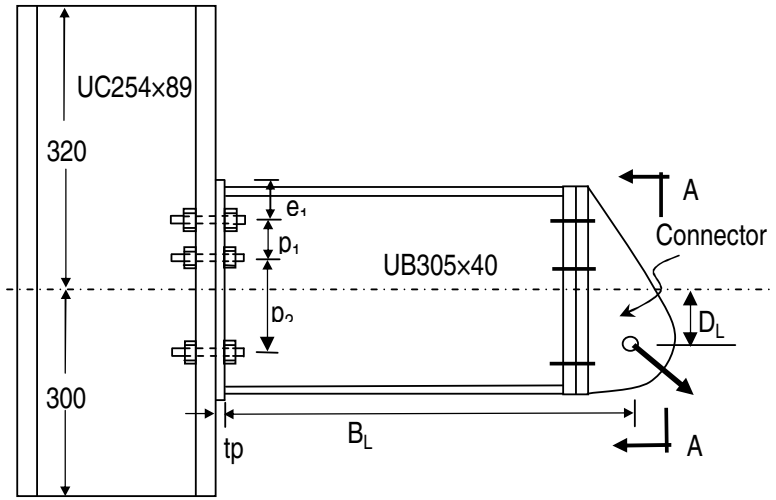
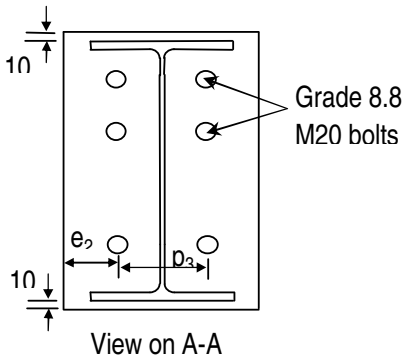
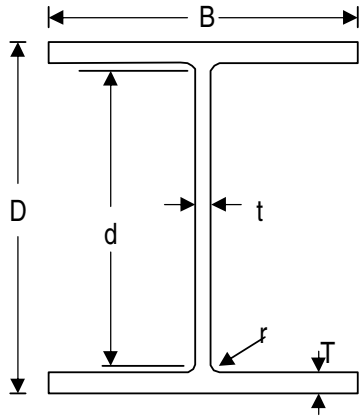

Reaction frame
Macalloy bars
Electrical furnace
Camera 1
Camera 2
α
F1
F3
C43
Support beam
Furnace bar
C45
Link bar
C41
Jack bar
Tested
connection
F2
C21
Reaction frame
Load jack


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)	10
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

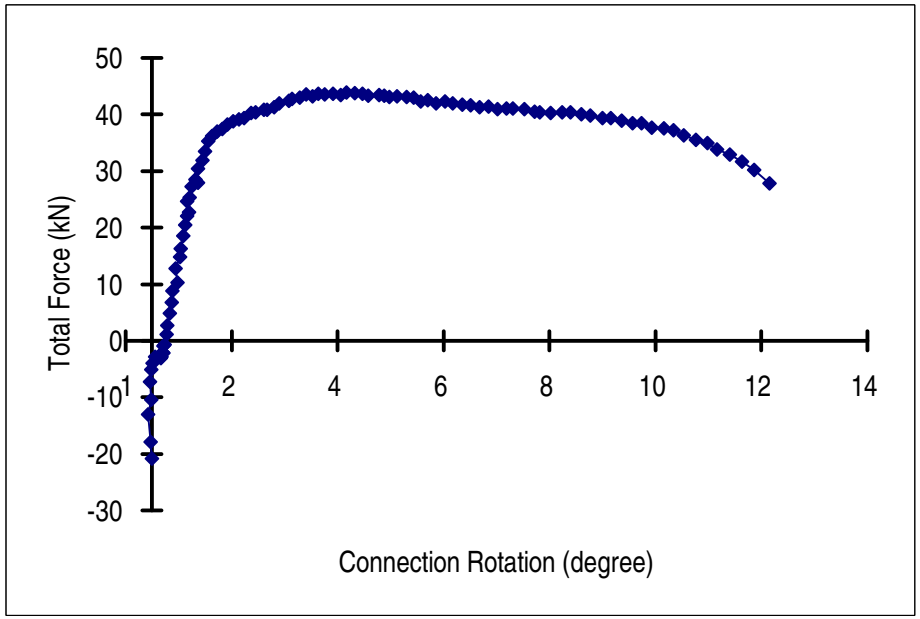
Nominal Temperature **650°C**

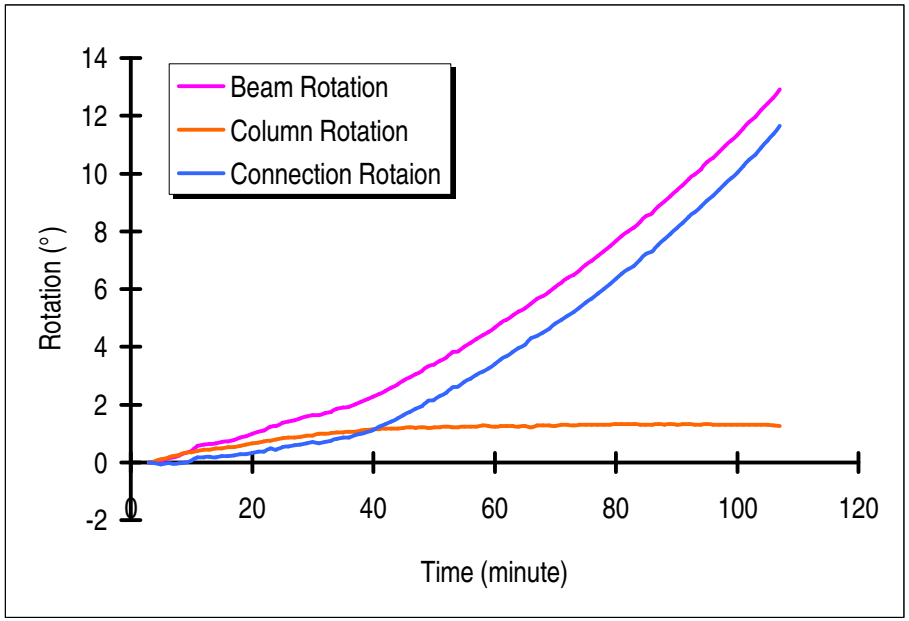
Time	Thermocouple	Jack Displacement	Load Angle	Beam Rotation	Column Rotation	Connection Rotation	Force Rotation	F3 from F1	F3 from F2	F3 Average	Tension	Shear	Moment
(minute)	Average(°C)	(mm)	α(°)	(°)	(°)	(°)	(°)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN*m)
0	649.750	2.141											
1	649.866	2.151											
2	649.856	2.161											
3	650.024	2.164	43.25	0.000	0.000	0.000	71.186	-23.46	-18.30	-20.88	-15.21	-14.31	-8090.73
4	650.085	3.561	43.32	0.014	0.038	-0.024	71.108	-19.53	-16.27	-17.90	-13.02	-12.28	-6943.07
5	650.022	5.267	43.28	0.034	0.107	-0.073	71.128	-14.70	-11.40	-13.05	-9.50	-8.95	-5057.90
6	650.140	6.869	43.22	0.125	0.143	-0.018	71.089	-11.28	-9.50	-10.39	-7.57	-7.12	-4025.50
7	650.107	8.464	43.25	0.164	0.209	-0.045	71.021	-8.30	-6.27	-7.29	-5.31	-4.99	-2823.57
8	650.164	10.078	43.22	0.241	0.261	-0.020	70.980	-5.83	-4.47	-5.15	-3.75	-3.52	-1993.06
9	650.232	11.612	43.18	0.324	0.319	0.005	70.931	-4.15	-3.79	-3.97	-2.89	-2.72	-1536.39
10	650.221	13.197	43.16	0.396	0.342	0.054	70.880	-3.24	-2.49	-2.86	-2.09	-1.96	-1107.26
11	650.404	14.804	43.03	0.563	0.400	0.163	70.842	-2.88	-3.27	-3.08	-2.25	-2.10	-1187.74
12	650.357	16.484	42.98	0.610	0.430	0.180	70.847	-2.51	-3.12	-2.82	-2.06	-1.92	-1087.05
13	650.422	18.114	42.76	0.635	0.436	0.199	71.040	-2.18	-2.00	-2.09	-1.53	-1.42	-803.05
14	650.499	19.608	42.73	0.666	0.484	0.182	71.041	-2.10	-2.54	-2.32	-1.70	-1.57	-891.16
15	650.442	21.075	43.08	0.698	0.483	0.215	70.662	-1.93	-2.37	-2.15	-1.57	-1.47	-830.09
16	650.589	22.538	43.13	0.733	0.519	0.214	70.580	-1.16	-0.63	-0.89	-0.65	-0.61	-344.91
17	650.606	23.739	43.13	0.769	0.528	0.241	70.543	-0.45	-0.98	-0.71	-0.52	-0.49	-276.09
18	650.593	25.116	43.10	0.855	0.576	0.279	70.487	1.00	1.26	1.13	0.82	0.77	435.78
19	650.640	26.597	43.10	0.906	0.618	0.288	70.436	2.67	2.69	2.68	1.96	1.83	1036.27
20	650.587	28.135	43.06	0.987	0.653	0.334	70.394	4.80	5.01	4.91	3.59	3.35	1895.27
21	650.661	29.639	43.02	1.058	0.688	0.370	70.363	6.97	6.51	6.74	4.93	4.60	2600.94
22	650.783	31.297	42.99	1.108	0.730	0.378	70.338	8.80	8.76	8.78	6.42	5.99	3388.36

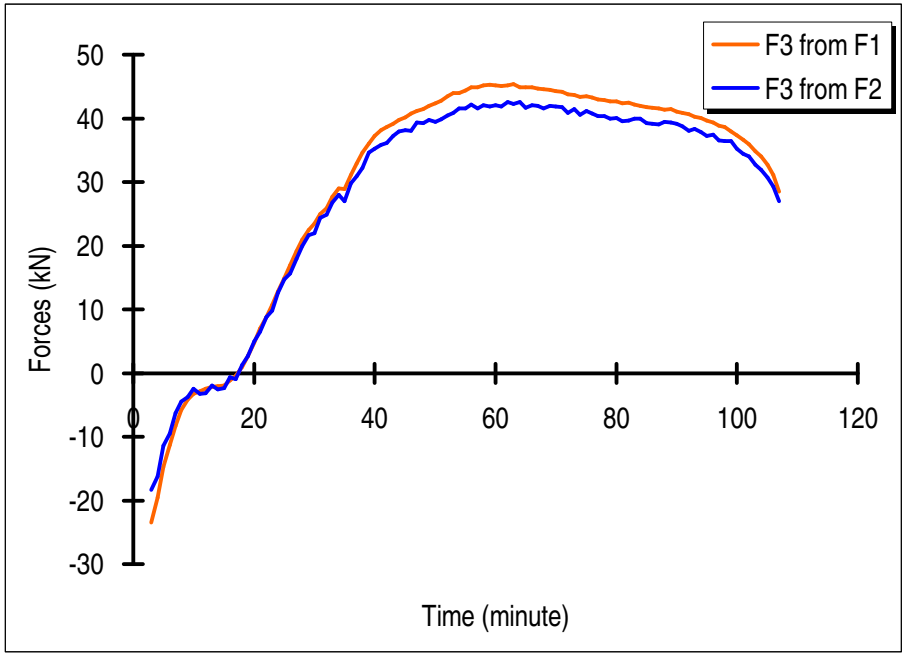
23	650.734	32.882	42.93	1.230	0.752	0.478	70.277	10.72	9.79	10.26	7.51	6.99	3953.03
24	650.935	34.492	42.97	1.249	0.801	0.448	70.218	12.82	12.63	12.73	9.31	8.67	4908.21
25	650.817	36.077	42.89	1.358	0.827	0.531	70.195	14.92	14.68	14.80	10.84	10.07	5700.33
26	650.929	37.542	42.88	1.403	0.858	0.545	70.159	16.92	15.64	16.28	11.93	11.08	6269.82
27	650.912	39.168	42.85	1.459	0.866	0.593	70.129	19.14	17.90	18.52	13.58	12.59	7127.92
28	650.850	40.706	42.81	1.516	0.890	0.626	70.111	20.93	19.98	20.46	15.01	13.90	7868.95
29	651.038	42.068	42.73	1.587	0.923	0.664	70.118	22.41	21.70	22.06	16.20	14.97	8474.57
30	650.968	43.324	42.74	1.627	0.929	0.698	70.070	23.50	22.01	22.75	16.71	15.44	8742.37
31	650.993	44.685	42.75	1.637	0.982	0.655	70.049	24.98	24.38	24.68	18.12	16.75	9485.43
32	651.076	45.959	42.72	1.702	0.994	0.708	70.016	25.87	24.90	25.38	18.65	17.22	9750.64
33	651.107	47.336	42.73	1.754	1.011	0.743	69.958	27.67	26.83	27.25	20.02	18.49	10468.27
34	651.348	48.681	42.64	1.866	1.047	0.819	69.930	29.01	28.02	28.52	20.98	19.32	10939.40
35	651.241	49.785	42.67	1.890	1.031	0.859	69.881	28.85	27.03	27.94	20.55	18.94	10723.73
36	651.190	51.243	42.68	1.919	1.056	0.863	69.842	31.06	29.77	30.41	22.36	20.62	11673.86
37	651.284	52.644	42.60	2.004	1.059	0.945	69.833	32.96	30.94	31.95	23.52	21.63	12248.42
38	651.229	54.238	42.52	2.108	1.111	0.997	69.806	34.64	32.23	33.43	24.64	22.60	12801.54
39	651.435	55.855	42.50	2.185	1.128	1.057	69.751	36.01	34.63	35.32	26.04	23.86	13518.33
40	651.414	57.368	42.47	2.268	1.140	1.128	69.702	37.19	35.25	36.22	26.72	24.45	13854.24
41	651.451	58.986	42.40	2.376	1.149	1.227	69.662	38.10	35.87	36.98	27.31	24.94	14131.78
42	651.594	60.579	42.32	2.483	1.160	1.323	69.638	38.67	36.15	37.41	27.66	25.19	14275.57
43	651.507	62.300	42.28	2.589	1.165	1.424	69.570	39.15	37.21	38.18	28.25	25.69	14560.46
44	651.674	63.902	42.20	2.699	1.170	1.529	69.540	39.70	37.95	38.83	28.76	26.08	14785.95
45	651.707	65.400	42.11	2.824	1.189	1.635	69.506	40.20	38.16	39.18	29.07	26.27	14897.91
46	651.806	66.976	42.05	2.944	1.209	1.735	69.446	40.75	38.09	39.42	29.27	26.40	14974.28
47	652.008	68.563	41.96	3.064	1.199	1.865	69.411	41.11	39.32	40.22	29.90	26.89	15255.00
48	651.887	70.140	41.94	3.161	1.208	1.953	69.333	41.46	39.23	40.34	30.01	26.97	15299.05
49	652.073	71.773	41.84	3.315	1.201	2.114	69.285	41.97	39.73	40.85	30.43	27.25	15462.19
50	652.046	73.311	41.79	3.392	1.224	2.168	69.252	42.32	39.46	40.89	30.48	27.25	15465.29
51	651.939	74.945	41.69	3.515	1.215	2.300	69.230	42.77	39.83	41.30	30.84	27.47	15595.67
52	652.067	76.570	41.62	3.637	1.234	2.403	69.183	43.47	40.42	41.94	31.36	27.86	15817.55

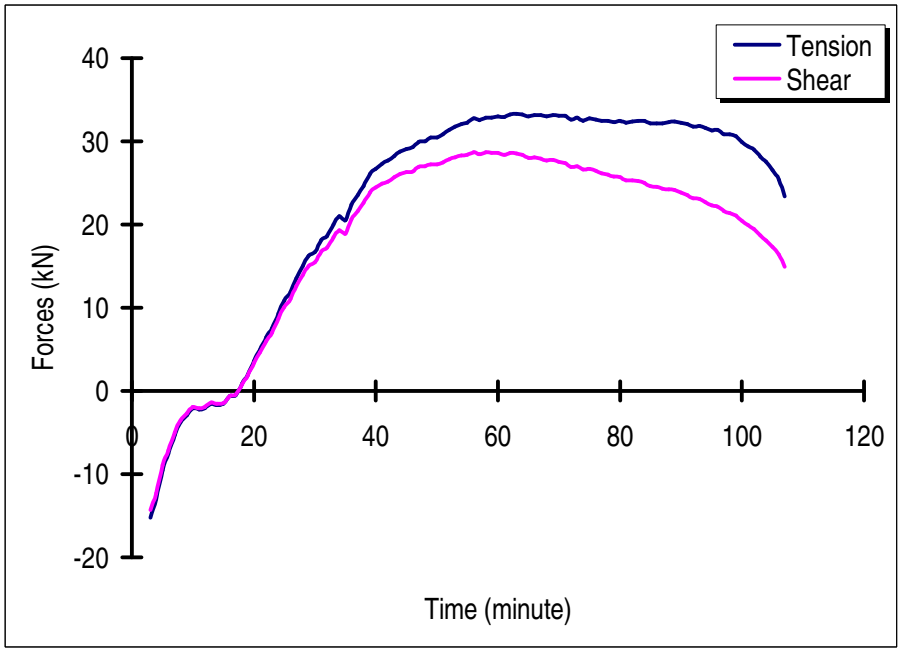
53	652.023	78.131	41.48	3.806	1.223	2.583	69.152	43.92	40.85	42.39	31.76	28.08	15948.08
54	652.165	79.859	41.47	3.856	1.221	2.635	69.115	44.01	41.56	42.79	32.06	28.33	16094.12
55	652.225	81.543	41.34	4.013	1.229	2.784	69.084	44.40	41.54	42.97	32.26	28.38	16127.33
56	652.177	83.150	41.25	4.149	1.244	2.905	69.041	44.90	42.18	43.54	32.73	28.71	16316.44
57	652.331	84.745	41.18	4.268	1.244	3.024	68.989	44.91	41.57	43.24	32.55	28.47	16186.32
58	652.315	86.418	41.08	4.410	1.270	3.140	68.944	45.15	42.07	43.61	32.87	28.66	16296.69
59	652.350	87.957	41.02	4.509	1.249	3.260	68.910	45.27	41.87	43.57	32.87	28.59	16262.85
60	652.415	89.637	40.91	4.662	1.244	3.418	68.869	45.19	42.10	43.65	32.99	28.58	16260.88
61	652.346	91.151	40.78	4.830	1.265	3.565	68.831	45.03	41.82	43.43	32.89	28.36	16142.86
62	652.440	92.760	40.72	4.932	1.265	3.667	68.785	45.20	42.59	43.89	33.27	28.64	16300.17
63	652.371	94.346	40.59	5.086	1.257	3.829	68.766	45.36	42.29	43.82	33.28	28.51	16235.44
64	652.605	96.004	40.48	5.214	1.246	3.968	68.749	44.88	42.53	43.70	33.24	28.37	16159.48
65	652.689	97.597	40.38	5.329	1.251	4.078	68.734	44.89	41.68	43.28	32.97	28.04	15976.01
66	652.580	99.223	40.24	5.490	1.207	4.283	68.705	44.83	42.11	43.47	33.18	28.08	16006.86
67	652.649	100.888	40.09	5.666	1.283	4.383	68.679	44.64	42.00	43.32	33.14	27.90	15910.28
68	652.687	102.448	40.04	5.764	1.282	4.482	68.631	44.59	41.60	43.10	32.99	27.73	15813.18
69	652.707	104.060	39.93	5.911	1.289	4.622	68.598	44.49	41.93	43.21	33.13	27.73	15822.86
70	652.829	105.780	39.78	6.070	1.263	4.807	68.584	44.30	41.87	43.09	33.11	27.57	15737.11
71	652.748	107.405	39.67	6.222	1.292	4.930	68.548	44.19	41.72	42.96	33.07	27.42	15656.46
72	652.870	109.064	39.55	6.370	1.306	5.064	68.523	43.78	40.86	42.32	32.63	26.94	15390.36
73	652.892	110.745	39.42	6.493	1.286	5.207	68.529	43.64	41.46	42.55	32.87	27.02	15437.68
74	652.853	112.235	39.29	6.651	1.294	5.357	68.498	43.37	40.58	41.97	32.49	26.58	15193.40
75	652.983	113.892	39.11	6.836	1.304	5.532	68.488	43.42	41.11	42.27	32.80	26.67	15251.45
76	652.885	115.574	38.99	6.982	1.310	5.672	68.471	43.22	40.79	42.01	32.65	26.43	15120.07
77	653.002	117.208	38.83	7.145	1.295	5.850	68.459	42.98	40.39	41.68	32.47	26.14	14962.77
78	653.007	118.769	38.70	7.311	1.306	6.005	68.427	42.89	40.37	41.63	32.49	26.03	14906.80
79	652.951	120.347	38.53	7.487	1.312	6.175	68.424	42.69	39.95	41.32	32.32	25.74	14746.72
80	653.012	121.884	38.35	7.671	1.323	6.348	68.416	42.70	40.10	41.40	32.47	25.69	14727.72
81	653.025	123.453	38.16	7.841	1.318	6.523	68.433	42.39	39.58	40.99	32.22	25.33	14527.77
82	653.033	124.983	38.00	8.005	1.317	6.688	68.433	42.43	39.69	41.06	32.36	25.28	14509.24

83	653.093	126.703	37.88	8.118	1.314	6.804	68.439	42.17	39.99	41.08	32.42	25.22	14483.13
84	653.033	128.418	37.64	8.335	1.312	7.023	68.466	41.96	39.96	40.96	32.44	25.01	14374.23
85	653.066	129.985	37.46	8.518	1.298	7.220	68.461	41.77	39.22	40.49	32.14	24.63	14160.79
86	653.035	131.653	37.34	8.628	1.310	7.318	68.467	41.69	39.18	40.43	32.15	24.53	14108.35
87	653.232	133.276	37.11	8.849	1.324	7.525	68.476	41.57	39.00	40.29	32.13	24.31	13993.45
88	653.328	135.007	36.90	9.046	1.312	7.734	68.495	41.38	39.43	40.41	32.32	24.26	13976.29
89	653.207	136.592	36.72	9.214	1.317	7.897	68.506	41.44	39.32	40.38	32.37	24.14	13917.15
90	653.321	138.267	36.51	9.414	1.311	8.103	68.514	41.02	39.17	40.10	32.23	23.86	13762.46
91	653.236	139.901	36.31	9.594	1.320	8.274	68.530	40.81	38.78	39.80	32.07	23.57	13605.99
92	653.312	141.406	36.07	9.814	1.320	8.494	68.552	40.64	38.05	39.34	31.80	23.17	13385.12
93	653.375	143.151	35.91	9.968	1.310	8.658	68.562	40.26	38.39	39.32	31.85	23.06	13332.93
94	653.339	144.825	35.70	10.154	1.295	8.859	68.584	40.00	37.87	38.93	31.62	22.72	13145.19
95	653.432	146.436	35.44	10.385	1.316	9.069	68.615	39.61	37.22	38.41	31.30	22.27	12898.86
96	653.363	148.156	35.26	10.548	1.311	9.237	68.630	39.37	37.46	38.42	31.37	22.18	12852.09
97	653.367	149.727	35.03	10.732	1.300	9.432	68.672	38.89	36.50	37.69	30.86	21.64	12551.61
98	653.368	151.430	34.78	10.968	1.309	9.659	68.690	38.67	36.43	37.55	30.84	21.42	12437.05
99	653.317	153.073	34.58	11.151	1.307	9.844	68.707	37.97	36.40	37.18	30.61	21.10	12261.95
100	653.464	154.690	34.34	11.343	1.310	10.033	68.752	37.31	35.21	36.26	29.94	20.46	11897.24
101	653.449	156.243	34.09	11.563	1.305	10.258	68.789	36.62	34.38	35.50	29.40	19.89	11582.96
102	653.459	157.917	33.83	11.780	1.300	10.480	68.833	35.89	34.02	34.95	29.04	19.46	11340.82
103	653.539	159.437	33.61	11.961	1.300	10.661	68.868	34.80	32.76	33.78	28.13	18.70	10908.25
104	653.442	161.111	33.32	12.200	1.299	10.901	68.920	34.01	31.92	32.96	27.54	18.11	10575.74
105	653.557	162.801	33.06	12.424	1.291	11.133	68.959	32.70	30.68	31.69	26.56	17.29	10108.58
106	653.455	164.530	32.82	12.631	1.273	11.358	68.983	31.07	29.32	30.19	25.37	16.37	9580.22
107	653.517	166.348	32.51	12.909	1.259	11.650	69.018	28.51	27.03	27.77	23.42	14.92	8747.80


Total Force (kN)
50
40
30
20
10
0
-10
-20
-30
1
2
4
6
8
10
12
14
Connection Rotation (degree)


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


F3 from F1
F3 from F2
50
40
30
20
10
0
-10
-20
-30
Forces (kN)
0
20
40
60
80
100
120
Time (minute)


Tension
Shear
40
30
20
10
0
-10
-20
Forces (kN)
0
20
40
60
80
100
120
Time (minute)

Photographs after Test