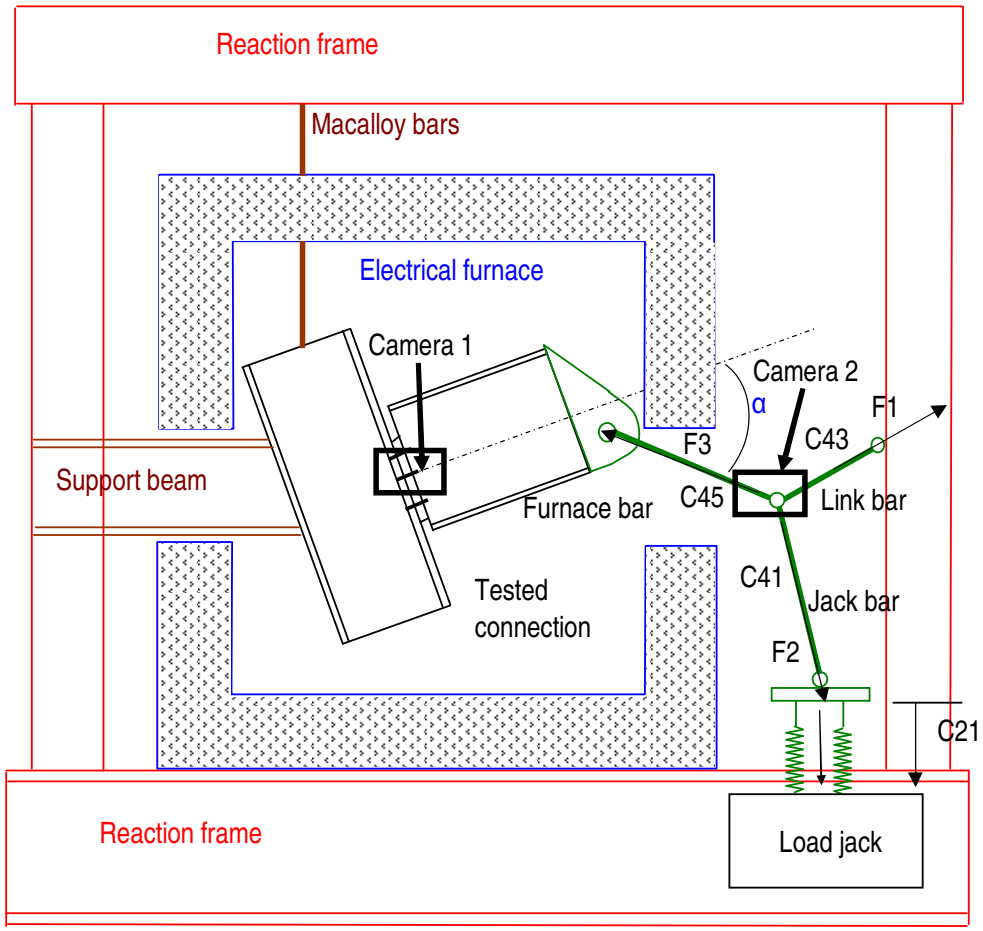
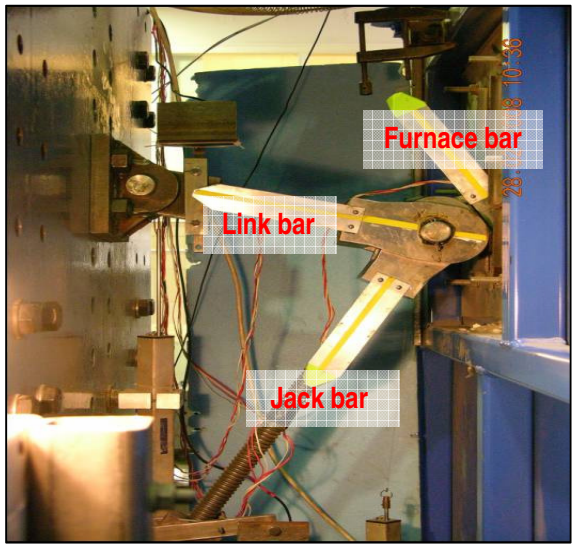
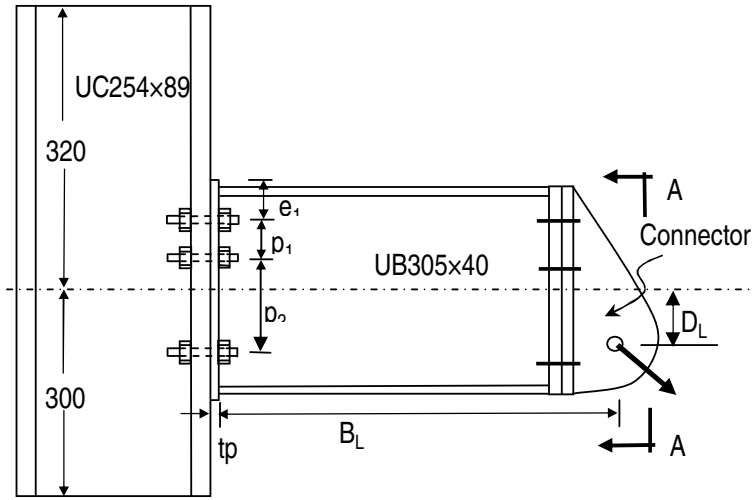
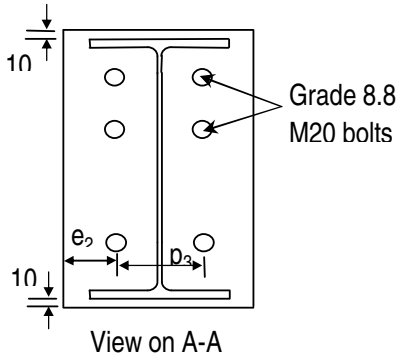

Reaction frame
Macalloy bars
Electrical furnace
Camera 1
Camera 2
α
F1
F3
C43
Support beam
Furnace bar
C45
Link bar
C41
Jack bar
Tested
connection
F2
C21
Reaction frame
Load jack

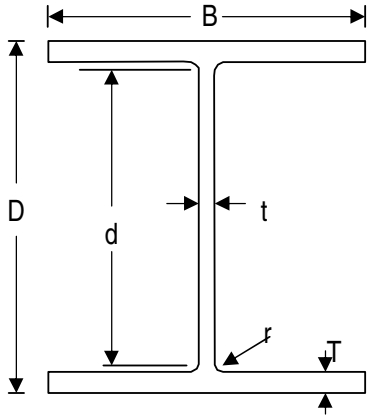

Camera 1


Furnace bar
Link bar
Jack bar





View on A-A



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

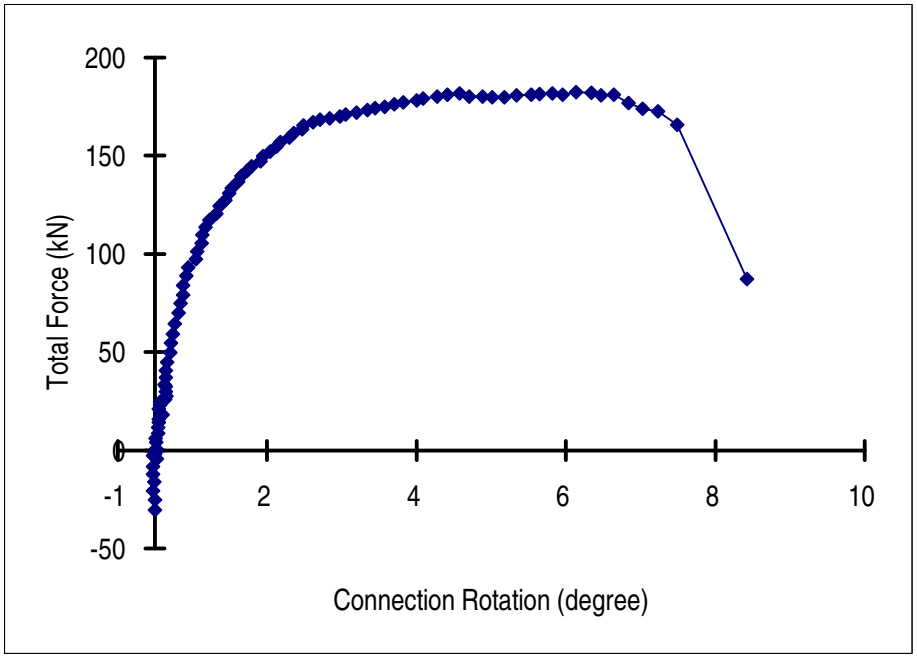
Nominal Temperature **450°C**

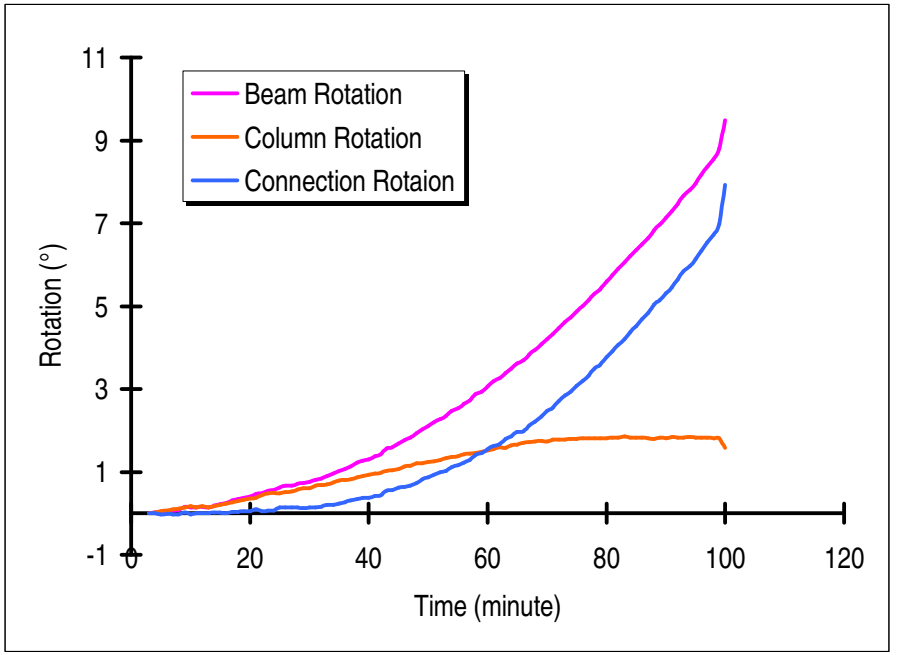
Time	Thermocouple	Jack Displacement	Load Angle	Beam Rotation	Column Rotation	Connection Rotation	Force Rotation	F3 from F1	F3 from F2	F3 Average	Tension	Shear	Moment
(minute)	Average(°C)	(mm)	α(°)	(°)	(°)	(°)	(°)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN*m)
0	440.759	0.797											
1	440.878	0.804											
2	441.047	0.806											
3	441.173	0.807	40.46	0.000	0.000	0.000	73.519	-34.01	-26.78	-30.39	-23.12	-19.72	-11236.36
4	441.263	2.086	40.54	0.027	0.026	0.001	73.421	-28.51	-22.27	-25.39	-19.29	-16.50	-9397.60
5	441.412	3.543	40.61	0.017	0.046	-0.028	73.355	-22.69	-18.33	-20.51	-15.57	-13.35	-7601.32
6	441.420	5.071	40.63	0.049	0.063	-0.014	73.302	-17.95	-14.37	-16.16	-12.26	-10.52	-5991.72
7	441.530	6.702	40.70	0.059	0.090	-0.031	73.228	-13.41	-10.93	-12.17	-9.23	-7.94	-4518.64
8	441.621	8.317	40.73	0.084	0.112	-0.028	73.165	-9.03	-7.53	-8.28	-6.27	-5.40	-3075.70
9	441.736	9.921	40.74	0.159	0.138	0.021	73.082	-5.33	-3.18	-4.25	-3.22	-2.78	-1580.59
10	441.899	11.619	40.85	0.140	0.167	-0.027	72.994	-3.03	-2.43	-2.73	-2.06	-1.79	-1015.88
11	441.940	13.169	40.94	0.145	0.148	-0.003	72.901	-2.79	-1.12	-1.96	-1.48	-1.28	-730.05
12	442.004	14.804	41.16	0.165	0.168	-0.002	72.663	-2.10	-0.56	-1.33	-1.00	-0.88	-498.39
13	442.117	16.319	41.16	0.150	0.147	0.003	72.67	-1.16	-0.94	-1.05	-0.79	-0.69	-392.78
14	442.205	17.775	41.19	0.189	0.174	0.016	72.6	0.60	1.18	0.89	0.67	0.59	333.39
15	442.331	19.422	41.25	0.222	0.206	0.016	72.514	3.21	4.73	3.97	2.99	2.62	1488.67
16	442.461	21.040	41.29	0.247	0.240	0.008	72.443	5.69	6.36	6.02	4.52	3.97	2258.73
17	442.551	22.684	41.32	0.310	0.271	0.039	72.355	8.22	9.00	8.61	6.47	5.68	3230.79
18	442.649	24.261	41.36	0.340	0.298	0.041	72.286	10.82	12.22	11.52	8.65	7.61	4326.80
19	442.717	25.780	41.40	0.378	0.330	0.048	72.207	13.33	14.80	14.07	10.55	9.30	5285.13
20	442.776	27.305	41.44	0.410	0.364	0.046	72.129	15.60	16.08	15.84	11.87	10.48	5955.34
21	442.927	28.801	41.42	0.474	0.378	0.096	72.085	17.94	18.52	18.23	13.67	12.06	6850.90
22	443.061	30.332	41.41	0.478	0.431	0.047	72.093	20.47	21.76	21.12	15.84	13.97	7935.67

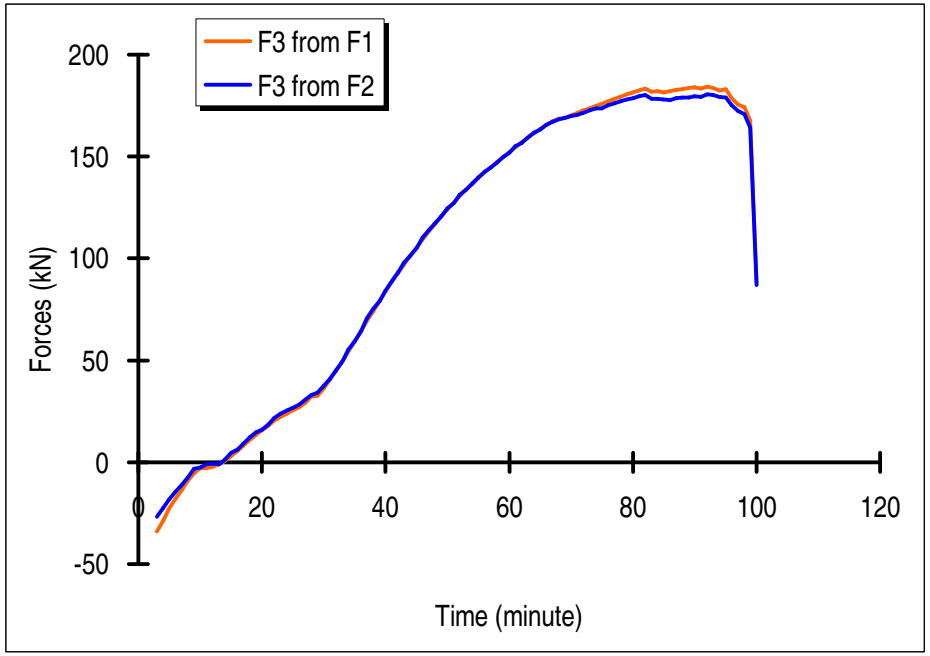
23	443.154	31.750	41.41	0.541	0.478	0.063	72.033	22.22	23.81	23.01	17.26	15.22	8648.33
24	443.276	32.972	41.42	0.563	0.499	0.064	71.998	23.95	25.53	24.74	18.55	16.37	9298.95
25	443.314	33.971	41.41	0.616	0.481	0.136	71.959	25.31	26.78	26.04	19.53	17.23	9787.42
26	443.352	35.073	41.36	0.663	0.514	0.150	71.963	26.87	28.14	27.50	20.64	18.17	10326.38
27	443.479	36.305	41.42	0.675	0.533	0.142	71.886	29.25	30.77	30.01	22.50	19.85	11279.00
28	443.621	37.587	41.44	0.719	0.577	0.142	71.823	32.21	32.82	32.52	24.37	21.52	12226.00
29	443.798	38.467	41.41	0.733	0.609	0.124	71.842	32.59	34.02	33.31	24.98	22.03	12516.15
30	443.910	39.837	41.43	0.758	0.613	0.145	71.799	36.43	37.64	37.03	27.77	24.50	13921.73
31	443.988	41.246	41.46	0.810	0.664	0.146	71.709	40.54	40.68	40.61	30.43	26.89	15274.83
32	444.030	42.725	41.50	0.842	0.681	0.161	71.643	44.87	45.11	44.99	33.69	29.81	16932.03
33	444.114	44.257	41.52	0.901	0.698	0.203	71.566	49.52	49.70	49.61	37.15	32.88	18677.32
34	444.223	45.842	41.54	0.956	0.745	0.211	71.487	54.29	55.11	54.70	40.94	36.27	20602.17
35	444.371	47.276	41.55	1.026	0.786	0.240	71.406	59.33	59.31	59.32	44.39	39.34	22345.39
36	444.461	48.852	41.55	1.067	0.801	0.266	71.37	64.36	64.48	64.42	48.21	42.73	24265.54
37	444.483	50.412	41.57	1.132	0.820	0.312	71.287	69.29	70.47	69.88	52.28	46.36	26329.28
38	444.561	51.983	41.56	1.217	0.874	0.343	71.204	74.20	75.42	74.81	55.97	49.63	28186.30
39	444.636	53.495	41.58	1.273	0.900	0.373	71.127	79.02	79.21	79.11	59.18	52.51	29819.27
40	444.726	55.025	41.64	1.308	0.936	0.372	71.036	83.87	84.14	84.01	62.78	55.82	31693.43
41	444.846	56.603	41.66	1.376	0.961	0.415	70.952	88.46	88.93	88.70	66.27	58.95	33471.79
42	444.979	58.171	41.70	1.423	0.984	0.439	70.861	92.91	93.32	93.12	69.53	61.94	35166.13
43	445.060	59.830	41.64	1.562	1.019	0.543	70.785	97.11	97.86	97.49	72.86	64.77	36777.07
44	445.168	61.287	41.67	1.594	1.034	0.560	70.716	101.38	101.32	101.35	75.70	67.39	38257.64
45	445.226	62.840	41.66	1.687	1.068	0.619	70.638	105.37	105.30	105.34	78.70	70.02	39753.10
46	445.272	64.432	41.64	1.765	1.130	0.635	70.577	109.35	110.24	109.80	82.05	72.96	41423.98
47	445.343	66.011	41.66	1.824	1.148	0.676	70.501	113.36	113.98	113.67	84.92	75.56	42898.22
48	445.472	67.570	41.59	1.937	1.210	0.727	70.46	117.09	117.39	117.24	87.69	77.82	44191.52
49	445.605	69.125	41.59	2.024	1.208	0.816	70.375	120.57	120.64	120.61	90.21	80.05	45458.71
50	445.667	70.719	41.55	2.109	1.246	0.863	70.321	124.10	124.56	124.33	93.04	82.47	46836.58
51	445.749	72.295	41.53	2.190	1.254	0.936	70.266	127.46	127.04	127.25	95.26	84.37	47916.70
52	445.811	73.922	41.47	2.281	1.293	0.988	70.229	130.55	131.24	130.90	98.08	86.69	49243.45

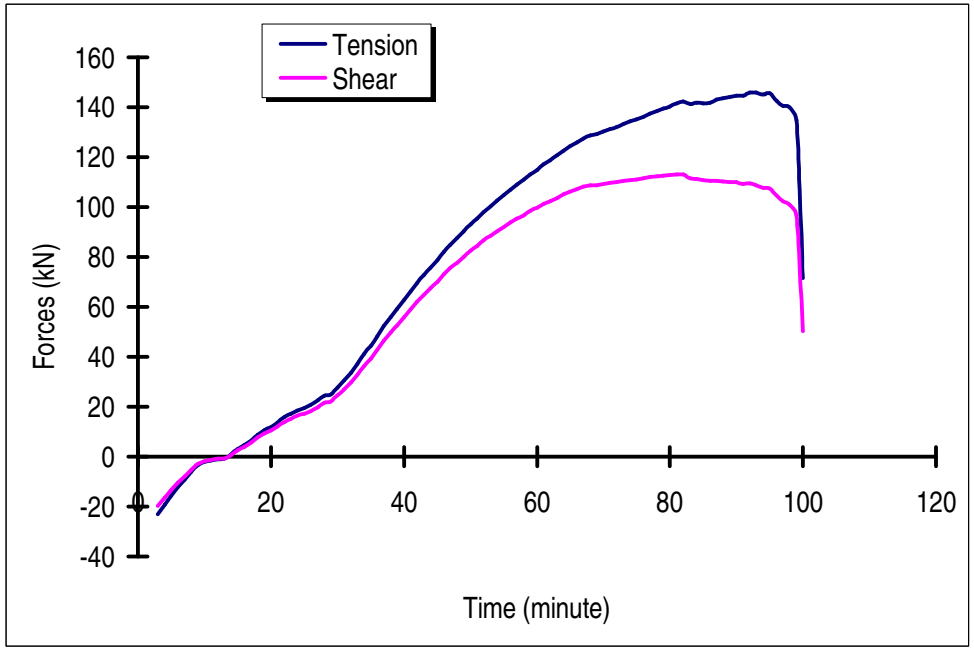
53	445.889	75.513	41.44	2.356	1.328	1.028	70.191	133.61	133.73	133.67	100.21	88.46	50254.75
54	446.073	77.028	41.36	2.472	1.362	1.110	70.156	136.58	136.94	136.76	102.66	90.36	51346.38
55	446.153	78.564	41.33	2.534	1.379	1.155	70.123	139.35	139.77	139.56	104.80	92.16	52369.88
56	446.241	80.110	41.23	2.651	1.419	1.232	70.101	142.10	142.45	142.27	107.00	93.77	53302.46
57	446.313	81.550	41.19	2.729	1.440	1.289	70.068	144.79	144.66	144.73	108.92	95.30	54179.16
58	446.282	83.128	41.08	2.873	1.460	1.413	70.027	147.34	146.99	147.16	110.92	96.71	54994.55
59	446.403	84.778	41.05	2.934	1.485	1.449	69.998	149.89	149.89	149.89	113.03	98.44	55981.53
60	446.562	86.347	40.96	3.057	1.515	1.542	69.966	152.23	151.94	152.09	114.85	99.70	56713.02
61	446.742	88.014	40.85	3.181	1.555	1.626	69.955	154.55	155.14	154.85	117.13	101.28	57629.46
62	446.849	89.574	40.78	3.267	1.588	1.679	69.933	156.90	156.73	156.81	118.73	102.43	58295.42
63	446.850	91.144	40.68	3.379	1.584	1.795	69.921	159.07	159.14	159.10	120.65	103.72	59043.88
64	446.892	92.729	40.58	3.496	1.635	1.861	69.91	161.38	161.57	161.48	122.64	105.04	59813.39
65	446.894	94.435	40.48	3.620	1.649	1.971	69.882	163.44	163.32	163.38	124.27	106.06	60414.82
66	446.936	96.029	40.43	3.690	1.702	1.988	69.864	165.49	165.38	165.43	125.93	107.28	61118.39
67	447.090	97.557	40.31	3.833	1.720	2.113	69.838	167.38	166.93	167.16	127.46	108.14	61628.18
68	447.195	99.248	40.22	3.941	1.730	2.211	69.825	168.59	168.42	168.51	128.67	108.80	62021.96
69	447.300	100.848	40.09	4.081	1.744	2.337	69.813	169.03	168.77	168.90	129.21	108.77	62025.53
70	447.338	102.465	39.98	4.210	1.739	2.471	69.792	170.26	169.94	170.10	130.34	109.29	62343.85
71	447.333	103.956	39.91	4.325	1.774	2.551	69.745	171.48	170.55	171.02	131.17	109.73	62604.70
72	447.298	105.469	39.78	4.472	1.773	2.699	69.732	172.70	171.27	171.99	132.17	110.04	62809.04
73	447.337	107.165	39.63	4.626	1.787	2.839	69.733	173.67	172.70	173.19	133.39	110.45	63070.66
74	447.517	108.719	39.54	4.737	1.796	2.941	69.71	174.85	173.47	174.16	134.32	110.87	63324.70
75	447.731	110.265	39.42	4.876	1.801	3.075	69.689	175.97	173.76	174.87	135.09	111.04	63444.75
76	447.771	111.842	39.31	5.008	1.808	3.200	69.665	177.10	175.15	176.13	136.27	111.58	63775.60
77	447.821	113.467	39.20	5.139	1.814	3.325	69.641	178.28	176.22	177.25	137.35	112.03	64056.17
78	447.866	115.093	39.03	5.308	1.810	3.498	69.642	179.32	177.05	178.19	138.41	112.22	64194.75
79	447.842	116.623	38.93	5.409	1.818	3.591	69.649	180.41	177.88	179.15	139.37	112.56	64411.75
80	447.818	118.270	38.78	5.588	1.815	3.773	69.619	181.57	178.58	180.07	140.38	112.78	64566.09
81	447.947	119.978	38.62	5.743	1.832	3.911	69.62	182.55	179.67	181.11	141.50	113.04	64749.63
82	448.095	121.578	38.46	5.900	1.828	4.072	69.62	183.31	180.17	181.74	142.30	113.05	64783.84

83	448.133	123.268	38.33	6.055	1.851	4.204	69.599	181.81	178.20	180.00	141.20	111.64	64003.06
84	448.232	124.804	38.16	6.214	1.832	4.382	69.611	182.12	178.34	180.23	141.71	111.35	63876.53
85	448.302	126.344	38.03	6.346	1.830	4.516	69.608	181.58	177.90	179.74	141.58	110.73	63546.77
86	448.246	127.905	37.90	6.498	1.820	4.678	69.589	182.15	177.55	179.85	141.92	110.47	63423.04
87	448.269	129.593	37.71	6.650	1.810	4.840	69.622	182.83	178.66	180.74	142.99	110.56	63513.17
88	448.323	131.059	37.52	6.836	1.803	5.033	69.623	183.20	178.81	181.00	143.55	110.25	63375.66
89	448.445	132.675	37.40	6.974	1.825	5.148	69.609	183.53	179.00	181.27	144.00	110.10	63315.43
90	448.550	134.221	37.21	7.140	1.818	5.322	69.629	184.00	179.47	181.74	144.73	109.92	63249.59
91	448.620	135.813	37.08	7.300	1.843	5.457	69.599	183.25	179.21	181.23	144.58	109.28	62911.93
92	448.608	137.369	36.91	7.460	1.821	5.639	69.616	184.42	180.54	182.48	145.91	109.59	63126.34
93	448.630	138.969	36.71	7.665	1.827	5.838	69.605	183.75	180.17	181.96	145.87	108.78	62706.10
94	448.607	140.706	36.59	7.807	1.841	5.966	69.589	182.35	179.13	180.74	145.13	107.73	62127.35
95	448.681	142.276	36.41	7.961	1.822	6.139	69.608	182.94	178.94	180.94	145.61	107.41	61982.01
96	448.738	143.989	36.22	8.170	1.830	6.340	69.59	178.51	175.15	176.83	142.65	104.49	60339.22
97	448.829	145.608	36.06	8.357	1.827	6.530	69.563	175.44	172.42	173.93	140.60	102.39	59159.07
98	448.874	147.280	35.83	8.544	1.816	6.728	69.614	174.30	170.75	172.53	139.89	100.98	58397.68
99	448.910	148.995	35.63	8.801	1.809	6.992	69.553	167.51	164.11	165.81	134.77	96.59	55898.34
100	449.061	151.708	35.05	9.493	1.573	7.920	69.438	87.89	86.79	87.34	71.50	50.16	29092.87


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


11
9
7
5
3
1
-1
0
20
40
60
80
100
120
Rotation (°)
Time (minute)
Beam Rotation
Column Rotation
Connection Rotaion


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


Tension
Shear
160
140
120
100
80
60
40
20
0
-20
-40
Forces (kN)
0
20
40
60
80
100
120
Time (minute)

Photographs after Test