COMMERCIAL-IN-CONFIDENCE

Resolute
Testing Laboratories

Test Report – Fire Resistance:

SUBJECT:	R&D Investigation into the performance of ROBUST SYSTEMS by ResCom (CMC) Exterior and Interior Fire and Impact System.
SCOPE:	Measurement of fire resistance in general accordance with AS1530.4:2014 Section 2.
TEST DATE:	9th March 2022
REPORT DATE:	9th March 2022
AUTHOR:	M.Lewis
REPORT NUMBER:	**RTL FT 1361.01**

Sponsor:

RGBP Whanau Trust

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1. Document History

Revision #	Date	Sent To	Additional Information
RTL FR 1361.DR	23/03/2022	Client	Draft issue for comment
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2. Facility Name and Address

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3. Report Authorisation

Written By	Title	Date	Signature
M.Lewis	Technical Manager	23/03/2022	

Authorised By	Title	Date	Signature
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4. INTRODUCTION

4.1. Identification of Specimen

The sponsor identified the specimen as ROBUST SYSTEMS by ResCom (CMC), Exterior and Interior Fire and Impact System.

4.2. Overview

This report details a test carried out on the above specimen. The fire test was carried out in general accordance with Australian Standard AS 1530.4:2014 to measure the fire-resistance of the specimen, departures from the Standard are discussed in Section 8. The specimen under test was installed into a steel restraint frame suitable for mounting to the test apparatus.

4.3. Manufacturers & Suppliers

The laboratory was not involved in the selection of any test specimen materials for this test.

Table 1 – Product Details

PRODUCT NAME	MANUFACTURER	SUPPLIER
90x45mm timber frame (M12)	Narangba Timbers	ResCom
10mm standard plasterboard	CSR Gyprock Batch #9314450006989	ResCom
R2.5 Glasswool	Knauf Insulation	ResCom
10mm ResCom (CMC) Shiplap	RGBP Global Building Products	ResCom
Vapor Barrier Wrap Model #MD-40-B	Ametalin	ResCom
8g self-tapering drywall screws	Zenith	ResCom
Fire Rated Caulking	CSR Easy-Flow	ResCom
Nails	Paslode	ResCom
Jointing compound	CSR Gyprock Multi-Purpose	ResCom
Jointing Tape	Builders Edge mesh tape	ResCom
InsulCore Rockwool 140 kg 450 x 600 x 35 mm	RGBP Insulation	ResCom

4.4. Test Standard

The measurements leading to the results presented in this report have been undertaken in general 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.
    - Generally Section 2
- **Please refer to Section 8 for deviations from the Standard.**

5. DESCRIPTION OF SPECIMEN

5.1. General

The test specimen consisted of a ROBUST SYSTEMS by ResCom (CMC), Exterior and Interior Fire and Impact System.

All dimensions are nominal unless otherwise stated, with the specimen orientation described as viewed form the exposed side.

5.2. Specimen A: ResCom (CMC) Hybrid Wall System

The specimen description has been provided by the Client. The lab was not able to fully verify all components due to the wall being delivered to us partially assembled.

Method of Construction:

Timber Framing Standards AS:1684 and AS:1720
Assemble M12 90mm x 45mm Stud Frame with at 450mm o/c Vertical Studs
Nail the timbers together using screw shank coil nails or similar
Nail Fix to the fire side of the system, 1 x layer of 10mm ResCom (CMC) Sheathing to the timber frame using screw shank coil nails or similar.
Nail spacings as per ResCom BP recommendations
Install insulation in the cavity as per ResCom BP recommendations
Screw / Nail Fix 1 x layer of standard 10mm Plasterboard to the non-fire side of the timber frame
Maximum Screw / Nail spacing at 300mm
Tape and set all joints with base coat jointing compound. Allow to dry before sanding and applying desired finishes.

5.3. Orientation

The supporting construction was placed vertically against the furnace chamber and subjected to fire exposure from one side only. The supporting construction was asymmetrical due to the installation of the differing board material on each face.

5.4. Support and Restraint Conditions

The test specimen was supported in the test specimen frame by refractory brick material covered with a ceramic fibre blanket to create a seal for the test specimen. The test specimen wall as restrained within the frame by way of two vertical steel angles and four screw clamps.

5.5. Pre-Test Conditioning

The specimen was completed on 4th March 2022 and left to cure in the indoor laboratory environment until the test day.

5.6. Construction of the test specimen

The Client supplied and constructed the supporting construction offsite and delivered it to Resolute. The lab then instrumented the internals of the wall, and the Client installed the final sheet of board.

6. DOCUMENTATION

The following documents were supplied or referenced by the sponsor as a complete description of the specimen and should be read in conjunction with this report:

- "ResCom Boundary Wall 60min FRL System" dated 09/03/2022
- Emailed specimen description dated 9th March 2022.

For ease of reference these have been included in Appendix C.

Should any discrepancy exist between the drawings and the body of this report, the report shall take precedence.

7. EQUIPMENT

7.1. Furnace

The furnace had a nominal opening of 1650 mm x 1650 mm for attachment of vertical or horizontal specimens. The furnace was lined with refractory blanket material meeting the requirements of Clause 2.1 of AS 1530.4:2014 and was heated by combustion of a mixture of LPG and air. The temperature of the furnace was 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

7.2. Temperature

The temperature in the furnace chamber was measured using four Type-K 3 mm diameter 310 stainless steel Mineral Insulated Metal Sheathed (MIMS) thermocouples. Each thermocouple was housed in 15NB 253MA steel support tubes, sealed at each end with refractory blanket with the measuring junction protruding into the furnace a minimum of 25 mm.

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

Roving thermocouples were available to measure temperatures at positions that appeared hotter than the positions monitored by fixed thermocouples.

The location of the thermocouples throughout the specimen is described in Table 4 and results are in Appendix B Test Results.

7.3. Pressure

Furnace pressure was measured with a Dwyer Magnesense pressure transmitter (S/N 71640), with a probe located 100 mm away from test specimen.

7.4. Measurement System

The measurement system comprised a multiple-channel data-logger scanning at 1 second intervals to internal storage and logging at 1 minute intervals to an external computer.

8. Deviations from the Test Standard

Fire rated wall systems shall be tested at "full-scale". AS 1530.4-2014 highlights this under C 3.2.2. referring to 2.9.2, where it states:

"The specimen shall be full size. Where the dimensions of the full size specimen exceed that of the furnace opening, the minimum dimensions of the specimen shall be 3000 mm x 3000 mm for vertical specimens and 4000 mm x 3000 mm for horizontal specimens"

Thus testing of a smaller specimen size has limited applicability, namely internal research, and development.

Other variations not considered are loading and restraint, deflection, vertical free edges, and interaction with other building elements.

This report should not be relied upon for Evidence of Suitability.

9. Termination of Test

The test was terminated at 84 minutes by agreement with the sponsor.

10. Test Results

10.1. Laboratory Ambient Temperature at Commencement of fire test

At 8.32 am on the test date at the commencement of the test, the indoor ambient temperature was 30 °c. Over the 84 minute test duration the temperature increased to 32 °c.

10.2. Observations

The following table includes the critical observations of the significant behavior of the specimen and details of the occurrence of the various performance criteria specified in AS 1530.4:2014.

Table 2 – Test Observations

Time		Observations
Min	Sec	
0	00	Test commenced.
11	00	Light to medium volumes of smoke coming from the perimeter of the framing.
15	00	The specimen maintains integrity & insulation in accordance with AS 1530.4:2014.
30	00	The specimen maintains integrity & insulation in accordance with AS 1530.4:2014.
45	00	The specimen maintains integrity & insulation in accordance with AS 1530.4:2014.
53	00	Slight discoloration around discrete area without cavity insulation
53	00	**TC42 positioned over the discrete area without cavity insulation recorded a temperature of 218°c.** **Failure of insulation in accordance with Clause 2.13.3 (b) of AS 1530.4:2014, where the maximum temperature of TC42 exceeded the initial temperature by more than 180 K.**
57	00	The discoloration noted above is increasing
60	00	The specimen maintains integrity in accordance with AS 1530.4:2014.
65	20	Discrete area with no cavity insulation is deteriorating quickly.
66	30	A crack has formed in the plasterboard in the discrete area with no cavity insulation.
69	10	The paper face of the plasterboard in the above location has started to ignite.
70	30	Blanket applied over discrete area without cavity insulation.
73	00	Significant discoloration occurring across the face of the wall.
77	00	Audible popping and cracks heard from within the wall.

78	00	Heavy discoloration / charring across the wall face
79	20	A crack is forming at the centre height of the right-hand plasterboard sheet
80	40	Some glowing / char is evident from the above noted crack
82	00	The crack has widened, and hot gas is being emitted
83	00	100x100mm cotton pad applied to above crack
83	30	**Cotton pad applied to the right-hand plasterboard sheet approx. mid height and resulted in ignition.** **Failure of integrity in accordance with Clause 2.13.2.2 of AS 1530.4:2014, where the cotton pad is applied for 30 s ±2 s and ignition occurs (defined as glowing or flaming).**
83	40	**Sustained flaming on the surface of the unexposed face, at the lower left-hand side of the wall.** **Failure of Integrity in accordance with Clause 2.13.2.4 of AS 1530.4-2014, where the flaming is sustained for 10 s or longer.**
84	12	Test stopped at the discretion of the laboratory.

Photographs of the specimen are included in Appendix D.

10.3. Furnace Temperature

Chart 1 shows the standard time-temperature curve for heating the furnace chamber along with the actual average and maximum time-temperature curves recorded during the heating period.

10.4. Furnace Severity

Chart 2 shows the furnace severity versus time during the heating period.

10.5. Furnace Pressure

Chart 3 shows the plot if the furnace pressure versus time. The probe was located at 100 mm from the supporting construction. Furnace pressure differential was controlled in accordance with 2.11.3.1 of AS 1530.4:2014.

10.6. Specimen Temperature

Charts in appendix B show the traces of the relevant thermocouples positioned throughout the wall for the duration of the test.

10.7. Performance

Performance observed in respect of the following AS 1530.4:2014 Clause 2.13 criteria:

SPECIMEN A: RESCOM (CMC) HYBRID WALL SYSTEM	
Structural Adequacy	Not applicable
Integrity	Failure at 83 minutes
Insulation	Failure at 53 minutes

This report details the methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variation with respect to size, construction details, loads, stresses, edge, or end conditions, other than those 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 the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

The results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions.

11. TESTED BY

	
Matthew Lewis, Technical Manager	Rob Biviano, Laboratory Technician

Appendix A – Measurement Locations

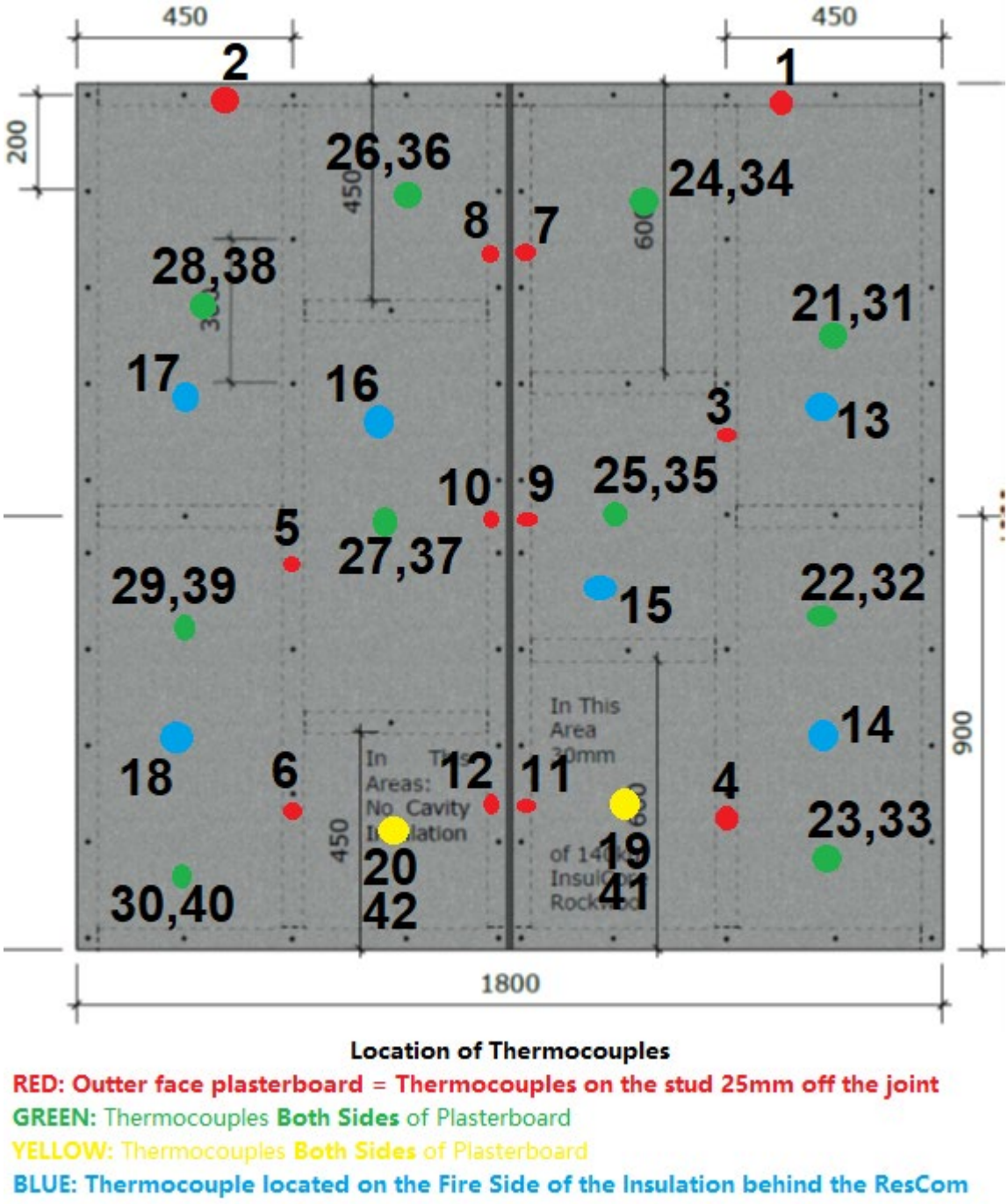


Figure 1 – Thermocouple Locations

Table 3 – Specimen Thermocouple Locations

Group Location	T/C No.	Description
A – NFS Plasterboard, Red	01	Top Left, over stud 25mm off the joint
	02	Top Right, over stud 25mm off the joint
	03	Middle Left, over stud
	04	Bottom Left, over stud
	05	Middle Right, over stud
	06	Bottom right, over stud
	07	Top Left, 25mm from central join, over stud
	08	Top Right, 25mm from central join, over stud
	09	Central Left, 25mm from central join, over stud
	10	Central Right, 25mm from central join, over stud
	11	Bottom Left, 25mm from central join, over stud
	12	Bottom Right, 25mm from central join, over stud
B – Cavity, FS of insulation, facing insulation, Blue	13	1/3 Down Left Side
	14	2/3 Down, left side
	15	Central, left side
	16	1/3 down right side
	17	1/3 down right side
	18	2/3 down right side
C – Cavity of discrete area of insulation change, Yellow	19	Bottom, left side with rockwool
	20	Bottom, right side with no insulation
D – Cavity, plasterboard, Green	21	1/3 down, left side
	22	2/3 down, left side
	23	Bottom, left side
	24	Top, left side
	25	Central, left side
	26	Top, right side
	27	Central, right side
	28	1/3 Down, right side
	29	Approx central, right side
	30	Bottom, right side
E – NFS, plasterboard, Green	31	1/3 down, left side
	32	2/3 down, left side
	33	Bottom, left side
	34	Top, left side
	35	Central, left side
	36	Top, right side
	37	Central, right side
	38	1/3 Down, right side
	39	Approx central, right side
	40	Bottom, right side
F – Over discrete area of insulation change, Yellow	41	Bottom, left side, over cavity with rockwool
	42	Bottom, right over cavity with no insulation

Appendix B – TEST DATA

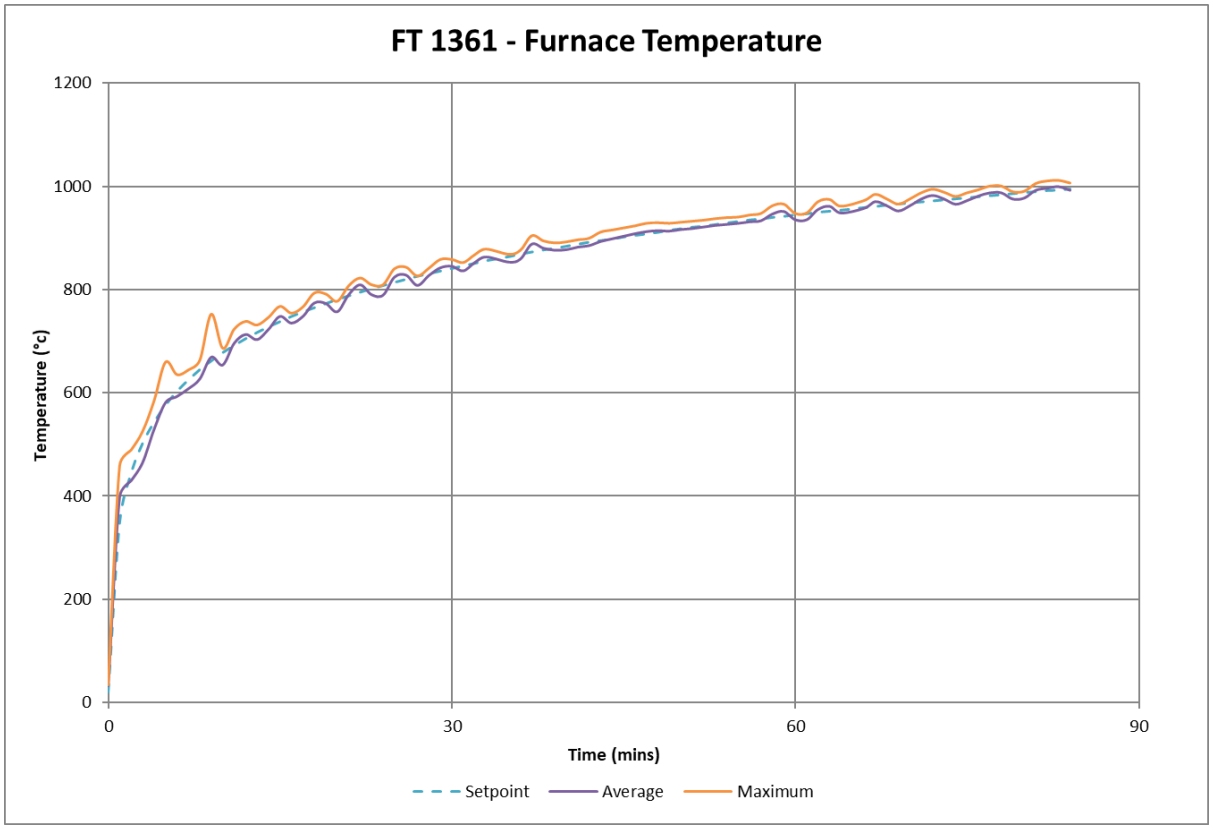


Chart 1 – Furnace Temperature

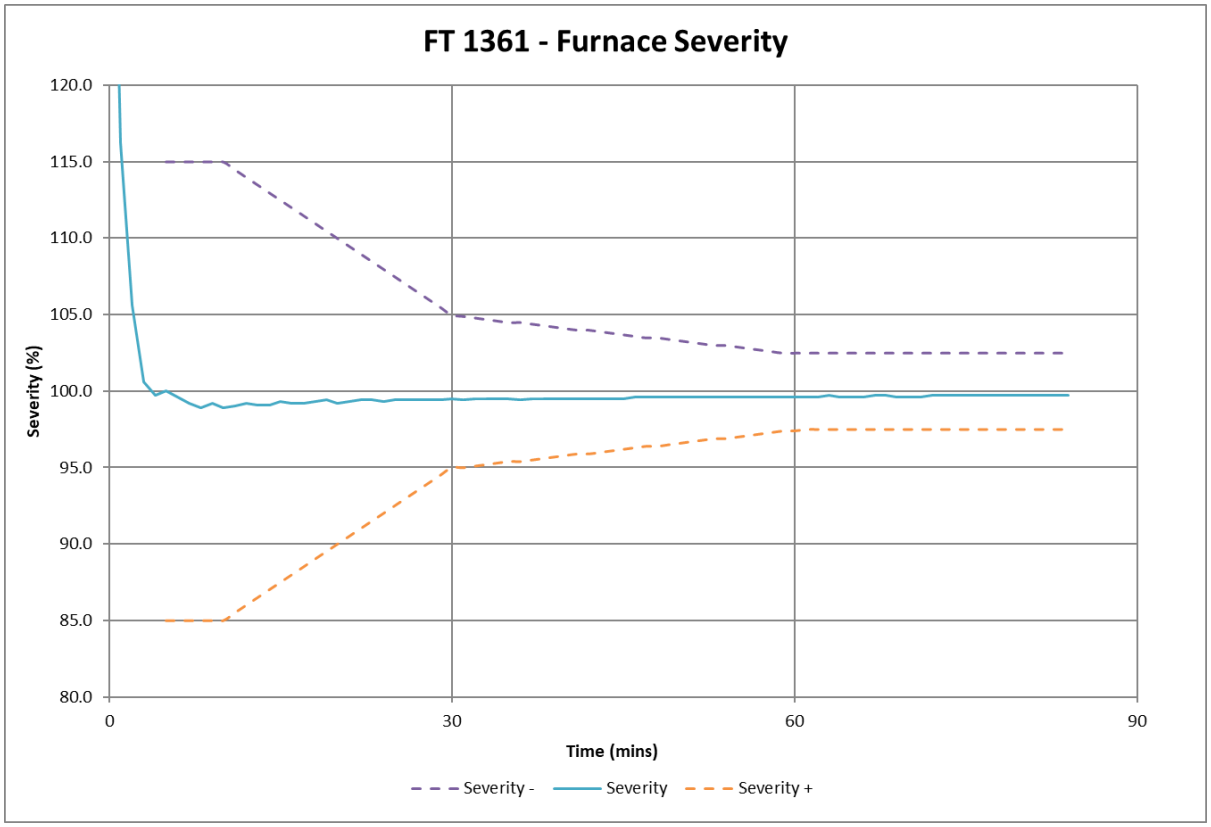


Chart 2 – Furnace Severity

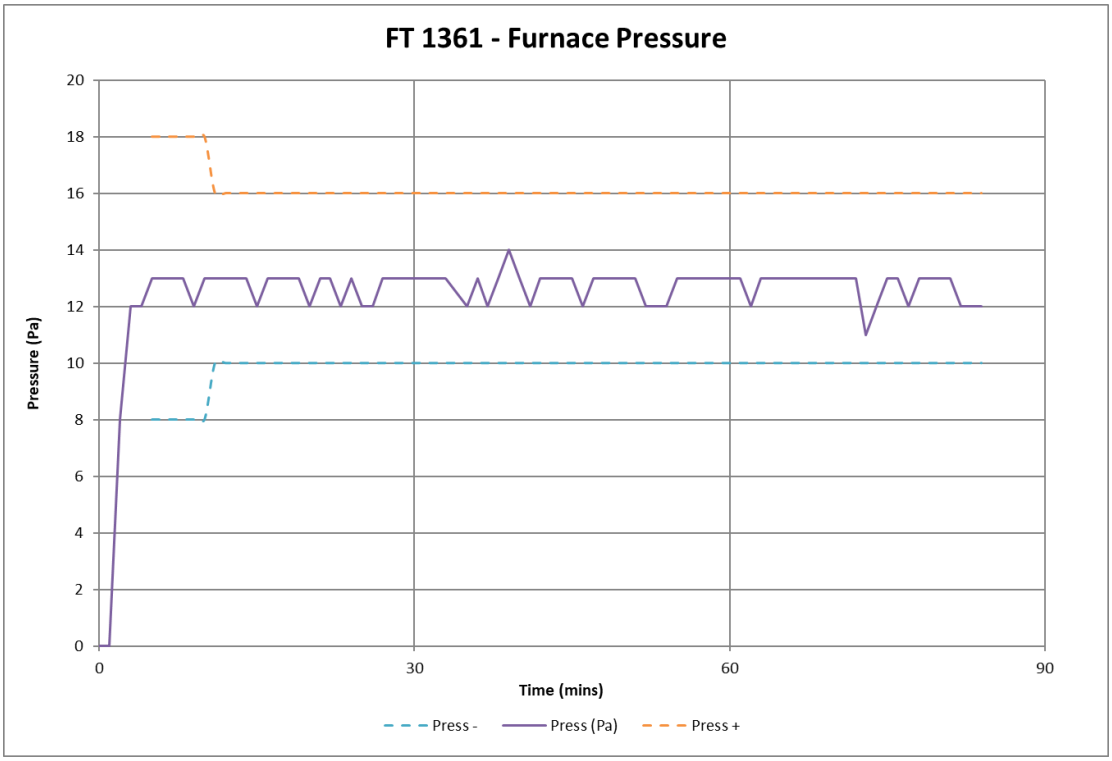


Chart 3 – Furnace Pressure

Note: Furnace pressure was controlled at the probe location at the mid height of the wall. The specimen was subjected to a target pressure of 20 Pa at the head of the wall.

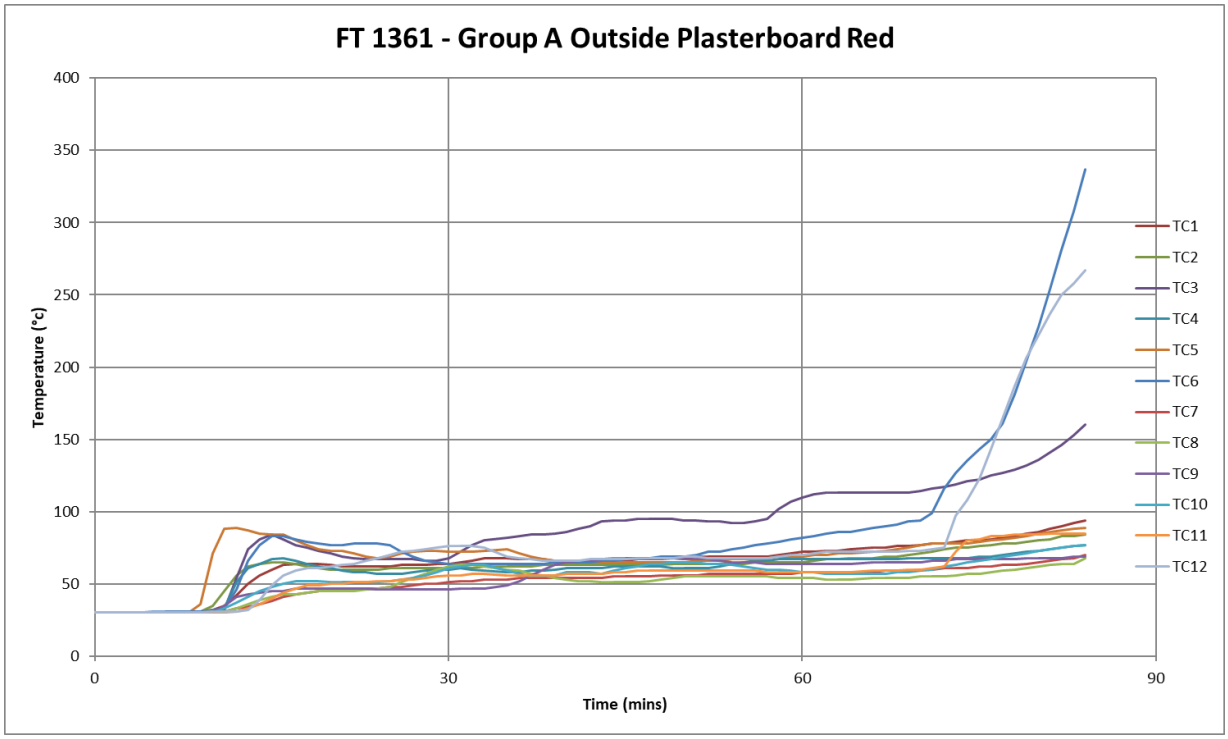


Chart 4 – Group A non-fireside plasterboard - red

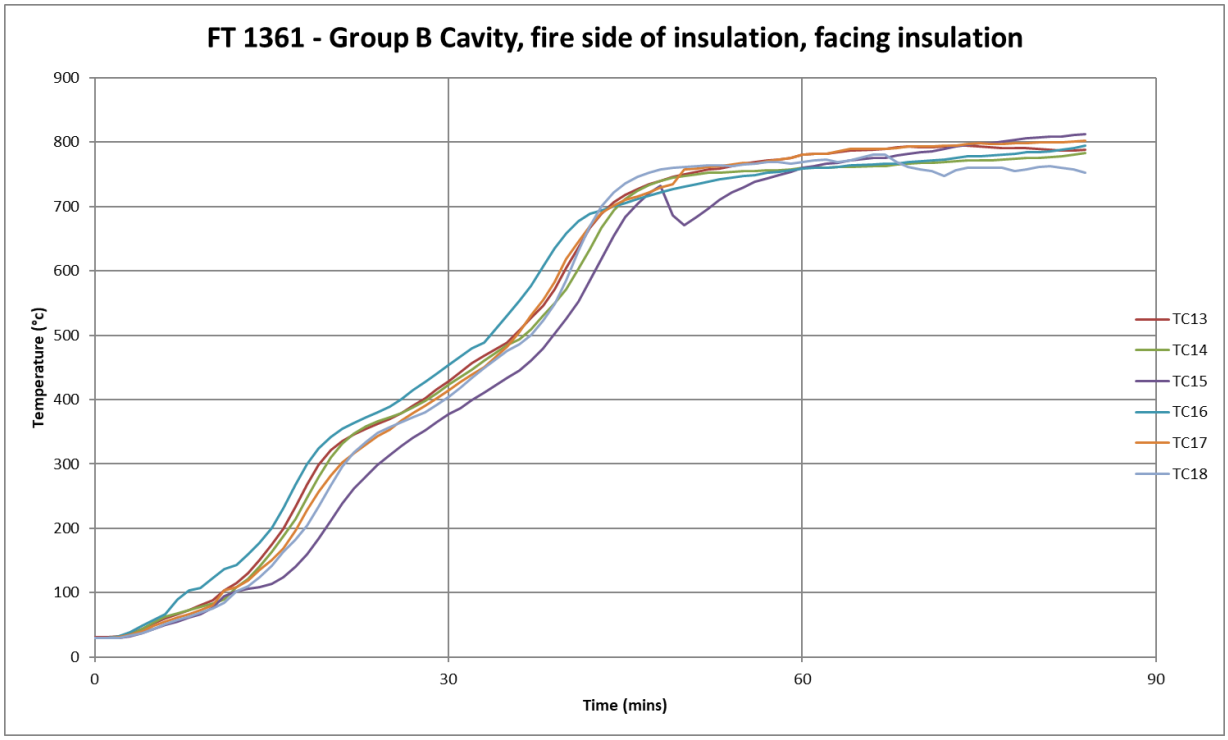


Chart 5 - Group B Cavity, fire side of insulation, facing insulation

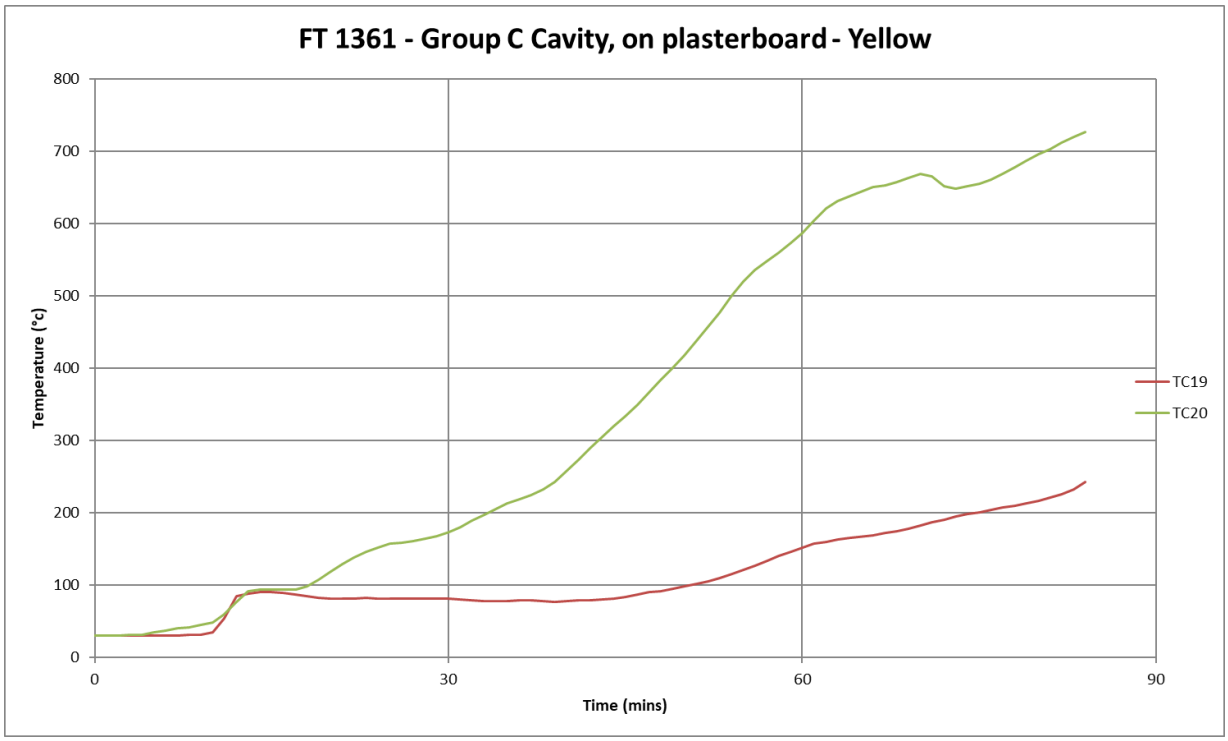


Chart 6 – Group C Cavity, on plasterboard - Yellow

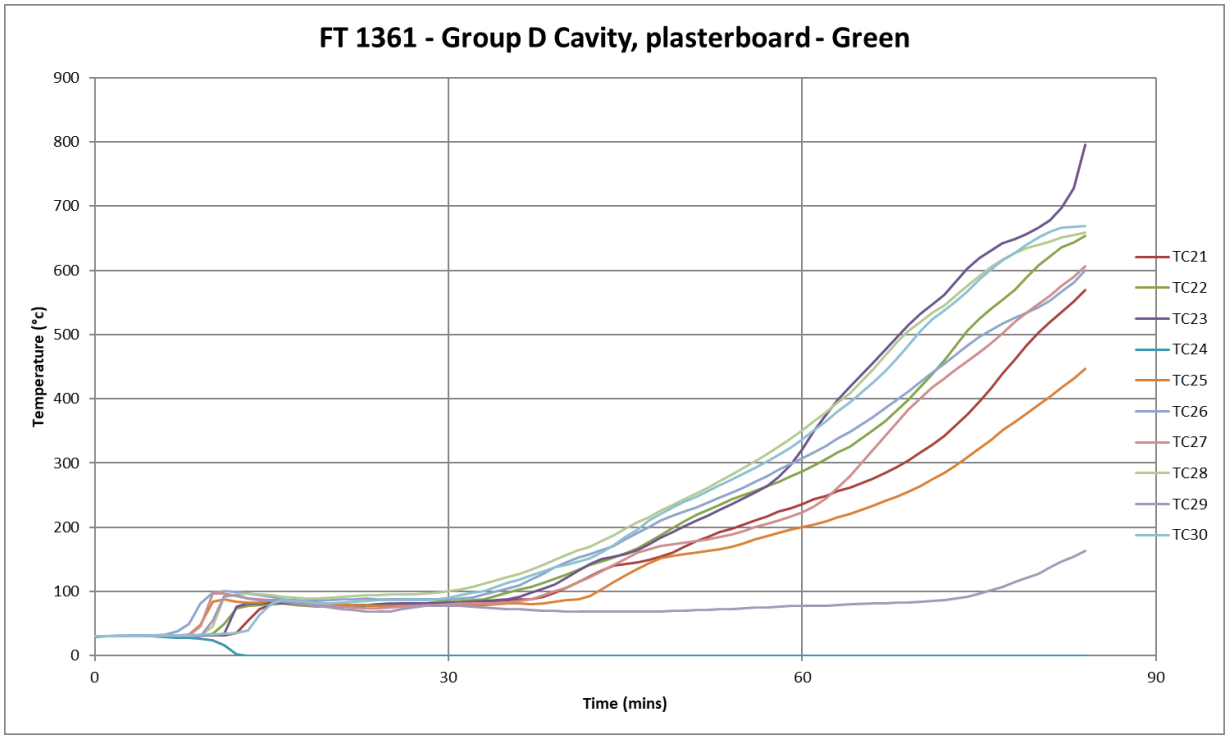


Chart 7 - Group D Cavity, plasterboard - Green

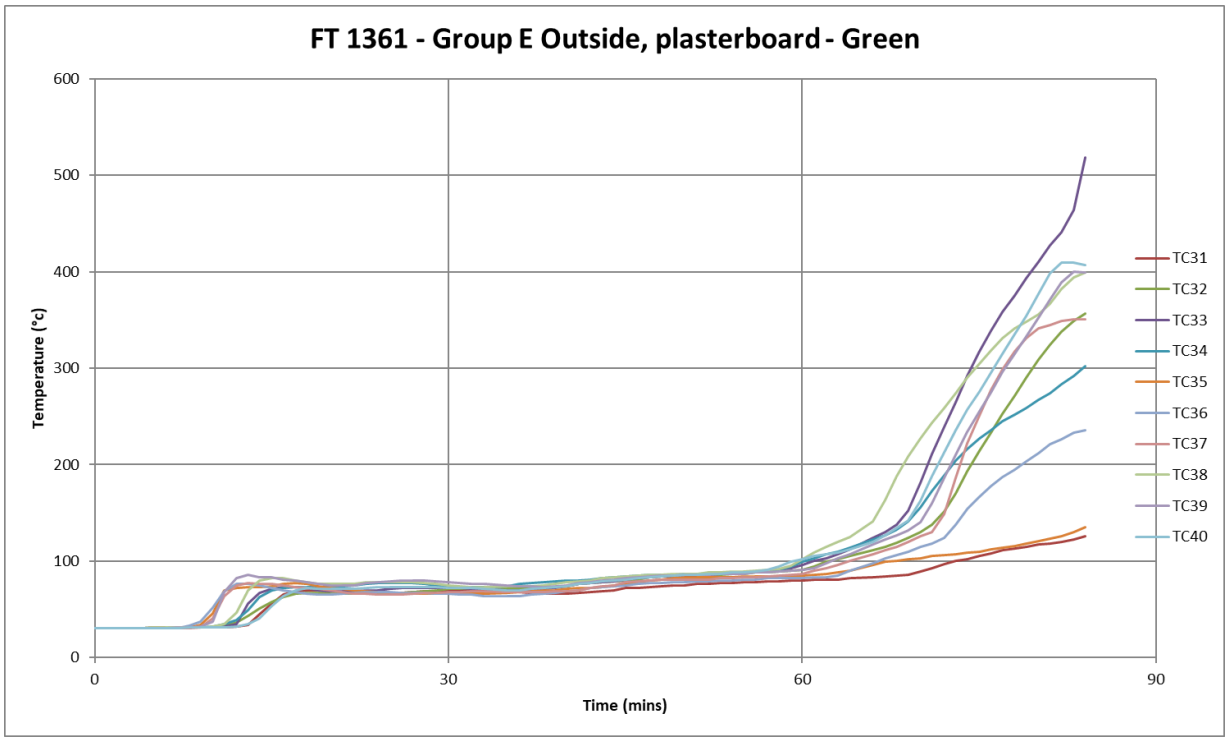


Chart 8 – Group E Outside, plasterboard - Green

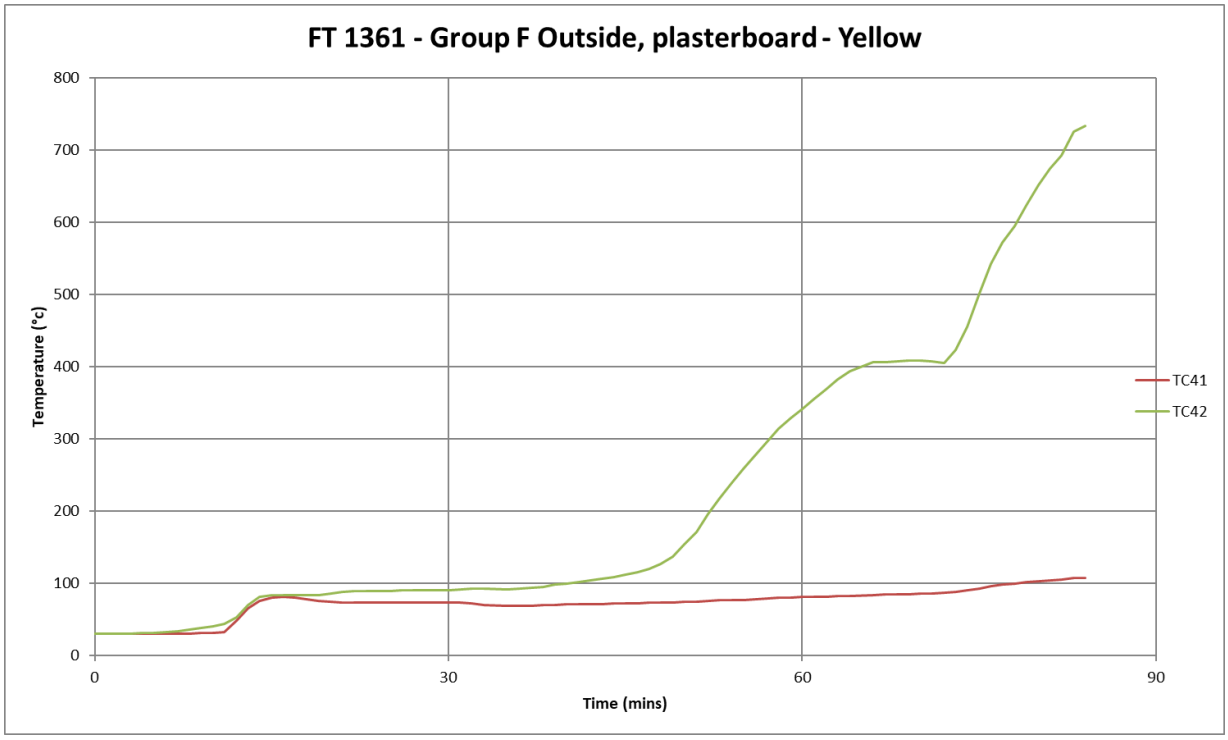


Chart 9 - Group F Outside, plasterboard – Yellow

Table 4 – Group A TCs, Labeled Red Outer Face Plasterboard

Time	Min	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC10	TC11	TC12
8:32:15 AM	0	30	30	30	30	30	30	30	30	30	30	30	30
8:33:15 AM	1	30	30	30	30	30	30	30	30	30	30	30	30
8:34:15 AM	2	30	30	30	30	30	30	30	30	30	30	30	30
8:35:15 AM	3	30	30	30	30	30	30	30	30	30	30	30	30
8:36:15 AM	4	30	30	30	30	30	30	30	30	30	30	30	30
8:37:15 AM	5	30	30	30	30	30	31	30	30	30	30	30	30
8:38:15 AM	6	30	30	30	30	30	31	30	30	30	30	30	30
8:39:15 AM	7	30	30	31	30	30	31	30	30	30	30	30	30
8:40:15 AM	8	31	30	31	30	30	31	30	30	30	30	30	30
8:41:15 AM	9	31	31	31	30	36	31	30	30	30	30	30	30
8:42:15 AM	10	32	35	31	31	71	32	31	31	30	30	30	31
8:43:15 AM	11	35	45	32	33	88	33	31	31	35	33	30	31
8:44:15 AM	12	42	56	54	51	89	46	33	33	41	37	31	31
8:45:15 AM	13	50	62	74	61	87	66	34	36	43	41	33	32
8:46:15 AM	14	56	64	81	64	85	77	36	39	44	45	36	39
8:47:15 AM	15	60	65	84	67	84	83	38	41	45	48	40	49
8:48:15 AM	16	63	65	81	68	84	83	41	43	45	50	44	56
8:49:15 AM	17	64	64	77	66	80	81	43	43	47	52	47	59
8:50:15 AM	18	64	62	75	64	77	79	44	44	47	52	49	61
8:51:15 AM	19	64	61	73	62	74	78	45	45	47	52	49	61
8:52:15 AM	20	63	60	71	61	73	77	46	45	47	51	50	62
8:53:15 AM	21	62	60	69	59	73	77	46	45	47	51	50	63

Time	Min	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC10	TC11	TC12
8:54:15 AM	22	62	60	68	58	71	78	47	45	47	51	51	64
8:55:15 AM	23	62	60	67	58	69	78	47	46	47	51	51	66
8:56:15 AM	24	62	60	67	57	68	78	47	47	46	51	52	68
8:57:15 AM	25	62	61	67	57	69	77	48	48	46	52	52	70
8:58:15 AM	26	63	61	67	57	71	72	48	51	46	53	53	72
8:59:15 AM	27	63	61	67	58	72	69	49	54	46	54	53	73
9:00:15 AM	28	63	61	66	59	73	66	50	57	46	56	54	74
9:01:15 AM	29	64	61	66	60	73	65	50	60	46	58	55	75
9:02:15 AM	30	64	61	68	60	72	64	51	62	46	61	56	76
9:03:15 AM	31	65	61	72	61	72	64	52	63	47	62	56	76
9:04:15 AM	32	66	61	77	60	72	64	52	63	47	63	57	76
9:05:15 AM	33	68	62	80	59	73	64	53	62	47	63	57	75
9:07:15 AM	35	68	62	82	58	74	64	53	60	49	59	56	69
9:08:15 AM	36	67	62	83	58	71	64	54	59	52	57	56	68
9:09:15 AM	37	67	62	84	59	69	64	54	57	56	55	56	67
9:10:15 AM	38	67	63	84	59	67	64	54	56	60	55	56	66
9:11:15 AM	39	66	63	85	60	66	65	54	54	63	56	56	66
9:12:15 AM	40	66	63	86	61	65	65	54	53	65	58	57	66
9:13:15 AM	41	66	63	88	61	65	65	54	52	66	58	57	66
9:14:15 AM	42	66	63	90	61	65	65	54	52	66	58	57	67
9:15:15 AM	43	66	63	93	61	65	66	54	51	67	57	57	67
9:16:15 AM	44	66	63	94	62	65	66	55	51	68	59	58	67
9:17:15 AM	45	66	63	94	62	65	67	55	51	68	61	58	67
9:18:15 AM	46	67	63	95	62	65	67	55	51	68	62	59	68
9:19:15 AM	47	67	63	95	62	65	68	55	52	68	64	59	68
9:20:15 AM	48	67	63	95	62	65	69	56	53	68	64	59	68
9:21:15 AM	49	68	64	95	61	65	69	56	54	68	65	59	68
9:22:15 AM	50	68	64	94	61	65	69	56	55	67	65	59	69
9:23:15 AM	51	69	64	94	61	66	70	56	55	67	65	59	69
9:24:15 AM	52	69	64	93	61	66	72	57	55	67	64	59	68
9:25:15 AM	53	69	64	93	62	66	72	57	55	66	64	59	68
9:26:15 AM	54	69	64	92	64	67	74	57	55	65	63	59	68
9:27:15 AM	55	69	64	92	65	67	75	57	55	65	62	59	68
9:28:15 AM	56	69	65	93	66	67	77	57	55	65	61	59	68
9:29:15 AM	57	69	65	95	66	68	78	57	55	64	60	58	68
9:30:15 AM	58	70	65	102	67	69	79	57	54	64	60	58	69
9:31:15 AM	59	71	65	107	67	69	81	57	54	64	59	58	70
9:32:15 AM	60	72	65	110	67	69	82	58	54	64	58	58	70
9:33:15 AM	61	72	66	112	67	70	83	58	54	64	58	58	71
9:34:15 AM	62	73	67	113	67	70	85	58	53	64	57	58	72
9:35:15 AM	63	73	67	113	67	71	86	58	53	64	57	58	72
9:36:15 AM	64	74	68	113	67	71	86	58	53	64	57	58	72
9:38:15 AM	66	75	68	113	67	72	89	58	54	65	57	59	72
9:39:15 AM	67	75	69	113	67	73	90	59	54	65	57	59	72

Time	Min	TC1	TC2	TC3	TC4	TC5	TC6	TC7	TC8	TC9	TC10	TC11	TC12
9:40:15 AM	68	76	69	113	67	74	91	59	54	65	58	59	72
9:41:15 AM	69	76	70	113	68	75	93	59	54	65	58	60	73
9:42:15 AM	70	77	71	114	68	77	94	60	55	65	59	60	73
9:43:15 AM	71	78	72	116	68	78	99	60	55	66	60	61	74
9:44:15 AM	72	78	74	117	68	78	116	61	55	66	62	62	75
9:45:15 AM	73	79	75	119	68	78	127	61	56	67	63	72	97
9:46:15 AM	74	80	75	121	68	78	135	61	57	67	65	80	108
9:47:15 AM	75	80	76	122	69	79	143	62	57	67	66	81	123
9:48:15 AM	76	81	77	125	69	80	150	62	58	67	67	83	143
9:49:15 AM	77	82	78	127	70	81	161	63	59	67	69	83	164
9:50:15 AM	78	83	78	129	71	82	181	63	60	67	70	84	187
9:51:15 AM	79	85	79	132	72	83	204	64	61	68	71	84	206
9:52:15 AM	80	86	80	136	73	85	228	65	62	68	73	84	222
9:53:15 AM	81	88	81	141	74	86	254	66	63	68	74	85	237
9:54:15 AM	82	90	83	146	75	87	281	67	64	68	75	85	250
9:55:15 AM	83	92	83	153	76	88	308	68	64	69	76	85	258
9:56:15 AM	84	94	84	160	77	89	337	70	68	69	77	85	267

Table 5 – Group B TCs, Labeled Blue Thermocouple Located on the Fire Side of the Insulation Behind the ResCom

Time	Mins	TC13	TC14	TC15	TC16	TC17	TC18
8:32:15 AM	0	31	30	30	30	30	30
8:33:15 AM	1	31	30	30	30	30	30
8:34:15 AM	2	32	31	30	32	31	30
8:35:15 AM	3	36	35	32	38	34	33
8:36:15 AM	4	44	43	37	48	40	37
8:37:15 AM	5	53	54	43	58	48	44
8:38:15 AM	6	60	63	50	67	55	51
8:39:15 AM	7	67	68	55	89	61	57
8:40:15 AM	8	73	73	61	103	67	63
8:41:15 AM	9	80	78	66	107	73	69
8:42:15 AM	10	88	83	77	122	81	76
8:43:15 AM	11	104	90	95	137	103	84
8:44:15 AM	12	115	108	102	143	109	102
8:45:15 AM	13	130	121	106	159	119	110
8:46:15 AM	14	151	141	109	177	135	124
8:47:15 AM	15	175	163	114	200	150	142
8:48:15 AM	16	199	187	124	231	168	163
8:49:15 AM	17	233	215	140	268	196	182
8:50:15 AM	18	268	247	159	300	228	204
8:51:15 AM	19	298	280	184	324	257	233
8:52:15 AM	20	321	310	212	342	282	267
8:53:15 AM	21	336	332	238	355	302	296
8:54:15 AM	22	346	347	261	364	317	318

Time	Mins	TC13	TC14	TC15	TC16	TC17	TC18
8:55:15 AM	23	355	358	281	372	330	334
8:56:15 AM	24	362	366	299	380	343	348
8:57:15 AM	25	370	372	314	389	354	357
8:58:15 AM	26	379	379	328	401	367	365
8:59:15 AM	27	390	388	340	414	379	372
9:00:15 AM	28	402	398	352	427	390	380
9:01:15 AM	29	416	410	365	440	402	391
9:02:15 AM	30	428	423	377	454	415	404
9:03:15 AM	31	443	435	387	467	427	418
9:04:15 AM	32	457	447	399	479	439	434
9:05:15 AM	33	468	461	411	489	450	449
9:07:15 AM	35	488	485	434	531	482	476
9:08:15 AM	36	508	494	445	554	505	486
9:09:15 AM	37	527	509	460	577	531	500
9:10:15 AM	38	546	530	480	607	555	523
9:11:15 AM	39	572	550	502	635	583	549
9:12:15 AM	40	605	572	526	658	618	585
9:13:15 AM	41	636	603	552	677	646	631
9:14:15 AM	42	667	634	586	689	670	670
9:15:15 AM	43	689	667	618	694	690	700
9:16:15 AM	44	706	694	654	700	702	722
9:17:15 AM	45	718	712	683	705	710	736
9:18:15 AM	46	727	724	704	712	716	746
9:19:15 AM	47	735	733	720	717	722	753
9:20:15 AM	48	740	740	732	722	730	758
9:21:15 AM	49	746	745	686	727	735	760
9:22:15 AM	50	750	748	671	731	757	762
9:23:15 AM	51	754	750	683	735	759	763
9:24:15 AM	52	757	752	697	739	761	764
9:25:15 AM	53	759	753	711	742	763	764
9:26:15 AM	54	763	754	722	745	765	763
9:27:15 AM	55	766	755	730	748	768	765
9:28:15 AM	56	769	755	738	749	767	767
9:29:15 AM	57	771	756	744	752	770	769
9:30:15 AM	58	773	756	749	754	773	769
9:31:15 AM	59	776	758	754	756	776	767
9:32:15 AM	60	780	760	760	759	780	769
9:33:15 AM	61	782	761	763	760	782	772
9:34:15 AM	62	782	760	766	760	782	773
9:35:15 AM	63	784	761	768	762	786	769
9:36:15 AM	64	787	762	771	764	789	772
9:38:15 AM	66	788	763	775	765	790	780
9:39:15 AM	67	789	763	776	766	790	780
9:40:15 AM	68	792	765	779	767	791	769

Time	Mins	TC13	TC14	TC15	TC16	TC17	TC18
9:41:15 AM	69	793	767	782	769	793	762
9:42:15 AM	70	792	768	784	770	793	758
9:43:15 AM	71	792	768	786	771	793	755
9:44:15 AM	72	793	769	789	773	794	748
9:45:15 AM	73	794	770	793	776	795	756
9:46:15 AM	74	795	771	796	778	797	760
9:47:15 AM	75	793	772	798	778	798	760
9:48:15 AM	76	792	772	799	779	797	760
9:49:15 AM	77	791	773	801	781	797	760
9:50:15 AM	78	791	774	803	782	798	755
9:51:15 AM	79	791	775	806	784	799	758
9:52:15 AM	80	790	776	807	785	800	761
9:53:15 AM	81	788	777	808	786	800	763
9:54:15 AM	82	787	778	809	788	800	760
9:55:15 AM	83	787	781	811	791	801	757
9:56:15 AM	84	788	783	813	794	802	753

Table 6 – Group C TCs, Labeled Yellow Thermocouples Both Sides of Plasterboard (Inside)

Time	Mins	TC19	TC20
8:32:15 AM	0	30	30
8:33:15 AM	1	30	30
8:34:15 AM	2	30	30
8:35:15 AM	3	30	31
8:36:15 AM	4	30	32
8:37:15 AM	5	30	35
8:38:15 AM	6	30	37
8:39:15 AM	7	30	40
8:40:15 AM	8	31	42
8:41:15 AM	9	32	45
8:42:15 AM	10	35	48
8:43:15 AM	11	54	60
8:44:15 AM	12	85	77
8:45:15 AM	13	88	92
8:46:15 AM	14	90	94
8:47:15 AM	15	91	94
8:48:15 AM	16	89	94
8:49:15 AM	17	87	94
8:50:15 AM	18	85	99
8:51:15 AM	19	83	108
8:52:15 AM	20	82	119
8:53:15 AM	21	82	129
8:54:15 AM	22	82	138
8:55:15 AM	23	83	146

Time	Mins	TC19	TC20
8:56:15 AM	24	82	152
8:57:15 AM	25	82	157
8:58:15 AM	26	82	159
8:59:15 AM	27	82	161
9:00:15 AM	28	82	164
9:01:15 AM	29	81	168
9:02:15 AM	30	81	173
9:03:15 AM	31	80	180
9:04:15 AM	32	79	189
9:05:15 AM	33	78	197
9:07:15 AM	35	78	213
9:08:15 AM	36	79	219
9:09:15 AM	37	79	225
9:10:15 AM	38	78	233
9:11:15 AM	39	77	243
9:12:15 AM	40	78	257
9:13:15 AM	41	79	273
9:14:15 AM	42	79	289
9:15:15 AM	43	80	304
9:16:15 AM	44	82	320
9:17:15 AM	45	84	334
9:18:15 AM	46	87	349
9:19:15 AM	47	90	367
9:20:15 AM	48	92	384
9:21:15 AM	49	95	401
9:22:15 AM	50	98	418
9:23:15 AM	51	102	438
9:24:15 AM	52	105	457
9:25:15 AM	53	110	477
9:26:15 AM	54	115	500
9:27:15 AM	55	121	520
9:28:15 AM	56	127	536
9:29:15 AM	57	134	548
9:30:15 AM	58	140	560
9:31:15 AM	59	146	573
9:32:15 AM	60	152	587
9:33:15 AM	61	157	604
9:34:15 AM	62	160	621
9:35:15 AM	63	163	631
9:36:15 AM	64	165	638
9:38:15 AM	66	169	650
9:39:15 AM	67	172	653
9:40:15 AM	68	175	657
9:41:15 AM	69	178	663

Time	Mins	TC19	TC20
9:42:15 AM	70	182	668
9:43:15 AM	71	187	665
9:44:15 AM	72	191	651
9:45:15 AM	73	195	648
9:46:15 AM	74	198	651
9:47:15 AM	75	201	655
9:48:15 AM	76	204	661
9:49:15 AM	77	207	668
9:50:15 AM	78	210	677
9:51:15 AM	79	213	687
9:52:15 AM	80	217	696
9:53:15 AM	81	221	703
9:54:15 AM	82	226	712
9:55:15 AM	83	232	720
9:56:15 AM	84	243	726

Table 7 – Group D TCs, Labeled Green Thermocouples Both Sides of Plasterboard (Inside)

Time	MINS	TC21	TC22	TC23	TC24*	TC25	TC26	TC27	TC28	TC29	TC30
8:32:15 AM	0	30	29	30	30	30	30	30	30	30	30
8:33:15 AM	1	30	30	30	30	30	30	30	30	30	30
8:34:15 AM	2	30	30	30	30	30	31	30	30	30	30
8:35:15 AM	3	30	30	30	30	30	31	30	30	30	30
8:36:15 AM	4	30	30	30	30	31	31	30	30	30	30
8:37:15 AM	5	30	30	31	30	31	31	30	30	30	31
8:38:15 AM	6	31	30	31	29	31	33	30	31	30	31
8:39:15 AM	7	31	31	31	28	31	38	30	31	30	31
8:40:15 AM	8	31	31	31	28	33	50	31	32	30	32
8:41:15 AM	9	32	32	32	26	48	81	45	32	30	33
8:42:15 AM	10	32	34	32	24	84	98	97	45	55	33
8:43:15 AM	11	32	50	34	16	88	100	97	91	93	34
8:44:15 AM	12	35	74	76	2	84	99	93	96	94	35
8:45:15 AM	13	55	77	81	0	83	97	89	97	89	39
8:46:15 AM	14	72	79	82	0	83	94	88	95	86	64
8:47:15 AM	15	80	80	83	0	86	91	87	94	86	82
8:48:15 AM	16	83	81	82	0	87	88	85	92	84	86
8:49:15 AM	17	83	79	81	0	86	86	83	90	82	85
8:50:15 AM	18	82	78	79	0	84	85	81	89	79	84
8:51:15 AM	19	80	76	77	0	83	86	79	89	77	82
8:52:15 AM	20	79	76	77	0	81	86	77	90	75	82
8:53:15 AM	21	79	76	77	0	80	88	76	91	72	83
8:54:15 AM	22	79	76	78	0	79	88	75	93	71	84
8:55:15 AM	23	79	77	79	0	79	89	74	94	69	85
8:56:15 AM	24	79	77	80	0	78	88	74	94	68	86

Time	MINS	TC21	TC22	TC23	TC24*	TC25	TC26	TC27	TC28	TC29	TC30
8:57:15 AM	25	80	78	81	0	78	88	75	95	69	87
8:58:15 AM	26	81	80	82	0	78	88	76	95	72	87
8:59:15 AM	27	81	81	82	0	78	88	77	96	75	87
9:00:15 AM	28	82	82	82	0	78	88	79	97	77	87
9:01:15 AM	29	82	84	82	0	78	88	79	98	78	88
9:02:15 AM	30	83	84	83	0	78	88	80	100	78	90
9:03:15 AM	31	83	85	83	0	78	89	81	103	77	94
9:04:15 AM	32	83	87	84	0	78	90	81	107	76	98
9:05:15 AM	33	84	88	85	0	79	95	82	112	75	101
9:07:15 AM	35	87	98	88	0	82	104	83	122	73	113
9:08:15 AM	36	88	103	92	0	81	110	85	128	72	119
9:09:15 AM	37	88	107	98	0	80	118	88	134	71	125
9:10:15 AM	38	92	113	104	0	81	128	94	141	70	131
9:11:15 AM	39	98	120	111	0	84	138	100	149	70	137
9:12:15 AM	40	106	126	121	0	86	145	106	157	69	141
9:13:15 AM	41	115	134	132	0	88	153	114	164	69	146
9:14:15 AM	42	124	141	143	0	93	158	122	170	69	152
9:15:15 AM	43	133	147	151	0	103	164	131	178	69	161
9:16:15 AM	44	140	153	154	0	114	171	141	187	69	172
9:17:15 AM	45	143	159	158	0	125	181	151	198	69	185
9:18:15 AM	46	145	167	165	0	135	191	160	208	69	197
9:19:15 AM	47	149	177	174	0	144	200	166	216	69	210
9:20:15 AM	48	154	188	184	0	152	210	171	226	69	221
9:21:15 AM	49	161	199	193	0	156	218	174	235	70	231
9:22:15 AM	50	169	209	201	0	158	225	176	244	70	240
9:23:15 AM	51	178	219	210	0	160	231	178	253	71	248
9:24:15 AM	52	185	227	218	0	163	239	181	262	71	257
9:25:15 AM	53	192	235	227	0	166	246	185	272	72	265
9:26:15 AM	54	198	243	236	0	170	254	189	282	73	274
9:27:15 AM	55	204	250	245	0	175	262	194	292	74	283
9:28:15 AM	56	211	256	254	0	181	271	200	303	75	292
9:29:15 AM	57	217	264	264	0	186	279	205	314	75	302
9:30:15 AM	58	224	271	278	0	191	289	211	326	76	313
9:31:15 AM	59	230	279	297	0	196	298	217	338	77	324
9:32:15 AM	60	236	287	321	0	200	307	223	351	77	337
9:33:15 AM	61	243	296	350	0	204	317	232	365	78	351
9:34:15 AM	62	249	306	375	0	209	327	245	379	78	365
9:35:15 AM	63	256	316	398	0	215	338	261	394	79	380
9:36:15 AM	64	262	326	418	0	220	349	280	409	80	394
9:38:15 AM	66	276	351	456	0	233	372	320	446	81	425
9:39:15 AM	67	285	365	476	0	241	385	342	467	82	443
9:40:15 AM	68	294	381	495	0	248	398	363	487	83	462
9:41:15 AM	69	304	398	514	0	255	411	383	505	83	483
9:42:15 AM	70	316	418	532	0	264	426	401	520	84	506

Time	MINS	TC21	TC22	TC23	TC24*	TC25	TC26	TC27	TC28	TC29	TC30
9:43:15 AM	71	328	438	547	0	274	440	417	533	85	524
9:44:15 AM	72	342	460	562	0	284	454	431	545	87	538
9:45:15 AM	73	358	483	582	0	296	469	445	560	89	551
9:46:15 AM	74	375	505	602	0	309	483	458	576	92	567
9:47:15 AM	75	395	525	619	0	323	496	472	591	97	586
9:48:15 AM	76	416	540	631	0	336	507	486	605	102	601
9:49:15 AM	77	439	554	642	0	351	517	502	617	107	615
9:50:15 AM	78	461	569	649	0	364	526	519	627	114	627
9:51:15 AM	79	483	589	656	0	377	533	534	634	121	639
9:52:15 AM	80	503	608	666	0	390	543	548	640	128	651
9:53:15 AM	81	519	622	678	0	403	553	561	645	137	660
9:54:15 AM	82	535	636	697	0	417	567	576	651	147	667
9:55:15 AM	83	552	644	728	0	432	581	590	655	154	668
9:56:15 AM	84	570	654	795	0	447	600	606	659	163	669

* - TC failed during test

Table 8 – Group E TCs, Labeled Green Thermocouples Both Sides of Plasterboard (Outside)

Time	MINS	TC31	TC32	TC33	TC34	TC35	TC36	TC37	TC38	TC39	TC40
8:32:15 AM	0	30	30	30	30	30	30	30	30	30	30
8:33:15 AM	1	30	30	30	30	30	30	30	30	30	30
8:34:15 AM	2	30	30	30	30	30	30	30	30	30	30
8:35:15 AM	3	30	30	30	30	30	30	30	30	30	30
8:36:15 AM	4	30	30	30	30	30	30	30	30	30	30
8:37:15 AM	5	30	30	30	31	31	30	30	31	30	30
8:38:15 AM	6	30	30	30	31	31	30	30	31	30	30
8:39:15 AM	7	31	30	31	31	31	30	30	31	31	30
8:40:15 AM	8	31	31	31	31	31	33	30	31	31	31
8:41:15 AM	9	31	31	31	31	34	37	31	31	32	31
8:42:15 AM	10	31	31	31	32	46	52	41	32	37	31
8:43:15 AM	11	31	33	32	35	70	69	64	35	68	31
8:44:15 AM	12	32	36	35	39	72	76	75	47	82	32
8:45:15 AM	13	34	43	56	49	73	76	77	70	86	35
8:46:15 AM	14	45	51	67	63	73	75	76	80	83	41
8:47:15 AM	15	56	58	71	70	74	72	76	82	83	53
8:48:15 AM	16	65	63	73	72	76	70	75	82	81	64
8:49:15 AM	17	69	66	73	73	77	68	73	80	80	70
8:50:15 AM	18	70	67	72	73	76	66	72	78	78	72
8:51:15 AM	19	70	67	70	73	74	65	71	76	76	71
8:52:15 AM	20	69	66	69	73	72	65	70	76	75	71
8:53:15 AM	21	68	66	69	74	71	66	68	76	75	71
8:54:15 AM	22	67	66	69	75	70	67	66	76	75	71
8:55:15 AM	23	67	66	70	76	69	68	66	78	77	72
8:56:15 AM	24	67	66	70	77	68	68	65	78	78	73
8:57:15 AM	25	67	66	71	77	67	68	65	78	79	73

Time	MINS	TC31	TC32	TC33	TC34	TC35	TC36	TC37	TC38	TC39	TC40
8:58:15 AM	26	67	67	72	77	67	67	65	78	80	73
8:59:15 AM	27	68	68	72	77	66	67	66	78	80	73
9:00:15 AM	28	69	69	72	76	66	67	67	77	80	73
9:01:15 AM	29	69	70	72	75	66	66	67	76	79	73
9:02:15 AM	30	69	71	72	74	66	66	68	75	78	72
9:03:15 AM	31	70	71	72	73	66	65	68	74	77	72
9:04:15 AM	32	70	71	71	73	66	65	69	73	76	72
9:05:15 AM	33	70	71	71	73	66	64	69	73	76	71
9:07:15 AM	35	69	71	70	74	67	64	68	74	75	70
9:08:15 AM	36	68	71	70	76	68	64	68	74	74	70
9:09:15 AM	37	67	72	70	77	69	65	68	74	74	71
9:10:15 AM	38	66	72	71	78	70	66	68	75	73	72
9:11:15 AM	39	66	73	72	79	70	67	69	76	74	73
9:12:15 AM	40	66	74	74	80	71	69	69	78	75	74
9:13:15 AM	41	67	76	76	80	72	70	70	79	77	76
9:14:15 AM	42	68	77	77	81	72	72	72	80	78	77
9:15:15 AM	43	69	78	78	82	73	73	74	82	80	79
9:16:15 AM	44	70	79	79	83	75	74	75	83	81	80
9:17:15 AM	45	72	80	81	84	76	75	78	84	82	81
9:18:15 AM	46	72	81	82	85	78	76	79	85	83	82
9:19:15 AM	47	73	83	83	86	80	77	80	86	84	83
9:20:15 AM	48	74	84	84	86	81	77	81	86	85	84
9:21:15 AM	49	75	85	84	86	82	78	81	87	85	85
9:22:15 AM	50	75	85	85	87	83	78	81	87	86	86
9:23:15 AM	51	76	86	85	87	83	79	81	87	86	86
9:24:15 AM	52	76	86	86	87	83	79	81	88	86	87
9:25:15 AM	53	77	86	87	87	83	80	82	88	87	87
9:26:15 AM	54	77	87	87	88	83	80	82	89	87	88
9:27:15 AM	55	78	87	88	88	84	81	83	89	87	88
9:28:15 AM	56	78	88	88	89	84	81	83	90	88	89
9:29:15 AM	57	79	88	89	90	84	82	84	91	88	91
9:30:15 AM	58	79	89	91	91	84	82	85	92	89	94
9:31:15 AM	59	80	90	93	94	85	82	86	95	90	99
9:32:15 AM	60	80	91	96	99	85	82	87	102	91	102
9:33:15 AM	61	81	94	100	103	86	83	90	109	93	105
9:34:15 AM	62	81	99	103	107	87	83	93	115	98	107
9:35:15 AM	63	81	102	107	110	88	85	96	120	103	109
9:36:15 AM	64	82	105	112	114	90	90	100	125	107	112
9:38:15 AM	66	83	111	124	122	96	98	107	141	117	120
9:39:15 AM	67	84	115	130	127	99	103	111	163	122	127
9:40:15 AM	68	85	119	138	133	100	106	115	188	127	134
9:41:15 AM	69	86	124	152	141	102	110	120	208	132	142
9:42:15 AM	70	89	130	181	156	103	115	126	227	140	162
9:43:15 AM	71	93	138	211	173	105	118	130	243	160	188

Time	MINS	TC31	TC32	TC33	TC34	TC35	TC36	TC37	TC38	TC39	TC40
9:44:15 AM	72	97	151	239	189	106	124	149	259	186	213
9:45:15 AM	73	100	170	265	204	107	138	186	274	210	236
9:46:15 AM	74	102	193	292	216	109	154	222	290	234	257
9:47:15 AM	75	105	214	317	227	110	167	251	305	255	276
9:48:15 AM	76	108	233	339	236	112	178	277	318	275	295
9:49:15 AM	77	111	253	358	245	114	187	299	331	296	315
9:50:15 AM	78	113	271	375	252	116	195	317	341	315	335
9:51:15 AM	79	115	290	393	259	118	203	331	348	333	354
9:52:15 AM	80	117	309	410	267	121	212	341	356	352	377
9:53:15 AM	81	118	324	427	274	123	221	345	367	371	398
9:54:15 AM	82	120	338	441	283	126	226	349	382	389	409
9:55:15 AM	83	122	349	464	292	130	233	351	394	400	409
9:56:15 AM	84	126	357	518	302	135	236	351	399	399	407

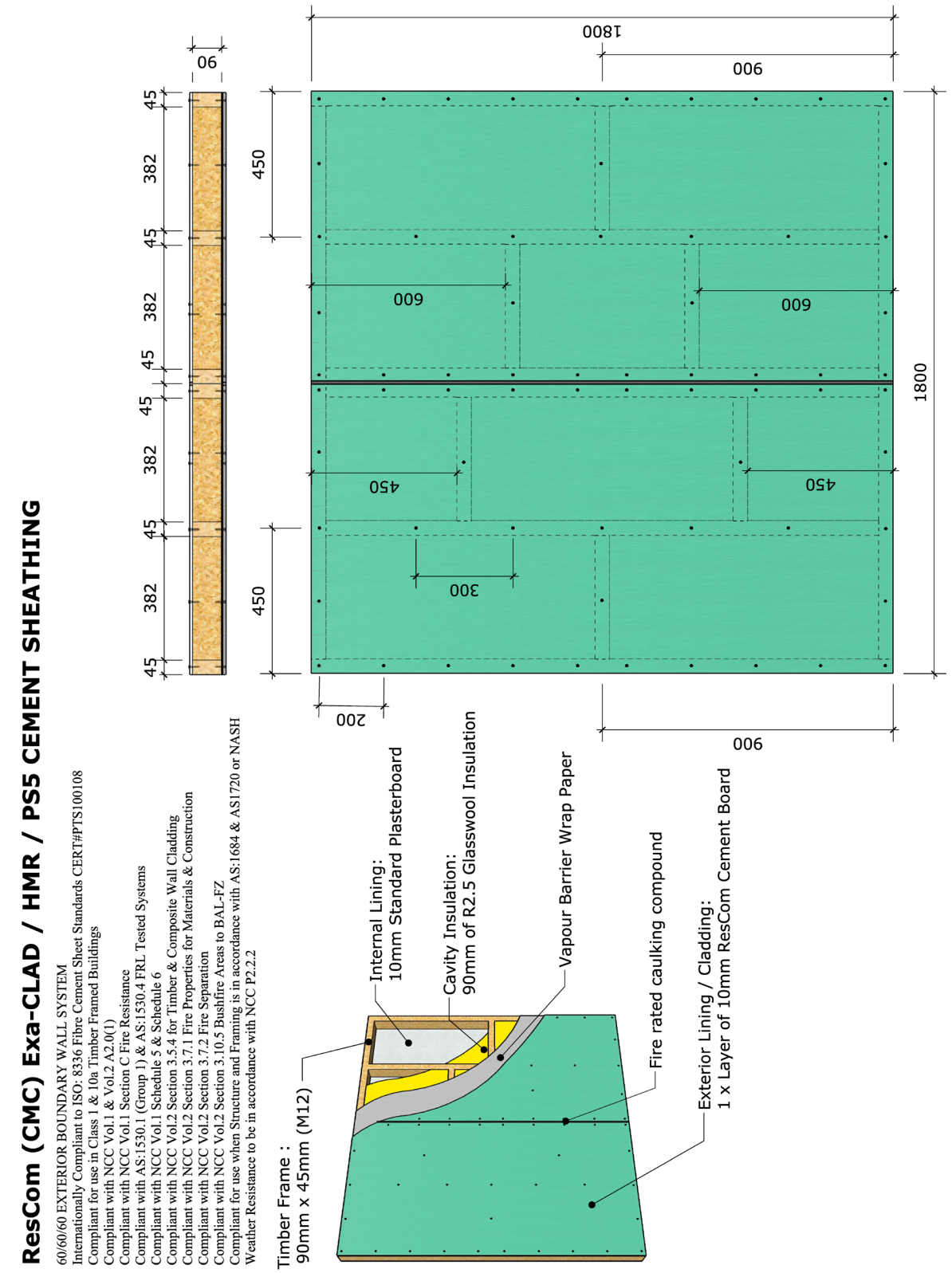
Table 9 – Group F TCs, Labeled Yellow Thermocouples Both Sides of Plasterboard (outside)

Time	MINS	TC41	TC42
8:32:15 AM	0	30	30
8:33:15 AM	1	30	30
8:34:15 AM	2	30	30
8:35:15 AM	3	30	30
8:36:15 AM	4	30	31
8:37:15 AM	5	30	32
8:38:15 AM	6	30	33
8:39:15 AM	7	30	34
8:40:15 AM	8	30	36
8:41:15 AM	9	31	38
8:42:15 AM	10	31	40
8:43:15 AM	11	33	44
8:44:15 AM	12	49	53
8:45:15 AM	13	66	70
8:46:15 AM	14	76	81
8:47:15 AM	15	80	84
8:48:15 AM	16	81	84
8:49:15 AM	17	80	84
8:50:15 AM	18	78	84
8:51:15 AM	19	76	84
8:52:15 AM	20	75	86
8:53:15 AM	21	74	88
8:54:15 AM	22	74	89
8:55:15 AM	23	74	89
8:56:15 AM	24	74	89
8:57:15 AM	25	74	89
8:58:15 AM	26	74	90

Time	MINS	TC41	TC42
8:59:15 AM	27	74	90
9:00:15 AM	28	74	90
9:01:15 AM	29	74	91
9:02:15 AM	30	73	91
9:03:15 AM	31	73	92
9:04:15 AM	32	72	93
9:05:15 AM	33	70	93
9:07:15 AM	35	69	92
9:08:15 AM	36	69	93
9:09:15 AM	37	69	94
9:10:15 AM	38	70	95
9:11:15 AM	39	70	98
9:12:15 AM	40	71	100
9:13:15 AM	41	71	102
9:14:15 AM	42	71	104
9:15:15 AM	43	71	106
9:16:15 AM	44	72	109
9:17:15 AM	45	72	112
9:18:15 AM	46	72	116
9:19:15 AM	47	73	120
9:20:15 AM	48	73	127
9:21:15 AM	49	74	137
9:22:15 AM	50	75	154
9:23:15 AM	51	75	171
9:24:15 AM	52	76	196
9:25:15 AM	53	77	218
9:26:15 AM	54	77	239
9:27:15 AM	55	77	259
9:28:15 AM	56	78	277
9:29:15 AM	57	79	296
9:30:15 AM	58	80	314
9:31:15 AM	59	80	329
9:32:15 AM	60	81	342
9:33:15 AM	61	82	355
9:34:15 AM	62	82	369
9:35:15 AM	63	83	382
9:36:15 AM	64	83	394
9:38:15 AM	66	84	406
9:39:15 AM	67	85	406
9:40:15 AM	68	85	407
9:41:15 AM	69	85	408
9:42:15 AM	70	86	409
9:43:15 AM	71	86	407
9:44:15 AM	72	87	405

Time	MINS	TC41	TC42
9:45:15 AM	73	88	423
9:46:15 AM	74	90	455
9:47:15 AM	75	93	501
9:48:15 AM	76	96	543
9:49:15 AM	77	98	572
9:50:15 AM	78	100	595
9:51:15 AM	79	102	623
9:52:15 AM	80	103	651
9:53:15 AM	81	104	674
9:54:15 AM	82	105	692
9:55:15 AM	83	107	725
9:56:15 AM	84	108	733

Appendix C – DRAWINGS



Drawing 1 - Legend

Appendix D – PHOTOGRAPHS

Photo 1 - Non-fire side before test

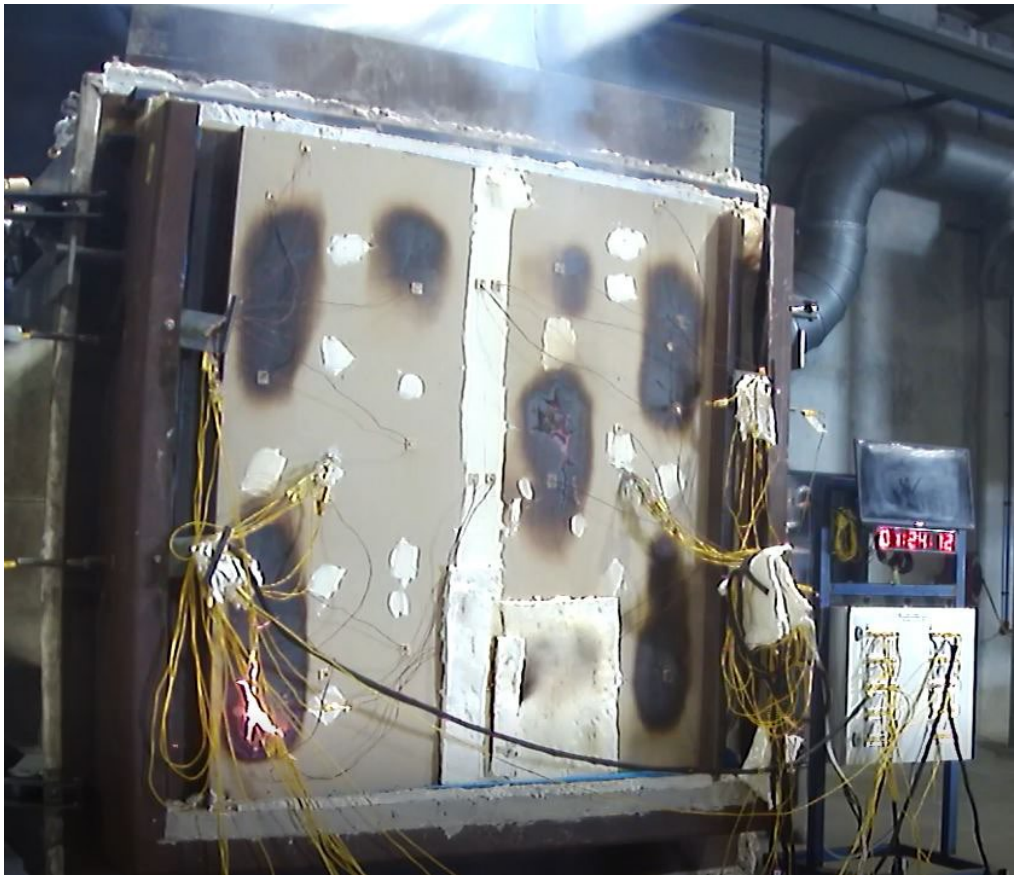


Photo 2 - Non-fire side after test

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