

Report Number: **BTC 21858F**

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

Test Date: 12th July 2021

Report Issue Date: 13th July 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 on the exposed face with a single layer of Glasroc X Sheathing Board and a triple layer of Gyproc FireLine incorporating a 20 mm deflection head and 100 mm Isover Steel Frame Infill Batt 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 6th and 7th July 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 12th July 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 P.P. Matthew Porter



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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 60 mm 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 60 mm 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.

100 mm Isover Steel Frame Infill Batt 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 unexposed 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 60 mm 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. A horizontal joint was positioned at 2400 mm from the base on the inner and outer layer unexposed face boards and at 600 mm from the base on the middle layer unexposed face boards. A Gypframe GFS1 Fixing Strap was used behind the horizontal outer layer board joint on the unexposed face only.

The exposed face of the specimen was clad with a single layer of 12.5 mm Glasroc X Sheathing Board with a full board at the right-hand side of the exposed face (as viewed from the unexposed side). 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 exposed 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 unexposed 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 unexposed 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

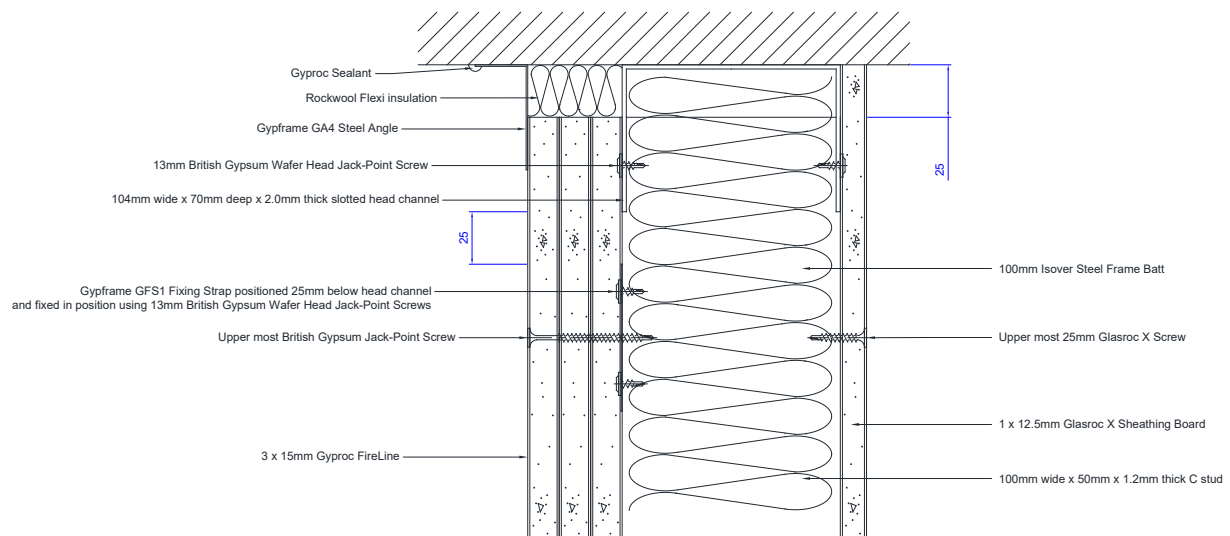


Figure 1 – Cross section through head.

Exposed Face Elevation

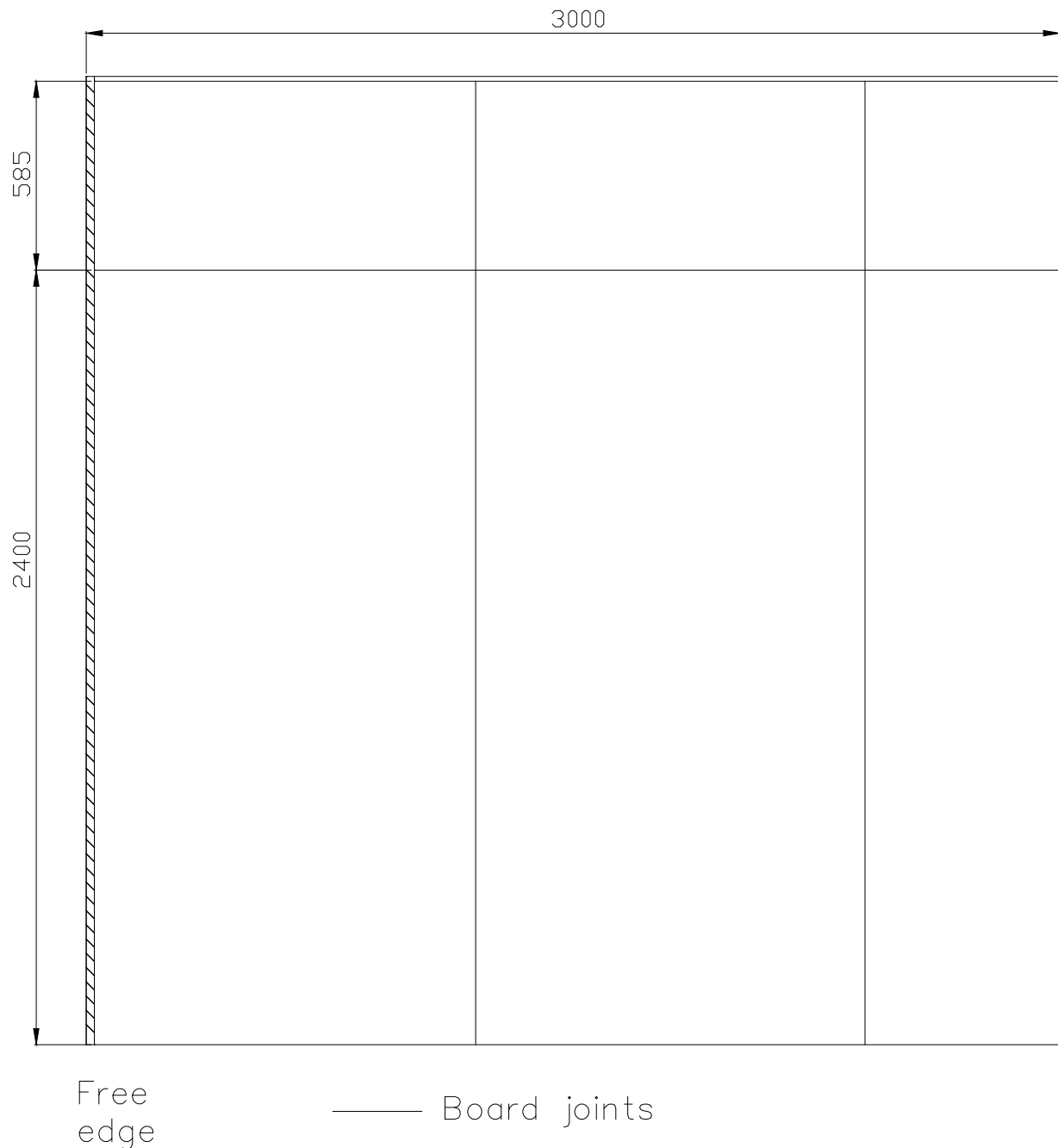


Figure 2 – Exposed face elevation.

Unexposed Face Elevation

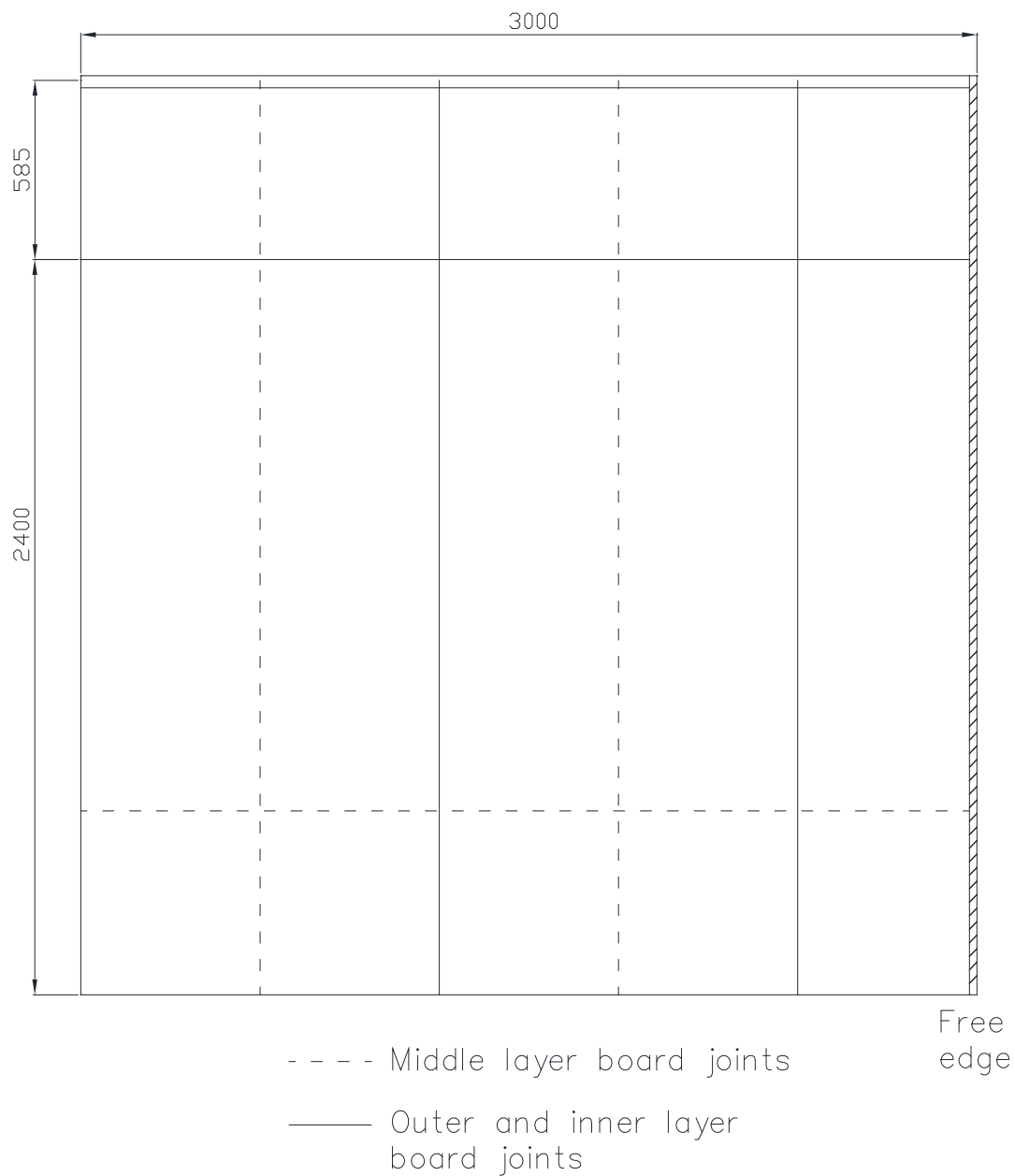


Figure 3 – Unexposed face elevation.

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:	31 170 21 17:01 31 170 21 17:01 31 170 21 17:02
Measured moisture content:	0.37 %

- 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:	11.0 kg/m ²
Measured thickness:	12.5 mm
Board identification numbers:	20 05 21 07:23 20 05 21 07:24 20 05 21 07:24
Measured moisture content:	0.26 %

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) 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	1.21 mm
Measured weight per metre	1.68 kg/m

- iv) 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	1.98 mm
Measured weight per metre	3.34 kg/m

- v) 100 mm x 50 mm x 1.2 mm gauge (with 12 mm returns) cold rolled structural steel studs manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	100 mm
Measured flange dimension	50 mm
Measured thickness	1.28 mm
Measured weight per metre	2.13 kg/m

- vi) Gypframe GFS1 Fixing Strap manufactured and supplied by British Gypsum.
vii) Gypframe GA4 Steel Angles manufactured and supplied by British Gypsum.

Fasteners

- viii) 13 mm British Gypsum Wafer Head Drywall 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.

Miscellaneous Components

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

Insulation

- xviii) Nominally 100 mm (thick) Steel Frame Infill Batt, manufactured by Saint-Gobain Isover and supplied by British Gypsum.

Measured surface density: 1.99 kg/m²

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

Measured surface density: 1.71 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 FireLine 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 21 °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	150 minutes, no failure.
Insulation		150 minutes, no failure.
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: Ryan Skilton
 Exposed face: Eric Chee, Beth Kelliher

Time		Observations
Hours	Minutes	
0	00	Test started.
0	10	No visible change.
0	20	Left-hand vertical joint had opened up to approximately 3-4 mm. Right-hand vertical joint had opened up to approximately 1-2 mm. Horizontal joint had opened up to approximately 3-4 mm.
0	30	Left-hand vertical joint had opened up to approximately 8-9 mm. Right-hand vertical joint had opened up to approximately 5-6 mm. Horizontal joint had opened up to approximately 8-9 mm. <i>Unexposed face</i> No visible change.
0	40	Left-hand vertical joint had opened up to approximately 17-18 mm. Right-hand vertical joint had opened up to approximately 10 mm. Horizontal joint had opened up to approximately 23-24 mm. Boards had begun to crack around screw heads adjacent to all board joints.
0	50	Left-hand vertical joint had opened up to approximately 22 mm. Right-hand vertical joint had opened up to approximately 16 mm. Horizontal joint had opened up to approximately 28 mm.
1	00	Left-hand vertical joint had opened up to approximately 26 mm. Right-hand vertical joint had opened up to approximately 20 mm. Horizontal joint had opened up to approximately 30 mm. <i>Unexposed face</i> No visible change.

Time		Observations
Hours	Minutes	
1	10	Left-hand vertical joint had opened up to approximately 30 mm. Right-hand vertical joint had opened up to approximately 22 mm. Horizontal joint had opened up to approximately 34 mm.
1	20	Left-hand vertical joint had opened up to approximately 32 mm. Right-hand vertical joint had opened up to approximately 24 mm. Horizontal joint had opened up to approximately 36 mm.
1	30	Left-hand vertical joint had opened up to approximately 34 mm. Right-hand vertical joint had opened up to approximately 26 mm. Horizontal joint had opened up to approximately 38 mm. Lower centre board had begun to bow into the furnace. <i>Unexposed face</i> No visible change.
1	40	Lower centre board had fallen into the furnace.
1	50	Second layer boards had crazed. Lower left-hand board had fallen into the furnace.
1	58	<i>Unexposed face</i> Screw heads adjacent to the left-hand vertical joint had discoloured from approximately 1500-1800 mm height. Screw heads adjacent to the right-hand vertical joint had discoloured from approximately 1500-2100 mm height.
2	00	Second layer horizontal joint had opened up to approximately 10 mm.
2	10	Upper centre board had fallen into the furnace. Second layer horizontal joint had opened up to approximately 11 mm.
2	20	Second layer lower centre board had fallen into the furnace. <i>Unexposed face</i> Screw heads on the centre of the lower centre board had discoloured from approximately 300-2100 mm height. Screw heads on the centre of the lower left-hand board had discoloured from approximately 300-2100 mm height.
2	30	TEST TERMINATED at the request of the sponsor.

Furnace Temperature Graph

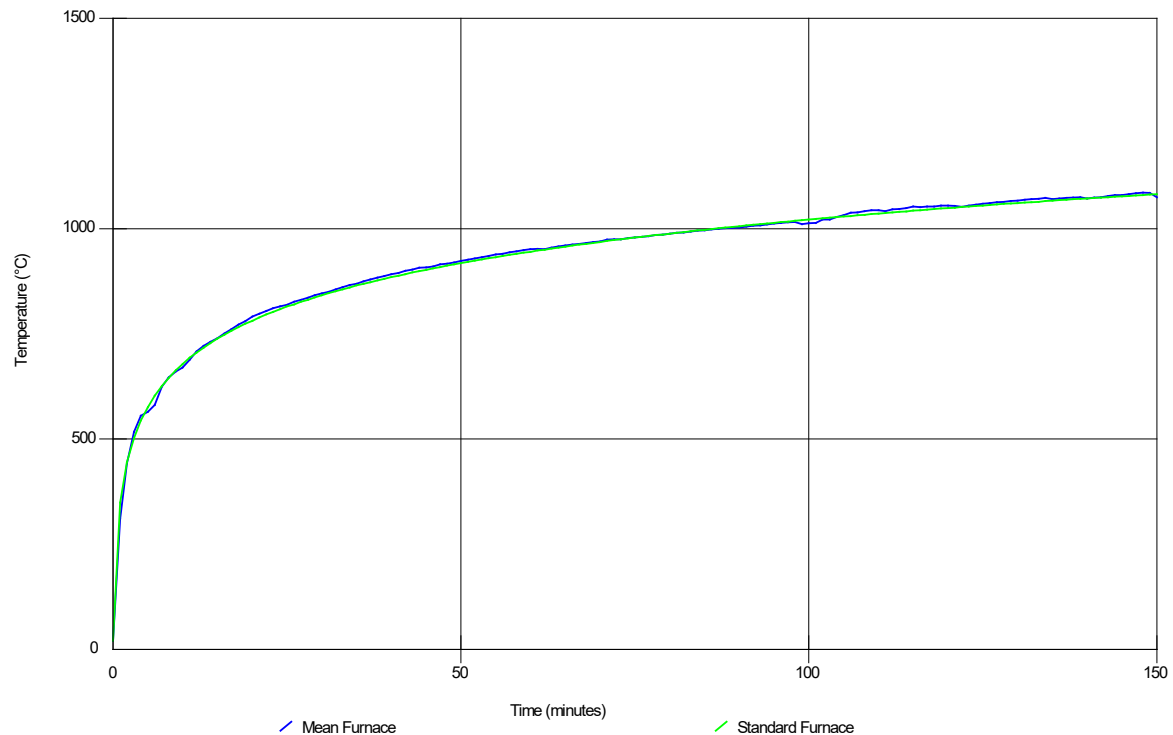


Figure 4 – Furnace temperature graph.

Furnace Pressure Graph

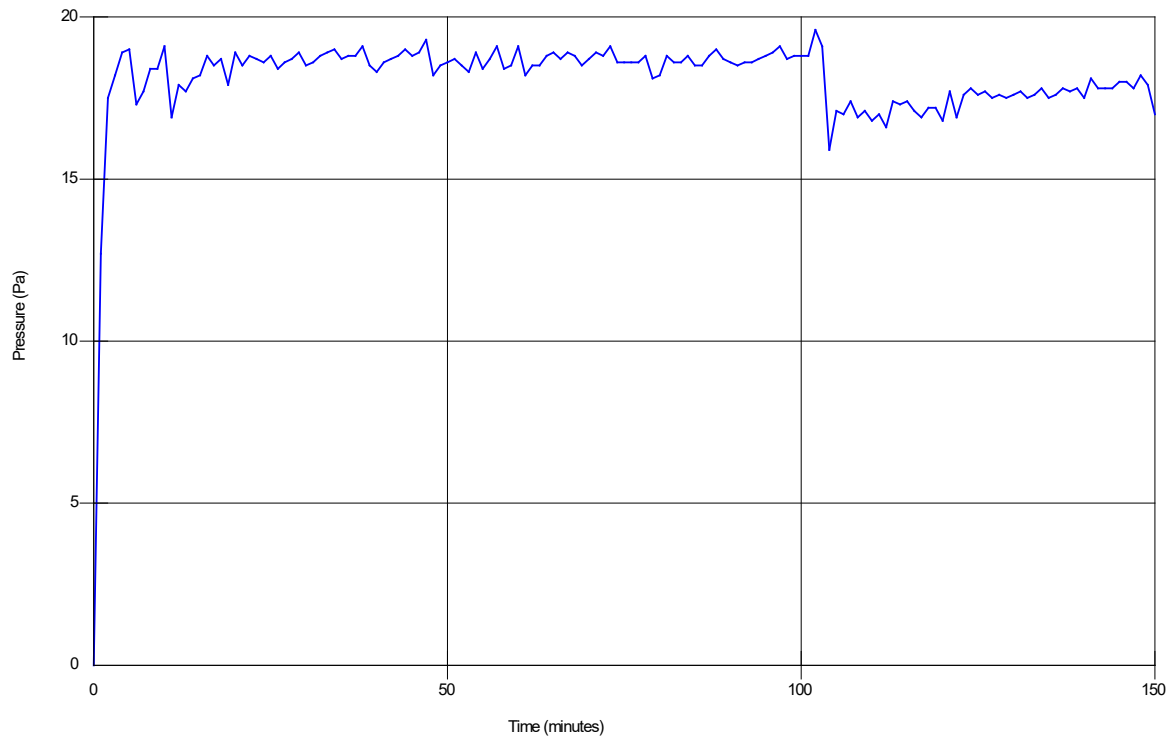


Figure 5 – Furnace pressure graph.

Unexposed Face Temperature Graph

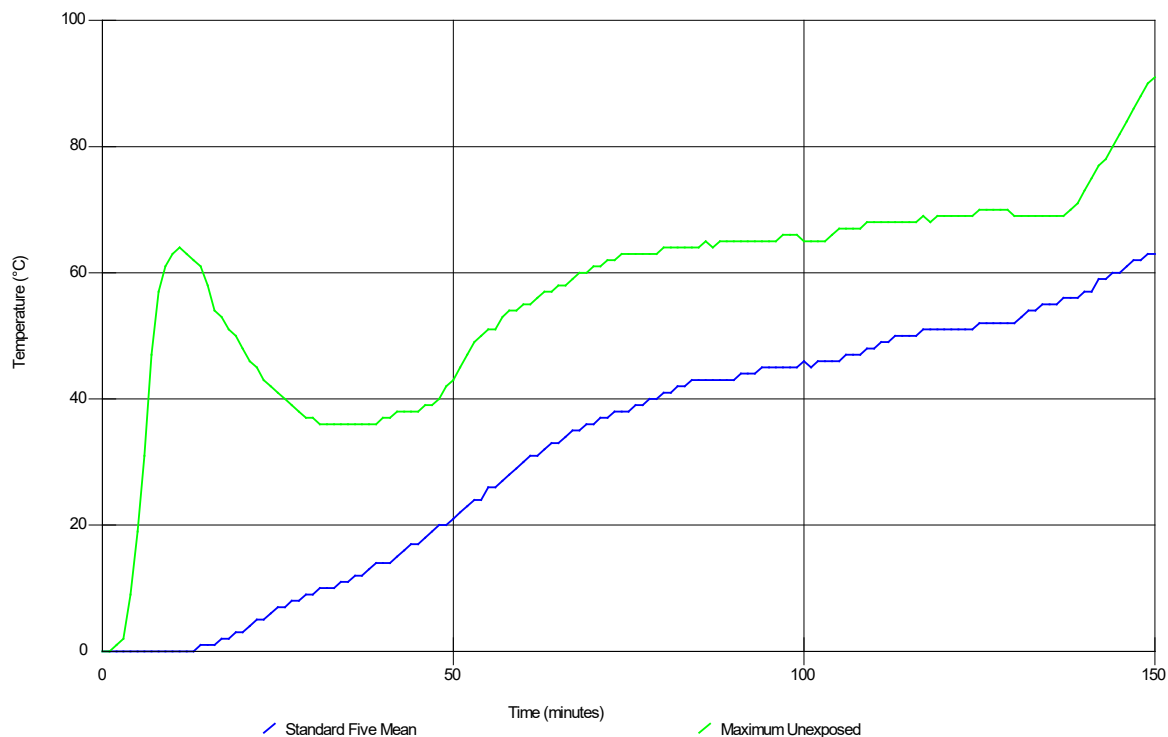


Figure 6 – Unexposed face temperature graph.

Unexposed Face Thermocouple Layout

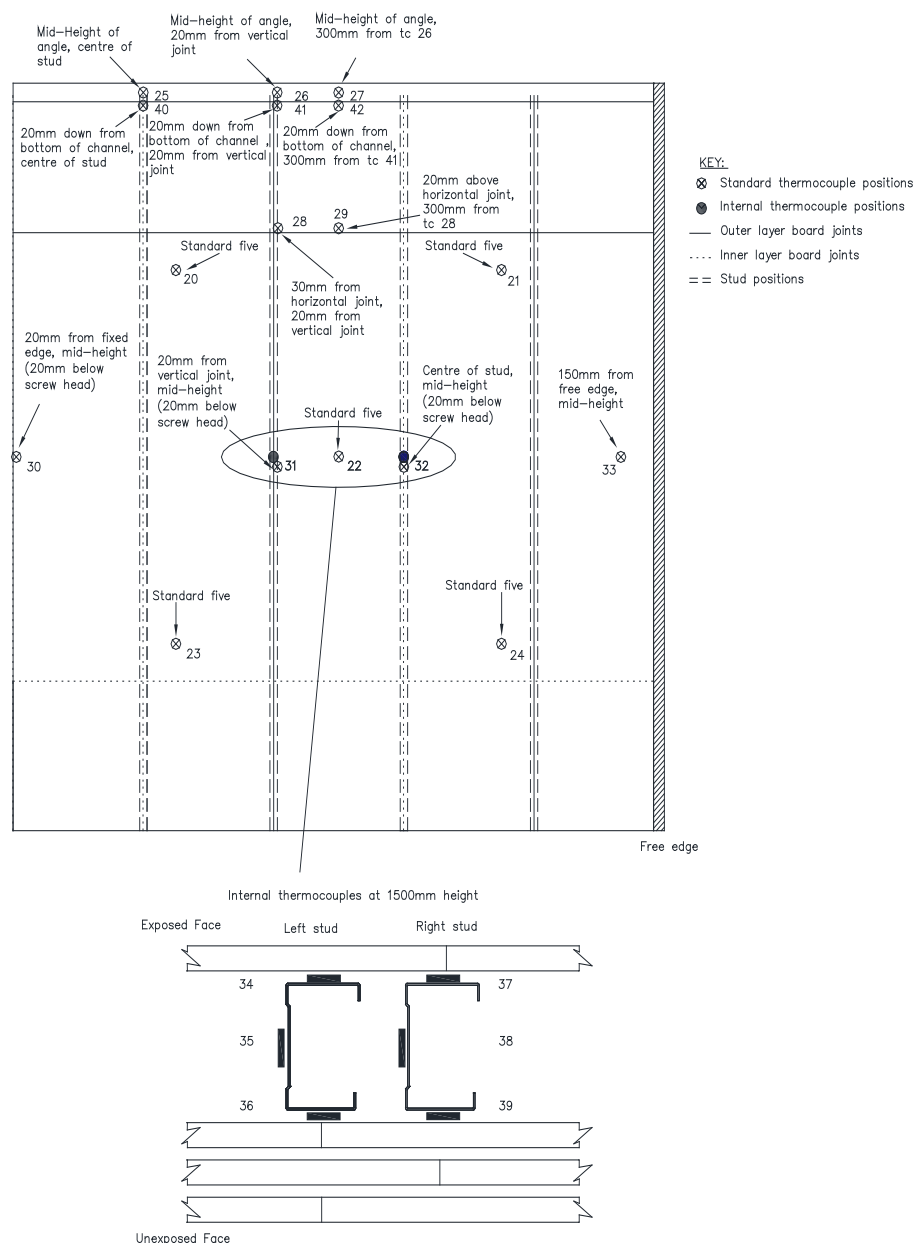


Figure 7 – Unexposed face thermocouple layout.

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

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

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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	40	46	40	39	39	41
81	41	47	41	39	39	41
82	41	47	42	40	40	42
83	42	48	42	40	40	42
84	42	48	43	40	40	43
85	42	48	43	40	41	43
86	43	48	44	40	41	43
87	43	49	44	40	41	43
88	43	49	44	40	41	43
89	43	49	44	40	41	43
90	43	49	44	40	41	43
91	44	49	44	40	42	44
92	44	49	45	40	42	44
93	44	49	45	40	43	44
94	45	49	46	41	43	45
95	45	49	46	40	43	45
96	45	49	47	41	44	45
97	45	49	47	40	44	45
98	45	49	48	41	44	45
99	45	49	48	40	44	45
100	46	49	49	40	44	46
101	46	48	49	40	44	45
102	46	48	49	41	45	46
103	46	48	49	42	45	46
104	46	48	49	42	45	46
105	47	48	49	43	45	46
106	47	48	50	44	45	47
107	47	48	50	45	46	47
108	47	48	50	46	46	47
109	48	48	51	46	47	48
110	48	48	51	47	47	48
111	48	48	52	48	48	49
112	48	49	52	48	49	49
113	48	49	52	49	50	50
114	48	49	52	49	50	50
115	48	50	52	50	51	50
116	49	50	52	50	51	50
117	49	50	53	50	51	51
118	49	50	53	50	51	51
119	49	50	53	50	51	51
120	49	50	53	51	51	51

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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	49	51	53	51	51	51
122	49	51	53	51	52	51
123	49	51	53	51	51	51
124	50	52	53	50	52	51
125	50	52	53	51	52	52
126	51	52	54	50	52	52
127	52	52	54	51	52	52
128	52	52	54	50	52	52
129	52	53	54	50	52	52
130	52	53	55	50	52	52
131	53	54	55	51	52	53
132	53	55	57	51	52	54
133	54	56	58	51	52	54
134	55	56	59	51	52	55
135	55	56	60	51	52	55
136	56	56	60	51	53	55
137	57	57	61	51	53	56
138	58	58	61	51	53	56
139	58	58	61	52	53	56
140	59	58	61	52	54	57
141	59	59	61	54	54	57
142	60	60	61	56	56	59
143	60	60	62	57	57	59
144	61	61	63	57	57	60
145	61	61	64	58	58	60
146	61	62	65	58	59	61
147	62	63	66	58	59	62
148	62	63	67	59	60	62
149	63	64	68	59	60	63
150	64	65	69	59	60	63

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	2	0	0	0
4	0	9	0	0	0
5	1	19	0	0	0
6	2	31	1	0	0
7	4	47	3	0	0
8	10	57	13	0	0
9	18	61	24	0	0
10	26	63	32	0	0
11	34	64	36	1	0
12	41	63	41	1	1
13	43	62	45	2	1
14	43	61	49	2	1
15	41	58	49	3	2
16	38	54	46	4	3
17	35	53	43	5	4
18	33	51	40	6	5
19	31	50	38	7	6
20	30	48	36	8	7
21	29	46	35	9	8
22	29	45	34	10	9
23	28	43	33	10	10
24	28	42	32	11	11
25	27	41	32	12	12
26	27	40	31	12	12
27	27	39	31	13	13
28	26	38	30	13	13
29	26	37	29	13	13
30	25	37	29	14	14
31	25	36	29	14	14
32	25	36	29	14	14
33	25	36	29	15	15
34	25	36	29	15	15
35	25	36	29	16	16
36	25	36	29	16	16
37	25	36	29	17	17
38	24	36	29	17	17

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

Customer: **British Gypsum**

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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	47	64	47	42	40
81	47	64	48	42	41
82	48	64	49	43	41
83	48	64	49	43	41
84	48	64	50	44	42
85	49	64	51	44	42
86	49	65	51	44	43
87	49	64	52	45	43
88	49	65	53	45	43
89	50	65	54	45	44
90	50	65	54	45	44
91	50	65	55	45	44
92	50	65	56	45	44
93	50	65	56	45	44
94	50	65	57	45	44
95	50	65	57	46	45
96	50	65	58	46	45
97	50	66	59	46	45
98	50	66	60	46	45
99	50	66	60	46	45
100	50	65	61	46	45
101	50	65	61	46	45
102	50	65	62	46	46
103	50	65	62	46	45
104	51	66	63	46	46
105	51	67	63	47	46
106	51	67	64	47	46
107	52	67	64	47	46
108	52	67	64	48	46
109	52	68	64	49	46
110	53	68	65	49	46
111	53	68	66	50	47
112	53	68	67	50	47
113	54	68	67	51	48
114	54	68	68	51	48
115	54	68	68	52	49
116	54	68	68	53	49
117	54	69	68	54	50
118	54	68	68	56	50
119	54	69	68	55	50
120	55	69	68	56	51

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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	55	69	68	57	52
122	55	69	68	57	53
123	55	69	68	58	53
124	56	69	68	58	54
125	56	70	68	59	55
126	56	70	68	60	55
127	57	70	68	60	56
128	57	70	68	61	57
129	58	70	68	62	57
130	58	69	68	63	58
131	59	69	68	64	58
132	59	69	68	64	59
133	60	69	68	66	60
134	62	69	68	66	60
135	64	69	68	67	61
136	66	69	68	68	61
137	67	69	67	69	62
138	67	69	67	70	63
139	68	69	67	71	63
140	68	69	66	72	64
141	68	69	66	73	64
142	69	69	66	74	65
143	69	70	66	75	66
144	69	70	66	76	67
145	69	70	67	77	68
146	69	70	67	79	69
147	69	70	67	80	69
148	69	71	67	81	70
149	69	71	68	82	71
150	69	71	68	83	72

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

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
39	10	17	20	14
40	10	18	22	14
41	11	19	23	15
42	11	20	25	15
43	11	21	27	16
44	12	22	28	16
45	12	24	30	17
46	13	25	32	18
47	13	26	35	18
48	14	27	37	19
49	14	28	40	19
50	15	29	43	21
51	16	30	45	20
52	16	30	47	21
53	17	31	49	22
54	18	32	50	23
55	18	32	51	24
56	19	33	51	24
57	20	34	52	25
58	20	34	52	25
59	21	35	53	26
60	22	35	53	27
61	22	36	53	28
62	23	36	53	28
63	24	37	54	29
64	25	37	54	29
65	25	37	54	30
66	26	38	53	30
67	27	38	52	31
68	28	38	51	31
69	29	38	50	31
70	29	39	49	32
71	31	39	48	32
72	31	39	48	33
73	32	40	48	33
74	33	40	48	33
75	34	41	48	34
76	35	41	49	34
77	35	41	49	34
78	36	42	49	34
79	36	42	50	34

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

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
121	56	56	58	48
122	57	56	59	49
123	57	56	60	49
124	57	56	60	49
125	58	57	61	49
126	58	57	62	50
127	59	58	62	50
128	59	59	62	50
129	60	59	63	50
130	61	60	63	51
131	62	60	64	50
132	63	60	64	51
133	63	60	65	51
134	64	60	66	51
135	65	61	66	51
136	66	61	67	50
137	67	61	68	51
138	68	61	70	51
139	70	61	71	51
140	71	61	73	51
141	72	61	75	51
142	73	62	77	51
143	74	63	78	52
144	75	64	80	52
145	76	66	82	52
146	77	67	84	53
147	78	69	86	53
148	79	73	88	54
149	81	75	90	54
150	82	78	91	55

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

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Additional Unexposed Face Temperature Data

	Thermocouple No. 40	Thermocouple No. 41	Thermocouple No. 42
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	2	0
5	0	2	0
6	0	2	0
7	0	5	0
8	0	8	0
9	0	11	0
10	1	13	0
11	2	15	0
12	5	17	0
13	9	19	1
14	15	19	1
15	20	17	1
16	24	16	2
17	27	16	3
18	29	17	3
19	30	18	4
20	30	18	5
21	30	18	6
22	30	18	8
23	30	18	9
24	30	18	10
25	30	18	11
26	29	18	12
27	29	18	12
28	29	18	13
29	29	18	14
30	29	18	14
31	29	18	15
32	28	18	15
33	28	18	16
34	28	18	16
35	28	18	17
36	28	18	17
37	28	18	17
38	27	18	18
39	27	18	18

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	Thermocouple No. 40	Thermocouple No. 41	Thermocouple No. 42
40	27	18	19
41	27	18	19
42	26	18	19
43	26	18	20
44	26	19	20
45	27	19	21
46	27	19	21
47	27	20	22
48	27	20	22
49	27	20	22
50	27	21	23
51	27	21	23
52	28	22	24
53	28	22	24
54	28	23	25
55	28	23	25
56	29	24	25
57	29	24	26
58	30	25	26
59	30	26	27
60	30	26	27
61	31	27	28
62	32	27	28
63	33	28	29
64	34	29	29
65	35	30	30
66	36	30	30
67	38	31	31
68	38	31	31
69	39	31	32
70	40	31	32
71	41	32	33
72	41	32	33
73	42	33	34
74	42	33	34
75	43	33	34
76	43	33	35
77	44	33	35
78	44	33	35
79	45	34	36
80	45	34	36
81	45	35	37
82	45	35	37

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	Thermocouple No. 40	Thermocouple No. 41	Thermocouple No. 42
83	45	35	37
84	45	35	38
85	45	35	38
86	46	36	38
87	46	36	39
88	46	36	39
89	46	36	39
90	46	36	39
91	46	36	39
92	46	37	40
93	46	36	40
94	46	37	40
95	46	38	41
96	46	38	41
97	46	38	41
98	47	39	42
99	47	39	42
100	47	39	42
101	47	40	42
102	47	40	43
103	47	40	43
104	47	40	43
105	47	40	44
106	47	41	45
107	48	41	45
108	48	43	46
109	48	43	47
110	49	43	47
111	49	44	48
112	49	43	48
113	49	43	49
114	50	44	49
115	50	44	49
116	50	44	50
117	50	44	50
118	50	44	50
119	50	44	50
120	51	45	51
121	51	46	51
122	51	45	51
123	51	46	52
124	51	46	52
125	51	47	52

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	Thermocouple No. 40	Thermocouple No. 41	Thermocouple No. 42
126	51	47	53
127	52	47	53
128	52	48	53
129	52	47	54
130	52	48	54
131	53	48	54
132	53	48	54
133	53	48	54
134	53	47	54
135	53	48	54
136	54	48	54
137	56	48	54
138	58	48	54
139	60	48	54
140	60	48	54
141	60	48	54
142	60	48	54
143	60	48	54
144	60	48	54
145	60	49	54
146	60	49	55
147	60	49	55
148	60	50	55
149	60	50	55
150	60	50	55

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	28	26	25	28	27	26
1	33	26	26	29	27	26
2	45	27	26	43	28	26
3	76	37	26	66	34	26
4	102	63	28	88	52	28
5	107	86	40	96	72	36
6	109	93	61	98	84	48
7	111	96	79	100	90	62
8	115	98	88	105	95	75
9	119	98	92	109	97	84
10	121	99	92	114	97	88
11	123	99	92	120	98	90
12	126	99	92	125	97	90
13	132	99	94	133	98	91
14	139	98	97	145	98	90
15	149	97	96	158	100	89
16	167	98	94	181	101	87
17	196	101	92	208	102	86
18	234	105	90	237	102	84
19	268	109	91	267	103	81
20	299	110	89	298	106	81
21	333	114	91	330	113	82
22	365	122	94	361	130	85
23	391	136	99	391	158	90
24	415	153	105	417	199	98
25	437	174	111	442	249	108
26	457	205	119	471	278	120
27	479	253	128	501	300	134
28	503	285	137	526	320	146
29	524	309	145	553	340	158
30	546	332	154	581	361	169
31	566	353	163	606	381	179
32	586	373	171	626	402	189
33	607	392	179	644	422	201
34	626	409	187	659	442	213
35	642	427	196	676	463	230
36	656	445	205	690	483	242

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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	667	462	213	704	501	251
38	678	477	221	714	519	258
39	688	492	229	723	536	266
40	697	506	237	730	552	274
41	705	520	245	738	567	280
42	711	532	252	744	581	286
43	716	542	259	750	594	293
44	721	549	267	753	604	301
45	726	553	276	753	612	307
46	729	557	282	753	616	312
47	732	563	285	753	622	316
48	734	568	287	754	627	322
49	735	573	289	755	632	327
50	737	577	290	756	638	332
51	737	581	291	757	643	338
52	738	584	291	758	652	344
53	738	588	292	762	662	351
54	738	591	291	767	674	360
55	738	593	291	770	678	369
56	738	594	293	772	674	376
57	737	594	293	773	666	380
58	736	593	294	773	666	382
59	735	590	295	774	669	384
60	733	582	296	778	672	385
61	730	567	296	782	679	387
62	726	541	295	788	681	389
63	720	510	294	795	678	391
64	712	494	291	801	669	392
65	705	492	289	811	655	393
66	698	498	290	819	641	393
67	688	508	293	833	619	393
68	681	515	300	845	596	395
69	679	528	310	855	579	401
70	679	545	326	861	572	408
71	673	559	345	855	574	415
72	605	568	366	850	590	425
73	611	576	389	837	608	438
74	622	586	414	785	649	477
75	629	597	440	764	654	567

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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	637	604	470	762	658	603
77	646	609	506	763	662	620
78	651	616	530	767	663	631
79	658	624	549	769	664	638
80	672	633	564	772	668	645
81	-	643	577	774	674	653
82	-	655	589	768	679	660
83	-	661	594	766	686	668
84	-	666	599	761	693	677
85	-	673	604	766	701	687
86	-	679	610	769	708	696
87	-	687	617	724	715	704
88	-	693	624	727	721	711
89	-	700	631	735	725	717
90	-	708	641	745	731	723
91	-	715	650	755	738	730
92	-	723	660	762	744	737
93	-	730	671	765	750	743
94	-	737	680	768	757	750
95	-	746	689	768	764	756
96	-	754	698	769	769	762
97	-	763	708	762	775	768
98	-	774	716	758	783	774
99	-	786	726	758	791	783
100	-	801	740	765	800	791
101	-	840	756	800	834	821
102	-	900	1071	907	924	919
103	-	1020	-	1268	1060	1087
104	-	-	-	-	1021	1104
105	-	-	-	-	1008	-
106	-	-	-	-	1080	-
107	-	-	-	-	1094	-
108	-	-	-	-	-	-

- Thermocouple broken due to equipment failure.

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

Customer: **British Gypsum**

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Specimen Lateral Deflection

Time (minutes)	Deflection (mm)
	Centre
0	0
1	1
2	2
3	4
4	6
5	7
6	6
7	5
8	5
9	4
10	4
11	4
12	4
13	4
14	5
15	6
16	8
17	11
18	15
19	19
20	24
21	28
22	32
23	36
24	39
25	42
26	45
27	47
28	49
29	51
30	53
31	54
32	56
33	57
34	57
35	57
36	58
37	57
38	57

The Building Test Centre

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The Building Test Centre

British Gypsum

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Loughborough

Leics. LE12 6NP

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Email: btc.testing@saint-gobain.com

Time (minutes)	Deflection (mm)
	Centre
39	56
40	55
41	54
42	53
43	52
44	51
45	50
46	49
47	48
48	48
49	47
50	46
51	45
52	44
53	44
54	43
55	42
56	42
57	41
58	40
59	40
60	39
61	38
62	37
63	36
64	35
65	34
66	34
67	32
68	31
69	30
70	29
71	29
72	28
73	27
74	27
75	26
76	26
77	25
78	25
79	25

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
80	25
81	25
82	25
83	26
84	26
85	27
86	27
87	28
88	28
89	29
90	29
91	30
92	30
93	30
94	30
95	31
96	31
97	31
98	32
99	32
100	33
101	34
102	35
103	34
104	34
105	33
106	33
107	33
108	33
109	33
110	33
111	33
112	32
113	33
114	33
115	33
116	32
117	32
118	32
119	32
120	32

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
121	32
122	32
123	33
124	33
125	33
126	34
127	34
128	35
129	35
130	36
131	36
132	36
133	36
134	37
135	37
136	37
137	37
138	38
139	38
140	38
141	38
142	39
143	40
144	40
145	41
146	41
147	42
148	42
149	42
150	41

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



Customer: **British Gypsum**

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Unexposed Face Prior to Test



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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



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 (minimum thickness 161.5 mm).
- iii) Increase thickness of component materials (minimum Gypframe stud depth 100 mm, minimum Gypframe stud gauge 2.0 mm).
- iv) Decrease in the linear dimensions of the boards but not thickness (≤ 2400 mm (long) $\times \leq 1200$ mm (wide) Gyproc FireLine and Glasroc X).
- 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