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

Report Number: **BTC 21755F**

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 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: 31st March 2021

Report Issue Date: 1st April 2021

www.btconline.co.uk

Customer: **British Gypsum**
East Leake
Loughborough
Leicestershire
LE12 6HX

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

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East Leake
Loughborough
Leics. LE12 6NP
Tel: (0115) 945 1564
Email: btc.testing@saint-gobain.com

FOREWORD

This test report details a fire resistance test conducted on a metal stud partition clad on each face with a triple layer of Gyproc FireLine on the unexposed face and a single layer of Glasroc X sheathing board on the exposed face, 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 Clark Building and Installation Services. The construction of the specimen took place between the 26th 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 31st 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	Authorised by
Liam Woodford *Scientist*	**Paul Miller** BSc. (Hons.) *Fire Test Manager*

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

TEST REPORT AMENDMENTS

Page	Amendments	Date

Report Amendments Author	Amendments Authorised by
Name *Role*	**Name** *Role*

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

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.

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 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.

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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.

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Test Construction Drawings

Cross Section Showing Head Detail

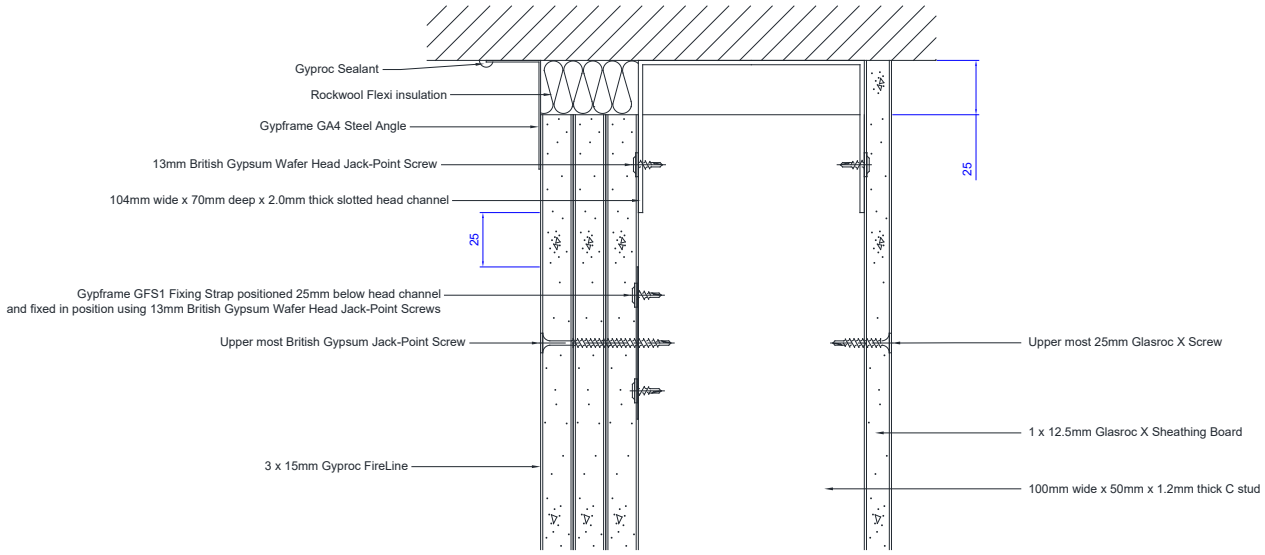

Figure 1 – Cross section through the head.

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Exposed Face Elevation

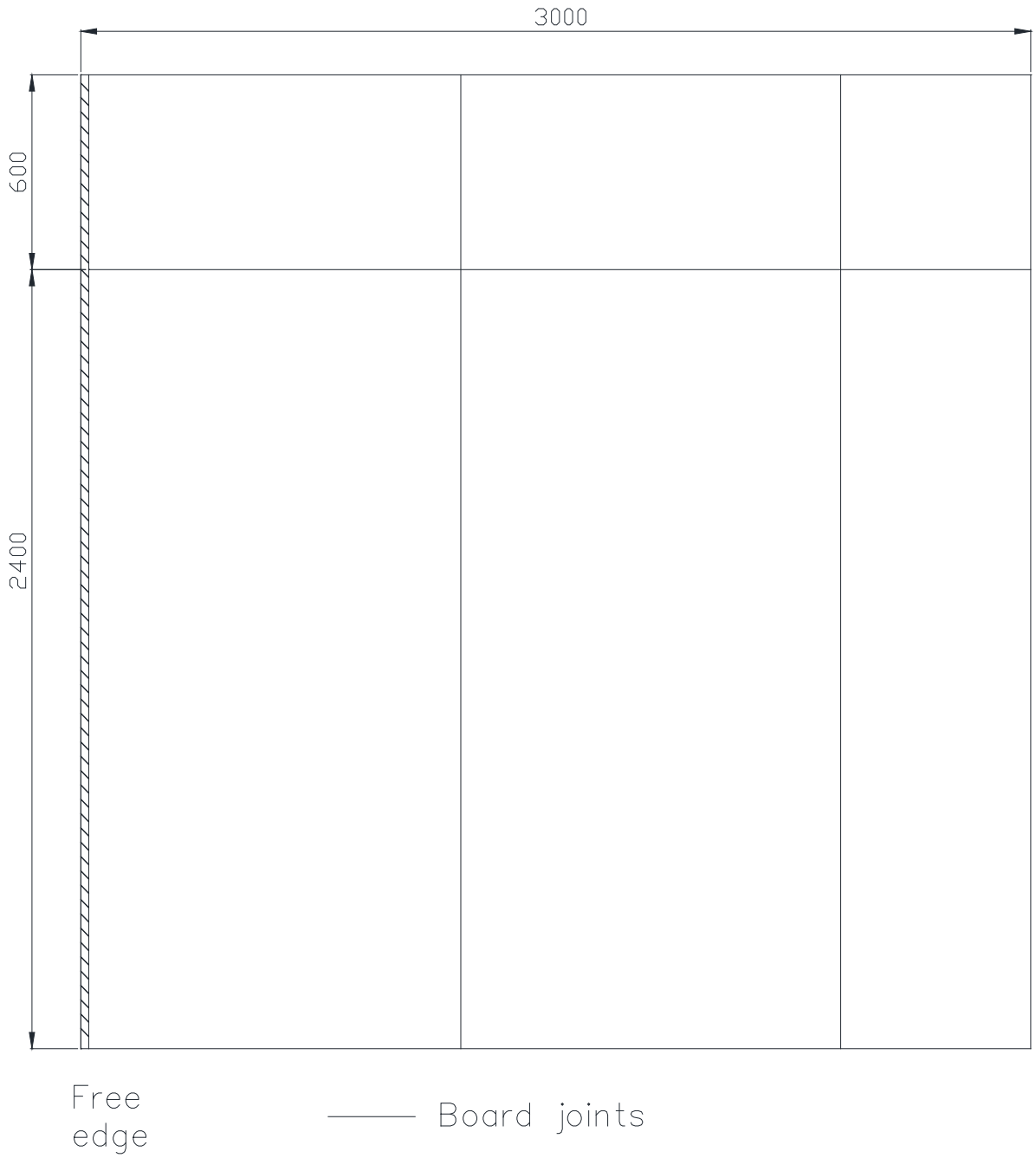

Figure 2 – Exposed face elevation.

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Unexposed Face Elevation

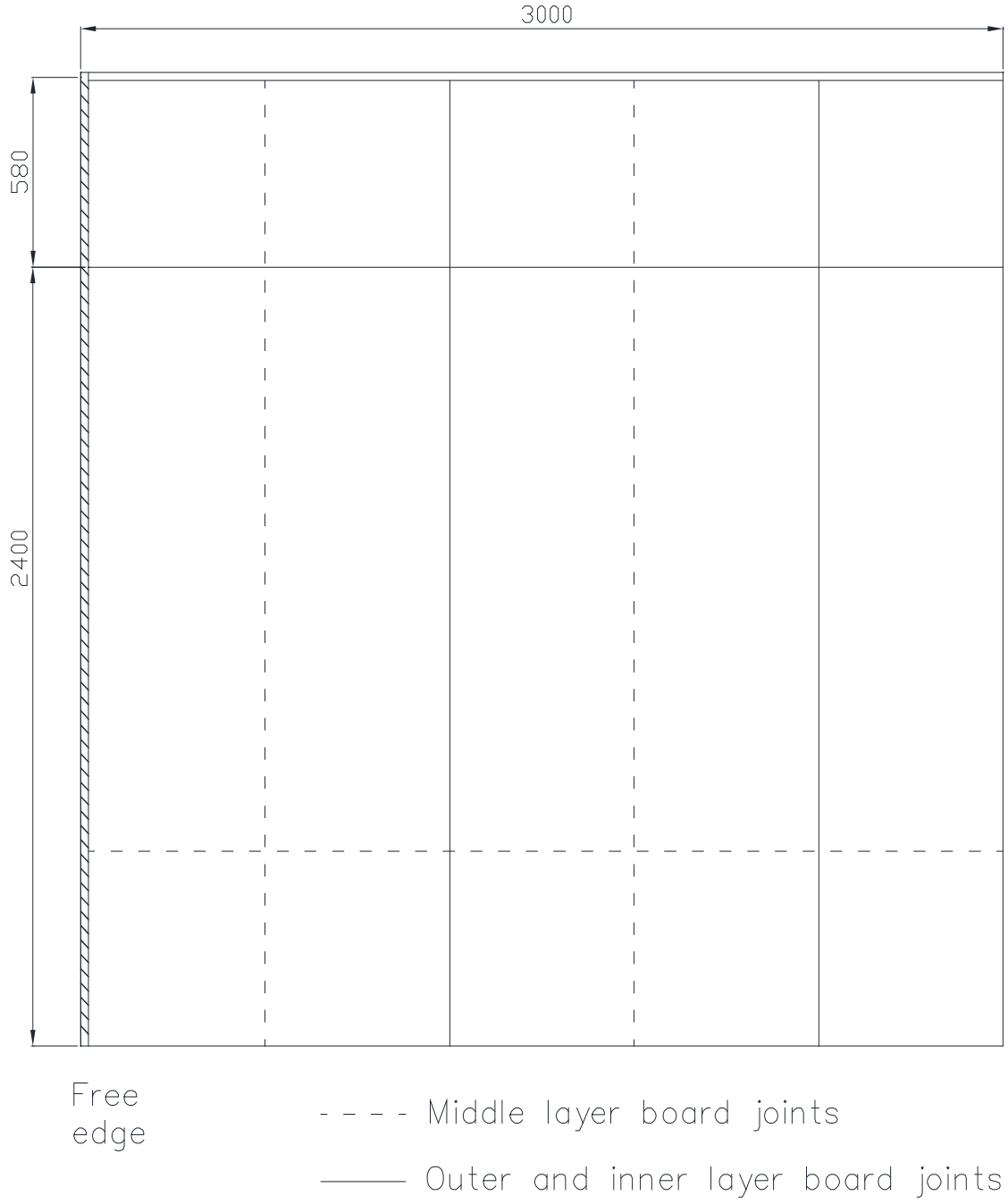

Figure 3 – Unexposed face elevation.

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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/m²
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:	0.74%

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/m²
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:	0.31%

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

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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 Drywall Screws, supplied by The Building Test Centre.
ix) 25 mm British Gypsum Drywall Screws, supplied by The Building Test Centre.
x) 41 mm British Gypsum Drywall Screws, supplied by The Building Test Centre.
xi) 60 mm British Gypsum Drywall Screws, supplied by The Building Test Centre.
xii) 25 mm Glasroc X Screws, supplied by The Building Test Centre.
xiii) 60 mm fire resistant fixings, supplied by The Building Test Centre.

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) Glasroc X Sealant, supplied by The British Gypsum.
xviii) Gyproc Sealant, supplied by The Building Test Centre.

Insulation

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

Measured surface density:	0.648 kg/m²

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Loughborough
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Tel: (0115) 945 1564
Email: btc.testing@saint-gobain.com

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

Measured surface density: 1.692 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.

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Loughborough
Leics. LE12 6NP
Tel: (0115) 945 1564
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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 the triple layer of 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 20 °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.

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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		**142 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.

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Email: btc.testing@saint-gobain.com

TEST DATA

Observations

All observations refer to the exposed face unless stated.

Observers: Unexposed face: Liam Woodford
Exposed face: Mark Shortland and William Pikett

Time Hours	Time Minutes	Observations
0	00	Test started.
0	10	No visible change.
0	20	Left-hand vertical joint had opened up to approximately 9-10 mm. Right-hand vertical joint had opened up to approximately 5-6 mm. Horizontal joint had opened up to approximately 9-10 mm.
0	30	Left-hand vertical joint had opened up to approximately 17-18 mm Right-hand vertical joint had opened up to approximately 15 mm. Horizontal joint had opened up to approximately 18-19 mm. Boards began pull away from screw heads. *Unexposed face* No visible change.
0	40	Left-hand vertical joint had opened up to approximately 20-21 mm. Right-hand vertical joint had opened up to approximately 16-17 mm. Horizontal joint had opened up to approximately 22-23 mm.
0	50	Top left corner of the lower centre board had bowed into the furnace. Left-hand vertical joint had opened up to approximately 25-30 mm. Right-hand vertical joint had opened up to approximately 20-22 mm. Horizontal joint had opened up to approximately 25-26 mm.
1	00	Upper left-hand quarter of lower centre board had fallen into furnace. *Unexposed face* No visible change.

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Time Hours	Time Minutes	Observations
1	10	Upper right-hand quarter of lower left-hand board had fallen into the furnace. Left-hand side of lower centre board had fallen into the furnace. Right-hand side of lower centre board was resting against furnace thermocouple.
1	20	Upper centre board had fallen into the furnace.
1	30	100% of the first layer boards had fallen into the furnace. Second layer horizontal joint had opened to approximately 5-6 mm. *Unexposed face* No visible change.
1	35	*Unexposed face* Screw heads had discoloured on the left-hand vertical joint.
1	40	Second layer horizontal joint had opened to approximately 6-8 mm. All second layer boards were crazed.
1	50	No visible change. *Unexposed face* Screw heads had discoloured on the right-hand vertical joint.
2	00	No visible change. *Unexposed face* No visible change.
2	10	Right-hand side of the second-layer centre board had fallen into the furnace. *Unexposed face* Gap at the fixed edge from approximately mid-height up to full height, open to approximately 1-3 mm. All screw heads had discoloured.
2	20	No visible change.

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Time		Observations
Hours	Minutes	
2	22	*Unexposed face* **INSULATION FAILURE.** The temperature rise of thermocouple no.41 positioned on the steel angle at the head of the specimen adjacent to the left-hand vertical joint, exceeded 180 °C.
2	27	*Unexposed face* Left-hand vertical joint had cracked.
2	30	**TEST TERMINATED** at the request of the sponsor.

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Furnace Temperature Graph

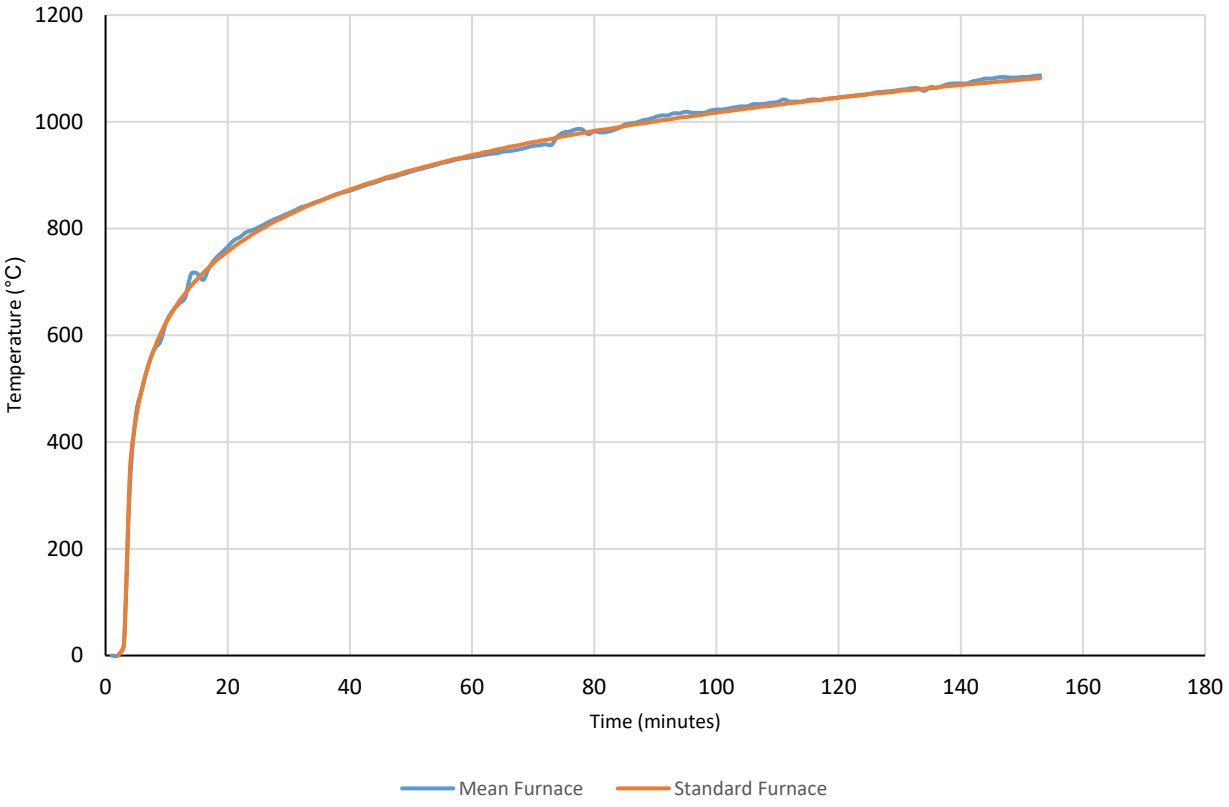

Figure 4 – Furnace temperature graph.

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Furnace Pressure Graph

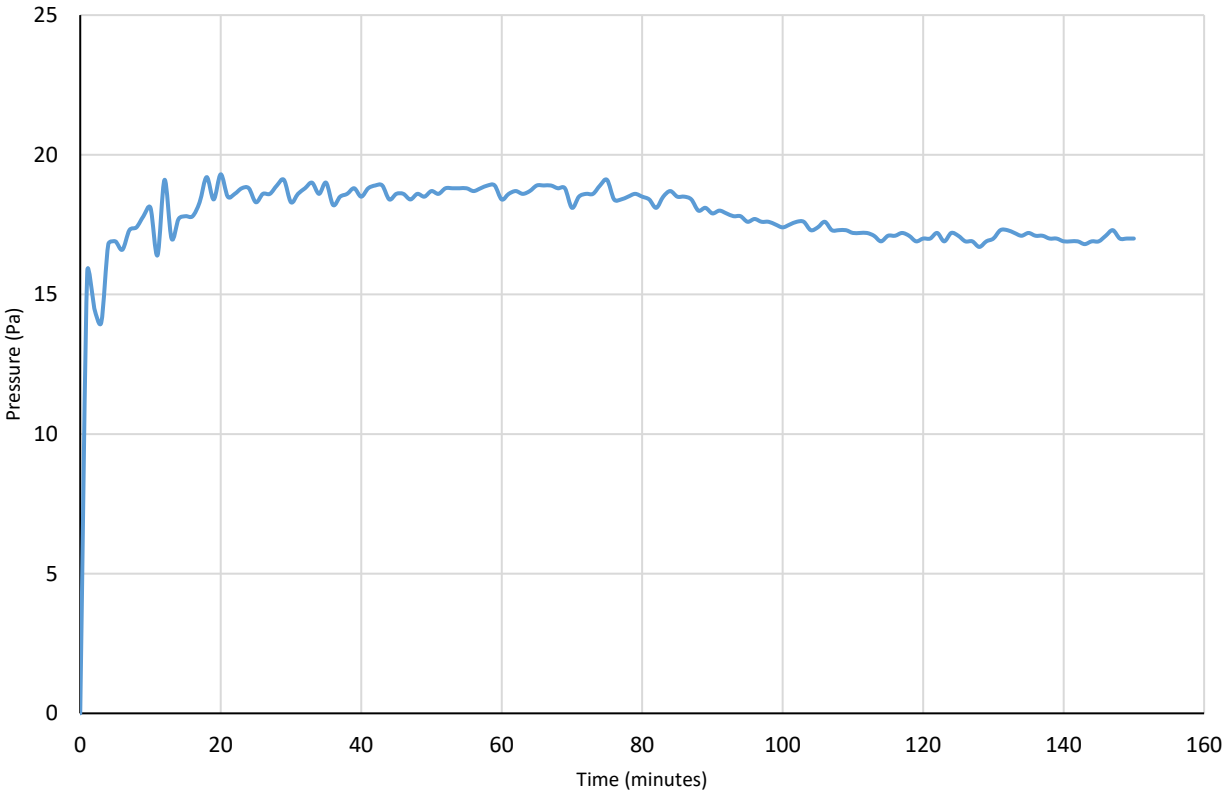

Figure 5 – Furnace pressure graph.

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Unexposed Face Temperature Graph

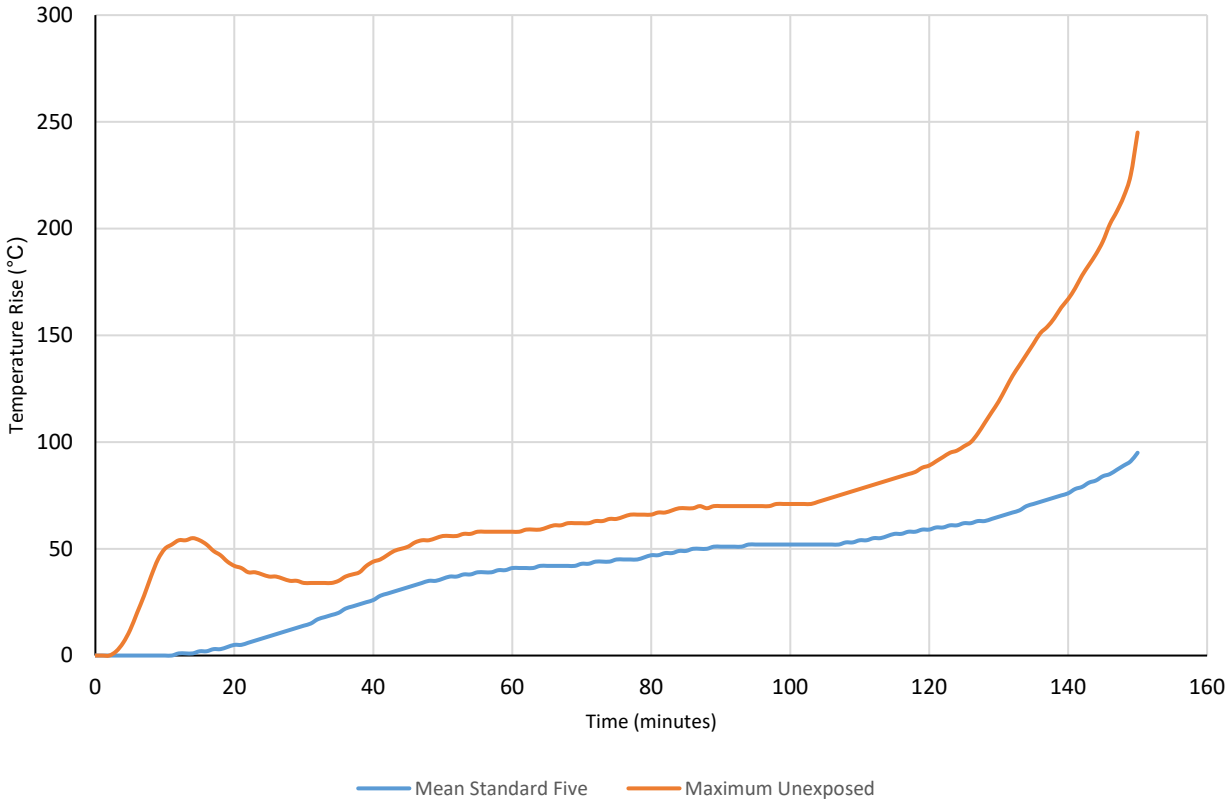

Figure 6 – Unexposed face temperature graph.

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Unexposed Face Thermocouple Layout

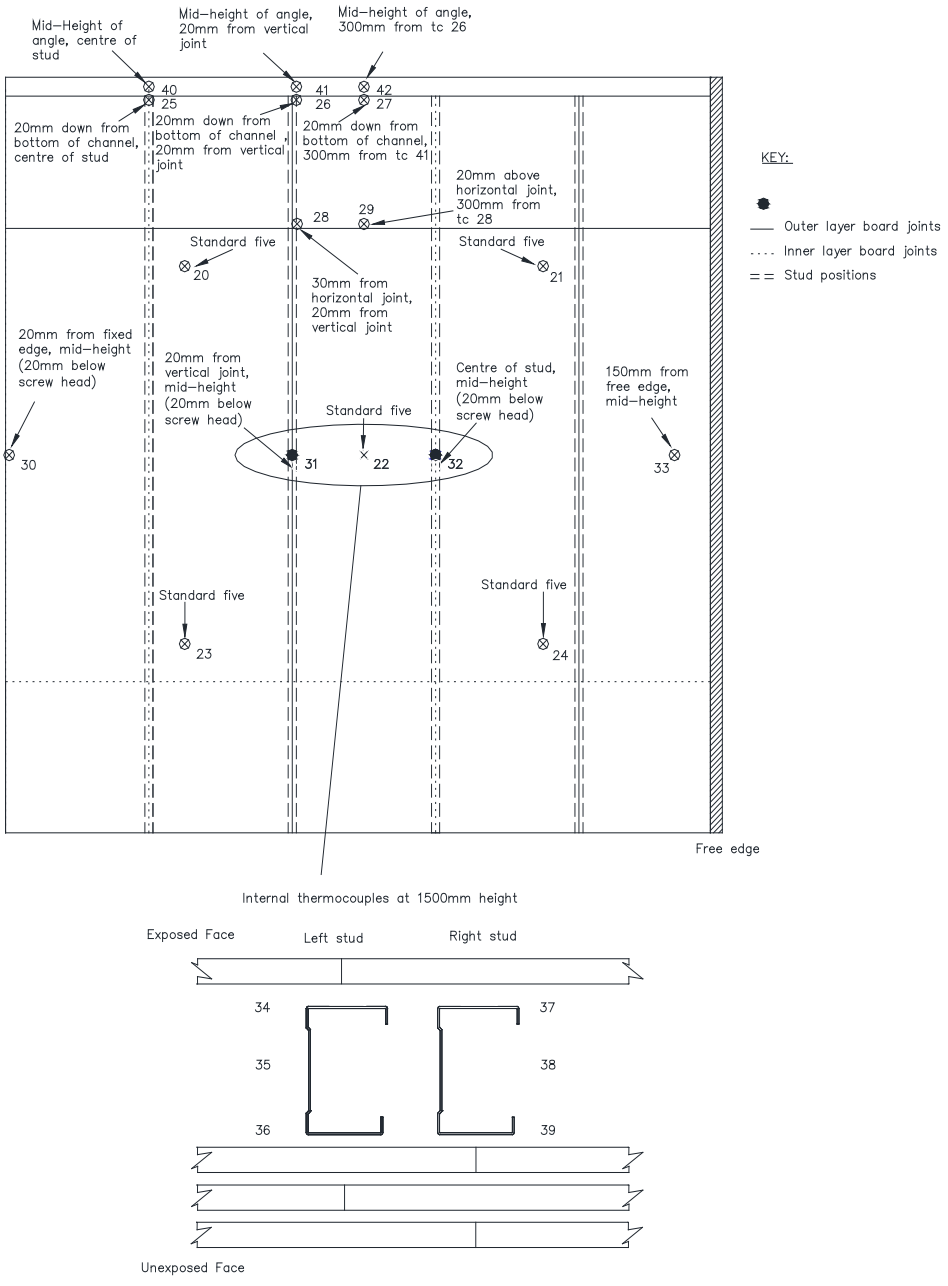

Figure 7 – Unexposed face thermocouple layout.

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

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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
37	17	26	24	26	21	23
38	18	27	25	28	23	24
39	19	28	26	29	24	25
40	20	29	27	30	26	26
41	21	30	28	32	27	28
42	22	31	29	33	28	29
43	23	32	30	34	29	30
44	25	33	31	35	31	31
45	26	33	32	36	32	32
46	27	34	33	37	33	33
47	28	35	34	38	34	34
48	29	36	34	39	35	35
49	30	36	35	39	36	35
50	31	37	36	40	37	36
51	32	37	36	40	38	37
52	33	38	37	41	38	37
53	34	38	37	41	39	38
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55	35	39	38	42	40	39
56	36	40	38	42	41	39
57	36	40	38	42	41	39
58	37	40	38	43	42	40
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63	39	42	39	44	43	41
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67	41	42	40	44	43	42
68	41	42	41	44	43	42
69	41	42	41	44	44	42
70	42	42	42	44	44	43
71	42	43	44	44	44	43
72	42	43	45	45	44	44
73	42	43	45	45	44	44
74	42	43	46	46	44	44
75	43	43	47	46	44	45
76	44	43	47	46	43	45
77	45	44	48	46	43	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
78	45	44	48	47	43	45
79	46	45	49	47	44	46
80	47	46	49	48	44	47
81	48	46	49	49	44	47
82	48	47	50	50	44	48
83	49	47	50	50	45	48
84	49	48	50	51	46	49
85	49	48	50	51	47	49
86	49	49	50	52	48	50
87	50	49	50	52	49	50
88	50	49	50	52	50	50
89	50	50	50	53	51	51
90	50	50	50	53	51	51
91	51	50	50	53	52	51
92	51	50	50	53	52	51
93	51	51	50	52	52	51
94	52	51	50	52	53	52
95	52	51	50	52	53	52
96	52	51	50	52	53	52
97	52	51	50	52	54	52
98	52	51	50	52	54	52
99	52	51	50	52	53	52
100	52	51	50	52	54	52
101	52	51	51	52	53	52
102	52	51	51	51	53	52
103	52	51	51	51	53	52
104	52	51	51	51	53	52
105	52	51	51	51	53	52
106	52	51	51	51	53	52
107	52	52	53	51	54	52
108	53	52	55	51	54	53
109	53	52	56	52	54	53
110	53	52	57	52	54	54
111	53	52	57	54	54	54
112	54	52	58	56	54	55
113	55	53	58	57	54	55
114	56	54	59	57	55	56
115	56	55	60	58	55	57
116	56	56	60	58	56	57
117	57	56	61	59	57	58
118	58	56	61	59	58	58

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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
119	59	56	61	59	59	59
120	59	56	62	59	60	59
121	60	57	62	60	60	60
122	61	57	63	60	61	60
123	61	58	63	61	61	61
124	61	58	64	61	61	61
125	61	59	64	62	62	62
126	62	60	65	63	62	62
127	62	60	66	63	62	63
128	62	61	67	64	62	63
129	63	61	68	65	63	64
130	64	62	70	66	63	65
131	66	63	72	66	63	66
132	67	63	74	67	63	67
133	68	65	75	69	64	68
134	70	66	76	71	65	70
135	71	68	78	73	65	71
136	72	69	79	74	66	72
137	73	71	80	76	66	73
138	74	72	81	77	67	74
139	75	73	83	78	67	75
140	76	74	84	79	68	76
141	77	75	86	80	70	78
142	78	76	88	82	72	79
143	79	77	90	83	74	81
144	80	78	92	84	76	82
145	81	79	94	86	78	84
146	83	80	96	88	79	85
147	84	81	99	89	80	87
148	85	82	104	91	81	89
149	87	84	110	93	82	91
150	89	85	120	96	84	95

See Figure 7 for the location of the thermocouples.

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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	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	1	0	0	0	0
7	1	0	0	0	0
8	2	1	0	0	0
9	5	1	2	1	0
10	10	1	2	1	0
11	16	2	3	1	1
12	24	3	4	2	1
13	30	5	5	2	1
14	35	8	6	3	1
15	38	10	6	3	2
16	40	13	7	4	2
17	40	16	10	5	2
18	39	18	11	6	3
19	39	20	11	7	3
20	37	22	12	8	4
21	36	23	13	9	4
22	33	24	13	10	5
23	32	24	14	11	5
24	32	25	15	12	6
25	33	25	15	13	7
26	33	25	15	14	8
27	33	26	16	15	9
28	32	26	16	16	9
29	32	26	16	18	10
30	32	26	17	19	11
31	32	26	17	20	12
32	32	26	17	22	13
33	32	26	17	23	14
34	32	27	18	24	15
35	33	27	18	26	16
36	33	27	19	27	18
37	33	26	19	28	19
38	33	26	20	29	20

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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	33	25	20	30	21
40	33	25	21	31	22
41	33	26	22	32	23
42	34	27	22	33	24
43	34	27	23	34	25
44	35	28	24	34	26
45	35	29	24	35	27
46	36	30	25	36	28
47	36	30	26	36	29
48	36	31	27	37	30
49	36	31	27	37	30
50	36	32	28	37	31
51	36	32	29	38	32
52	37	33	29	38	33
53	36	33	30	38	33
54	36	34	30	39	34
55	36	34	31	39	34
56	36	34	31	40	35
57	36	35	32	40	35
58	37	35	32	40	36
59	37	35	32	41	36
60	38	35	33	41	37
61	37	35	34	42	37
62	37	35	34	42	38
63	37	36	35	42	38
64	37	36	35	43	39
65	37	36	36	43	39
66	37	37	36	43	40
67	37	37	37	44	40
68	38	37	37	44	41
69	38	38	37	44	42
70	38	38	38	44	42
71	38	38	38	45	43
72	38	39	38	45	44
73	38	39	38	46	45
74	38	39	39	46	46
75	39	40	39	47	46
76	39	40	39	47	46
77	39	40	39	47	47
78	40	41	40	48	47
79	42	42	41	48	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	43	43	41	48	47
81	43	42	42	48	48
82	42	43	42	49	48
83	42	43	43	49	48
84	42	44	44	49	49
85	42	44	44	49	49
86	43	45	45	50	49
87	44	45	46	50	50
88	44	46	47	50	50
89	45	46	48	51	50
90	46	46	49	51	50
91	46	47	50	51	51
92	47	47	51	52	51
93	48	47	51	52	52
94	49	47	51	53	52
95	50	47	52	53	53
96	51	47	52	54	53
97	52	47	52	56	54
98	53	47	52	57	54
99	53	46	51	57	55
100	53	47	51	58	56
101	55	47	51	58	56
102	59	47	51	59	56
103	63	47	51	60	57
104	63	47	51	60	57
105	66	47	51	61	58
106	67	47	51	62	59
107	67	48	52	62	59
108	67	48	52	63	60
109	66	48	52	63	61
110	66	48	52	64	61
111	66	48	52	65	62
112	62	49	52	66	62
113	64	49	52	66	63
114	63	49	52	67	64
115	62	50	52	68	64
116	61	50	52	69	65
117	63	51	52	70	66
118	65	51	52	71	66
119	63	52	52	71	67
120	62	52	53	72	68

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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	61	53	53	73	69
122	60	53	53	74	70
123	62	54	54	75	70
124	60	55	54	76	71
125	63	55	55	77	72
126	61	55	57	78	73
127	63	55	58	79	73
128	63	55	59	80	74
129	63	56	60	81	75
130	65	55	60	82	75
131	66	55	61	83	76
132	66	55	61	84	77
133	66	55	61	86	78
134	65	55	61	87	79
135	65	56	61	88	79
136	64	56	62	89	80
137	64	56	62	90	81
138	63	57	62	91	82
139	63	57	62	93	83
140	61	57	62	95	84
141	60	57	62	98	85
142	59	57	62	101	86
143	58	57	63	107	88
144	58	58	63	116	89
145	57	58	63	125	91
146	57	58	63	133	93
147	57	59	63	141	95
148	56	59	64	154	98
149	56	60	64	170	101
150	57	60	65	182	105

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

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

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
80	47	48	55	43
81	48	48	56	43
82	48	48	56	43
83	48	48	56	43
84	49	48	57	43
85	49	48	57	43
86	50	48	57	44
87	50	49	58	44
88	51	48	58	45
89	51	48	59	46
90	52	48	60	47
91	52	49	61	48
92	52	49	61	48
93	52	49	62	49
94	53	49	62	49
95	53	49	63	49
96	53	50	64	50
97	53	50	65	50
98	53	51	66	50
99	53	52	67	51
100	53	53	68	51
101	54	55	69	51
102	54	56	70	51
103	54	57	71	51
104	54	57	72	51
105	55	58	73	52
106	55	59	74	52
107	55	59	75	52
108	56	60	76	52
109	56	60	77	52
110	57	60	78	52
111	58	61	79	53
112	58	61	80	53
113	59	61	81	53
114	61	62	82	53
115	62	62	83	54
116	64	63	84	54
117	66	63	85	54
118	67	63	86	54
119	69	63	88	54
120	70	64	89	54

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Time (minutes)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
121	71	64	91	55
122	72	64	93	55
123	73	65	95	55
124	74	65	96	56
125	75	66	98	57
126	76	67	100	57
127	77	68	102	58
128	78	72	105	58
129	79	76	108	58
130	79	78	111	58
131	80	80	114	59
132	81	82	118	60
133	82	83	122	61
134	83	84	125	61
135	84	85	129	62
136	85	87	133	63
137	86	89	136	63
138	87	92	140	64
139	88	94	144	64
140	89	96	149	65
141	90	99	154	65
142	92	103	159	66
143	93	110	164	67
144	95	124	170	69
145	97	140	175	70
146	99	161	180	72
147	101	185	185	73
148	104	205	191	74
149	106	225	196	75
150	110	245	202	76

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

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Additional Unexposed Face Temperature Data

Time (minutes)	Temperature Rise (°C)		
	Thermocouple No.40	Thermocouple No. 41	Thermocouple No. 42
0	0	0	0
1	0	0	0
2	0	0	0
3	2	0	0
4	6	1	1
5	12	1	3
6	20	3	6
7	28	6	13
8	37	12	24
9	45	19	36
10	50	29	46
11	52	37	51
12	54	43	53
13	54	45	53
14	55	46	53
15	54	45	50
16	52	44	48
17	49	43	45
18	47	42	43
19	44	41	42
20	42	40	41
21	41	39	40
22	39	37	39
23	38	36	39
24	37	35	38
25	36	34	37
26	36	34	37
27	36	33	36
28	35	33	35
29	35	33	35
30	34	33	34
31	34	32	34
32	34	33	34
33	34	33	34
34	34	34	34
35	34	35	34
36	34	37	34
37	34	38	35
38	34	39	35

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Time (minutes)	Temperature Rise (°C)		
	Thermocouple No.40	Thermocouple No. 41	Thermocouple No. 42
39	35	42	35
40	35	44	36
41	36	45	37
42	36	47	37
43	36	49	38
44	37	50	39
45	37	51	40
46	38	53	41
47	39	54	42
48	39	54	43
49	40	55	44
50	40	56	45
51	41	56	46
52	41	56	46
53	41	57	45
54	42	57	45
55	42	58	45
56	42	58	44
57	43	58	44
58	43	58	45
59	43	58	46
60	44	58	47
61	44	58	49
62	44	59	49
63	45	59	50
64	45	59	50
65	45	60	50
66	46	61	49
67	45	61	49
68	46	62	49
69	46	62	48
70	46	62	48
71	47	62	48
72	47	63	47
73	47	63	47
74	48	64	48
75	48	64	48
76	48	65	49
77	48	66	49
78	49	66	50
79	51	66	51

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Time (minutes)	Temperature Rise (°C)		
	Thermocouple No.40	Thermocouple No. 41	Thermocouple No. 42
80	53	66	52
81	53	67	54
82	53	67	55
83	53	68	57
84	54	69	59
85	54	69	60
86	55	69	62
87	56	70	63
88	58	69	63
89	59	70	64
90	61	70	64
91	62	70	65
92	64	70	65
93	65	70	65
94	66	70	65
95	67	70	65
96	68	70	65
97	69	70	65
98	69	71	65
99	70	71	65
100	70	71	65
101	70	71	65
102	70	71	65
103	70	71	65
104	70	71	65
105	70	71	65
106	71	71	65
107	71	71	65
108	71	71	65
109	71	71	64
110	71	71	64
111	71	71	64
112	71	71	64
113	71	71	64
114	71	71	64
115	71	71	64
116	71	72	64
117	71	72	64
118	71	73	64
119	71	74	64
120	71	76	65

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Time (minutes)	Temperature Rise (°C)		
	Thermocouple No.40	Thermocouple No. 41	Thermocouple No. 42
121	71	80	65
122	71	84	65
123	71	88	66
124	71	92	67
125	71	96	67
126	70	99	68
127	70	104	68
128	70	109	69
129	70	114	69
130	71	119	69
131	71	125	69
132	71	131	69
133	71	136	69
134	71	141	69
135	71	146	68
136	71	151	68
137	71	154	68
138	72	158	68
139	72	163	68
140	73	167	68
141	74	172	69
142	76	**178**	69
143	77	183	70
144	78	188	70
145	80	194	71
146	81	202	72
147	83	208	74
148	84	215	76
149	86	221	79
150	88	229	82

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

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

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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	35	34	31	35	33	30
1	43	34	31	36	33	30
2	56	41	31	49	42	31
3	78	66	39	78	70	41
4	89	77	52	87	80	57
5	97	81	64	93	83	69
6	101	84	70	97	86	76
7	105	88	75	99	89	81
8	107	92	81	100	92	86
9	109	94	83	101	94	89
10	111	96	85	102	96	91
11	114	99	87	103	98	92
12	119	101	88	104	100	92
13	124	103	89	108	103	92
14	133	105	90	116	109	91
15	148	111	90	135	127	88
16	176	134	88	174	157	88
17	220	175	92	228	197	94
18	269	225	98	279	242	107
19	315	269	108	334	283	121
20	358	308	121	385	319	141
21	397	342	138	428	352	161
22	429	372	161	468	386	180
23	459	399	181	502	415	194
24	486	423	197	531	438	211
25	509	444	209	556	460	227
26	528	462	223	575	481	241
27	543	478	236	593	499	255
28	554	492	247	609	517	267
29	565	504	258	624	535	279
30	575	513	268	639	553	291
31	585	524	277	651	567	303
32	594	533	286	658	578	314
33	601	541	294	668	588	324
34	608	549	302	677	597	334
35	614	556	310	682	604	343
36	619	562	318	690	611	352

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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	625	567	325	697	618	361
38	629	572	332	701	623	369
39	635	576	338	706	629	378
40	639	580	345	710	635	387
41	642	583	350	714	640	396
42	646	586	356	718	645	406
43	649	588	361	723	650	416
44	652	590	366	727	654	426
45	659	592	371	732	657	438
46	663	594	376	734	660	450
47	-	596	381	738	665	462
48	-	597	386	742	670	474
49	-	599	391	744	673	485
50	-	601	395	744	676	494
51	-	603	400	745	679	502
52	-	607	406	746	682	509
53	-	612	412	748	683	515
54	-	618	421	751	678	522
55	-	628	430	749	668	538
56	-	637	437	736	659	573
57	-	649	446	737	660	598
58	-	658	456	751	677	623
59	-	676	467	769	699	653
60	-	703	480	798	731	690
61	-	726	498	825	761	727
62	-	754	520	858	799	769
63	-	803	547	888	831	811
64	-	843	594	899	850	837
65	-	847	661	901	857	856
66	-	857	714	895	862	866
67	-	865	739	892	867	875
68	-	873	759	890	875	883
69	-	881	775	897	889	895
70	-	889	790	901	885	907
71	-	901	810	909	895	921
72	-	909	822	921	910	942
73	-	908	826	937	933	956
74	-	916	825	932	925	994
75	-	939	830	929	927	998

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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	-	968	791	953	945	1026
77	-	953	776	961	949	1036
78	-	931	780	965	960	973
79	-	906	784	957	966	926
80	-	-	781	969	952	886
81	-	-	782	998	947	892
82	-	-	791	-	943	912
83	-	-	790	-	944	915
84	-	-	796	-	934	909
85	-	-	788	-	937	913
86	-	-	777	-	937	953
87	-	-	768	-	948	972
88	-	-	761	-	954	968
89	-	-	775	-	966	952
90	-	-	752	-	979	939
91	-	-	726	-	993	1000
92	-	-	694	-	1004	999
93	-	-	667	-	1013	997
94	-	-	651	-	1017	995
95	-	-	612	-	1021	1000
96	-	-	607	-	1025	1003
97	-	-	585	-	1033	998
98	-	-	587	-	1040	996
99	-	-	718	-	1044	1003
100	-	-	826	-	1056	1051
101	-	-	853	-	1061	1005
102	-	-	882	-	1073	1073
103	-	-	835	-	1083	1029
104	-	-	881	-	1088	-
105	-	-	854	-	1088	-
106	-	-	890	-	1059	-
107	-	-	836	-	1031	-
108	-	-	817	-	-	-
109	-	-	997	-	-	-
110	-	-	1024	-	-	-
111	-	-	1026	-	-	-
112	-	-	1028	-	-	-
113	-	-	1029	-	-	-
114	-	-	1030	-	-	-

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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	-	-	1032	-	-	-
116	-	-	1034	-	-	-
117	-	-	1034	-	-	-
118	-	-	1037	-	-	-
119	-	-	1040	-	-	-
120	-	-	1040	-	-	-
121	-	-	1040	-	-	-
122	-	-	1044	-	-	-
123	-	-	1045	-	-	-
124	-	-	1047	-	-	-
125	-	-	1050	-	-	-
126	-	-	1055	-	-	-
127	-	-	1056	-	-	-
128	-	-	1053	-	-	-
129	-	-	1054	-	-	-
130	-	-	1054	-	-	-
131	-	-	1051	-	-	-
132	-	-	1056	-	-	-
133	-	-	1048	-	-	-
134	-	-	1060	-	-	-
135	-	-	1070	-	-	-
136	-	-	1071	-	-	-
137	-	-	-	-	-	-

- 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	1
3	3
4	3
5	3
6	3
7	3
8	3
9	3
10	3
11	3
12	3
13	3
14	4
15	6
16	10
17	15
18	20
19	25
20	31
21	35
22	39
23	42
24	45
25	47
26	49
27	51
28	52
29	53
30	53
31	53
32	54
33	54
34	54
35	54
36	54
37	54
38	53

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

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

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Time (minutes)	Deflection (mm)
	Centre
121	29
122	29
123	29
124	29
125	30
126	30
127	30
128	30
129	30
130	29
131	29
132	29
133	28
134	27
135	26
136	26
137	26
138	25
139	25
140	24
141	24
142	23
143	22
144	22
145	21
146	21
147	21
148	21
149	20
150	20

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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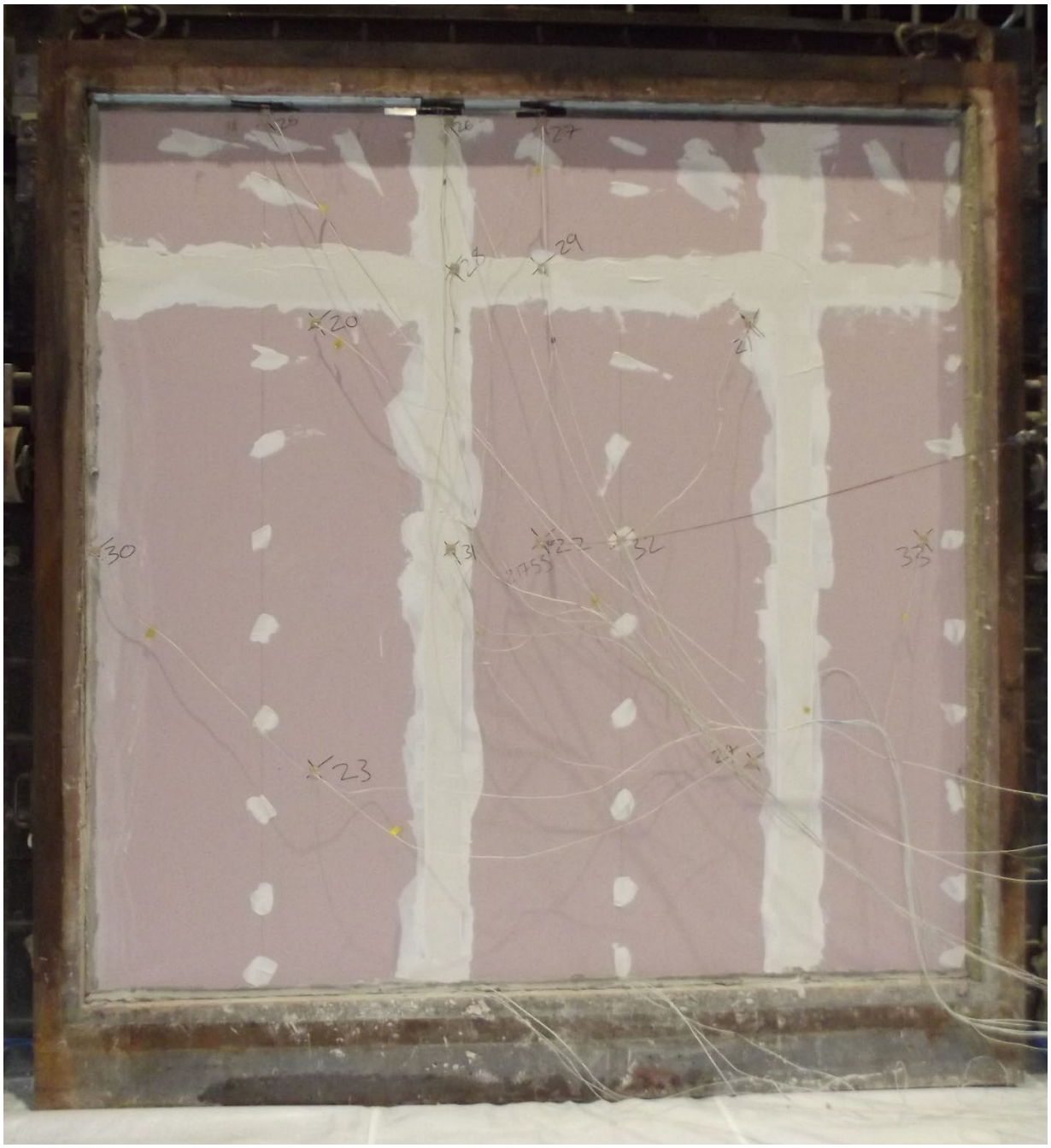
Unexposed Face Prior to Test



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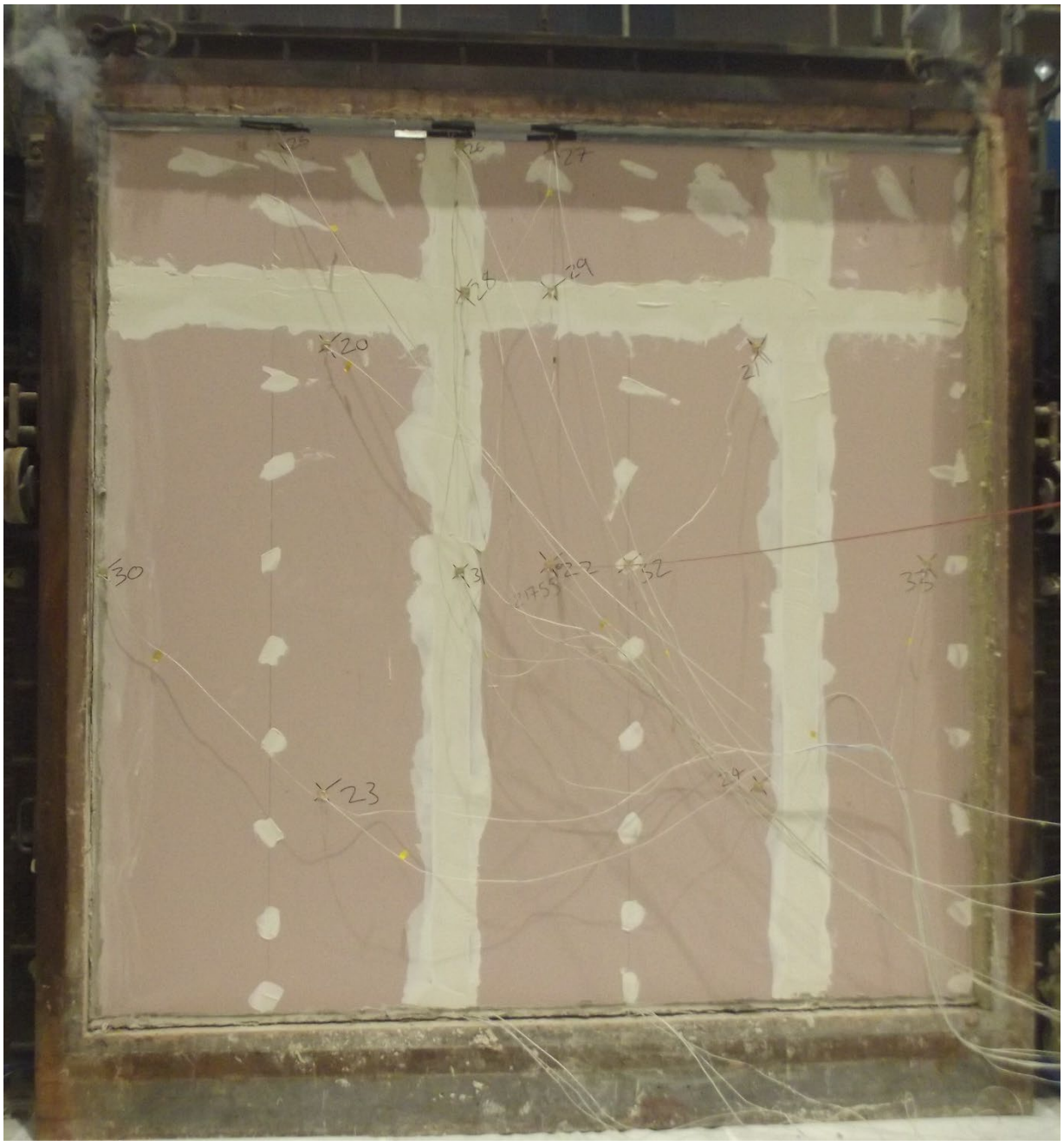
Unexposed Face at 30 Minutes



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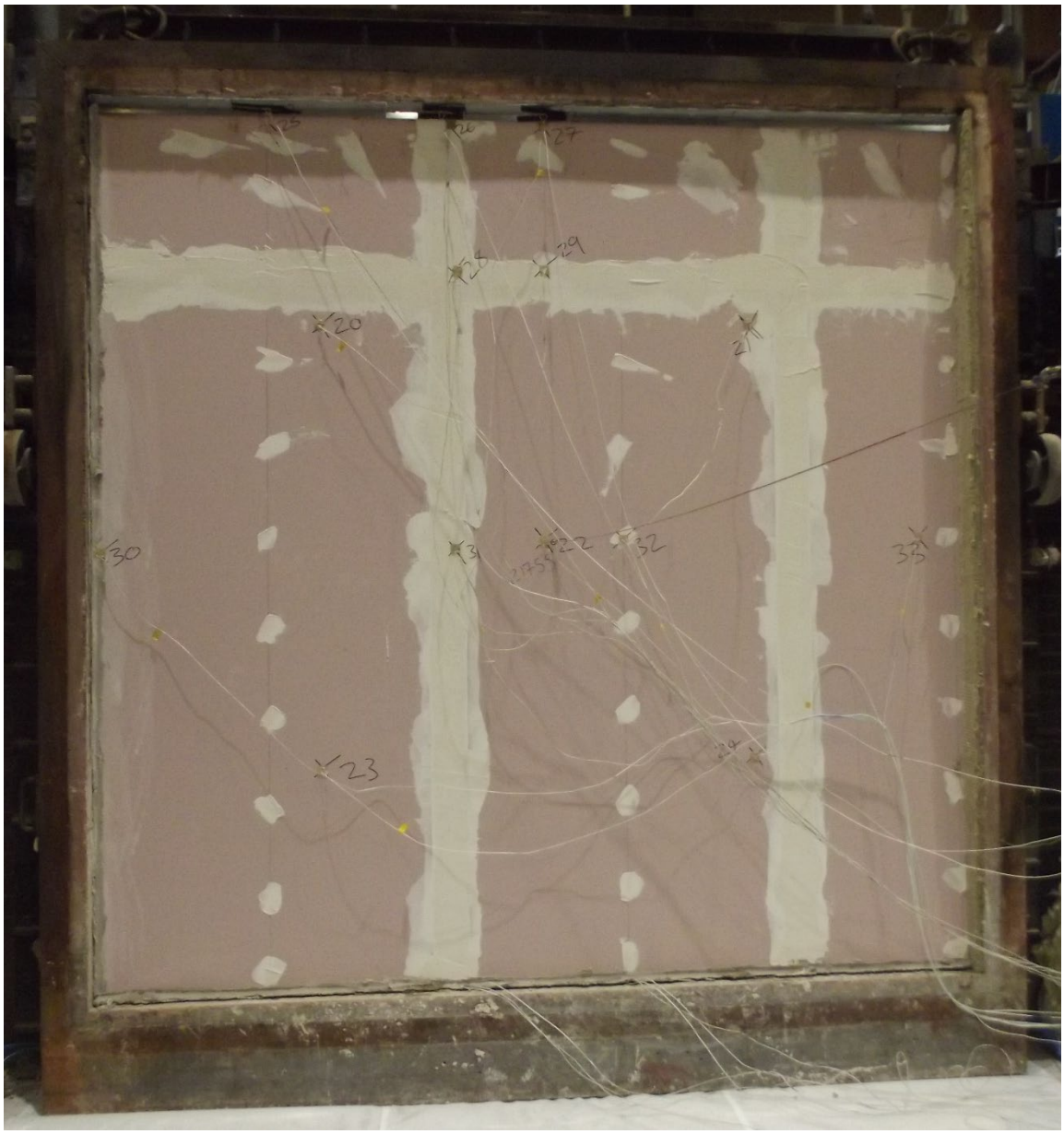
Unexposed Face at 1 Hour



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Unexposed Face at 1 Hour, 30 Minutes

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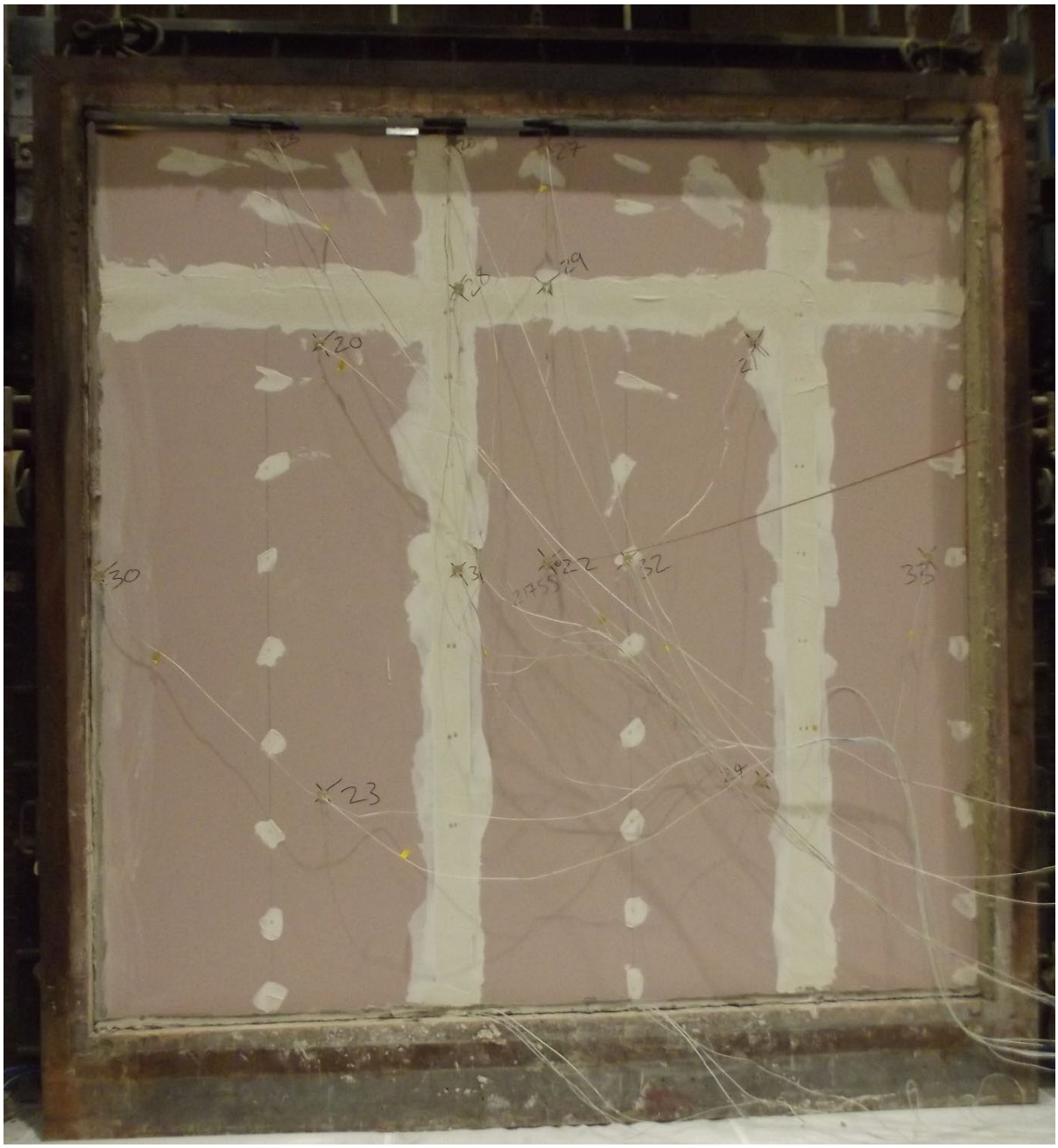
Unexposed Face at 2 Hours



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

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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 (minimum thickness 161.5 mm).

iii) Increase thickness of component materials (minimum Gypframe stud depth 100 mm, minimum Gypframe stud gauge 1.2 mm).

iv) Decrease in the linear dimensions of the boards but not thickness (≤2400 mm (long) x ≤ 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
≤ 100 mm	≤ 100 mm	≤ 100 mm	≤ 100 mm