The Building Test Centre
Fire Acoustics Structures

The Building Test Centre
British Gypsum
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Report Number: **BTC 21428F**

A FIRE RESISTANCE TEST ON A IWL TWIN PARTITION CLAD EACH SIDE WITH A DOUBLE LAYER OF 15 MM SOUNDBLOC INCORPORATING 25 MM ACOUSTIC PARTITION ROLL, CONDUCTED IN ACCORDANCE WITH BS 476: PART 22: 1987: CLAUSE 5.

Test Date: 30th July 2020

Report Issue Date: 2nd September 2020

Report amended 22nd September 2020

www.btconline.co.uk

Customer: **Hadley Group**
Downing Street
Smethwick
West Midlands
B66 2PA

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FOREWORD

This test report details a fire resistance test conducted on a IWL twin metal stud partition clad on each face with a double layer of Gyproc SoundBloc.

The test sponsor was CMH Design & Consultancy Services Ltd.

The test specimen was installed by PVR Joinery. The construction of the specimen took place between the 27th and 28th July 2020. The Building Test Centre played no role in the design or selection of materials comprising the test specimen. This information is provided by the sponsor.

The test was conducted on the 30th July 2020.

"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." (BS EN 1363-1: 2012, section 12.1)

REPORT AUTHORISATION

Report Author	Authorised by
Danielle Yates BSc. (Hons.) MSc. *Scientist*	**Paul Miller** BSc. (Hons.) *Fire Test Manager*

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TEST REPORT AMENDMENTS

Page	Amendments	Date
1	Customer information changed to the correct company name and address – at customer request. Page amendment date added in footer. From: **CMH Design & Consultancy Services Ltd** 40 Ridgeway Hixon Stafford ST18 0NZ To: **Hadley Group** Downing Street Smethwick West Midlands B66 2PA	22/09/2020
1-47	For all pages, customer company name corrected in footer. Page amendment date added in footer. From: **CMH Design & Consultancy Services Ltd** To: **Hadley Group**	22/09/2020
5	Test report amendments page updated. Page amendment date added in footer.	22/09/2020

Report Amendments Author

Eric Chee
Scientist

Amendments Authorised by

James Lucas
BTC Technical Manager

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TEST CONSTRUCTION

Description of Construction

The specimen was constructed in a refractory concrete lined steel restraint test frame with an opening of 3000 mm (high) x 3000 mm (wide).

Twin Hadley Group HRP5305 Floor and Ceiling Channels were fixed to the head and base of the test aperture, 40 mm apart at 600 mm centres using 60 mm fire resistant fixings.

Hadley HRP5954 'I' studs were positioned at 600 mm centres between the channels of both frames. The right hand studs viewed from the unexposed face were not fixed to the perimeter of the test frame and the gap between the stud and the frame lining was filled with a 25 mm rock mineral fibre gasket.

At the left hand edge, Hadley HRP5954 'I' studs were used to fix the partition to the test frame using 60 mm fire resistant fixings at 600 mm centres.

Both the unexposed and exposed face of the specimen were clad with a double layer of 15 mm Gyproc SoundBloc. The inner layer of boards was fixed with 25 mm Gyproc drywall screws at 300 mm centres around the perimeter of the boards only. The outer layer of boards was fixed with 40 mm Gyproc drywall screws at 300 mm centres around the perimeter and within the field of the boards.

A layer of 25 mm Acoustic Partition Roll insulation was positioned between the studs on the unexposed face.

All vertical joints were staggered between layers with a full board at the free edge on the exposed face. A horizontal joint was positioned at 2375 mm from the base of the inner layer boards and at 2400 mm from the base of the outer layer of boards, on both faces of the specimen. A Hadley Group fixing strap HRP5179 was used behind the horizontal outer layer board joint.

All external board joints were taped and filled using Gyproc Paper Joint Tape and Gyproc Joint Filler as appropriate. All screw heads were spotted using Gyproc Joint Filler.

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Test Construction Drawings

Horizontal Cross Section

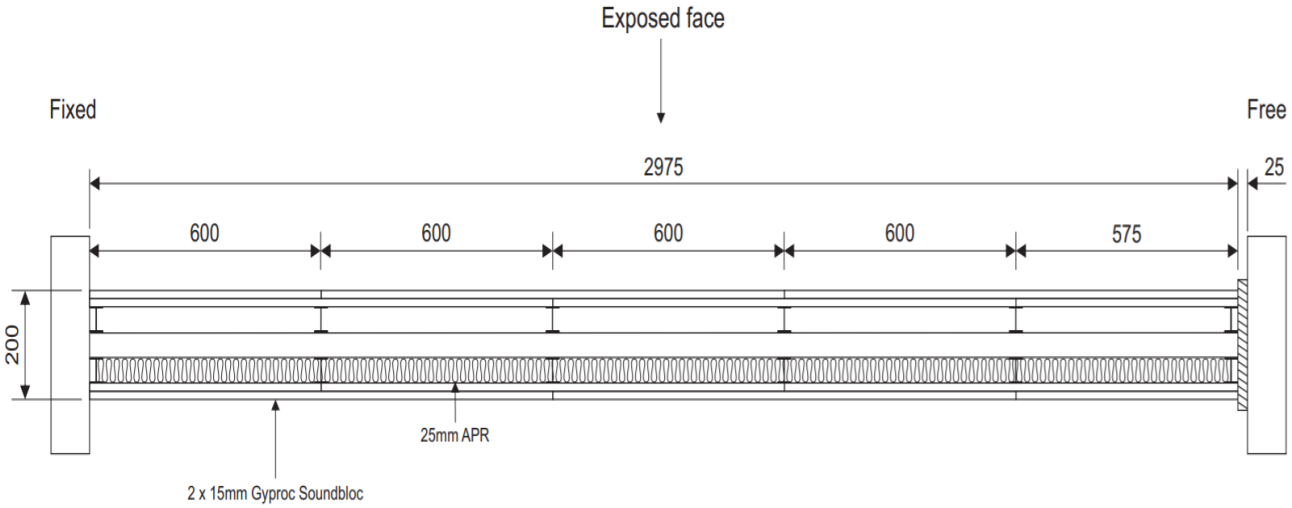

Figure 1 – Horizontal cross section.

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Exposed Face Inner Layer Elevation

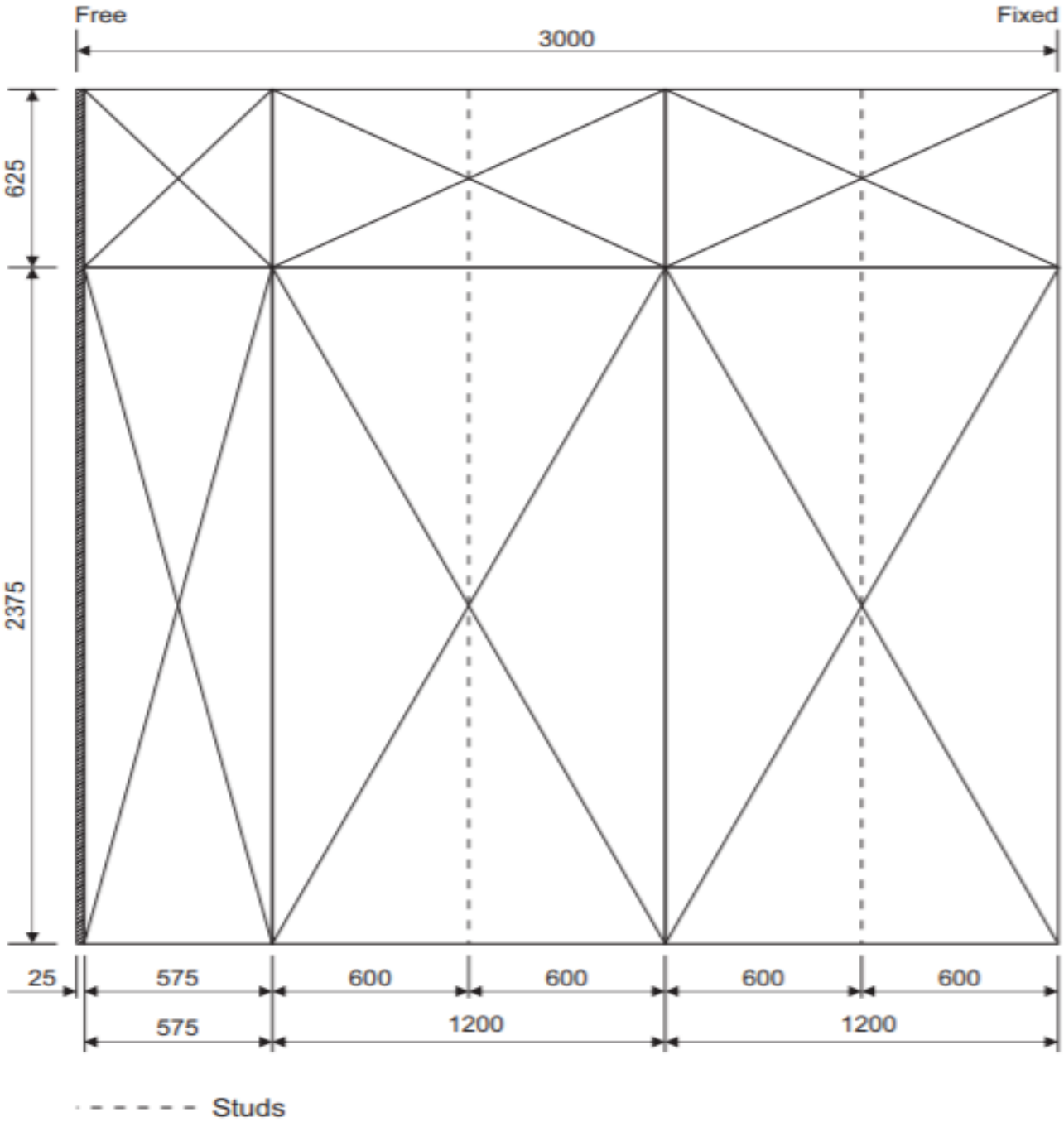

Figure 2 – Exposed face inner layer elevation.

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Exposed Face Outer Layer Elevation

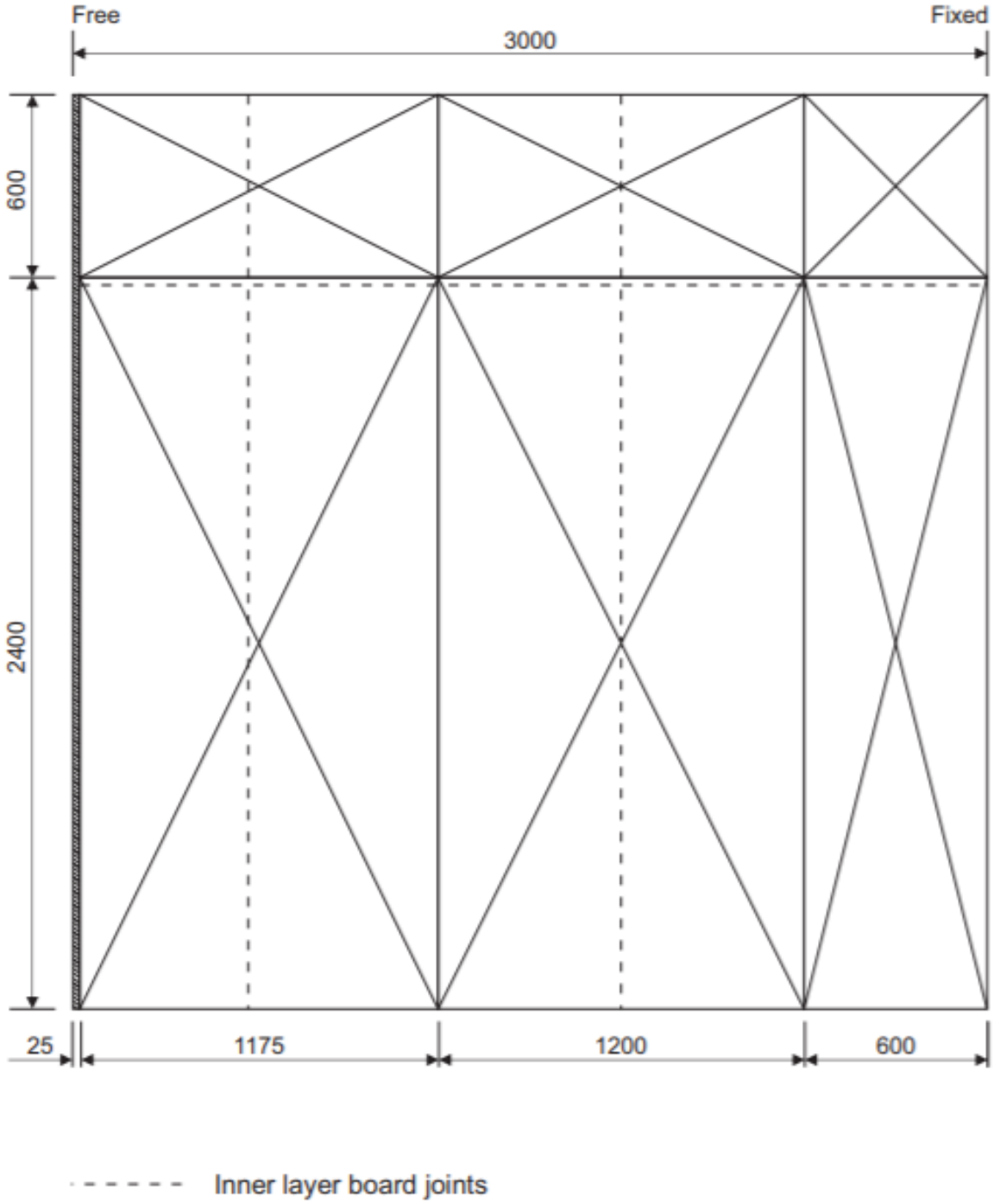

Figure 3 – Exposed face outer layer elevation.

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Unexposed Face Inner Layer Elevation

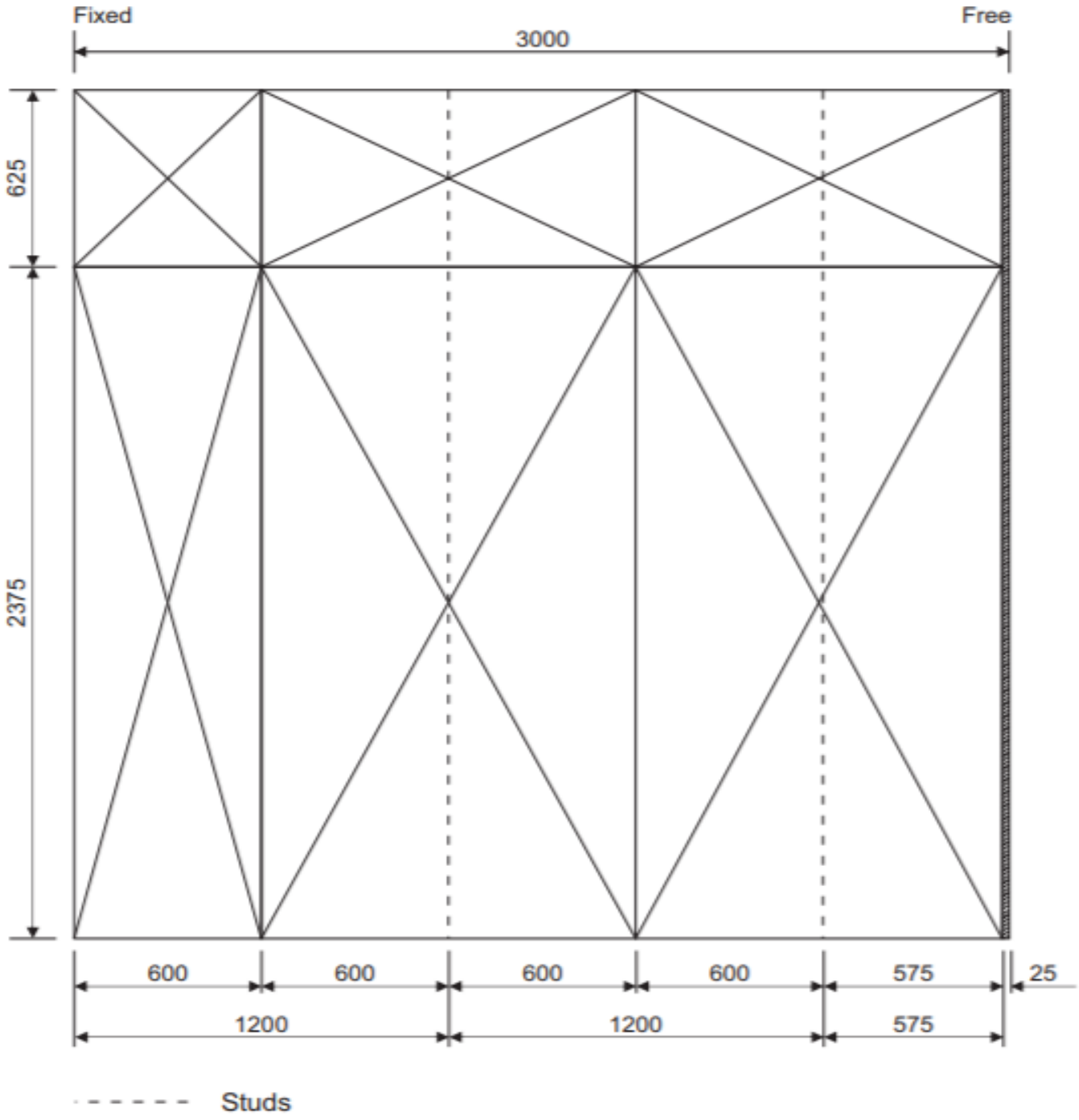

Figure 4 – Unexposed face Inner layer elevation.

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Unexposed Face Outer Layer Elevation

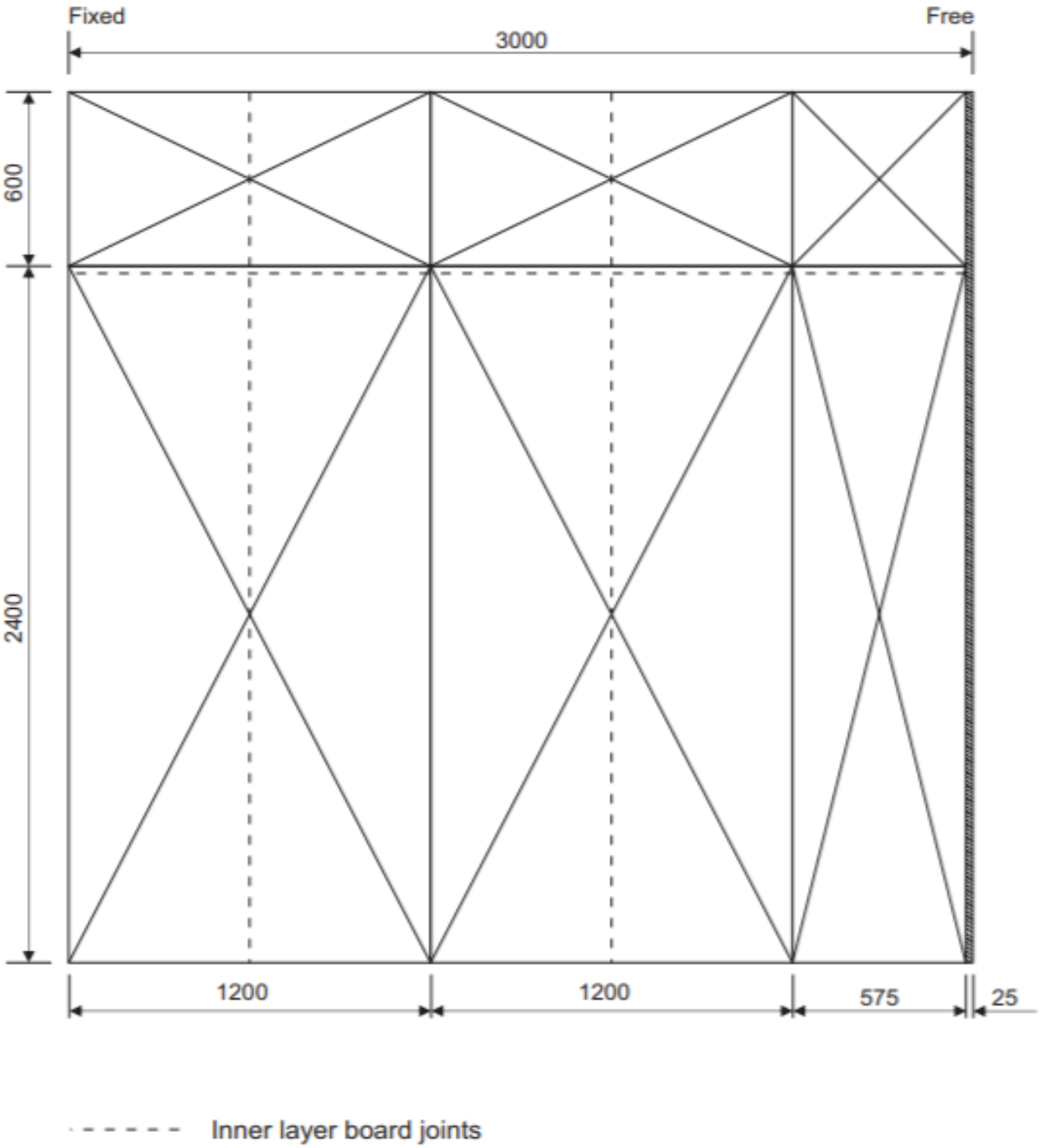

Figure 6 – Unexposed face outer layer elevation

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TEST MATERIALS

Plasterboard

i) Nominally, 2400 mm (long) x 1200 mm (wide) x 15 mm (thick), Gyproc SoundBloc (TE), manufactured by British Gypsum and supplied by CMH Design & Consultancy Services Ltd, ex Sherburn.

Measured mass per unit area:	11.1 kg/m²
Measured thickness:	15.0 mm
Board identification numbers:	31 188 20 19:17
	31 188 20 19:17
	31 188 20 19:18
Measured moisture content:	0.44%

The surface density and board thickness were calculated using the actual weight and size of a selection of boards used in the test specimen. The moisture content of plasterboard was determined using samples dried to constant weight in an oven at 50 °C.

Material dimensions were supplied by The Building Test Centre.

Metal Components

ii) Hadley Group HRP5305 Floor and Ceiling Channels.
iii) Hadley Group HRP5954 'I' Studs.
iv) Hadley Group HRP5179 Fixing Strap.

All metal components were supplied by CMH Design & Consultancy Services Ltd.

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Fasteners

v) 25 mm British Gypsum Drywall Screws, supplied by The Building Test Centre.
vi) 40 mm British Gypsum Drywall Screws, supplied by The Building Test Centre.
vii) 60 mm fire resistant fixings, supplied by The Building Test Centre.

Miscellaneous Components

viii) Gyproc Paper Joint Tape, supplied by The Building Test Centre.
ix) Gyproc Joint Filler, supplied by The Building Test Centre.
x) Rock mineral fibre gasket, supplied by The Building Test Centre.

Where measurements could not be taken and were provided by the customer or the manufacturer e.g. from material labelling, or where mass and dimension measurements were provided by the customer or the manufacturer e.g. customer has completed material dimension forms the results only apply to the sample as received.

All data and materials supplied by the customer or manufacturer are clearly identified.

Material information was sampled and recorded according to procedure AP070 vs. 1.1.

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TEST PROCEDURE

The test was conducted fully in accordance with BS 476: Part 22: 1987, Clause 5. The specimen was subjected to fire from one side, as specified in BS 476: Part 22: 1987, Clause 5.

The test specimen was not symmetrical and should therefore be tested in both orientations. No performance can be claimed for the system is installed with 25 mm Acoustic Partition Roll positioned in the frame exposed to the furnace without a separate test being undertaken to substantiate this orientation.

Where areas of the test specification are ambiguous, or open to interpretation, the Fire Test Study Group Resolutions 43, 50, 53, 70, 71, 72, 77, 83 have been followed (where appropriate). These Resolutions provide the basis of common agreement between the fire test laboratories which are members of this group.

The test procedure used was AP 102, Version 1.0.

The ambient temperature at the commencement of the test was 23 °C.

The furnace pressure was set to control at 16.2 ± 2 Pa positive with respect to atmosphere, at a point 100 mm below the top of the specimen. Furnace pressure data is shown in **Figure 8**.

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TEST RESULTS

The requirement of the standard was satisfied for the following periods:

Integrity	**Sustained Flaming**	**143 minutes, no failure.**
	6mm Gap Gauge	**142 minutes.**
	25mm Gap Gauge	**143 minutes, no failure.**
	Cotton Pad	**143 minutes, no failure.**
Insulation		**134 minutes.**
Test Terminated		**143 minutes, at the request of the sponsor.**

LIMITATIONS

The results only relate to the behaviour of the specimen of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

The specification and interpretation of fire test methods are the subject of on-going development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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TEST DATA

Observations

All observations refer to the exposed face unless stated.

Observers: Unexposed face: Lindsey Watson
Exposed face: Mark Shortland

Time Hours	Time Minutes	Observations
0	00	Test started.
0	10	Jointing material was flaking away. Face papers had charred.
0	20	Left-hand vertical joint had opened up to approximately 2-3 mm. Right-hand vertical joint had opened up to approximately 2-3 mm. Horizontal joint had opened up to approximately 1-2 mm.
0	30	Left-hand vertical joint had opened up to approximately 4-5 mm. Right-hand vertical joint had opened up to approximately 2-3 mm. Horizontal joint had opened up to approximately 5-6 mm. *Unexposed face* No visible change.
0	40	All joints had opened up to approximately 10-12 mm. Boards had broken around all screw heads on perimeter of boards.
0	50	Left-hand vertical joint had opened up to approximately 12-15 mm. Right-hand vertical joint had opened up to approximately 12-15 mm. Horizontal joint had opened up to approximately 10-12 mm.
1	00	No visible change. *Unexposed face* No visible change.
1	10	Left-hand vertical joint had opened up to approximately 15-16 mm. Right-hand vertical joint had opened up to approximately 12-15 mm. Horizontal joint had opened up to approximately 12-15 mm.

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Time Hours	Time Minutes	Observations
1	20	Left-hand vertical joint had opened up to approximately 25-30 mm. Right-hand vertical joint had opened up to approximately 18-22 mm. Horizontal joint had opened up to approximately 25-28 mm.
1	30	First layer lower centre board had fallen. Second layer crazed where visible. *Unexposed face* No visible change.
1	40	First layer lower left-hand board had fallen. First layer upper left-hand and upper centre boards had fallen. Second layer left and centre boards had fallen. Studs warped where visible.
1	50	All first and second layer boards had fallen. Third layer horizontal joint had opened up to approximately 4-5 mm.
2	00	All third layer boards crazed. *Unexposed face* No visible change.
2	10	Third layer horizontal joint had opened up to approximately 10-12 mm.
2	14	*Unexposed face* **INSULATION FAILURE.** The temperature rise of thermocouple no.32 positioned at mid-height on the right-hand vertical joint exceeded 180 °C.
2	15	*Unexposed face* Discolouration along the centre of the lower centre board at approximately 300-2700 mm height. Screw heads had discoloured along the left-hand vertical joint.
2	20	Third layer board fall. Lower half of centre board had fallen.
2	22	*Unexposed face* **INTEGRITY FAILURE.** The gap at approximately 900-1200 mm height on the centre of the lower centre board exceeded 6 mm x 150 mm (6 mm visual).
2	23	**TEST TERMINATED** at the request of the sponsor.

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Furnace Temperature Graph

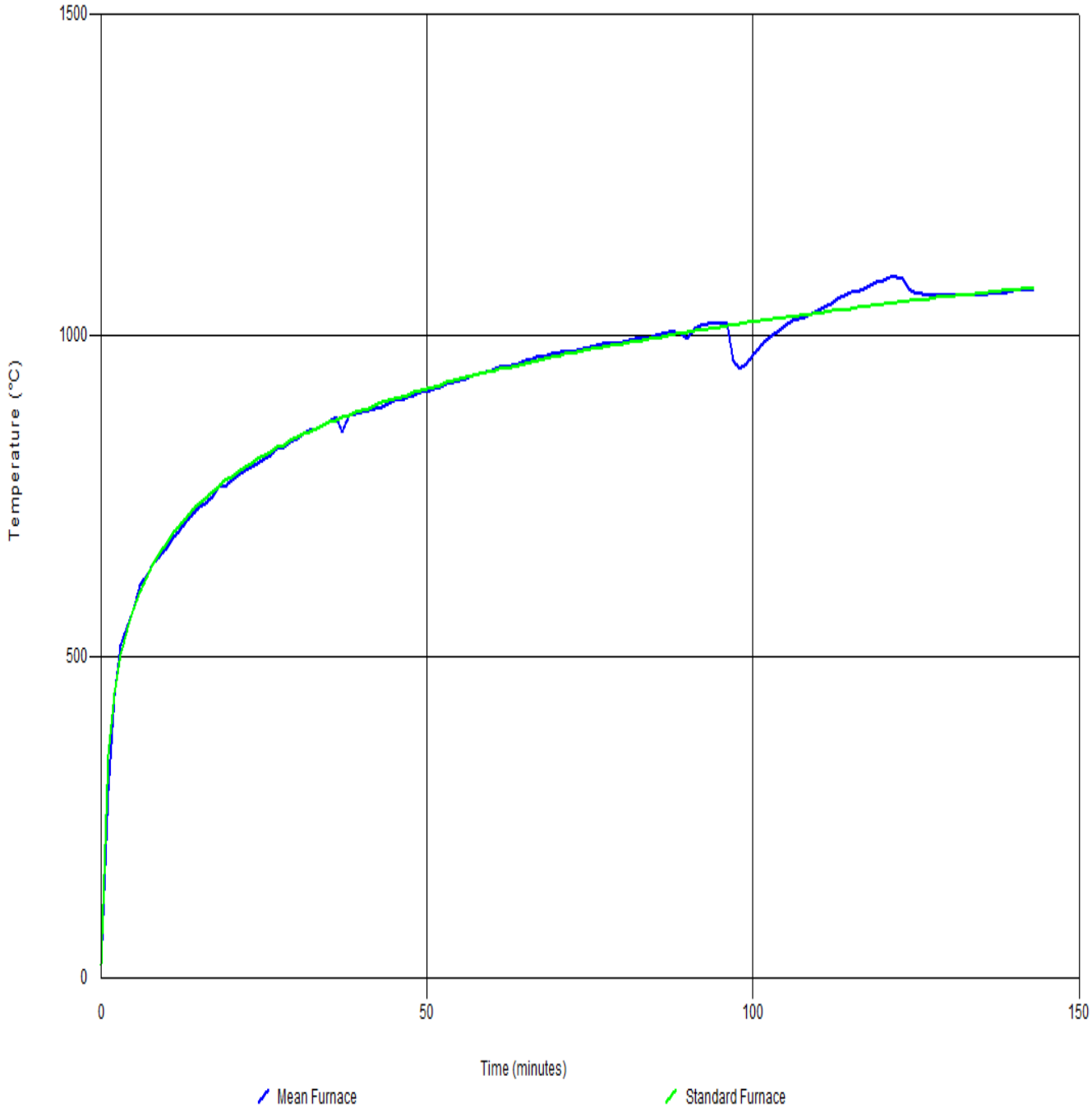

Figure 7 – Furnace temperature graph.

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Furnace Pressure Graph

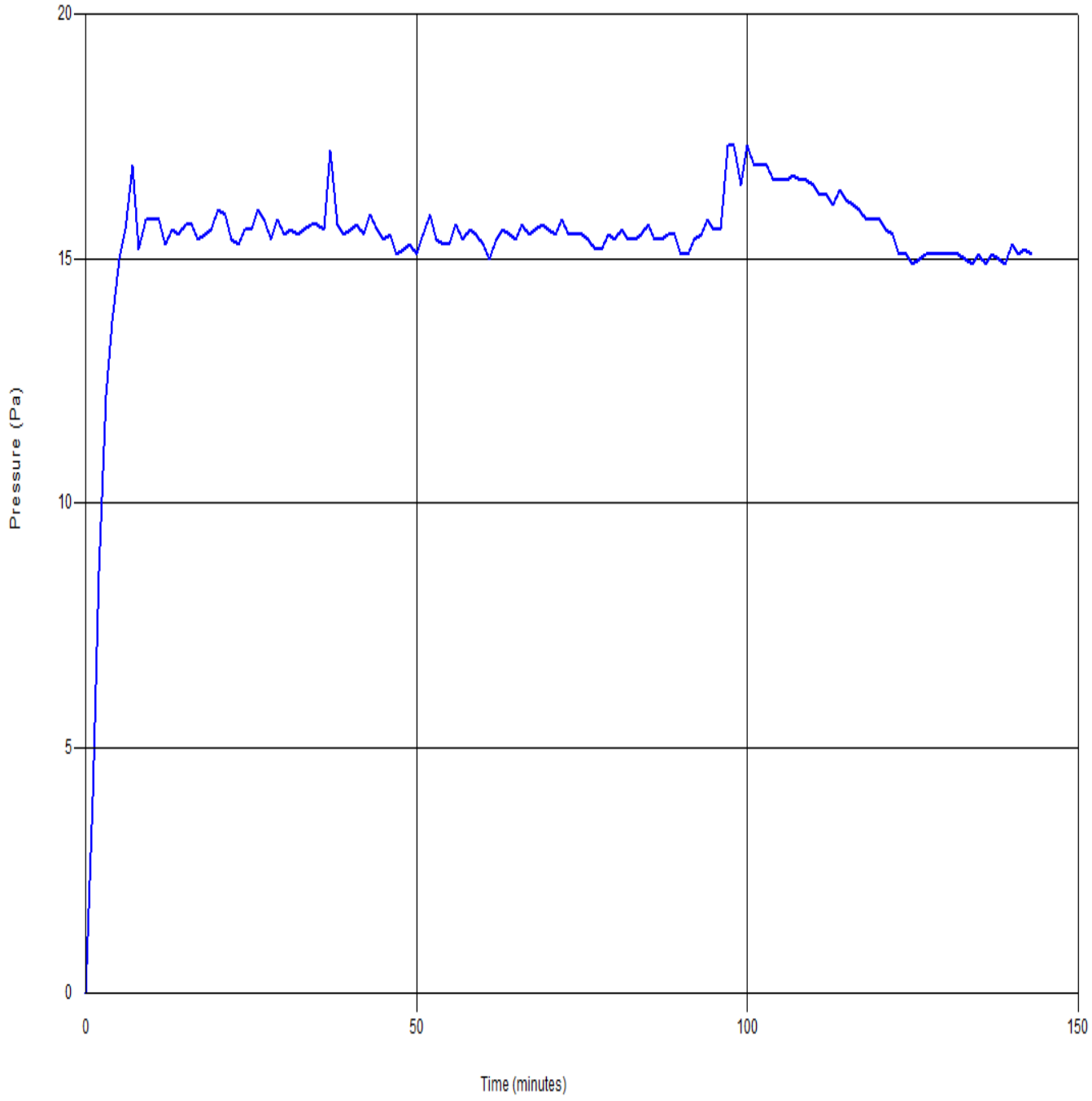

Figure 8 – Furnace pressure graph.

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Unexposed Face Temperature Graph

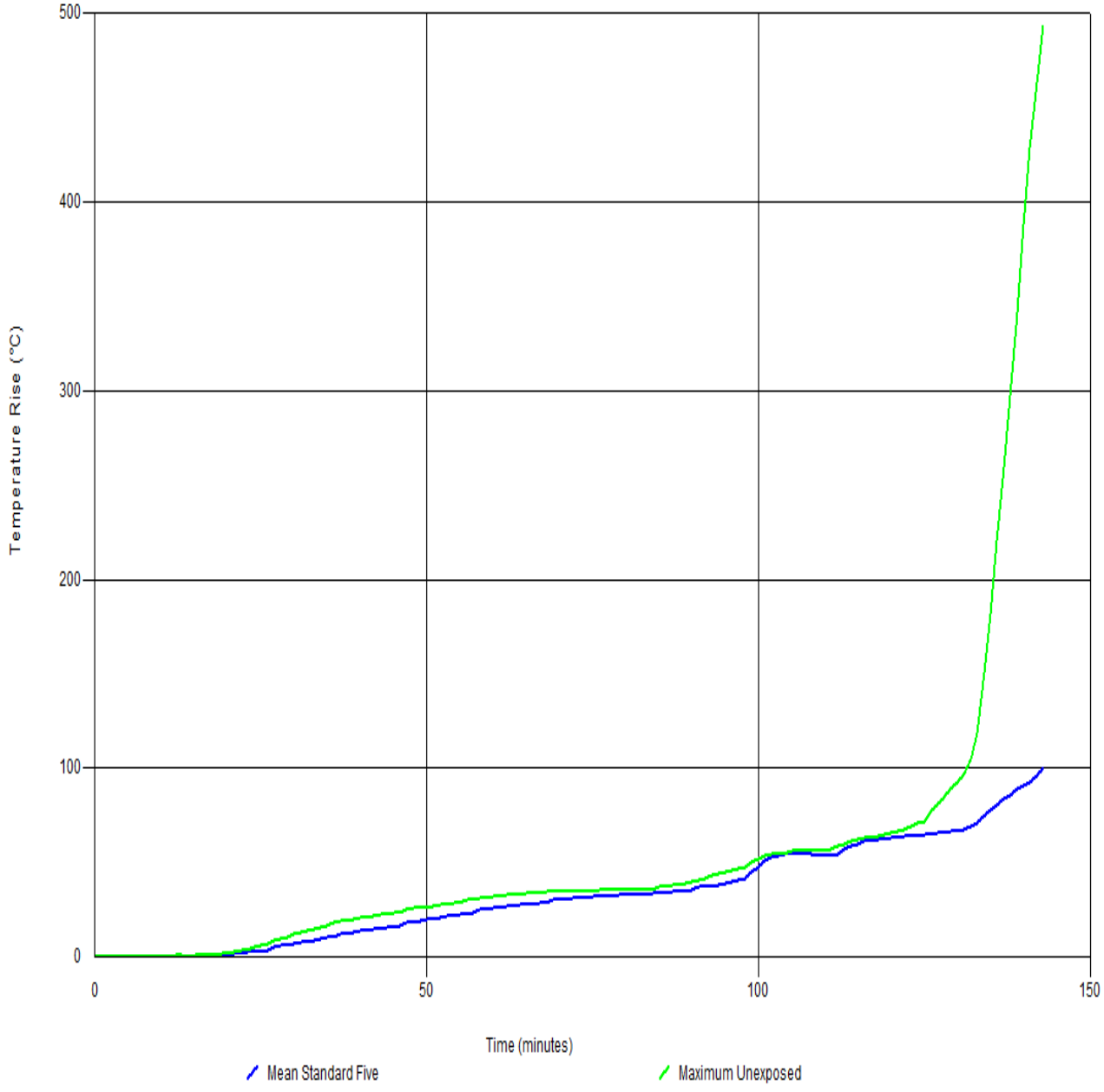

Figure 9 – Unexposed face temperature graph.

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Unexposed Face Thermocouple Layout

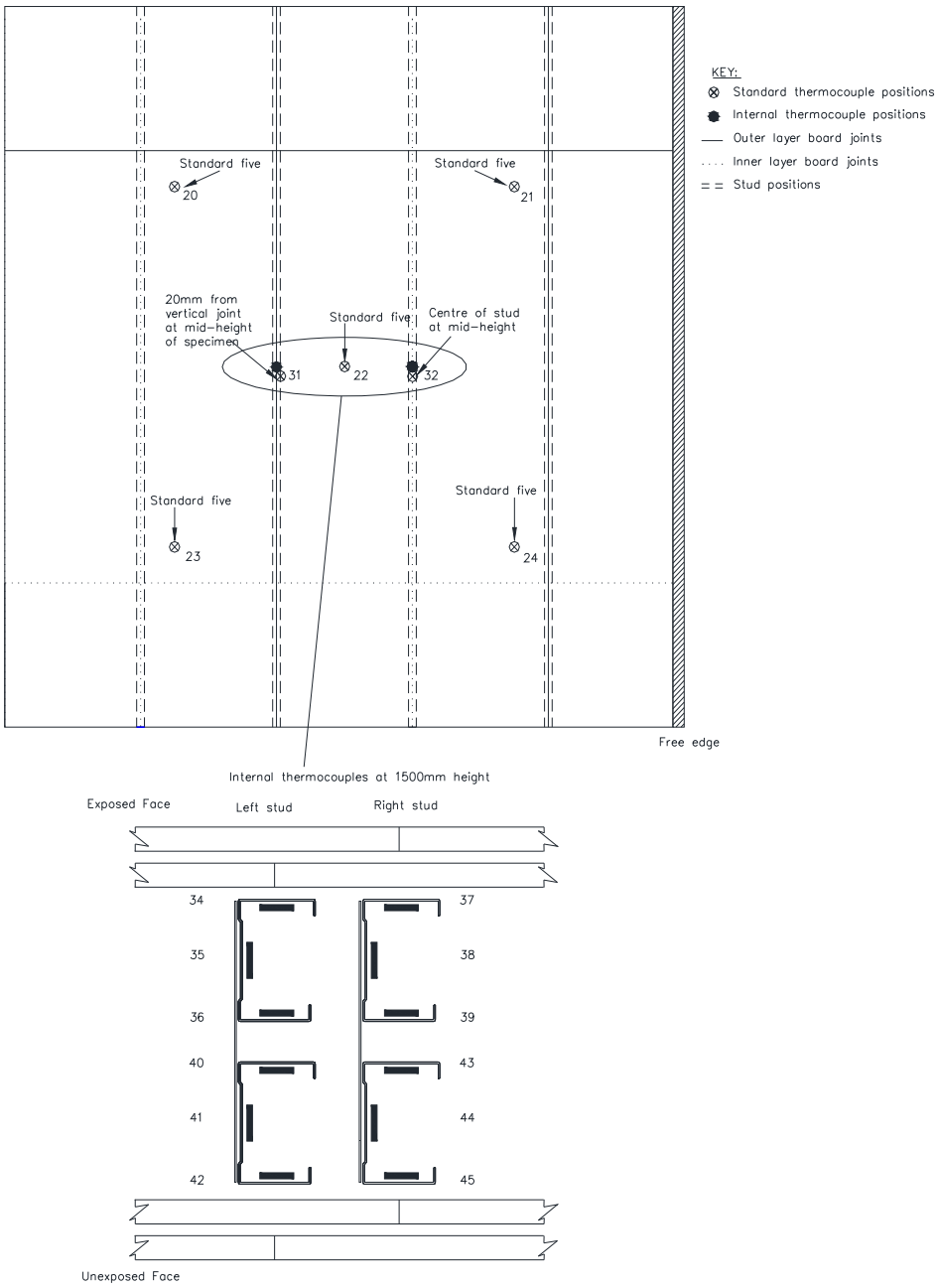

Figure 10 – Unexposed face thermocouple layout.

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Unexposed Face Standard Five Temperature Data

Time (minutes)	Temperature Rise (°C)					
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24	Mean Standard Five
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	1	0	0	0
13	0	0	1	0	0	0
14	0	0	0	0	0	0
15	1	1	1	0	0	1
16	1	1	1	0	0	1
17	1	1	1	0	0	1
18	1	1	1	1	1	1
19	1	2	1	1	1	1
20	2	2	1	1	1	1
21	2	3	2	1	1	2
22	2	3	2	1	1	2
23	3	4	3	1	2	3
24	3	5	3	1	2	3
25	4	6	4	1	2	3
26	5	7	4	2	3	4
27	5	9	5	2	3	5
28	6	10	6	2	4	6
29	7	11	7	2	4	6
30	8	12	8	3	5	7
31	9	13	8	3	5	8
32	9	14	9	3	6	8
33	10	15	10	4	7	9
34	11	16	11	4	7	10
35	12	17	12	4	8	11
36	12	18	12	5	8	11
37	13	19	13	5	9	12
38	14	19	14	5	10	12

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Time (minutes)	Temperature Rise (°C)					
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24	Mean Standard Five
39	14	20	14	6	10	13
40	15	21	15	6	11	14
41	16	21	16	6	12	14
42	16	22	17	7	12	15
43	17	23	17	7	13	15
44	17	23	18	8	13	16
45	18	24	18	8	14	16
46	19	24	19	9	15	17
47	19	25	20	9	16	18
48	20	26	20	10	16	18
49	21	26	21	10	17	19
50	21	26	22	11	18	20
51	22	27	22	11	19	20
52	22	28	23	12	19	21
53	23	28	24	13	20	22
54	24	29	25	13	21	22
55	24	29	25	14	21	23
56	25	30	26	14	22	23
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71	31	35	32	23	31	30
72	31	35	33	24	31	31
73	31	35	33	24	32	31
74	31	35	33	25	32	31
75	32	35	33	26	32	32
76	32	35	34	26	33	32
77	32	35	34	27	33	32
78	32	35	34	27	33	32
79	33	35	34	28	33	33

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Time (minutes)	Temperature Rise (°C)					
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24	Mean Standard Five
80	33	35	34	28	33	33
81	33	35	34	29	33	33
82	34	35	35	29	33	33
83	34	35	35	29	33	33
84	35	35	35	30	33	34
85	35	35	35	30	33	34
86	35	35	36	31	33	34
87	36	36	36	31	34	35
88	36	37	37	31	34	35
89	37	37	37	32	34	35
90	37	38	38	32	35	36
91	38	39	38	33	35	37
92	39	39	39	33	35	37
93	39	40	39	33	36	37
94	40	41	40	34	36	38
95	41	42	41	35	37	39
96	42	42	42	35	38	40
97	43	43	43	36	38	41
98	44	44	45	36	40	42
99	48	49	48	38	43	45
100	52	52	50	42	46	48
101	54	54	52	47	49	51
102	55	55	53	52	51	53
103	55	55	54	54	52	54
104	55	55	55	55	53	55
105	55	55	55	56	53	55
106	55	55	55	56	53	55
107	55	55	54	56	54	55
108	55	54	54	56	54	55
109	54	54	54	56	54	54
110	55	54	54	56	54	55
111	55	54	54	55	54	54
112	55	54	56	55	54	55
113	57	56	59	56	55	57
114	59	59	60	58	57	59
115	60	60	61	60	59	60
116	61	60	61	62	60	61
117	61	60	62	63	60	61
118	61	61	62	63	61	62
119	61	62	63	63	62	62
120	62	62	64	64	62	63

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Time (minutes)	Temperature Rise (°C)					
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24	Mean Standard Five
121	62	62	64	63	63	63
122	63	63	65	64	63	64
123	63	63	65	64	64	64
124	64	64	65	65	64	64
125	65	64	66	65	64	65
126	66	65	66	65	65	65
127	66	65	66	66	65	66
128	66	66	67	66	65	66
129	67	66	67	67	66	67
130	67	66	68	68	67	67
131	68	67	69	69	68	68
132	69	68	70	69	70	69
133	70	69	72	71	74	71
134	72	71	76	74	77	74
135	77	75	80	78	80	78
136	80	79	84	81	83	81
137	82	82	86	83	85	84
138	85	84	89	86	87	86
139	87	87	91	89	89	89
140	89	89	94	91	92	91
141	91	91	97	94	94	93
142	93	93	102	96	96	96
143	95	95	112	98	100	100

See **Figure 10** for the location of the thermocouples.

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Loughborough
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Additional Unexposed Face Temperature Data

Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 25	Thermocouple No. 26
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	1
13	1	1
14	0	0
15	1	1
16	1	1
17	1	1
18	1	1
19	2	1
20	2	2
21	3	2
22	4	2
23	4	3
24	5	3
25	6	4
26	7	5
27	8	6
28	9	6
29	10	7
30	11	8
31	12	9
32	13	9
33	14	10
34	14	11
35	15	11
36	16	12
37	17	13
38	17	13

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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 25	Thermocouple No. 26
39	18	14
40	19	14
41	20	15
42	20	15
43	21	16
44	21	16
45	22	17
46	23	18
47	23	18
48	24	18
49	24	19
50	25	19
51	26	20
52	27	21
53	27	21
54	28	22
55	28	22
56	29	23
57	29	23
58	30	24
59	30	24
60	31	25
61	31	25
62	32	26
63	32	26
64	32	27
65	33	27
66	33	27
67	33	28
68	34	28
69	34	28
70	34	28
71	35	29
72	35	29
73	35	29
74	35	29
75	35	30
76	36	30
77	36	30
78	36	30
79	36	30

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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 25	Thermocouple No. 26
80	36	31
81	36	31
82	36	31
83	36	31
84	36	32
85	37	32
86	37	33
87	38	34
88	38	34
89	39	35
90	40	36
91	41	37
92	42	38
93	43	39
94	44	40
95	45	41
96	46	42
97	47	43
98	48	44
99	50	46
100	52	48
101	53	50
102	54	51
103	54	51
104	55	52
105	55	53
106	54	53
107	54	54
108	54	54
109	54	55
110	54	56
111	55	57
112	56	59
113	59	60
114	61	61
115	62	62
116	63	62
117	63	63
118	63	64
119	64	65
120	65	66

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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 25	Thermocouple No. 26
121	65	67
122	66	68
123	67	69
124	67	71
125	68	72
126	68	77
127	69	81
128	70	85
129	72	89
130	76	93
131	79	97
132	81	105
133	84	119
134	86	**146**
135	88	182
136	90	220
137	93	259
138	96	297
139	100	341
140	106	388
141	115	429
142	136	463
143	164	493

Figures highlighted in red indicated the minute in which the temperature rise exceeded 180 °C.

See **Figure 10** for the location of the thermocouples.

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Internal Temperature Data at 1500mm Height

Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 34	Web Thermocouple No. 35	Cold Flange Thermocouple No. 36	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39
0	30	30	30	27	26	25
1	30	30	30	27	27	25
2	31	30	30	27	27	26
3	31	30	30	27	27	26
4	32	30	30	27	27	26
5	33	31	30	28	27	25
6	39	33	30	28	27	26
7	52	38	32	29	27	26
8	67	47	36	30	29	26
9	78	55	42	33	31	27
10	83	61	48	38	34	29
11	86	66	54	44	40	32
12	88	70	59	51	46	36
13	89	74	64	57	53	42
14	90	76	68	62	59	47
15	91	79	72	66	64	53
16	92	82	75	69	67	57
17	93	84	78	71	69	60
18	93	85	80	73	72	63
19	94	86	82	74	73	66
20	94	87	83	76	74	67
21	94	88	84	76	76	69
22	94	89	85	77	76	70
23	94	89	86	77	76	70
24	94	90	86	77	76	71
25	95	90	86	77	76	71
26	95	90	87	78	76	71
27	95	90	87	78	77	72
28	94	91	87	79	77	72
29	95	91	88	79	78	73
30	98	92	88	80	78	74
31	100	93	89	80	79	74
32	102	95	90	81	80	75
33	104	97	91	82	80	76
34	105	99	93	83	81	76
35	108	101	95	84	81	77
36	110	104	97	85	82	77

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 34	Web Thermocouple No. 35	Cold Flange Thermocouple No. 36	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39
37	114	106	99	86	83	78
38	118	109	101	87	84	78
39	122	111	103	88	84	79
40	126	113	105	90	85	80
41	129	115	107	91	86	81
42	133	118	109	92	87	81
43	136	120	111	93	88	82
44	140	122	112	94	89	83
45	145	125	114	95	89	83
46	151	129	116	96	90	84
47	156	133	118	97	91	84
48	162	136	120	98	92	85
49	167	140	122	100	92	85
50	173	144	124	101	93	86
51	180	148	127	102	94	86
52	187	152	129	103	95	86
53	195	156	132	104	95	87
54	202	160	135	105	96	87
55	210	164	137	106	96	87
56	218	168	140	107	97	88
57	226	171	143	108	98	88
58	234	176	145	109	98	89
59	242	179	148	110	99	89
60	249	183	150	111	100	89
61	256	187	153	112	101	90
62	262	191	155	114	102	90
63	267	194	157	115	103	91
64	271	197	159	117	104	91
65	276	200	162	119	106	92
66	280	204	165	122	107	92
67	285	208	169	125	109	93
68	289	213	173	129	112	94
69	294	218	179	134	116	95
70	298	225	186	140	120	97
71	304	233	194	148	126	99
72	311	242	203	157	134	101
73	319	252	214	169	142	105
74	329	264	226	182	153	109
75	340	277	240	196	165	113

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 34	Web Thermocouple No. 35	Cold Flange Thermocouple No. 36	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39
76	352	290	254	211	177	118
77	365	303	268	227	189	124
78	379	316	282	242	201	131
79	394	329	300	260	214	138
80	406	342	317	275	227	145
81	418	356	331	290	239	153
82	431	370	347	305	252	160
83	446	385	363	322	266	168
84	463	400	380	340	281	175
85	475	415	396	357	296	183
86	486	430	411	373	311	191
87	494	444	423	388	324	199
88	502	457	439	401	335	206
89	512	470	456	414	347	213
90	527	489	477	429	361	220
91	661	575	552	475	388	226
92	742	628	601	525	422	235
93	790	660	632	557	451	247
94	828	704	658	584	475	259
95	867	771	719	633	509	275
96	887	813	758	676	541	298
97	969	967	971	806	785	509
98	834	834	825	762	785	825
99	834	835	826	806	820	884
100	831	832	828	791	858	895
101	860	857	854	786	897	915
102	875	875	868	798	922	932
103	906	901	882	811	928	934
104	907	910	888	819	924	926
105	903	911	887	818	908	914
106	906	910	889	844	889	898
107	904	911	886	876	865	884
108	870	873	865	884	838	857
109	856	850	871	944	851	869
110	873	865	889	958	875	884
111	882	878	893	967	886	885
112	892	887	872	933	896	898
113	910	904	880	924	912	910
114	940	918	914	906	924	964

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 34	Web Thermocouple No. 35	Cold Flange Thermocouple No. 36	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39
115	934	921	928	886	927	980
116	942	933	941	831	932	987
117	948	942	949	824	922	968
118	935	970	955	852	927	941
119	939	992	961	877	947	904
120	927	968	968	843	974	868
121	847	1065	973	806	929	954
122	747	1129	984	763	1058	962
123	833	1053	982	870	928	969
124	768	839	979	792	947	962
125	863	986	974	766	985	966
126	858	918	973	777	922	1029
127	849	877	971	782	919	1034
128	869	912	969	-	952	-
129	929	925	-	-	-	-
130	-	-	-	-	-	-

- Thermocouple broken due to equipment failure.

See **Figure 10** for the location of the thermocouples.

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Internal Temperature Data at 1500mm Height

Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42	Hot Flange Thermocouple No. 43	Web Thermocouple No. 44	Cold Flange Thermocouple No. 45
0	30	30	30	27	26	25
1	30	30	30	28	27	25
2	31	30	30	27	27	25
3	32	30	30	28	27	25
4	33	30	30	28	27	25
5	34	31	30	28	27	25
6	37	32	30	28	27	25
7	41	33	31	29	27	26
8	47	36	33	30	28	26
9	53	40	37	33	30	26
10	60	46	41	37	33	27
11	66	51	46	44	38	28
12	72	57	52	50	44	30
13	76	62	57	56	50	33
14	80	67	61	60	55	36
15	84	71	65	64	60	41
16	87	74	69	67	64	44
17	90	77	72	70	67	48
18	92	80	75	72	69	52
19	93	82	77	73	71	54
20	95	84	79	75	73	57
21	96	85	81	76	74	59
22	97	86	82	76	75	61
23	98	87	83	76	75	62
24	99	88	84	77	75	63
25	100	88	85	77	75	63
26	101	89	85	77	76	64
27	102	90	86	77	76	65
28	104	90	86	78	76	65
29	105	91	87	78	76	66
30	107	92	88	78	77	66
31	109	93	89	79	77	67
32	112	95	90	80	78	67
33	115	96	91	80	79	68
34	118	98	92	81	79	69
35	122	100	94	82	79	69
36	124	102	95	82	80	70

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42	Hot Flange Thermocouple No. 43	Web Thermocouple No. 44	Cold Flange Thermocouple No. 45
37	127	104	97	83	80	70
38	130	106	99	84	81	71
39	134	108	101	85	82	72
40	136	110	102	86	82	72
41	138	112	104	87	83	73
42	140	114	106	88	84	74
43	141	116	108	89	85	75
44	142	117	109	90	87	75
45	143	119	110	91	88	76
46	145	120	111	92	89	77
47	147	121	112	93	90	78
48	149	122	113	94	90	78
49	151	123	114	94	91	79
50	154	124	114	95	92	80
51	159	125	115	96	92	80
52	165	126	116	96	93	81
53	171	128	117	97	93	81
54	180	130	118	98	94	82
55	191	133	119	98	94	82
56	203	136	121	99	95	82
57	215	140	123	99	95	83
58	227	145	125	100	96	83
59	239	151	128	101	96	83
60	251	157	132	102	97	84
61	262	164	136	102	97	84
62	274	170	140	103	98	84
63	284	178	145	105	99	84
64	295	185	150	106	100	85
65	305	192	156	108	101	85
66	315	200	162	111	102	85
67	324	207	169	115	104	86
68	333	215	176	121	107	86
69	341	222	183	127	110	87
70	350	229	190	134	113	88
71	358	237	199	144	119	89
72	365	247	209	154	125	91
73	373	257	220	167	133	93
74	382	268	233	181	143	96
75	392	282	247	197	154	99

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42	Hot Flange Thermocouple No. 43	Web Thermocouple No. 44	Cold Flange Thermocouple No. 45
76	403	295	263	213	165	102
77	414	309	279	230	178	106
78	424	323	296	249	191	110
79	435	338	314	268	205	118
80	446	353	332	288	220	134
81	458	367	347	305	234	143
82	472	380	361	322	249	153
83	478	393	374	337	263	163
84	486	406	388	352	277	173
85	496	419	402	367	290	181
86	506	433	416	381	303	189
87	516	446	429	395	316	197
88	526	461	444	408	327	205
89	536	476	463	422	340	212
90	547	491	479	439	353	219
91	561	508	499	460	369	227
92	576	528	521	482	388	236
93	591	546	541	502	407	245
94	607	564	561	523	428	255
95	629	591	596	555	461	266
96	656	628	638	592	492	280
97	931	923	937	833	804	802
98	881	871	881	842	843	845
99	880	880	900	868	861	897
100	768	775	829	804	808	810
101	776	760	823	787	790	785
102	859	773	847	824	831	823
103	891	750	853	847	858	846
104	882	813	838	863	873	865
105	891	847	820	868	868	877
106	907	872	834	864	854	884
107	918	887	835	856	866	889
108	920	906	843	880	873	851
109	894	918	844	893	891	854
110	851	926	870	903	907	872
111	849	936	888	904	916	888
112	853	945	929	906	929	897
113	864	956	899	916	943	911
114	871	966	919	931	920	926

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42	Hot Flange Thermocouple No. 43	Web Thermocouple No. 44	Cold Flange Thermocouple No. 45
115	889	977	936	924	934	937
116	904	985	948	899	961	946
117	918	990	955	905	967	962
118	931	992	962	916	1002	989
119	924	995	953	937	1089	997
120	922	949	954	964	1136	1012
121	925	1002	963	969	1137	1013
122	929	1010	-	970	-	1014
123	-	-	-	974	-	1015
124	-	-	-	-	-	-

See **Figure 10** for the location of the thermocouples.

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Specimen Lateral Deflection

Time (minutes)	Deflection (mm)
	Centre
0	-0.1
1	-0.3
2	-0.1
3	0.2
4	0.3
5	0.6
6	1.1
7	1.7
8	2.6
9	3.7
10	5.5
11	6.9
12	8.3
13	9.5
14	10.6
15	11.5
16	12.2
17	12.9
18	13.3
19	13.8
20	14.1
21	14.4
22	14.6
23	14.9
24	15.1
25	15.2
26	15.3
27	15.4
28	15.6
29	15.7
30	15.9
31	16.1
32	16.3
33	16.4
34	16.9
35	17
36	17.3
37	17.5
38	17.9

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Time (minutes)	Deflection (mm)
	Centre
39	18.3
40	18.7
41	19
42	19.3
43	19.6
44	19.9
45	20.2
46	20.6
47	20.8
48	21
49	21.3
50	21.5
51	21.7
52	22
53	22.2
54	22.3
55	22.4
56	22.7
57	23
58	23.1
59	23.2
60	23.3
61	23.6
62	23.8
63	24
64	24.3
65	24.7
66	25.2
67	25.7
68	26.3
69	27.1
70	28
71	29.2
72	30.4
73	31.8
74	33.5
75	35.2
76	37
77	39.1
78	42.2
79	45.8

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Time (minutes)	Deflection (mm)
	Centre
80	48.7
81	51.4
82	54.3
83	57.2
84	59.9
85	62.3
86	64.8
87	66.9
88	69
89	71.4
90	74.1
91	78.2
92	82.2
93	85.8
94	89.3
95	93.4
96	95.1
97	97.1
98	96.3
99	95.3
100	93.7
101	93
102	92.3
103	91.9
104	91.7
105	91.3
106	91.3
107	91.3
108	91.3
109	91.1
110	90.6
111	90.5
112	91.4
113	91.4
114	91.7
115	92
116	92.4
117	93
118	93.5
119	93.9
120	94.2

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Time (minutes)	Deflection (mm)
	Centre
121	94.5
122	94.8
123	95.1
124	95.2
125	95.3
126	95.6
127	95.7
128	95.7
129	95.6
130	95.6
131	95.4
132	95.1
133	94.3
134	93.7
135	92.9
136	91.4
137	89.5
138	86.4
139	82.2
140	77.6
141	73.1
142	66.4
143	58.2

The deflection was recorded at the approximate centre of the specimen.

Positive readings indicate deflection into the furnace.

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PHOTOGRAPHS

Exposed Face Prior to Test

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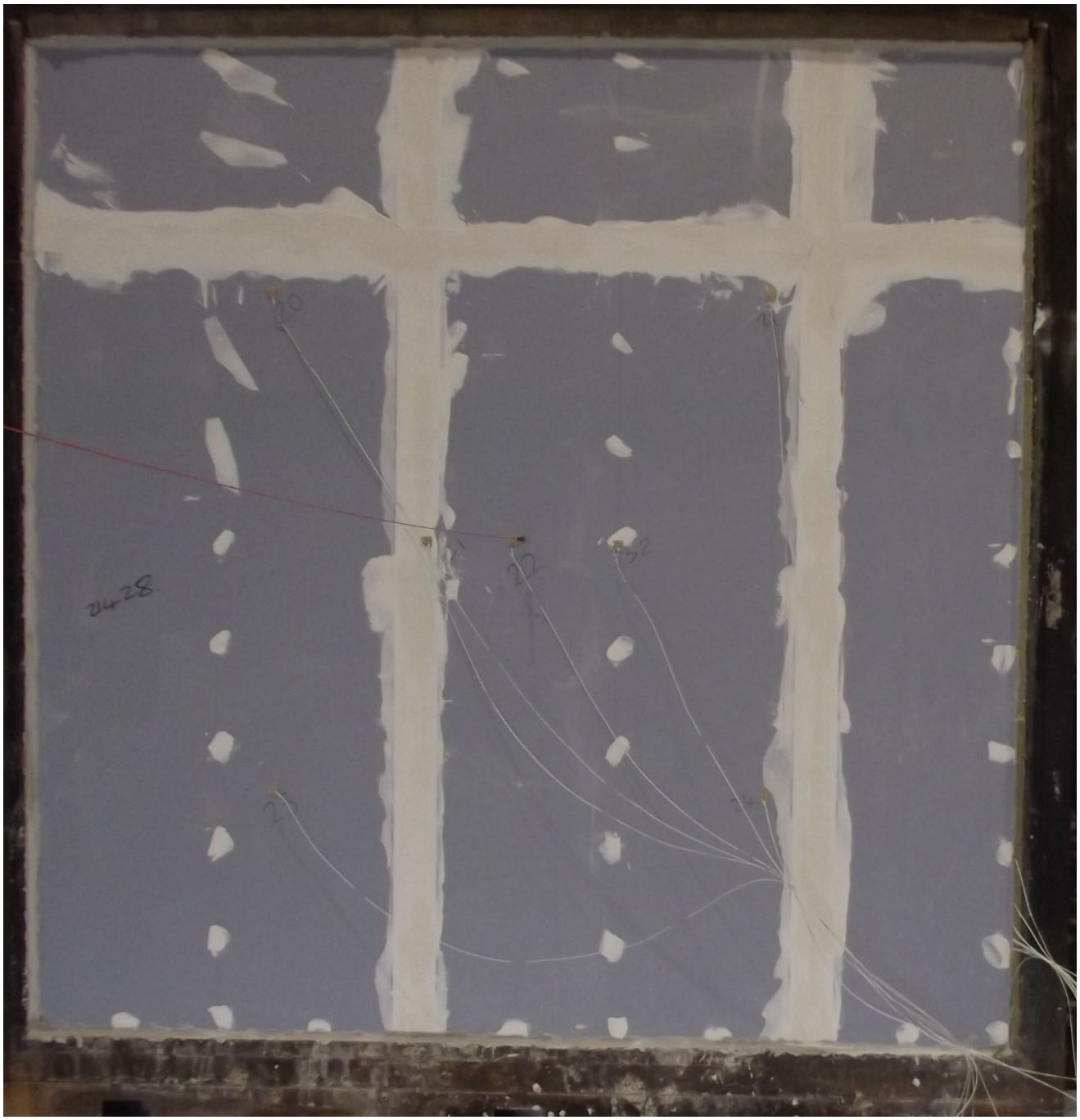
Email: btc.testing@saint-gobain.com

Unexposed Face Prior to Test



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Loughborough
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Unexposed Face at 30 Minutes

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Unexposed Face at 1 Hour

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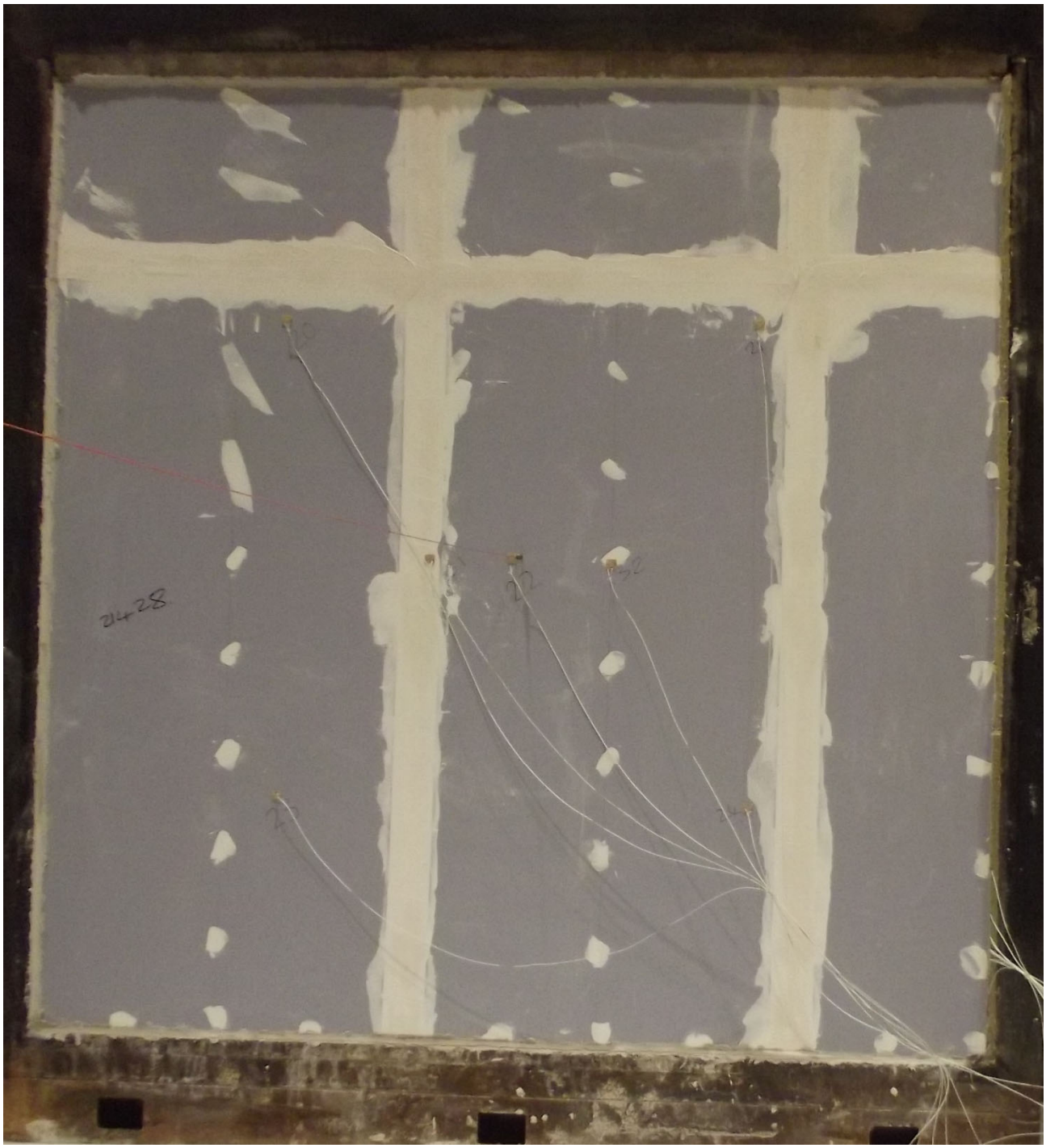
Unexposed Face at 1 Hour, 30 Minutes



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Unexposed Face at 2 Hours

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