



Sponsor:

Fire Combat Australia Pty Ltd
PO Box 370
Pyrmont
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NSW 2009

Test Report – Fire Resistance:

TESTING PERFORMED ON: A horizontal separating element, floor/ceiling system

TEST DATE:	05/12/2017
REPORT WRITTEN BY:	M. Lewis
REPORT DATE:	16/01/2018
RTL REPORT NO:	TR-F012.01 (PR0039)
TEST ID:	FR012S4/2017
SCOPE:	Measurement of fire resistance in general accordance with AS1530.4-2014 Sections 1, 2 & 4

1. DOCUMENT HISTORY

Revision #	Date	Sent to	Additional Information
TR-F012.DR (PR0039)	24/01/2017	Client	Draft issue for comment
TR-F012.01 (PR0039)	29/01/2017	Client	Final issue

2. TESTING FACILITY NAME AND ADDRESS

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3. REPORT AUTHORISATION

Report Written by	Title	Date	Signature
M. Lewis	Technical Manager Fire & Smoke	31/01/2018	


Report Authorised by	Title	Date	Signature
M. Lewis	Technical Manager Fire & Smoke	31/01/2018	

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4. REPORT SUMMARY

Fire resistance test on a horizontal separating element comprising of ceiling lining boards on the fire side, steel ceiling joists, cavity insulation and flooring boards on the non-fire side. The specimen under test achieved the following fire-resistance levels in accordance with AS1530.4-2014.

Specimen

Test Results	
Structural adequacy	n/a
Integrity	96 minutes ¹
Insulation	94 minutes
FRL	-/90/90
Resistance to incipient spread of fire	39 minutes

¹ No failure recorded

5. INTRODUCTION

This report details a test carried out on a horizontal separating element comprising of Fire Combat Australia's (FCA) ceiling lining boards on the fire side, steel ceiling joists, cavity insulation and Fire Combat Australia's flooring boards on the non-fire side. The test was carried out in general accordance with AS 1530.4-2014 to measure the fire-resistance of the specimen. The specimen under test was installed into a steel restraint frame suitable for mounting to the test apparatus.

6. STANDARDS

The measurements leading to the results presented in this report have been undertaken in accordance with standards which specify a method for measuring the fire resistance of building elements:

- AS 1530.4—2014 Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction.

The test facility and equipment were in accordance with:

- AS 1530.4—2014 Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction.

7. DEVIATIONS FROM THE TEST STANDARD:

Pressure – there were a number of pressure variances outside of the control parameters during the test. These are not considered to have adversely affected the test results.

8. PERFORMANCE CRITERIA

Criteria of Failure

Under AS1530.4-2014 the following conditions are set out to describe failure of the element under test with regards to:

Structural Adequacy (loadbearing capacity)

No load was applied for this test. Structural adequacy not evaluated.

Integrity

Failure in relation to integrity shall be deemed to have occurred when evaluated in accordance with Clauses 2.13.2.2 to 2.13.2.4.

The measurement of the integrity of the test specimen shall be made by cotton pad, gap gauge or sustained flaming. For uninsulated assemblies, other than service penetrations, the cotton pad is deemed inappropriate and gap gauges shall be used. The cotton pad is also deemed inappropriate, except for penetration systems, where a fixed or roving thermocouple measures a temperature exceeding 300°C.

Insulation

The measurement of insulation performance is made by thermocouples on the unexposed face compared to the initial temperature.

The specimen shall be deemed to have failed when:

The average temperature on the unexposed face of the test specimen exceeds the initial temperature by more than 140 K; or

The temperature at any location on the unexposed face of the test specimen exceeds the initial temperature by more than 180 K.

Radiation

Not evaluated for this test.

9. CONSTRUCTION DETAILS

Manufacture Information

Lining boards manufactured by Fire Combat Australia Pty Ltd

Steel framing manufactured by Stratco Steel Australia

Sealants manufactured by TREMstop

Insulation manufactured by CSR

Fixings manufactured by Bremick

Supporting Construction

No supporting construction was used for this test.

Test Specimen Description

Purpose

Ceiling floor fire test on steel frame construction using 2 layers of 10mm FCA MBE -SE10 with 50mm/ 75mm offset fire joints to enable a solid 20mm thickness FCA facing the furnace on the underside (fire exposure from below) with 19mm FCA on the steel framed top side (unexposed side).

The 2 x 10mm FCA boards were fixed to one side of a 2.1 m x 2.1 m dimension steel frame.

Frame specification 3 x 250mm x 75mm C section span joists 2.4mm BMT, 2.1 m long, screw fixed to the frame edges with Bremick winged self-drilling philips head drive 10g x 45mm steel specification 2.4mm BMT.

Fixings

The screw fixings were corrosion proof Bremick winged self-drilling philips head drive 10g x 45mm length to suit such fixings to the outer frame and the 10mm and 19mm boards.

Fire Sealant

The under facings of the framed sections (exposed face) were covered with 2 x 3mm beads of TREMstop PU sealant. The TREMstop PU was compressed/spread under the 10mm sheets when applied to the outer lower facings of the exposed side of the module frame and screw fixed together.

The centre joint was filled with TREMstop PU fire sealant on compression and fixing of the boards.

The edges and all cavities and potential air gap infiltration points of the joints were all similarly treated with TREMstop PU.

Insulation

The 250mm cavity was partially filled with 100mm depth CSR Bradford Fibertex 350 board of nominal density 60Kg in 2 x 50mm thick panels.

Unexposed Face Top Substrate

The TREMstop PU sealant was applied in 2 x 3mm thick beads over the facings of the upper frame and joists under the facings of the 19mm FCA MBE-TG19mm substrate. The TG section was filled with TREMstop PU fire sealant before the tongue section pushed into place and screw fixed at 200mm centres to the frame edges and joist facings.

10. SUPPORT AND RESTRAINT CONDITIONS

The test specimen, measuring approximately 2.1m x 2.1m was installed within a steel test frame suitable for mounting onto the test furnace. The specimen was simply supported on all four sides of the test frame and sat upon a ceramic fibre blanket creating a seal. The weight of the ceiling was sufficient for it to remain in place, no additional restraint was utilised.

11. PRE-TEST CONDITIONING

The specimen was completed on 1st Dec and left to cure in the indoor laboratory environment for 4 days.

12. DIRECTION OF EXPOSURE

The specimen was subjected to fire exposure from the underside, as required by the Standard.

13. SELECTION OF TEST SPECIMEN

The laboratory was not involved in the selection of any specimen materials for this test. The Client supplied and installed all materials for their specimen.

14. TEST PROCEDURE

Furnace Heating Conditions – Temperature Curve

The temperature of the furnace shall be controlled to vary with time, as close as possible, in accordance with the following relationship:

$$T = 345 \log_{10} (8t + 1) + 20$$

Where

T = furnace temperature at time (t), in degrees centigrade

T = time into the test, measured from the ignition of the furnace, in minutes

Laboratory Ambient Temperature at Commencement of Fire Test

At 10:10 on the 5th Dec at the commencement of the test, the indoor ambient temperature was 27°C. Over the 96-minute test duration the temperature increased to 29°C.

Furnace Pressure Differential

Furnace pressure was measured with a Dwyer Magnesense pressure transmitter (S:N 71640), with a probe located 100mm below the underside of the test specimen.

Specimen Temperatures

Specimen temperatures measured with type K thermocouples of wire diameter not exceeding 0.5mm, with the measuring junction silver soldered to the face of a 12mm diameter by 0.2mm thick copper disc. Each thermocouple shall be covered with a 30±0.5mm x 30±0.5mm x 2.0±0.5mm thick millboard pad.

Deflection Measurement

Deflection measurement was not taken during this test.

15. TEST RESULTS

Performance (whole minutes and FRL)

Test Results	
Structural adequacy	n/a
Integrity	96 minutes ¹
Insulation	94 minutes
FRL	-/90/90
Resistance to incipient spread of fire	39 minutes

STATEMENTS

THE RESULTS OF THESE FIRE TESTS MAY BE USED TO DIRECTLY ASSESS FIRE HAZZARD, BUT IT SHOULD BE RECOGNIZED THAT A SINGLE TEST METHOD WILL NOT PRODUCE A FULL ASSESSMENT OF FIRE HAZARD UNDER ALL FIRE CONDITIONS.

THIS REPORT DETAILS METHODS OF CONSTRUCTION, THE TEST CONDITIONS AND THE RESULTS OBTAINED WHEN THE SPECIFIC ELEMENT OF CONSTRUCTION DESCRIBED HERIN WAS TESTED FOLLOWING THE PROCEDURE OUTLINED IN AS1530.4. ANY SIGNIFICANT VARIATION WITH RESPECT TO SIZE, CONSTRUCTION DETAILS, LOADS STRESSES, EDGE OR END CONDITIONS, OTHER THAN THAT ALLOWED UNDER THE FIELD OF DIRECT APPLICATION IN THE RELEVANT TEST METHOD, IS NOT COVERED BY THIS REPORT.

BECAUSE OF THE NATURE OF FIRE RESISTANCE TESTING AND THE CONSEQUENT DIFFICULTY IN QUANTIFYING UNCERTAINTY OF MEASUREMENT OF FIRE RESISTANCE TESTING, IT IS NOT POSSIBLE TO PROVIDE A STATED DEGREE OF ACCURACY OF THE RESULT.

Test Limitations

The test was conducted on a small-scale furnace and as such not in accordance with the size requirements of the Standard for evaluating a full-size system. The intent of the test was to assess the specimen construction for integrity and insulation performance and the data contained within this report may be used to that end.

16. APPENDIX A - FIGURES.

Figure 1: Specimen Thermocouple Locations

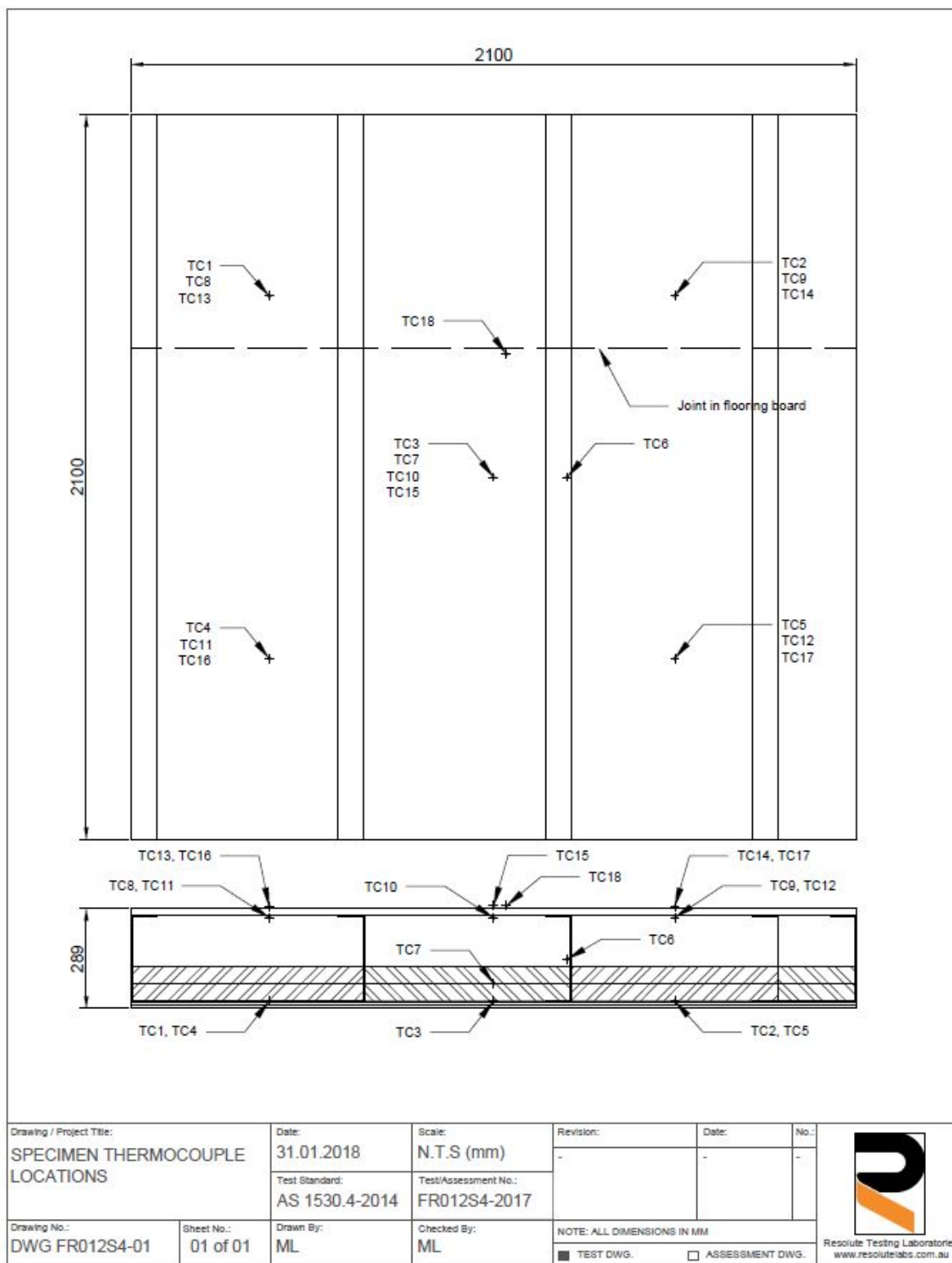


Figure 2: Furnace Temperature

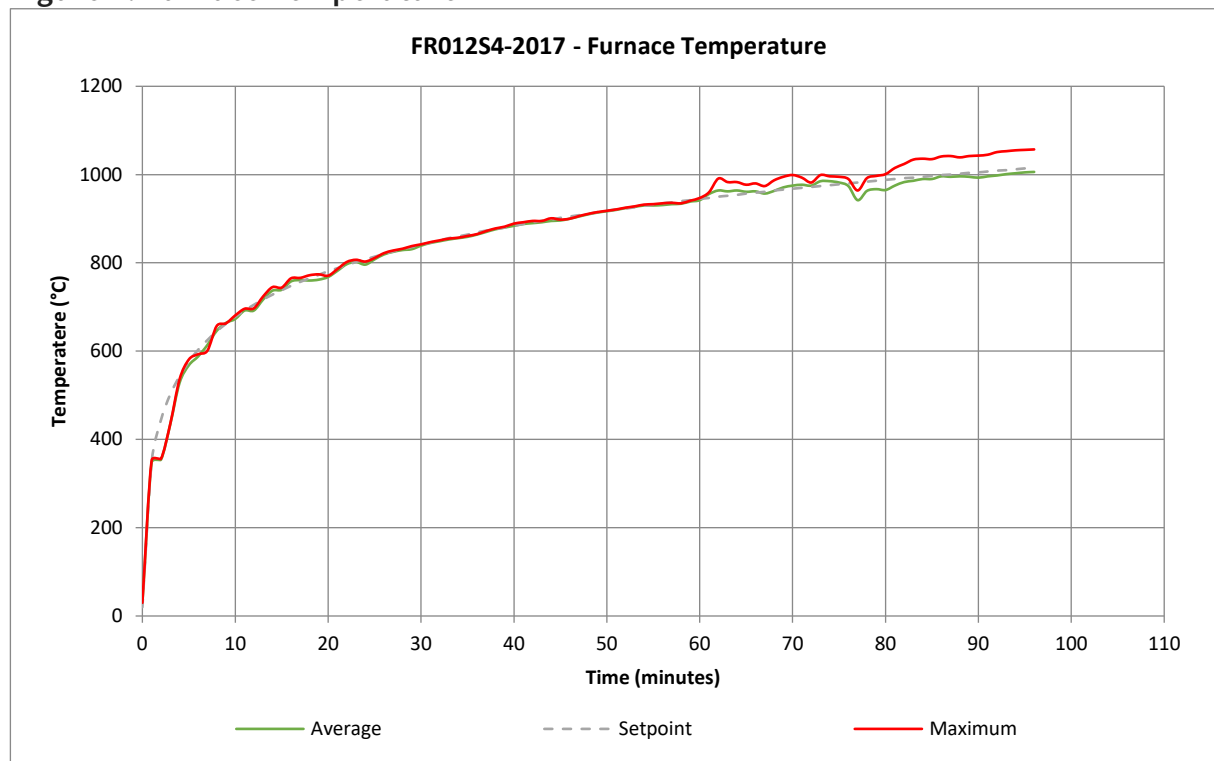


Figure 3: Average Furnace Temperature Severity

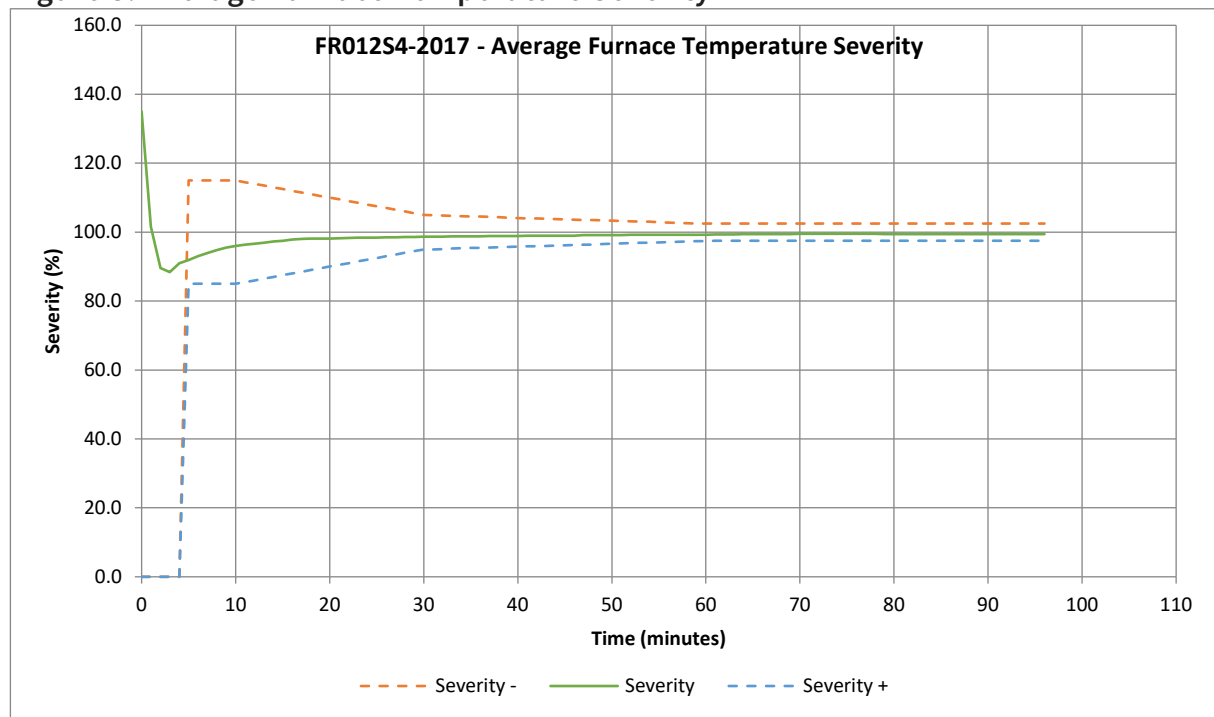


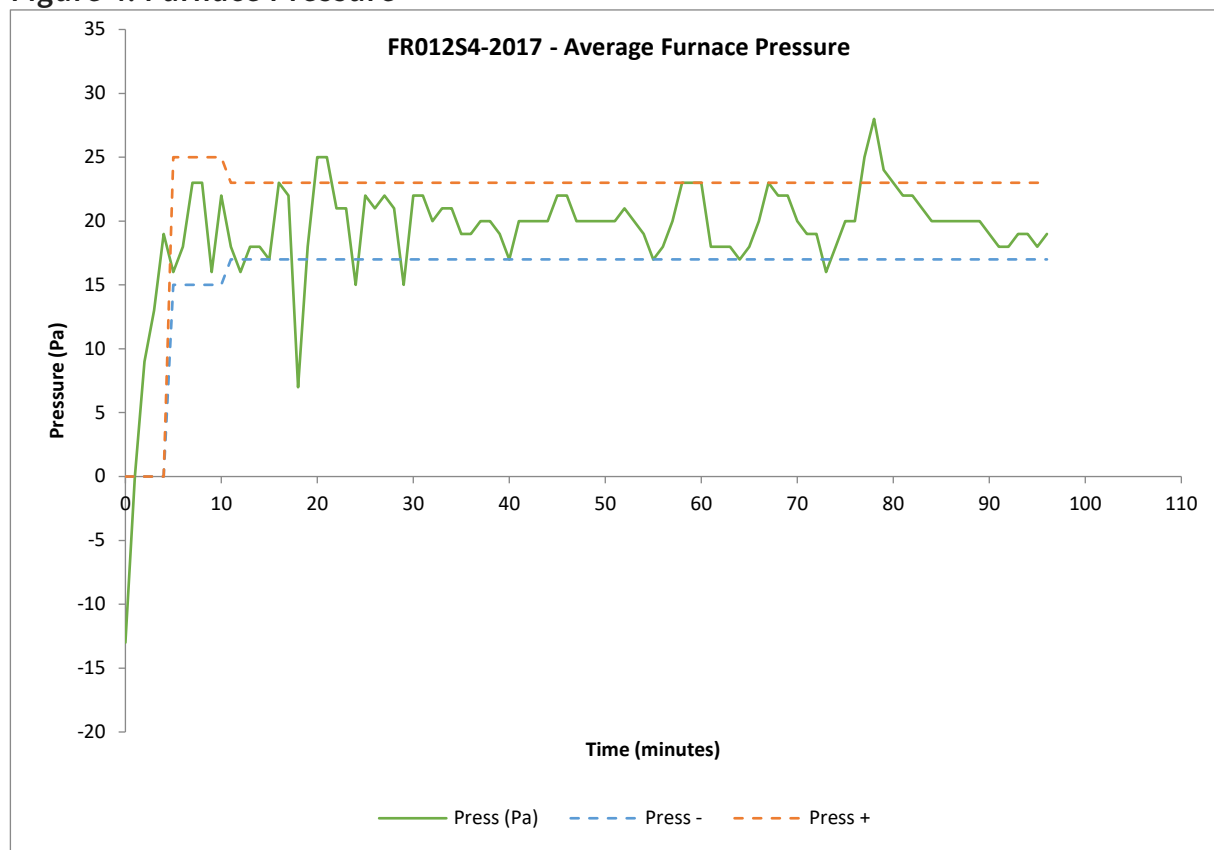
Figure 4: Furnace Pressure

Figure 5: Specimen TC's 1 to 5, on top side of ceiling lining board

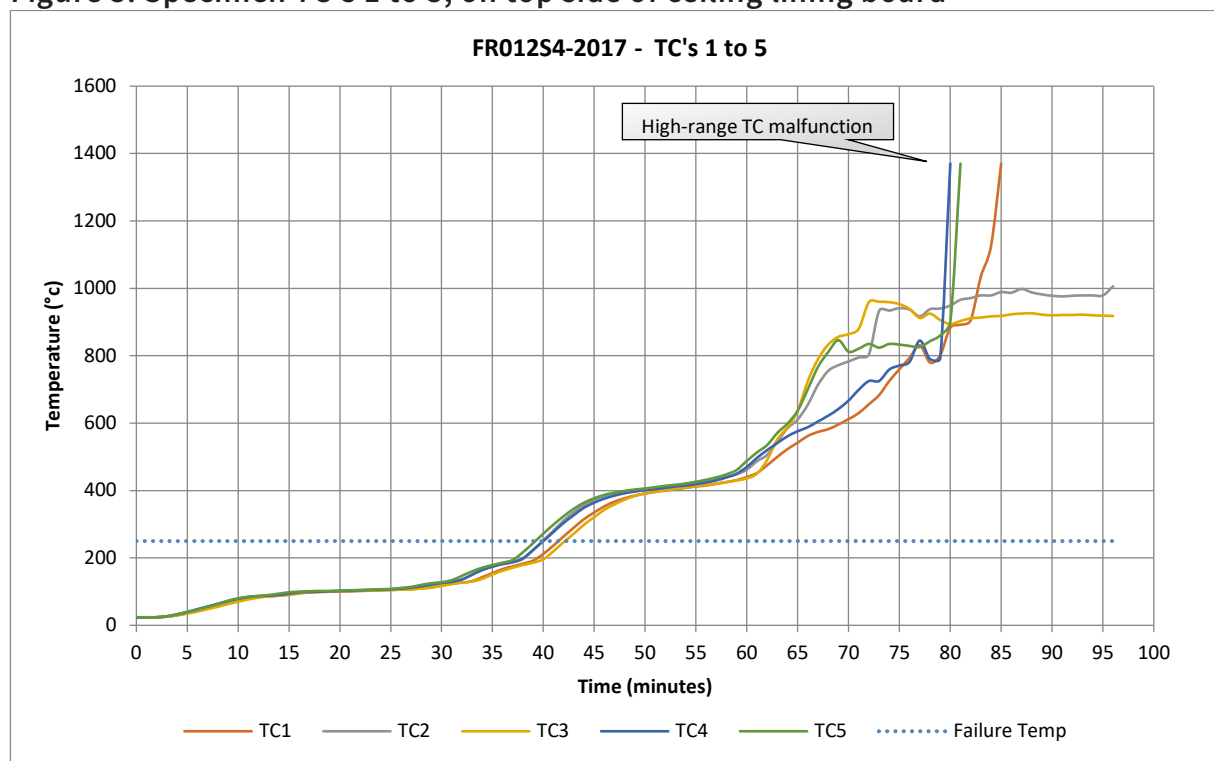


Figure 6: TC's 6 & 7, on the steel joist and mid thickness of insulation

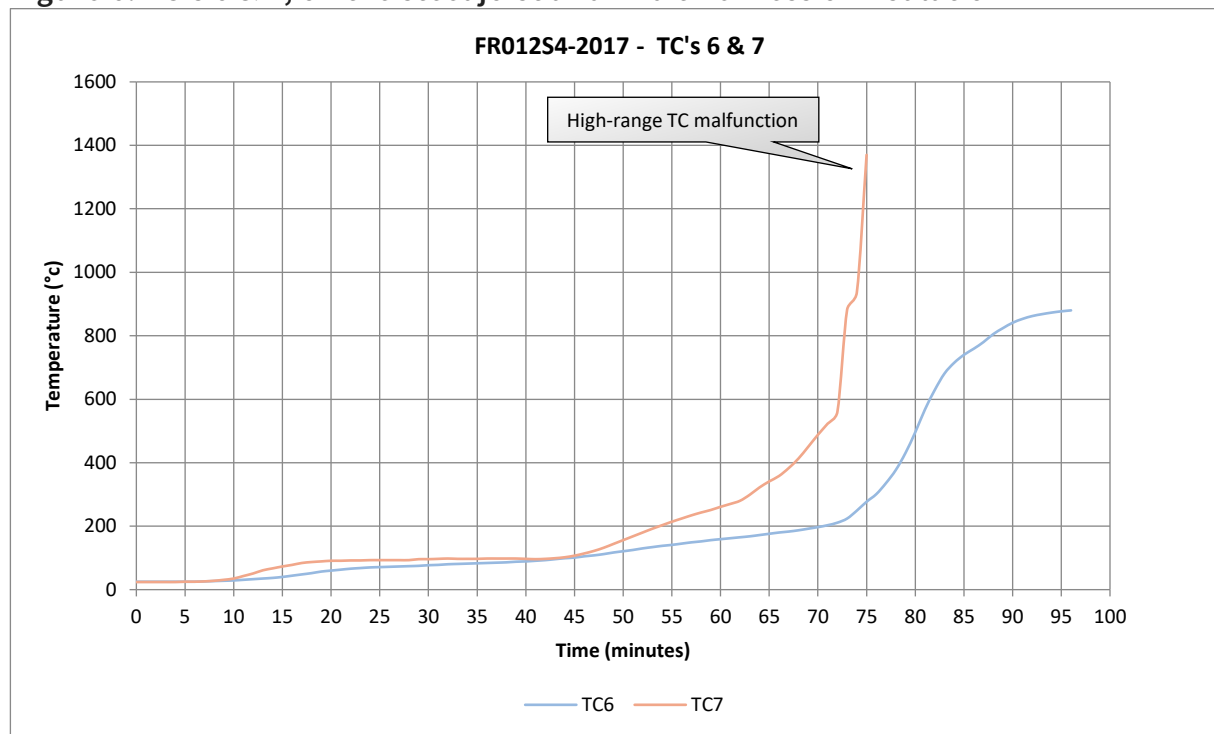


Figure 7: Specimen TC's 8 to 12, on the underside of the flooring board

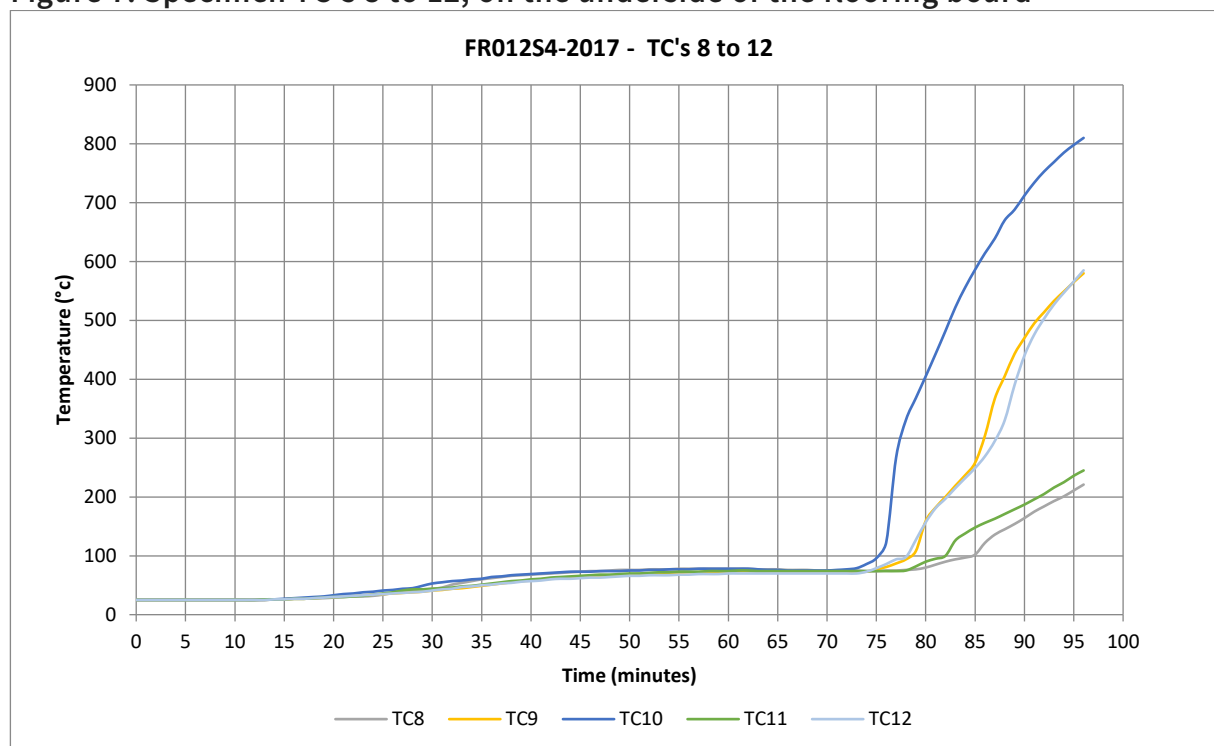


Figure 8: Specimen TC's 13 to 18, on the top side of the flooring board

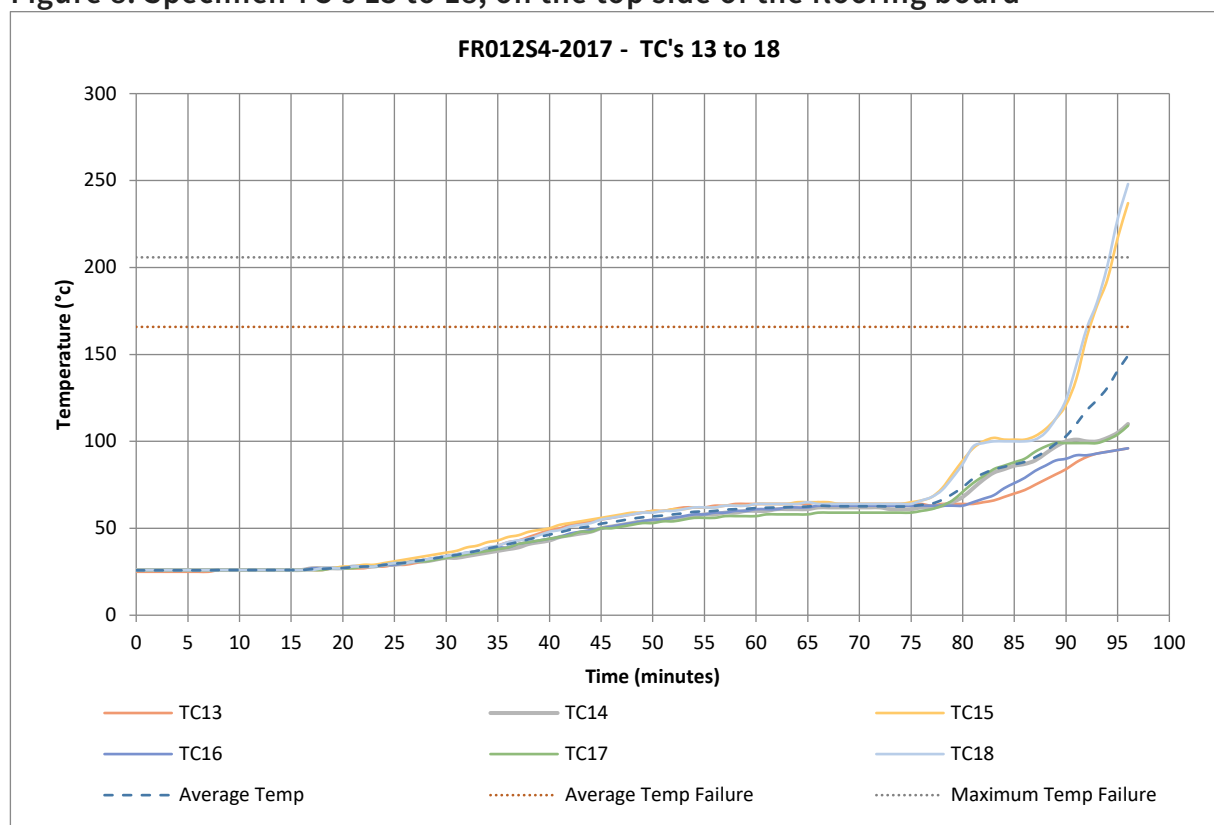
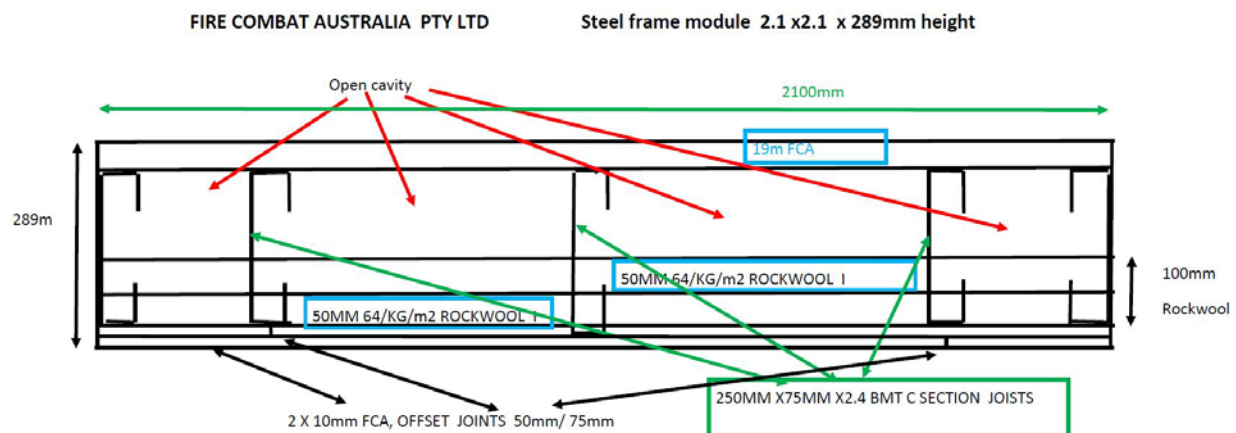


Figure 9: Client Supplied Drawing of Specimen



17. APPENDIX B – TABLES

Table 1: Specimen Temperatures (TC 1 to 12)

TIME	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC10	TC11	TC12
0	23	23	23	23	24	25	24	25	25	25	25	25
1	23	23	23	24	24	25	24	25	25	25	25	25
2	24	24	24	24	24	25	24	25	25	25	25	25
3	26	26	26	27	27	25	24	25	25	25	25	25
4	30	30	30	33	32	25	24	25	25	25	25	25
5	36	36	35	40	39	25	25	25	25	25	25	25
6	43	43	41	48	46	25	25	25	25	25	25	25
7	51	51	48	56	55	26	26	25	25	25	25	25
8	59	59	55	64	63	27	28	25	25	25	25	25
9	66	69	63	72	73	28	31	25	25	25	25	25
10	74	78	70	79	80	29	35	25	25	25	25	25
11	80	83	77	84	85	31	43	25	25	25	25	25
12	84	86	82	87	87	33	51	25	25	25	25	25
13	86	88	86	88	90	35	61	26	25	25	26	25
14	88	90	88	90	94	37	67	26	26	26	26	26
15	92	95	90	94	98	40	73	26	26	27	26	26
16	96	98	94	98	100	44	78	27	27	28	27	27
17	98	99	98	99	101	48	84	27	27	29	27	27
18	99	100	99	100	102	52	87	28	28	30	28	28
19	100	101	100	101	102	57	89	28	29	31	29	29
20	101	101	101	102	103	60	91	29	30	33	30	30
21	101	102	102	103	104	63	91	30	31	35	30	31
22	102	103	103	104	105	66	92	31	32	36	31	32
23	103	104	103	105	106	68	92	31	33	38	32	33
24	104	105	104	106	107	70	93	32	34	39	34	34
25	105	107	105	107	108	71	93	34	35	41	36	35
26	106	108	106	109	111	72	93	37	36	42	38	36
27	107	110	107	112	114	73	93	40	37	44	41	37
28	110	114	109	116	120	74	93	42	38	45	43	38
29	113	120	112	121	125	75	96	43	39	49	43	39
30	118	126	117	126	128	77	96	44	41	53	44	41

Table 1: Specimen Temperatures (TC 1 to 12) cont.

TIME	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC10	TC11	TC12
31	123	130	123	129	134	78	97	46	42	55	45	43
32	127	136	127	136	147	80	98	51	44	57	46	44
33	131	151	130	150	160	81	97	54	45	58	48	47
34	143	166	138	164	171	82	97	57	47	60	49	48
35	155	175	151	174	179	83	97	60	49	61	51	50
36	167	182	162	182	186	84	98	62	51	64	53	51
37	175	187	171	188	194	85	98	64	53	65	55	53
38	183	197	179	199	217	86	98	66	55	67	57	54
39	192	223	186	224	244	88	98	67	57	68	58	56
40	212	252	196	250	272	89	97	68	58	69	60	57
41	237	281	220	277	299	91	96	69	60	70	61	58
42	264	311	247	304	324	93	97	70	61	71	63	60
43	290	336	272	327	346	96	99	71	62	72	64	61
44	315	357	299	349	364	99	102	72	63	73	65	61
45	335	372	321	364	377	101	107	73	64	73	66	62
46	353	384	343	376	387	105	114	74	65	73	67	63
47	367	391	359	385	394	108	122	74	66	74	68	63
48	377	397	373	392	399	112	132	75	67	74	68	64
49	385	401	384	397	403	117	144	76	67	74	69	65
50	391	404	391	401	406	121	156	76	68	75	70	66
51	396	408	397	404	410	125	168	76	69	75	70	66
52	400	411	401	408	414	130	180	77	69	76	71	67
53	404	415	405	412	417	134	192	77	70	76	72	67
54	408	419	409	415	421	138	203	77	71	77	72	67
55	412	423	413	419	426	141	214	78	71	77	73	68
56	415	427	417	424	432	145	224	78	72	77	73	68
57	420	433	420	430	439	149	234	78	72	78	73	69
58	425	440	425	439	448	152	243	78	73	78	74	69
59	431	448	430	450	461	156	251	78	73	78	74	69
60	440	462	436	470	488	159	261	78	73	78	74	70

Table 1: Specimen Temperatures (TC 1 to 12) cont.

TIME	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC1 0	TC1 1	TC1 2
61	452	487	450	497	513	162	270	78	74	78	75	70
62	475	506	491	520	535	165	280	78	74	78	75	70
63	500	545	552	541	571	168	299	77	73	77	74	70
64	523	585	588	561	599	172	322	77	73	76	74	70
65	542	611	637	576	637	176	341	77	73	76	74	70
66	562	655	725	588	701	180	358	76	73	75	74	70
67	574	714	790	605	767	183	383	76	73	75	74	70
68	582	755	833	622	811	187	413	76	73	75	74	70
69	596	772	856	642	846	192	450	75	72	75	74	70
70	612	783	864	667	812	197	488	75	72	75	74	70
71	630	795	880	699	821	203	523	75	72	76	74	70
72	656	804	959	725	835	211	560	75	72	77	74	70
73	683	933	960	725	824	224	882	75	73	79	74	70
74	725	934	959	759	835	249	937	74	73	86	74	73
75	760	941	953	771	833	277	1370	74	77	96	74	79
76	794	937	939	782	829	301	1370	75	81	123	74	86
77	831	917	912	845	826	336	1370	75	87	267	74	94
78	780	938	925	790	843	377	1370	76	94	331	75	98
79	801	940	906	792	860	431	0	77	108	368	82	127
80	883	949	894	1370	901	496	742	80	159	405	90	157
81	892	966	903	1352	1370	568	727	85	182	443	95	181
82	905	971	911	1240	1370	629	737	90	200	482	100	197
83	1035	979	913	1370	1370	681	745	94	219	522	126	215
84	1125	979	917	1370	1370	715	754	97	237	556	138	232
85	1370	989	918	1370	1370	740	762	102	258	586	148	249
86	1370	987	923	1370	1158	759	759	122	304	614	156	269
87	1370	998	925	1370	911	780	770	136	367	639	163	295
88	1370	988	926	1370	753	805	778	145	405	670	171	330
89	1370	982	922	1370	574	824	781	154	443	688	179	390
90	1370	978	920	1370	630	841	804	164	470	712	187	440

Table 1: Specimen Temperatures (TC 1 to 12) cont.

TIME	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC1 0	TC1 1	TC1 2
91	1370	976	921	1370	576	853	804	175	495	734	196	476
92	1370	978	921	1370	538	862	809	184	514	753	205	503
93	1370	979	922	1370	575	868	812	193	533	769	216	527
94	1370	979	920	1370	532	873	821	201	549	785	225	547
95	1370	979	919	1370	562	877	823	211	565	798	236	566
96	1370	1006	918	1370	581	880	822	221	580	810	245	585
97												
98												
99												
100												
101												
102												
103												
104												
105												
106												
107												
108												
109												
110												
111												
112												
113												
114												
115												
116												
117												
118												
119												
120												

Table 2: Specimen Temperatures (TC 13 to 18)

TIME	TC13	TC14	TC15	TC16	TC17	TC18	UNEXPOSED FACE AVERAGE
0	25	26	26	26	26	26	26
1	25	26	26	26	26	26	26
2	25	26	26	26	26	26	26
3	25	26	26	26	26	26	26
4	25	26	26	26	26	26	26
5	25	26	26	26	26	26	26
6	25	26	26	26	26	26	26
7	25	26	26	26	26	26	26
8	26	26	26	26	26	26	26
9	26	26	26	26	26	26	26
10	26	26	26	26	26	26	26
11	26	26	26	26	26	26	26
12	26	26	26	26	26	26	26
13	26	26	26	26	26	26	26
14	26	26	26	26	26	26	26
15	26	26	26	26	26	26	26
16	26	26	26	26	26	26	26
17	26	27	27	27	26	26	27
18	26	27	27	27	26	27	27
19	27	27	27	27	27	27	27
20	27	27	28	27	27	27	27
21	27	28	28	28	27	28	28
22	27	28	29	28	28	28	28
23	28	28	29	28	28	28	28
24	28	29	30	29	29	29	29
25	29	29	31	29	30	30	30
26	29	30	32	30	30	30	30
27	30	31	33	31	31	31	31
28	31	31	34	32	31	32	32
29	32	32	35	33	32	33	33
30	33	33	36	34	33	34	34

Table 2: Specimen Temperatures (TC 13 to 18) cont.

TIME	TC13	TC14	TC15	TC16	TC17	TC18	UNEXPOSED FACE AVERAGE
31	34	33	37	35	34	35	35
32	35	34	39	36	35	36	36
33	37	35	40	37	36	37	37
34	38	36	42	38	37	39	38
35	40	37	43	39	38	40	40
36	42	38	45	39	39	42	41
37	43	39	46	41	41	43	42
38	45	41	48	42	42	44	44
39	47	42	49	43	43	46	45
40	49	43	50	44	44	48	46
41	50	45	52	45	45	49	48
42	52	46	53	47	46	51	49
43	53	47	54	48	48	52	50
44	54	48	55	49	48	53	51
45	55	50	56	50	50	55	53
46	56	51	57	51	50	56	54
47	57	52	58	52	51	57	55
48	58	53	59	53	52	58	56
49	59	54	59	54	53	59	56
50	60	54	60	55	53	59	57
51	60	55	60	55	54	60	57
52	61	56	61	56	54	60	58
53	62	56	61	57	55	61	59
54	62	57	62	58	56	62	60
55	62	58	62	58	56	62	60
56	63	58	62	59	56	62	60
57	63	59	63	59	57	63	61
58	64	59	63	60	57	63	61
59	64	60	63	60	57	63	61
60	64	60	64	61	57	64	62

Table 2: Specimen Temperatures (TC 13 to 18) cont.

TIME	TC13	TC14	TC15	TC16	TC17	TC18	UNEXPOSED FACE AVERAGE
61	64	60	64	61	58	64	62
62	64	61	64	61	58	64	62
63	64	61	64	62	58	64	62
64	64	61	65	62	58	64	62
65	64	61	65	62	58	65	63
66	65	62	65	63	59	64	63
67	64	62	65	63	59	64	63
68	64	62	64	63	59	64	63
69	64	62	64	63	59	64	63
70	64	62	64	63	59	64	63
71	64	62	64	63	59	64	63
72	64	62	64	63	59	64	63
73	64	61	64	63	59	64	63
74	64	61	64	63	59	64	63
75	64	61	65	63	59	64	63
76	64	62	66	63	60	66	64
77	63	62	68	63	61	68	64
78	64	63	73	63	63	72	66
79	64	65	81	63	66	79	70
80	64	68	89	63	71	87	74
81	64	73	96	65	76	97	79
82	65	78	100	67	80	99	82
83	66	82	102	69	84	100	84
84	68	84	101	73	86	100	85
85	70	86	101	76	88	100	87
86	72	87	101	79	90	100	88
87	75	89	103	83	94	101	91
88	78	93	107	86	97	105	94
89	81	97	113	89	99	113	99
90	84	100	121	90	99	124	103

Table 2: Specimen Temperatures (TC 13 to 18) cont.

TIME	TC13	TC14	TC15	TC16	TC17	TC18	UNEXPOSED FACE AVERAGE
91	88	101	136	92	99	144	110
92	91	100	160	92	99	165	118
93	93	100	178	93	99	180	124
94	94	102	193	94	101	201	131
95	95	105	217	95	104	228	141
96	96	110	237	96	109	248	149
97							
98							
99							
100							
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120							

Table 3: Critical Observations

TIME		OBSERVATIONS
MINS	SECS	
41	00	Slight amount of smoke emitting from North edge of specimen
60	00	Viewing into furnace from underside viewing ports restricted due to fallen debits
84	00	Smoke emitting from floor board joints and discolouration evident at East and West ends (of joints)
88	00	Floor board joints beginning to show signs of opening up
90	00	Floor board joints glow is visible around the centre of each, cotton pad not applied as test to be terminated

18. APPENDIX C – PHOTOGRAPHS

Photo Group 1 – Specimen Thermocouple Locations



Photo 2 – Exposed side prior to mounting on furnace



Photo 3 – Unexposed side prior to test commencement



Photo Group 4 – Unexposed joints at 84 minutes



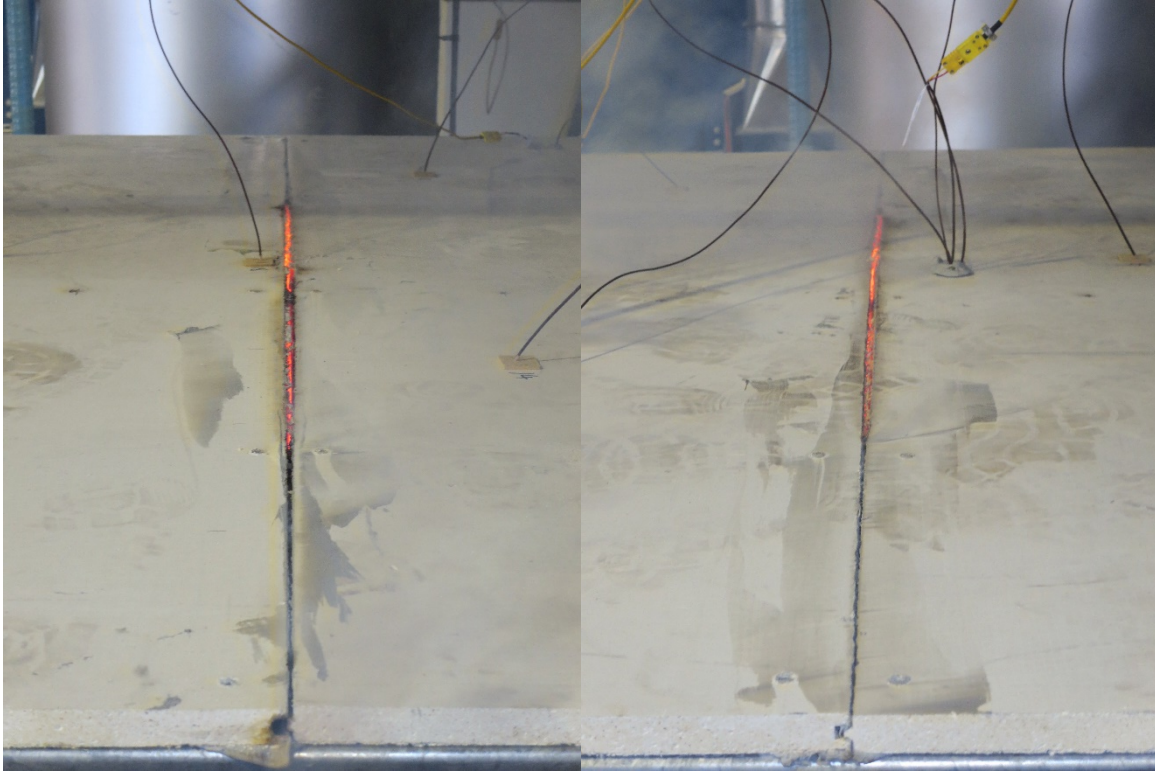
Photo Group 5 – Smoke from specimen at 86 minutes



Photo 6 – Joint at 88 minutes



Photo 7 & 8 – Joints at 91 minutes



-----END OF REPORT-----