

COMPFIRE

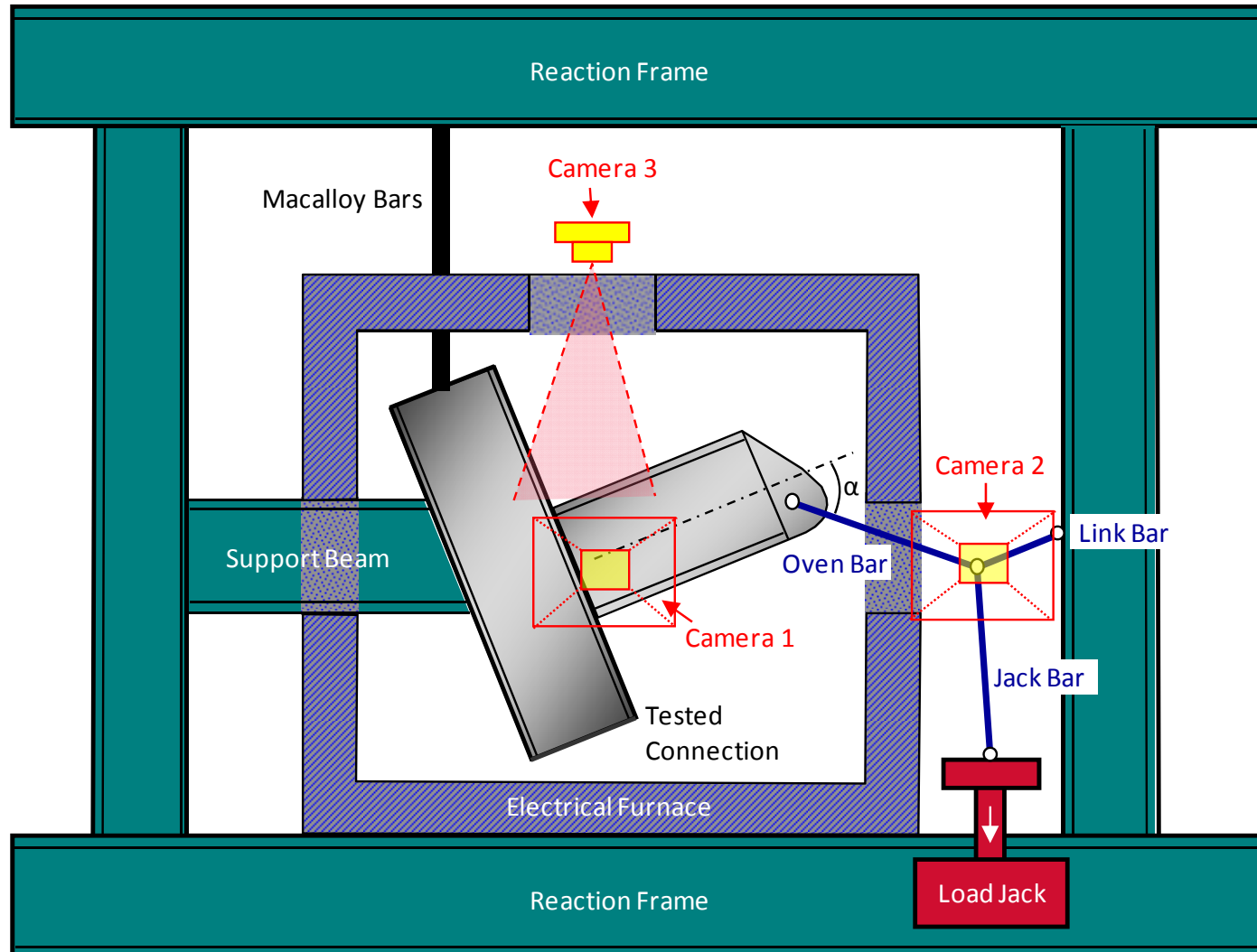
CCFT-UKPFC180_550_55_23-09-2010

23 September 2010 Reverse Channel Connection (UKPFC 180x90x26) to Circular Concrete-Filled Tube Test Result

RFSR-CT-2009-0021

Design of joints to composite columns for improved fire robustness

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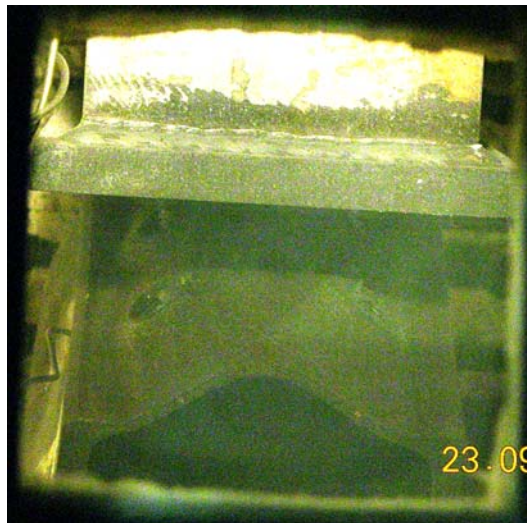
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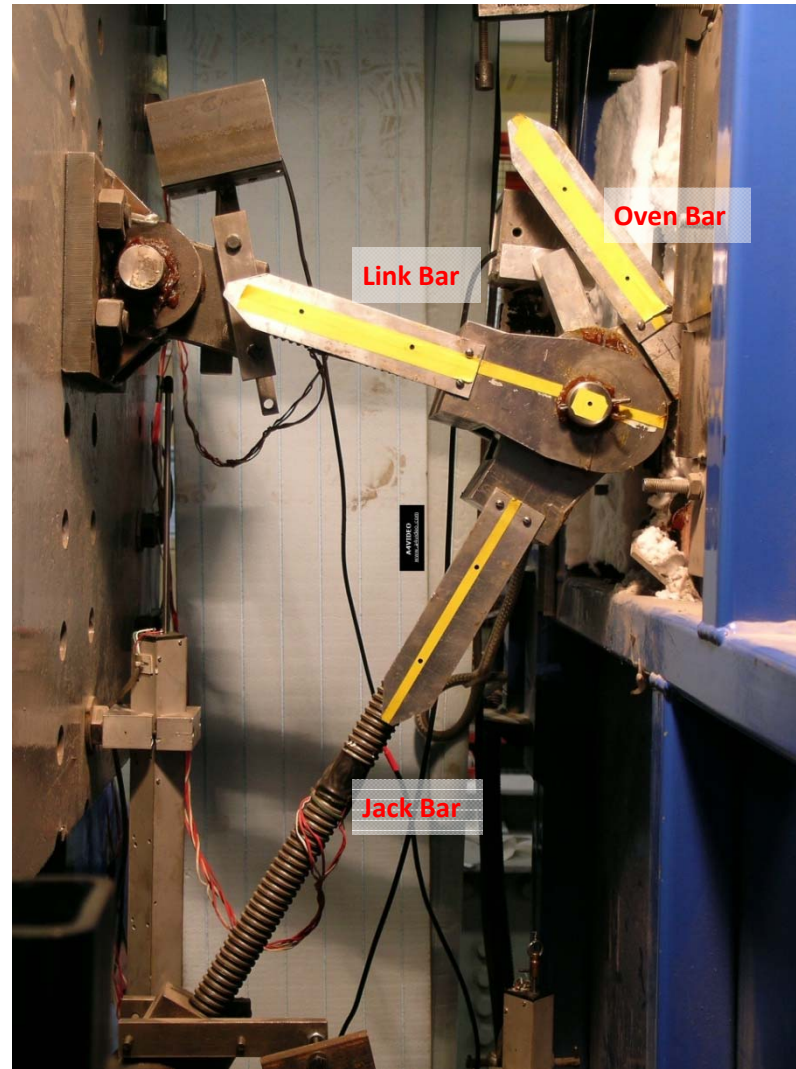
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View of Camera 1



View of Camera 3

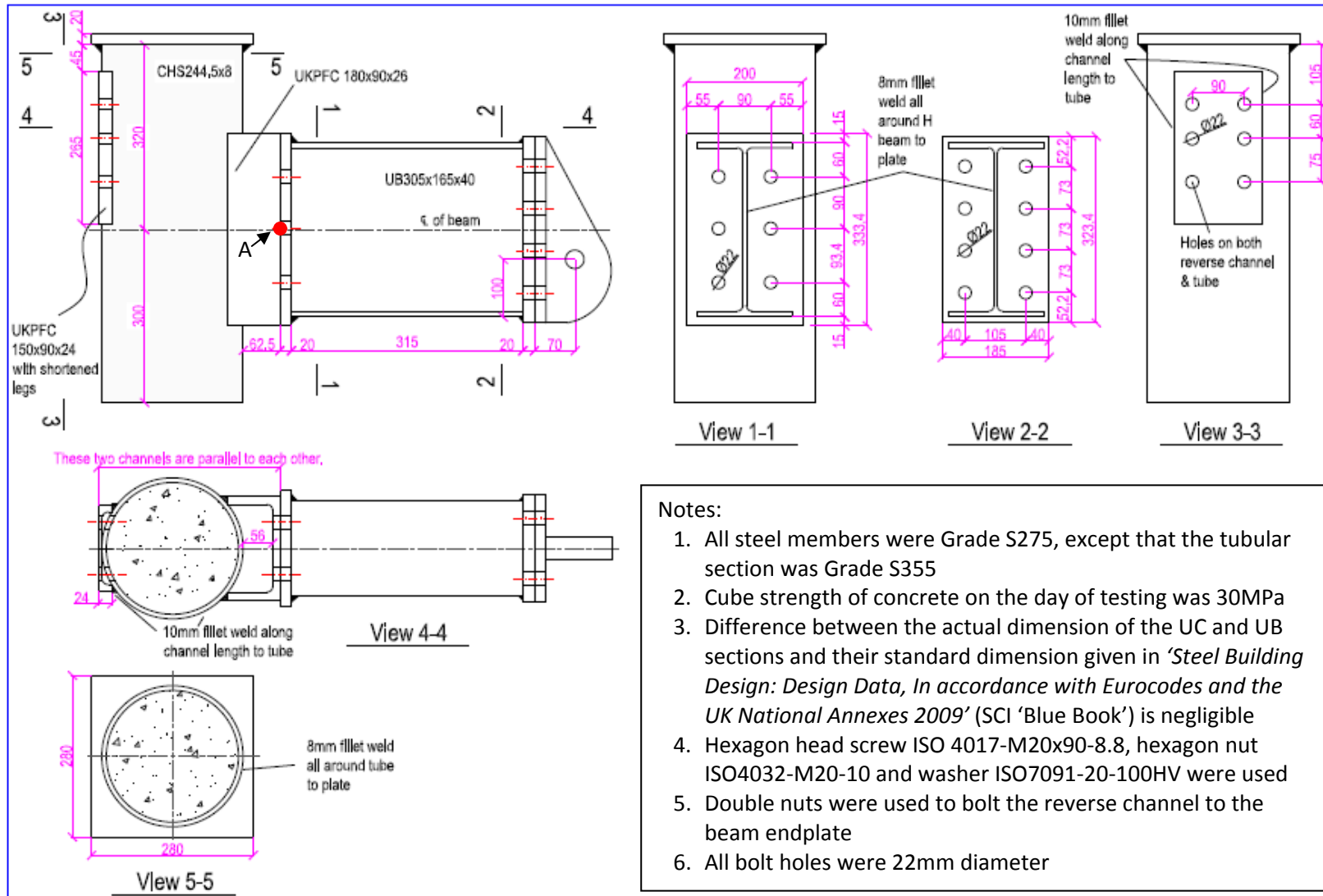


View of Camera 2

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Nominal Temperature: 550°C

Time	Temperature*	Jack Displacement	Load Angle	Beam Rotation	Column Rotation	Connection Rotation	Oven Bar Force	Tension	Shear	Moment**
(minute)	Average (°C)	(mm)	α (°)	(°)	(°)	(°)	(kN)	(kN)	(kN)	(kNm)
0	546.63	0.03	53.36	0.00	0.00	0.00	-5.51	-3.29	-4.42	-1.71
1	546.95	0.94	53.19	0.19	0.17	0.02	-2.17	-1.30	-1.74	-0.67
2	547.08	2.60	53.18	0.24	0.21	0.03	0.38	0.23	0.31	0.12
3	547.19	4.31	53.20	0.25	0.20	0.04	0.52	0.31	0.41	0.16
4	547.32	5.91	53.24	0.25	0.21	0.04	0.71	0.42	0.57	0.22
5	547.40	7.47	53.26	0.26	0.20	0.06	1.22	0.73	0.98	0.38
6	547.64	8.57	53.43	0.28	0.21	0.07	1.78	1.06	1.43	0.55
7	547.77	10.23	53.54	0.33	0.23	0.10	3.58	2.13	2.88	1.11
8	547.86	11.92	53.57	0.37	0.25	0.12	5.54	3.29	4.45	1.72
9	547.99	13.48	53.55	0.43	0.28	0.16	8.14	4.84	6.55	2.53
10	548.13	15.02	53.55	0.48	0.29	0.20	10.62	6.31	8.54	3.30
11	548.39	16.61	53.54	0.52	0.29	0.23	12.14	7.22	9.77	3.78
12	548.57	17.95	53.52	0.55	0.32	0.23	14.02	8.34	11.27	4.36
13	548.70	19.18	53.50	0.60	0.32	0.28	17.03	10.13	13.69	5.29
14	548.73	21.30	53.45	0.65	0.36	0.29	19.83	11.81	15.93	6.16
15	548.88	22.85	53.40	0.71	0.38	0.33	23.17	13.81	18.60	7.19
16	549.06	24.38	53.38	0.77	0.42	0.35	26.44	15.77	21.22	8.20
17	549.18	26.45	53.33	0.83	0.44	0.39	29.52	17.63	23.68	9.15
18	549.31	27.82	53.27	0.92	0.47	0.44	33.14	19.82	26.56	10.26
19	549.46	29.34	53.22	0.99	0.50	0.49	36.60	21.91	29.31	11.32
20	549.63	30.69	53.13	1.09	0.53	0.56	39.88	23.93	31.91	12.32
21	549.83	32.10	53.05	1.18	0.56	0.61	42.99	25.84	34.35	13.26



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22	549.97	33.69	52.97	1.26	0.58	0.68	45.82	27.59	36.58	14.12
23	550.15	35.32	52.90	1.37	0.62	0.75	48.37	29.18	38.57	14.89
24	550.27	36.98	52.80	1.49	0.65	0.84	50.65	30.63	40.35	15.56
25	550.30	38.62	52.70	1.59	0.67	0.92	52.73	31.95	41.95	16.18
26	550.42	40.13	52.59	1.72	0.70	1.02	54.76	33.27	43.50	16.77
27	550.57	41.74	52.48	1.83	0.72	1.11	56.57	34.46	44.87	17.29
28	550.71	43.23	52.38	1.96	0.74	1.22	58.25	35.56	46.13	17.77
29	550.86	44.77	52.28	2.07	0.76	1.31	59.65	36.50	47.18	18.17
30	550.95	46.42	52.16	2.20	0.78	1.42	61.07	37.47	48.23	18.56
31	551.05	48.01	52.05	2.32	0.80	1.52	62.41	38.38	49.22	18.93
32	551.21	49.64	51.92	2.46	0.82	1.64	63.56	39.20	50.03	19.23
33	551.33	51.20	51.81	2.59	0.85	1.74	64.58	39.93	50.76	19.51
34	551.55	52.87	51.68	2.73	0.86	1.87	65.73	40.76	51.56	19.81
35	551.65	54.46	51.56	2.86	0.90	1.96	66.78	41.52	52.31	20.09
36	551.87	55.99	51.45	2.99	0.92	2.07	67.86	42.29	53.07	20.37
37	551.94	57.64	51.33	3.12	0.94	2.18	68.93	43.07	53.82	20.65
38	552.03	59.29	51.20	3.26	0.96	2.30	69.99	43.86	54.54	20.91
39	552.13	60.90	51.09	3.39	0.98	2.41	71.12	44.67	55.34	21.21
40	552.24	62.51	50.96	3.53	1.01	2.52	72.17	45.45	56.06	21.47
41	552.40	64.07	50.82	3.67	1.02	2.65	73.17	46.23	56.72	21.71
42	552.52	65.55	50.70	3.81	1.04	2.77	74.24	47.02	57.45	21.98
43	552.41	67.05	50.56	3.95	1.06	2.89	75.26	47.81	58.12	22.23
44	552.48	68.59	50.43	4.10	1.08	3.01	76.33	48.62	58.84	22.49
45	552.57	70.08	50.30	4.24	1.10	3.14	77.43	49.45	59.58	22.76
46	552.69	71.62	50.16	4.38	1.13	3.26	78.57	50.33	60.33	23.04
47	552.84	73.11	50.03	4.53	1.14	3.39	79.65	51.17	61.03	23.29
48	552.95	74.59	49.92	4.67	1.16	3.51	80.64	51.93	61.70	23.54

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49	553.10	76.16	49.76	4.82	1.17	3.65	81.61	52.73	62.30	23.75
50	553.18	77.67	49.62	4.96	1.19	3.77	82.68	53.56	62.98	24.00
51	553.30	79.15	49.46	5.12	1.20	3.92	83.75	54.43	63.65	24.24
52	553.37	80.83	49.35	5.25	1.22	4.04	84.66	55.15	64.23	24.45
53	553.49	82.38	49.21	5.41	1.23	4.18	85.65	55.95	64.84	24.67
54	553.67	84.01	49.07	5.54	1.25	4.29	86.72	56.81	65.52	24.91
55	553.74	85.53	48.91	5.72	1.27	4.45	87.73	57.66	66.12	25.12
56	553.84	87.06	48.76	5.87	1.28	4.59	88.71	58.47	66.71	25.33
57	553.96	88.59	48.61	6.02	1.29	4.73	89.73	59.33	67.32	25.55
58	554.06	90.15	48.45	6.19	1.30	4.89	90.88	60.28	68.01	25.79
59	554.21	91.74	48.31	6.33	1.32	5.02	91.91	61.13	68.63	26.01
60	554.24	93.23	48.16	6.49	1.32	5.17	92.95	62.01	69.24	26.22
61	554.34	94.81	48.01	6.64	1.34	5.31	93.91	62.83	69.80	26.42
62	554.45	96.22	47.84	6.82	1.35	5.47	94.90	63.69	70.35	26.60
63	554.57	97.67	47.67	6.98	1.35	5.63	95.95	64.61	70.94	26.81
64	554.73	99.14	47.52	7.14	1.37	5.77	96.99	65.50	71.53	27.01
65	554.80	100.60	47.36	7.31	1.38	5.93	98.07	66.43	72.14	27.22
66	554.89	102.06	47.18	7.47	1.40	6.07	99.14	67.38	72.72	27.42
67	555.00	103.61	47.02	7.63	1.40	6.23	100.11	68.25	73.24	27.60
68	555.07	105.28	46.86	7.79	1.41	6.38	101.07	69.12	73.74	27.77
69	555.20	106.65	46.70	7.96	1.43	6.53	102.11	70.03	74.31	27.96
70	555.29	108.24	46.51	8.13	1.44	6.69	103.16	70.99	74.85	28.14
71	555.40	109.67	46.34	8.30	1.46	6.84	104.08	71.85	75.30	28.29
72	555.53	111.23	46.18	8.46	1.47	6.99	104.92	72.64	75.70	28.42
73	555.56	112.75	46.01	8.63	1.47	7.16	105.77	73.45	76.10	28.55
74	555.77	114.33	45.82	8.80	1.48	7.32	106.68	74.34	76.51	28.67
75	555.87	115.92	45.64	8.98	1.49	7.48	107.45	75.13	76.82	28.77

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76	556.02	117.40	45.48	9.16	1.50	7.66	108.17	75.85	77.12	28.86
77	556.10	119.03	45.26	9.34	1.51	7.83	108.92	76.67	77.37	28.92
78	556.17	120.32	45.08	9.52	1.51	8.00	109.76	77.51	77.71	29.02
79	556.25	121.92	44.92	9.70	1.53	8.17	110.20	78.04	77.81	29.03
80	556.28	123.18	44.71	9.88	1.54	8.34	110.88	78.80	78.00	29.08
81	556.34	124.62	44.51	10.06	1.54	8.51	111.44	79.47	78.13	29.10
82	556.48	126.18	44.33	10.23	1.55	8.69	111.78	79.96	78.12	29.07
83	556.70	127.56	44.12	10.41	1.56	8.85	112.11	80.48	78.04	29.01
84	556.85	129.01	43.94	10.60	1.57	9.03	112.43	80.96	78.01	28.97
85	556.86	130.45	43.75	10.78	1.57	9.21	112.52	81.28	77.81	28.87
86	556.90	131.77	43.55	10.97	1.57	9.40	112.72	81.70	77.66	28.78
87	556.94	133.15	43.34	11.16	1.57	9.59	112.55	81.86	77.24	28.59
88	557.12	134.53	43.13	11.36	1.59	9.77	112.24	81.92	76.74	28.38
89	557.31	135.90	42.91	11.56	1.58	9.98	111.79	81.88	76.11	28.11
90	557.37	137.33	42.71	11.75	1.58	10.18	111.02	81.57	75.31	27.79
91	557.43	138.66	42.47	11.96	1.57	10.39	109.78	80.97	74.13	27.32
92	557.48	140.07	42.25	12.18	1.57	10.61	108.21	80.10	72.76	26.78
93	557.54	141.71	42.01	12.40	1.57	10.84	105.64	78.50	70.70	25.99
94	557.67	143.33	41.76	12.64	1.54	11.10	102.58	76.53	68.32	25.08
95	557.76	144.96	41.48	12.89	1.54	11.36	98.46	73.76	65.22	23.90
96	557.97	147.10	40.98	13.37	1.42	11.95	70.92	53.54	46.51	17.00
97	558.05	148.81	40.71	13.65	1.40	12.25	65.20	49.42	42.52	15.52
98	558.16	150.56	40.46	13.89	1.38	12.51	63.71	48.47	41.34	15.07
99	558.20	152.14	40.21	14.11	1.38	12.73	62.79	47.95	40.54	14.75
100	558.22	153.91	39.98	14.34	1.36	12.98	62.46	47.86	40.13	14.58
101	558.34	155.48	39.71	14.58	1.38	13.20	62.41	48.01	39.87	14.46
102	558.48	156.99	39.46	14.80	1.38	13.42	62.14	47.97	39.49	14.30

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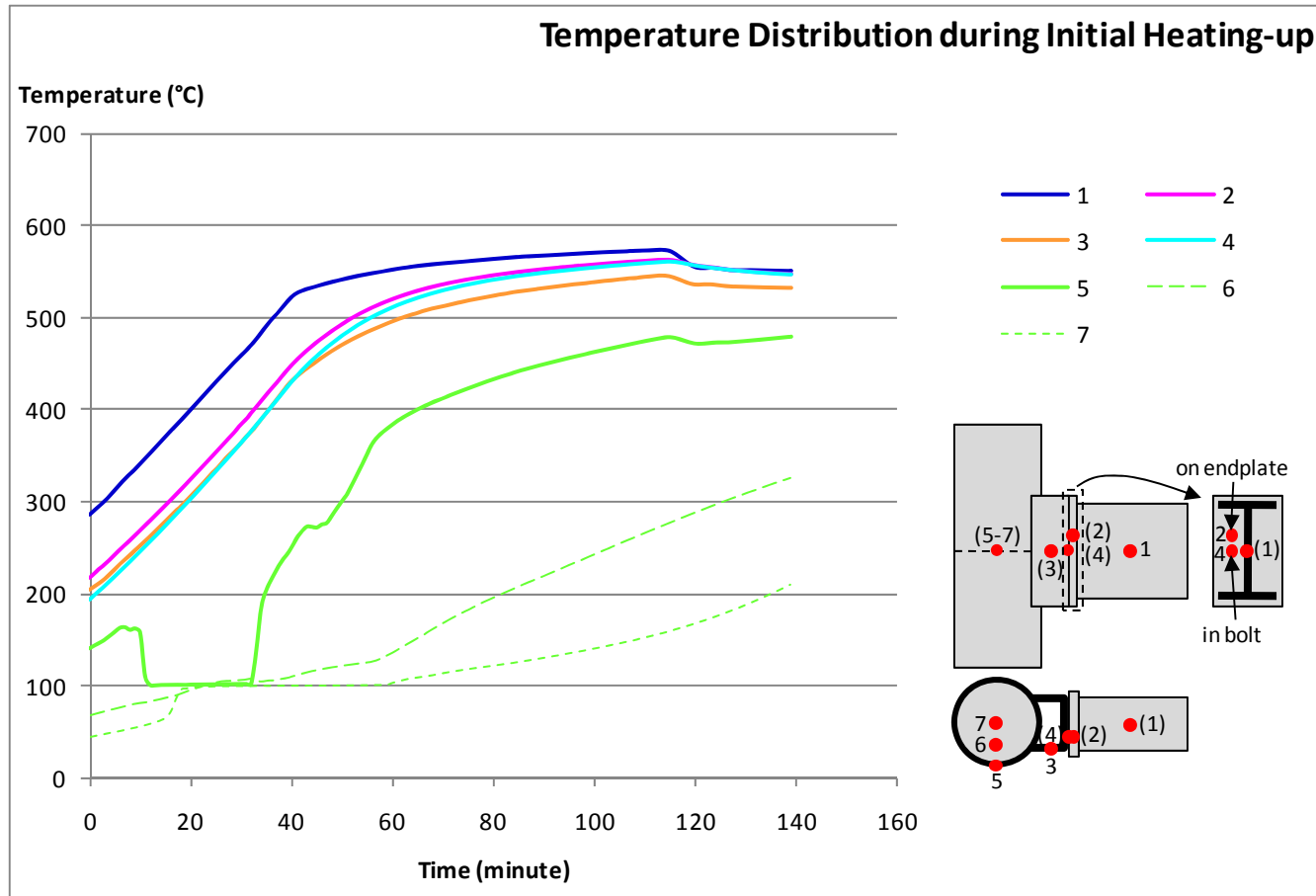
103	558.66	158.55	39.21	15.02	1.36	13.66	61.91	47.97	39.13	14.15
104	558.76	160.04	38.93	15.27	1.36	13.91	61.60	47.92	38.71	13.97
105	558.82	161.80	38.70	15.49	1.36	14.13	61.24	47.79	38.28	13.80
106	558.92	163.46	38.43	15.72	1.36	14.36	60.85	47.67	37.82	13.61
107	558.91	165.27	38.17	15.95	1.35	14.60	60.37	47.46	37.31	13.40
108	558.95	166.94	37.91	16.19	1.35	14.84	59.80	47.18	36.74	13.17
109	559.15	168.46	37.62	16.44	1.33	15.12	59.19	46.88	36.13	12.93
110	559.22	170.14	37.34	16.69	1.34	15.36	58.29	46.34	35.35	12.63
111	559.38	171.62	37.07	16.94	1.33	15.61	57.16	45.61	34.45	12.29
112	559.45	173.46	36.78	17.19	1.33	15.86	55.91	44.78	33.48	11.91
113	559.39	175.12	36.49	17.46	1.33	16.13	54.28	43.64	32.28	11.46
114	559.48	176.76	36.18	17.73	1.32	16.41	52.10	42.05	30.76	10.90
115	559.57	178.70	35.86	18.01	1.31	16.70	49.48	40.10	28.98	10.25
116	559.77	180.26	35.48	18.34	1.26	17.07	43.08	35.09	25.00	8.81
117	559.94	182.53	34.98	18.83	1.17	17.66	24.89	20.39	14.27	5.01
118	560.04	183.93	34.68	19.09	1.17	17.92	24.62	20.25	14.01	4.91

* Average temperature of the beam web, endplate, reverse channel and bolt

** Moment about Point A on the specimen drawing

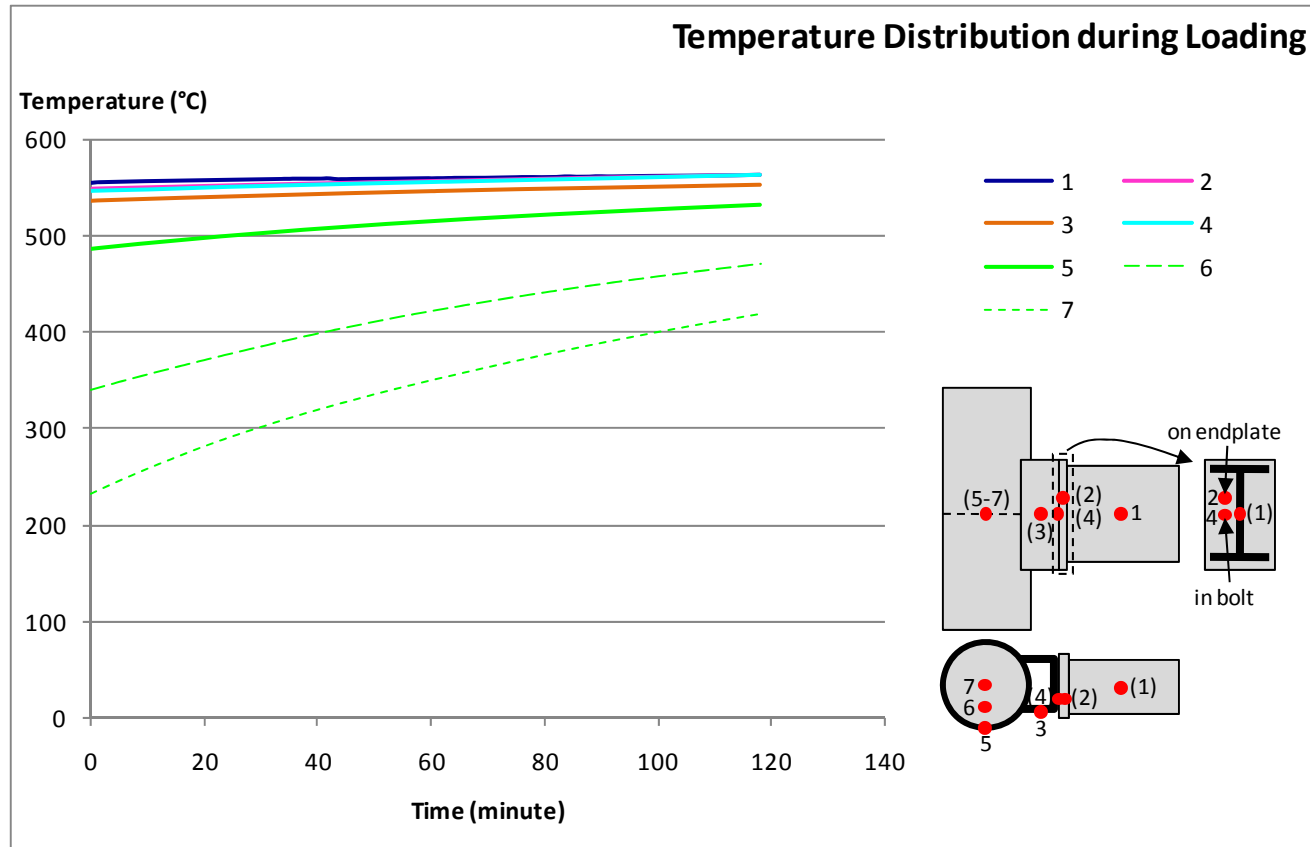
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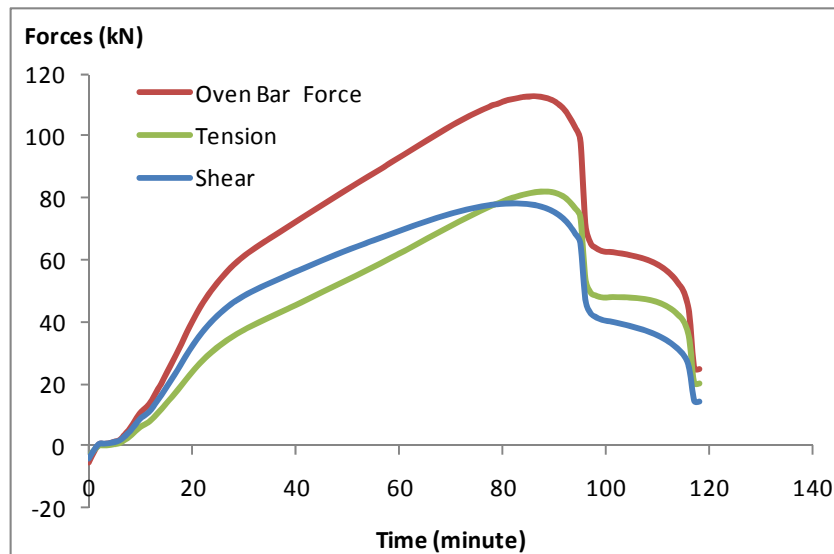
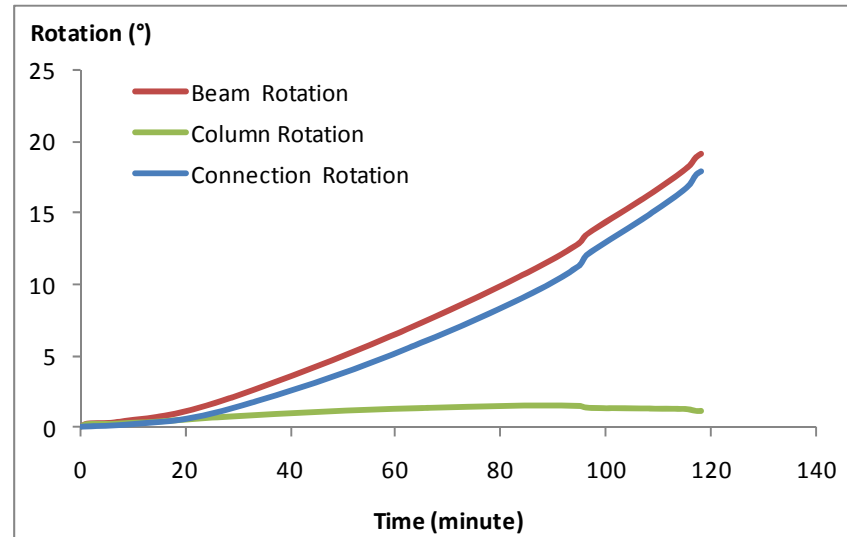
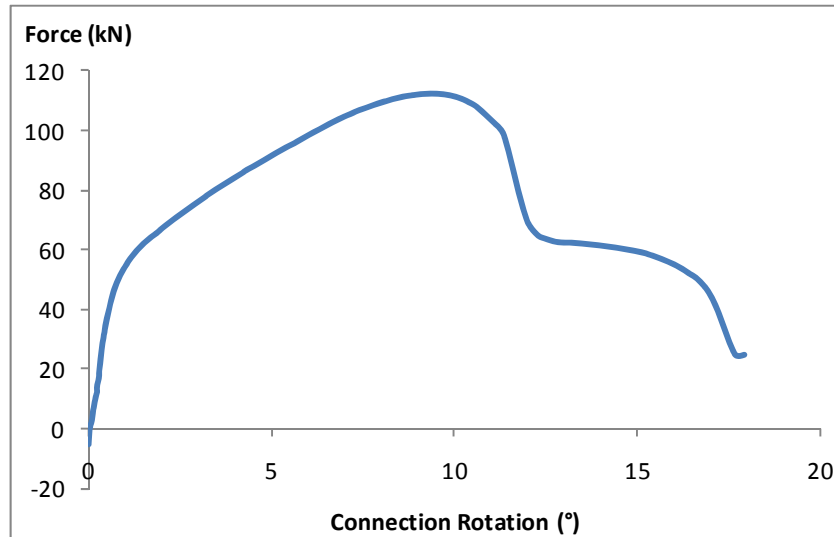
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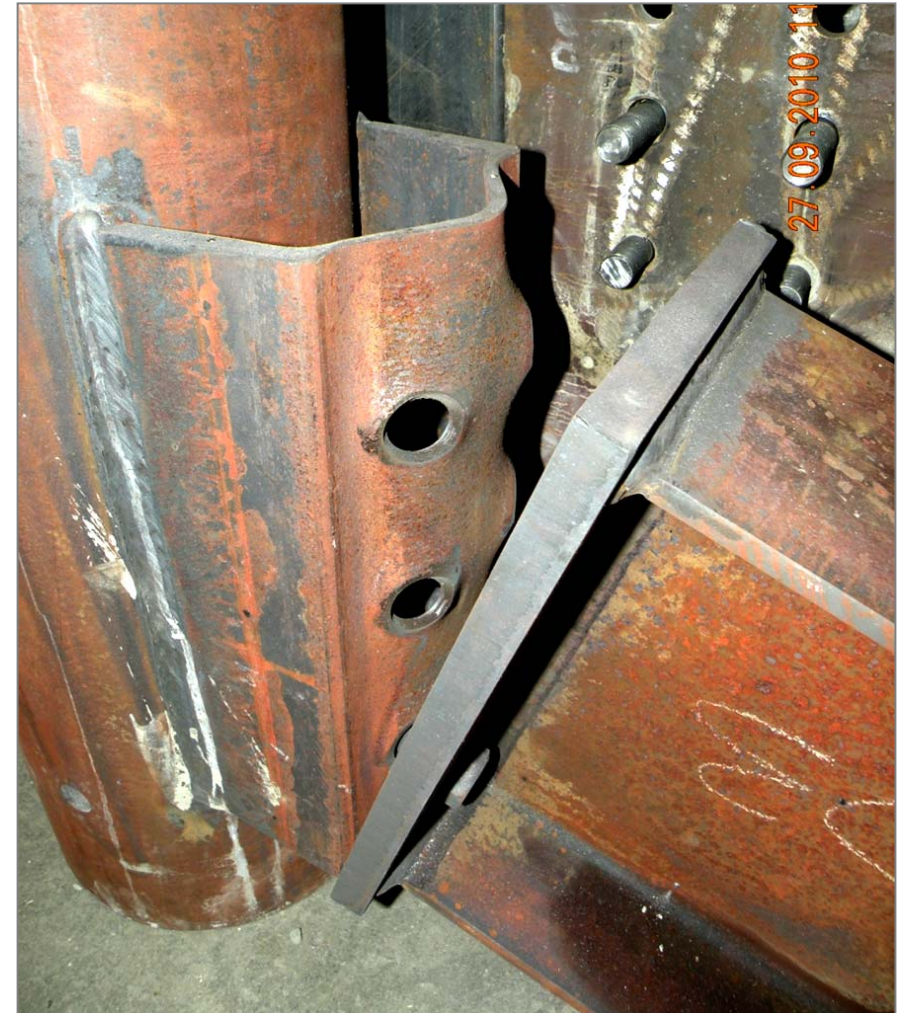
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Photographs after Test



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