

Report Number: **BTC 21016F**

A FIRE RESISTANCE TEST ON A GYPLYNER IWL METAL STUD PARTITION WITH 48MM STUD FRAMEWORK CLAD ON THE EXPOSED SIDE WITH A DOUBLE LAYER OF 12.5MM GYPROC FIRELINE WITH 50MM ISOVER STEEL FRAME INFILL BATT IN THE CAVITY AND GALVANISED STEEL CLADDING ON THE UNEXPOSED FACE, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1: 2015.

Test Date: 9th July 2019

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Loughborough
Leicestershire
LE12 6HX

Customer: **British Gypsum**

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FOREWORD

This test report details a fire resistance test conducted on a twin frame metal stud partition clad on the exposed face with a double layer of Gyproc FireLine incorporating 50 mm Isover Steel Frame Infill Batt in the cavity. The unexposed face metal stud framework was lined on the unexposed face with galvanized steel sheets.

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 2019. The Building Test Centre played no role in the design or selection of materials comprising the test specimen.

The test was witnessed by Mr Rob Evans and was conducted on the 9th July 2019.

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: 2012, section 12.1)

REPORT AUTHORISATION

Report Author



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Scientist

Authorised by



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TEST REPORT AMENDMENTS

Page	Amendments	Date

Report Amendments Author

Name
Role

Amendments Authorised by

Name
Role

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TEST CONSTRUCTION

Description of Construction

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

Gypframe 50FEC50 Folded Edge Standard Floor and Ceiling Channels were fixed to the head and base of the test aperture at 600mm centres using 60mm fire resistant fixings.

At the left-hand edge a Gypframe 48S50 'C' Stud was used to fix the partition to the test frame, using 60mm fire resistance fixings at 600mm centres.

Gypframe 48I50 'I' Studs were positioned at 600mm centres between the channels. The right hand stud viewed from the unexposed face was not fixed to the perimeter of the test frame.

A second framework was positioned 15mm adjacent to the first frame on the unexposed face side of the test frame. A 100mm wide x 25mm thick rock mineral fibre gasket was positioned on the web of the Gypframe 50FEC50 Folded Edge Standard Floor and Ceiling Channel and fixed to the head of the test aperture at 600mm centres using 60mm fire resistant fixings. The rock mineral fibre gasket was positioned such that a 50mm wide overhang was positioned on the unexposed face side of the channel.

A 100mm wide x 25mm thick rock mineral fibre gasket was positioned on the web of the Gypframe 50FEC50 Folded Edge Standard Floor and Ceiling Channel and fixed to the base of the test aperture at 600mm centres using 60mm fire resistant fixings. The rock mineral fibre gasket was positioned such that a 50mm wide overhang was positioned on the unexposed face side of the channel.

At the left-hand edge a Gypframe 48S50 'C' Stud was used to fix the partition to the test frame, using 60mm fire resistance fixings at 600mm centres.

Gypframe 48I50 'I' Studs were positioned at alternating 600mm/400mm centres between the channels to coincide with the troughs on the cladding panels. The right hand stud viewed from the unexposed face was not fixed to the perimeter of the test frame.

The gap between the right-hand studs in both frameworks and the frame lining was filled with a 25mm thick rock mineral fibre gasket.

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

50mm Isover Steel Frame Infill Batt was placed within the stud cavity of the framework on the exposed face of the test aperture.

The exposed face of the specimen was clad with a double layer of 12.5mm Gyproc FireLine. The inner layer boards were fixed with 25mm British Gypsum Drywall Screws at 300mm centres around the perimeter of the boards only. The outer layer boards were fixed with 35mm British Gypsum Drywall Screws at 300mm centres around the perimeter and within the field of the boards.

All vertical joints were staggered between layers, with a full board at the free end of the exposed face. A horizontal joint was positioned at 2400mm from the base on the outer layer boards and at 600mm from the base on the inner layer boards, on the exposed face of the specimen. A Gyproframe GFS1 Fixing Strap was used behind the horizontal outer layer board joint.

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

The unexposed face of the test specimen was clad with 3000mm long x 0.5mm thick 32/1000RR galvanised steel profile cladding sheet.

The sheeting was pushed into the rock mineral fibre gasket at the head and base of the specimen to inhibit convective air flow through the specimen cavity.

The steel sheet was fixed to all framing members through the troughs in the sheeting using 13mm British Gypsum Wafer Head Jack-Point Screws. The sheet was fixed to the head and base channels at approximately 200mm centres and to the vertical studs at 300mm centres. The sheets were joined together by overlapping the two adjacent sheets as shown in figure 3 and were fixed through both sheets into the vertical metal framework using 13mm British Gypsum Wafer Head Jack-Point Screws at 300mm centres.

Test Construction Drawings

Horizontal Cross Section

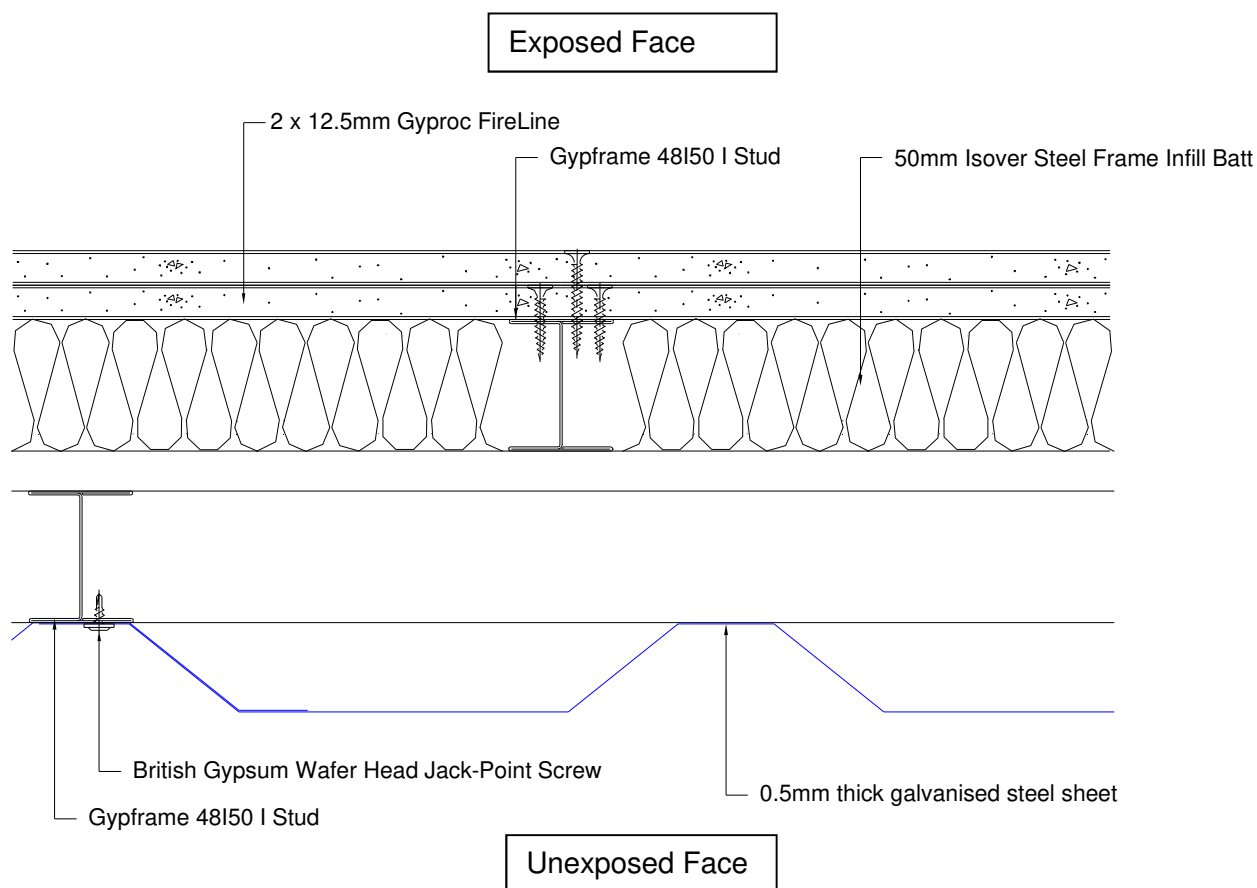


Figure 1 – Horizontal cross section.

Vertical Cross Section through the Head of the Test Specimen

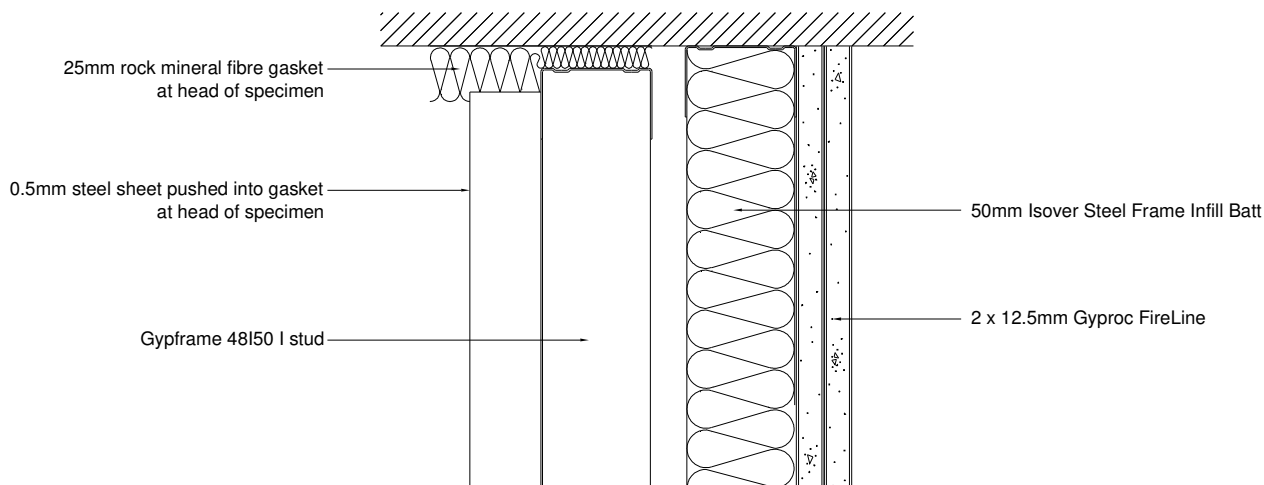


Figure 2 – Vertical cross section through the head of the test specimen.

Overlapping Detail for Steel Sheet

Unexposed face of specimen

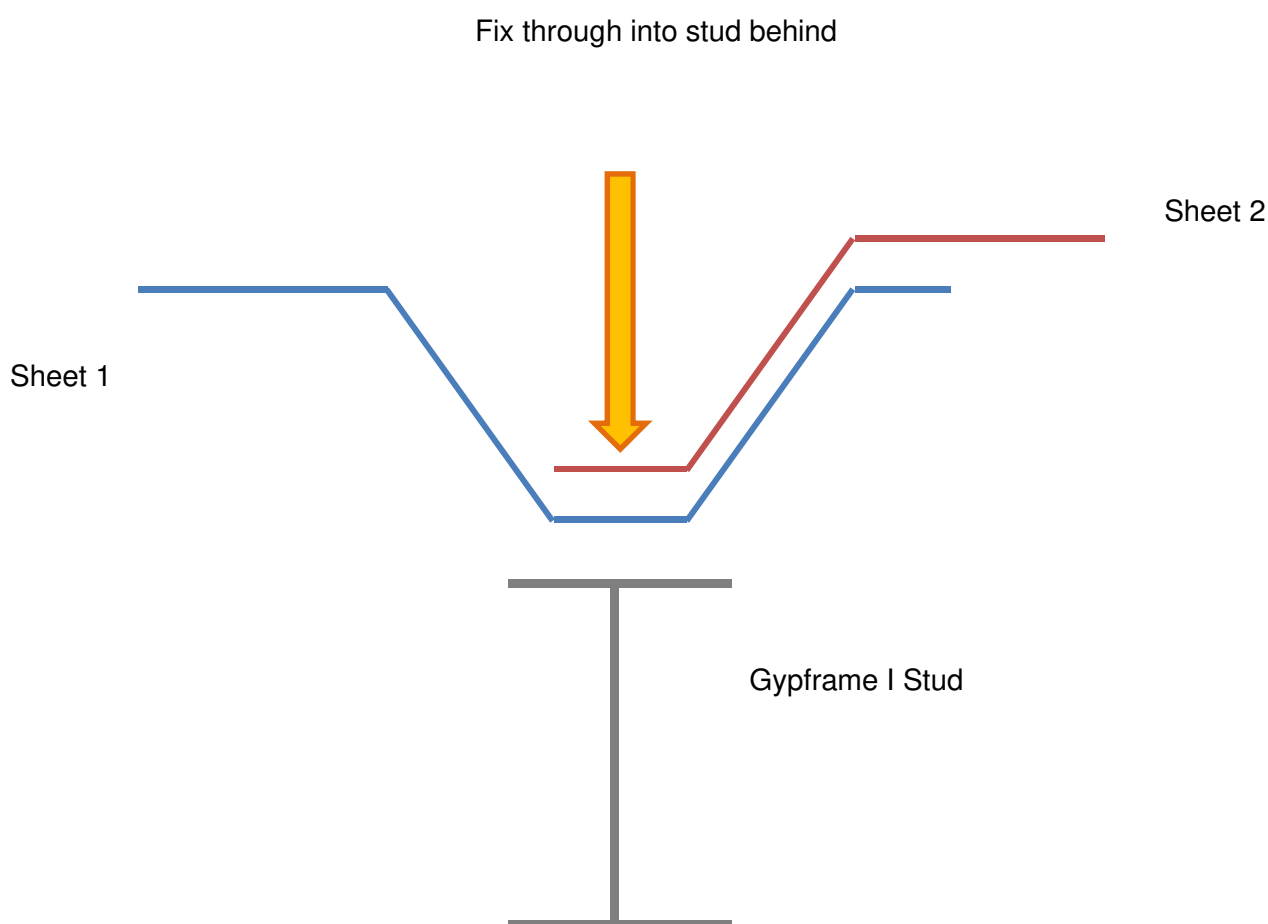
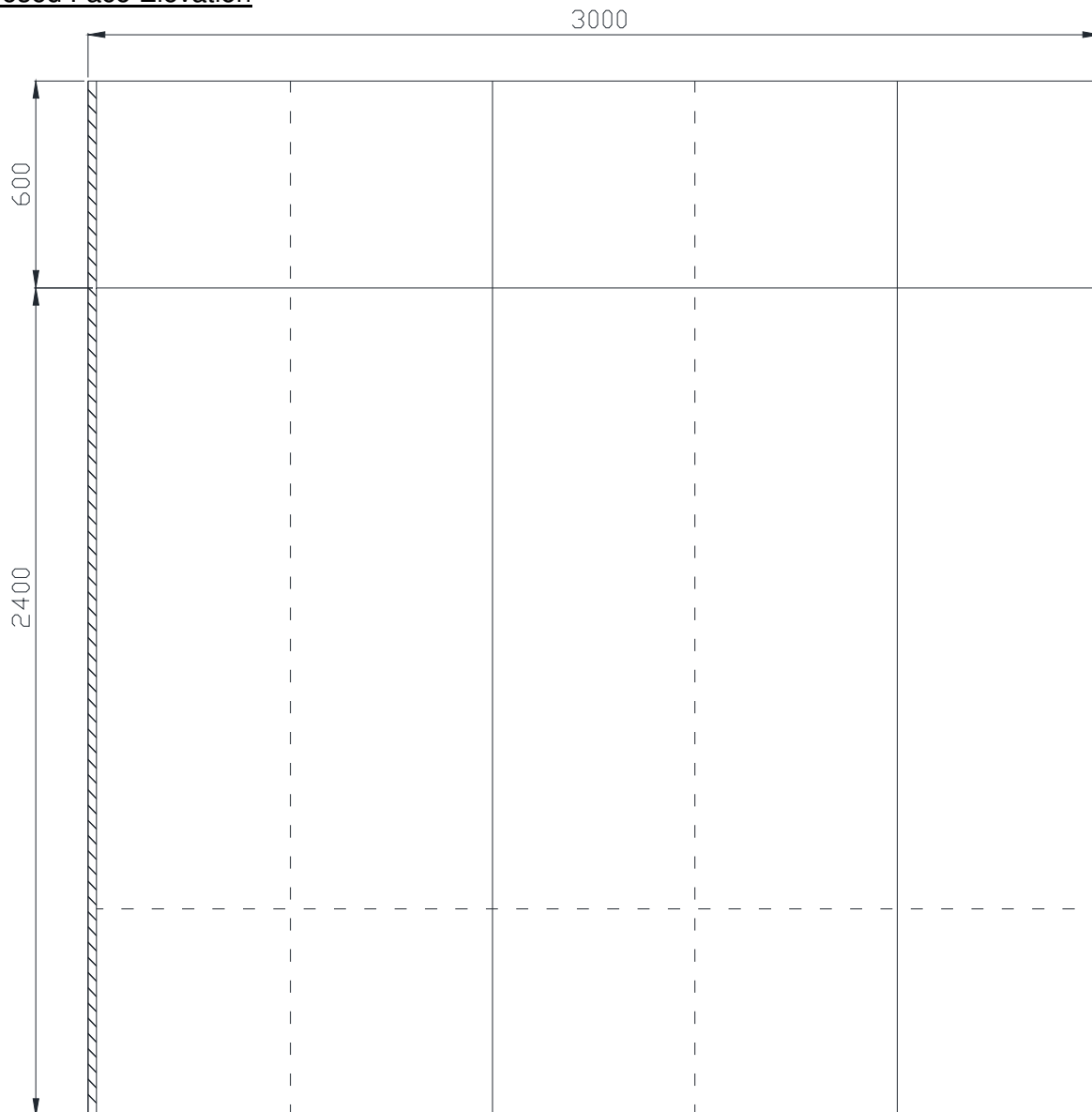


Figure 3 – Overlapping detail for steel sheet.

Exposed Face Elevation



Free
edge

- - - - Inner layer board joints

—— Outer layer board joints

Figure 4 – Exposed face elevation.

Unexposed Face Elevation

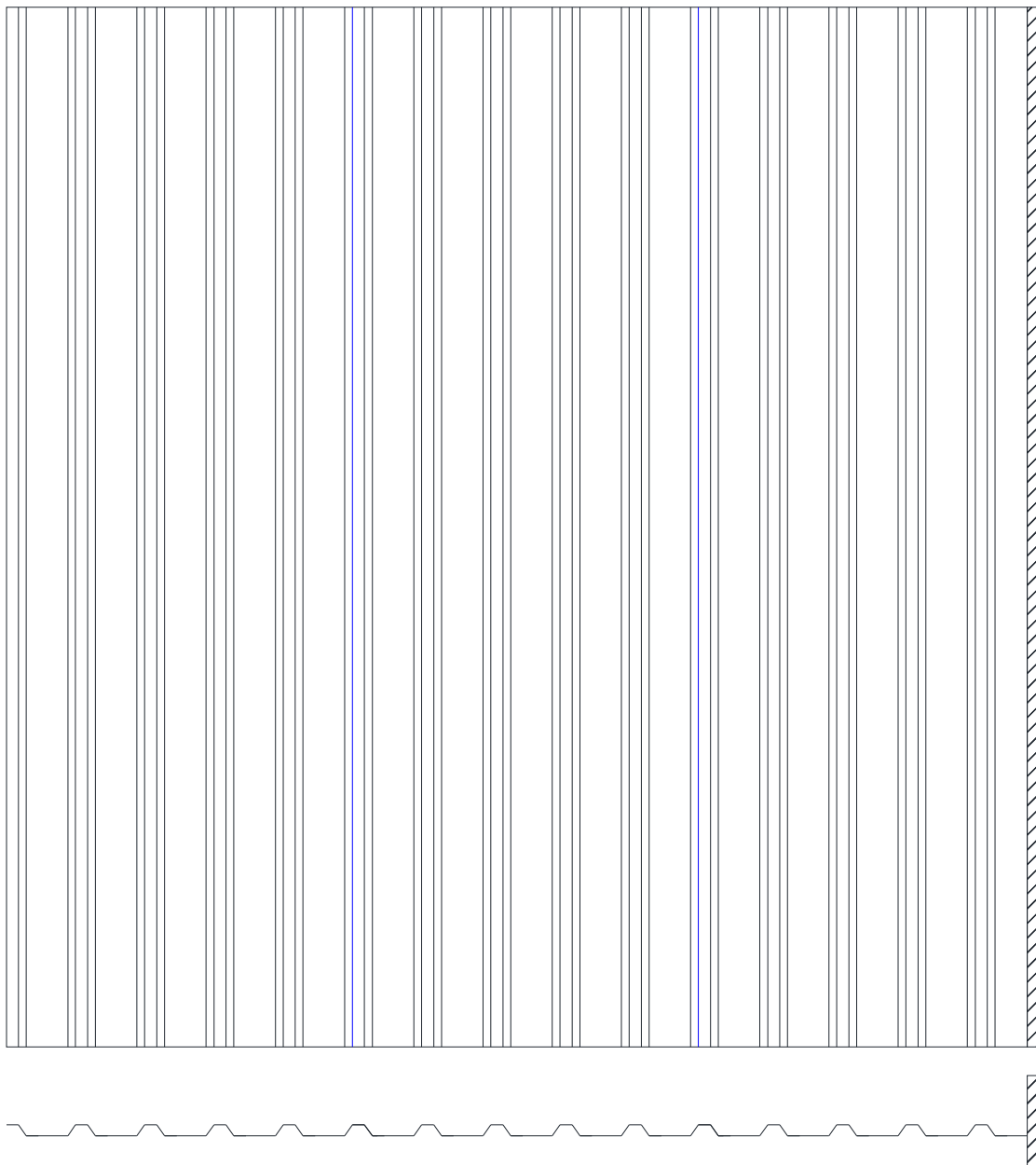


Figure 5 – Unexposed face elevation.

TEST MATERIALS

Plasterboard

- i) Nominally, 2400mm (long) x 1200mm (wide) x 12.5mm (thick), Gyproc FireLine (TE), manufactured and supplied by British Gypsum, ex Sherburn.

Measured mass per unit area:	9.8 kg/m ²
Measured thickness:	13.0 mm
Board identification numbers:	31 134 19 14:16 31 134 19 14:17 31 134 19 14:17
Measured moisture content:	1.07%

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

- ii) Gypframe 50FEC50 Standard Folded Edge Floor & Ceiling Channels.
- iii) Gypframe 48S50 'C' Studs.
- iv) Gypframe 48I50 'I' Studs.
- v) Gypframe GFS1 Fixing Strap.
- vi) Nominally 1000 mm (wide) x 0.5 mm (thick), 32/1000RR Galvanised Steel Profile Cladding Sheet.

All metal components were supplied by British Gypsum.

Fasteners

- vii) 13 mm British Gypsum Wafer Head Jack-Point Screws, supplied by British Gypsum.
- viii) 25 mm British Gypsum Drywall Screws, supplied by British Gypsum.
- ix) 35 mm British Gypsum Drywall Screws, supplied by British Gypsum.
- x) 60 mm fire resistant fixings, supplied by The Building Test Centre.

Miscellaneous Components

- xi) Gyproc Paper Joint Tape, supplied by British Gypsum.
- xii) Gyproc Joint Filler, supplied by British Gypsum.
- xiii) Rock mineral fibre gasket, Rockwool Firebatt 825, supplied by The Building Test Centre.

Insulation

- xiv) Nominally 50mm (thick) Steel Frame Infill Batt, manufactured and supplied by Saint-Gobain Isover.

Measured surface density: 1.043 kg/m²

Where measurements could not be taken then mass and dimensions were provided by the customer or the manufacturer e.g. from material labelling. Material information was 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 the steel panels 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 7**.

The test conditions did not meet the full requirements of BS EN 1363-1: 2012 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: 2012.

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	146 minutes.
Insulation		71 minutes.
Test Terminated		150 minutes, at the request of the sponsor.

LIMITATIONS

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

TEST DATA

Observations

All observations refer to the exposed face unless stated.

Observers: Unexposed face: Lindsey Watson
Exposed face: Alex Hardy

Time		Observations
Hours	Minutes	
0	00	Test started.
0	10	Jointing material was flaking away. Face papers had charred.
0	20	Left-hand vertical joint had opened up to approximately 1mm. Right-hand vertical joint had opened up to approximately 1mm. Horizontal joint had opened up to approximately 1mm.
0	30	Left-hand vertical joint had opened up to approximately 3mm. Right-hand vertical joint had opened up to approximately 2mm. Horizontal joint had opened up to approximately 2mm. <i>Unexposed face</i> No visible change.
0	40	Left-hand vertical joint had opened up to approximately 6mm. Right-hand vertical joint had opened up to approximately 4mm. Horizontal joint had opened up to approximately 3mm.
0	50	Left-hand vertical joint had opened up to approximately 8-9mm. Right-hand vertical joint had opened up to approximately 6mm. Horizontal joint had opened up to approximately 5mm. Boards had cracked around screw heads adjacent to all joints.

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Time		Observations
Hours	Minutes	
1	00	Left-hand vertical joint had opened up to approximately 11mm. Right-hand vertical joint had opened up to approximately 8mm. Horizontal joint had opened up to approximately 10-13mm. Boards were breaking around screw heads adjacent to joints. <i>Unexposed face</i> Right-hand vertical joint had discoloured from approximately 1700mm to 3000mm height.
1	10	Left-hand vertical joint had opened up to approximately 20mm. Right-hand vertical joint had opened up to approximately 15mm. Horizontal joint had opened up to approximately 15mm.
1	11	<i>Unexposed face</i> INSULATION FAILURE. The temperature rise of thermocouple no.30 positioned at head of specimen at approximately 600mm from fixed edge exceeded 180°C.
1	12	<i>Unexposed face</i> The mean temperature rise of the standard ten thermocouples exceeded 140°C.
1	20	Lower centre board had fallen into the furnace. Second layer was crazed.
1	27	<i>Unexposed face</i> Cotton pad attempt at approximately 2700mm height and 400mm from free edge – no failure.
1	29	<i>Unexposed face</i> Upper left-hand and centre panels changed colour from approximately 1000mm to 2700mm height.
1	30	The stud approximately 1000mm from the fixed edge had visibly warped and opened a gap to the steel clad layer. The second layer boards had begun to crack. <i>Unexposed face</i> Upper right-hand and centre panels changed colour from approximately 1800mm to 2700mm height.

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Time		Observations
Hours	Minutes	
1	40	Second layer left-hand vertical joint had opened up to approximately 20mm. Second layer right-hand vertical joint had opened up to approximately 60mm.
1	47	<i>Unexposed face</i> Fixed edge discoloured from approximately 600mm to 3000mm height.
1	48	<i>Unexposed face</i> Approximately 80% of centre panel had changed colour.
1	50	Second layer left-hand vertical joint had opened up to approximately 30mm. Second layer right-hand vertical joint had opened up to approximately 70mm.
1	54	<i>Unexposed face</i> Cotton pad attempt on fixed edge at head of specimen – no failure.
2	00	No visible change. <i>Unexposed face</i> No visible change.
2	10	Second layer left-hand vertical joint had opened up to approximately 35mm. Second layer right-hand vertical joint had opened up to approximately 80mm.
2	20	Second layer boards were severely crazed and were beginning to split.
2	26	<i>Unexposed face</i> INTEGRITY FAILURE. The cotton pad ignited (flamed) when placed approximately 1000mm from fixed edge and 600mm height.
2	30	TEST TERMINATED at the request of the sponsor.

Furnace Temperature Graph

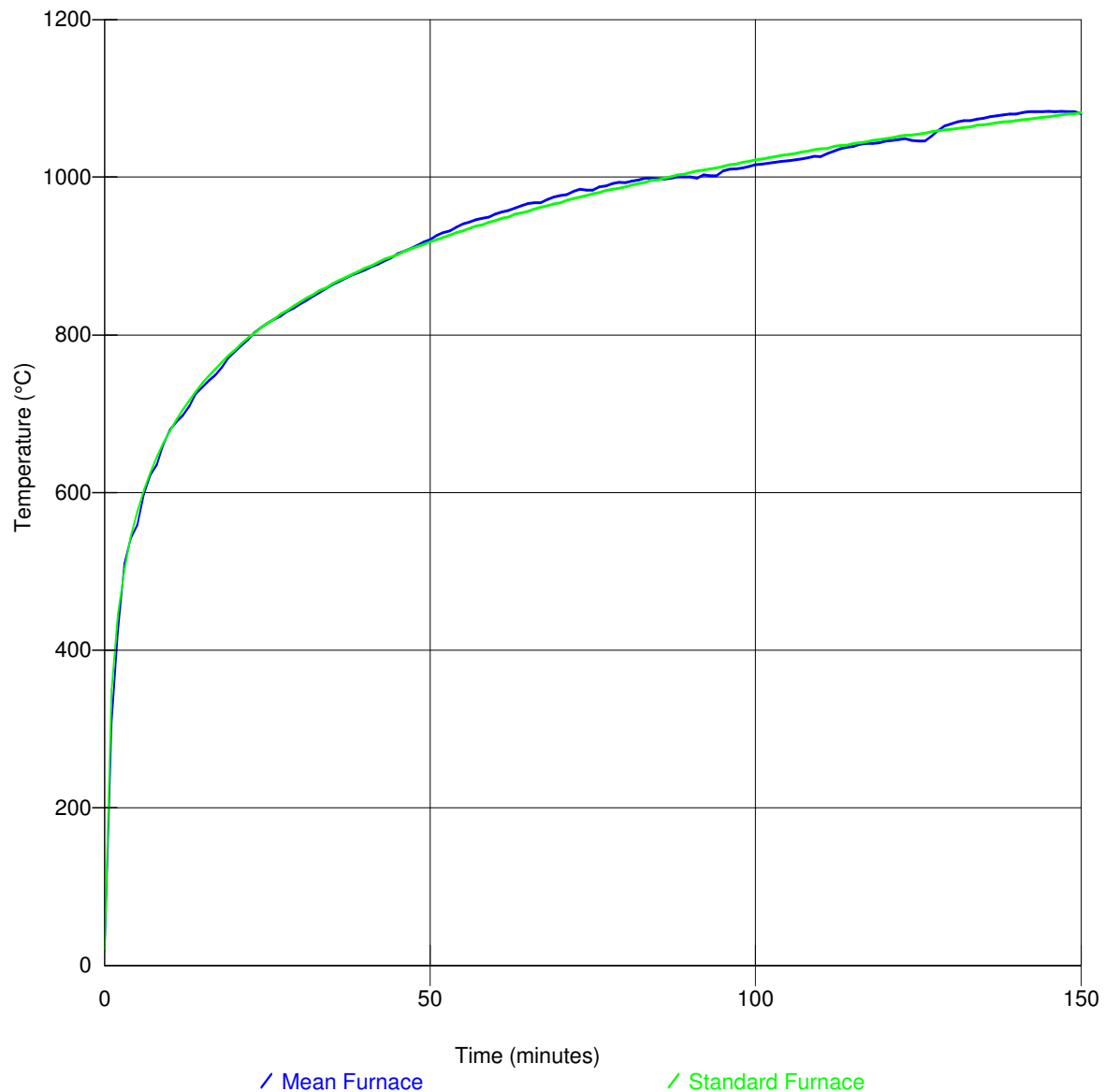


Figure 6 – Furnace temperature graph.

Furnace Pressure Graph

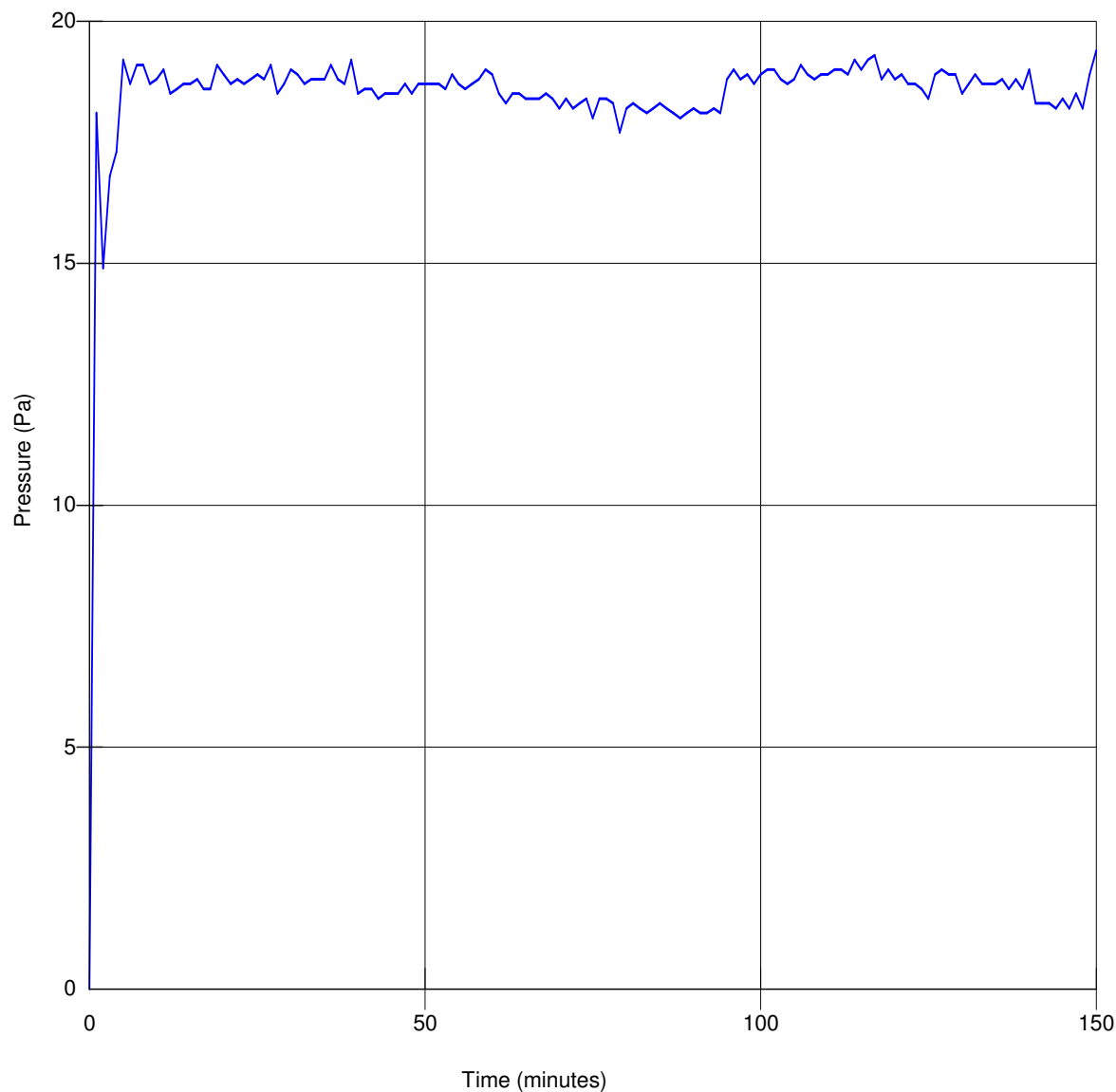


Figure 7 – Furnace pressure graph.

Unexposed Face Temperature Graph

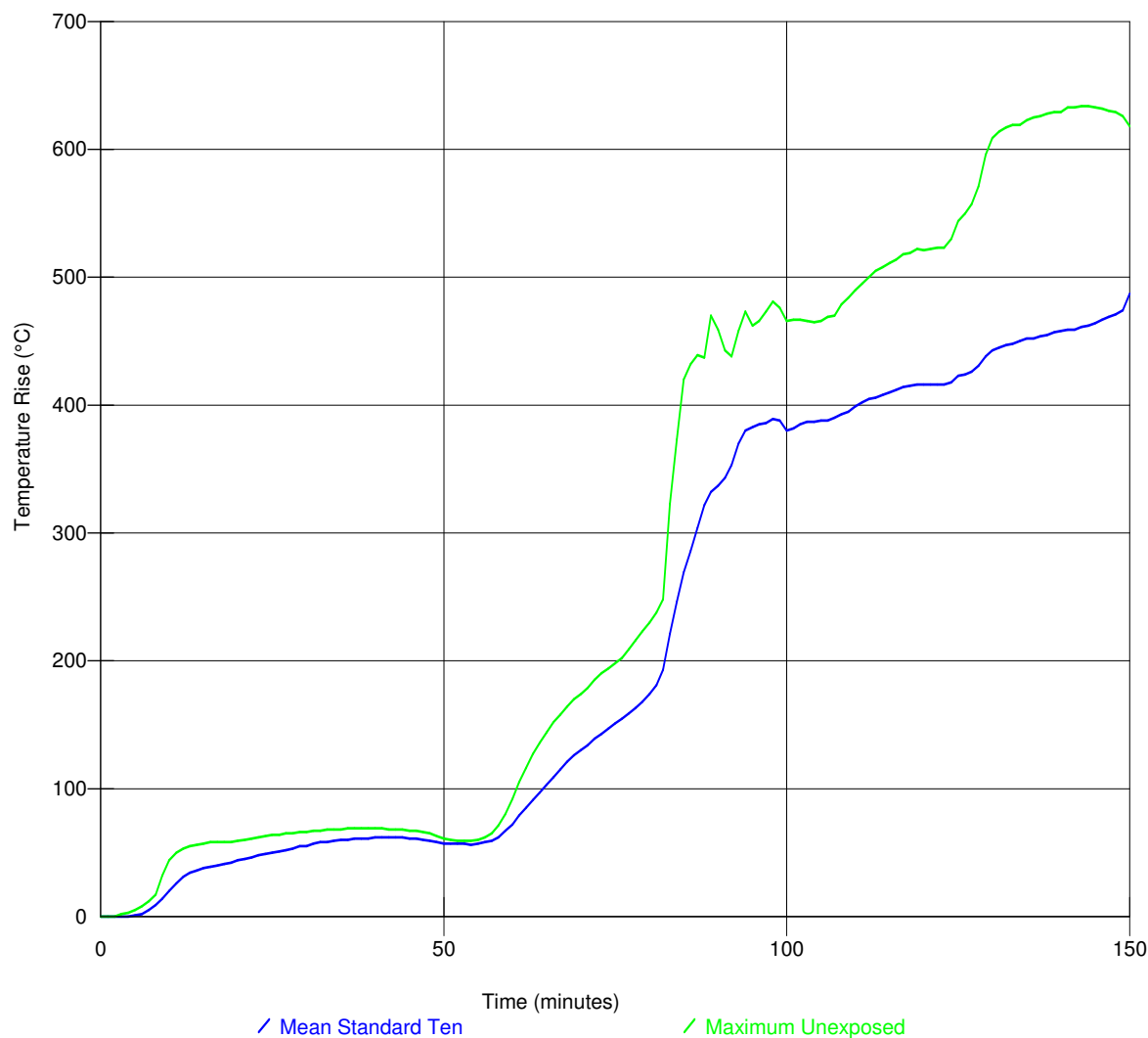


Figure 8 – Unexposed face temperature graph.

Unexposed Face Thermocouple Layout

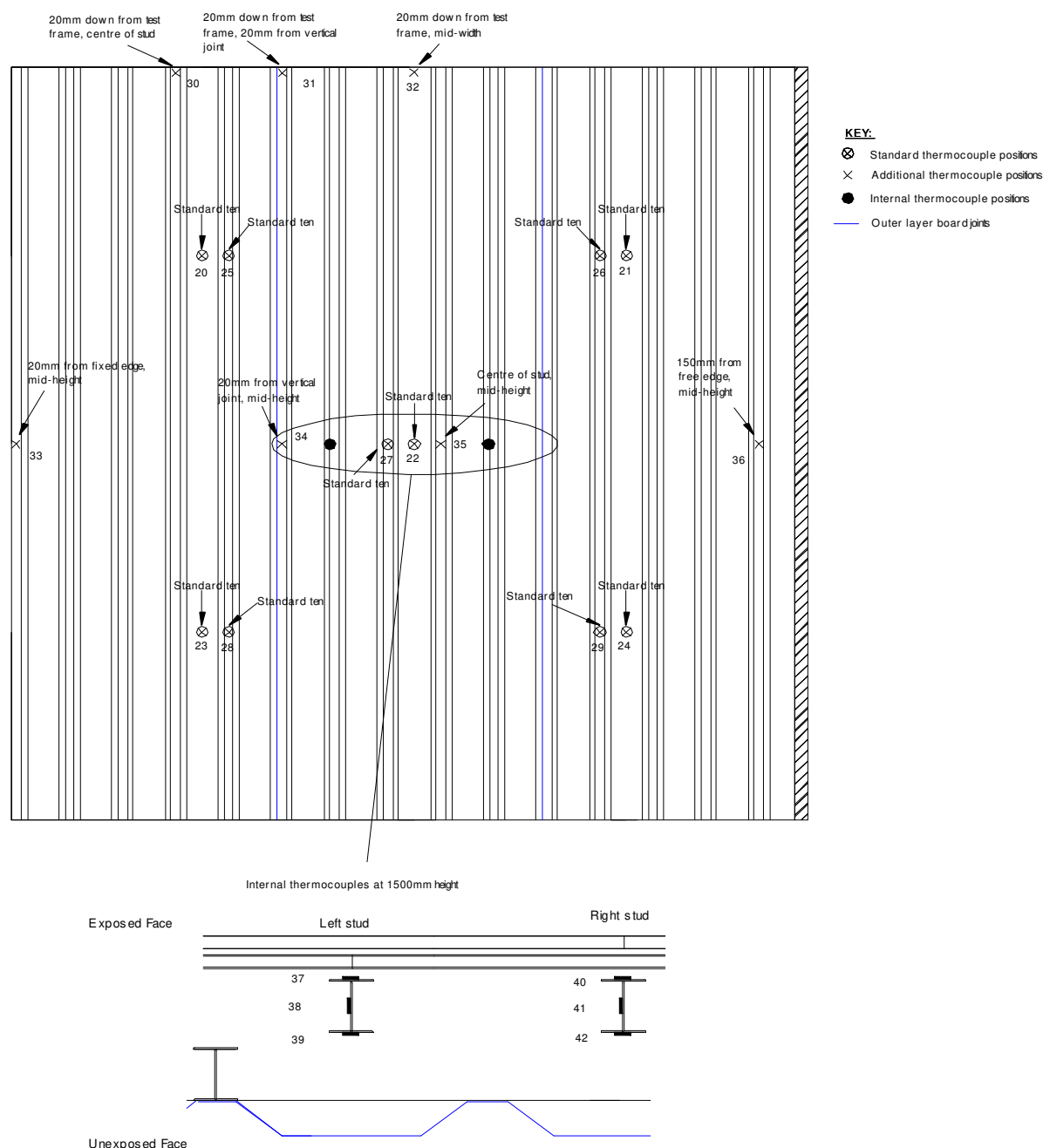


Figure 9 – Unexposed face thermocouple layout.

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Unexposed Face Standard Ten Temperature Data

Time (minutes)	Temperature Rise (°C)										Mean Standard Ten
	TC No.20	TC No.21	TC No.22	TC No.23	TC No.24	TC No.25	TC No.26	TC No.27	TC No.28	TC No.29	
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	1	0	1	1	1	1	0	1	1	1	1
6	3	1	1	2	2	3	1	1	2	1	2
7	7	4	4	6	3	7	3	3	6	3	5
8	13	9	8	10	6	13	8	7	10	5	9
9	19	17	14	15	9	18	14	12	15	8	14
10	24	26	20	21	13	24	20	18	21	12	20
11	30	34	28	28	18	30	26	24	27	16	26
12	34	40	33	32	23	34	32	29	31	20	31
13	38	44	37	34	26	38	35	32	33	23	34
14	41	46	40	35	29	41	38	35	35	25	36
15	43	47	42	36	31	43	39	37	36	26	38
16	46	48	44	37	32	45	41	38	36	27	39
17	47	49	45	38	33	47	42	39	37	28	40
18	48	50	46	38	34	48	43	40	38	29	41
19	50	51	47	39	35	49	44	41	39	30	42
20	52	53	48	41	37	51	45	43	40	31	44
21	53	54	50	42	38	53	46	44	42	32	45
22	54	55	51	44	39	54	48	45	43	33	46
23	56	57	53	45	41	55	49	46	45	35	48
24	57	58	54	47	42	56	50	48	46	36	49
25	58	58	55	48	44	57	51	49	48	37	50
26	58	59	56	50	45	58	51	50	49	38	51
27	59	60	57	51	46	59	52	50	50	40	52
28	60	61	58	52	47	60	53	51	51	41	53
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30	62	62	60	54	50	61	54	53	54	43	55
31	63	63	61	56	51	62	55	54	55	45	57
32	64	63	62	57	52	63	56	55	56	46	58
33	64	64	62	58	53	64	56	56	57	46	58
34	65	65	63	59	55	64	56	56	58	48	59
35	65	65	64	60	56	65	57	57	59	49	60
36	66	65	64	60	56	65	57	58	59	50	60
37	66	65	65	61	57	66	57	58	60	50	61

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Time (minutes)	Temperature Rise (°C)										Mean Standard Ten
	TC No.20	TC No.21	TC No.22	TC No.23	TC No.24	TC No.25	TC No.26	TC No.27	TC No.28	TC No.29	
38	66	65	65	62	57	66	57	58	61	51	61
39	66	65	65	62	58	66	57	58	61	52	61
40	67	65	65	62	58	66	57	59	61	52	62
41	67	65	65	62	59	66	57	59	62	53	62
42	67	65	65	62	59	66	57	59	62	53	62
43	66	65	65	62	59	66	57	58	62	53	62
44	66	65	65	62	59	66	57	58	61	53	62
45	65	64	64	61	59	65	56	57	61	53	61
46	65	64	64	61	59	65	56	58	61	53	61
47	64	63	63	60	58	64	56	57	60	53	60
48	63	62	62	60	57	63	55	56	59	52	59
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58	65	69	67	59	57	71	60	61	59	52	62
59	74	77	72	60	59	78	66	65	62	53	67
60	82	85	77	64	63	86	74	70	65	55	72
61	90	94	84	71	68	93	81	77	71	60	79
62	95	102	89	78	73	98	89	83	79	65	85
63	102	110	90	86	80	107	96	90	87	69	91
64	108	118	94	93	86	115	101	95	95	73	97
65	115	124	100	98	91	123	105	100	101	77	103
66	122	131	108	104	97	129	109	106	107	81	109
67	129	137	115	109	102	136	113	111	112	85	115
68	135	143	121	114	107	142	117	116	116	91	121
69	139	149	127	119	111	147	122	121	121	97	126
70	144	152	132	123	114	152	125	125	126	100	130
71	148	158	137	127	119	157	128	129	130	105	134
72	152	167	141	131	121	161	131	133	133	108	139
73	157	177	146	134	125	166	136	137	136	111	143
74	161	185	150	137	129	171	142	140	139	114	147
75	166	192	154	140	131	176	146	144	142	117	151
76	171	200	158	142	133	181	152	148	144	120	155
77	175	209	162	145	136	187	159	151	146	121	159

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Time (minutes)	Temperature Rise (°C)										Mean Standard Ten
	TC No.20	TC No.21	TC No.22	TC No.23	TC No.24	TC No.25	TC No.26	TC No.27	TC No.28	TC No.29	
78	180	216	166	146	138	192	165	155	149	124	163
79	186	223	172	150	140	199	167	160	152	126	168
80	195	230	179	155	144	207	165	167	158	128	174
81	204	238	187	162	148	217	158	175	166	131	181
82	227	248	196	172	153	247	160	184	178	136	193
83	323	265	214	186	161	308	169	197	194	142	221
84	373	277	237	204	173	369	182	213	216	153	246
85	387	292	283	216	185	420	198	240	232	162	269
86	387	320	329	210	201	432	214	293	225	178	286
87	390	359	365	210	216	439	228	351	218	191	304
88	391	407	389	215	228	437	-	407	221	204	322
89	384	423	401	229	239	432	-	434	235	215	332
90	373	418	400	253	247	426	-	427	269	224	337
91	364	408	394	283	251	420	-	420	315	233	343
92	365	399	396	312	257	420	-	418	371	237	353
93	369	387	404	358	267	424	-	422	458	242	370
94	371	389	409	405	273	427	-	423	473	246	380
95	372	392	411	435	275	427	-	422	462	247	383
96	372	393	412	437	282	425	-	423	466	256	385
97	371	391	414	442	287	424	-	423	473	252	386
98	373	388	416	452	295	421	-	426	481	245	389
99	378	389	404	447	303	431	-	410	476	250	388
100	356	387	393	438	309	411	-	401	466	255	380
101	360	388	391	438	314	413	-	403	467	261	382
102	367	388	392	438	320	420	-	406	467	266	385
103	372	385	392	437	326	423	-	407	466	271	387
104	373	384	392	437	332	423	-	405	465	275	387
105	373	382	389	439	336	421	-	404	466	278	388
106	373	380	388	441	338	420	-	402	469	281	388
107	378	379	387	443	342	423	-	402	470	286	390
108	382	378	386	451	344	426	-	401	479	287	393
109	386	378	385	456	347	428	-	400	484	292	395
110	395	380	386	462	349	430	-	401	490	294	399
111	402	380	387	469	351	432	-	402	495	298	402
112	409	380	390	475	351	436	-	404	500	300	405
113	409	381	391	479	351	437	-	404	505	300	406
114	411	381	392	483	352	439	-	406	508	302	408
115	415	383	393	485	352	442	-	408	511	304	410
116	417	384	396	489	350	445	-	409	514	304	412
117	418	385	397	492	351	446	-	411	518	306	414

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)										Mean Standard Ten
	TC No.20	TC No.21	TC No.22	TC No.23	TC No.24	TC No.25	TC No.26	TC No.27	TC No.28	TC No.29	
118	419	387	398	493	352	447	-	412	519	307	415
119	419	388	399	494	352	448	-	413	522	308	416
120	419	388	399	494	352	448	-	413	521	310	416
121	420	388	400	494	350	449	-	414	522	309	416
122	419	389	401	492	349	448	-	414	523	309	416
123	418	390	402	493	350	448	-	415	523	309	416
124	418	389	403	498	350	450	-	417	530	310	418
125	423	391	405	512	348	454	-	418	544	309	423
126	423	391	406	517	348	454	-	419	550	310	424
127	423	392	407	521	350	455	-	421	557	311	426
128	426	394	410	536	351	458	-	423	571	313	431
129	426	396	412	560	353	460	-	426	596	314	438
130	428	397	415	573	354	463	-	429	609	316	443
131	428	400	418	578	355	464	-	432	614	317	445
132	428	401	420	579	358	465	-	434	617	320	447
133	431	402	422	579	359	466	-	435	619	323	448
134	431	404	423	579	362	468	-	436	619	325	450
135	433	405	424	582	364	469	-	437	623	327	452
136	432	406	425	583	364	469	-	438	625	328	452
137	433	407	426	586	365	470	-	439	626	331	454
138	435	410	428	586	364	473	-	440	628	333	455
139	434	413	429	588	364	473	-	441	629	338	457
140	435	415	431	588	364	473	-	442	629	343	458
141	435	418	432	591	363	473	-	444	633	344	459
142	432	418	432	592	363	473	-	443	633	349	459
143	434	420	433	593	364	474	-	444	634	353	461
144	435	422	435	592	366	475	-	446	634	355	462
145	436	424	440	590	369	476	-	453	633	357	464
146	436	427	448	590	372	477	-	461	632	361	467
147	435	431	453	587	376	475	-	468	630	364	469
148	430	433	459	586	384	471	-	474	629	369	471
149	428	439	470	582	394	470	-	486	626	373	474
150	466	447	488	573	403	506	-	501	618	381	487

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

- Thermocouple broken due to equipment failure.

See **Figure 9** for the location of the thermocouples.

Customer: **British Gypsum**

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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	Thermocouple No. 34
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	2	0	0	0	0
4	3	0	0	0	0
5	5	0	1	0	1
6	8	3	2	1	2
7	12	8	7	3	5
8	17	13	16	7	9
9	23	18	32	13	14
10	29	26	44	19	18
11	35	37	50	26	23
12	43	45	53	31	27
13	48	50	55	34	30
14	51	52	56	37	33
15	52	54	57	39	35
16	54	55	58	40	36
17	54	55	58	41	37
18	55	56	58	42	38
19	56	56	58	44	39
20	56	56	59	45	41
21	57	57	60	47	42
22	59	58	61	49	43
23	60	60	62	50	45
24	61	61	63	51	46
25	62	62	64	52	47
26	63	63	64	53	48
27	63	63	65	55	49
28	64	64	65	56	50
29	65	64	66	57	51
30	65	65	66	58	52
31	66	66	67	59	53
32	66	66	67	59	54
33	66	67	68	60	55
34	67	67	68	61	56
35	67	67	68	61	57
36	67	67	69	62	58
37	68	68	69	62	59

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33	Thermocouple No. 34
38	68	68	69	63	59
39	68	68	69	63	59
40	68	68	69	63	60
41	68	68	69	63	60
42	68	68	68	64	60
43	67	68	68	63	60
44	67	67	68	63	60
45	66	66	67	62	59
46	66	66	67	62	59
47	65	65	66	61	58
48	65	64	65	60	57
49	63	62	63	59	56
50	61	61	61	59	55
51	60	59	58	58	54
52	58	58	58	57	54
53	58	57	57	57	53
54	58	57	57	57	54
55	58	58	58	57	54
56	60	59	60	57	55
57	63	60	64	58	56
58	70	63	71	58	58
59	80	67	80	58	61
60	92	72	87	58	64
61	105	79	95	61	67
62	116	87	102	69	73
63	127	86	108	77	81
64	136	94	114	83	89
65	144	105	120	89	96
66	152	115	125	94	102
67	158	125	130	98	108
68	164	133	134	102	114
69	170	141	140	106	119
70	174	147	143	110	123
71	179	152	148	113	128
72	185	158	155	117	132
73	190	162	163	120	136
74	194	167	171	124	140
75	198	172	178	127	144
76	202	177	184	130	147
77	205	182	190	133	151

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33	Thermocouple No. 34
78	209	187	196	136	155
79	212	193	201	139	159
80	218	200	204	143	164
81	226	211	204	147	171
82	241	232	213	153	182
83	262	253	235	166	197
84	283	269	247	179	212
85	297	281	259	196	231
86	305	290	269	209	263
87	310	296	282	220	328
88	322	299	297	228	418
89	330	300	307	234	470
90	334	298	309	238	459
91	333	298	307	240	443
92	335	297	318	243	438
93	339	297	328	246	444
94	342	298	337	251	447
95	345	300	341	255	447
96	348	306	341	258	446
97	351	319	340	261	447
98	357	339	344	263	451
99	364	356	340	265	444
100	362	363	341	264	430
101	359	363	333	263	430
102	358	359	326	265	432
103	360	356	323	269	432
104	363	353	321	274	431
105	365	350	319	280	430
106	365	348	318	287	429
107	367	347	317	293	430
108	370	346	319	299	432
109	371	347	322	305	432
110	373	349	326	310	434
111	374	351	330	317	436
112	375	351	333	329	439
113	376	352	337	342	441
114	378	354	338	361	444
115	378	355	341	382	447
116	378	357	342	393	450
117	378	358	343	400	452

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)				
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33	Thermocouple No. 34
118	379	360	344	406	453
119	380	361	344	404	455
120	380	362	344	398	456
121	381	362	345	396	456
122	382	363	343	394	457
123	383	362	345	394	458
124	383	363	345	393	459
125	384	363	345	393	461
126	385	364	346	394	462
127	388	366	348	392	464
128	389	366	349	395	467
129	389	366	350	395	470
130	390	367	351	396	472
131	389	370	352	396	475
132	389	371	353	397	476
133	390	372	354	397	477
134	391	373	356	398	478
135	392	374	356	399	478
136	393	375	357	398	479
137	393	377	358	398	480
138	394	377	358	399	482
139	395	379	359	399	482
140	395	380	362	401	483
141	395	384	365	402	484
142	396	387	367	404	484
143	397	391	370	406	484
144	398	395	373	407	485
145	401	399	375	410	487
146	401	401	379	411	488
147	402	404	384	411	490
148	403	404	392	410	490
149	404	407	403	410	494
150	414	414	445	414	503

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

See **Figure 9** for the location of the thermocouples.

Additional Unexposed Face Temperature Data

Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 35	Thermocouple No. 36
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	1	1
6	1	2
7	2	5
8	5	9
9	10	16
10	16	23
11	21	31
12	23	35
13	24	38
14	24	40
15	25	41
16	26	43
17	26	43
18	28	44
19	30	46
20	33	47
21	36	49
22	38	50
23	39	51
24	41	53
25	44	54
26	47	55
27	50	56
28	52	57
29	55	58
30	57	58
31	59	59
32	60	60
33	61	61
34	62	62
35	63	62
36	64	63
37	64	63

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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 35	Thermocouple No. 36
38	65	63
39	64	64
40	65	64
41	65	64
42	65	63
43	65	63
44	64	63
45	64	62
46	64	63
47	62	61
48	62	60
49	60	59
50	59	59
51	59	58
52	59	58
53	58	58
54	58	58
55	58	59
56	58	60
57	58	64
58	58	70
59	58	80
60	58	90
61	60	94
62	67	100
63	78	108
64	87	115
65	94	123
66	100	131
67	105	138
68	109	144
69	114	150
70	120	155
71	124	161
72	130	166
73	136	172
74	141	178
75	146	185
76	150	191
77	155	198

Customer: **British Gypsum**

BTC 21016F: Page 33 of 50



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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 35	Thermocouple No. 36
78	158	205
79	164	210
80	169	216
81	175	222
82	184	228
83	201	243
84	217	263
85	237	281
86	259	297
87	284	322
88	304	361
89	321	387
90	336	388
91	357	385
92	380	393
93	391	401
94	388	412
95	375	411
96	367	408
97	371	406
98	377	397
99	377	396
100	373	395
101	369	394
102	367	399
103	366	408
104	365	404
105	365	403
106	363	401
107	360	402
108	361	406
109	359	411
110	359	413
111	359	414
112	359	419
113	362	418
114	361	418
115	361	415
116	363	415
117	362	416

Customer: **British Gypsum**

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Time (minutes)	Temperature Rise (°C)	
	Thermocouple No. 35	Thermocouple No. 36
118	363	416
119	364	417
120	362	418
121	364	417
122	364	416
123	365	416
124	366	416
125	367	417
126	368	418
127	368	419
128	369	421
129	370	424
130	372	426
131	375	429
132	376	431
133	379	432
134	378	433
135	379	433
136	381	433
137	381	435
138	383	435
139	383	435
140	385	440
141	389	443
142	390	444
143	391	445
144	393	446
145	394	445
146	396	445
147	399	445
148	403	446
149	408	447
150	416	449

See **Figure 9** for the location of the thermocouples.

Customer: **British Gypsum**

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Internal Temperature Data on Exposed Face Studs at 1500 mm Height

Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42
0	29	27	26	29	27	25
1	31	27	26	32	27	26
2	33	28	26	36	27	26
3	42	31	26	41	27	26
4	69	50	30	48	28	26
5	75	63	40	57	31	27
6	80	66	48	68	36	28
7	85	68	54	79	43	31
8	89	70	58	87	52	37
9	93	73	62	93	60	45
10	95	75	66	98	67	53
11	98	78	70	102	73	60
12	100	80	73	103	77	66
13	101	82	75	103	80	70
14	102	83	77	106	82	73
15	103	84	78	108	83	75
16	104	85	79	111	84	76
17	105	86	79	115	85	77
18	107	87	81	120	87	78
19	109	89	82	126	89	80
20	111	91	84	131	90	82
21	113	92	86	136	91	83
22	116	92	87	140	91	84
23	119	93	87	145	92	85
24	123	93	88	150	92	86
25	128	94	89	155	93	87
26	132	95	89	160	94	88
27	136	95	90	165	94	88
28	140	96	91	170	95	89
29	143	97	91	174	96	90
30	146	98	92	179	97	90
31	149	99	92	184	98	91
32	153	100	93	190	99	92
33	156	101	93	197	99	92
34	161	102	94	206	101	93
35	166	103	93	215	102	93

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42
36	174	105	93	227	103	93
37	186	109	92	240	106	93
38	201	117	92	256	109	94
39	222	128	93	272	114	94
40	246	143	95	289	122	94
41	272	160	97	307	134	95
42	299	179	102	326	146	96
43	326	198	109	344	160	98
44	351	216	120	363	175	101
45	372	232	131	381	190	107
46	394	247	144	400	207	115
47	414	261	156	417	224	125
48	433	276	167	434	242	137
49	451	292	179	450	259	150
50	470	308	189	464	275	164
51	489	325	199	480	291	176
52	505	341	209	494	306	188
53	519	356	219	508	320	197
54	531	369	228	521	333	206
55	542	382	238	533	347	215
56	552	394	247	544	360	224
57	562	405	257	554	373	233
58	572	416	266	564	386	243
59	583	426	276	573	398	252
60	593	436	285	582	410	262
61	603	447	295	590	421	271
62	611	457	304	599	431	280
63	620	467	313	607	442	290
64	627	482	322	614	452	300
65	633	490	330	620	462	309
66	639	499	339	627	471	318
67	644	506	346	633	481	326
68	649	514	354	639	490	334
69	654	521	361	645	499	342
70	658	527	368	651	508	349
71	661	534	376	658	517	356
72	664	540	383	665	526	363
73	667	546	391	671	535	370

Customer: **British Gypsum**

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Time (minutes)	Actual Temperature (°C)					
	Left stud			Right stud		
	Hot Flange Thermocouple No. 37	Web Thermocouple No. 38	Cold Flange Thermocouple No. 39	Hot Flange Thermocouple No. 40	Web Thermocouple No. 41	Cold Flange Thermocouple No. 42
74	670	553	398	677	543	378
75	674	560	404	683	552	385
76	679	566	410	688	561	392
77	687	575	416	694	568	399
78	777	631	430	700	575	405
79	835	713	482	707	583	411
80	867	773	561	712	586	418
81	876	793	627	-	-	419
82	891	-	675	-	-	425
83	916	-	726	-	-	467
84	1016	-	772	-	-	491
85	-	-	799	-	-	507
86	-	-	-	-	-	532
87	-	-	-	-	-	555
88	-	-	-	-	-	574
89	-	-	-	-	-	591
90	-	-	-	-	-	595
91	-	-	-	-	-	-

- Thermocouple broken due to equipment failure.

See **Figure 9** for the location of the thermocouples.

Customer: **British Gypsum**

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Specimen Lateral Deflection

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

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Time (minutes)	Deflection (mm)
	Centre
38	-1
39	-1
40	-1
41	-1
42	-1
43	-1
44	-1
45	-1
46	-1
47	-1
48	-1
49	-1
50	-1
51	-1
52	-1
53	0
54	0
55	1
56	1
57	1
58	1
59	1
60	2
61	2
62	2
63	2
64	2
65	3
66	3
67	3
68	3
69	4
70	4
71	4
72	4
73	4
74	4
75	5
76	5
77	5

Customer: **British Gypsum**

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The Building Test Centre

Fire Acoustics Structures

The Building Test Centre

British Gypsum

East Leake

Loughborough

Leicestershire, LE12 6NP

Tel: (0115) 945 1564

Fax: (0115) 945 1562

Email: btc.testing@saint-gobain.com

Time (minutes)	Deflection (mm)
	Centre
78	6
79	6
80	7
81	7
82	7
83	9
84	10
85	11
86	12
87	10
88	11
89	11
90	11
91	12
92	12
93	12
94	11
95	11
96	12
97	12
98	12
99	12
100	12
101	12
102	13
103	13
104	13
105	13
106	13
107	13
108	13
109	13
110	13
111	13
112	13
113	13
114	13
115	13
116	13
117	13

Customer: **British Gypsum**

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Time (minutes)	Deflection (mm)
	Centre
118	13
119	13
120	13
121	13
122	13
123	13
124	13
125	13
126	13
127	13
128	13
129	13
130	13
131	13
132	13
133	13
134	13
135	13
136	13
137	13
138	13
139	13
140	13
141	13
142	13
143	13
144	13
145	13
146	13
147	13
148	13
149	13
150	13

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

Customer: **British Gypsum**

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PHOTOGRAPHS

Exposed Face Prior to Test



Customer: **British Gypsum**

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Unexposed Face Prior to Test



Customer: **British Gypsum**

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Unexposed Face at 30 Minutes



Customer: **British Gypsum**

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Unexposed Face at 1 Hour



Customer: **British Gypsum**

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Unexposed Face at 1 Hour, 30 Minutes



Customer: **British Gypsum**

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Unexposed Face at 2 Hours



Customer: **British Gypsum**

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



Customer: **British Gypsum**

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FIELD OF DIRECT APPLICATION

General

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

- i) Decrease in height.
- 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 in the linear dimensions of the panels but not thickness.
(Galvanised Steel Profile Cladding Sheet)
- vi) Decrease stud spacing for the Gyproc FireLine.
- vii) Decrease stud spacing for the Galvanised Steel Profile Cladding Sheet.
- viii) Decrease in fixing centres for the Gyproc FireLine.
- ix) Decrease in fixing centres for the Galvanised Steel Profile Cladding Sheet.
- x) 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
$\leq 100\text{mm}$	$\leq 100\text{mm}$	$\leq 100\text{mm}$	$\leq 100\text{mm}$