

The Building Test Centre

Fire Acoustics Structures

The Building Test Centre

British Gypsum

East Leake

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Report Number: **BTC 21860F**

A FIRE RESISTANCE TEST ON A SFS EXTERNAL WALL SYSTEM WITH A 70 MM COLD-ROLLED STRUCTURAL STEEL STUD FRAMEWORK CLAD ON THE UNEXPOSED SIDE WITH A SINGLE LAYER OF 15 MM GYPROC FIRELINE WITH 50 MM ISOVER APR 1200 IN THE CAVITY AND 50 MM POLTERM INSULATION ON THE EXTERIOR, INCORPORATING A 20 MM DEFLECTION HEAD, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1: 2015.

Test Date: 13th July 2021

Report Issue Date: 15th July 2021

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Customer: **British Gypsum**
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Loughborough
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LE12 6HX

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 unexposed face with a single layer of Gyproc FireLine and clad on the exposed face with an inner layer of Glasroc X Sheating Board and an outer layer of Isover Polterm Insulation, incorporating a 20 mm deflection head and 50 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 7th and 8th 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 customer.

The test was conducted on the 13th 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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BSc. (Hons.)
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TEST REPORT AMENDMENTS

Page	Amendments	Date

<p>Report Amendments Author</p> <p>Name <i>Role</i></p>

<p>Amendments Authorised by</p> <p>Name <i>Role</i></p>

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 75 mm x 38 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 75 mm x 70 mm x 2.0 mm gauge cold rolled structural steel channel was fixed to the head of the test aperture at 600 mm centres using 60 mm fire resistant fixings.

70 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 a 'Slip Klip' which was fixed to the head channel with 4 x 13 mm British Gypsum Wafer Head Jack-Point Screws.

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 70 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 unexposed face 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 single layer of 15 mm Gyproc FireLine. All the boards were reduced to leave a 25 mm gap at the head of the specimen.

The boards were fixed with 25 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. A horizontal joint was positioned at 2400 mm from the base on the unexposed face boards. A Gypframe GFS1 Fixing Strap was used behind the horizontal board joint on the unexposed face.

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.

The exposed 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 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 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.

50 mm Isover Polterm Max was installed over the Glasroc X Sheathing Boards and fixed in position to the steel framework using with 70 mm diameter metal washer plates (IRD70x70-6,8) and 100 mm self-drilling stainless steel screws (SXC5-6,3 x 100mm-A2) as per Figure 2 below. The Isover Polterm Max not cut short at the head.

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 Through the Head Prior to the Insulation of the Isover Polterm

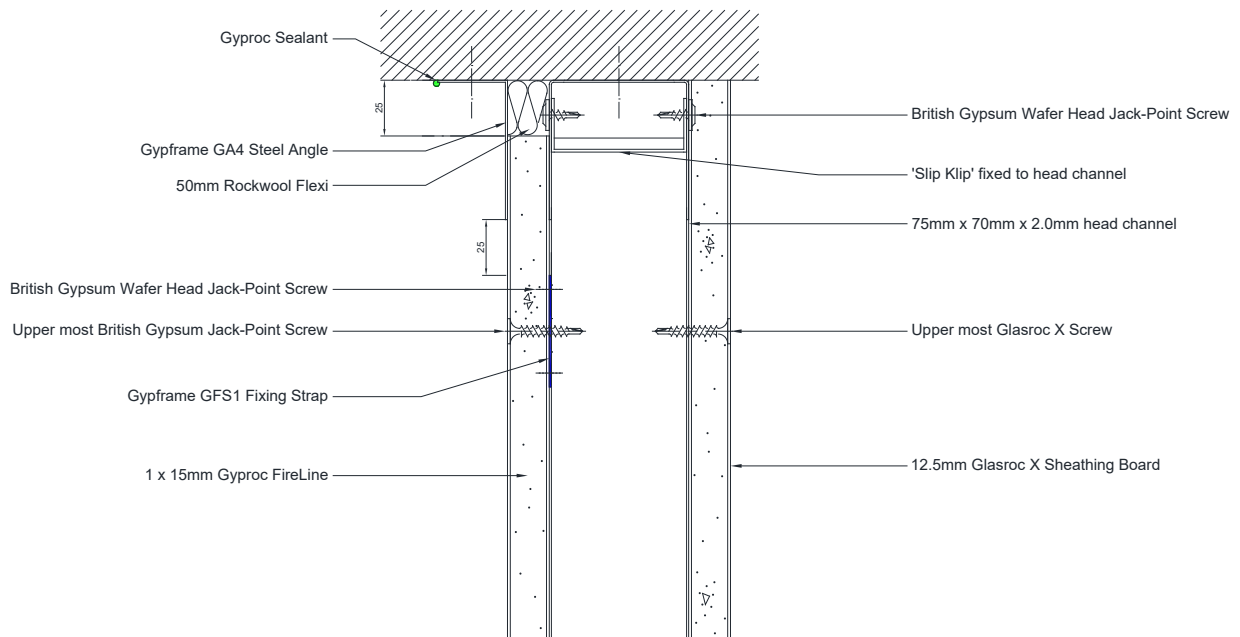


Figure 1 – Cross section through the head prior to the installation of the Isover Polterm.

Exposed Face Elevation Outer Layer - Isover Polterm Max Layout and Fixing Pattern

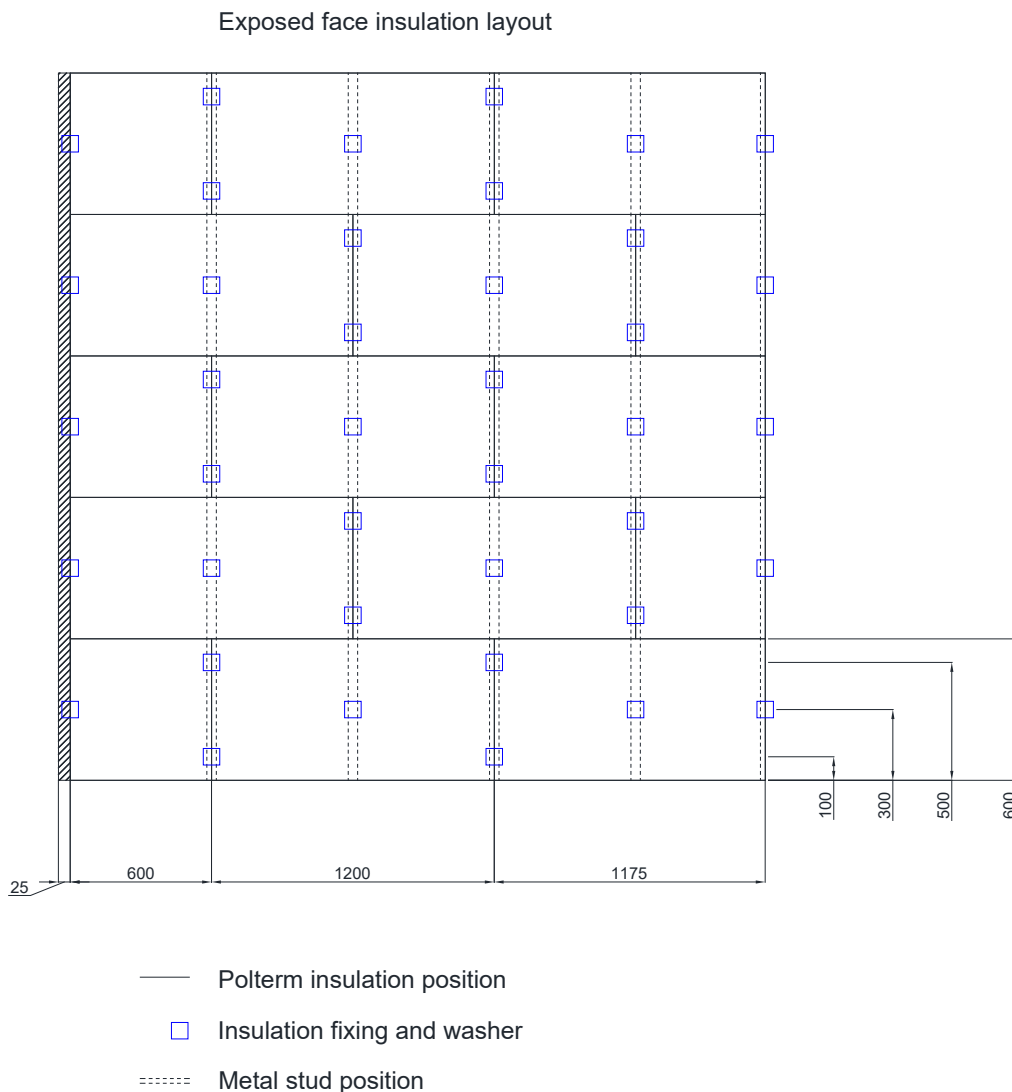


Figure 2 – Exposed Face Elevation Outer Layer - Isover Polterm Max layout and fixing pattern.

Exposed Face Elevation Inner Layer – Glasroc X Sheathing Boards.

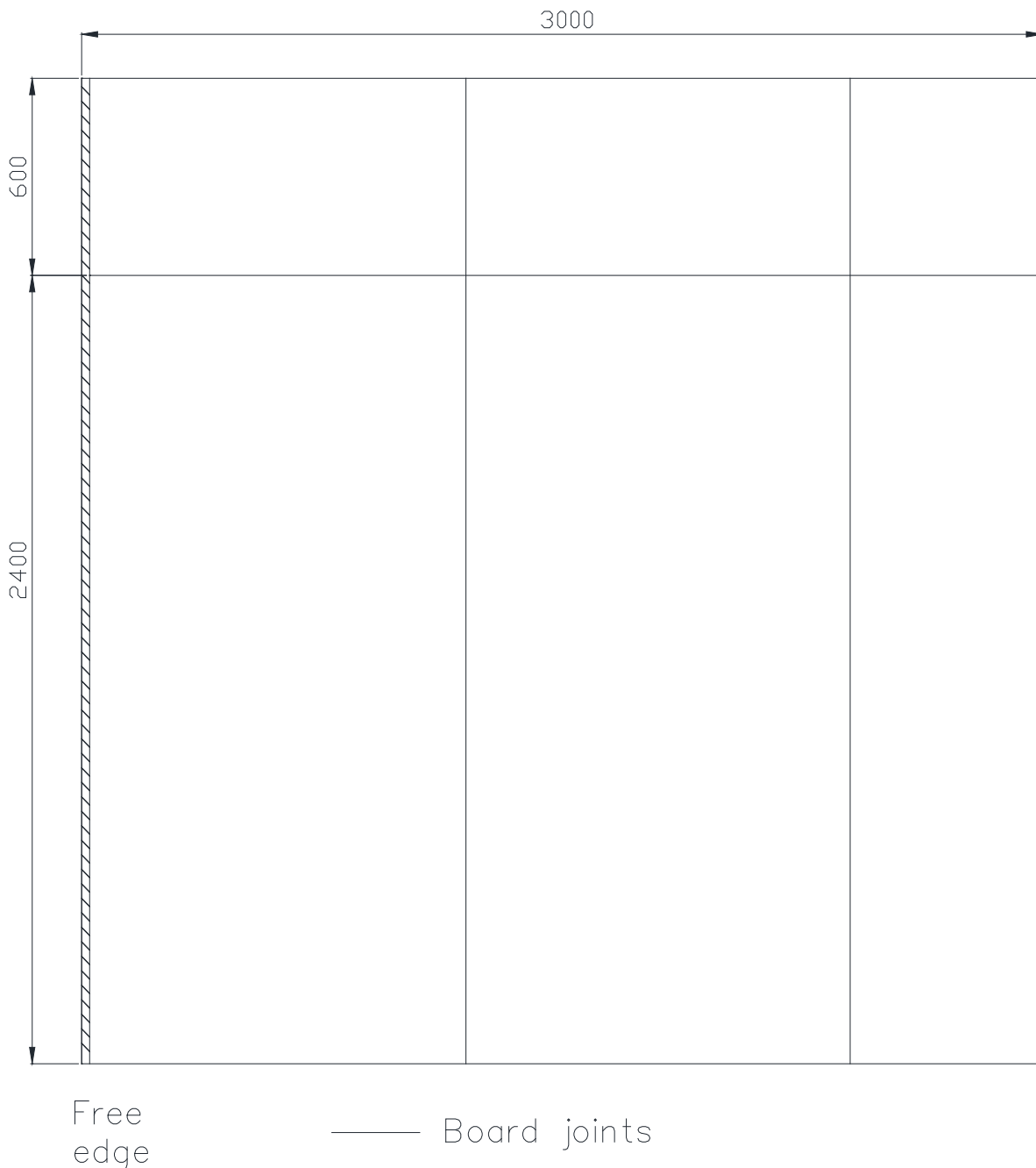


Figure 3 – Exposed Face Elevation Inner Layer – Glasroc X Sheathing Boards.

Unexposed Face Elevation

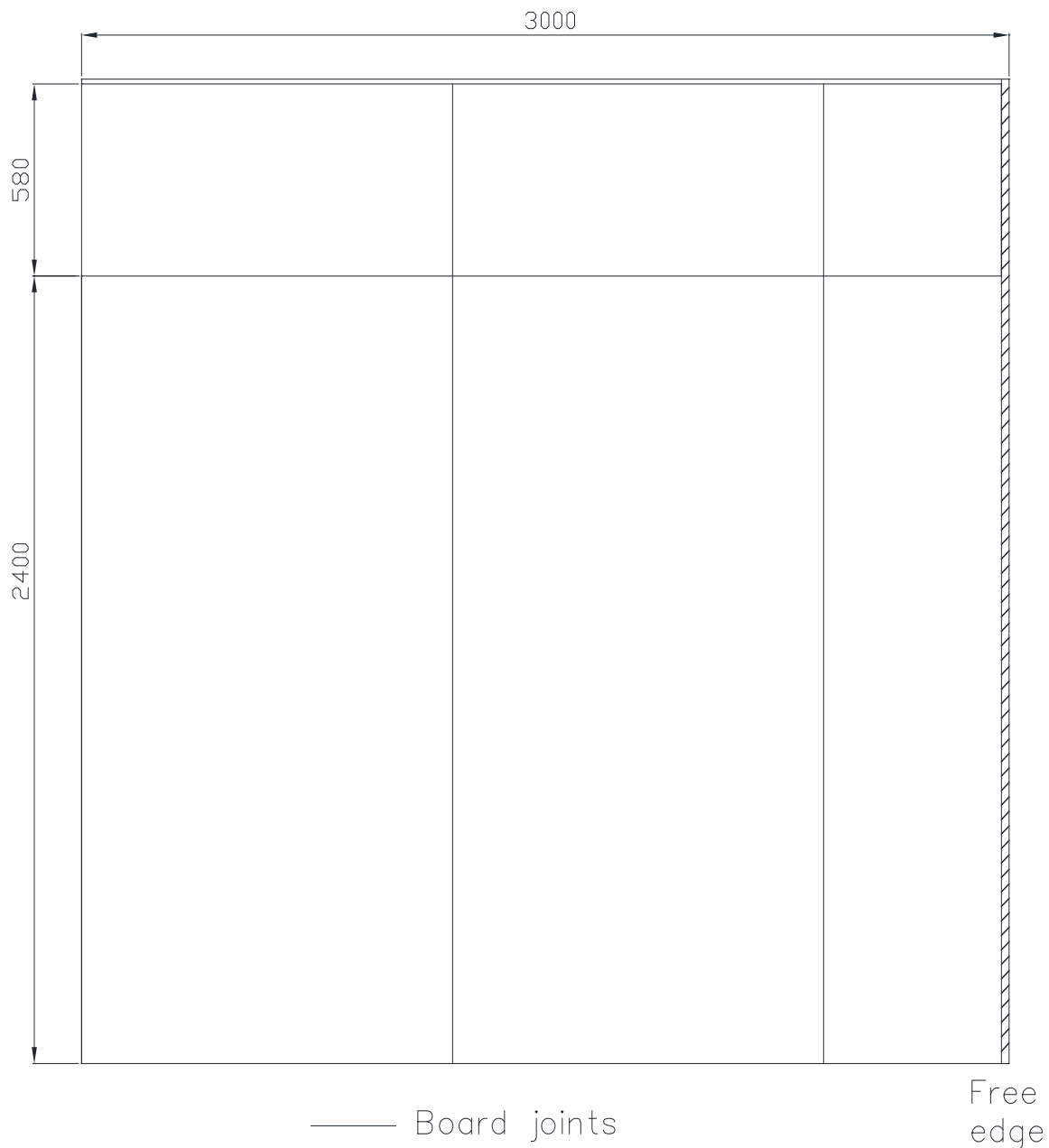


Figure 4 – Unexposed face elevation.

TEST MATERIALS

Plasterboard

- i) 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/m²
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: 0.25 %

- ii) 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/m²
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: 0.18 %

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 GFS1 Fixing Strap, supplied by The Building Test Centre.
iv) Gypframe GA4 Steel Angle, supplied by British Gypsum.
v) 75 mm x 38 mm x 1.2 mm gauge cold rolled structural steel channel manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	76 mm
Measured flange dimension	38 mm
Measured thickness	1.19 mm
Measured weight per metre	1.45 kg/m

- vi) 75 mm x 70 mm x 2.0 mm gauge cold rolled structural steel channel manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	76 mm
Measured flange dimension	70 mm
Measured thickness	1.95 mm
Measured weight per metre	3.21 kg/m

- vii) 70 mm x 50 mm x 1.2 mm gauge (with 12mm returns) cold rolled structural steel studs manufactured by Hadley Steel Framing and supplied by British Gypsum.

Measured web dimension	70 mm
Measured flange dimension	48 mm
Measured thickness	1.22 mm
Measured weight per metre	1.77 kg/m

Fasteners

- viii) 13 mm British Gypsum Wafer Head Jack-point Screws, supplied by The Building Test Centre.
- ix) 25 mm British Gypsum Drywall Jack-point Screws, supplied by The Building Test Centre.
- x) 25 mm Glasroc X Screws, supplied by British Gypsum.
- xi) 60 mm fire resistant fixings, supplied by The Building Test Centre.
- xii) SXC5-6.3 x 100-A2. Stainless steel self-drilling insulation fastener screw 100 mm long x 6.3 mm diameter, manufactured by SFS Intec and supplied by British Gypsum.
- xiii) IDR-70x70-6.8. Stress Plate square retaining washers. 70 mm x 70 mm, 6.8 mm diameter central hole, 304 Grade, manufactured by SFS Intec and 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) 'Slip Klips' manufactured by Hadley Steel Framing and supplied by British Gypsum.
- 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: 0.660 kg/m²

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

Measured surface density: 1.779 kg/m²

- xxi) Nominally 50 mm (thick) Isover Polterm Max manufactured by Isover and supplied by British Gypsum.

Measured surface density: 3.235 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 Gyproc 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 23 °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 6**.

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	138 minutes, no failure.
	6 mm Gap Gauge	138 minutes, no failure.
	25 mm Gap Gauge	138 minutes, no failure.
	Cotton Pad	137 minutes.
Insulation		117 minutes.
Test Terminated		138 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: Liam Woodford
Exposed face: Ryan Skilton and Beth Kelliher

Time		Observations
Hours	Minutes	
0	00	Test started.
0	10	No visible change.
0	20	No visible change.
0	30	Gaps adjacent to each corner had opened up to approximately 5-10 mm on all batts where visible. <i>Unexposed face</i> No visible change.
0	40	Batt at approximately mid-height adjacent to the free edge had begun to melt.
0	50	Batt at approximately mid-height adjacent to the free edge had peeled into the furnace.
1	00	All joints had opened up to between approximately 4-10 mm. Polterm batts were breaking around fixings. <i>Unexposed face</i> No visible change.
1	10	All joints had opened up to between approximately 10-30 mm.
1	20	All batts had broken around the fixing points and were beginning to fall into the furnace.

Time		Observations
Hours	Minutes	
1	30	<p>Approximately 50 % of the Polterm has fallen into the furnace. Left-hand vertical joint had opened up to approximately 25-30 mm. Right-hand vertical joint had opened up to approximately 8 mm.</p> <p><i>Unexposed face</i> Screw heads had discoloured along the centre of the lower centre board.</p>
1	40	<p>Left-hand vertical joint had opened up to approximately 40 mm. Right-hand vertical joint had opened up to approximately 15 mm.</p>
1	50	<p>Left-hand vertical joint had opened up to approximately 40-45 mm. Right-hand vertical joint had opened up to approximately 30 mm.</p> <p><i>Unexposed face</i> Right-hand vertical joint had discoloured at approximately 1800 mm height.</p>
1	57	<p><i>Unexposed face</i> INSULATION FAILURE. The temperature rise at a point approximately 1800 mm from the base of the specimen on the right-hand vertical joint, exceeded 180 °C (roving thermocouple). Lower right-hand board had discoloured. Lower centre board had discoloured.</p>
2	00	<p>No visible change.</p> <p><i>Unexposed face</i> Left-hand vertical joint had discoloured.</p>
2	04	<p><i>Unexposed face</i> The mean temperature rise of the standard five thermocouples exceeded 140 °C.</p>
2	07	<p><i>Unexposed face</i> Left-hand vertical joint had opened up to approximately 5 mm.</p>
2	10	<p>Right-hand vertical joint had opened up to approximately 45 mm.</p>
2	17	<p><i>Unexposed face</i> INTEGRITY FAILURE. The cotton pad ignited (flamed) when placed on the left-hand vertical joint at approximately 1800 mm height.</p>

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Time		Observations
Hours	Minutes	
2	18	TEST TERMINATED at the request of the sponsor.



Furnace Temperature Graph

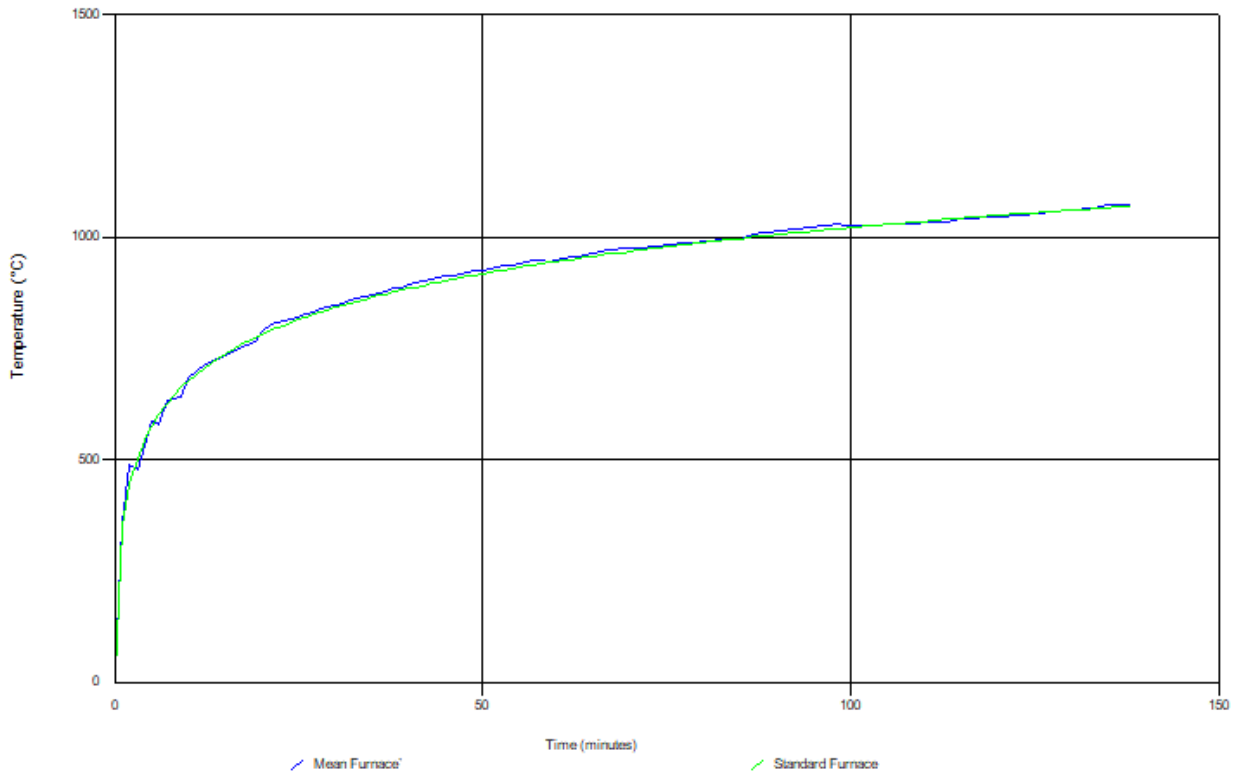


Figure 5 – Furnace temperature graph.

Furnace Pressure Graph

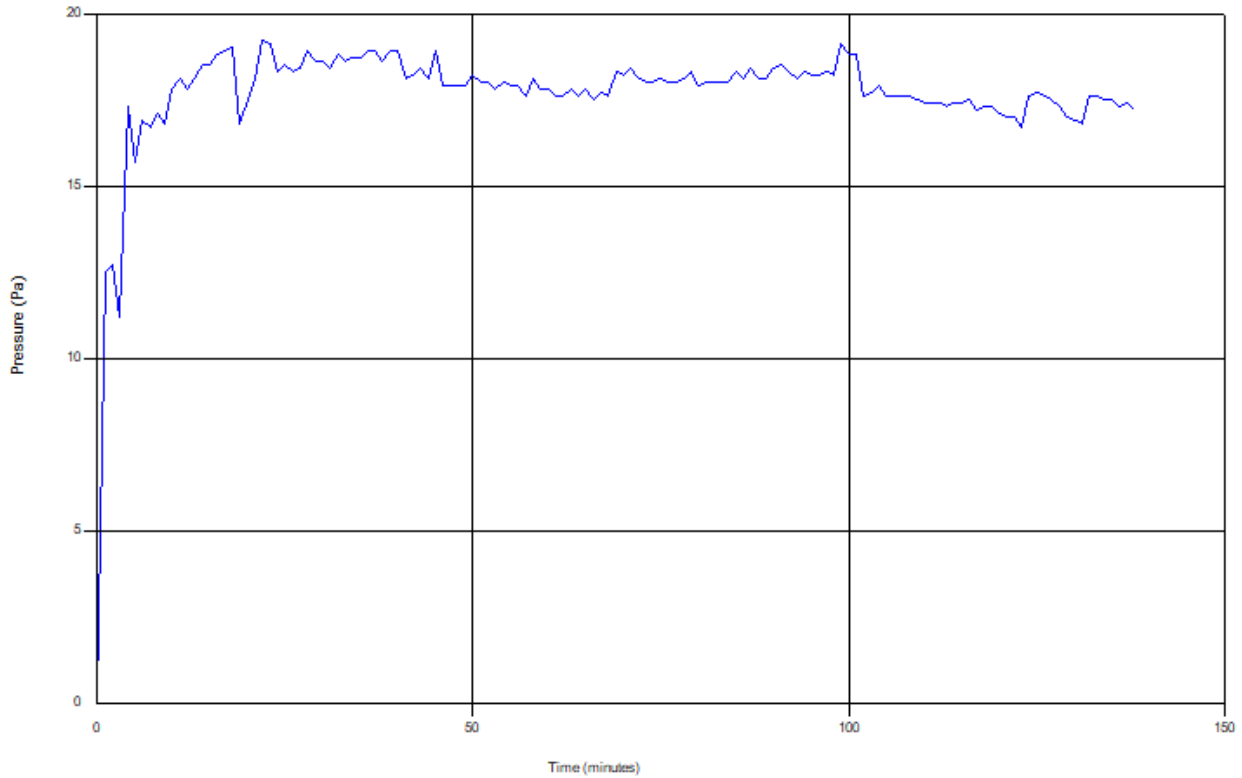


Figure 6 – Furnace pressure graph.

Unexposed Face Temperature Graph

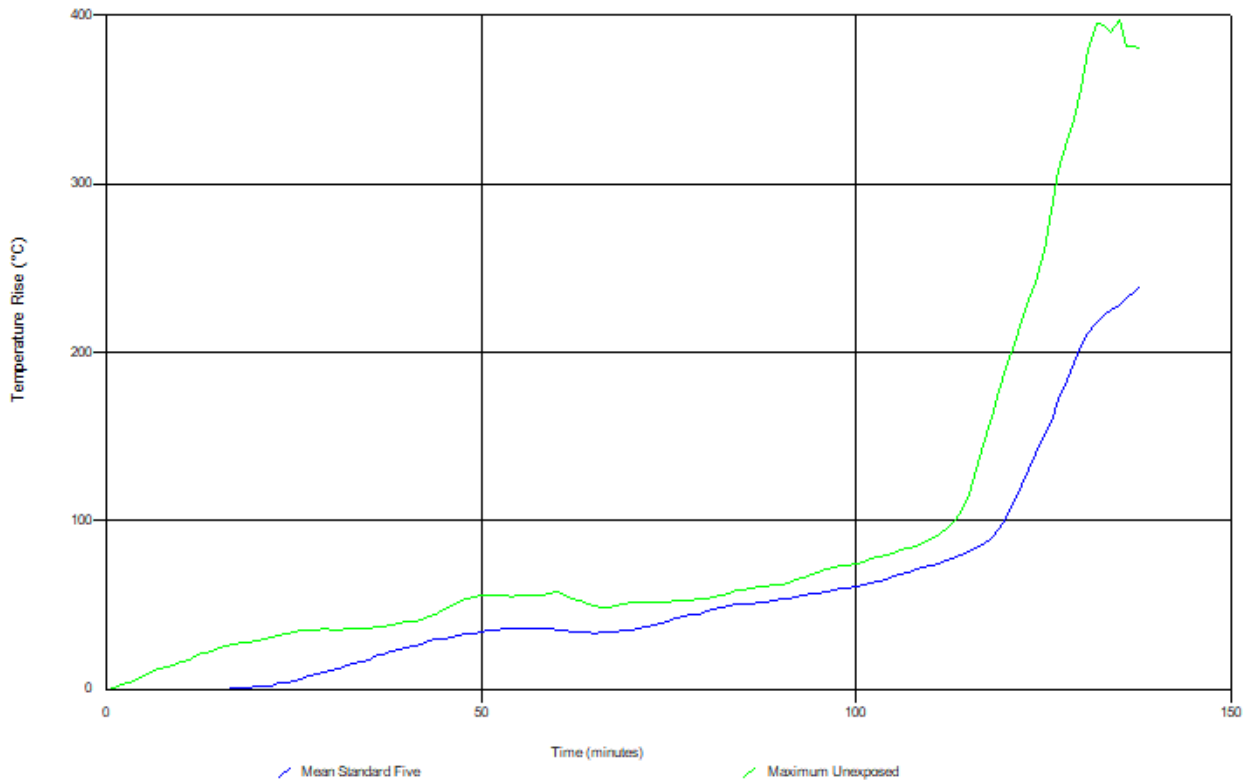


Figure 7 – Unexposed face temperature graph.

Unexposed Face Thermocouple Layout

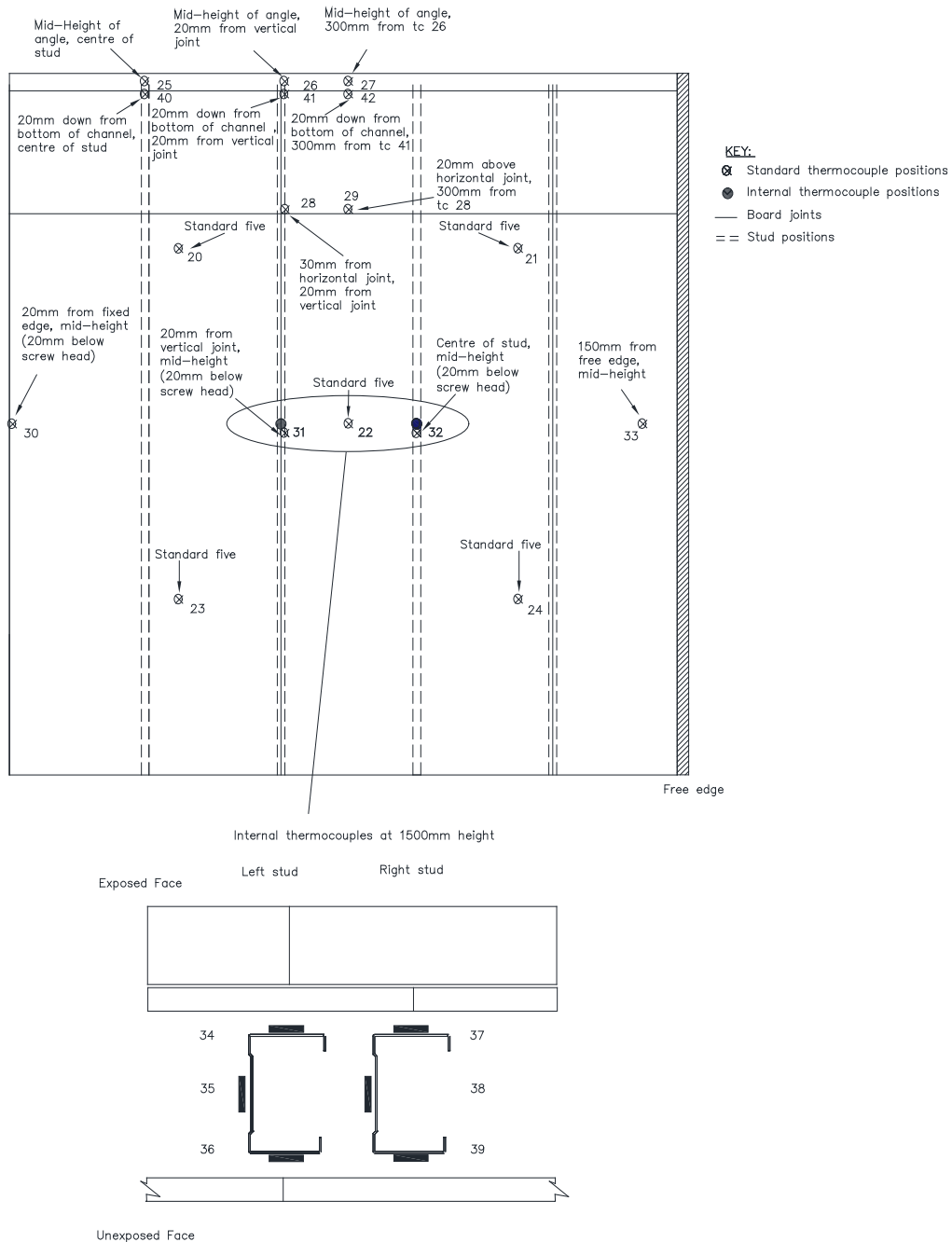


Figure 8 – Unexposed face thermocouple layout.

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Unexposed Face Standard Five Temperature Data

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

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

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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	39	44	48	51	51	47
81	40	46	49	52	51	48
82	41	47	50	53	52	49
83	43	48	51	53	53	50
84	44	49	52	53	55	51
85	45	49	53	53	55	51
86	45	50	53	53	56	51
87	45	50	52	54	57	52
88	46	50	52	55	58	52
89	46	51	53	56	59	53
90	47	51	53	57	61	54
91	47	50	54	58	62	54
92	48	50	54	59	64	55
93	48	50	55	60	65	56
94	49	51	56	61	66	57
95	50	52	57	62	66	57
96	50	52	58	63	67	58
97	51	53	59	64	67	59
98	52	54	59	65	68	60
99	53	54	60	66	69	60
100	53	54	61	66	70	61
101	54	55	62	67	71	62
102	55	56	63	68	71	63
103	56	56	64	68	74	64
104	57	57	65	69	78	65
105	58	58	66	70	81	67
106	59	59	67	70	83	68
107	60	59	68	74	84	69
108	61	60	69	78	85	71
109	62	61	71	80	87	72
110	63	63	74	82	88	74
111	64	64	76	84	89	75
112	65	65	78	85	91	77
113	67	66	79	87	93	78
114	69	67	81	89	96	80
115	71	68	82	91	98	82
116	73	69	83	93	102	84
117	75	70	85	96	105	86
118	76	71	87	99	116	90
119	78	72	90	102	133	95
120	80	74	93	109	153	102

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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	82	75	95	126	181	112
122	84	76	99	144	202	121
123	86	77	103	171	220	131
124	90	78	107	191	235	140
125	94	79	121	208	247	150
126	99	80	141	222	255	159
127	108	81	175	234	261	172
128	124	83	199	243	265	183
129	149	85	219	249	268	194
130	172	87	235	253	271	204
131	191	89	249	256	273	212
132	205	93	261	256	275	218
133	218	96	270	255	272	222
134	228	100	277	253	269	225
135	235	105	284	251	266	228
136	241	120	288	248	263	232
137	245	137	290	244	261	235
138	248	167	288	241	258	240

Figures highlighted in red indicate the minute in which the mean temperature rise exceeded 140 °C.

See **Figure 8** for the location of the thermocouples.

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The Building Test Centre

British Gypsum

East Leake

Loughborough

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

Customer: **British Gypsum**

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British Gypsum

East Leake

Loughborough

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

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	44	54	32	45	35
81	46	55	33	47	36
82	47	56	33	49	37
83	48	57	34	50	38
84	50	59	35	52	39
85	51	59	36	52	41
86	53	60	36	53	42
87	55	61	37	53	43
88	56	61	38	54	45
89	58	62	39	54	46
90	59	61	40	55	48
91	60	61	40	55	49
92	61	62	41	56	50
93	61	61	43	57	51
94	63	62	44	58	52
95	64	62	45	59	52
96	64	62	45	59	53
97	65	61	45	60	53
98	66	62	46	61	54
99	67	62	47	62	54
100	67	63	48	62	55
101	68	63	49	63	56
102	68	63	49	64	56
103	67	64	49	65	57
104	67	63	49	65	58
105	68	63	50	66	58
106	68	64	50	67	59
107	68	63	51	68	60
108	69	64	51	69	61
109	69	64	52	70	62
110	68	64	51	73	63
111	68	64	52	75	64
112	69	64	52	77	64
113	69	64	53	79	65
114	70	64	53	81	66
115	70	64	53	82	67
116	70	64	53	84	67
117	70	64	55	86	68
118	70	64	54	89	69
119	71	64	55	91	70
120	71	64	56	95	71

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
121	71	64	56	98	72
122	71	65	57	101	73
123	71	67	58	111	75
124	71	70	60	120	76
125	71	73	61	135	79
126	71	77	62	148	81
127	71	83	62	178	84
128	71	92	65	205	87
129	72	100	66	225	89
130	71	110	67	247	92
131	71	120	69	277	96
132	72	130	73	317	100
133	74	141	74	349	103
134	72	148	71	371	104
135	71	156	77	385	114
136	75	161	73	382	125
137	75	165	72	381	149
138	75	169	80	379	187

See **Figure 8** for the location of the thermocouples.

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

Customer: **British Gypsum**

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

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
80	36	48	54	54
81	36	50	55	55
82	37	51	56	56
83	38	52	57	56
84	39	53	58	57
85	40	54	58	58
86	40	54	59	59
87	41	55	59	59
88	42	55	60	60
89	44	56	61	61
90	45	57	61	62
91	47	58	62	63
92	50	60	62	65
93	52	61	63	66
94	54	62	64	68
95	55	63	66	69
96	55	64	67	71
97	56	65	68	72
98	56	65	70	73
99	57	66	71	74
100	57	65	72	75
101	58	66	74	76
102	59	67	75	78
103	59	68	77	79
104	60	69	78	80
105	60	71	80	81
106	61	75	81	83
107	62	78	83	84
108	62	81	84	85
109	63	83	86	87
110	63	85	88	89
111	63	86	91	92
112	64	88	95	95
113	64	90	99	98
114	65	92	105	102
115	65	96	116	108
116	66	99	131	120
117	66	101	145	134
118	66	105	162	157
119	67	117	177	176
120	67	135	191	191

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
121	68	157	205	203
122	68	184	219	212
123	68	212	231	220
124	68	239	242	225
125	69	260	253	230
126	69	284	265	234
127	70	308	277	237
128	70	326	288	240
129	71	338	296	242
130	72	357	299	243
131	72	379	297	245
132	73	395	294	246
133	74	394	289	247
134	74	390	285	248
135	75	397	282	248
136	76	379	279	249
137	78	358	277	248
138	79	343	275	248

See **Figure 8** for the location of the thermocouples.

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Additional Unexposed Face Temperature Data

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

Customer: **British Gypsum**

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

Customer: **British Gypsum**

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Time (minutes)	Thermocouple		
	No. 40	No. 41	No. 42
79	38	49	40
80	39	50	41
81	41	51	42
82	42	52	43
83	43	52	44
84	45	53	45
85	46	54	46
86	47	54	47
87	47	55	48
88	48	55	49
89	49	56	49
90	49	56	50
91	50	56	51
92	50	56	52
93	50	56	53
94	51	56	53
95	52	56	54
96	52	57	54
97	53	57	54
98	53	57	54
99	53	58	54
100	54	58	54
101	55	59	55
102	55	59	55
103	56	60	55
104	56	60	56
105	57	62	57
106	57	63	58
107	57	64	59
108	57	65	60
109	58	66	62
110	58	67	63
111	59	68	64
112	60	68	65
113	61	69	66
114	62	70	66
115	63	70	67
116	65	71	67
117	67	71	68
118	68	72	68
119	69	72	68

Customer: **British Gypsum**

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Time (minutes)	Thermocouple		
	No. 40	No. 41	No. 42
120	71	73	69
121	72	74	69
122	72	75	69
123	74	78	70
124	74	80	70
125	76	81	71
126	77	82	72
127	78	84	73
128	79	85	75
129	82	85	75
130	85	87	77
131	86	90	80
132	88	92	84
133	89	94	85
134	90	95	84
135	93	98	89
136	96	98	84
137	97	100	83
138	100	103	87

See **Figure 8** 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	27	26	26	28	27	26
1	27	26	26	28	27	26
2	27	26	26	28	27	26
3	27	26	26	29	27	26
4	27	26	26	30	27	26
5	28	26	26	31	28	26
6	28	27	26	32	28	26
7	29	27	26	34	29	26
8	30	27	26	37	30	27
9	31	28	26	39	31	27
10	33	28	26	42	32	27
11	36	30	27	46	34	28
12	38	31	27	49	36	29
13	41	33	28	53	38	30
14	45	36	30	58	41	31
15	49	38	31	62	45	33
16	53	41	33	67	48	34
17	56	44	35	71	51	36
18	61	47	37	75	54	38
19	65	50	40	80	58	41
20	70	54	43	84	62	44
21	75	58	46	88	66	47
22	79	62	49	93	70	50
23	83	66	52	96	74	53
24	86	69	55	99	77	57
25	88	72	58	102	79	60
26	91	75	61	105	82	63
27	93	77	63	107	84	65
28	94	80	66	109	86	68
29	96	82	68	111	88	70
30	97	83	70	113	89	72
31	98	85	72	115	90	74
32	99	86	74	117	91	76
33	100	87	75	119	92	77
34	101	88	76	120	93	78
35	102	89	78	122	94	79
36	102	89	79	123	95	80

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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	103	90	80	125	96	81
38	103	91	81	126	97	82
39	104	91	82	128	98	82
40	105	92	82	130	99	83
41	105	94	83	131	100	83
42	106	96	84	133	101	84
43	106	96	85	135	102	85
44	107	97	85	137	103	86
45	109	97	86	140	104	87
46	110	98	86	141	105	88
47	111	98	87	143	106	89
48	112	99	87	143	107	89
49	114	100	88	147	108	90
50	115	102	88	151	110	90
51	116	104	88	155	112	90
52	116	107	88	158	113	91
53	115	107	87	162	115	91
54	115	110	87	166	117	91
55	117	113	87	171	119	90
56	119	112	88	175	121	90
57	122	110	89	174	124	91
58	125	108	90	181	127	94
59	129	108	92	188	131	98
60	134	109	92	193	138	101
61	139	110	93	200	145	104
62	145	112	94	210	152	107
63	152	116	96	221	161	111
64	163	120	99	233	171	116
65	174	126	102	246	182	121
66	188	135	106	261	194	127
67	202	145	110	279	207	133
68	218	155	115	299	221	141
69	234	168	120	320	236	148
70	249	178	126	342	251	156
71	265	189	132	364	265	163
72	281	199	138	388	281	168
73	297	210	139	413	299	176
74	313	221	146	436	314	183
75	329	232	154	456	330	190

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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	345	243	161	479	346	197
77	360	255	169	499	362	206
78	376	267	177	518	376	217
79	391	278	185	536	392	227
80	406	289	192	553	407	237
81	419	301	199	568	420	247
82	434	312	207	582	433	258
83	449	323	214	595	445	268
84	465	334	221	607	457	277
85	481	346	229	620	468	287
86	498	358	238	634	480	298
87	520	372	246	650	493	309
88	543	387	256	666	508	323
89	567	404	267	684	526	340
90	592	423	280	696	543	362
91	615	444	295	703	559	387
92	633	461	311	708	573	414
93	643	473	327	715	582	442
94	648	482	343	719	587	466
95	652	491	359	720	587	485
96	652	500	375	719	587	511
97	651	508	389	719	589	528
98	649	516	402	721	592	539
99	648	522	415	723	596	549
100	646	528	433	725	600	559
101	646	536	454	727	604	567
102	646	544	474	728	606	574
103	646	550	498	730	608	580
104	647	558	516	730	612	586
105	649	566	530	730	615	594
106	652	575	542	729	618	600
107	654	583	552	730	621	606
108	655	590	562	731	626	614
109	657	598	572	734	634	627
110	663	611	586	738	642	641
111	674	627	604	744	651	655
112	685	642	623	750	658	663
113	695	652	639	754	665	670
114	704	660	652	758		676

Customer: **British Gypsum**

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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	710	668	662	760	-	680
116	-	674	669	761	-	682
117	-	678	674	764	-	686
118	-	680	677	768	-	692
119	-	685	682	773	-	699
120	-	691	688	775	-	707
121	-	699	695	781	-	716
122	-	707	704	-	-	724
123	-	715	713	-	-	733
124	-	724	722	-	-	742
125	-	733	730	-	-	750
126	-	740	738	-	-	758
127	-	748	746	-	-	765
128	-	754	752	-	-	770
129	-	759	756	-	-	775
130	-	761	757	-	-	778
131	-	761	758	-	-	782
132	-	762	-	-	-	784
133	-	763	-	-	-	786
134	-	765	-	-	-	788
135	-	766	-	-	-	790
136	-	766	-	-	-	790
137	-	766	-	-	-	792
138	-	766	-	-	-	794

See **Figure 8** for the location of the thermocouples.

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

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Time (minutes)	Deflection (mm)
	Centre
39	4
40	4
41	4
42	4
43	4
44	4
45	4
46	4
47	4
48	4
49	4
50	4
51	5
52	5
53	6
54	7
55	7
56	8
57	9
58	11
59	12
60	14
61	16
62	18
63	20
64	22
65	25
66	28
67	30
68	33
69	36
70	39
71	42
72	45
73	47
74	50
75	52
76	54
77	56
78	58
79	61

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
80	62
81	65
82	66
83	68
84	70
85	72
86	73
87	75
88	77
89	79
90	80
91	81
92	79
93	79
94	79
95	79
96	79
97	80
98	80
99	81
100	79
101	78
102	78
103	77
104	77
105	76
106	75
107	74
108	73
109	72
110	71
111	70
112	68
113	66
114	64
115	62
116	61
117	59
118	58
119	57
120	58

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
121	59
122	61
123	62
124	62
125	62
126	61
127	60
128	59
129	59
130	58
131	57
132	57
133	56
134	56
135	55
136	55
137	55
138	55

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

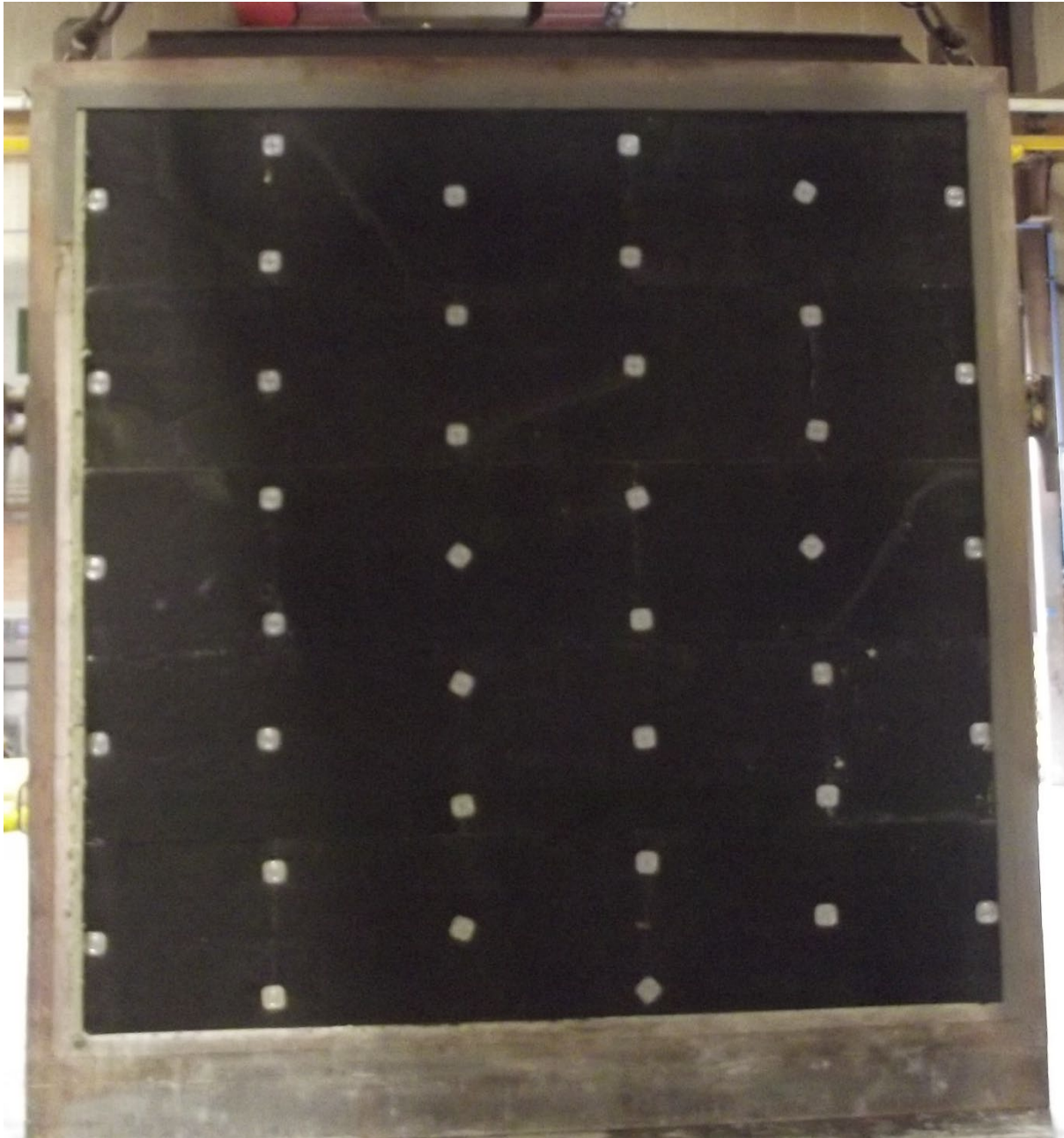
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PHOTOGRAPHS

Exposed Face Prior to Test



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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, 18 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.
- 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.
- vi) Decrease in fixing centres from.
- 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
≤ 100 mm	≤ 100 mm	≤ 100 mm	≤ 100 mm