

Report Number: **BTC 21749F**

A FIRE RESISTANCE TEST ON A SFS EXTERNAL WALL SYSTEM WITH A 100 MM COLD-ROLLED STRUCTURAL STEEL STUD FRAMEWORK CLAD ON THE EXPOSED SIDE WITH A TRIPLE LAYER OF 15 MM GYPROC FIRELINE WITH 50 MM ISOVER APR 1200 IN THE CAVITY AND A 20 MM DEFLECTION HEAD, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1: 2015.

Test Date: 30th March 2021

Report Issue Date: 01st April 2021

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Customer: **British Gypsum**

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FOREWORD

This test report details a fire resistance test conducted on a metal stud partition clad with a single layer of Glasroc X Sheathing Board on the unexposed face and a triple layer of Gyproc Fireline on the exposed face, incorporating a 20 mm deflection head and 20 mm Isover Acoustic Partition Roll in the cavity.

The test sponsor was British Gypsum.

The test specimen was installed by PVR Joinery. The construction of the specimen took place between the 25th and 29th March 2021. 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 March 2021.

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedures outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, constructional details, loads, stresses, edge of end conditions other than those allowed under the field of direct application in EN 1364-1 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.” (BS EN 1363-1: 2020, section 12.1)

REPORT AUTHORISATION

Report Author



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Scientist

Authorised by



Paul Miller
BSc. (Hons.)
Fire Test Manager

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TEST REPORT AMENDMENTS

Page	Amendments	Date

Report Amendments Author

Name
Role

Amendments Authorised by

Name
Role

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).

A 104 mm x 40 mm x 1.2 mm gauge cold rolled structural steel channel was fixed to the base of the test aperture at 600 mm centres using 60mm fire resistant fixings.

A 104 mm x 70 mm x 2.0 mm gauge cold rolled structural steel 'Slotted head' channel was fixed to the head of the test aperture at 600 mm centres using 60mm fire resistant fixings.

100 mm x 50 mm x 1.2 mm gauge cold rolled structural steel studs were positioned at 600 mm centres between the channels. Each stud was cut 25 mm short and engaged into the slotted head channel and fixed through the slots with a 13 mm British Gypsum Wafer Head Jack-point Screw each side of the stud positions (25 mm below the top of the slot).

The right hand stud viewed from the unexposed face was 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 thick rock mineral fibre gasket (stud was cut 25 mm short).

At the left-hand edge a 100 mm x 50 mm x 1.2 mm gauge cold rolled structural steel stud was used to fix the partition to the test frame, using 60 mm fire resistance fixings at 600 mm centres (stud was cut 25 mm short).

Thermocouples were added to the studs at mid height on the web, hot and cold flanges of the central two studs.

50 mm Isover APR 1200 was placed within the stud cavity.

A Gypframe GFS1 Fixing Strap was positioned 25 mm below the bottom edge of the head channel on the corridor (plasterboard) side of the partition and fixed to each stud with two 13 mm British Gypsum Wafer Head Jack-point Screws.

The exposed face of the specimen was clad with a triple layer of 15 mm Gyproc FireLine. All the boards were reduced to leave a 25 mm gap at the head of the specimen.

The inner layer boards were fixed with 25 mm British Gypsum Jack-Point Screws at 300 mm centres around the perimeter of the boards only, except to the head channel.

The middle layer boards were fixed with 41 mm British Gypsum Jack-Point Screws at 300 mm centres around the perimeter of the boards only, except to the head channel.

The outer layer boards were fixed with 60mm British Gypsum Jack-Point Screws at 300 mm centres around the perimeter and within the field of the boards to all framing members except the head channel. The uppermost board fixings were positioned 130 mm below the test frame concrete soffit.

All vertical joints were staggered between layers, with a full board at the right-hand side of the exposed face (as viewed from the unexposed side). A horizontal joint was positioned at 2400 mm from the base on the inner and outer layer exposed face boards and at 600 mm from the base on the middle layer exposed face boards. A Gypframe GFS1 Fixing Strap was used behind the horizontal outer layer board joint on the exposed face only.

The unexposed face of the specimen was clad with a single layer of 12.5 mm Glasroc X Sheathing Board. The boards were not cut short at the head. The boards were fixed with 25 mm Glasroc X Screws at 300 mm centres around the perimeter and within the field of the boards, except to the head channel. A horizontal joint was positioned at 2400 mm from the base on the unexposed face boards. The uppermost board fixings were positioned 130 mm below the test frame concrete soffit.

A continuous 6 mm bead of Glasroc X Sealant was applied along the vertical and horizontal edges of the board which had boards abutting against them. The Glasroc X Sheathing Boards were pushed up to the previous board so that the sealant 'mushroomed' out fully sealing the joint.

On the exposed face the 25 mm gap above the Gyproc FireLine boards was filled with a strip of Rockwool Flexi stone mineral wool insulation. A continuous bead of Gyproc Sealant was applied to the 25 mm legs of Gypframe GA4 Steel Angles and fixed to the head of the of the test aperture at 600 mm centres using 60 mm fire resistant fixings. The 50 mm legs extended down to cover the deflection head gap. A butt joint was added in the Gypframe GA4 Steel Angles 1000 mm from the fixed end.

All exposed face outer layer Gyproc FireLine 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.

Note. The deflection head is constructed to 25 mm to accommodate a 20 mm downward deflection. This is due to the Rockwool Flexi in the head not being able to completely compress.

Test Construction Drawings

Horizontal Cross Section

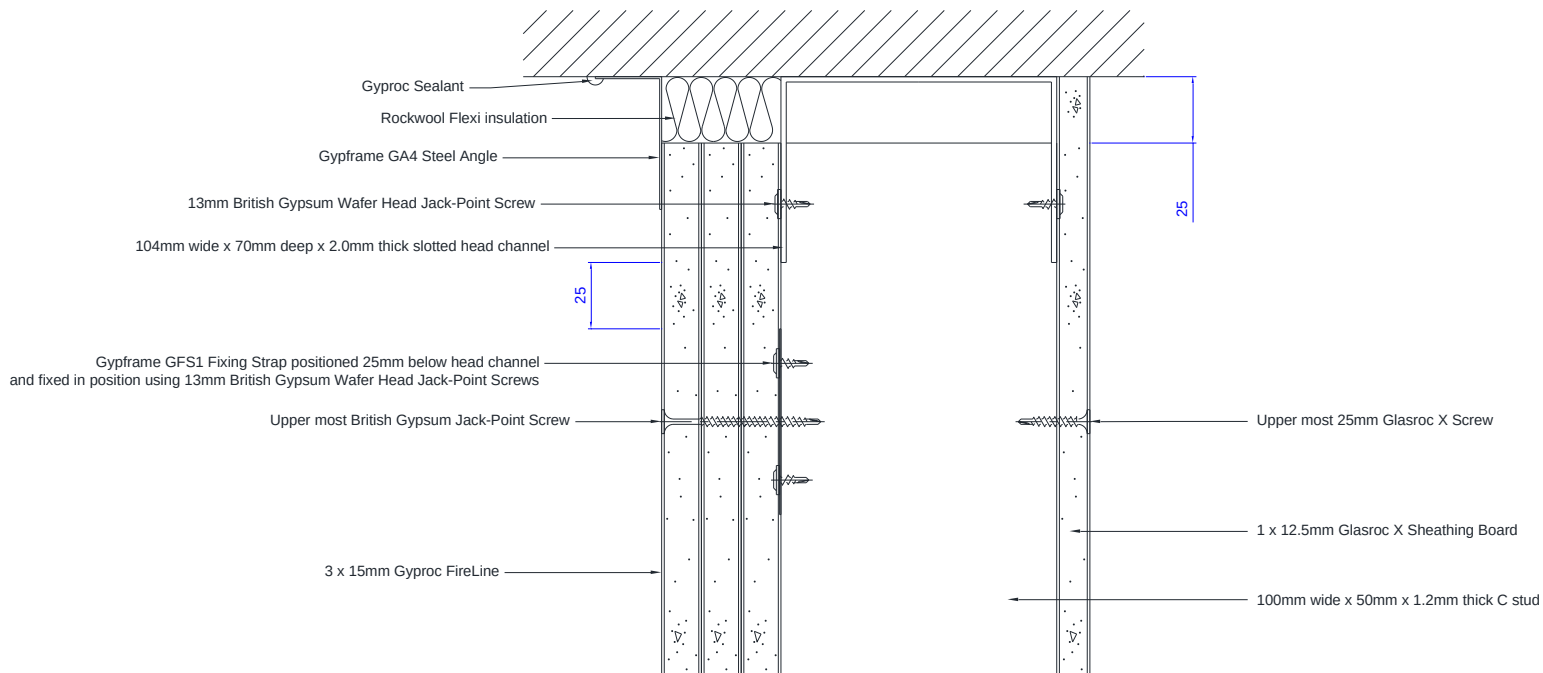


Figure 1 – Horizontal cross section.

Exposed Face Elevation

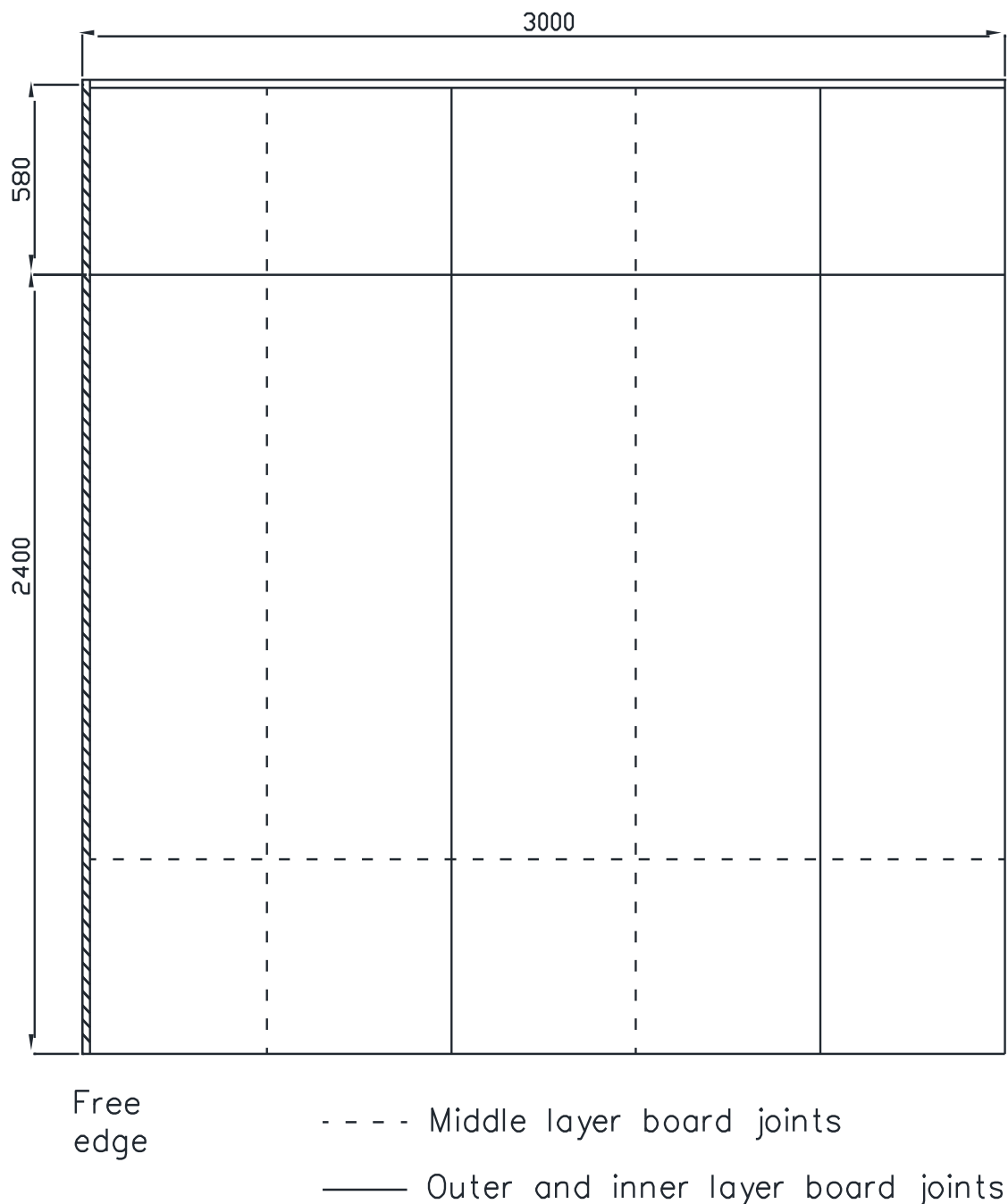


Figure 2 – Exposed face elevation.

Unexposed Face Elevation

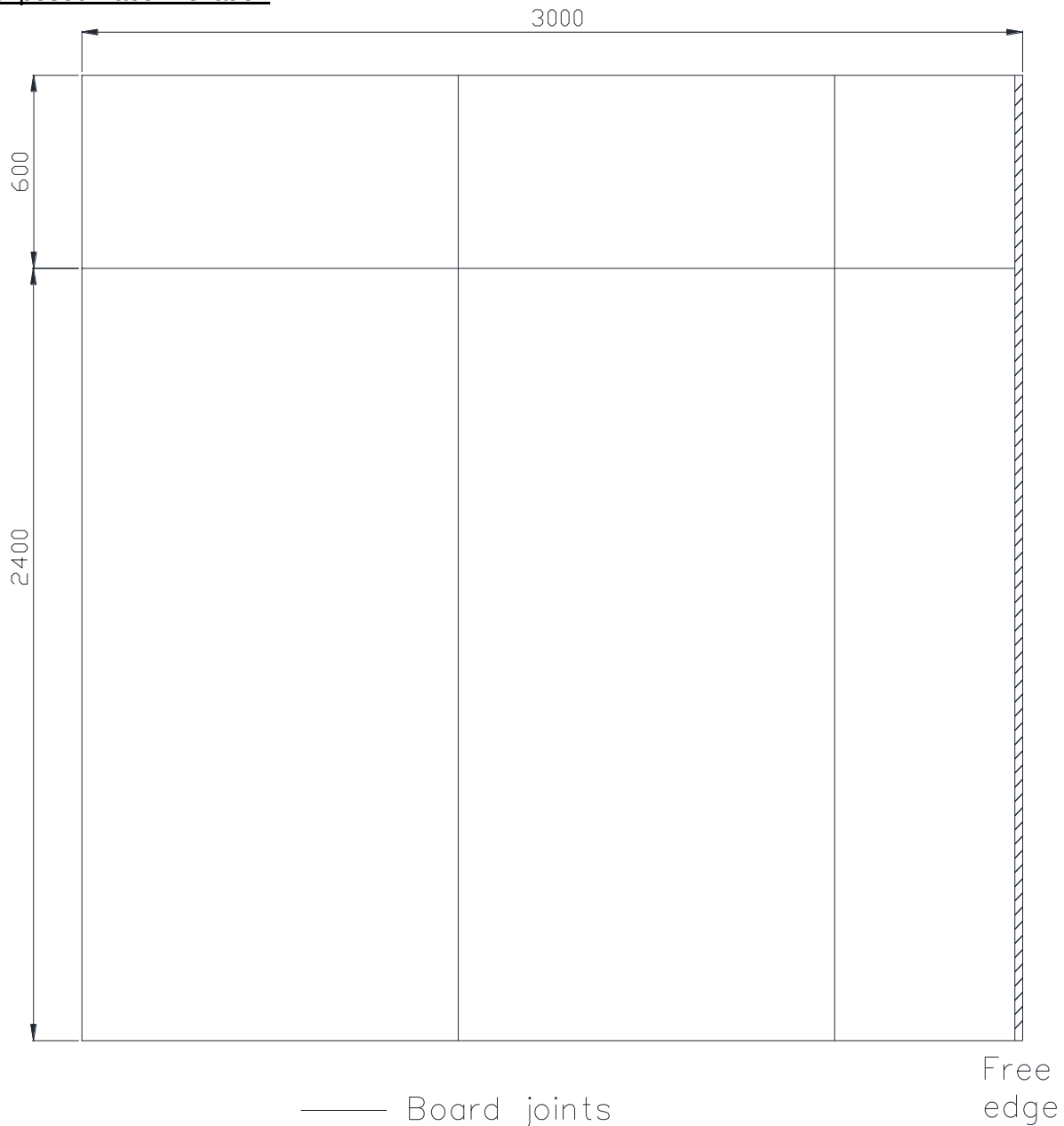


Figure 3 – Unexposed face elevation.

TEST MATERIALS

Plasterboard

- i) Nominally, 2400 mm (long) x 1200 mm (wide) x 15 mm (thick), Gyproc FireLine (TE), manufactured and supplied by British Gypsum, ex Sherburn.

Measured mass per unit area:	13.0 kg/m ²
Measured thickness:	15.4 mm
Board identification numbers:	31 285 20 19:16 31 285 20 19:17 31 285 20 19:17
Measured moisture content:	0.51 %

- ii) Nominally, 2400 mm (long) x 1200 mm (wide) x 12.5 mm (thick), Glasroc X Sheathing Board (SE), manufactured and supplied by British Gypsum, ex Melnik.

Measured mass per unit area:	11.1 kg/m ²
Measured thickness:	12.5 mm
Board identification numbers:	19/11/20 09:40:00 19/11/20 09:40:00 19/11/20 09:40:00
Measured moisture content:	0.42 %

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 British Gypsum.

Metal Components

- iii) Gypframe GA4 Steel Angle, supplied by British Gypsum.
iv) Gypframe GFS1 Fixing Strap, supplied by The Building Test Centre
v) 104 mm x 40 mm x 1.2 mm gauge cold rolled structural steel channel manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	105 mm
Measured flange dimension	40 mm
Measured thickness	1.211 mm
Measured weight per metre	1.68 kg/m

- vi) 104 mm x 70 mm x 2.0 mm gauge cold rolled structural steel 'slotted head' channel. Incorporating slots on both sides 40 mm long at 25 mm centres manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	104 mm
Measured flange dimension	70 mm
Measured thickness	1.975 mm
Measured weight per metre	3.34 kg/m

- vii) 100 mm x 50 mm x 1.2 mm gauge (with 13 mm returns) cold rolled structural steel studs manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	100 mm
Measured short flange dimension	50 mm
Measured thickness	1.280 mm
Measured weight per metre	2.13 kg/m

Fasteners

- viii) 13 mm British Gypsum Wafer Head Jack-Point Screws, supplied by The Building Test Centre.
ix) 25 mm British Gypsum Jack-Point Screws, supplied by The Building Test Centre.
x) 41 mm British Gypsum Jack-Point Screws, supplied by The Building Test Centre.
xi) 60 mm British Gypsum Jack-Point Screws, supplied by The Building Test Centre.
xii) 60 mm Fire Resistant Fixings, supplied by The Building Test Centre.
xiii) 25 mm Glasroc X Screws, supplied by British Gypsum.

Miscellaneous Components

- xiv) Gyproc Paper Joint Tape, supplied by The Building Test Centre.
xv) Gyproc Joint Filler, supplied by The Building Test Centre.
xvi) Rock mineral fibre gasket, supplied by The Building Test Centre.
xvii) Gyproc Sealant, supplied by The Building Test Centre.
xviii) Glasroc X Sealant, supplied by British Gypsum.

Insulation

- xix) Nominally 50 mm (thick) APR 1200 (Acoustic Partition Roll), manufactured by Saint-Gobain Isover and supplied by British Gypsum.

Measured surface density: 0.677 kg/m²

- xx) Nominally 50 mm (thick) Rockwool Flexi, manufactured by Rockwool and supplied by British Gypsum.

Measured surface density: 1.635 kg/m²

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.

TEST PROCEDURE

The test was conducted fully in accordance with BS EN 1364-1: 2015. The specimen was subjected to fire from one side, as specified in BS EN 1364-1: 2015.

The test specimen was not symmetrical and should therefore be tested in both orientations. No performance can be claimed for the system if installed with Glasroc X Sheathing Board exposed to the furnace without a separate test being undertaken to substantiate this orientation.

The test procedure used was EN 1364-1 Issue 3.

The ambient temperature at the commencement of the test was 19 °C.

The furnace pressure was set to control at 18 ± 2 Pa positive with respect to atmosphere, at the top of the specimen. Furnace pressure data is shown in **Figure 5**.

The test conditions did not meet the full requirements of BS EN 1363-1: 2020 as the test frame stiffness did not fully comply.

The specimen and associated construction were not conditioned in accordance with clause 8 of BS EN 1363-1: 2020.

TEST RESULTS

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

Integrity	Sustained Flaming	150 minutes, no failure.
	6 mm Gap Gauge	150 minutes, no failure.
	25 mm Gap Gauge	150 minutes, no failure.
	Cotton Pad	149 minutes.
Insulation		148 minutes.
Test Terminated		150 minutes, at the request of the sponsor.

LIMITATIONS

The scope of the Field of Direct Application of the results and construction details in this test report is explained in BS EN 1364-1: 2015, section 13.

TEST DATA

Observations

All observations refer to the exposed face unless stated.

Observers: Unexposed face: Lindsey Watson
Exposed face: Liam Woodford and William Pikett

Time		Observations
Hours	Minutes	
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 2-3 mm.
0	30	Left-hand vertical joint had opened up to approximately 4-5 mm. Right-hand vertical joint had opened up to approximately 3-4 mm. Horizontal joint had opened up to approximately 4-5 mm. Boards began to crack around screw heads. <i>Unexposed face</i> No visible change
0	40	Left-hand vertical joint had opened up to approximately 7-8 mm. Right-hand vertical joint had opened up to approximately 5-6 mm. Horizontal joint had opened up to approximately 6-7 mm.
0	50	Left-hand vertical joint had opened up to approximately 10-11 mm. Right-hand vertical joint had opened up to approximately 6-7 mm. Horizontal joint had opened up to approximately 8-9 mm.
1	00	Left-hand vertical joint had opened up to approximately 11-12 mm. Right-hand vertical joint had opened up to approximately 7-8 mm. Horizontal joint had opened up to approximately 9-10 mm. <i>Unexposed face</i> No visible change

Time		Observations
Hours	Minutes	
1	10	No visible change.
1	20	No visible change.
1	30	Left-hand vertical joint had opened up to approximately 13-14 mm. Right-hand vertical joint had opened up to approximately 8 mm. Horizontal joint had opened up to approximately 11-12 mm. Metal angle had opened up to approximately 1-2 mm on the deflection head. <i>Unexposed face</i> No visible change
1	40	No visible change.
1	50	Horizontal joint had opened up to approximately 15-16 mm. Lower-centre board had started to crack.
2	00	Right-hand side of the lower left-hand board had fallen into the furnace. Lower-centre board had fallen into the furnace. Second layer right-hand vertical joint had opened up to approximately 8 mm. <i>Unexposed face</i> No visible change
2	10	Remainder of the lower left-hand board had fallen into the furnace. Second layer boards had crazed.
2	20	100 % of the first layer boards had fallen into the furnace. Approximately 80 % of the second layer board had fallen into the furnace. Third layer boards had crazed.
2	27	<i>Unexposed face</i> Glow visible on the left hand vertical joint from approximately 1000-2000 mm height.
2	28	<i>Unexposed face</i> INSULATION FAILURE. The temperature rise of thermocouple no.29 positioned at mid-height at the centre of the horizontal joint exceeded 180 °C.

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Time		Observations
Hours	Minutes	
2	29	<i>Unexposed face</i> INTEGRITY FAILURE. The cotton pad ignited (flamed) when placed on the left-hand vertical joint at approximately 1800 mm height.
2	30	TEST TERMINATED at the request of the sponsor.

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Furnace Temperature Graph

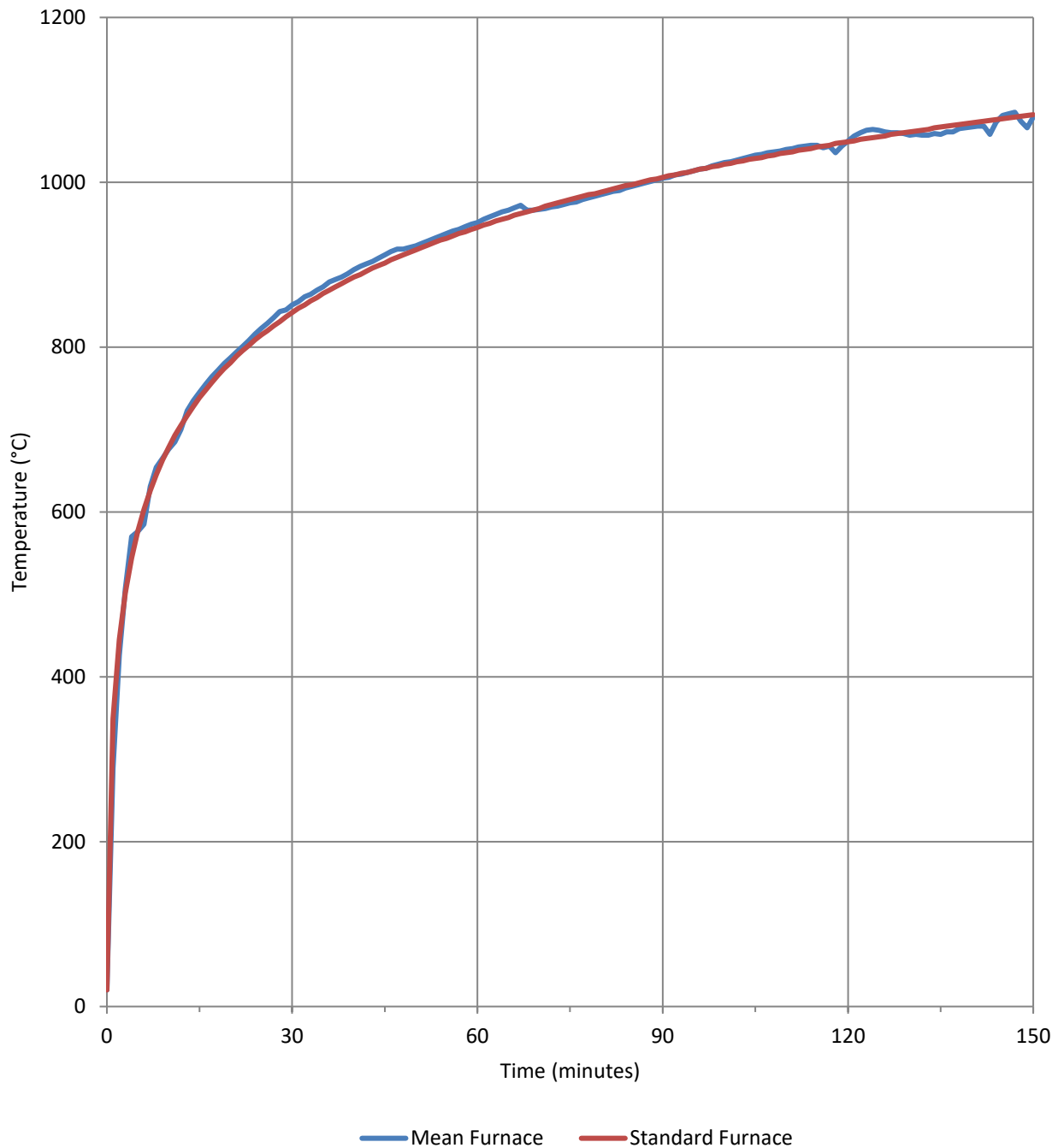


Figure 4 – Furnace temperature graph.

Furnace Pressure Graph

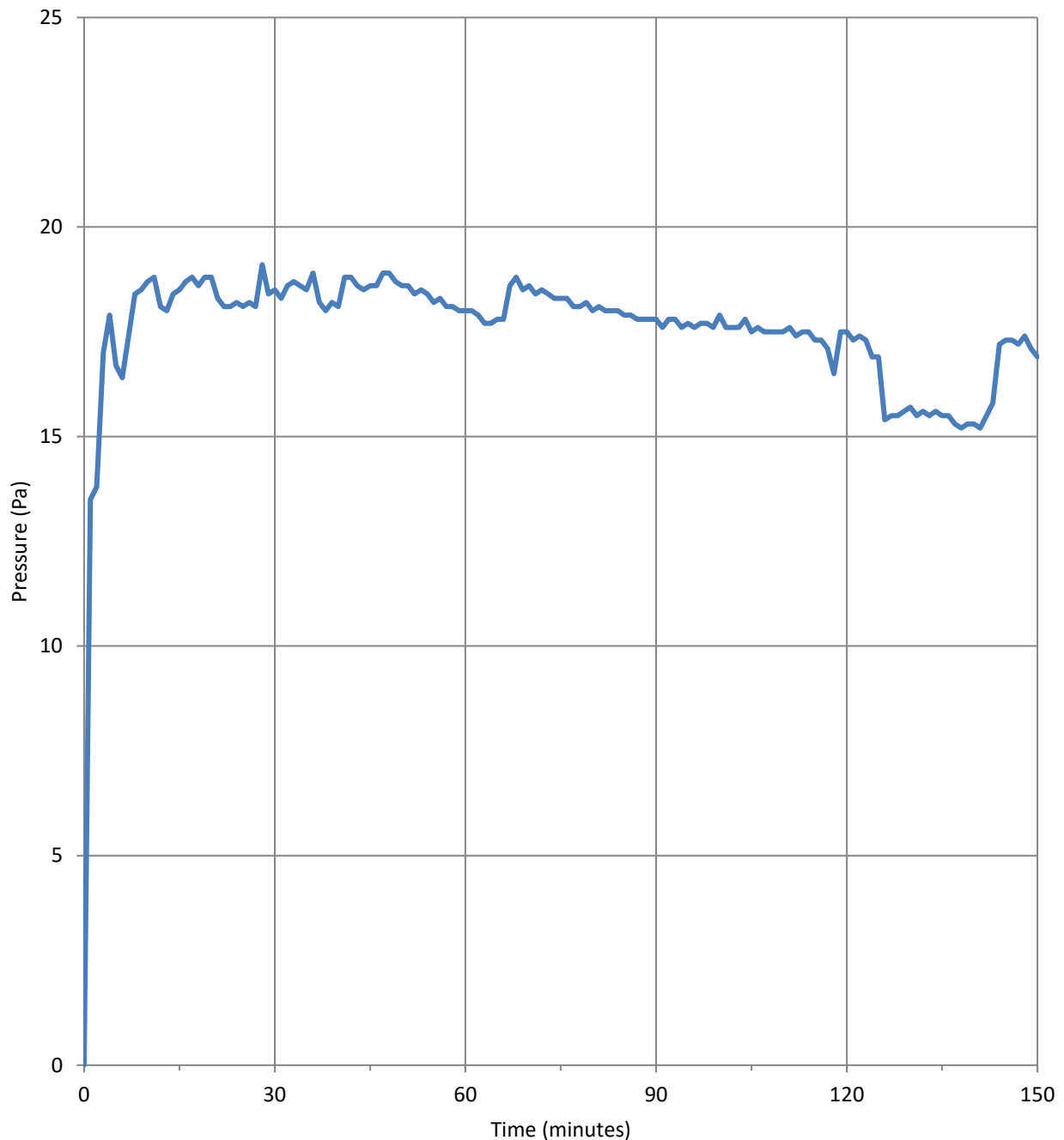


Figure 5 – Furnace pressure graph.

Unexposed Face Temperature Graph

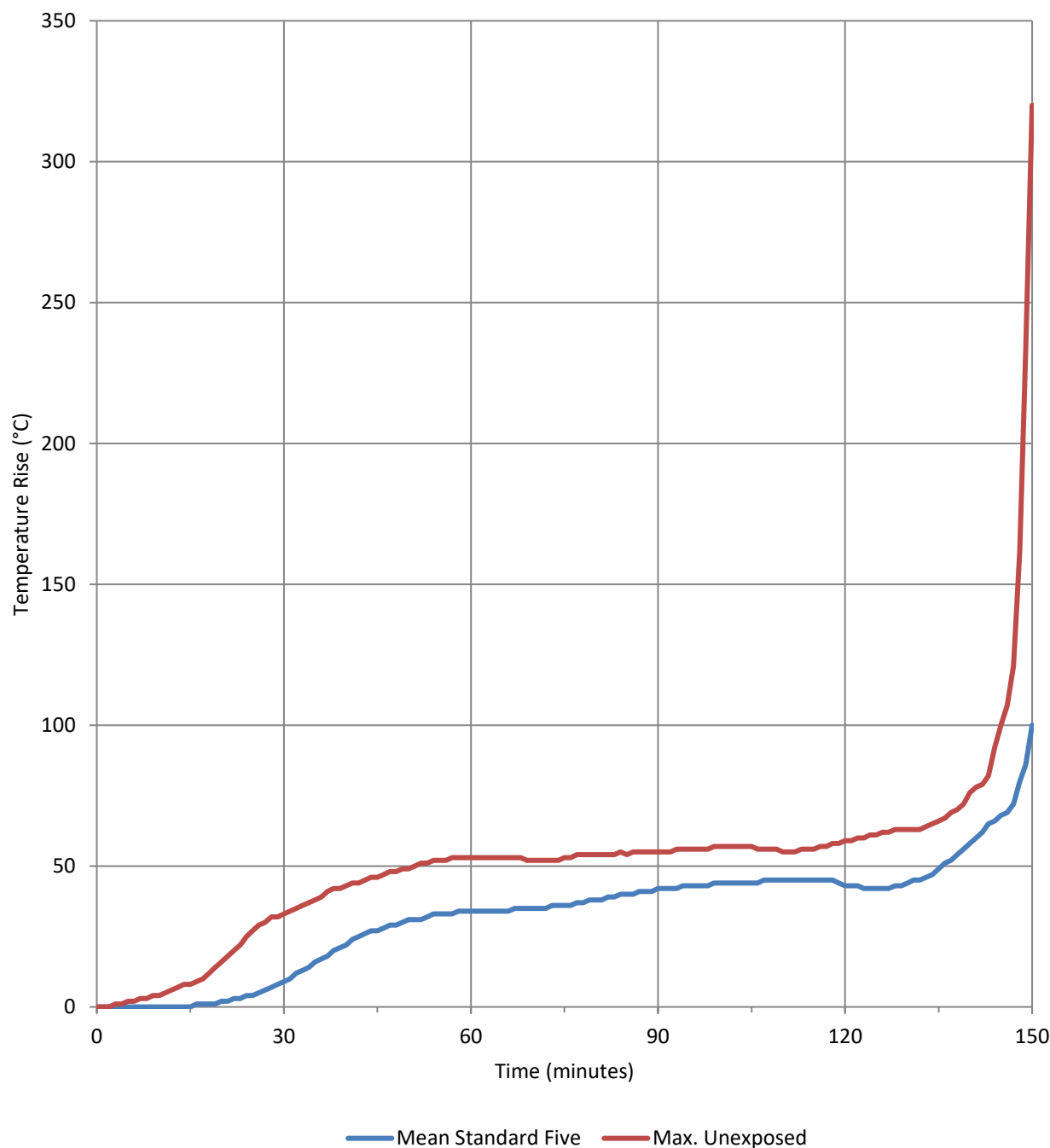


Figure 6 – Unexposed face temperature graph.

Unexposed Face Thermocouple Layout

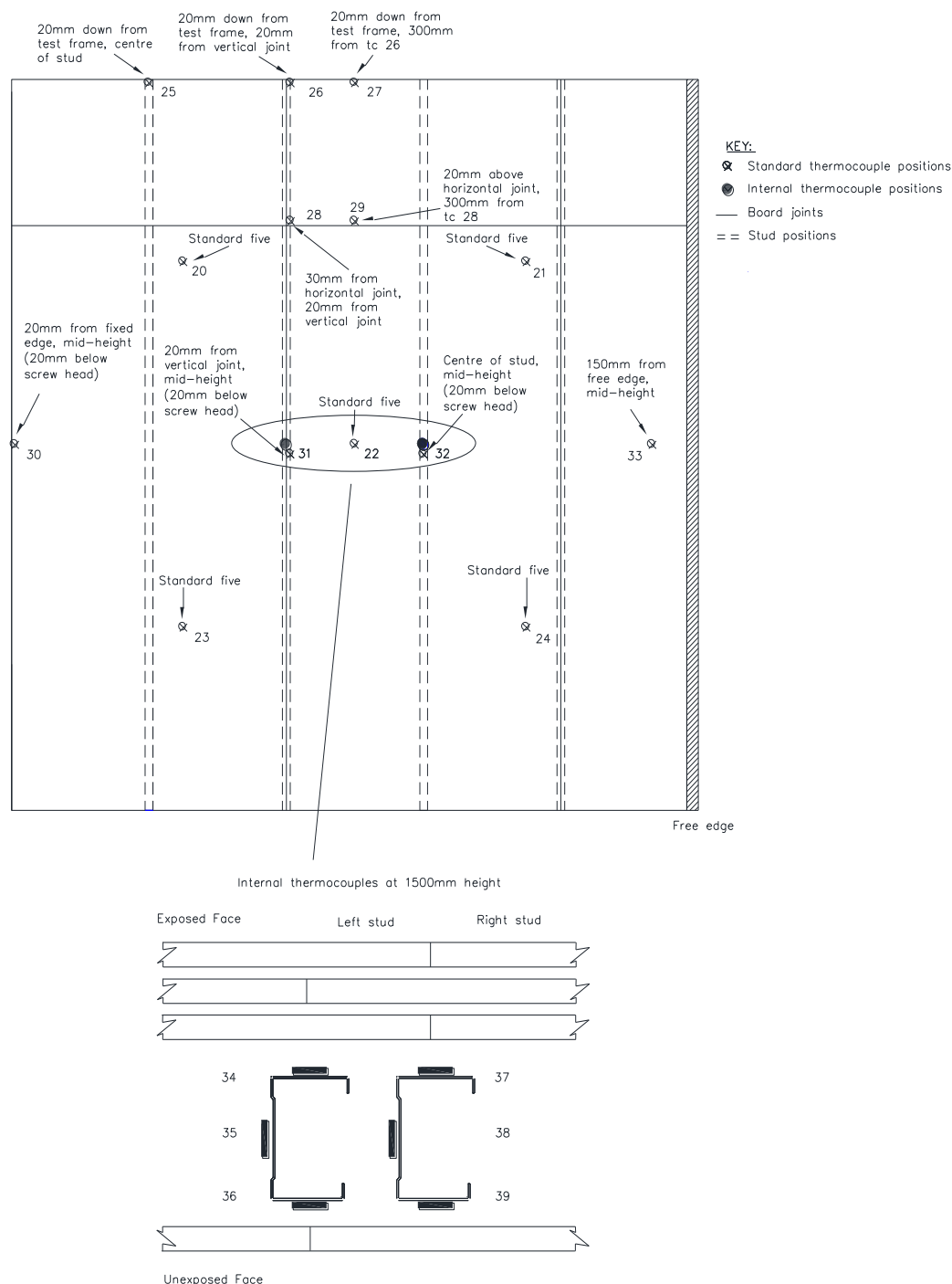


Figure 7 – Unexposed face thermocouple layout.

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	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	1	1	0	0	0	0
16	1	1	1	0	0	1
17	1	1	1	1	0	1
18	1	1	1	1	1	1
19	2	2	1	1	1	1
20	2	2	2	1	1	2
21	3	3	2	1	1	2
22	3	3	3	2	2	3
23	4	4	4	2	2	3
24	5	5	5	2	2	4
25	6	6	5	2	2	4
26	7	7	6	3	3	5
27	9	8	7	3	3	6
28	10	9	9	4	3	7
29	12	10	10	4	4	8
30	13	12	11	5	4	9
31	15	13	13	5	5	10
32	17	15	15	6	5	12
33	19	17	16	7	6	13
34	21	18	18	8	7	14
35	23	20	20	8	8	16
36	25	22	22	9	8	17
37	26	23	24	10	9	18
38	28	25	25	11	10	20

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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	30	27	27	12	11	21
40	31	28	28	13	12	22
41	32	29	30	14	13	24
42	33	30	31	15	14	25
43	34	31	32	16	15	26
44	35	32	33	17	16	27
45	35	33	34	18	17	27
46	36	34	34	19	18	28
47	36	34	35	20	19	29
48	36	35	35	21	19	29
49	37	36	36	21	19	30
50	37	36	37	22	21	31
51	38	37	37	23	22	31
52	38	37	37	23	22	31
53	38	38	38	24	23	32
54	39	38	38	25	23	33
55	39	38	38	25	24	33
56	39	38	38	25	24	33
57	39	38	39	26	25	33
58	39	39	39	26	25	34
59	40	39	39	26	26	34
60	40	39	39	26	26	34
61	40	39	39	27	26	34
62	40	39	39	27	26	34
63	40	39	39	27	27	34
64	40	39	39	27	27	34
65	40	39	39	27	27	34
66	40	38	40	27	27	34
67	40	38	40	27	28	35
68	40	38	40	27	28	35
69	40	38	40	28	28	35
70	40	39	40	28	28	35
71	40	39	41	28	29	35
72	40	39	41	28	29	35
73	41	39	41	28	29	36
74	41	40	42	29	30	36
75	41	40	42	29	30	36
76	41	40	42	29	30	36
77	41	41	43	30	31	37
78	42	41	43	30	31	37
79	42	42	44	30	32	38

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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	42	42	44	31	32	38
81	42	42	44	31	33	38
82	43	43	45	31	33	39
83	43	43	45	32	33	39
84	43	43	46	32	34	40
85	43	44	46	33	34	40
86	44	44	46	33	35	40
87	44	44	47	33	35	41
88	44	45	47	34	35	41
89	44	45	47	34	36	41
90	45	45	47	35	36	42
91	45	45	47	35	36	42
92	45	45	48	35	37	42
93	45	46	48	36	37	42
94	46	46	48	36	38	43
95	46	46	48	36	38	43
96	46	46	48	37	38	43
97	46	46	48	37	39	43
98	46	46	48	37	39	43
99	46	47	49	38	39	44
100	47	47	49	38	39	44
101	47	47	49	38	40	44
102	47	47	49	38	40	44
103	47	47	49	39	40	44
104	47	47	49	39	40	44
105	47	47	49	39	40	44
106	47	47	49	39	40	44
107	47	47	50	40	41	45
108	47	47	50	40	41	45
109	47	47	50	40	41	45
110	47	47	50	40	41	45
111	47	47	50	40	41	45
112	47	47	50	40	41	45
113	47	47	49	40	41	45
114	47	46	49	41	41	45
115	47	46	49	41	41	45
116	47	46	49	41	41	45
117	46	46	49	41	42	45
118	46	46	48	41	42	45
119	46	45	47	40	41	44
120	45	44	47	40	41	43

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Time (minutes)	Temperature Rise (°C)					Mean Standard Five
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24	
121	45	43	46	40	41	43
122	44	43	46	40	40	43
123	44	42	45	40	40	42
124	43	42	45	40	39	42
125	43	43	45	39	39	42
126	42	44	46	39	39	42
127	42	45	46	39	39	42
128	41	47	47	39	39	43
129	41	48	48	39	40	43
130	41	49	49	40	40	44
131	42	50	50	40	41	45
132	43	51	51	40	41	45
133	45	52	52	40	42	46
134	46	53	54	41	43	47
135	48	55	56	41	44	49
136	50	57	58	42	46	51
137	51	59	61	43	47	52
138	52	62	64	45	49	54
139	54	64	66	47	51	56
140	55	66	67	49	54	58
141	57	67	67	51	57	60
142	58	68	68	54	60	62
143	60	69	80	57	61	65
144	61	69	80	60	62	66
145	63	70	80	63	63	68
146	64	70	80	65	64	69
147	65	71	89	71	65	72
148	66	73	102	80	80	80
149	74	79	117	80	80	86
150	77	81	180	81	80	100

See **Figure 7** for the location of the thermocouples.

Additional Unexposed Face Temperature Data

Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 25	Thermocouple No. 26	Thermocouple No. 27	Thermocouple No. 28	Thermocouple No. 29
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	1	0	0	0
4	0	1	0	0	0
5	0	2	0	0	0
6	1	2	0	0	0
7	1	3	0	0	0
8	2	3	1	0	0
9	2	4	1	0	0
10	3	4	1	0	0
11	3	5	2	0	0
12	4	6	2	0	0
13	5	7	3	0	0
14	6	8	3	0	1
15	8	8	4	0	1
16	9	9	5	1	1
17	10	10	6	1	1
18	12	10	6	1	2
19	14	11	7	2	3
20	16	11	8	2	3
21	18	12	9	2	4
22	20	12	10	3	6
23	22	13	11	3	7
24	25	13	13	4	8
25	27	14	15	5	10
26	29	14	17	6	12
27	30	15	20	7	14
28	32	16	22	8	16
29	32	17	25	9	18
30	33	17	27	10	20
31	34	18	30	11	23
32	35	19	32	12	25
33	36	21	34	14	27
34	37	22	36	14	29
35	38	23	38	16	31
36	39	25	39	16	33
37	41	26	41	17	34
38	41	27	42	18	36

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 25	Thermocouple No. 26	Thermocouple No. 27	Thermocouple No. 28	Thermocouple No. 29
39	42	29	42	19	37
40	43	30	43	19	38
41	44	31	43	20	39
42	44	32	42	20	39
43	45	32	41	20	40
44	46	33	39	21	41
45	46	34	38	21	41
46	47	34	38	21	42
47	48	35	38	22	42
48	48	35	40	22	43
49	49	36	41	23	42
50	49	37	43	22	44
51	50	37	44	23	44
52	51	38	45	23	44
53	51	39	46	23	44
54	52	39	46	24	45
55	52	40	47	23	45
56	52	41	46	23	45
57	53	42	47	24	45
58	53	43	48	24	45
59	53	45	49	24	45
60	53	46	50	24	45
61	53	47	50	24	45
62	53	48	51	24	45
63	53	49	51	23	45
64	53	49	51	23	45
65	53	50	51	23	45
66	53	50	51	23	45
67	53	50	51	23	45
68	53	50	51	23	45
69	52	50	51	23	44
70	52	50	51	23	45
71	52	50	51	23	45
72	52	50	51	24	45
73	52	50	51	24	45
74	52	50	51	23	46
75	53	50	51	24	46
76	53	50	52	23	46
77	54	50	52	24	47
78	54	50	52	24	47
79	54	50	52	25	47

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 25	Thermocouple No. 26	Thermocouple No. 27	Thermocouple No. 28	Thermocouple No. 29
80	54	49	51	24	47
81	54	49	51	25	47
82	54	50	51	25	48
83	54	50	51	25	48
84	55	50	51	25	48
85	54	51	50	25	48
86	55	51	50	25	49
87	55	52	50	26	49
88	55	52	50	25	49
89	55	53	50	26	49
90	55	53	50	26	49
91	55	54	50	26	49
92	55	54	50	26	49
93	56	54	50	26	49
94	56	55	50	26	49
95	56	55	50	26	49
96	56	56	50	26	49
97	56	56	50	25	49
98	56	56	50	26	49
99	56	57	50	25	49
100	56	57	51	26	49
101	56	57	51	26	49
102	55	57	51	26	49
103	56	57	52	26	49
104	55	57	52	26	49
105	55	57	52	26	49
106	55	56	53	26	49
107	55	56	53	26	50
108	55	56	54	26	50
109	56	56	54	26	49
110	55	55	54	25	49
111	55	55	55	26	49
112	55	55	55	26	49
113	55	55	56	26	49
114	55	55	56	27	48
115	55	55	56	26	48
116	54	55	57	28	48
117	54	55	57	28	47
118	54	55	58	27	47
119	54	55	58	27	47
120	54	55	59	27	48

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 25	Thermocouple No. 26	Thermocouple No. 27	Thermocouple No. 28	Thermocouple No. 29
121	54	55	59	26	48
122	54	54	60	26	48
123	53	54	60	26	49
124	54	55	61	26	50
125	54	55	61	26	51
126	54	56	62	26	52
127	54	56	62	27	54
128	55	56	63	27	55
129	55	56	63	28	57
130	55	56	63	29	58
131	56	57	63	29	59
132	57	59	63	29	61
133	57	61	64	30	62
134	58	62	64	31	64
135	59	63	64	32	66
136	59	63	64	34	67
137	60	64	64	34	69
138	60	64	65	35	70
139	61	65	65	38	72
140	62	65	64	36	76
141	62	66	64	37	78
142	63	66	62	39	79
143	64	66	62	42	82
144	65	66	63	45	92
145	65	66	63	51	100
146	66	67	64	58	107
147	67	68	65	72	121
148	69	68	67	83	162
149	71	69	67	115	234
150	71	71	76	112	320

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

See **Figure 7** for the location of the thermocouples.

Additional Unexposed Face Temperature Data

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

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
39	18	24	19	20
40	19	25	20	21
41	20	27	21	22
42	21	28	22	23
43	22	29	23	24
44	23	30	24	25
45	24	30	25	26
46	25	31	26	27
47	25	32	27	27
48	26	32	27	28
49	27	33	28	28
50	27	33	28	29
51	28	34	29	29
52	28	34	29	29
53	29	34	30	30
54	29	35	30	30
55	30	35	30	30
56	30	35	31	31
57	30	35	31	31
58	31	36	31	31
59	31	36	31	31
60	31	36	32	31
61	32	36	32	31
62	32	36	32	32
63	32	36	32	32
64	32	36	32	32
65	32	36	32	32
66	33	36	32	32
67	33	36	33	32
68	33	37	33	32
69	33	37	33	32
70	34	37	33	32
71	34	37	33	33
72	34	37	34	33
73	34	38	34	33
74	34	38	34	33
75	34	38	34	34
76	35	38	35	34
77	35	39	35	34
78	35	39	35	34
79	35	39	36	35

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
80	36	40	36	35
81	36	40	36	35
82	37	40	37	36
83	37	41	37	36
84	37	41	37	36
85	37	41	38	37
86	38	41	38	37
87	38	42	38	37
88	38	42	39	38
89	39	42	39	38
90	39	42	40	38
91	39	42	40	39
92	40	43	40	39
93	40	43	41	39
94	40	43	41	39
95	41	43	41	40
96	41	43	42	40
97	42	43	42	40
98	42	43	43	40
99	42	43	43	41
100	43	43	43	41
101	43	44	43	41
102	44	44	44	41
103	44	44	44	42
104	44	44	44	42
105	45	44	45	42
106	45	44	45	42
107	45	44	46	42
108	46	44	46	43
109	46	44	46	43
110	46	44	47	43
111	47	44	47	43
112	47	44	48	43
113	47	44	48	43
114	47	44	49	43
115	47	44	49	43
116	48	44	50	43
117	48	44	50	44
118	48	43	51	44
119	48	43	51	43
120	49	43	52	43

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
121	49	42	52	43
122	49	42	53	43
123	49	42	53	42
124	50	42	54	42
125	50	42	55	42
126	50	42	56	41
127	51	42	57	40
128	51	42	58	40
129	51	43	59	39
130	51	44	60	39
131	52	45	61	39
132	52	46	63	39
133	53	47	64	39
134	53	48	65	40
135	53	50	66	40
136	54	53	67	41
137	55	56	68	42
138	55	59	69	43
139	56	62	70	44
140	56	64	71	45
141	57	65	73	46
142	58	67	74	47
143	58	79	77	48
144	59	81	82	49
145	60	83	86	50
146	61	87	90	51
147	62	93	97	52
148	63	103	115	53
149	63	126	161	55
150	64	263	254	57

See **Figure 7** for the location of the thermocouples.

Internal Temperature Data at 1500 mm 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	21	20	20	22	21	20
1	22	21	20	22	21	20
2	22	21	20	24	21	20
3	23	21	20	25	21	20
4	24	21	20	27	21	20
5	26	21	20	28	21	20
6	27	21	20	30	22	20
7	28	22	20	31	22	20
8	30	22	20	34	22	21
9	32	22	21	36	23	21
10	34	23	21	38	23	21
11	36	24	21	41	24	21
12	38	25	21	44	25	21
13	41	26	21	47	26	22
14	44	27	22	50	27	22
15	47	28	22	52	29	23
16	50	30	23	55	30	23
17	53	32	24	58	32	24
18	56	34	24	60	33	25
19	60	36	25	62	35	26
20	63	39	26	65	37	28
21	66	42	27	67	39	29
22	69	44	28	70	40	30
23	72	46	30	75	42	32
24	74	48	31	84	45	34
25	76	50	32	91	48	36
26	79	52	34	95	51	38
27	82	54	35	99	54	40
28	84	56	37	100	58	43
29	87	57	39	101	60	45
30	88	59	41	103	63	48
31	89	61	43	104	67	50
32	91	63	45	105	70	53
33	92	65	47	105	72	56
34	94	67	49	106	74	59
35	95	69	51	107	71	61
36	96	70	53	108	74	63

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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	97	72	55	109	75	64
38	97	73	57	109	77	66
39	98	75	58	109	78	67
40	99	75	59	110	79	68
41	99	76	61	111	80	69
42	100	77	62	112	80	70
43	100	77	63	112	81	71
44	101	78	64	113	82	72
45	101	78	64	115	82	73
46	101	79	65	116	83	73
47	102	79	66	117	83	74
48	102	79	66	118	84	77
49	103	80	67	119	84	77
50	103	80	67	121	85	78
51	103	80	68	123	85	77
52	104	81	68	127	86	77
53	104	81	69	131	86	77
54	105	81	69	134	86	78
55	105	81	69	137	87	78
56	105	82	69	140	88	78
57	106	82	70	144	89	78
58	106	82	70	147	89	78
59	107	82	70	152	91	79
60	108	83	70	155	92	79
61	109	83	70	158	93	79
62	110	84	70	161	94	80
63	111	84	70	164	95	80
64	113	84	70	166	96	80
65	114	84	71	169	97	81
66	115	84	71	172	97	80
67	116	85	71	175	99	81
68	118	85	71	179	100	82
69	119	85	71	183	101	82
70	121	86	71	188	102	83
71	123	87	72	192	104	83
72	124	87	72	197	105	83
73	126	88	72	201	107	84
74	127	89	72	205	108	84
75	129	89	73	209	110	85

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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	130	90	73	213	111	86
77	131	91	74	217	113	87
78	132	91	74	221	114	88
79	133	92	75	225	116	89
80	134	93	75	228	117	89
81	135	93	75	232	119	90
82	136	94	76	237	120	91
83	137	95	76	241	122	92
84	138	95	76	246	124	92
85	139	96	77	250	125	93
86	140	96	77	254	127	94
87	141	97	78	259	129	95
88	142	98	78	263	131	96
89	143	98	79	266	133	97
90	144	99	79	269	135	98
91	145	100	79	272	136	99
92	147	100	80	274	138	100
93	148	101	80	277	140	100
94	149	101	80	279	141	99
95	151	102	81	281	143	100
96	153	102	81	283	144	101
97	155	103	81	285	146	102
98	157	103	82	288	148	103
99	159	104	82	290	149	104
100	161	105	82	292	151	105
101	163	105	82	295	153	107
102	165	106	83	298	155	107
103	167	107	83	302	158	108
104	169	107	83	306	160	109
105	172	108	83	332	163	110
106	174	109	83	-	165	112
107	177	110	84	-	168	113
108	180	111	84	-	171	114
109	184	112	84	-	174	116
110	189	114	84	-	177	117
111	194	116	85	-	181	118
112	199	118	85	-	184	120
113	205	121	86	-	188	121
114	211	123	87	-	191	123

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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	218	127	88	-	195	125
116	226	131	89	-	199	127
117	235	136	90	-	203	130
118	246	142	92	-	207	133
119	261	148	93	-	212	135
120	277	155	95	-	216	138
121	295	163	97	-	221	140
122	313	172	100	-	226	142
123	332	182	103	-	232	145
124	351	194	106	-	240	148
125	370	206	110	-	245	151
126	389	219	114	-	255	154
127	407	232	118	-	262	158
128	425	244	123	-	269	161
129	441	257	128	-	272	165
130	458	269	133	-	288	169
131	476	281	139	-	295	174
132	495	294	145	-	308	179
133	514	310	151	-	325	186
134	533	327	157	-	342	196
135	551	347	164	-	351	208
136	570	368	172	-	361	219
137	591	388	180	-	375	232
138	614	409	189	-	392	246
139	639	433	202	-	413	262
140	660	460	219	-	437	282
141	682	486	238	-	464	317
142	766	566	417	-	523	390
143	916	905	620	-	670	676
144	911	967	735	-	925	976
145	1031	1049	867	-	992	1009
146	-	-	1058	-	1007	1073
147	-	-	-	-	1049	-

- Thermocouple broken due to equipment failure.

See **Figure 7** for the location of the thermocouples.

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Specimen Lateral Deflection

Time (minutes)	Deflection (mm)
	Centre
0	0
1	0
2	0
3	0
4	0
5	1
6	1
7	1
8	1
9	1
10	2
11	2
12	3
13	3
14	3
15	3
16	4
17	4
18	4
19	4
20	5
21	5
22	5
23	5
24	5
25	5
26	6
27	6
28	6
29	6
30	6
31	6
32	6
33	6
34	6
35	6
36	6
37	6
38	6

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Time (minutes)	Deflection (mm)
	Centre
39	6
40	6
41	6
42	6
43	6
44	6
45	6
46	6
47	6
48	6
49	6
50	6
51	6
52	6
53	5
54	5
55	5
56	5
57	5
58	5
59	5
60	5
61	5
62	5
63	5
64	5
65	5
66	5
67	5
68	5
69	5
70	5
71	5
72	5
73	5
74	5
75	5
76	5
77	5
78	5
79	5

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Time (minutes)	Deflection (mm)
	Centre
80	5
81	5
82	5
83	5
84	5
85	5
86	5
87	6
88	6
89	6
90	6
91	6
92	6
93	7
94	7
95	7
96	7
97	8
98	8
99	8
100	9
101	9
102	10
103	10
104	11
105	11
106	12
107	12
108	13
109	14
110	14
111	15
112	16
113	17
114	17
115	18
116	19
117	20
118	22
119	23
120	24

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
121	26
122	27
123	29
124	31
125	33
126	35
127	37
128	39
129	41
130	43
131	46
132	49
133	52
134	55
135	58
136	60
137	61
138	62
139	62
140	63
141	63
142	62
143	61
144	64
145	66
146	62
147	55
148	46
149	20
150	6

The deflection was recorded at the approximate centre of the specimen. Positive readings indicate deflection into the furnace.

The Building Test Centre

Fire Acoustics Structures

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel: (0115) 945 1564
Email: btc.testing@saint-gobain.com

PHOTOGRAPHS

Exposed Face Prior to Test



Customer: **British Gypsum**

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Unexposed Face Prior to Test



Customer: **British Gypsum**

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Unexposed Face at 30 Minutes



Customer: **British Gypsum**

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Unexposed Face at 1 Hour



Customer: **British Gypsum**

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Unexposed Face at 1 Hour, 30 Minutes



Customer: **British Gypsum**

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Unexposed Face at 2 Hours



Customer: **British Gypsum**

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Unexposed Face at 2 Hours, 30 Minutes, at Test Termination



Customer: **British Gypsum**

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FIELD OF DIRECT APPLICATION

General

The results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and stability.

- i) Decrease in height from 3000 mm.
- ii) Increase in the thickness of the wall.
- iii) Increase thickness of component materials.
- iv) Decrease in the linear dimensions of the boards but not thickness.
- v) Decrease stud spacing from 600 mm.
- vi) Decrease in fixing centres from 300 mm.
- vii) Increase in the number of horizontal joints, of the type tested, when tested with one joint not more than (500 ± 150) mm from the top edge.

Extension of Width

For test specimens tested without a supporting construction, the width of an identical construction may be increased as the specimen was tested at nominally 3000 mm wide with one vertical edge without restraint.

Extension of Height

The height of the construction may be increased by 1000 mm under the following conditions:

30 minutes	60 minutes	90 minutes	120 minutes	150 minutes
≤ 100 mm	≤ 100 mm	≤ 100 mm	≤ 100 mm	≤ 100 mm