



# **The Building Test Centre**

**Fire Acoustics Structures**

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Report Number **BTC 13189F**

FULL SCALE FIRE RESISTANCE TEST ON A BRITISH GYPSUM CASOLINE MF SUSPENDED CEILING CLAD WITH A DOUBLE LAYER OF 15mm GLASROC FIRECASE S CONDUCTED IN ACCORDANCE WITH BS EN 1364-2: 1999.

Test Date: 21<sup>st</sup> January 2004

[www.btconline.co.uk](http://www.btconline.co.uk)

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East Leake  
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**Customer:** **British Gypsum Limited**

BTC 13189F: Page 1 of 24



0296

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## **TABLE OF CONTENTS**

<b><i>FOREWORD</i></b>	<b>3</b>
<b><i>REPORT AUTHORISATION</i></b>	<b>3</b>
<b><i>TEST CONSTRUCTION</i></b>	<b>4</b>
<b><i>TEST MATERIALS</i></b>	<b>8</b>
Glasroc FireCase s	8
Insulation Components	8
Metal Components	8
Fixings	9
Miscellaneous Components	9
<b><i>TEST PROCEDURE</i></b>	<b>10</b>
<b><i>TEST RESULTS</i></b>	<b>10</b>
<b><i>LIMITATIONS</i></b>	<b>11</b>
<b><i>TEST DATA</i></b>	<b>12</b>
Observations	12
Furnace Temperature Graph	14
Furnace Pressure Graph	15
Unexposed Face Temperature Graph	16
Unexposed Face Thermocouple Layout	17
Unexposed Face Standard Five Thermocouple Data	18
<b><i>PHOTOGRAPHS</i></b>	<b>20</b>
<b><i>FIELD OF DIRECT APPLICATION</i></b>	<b>24</b>



## FOREWORD

This test report details a full scale fire resistance test on a suspended ceiling. The test sponsor was British Gypsum Limited.

The test specimen was installed by the British Gypsum Limited. The construction of the specimen took place between the 19<sup>th</sup> and 20<sup>th</sup> January 2004. British Gypsum Limited designed and selected the materials comprising the test specimen.

The test was carried out on the 21<sup>st</sup> January 2004.

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, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in EN 1364-2 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.

## REPORT AUTHORISATION

Report Author

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Authorised by

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## TEST CONSTRUCTION

The specimen was constructed in a refractory concrete lined steel restraint frame having an opening of 4000mm long x 3000mm wide.

Two 254mm x 146mm x 31kg/m structural steel I beams were positioned at 1200mm centres, approximately 900mm from the frame edge, spanning the 4000mm length of the test frame.

Gypframe MF6A Perimeter Channel was fixed around the perimeter of the restraint frame, approximately 200mm below the steel I beams, using 60mm fire resistant fixings at 600mm centres.

Gypframe MF12 Soffit Cleats were bolted to the underside of each I beam at 1200mm centres (forming 1200mm x 1200mm grids).

Gypframe MF8 Strap Hanger was fixed to each Gypframe MF12 Soffit Cleat using a Gypframe MF11 Nut and Bolt.

The primary grid was formed using Gypframe MF7 Support Channels fitted on the top flange of the Gypframe MF6A Perimeter Channel at 1200mm centres, running parallel to (and directly below) the I beams. The Gypframe MF7 Support Channels were extended by overlapping two sections by 150mm and fixing together with two Gypframe Wafer Head Jack-Point Screws.

The Gypframe MF7 Support Channel was fixed to each section of Gypframe MF8 Strap Hanger using two Gypframe Wafer Head Jack-Point Screws.

The secondary grid was formed below and perpendicular to the primary grid using Gypframe MF5 Ceiling Section at 450mm centres. The grids were joined together using Gypframe MF9 Connecting Clips.

The ceiling consisted of a double layer of 15mm Glasroc FireCase s screw fixed to the Gypframe MF5 Ceiling Section as follows:

The inner layer was fixed at 234mm centres (6 fixings per board width) within the field of the board, at 225mm centres along the long edge of the ceiling perimeter and at 234mm centres along the short edge of the ceiling perimeter with 25mm Gyproc drywall screws.

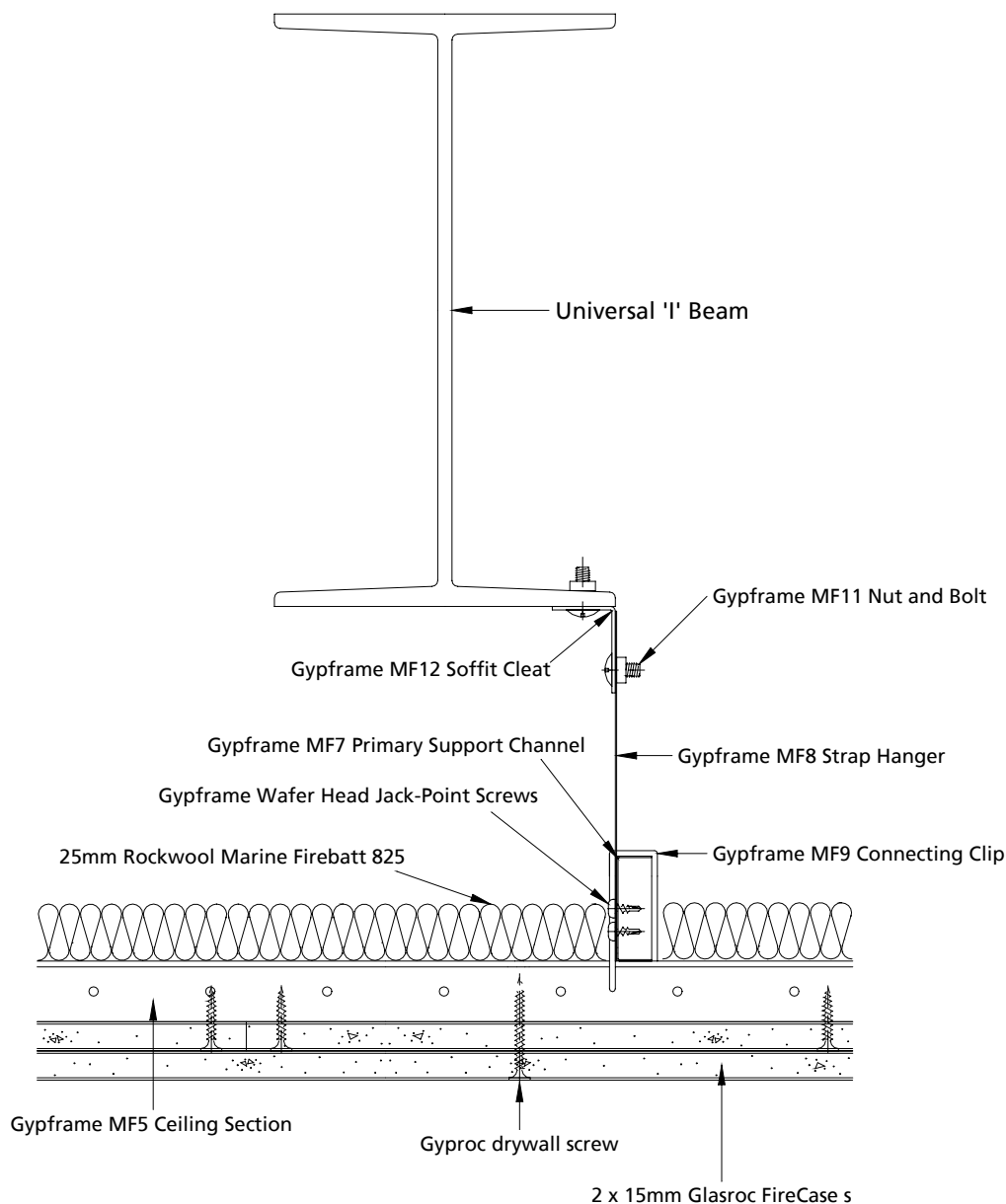
The outer layer was fixed at 234mm centres (6 fixings per board width) within the field of the board, at 225mm centres along the long edge of the ceiling perimeter and at 234mm centres along the short edge of the ceiling perimeter with 42mm Gyproc drywall screws.

Customer: **British Gypsum Limited**

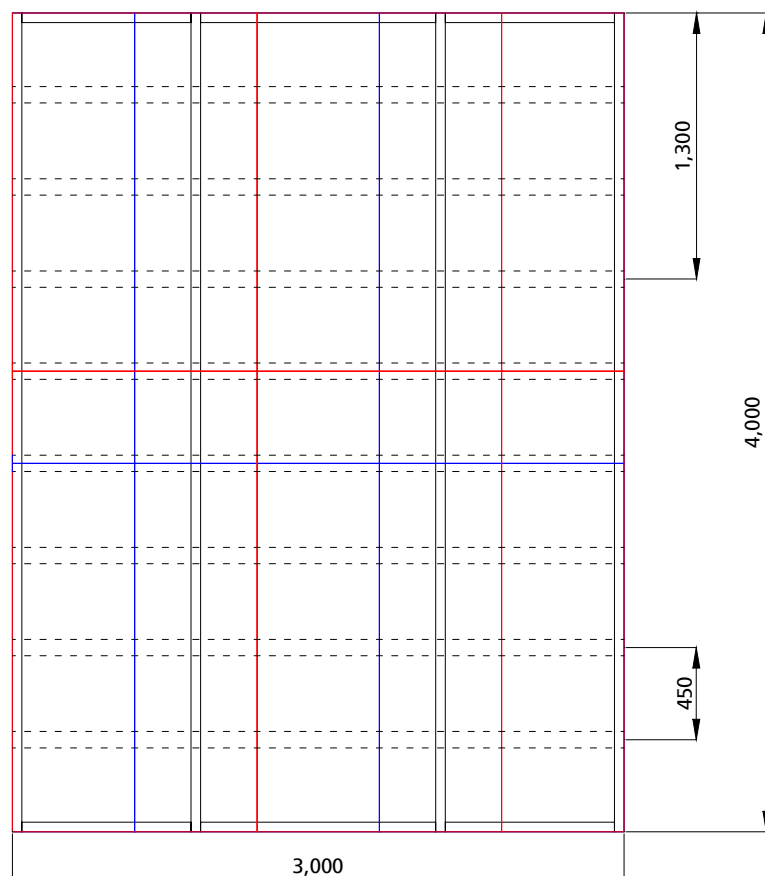
All joints were staggered between layers and all board ends coincided with the Gypframe MF5 Ceiling Sections.

25mm thick Rockwool Marine Firebatt 825 was laid on top of the Gypframe MF5 Ceiling Sections and the joints coincided with the Gypframe MF5 Ceiling Sections.

All joints were finished using Gyproc Tape and Gyproc Joint Filler. All screw heads were spotted using Gyproc Joint Filler.



**Figure 1.** Cross-section of specimen showing British Gypsum CasoLine MF detail.



- Inner Layer board positions
- Outer Layer board positions
- - - Gypframe MF5 Ceiling Section
- ==== Gypframe MF6A Perimeter Channel &  
Gypframe MF7 Primary Support Channel

**Figure 2.** Board and ceiling grid layout.

*The descriptions of individual components making up the test specimen were provided by the customer and were checked for accuracy wherever possible.*



## TEST MATERIALS

### Glasroc FireCase s

Nominally, 2400mm (long) x 1200mm (wide) x 15mm (thick), Glasroc FireCase s manufactured and supplied by British Gypsum Limited, ex Sherburn works.

Actual surface density:	12.83kg/m <sup>2</sup> .
Actual density:	853.3kg/m <sup>3</sup>
Actual thickness:	15.04mm.
Board identification numbers:	28.10.03 Shift B Stack no. 2696
Actual moisture content:	0.35%

The surface density was calculated using the actual weight and size of a selection of the boards used in the test specimen. The moisture content of the board used in construction was established from measurements made using samples dried to a constant weight in an oven at 40°C.

### Insulation Components

Nominally, 900mm (long) x 600mm (wide) x 25mm (thick), Rockwool Marine Firebatt 825, manufactured by Rockwool Limited and supplied by Sheffield Insulations Group plc.

Actual density:	104.4kg/m <sup>3</sup>
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The density was calculated using the actual weight and size of a selection of the insulation used in the test specimen.

### Metal Components

- i) Gypframe MF6A Perimeter Channel. Manufactured from galvanised mild steel.
- ii) Gypframe MF5 Ceiling Section. Manufactured from galvanised mild steel.
- iii) Gypframe MF7 Primary Support Channel. Manufactured from galvanised mild steel.
- iv) Gypframe MF8 Strap Hanger. Manufactured from galvanised mild steel.
- v) Gypframe MF9 Connecting Clip. Manufactured from galvanised mild steel.
- vi) Gypframe MF12 Soffit Cleat. Manufactured from galvanised mild steel.
- vii) Structural steel I beams.

All metal components, except vii) were supplied by British Gypsum Limited.





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## Fixings

- i) 25mm Gyproc drywall screws supplied by British Gypsum Limited.
- ii) 42mm Gyproc drywall screws supplied by British Gypsum Limited.
- iii) 13mm Gypframe Wafer Head Jack-Point Screws supplied by British Gypsum Limited.
- iv) Gypframe MF11 Nuts and Bolts supplied by British Gypsum Limited.
- v) 60mm fire resistant fixings.

## Miscellaneous Components

- i) Gyproc Joint Filler supplied by British Gypsum Limited.
- ii) Gyproc Paper Tape supplied by British Gypsum Limited.

Customer: **British Gypsum Limited**





## **TEST PROCEDURE**

The test was conducted fully in accordance with BS EN 1364-2: 1999. The asymmetrical specimen was subjected to fire from the underside (plasterboard side) this being the required direction of fire resistance as specified in BS EN 1363-1: 1999.

The test procedure used was EN 1364-2 Issue 1.

The ambient temperature at the commencement of the test was 16°C.

The furnace pressure was set to control at  $18 \pm 2$  Pa positive with respect to atmosphere, 100mm below the underside of the specimen, except during the first 5 minutes of the test.

The allowable tolerances are  $\pm 5$  Pa from 5 minutes to 10 minutes and  $\pm 3$  Pa from 10 minutes onwards. It is of the opinion of the laboratory that the variations in the furnace pressure exceeding the tolerances stated in BS EN 1363-1:1999 have not unduly influenced the results of this test. The furnace pressure graph is on page 15.

The test conditions did not meet the full requirements of BS EN 1363-1: 1999 as the test frame stiffness did not fully comply. The test centre is of the opinion that these deviations from the documented method will not unduly effect the result of the test.

## **TEST RESULTS**

The requirements of the standard were satisfied for the following periods:

Integrity- Sustained flaming	71 minutes	No failure (test discontinued)
Integrity- 25mm gap gauge	71 minutes	No failure (test discontinued)
Integrity - 6mm gap gauge	71 minutes	No failure (test discontinued)
Integrity- Cotton pad	71 minutes	
Insulation	71 minutes	By virtue of integrity

The test was terminated at 71 minutes.

## LIMITATIONS

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.



## TEST DATA

### Observations

Observers: Unexposed face R Evans and L Cooper  
Exposed face P Cao

Time		Observations
hrs	mins	
		All observations refer to the exposed face unless otherwise stated.
	0	Test started.
	5	The boards had started to char and the jointing material had started to fall into the furnace.
	10	All the jointing material had fallen into the furnace.
	15	All longitudinal board joints had opened to approximately 1mm.
	20	All longitudinal board joints had opened to approximately 2mm.
	25	All longitudinal board joints had opened to approximately 2-3mm.
	30	All longitudinal board joints had opened to approximately 3mm.
	35	No visible change in the specimen.
	40	No visible change in the specimen.
	45	No visible change in the specimen.
	50	No visible change in the specimen.
	55	No visible change in the specimen.
1	00	All longitudinal board joints had opened to approximately 3-4mm. The boards adjacent to the left-hand longitudinal joint, approximately 2000mm from the viewing platform, had sagged into the furnace by approximately 30-40mm.

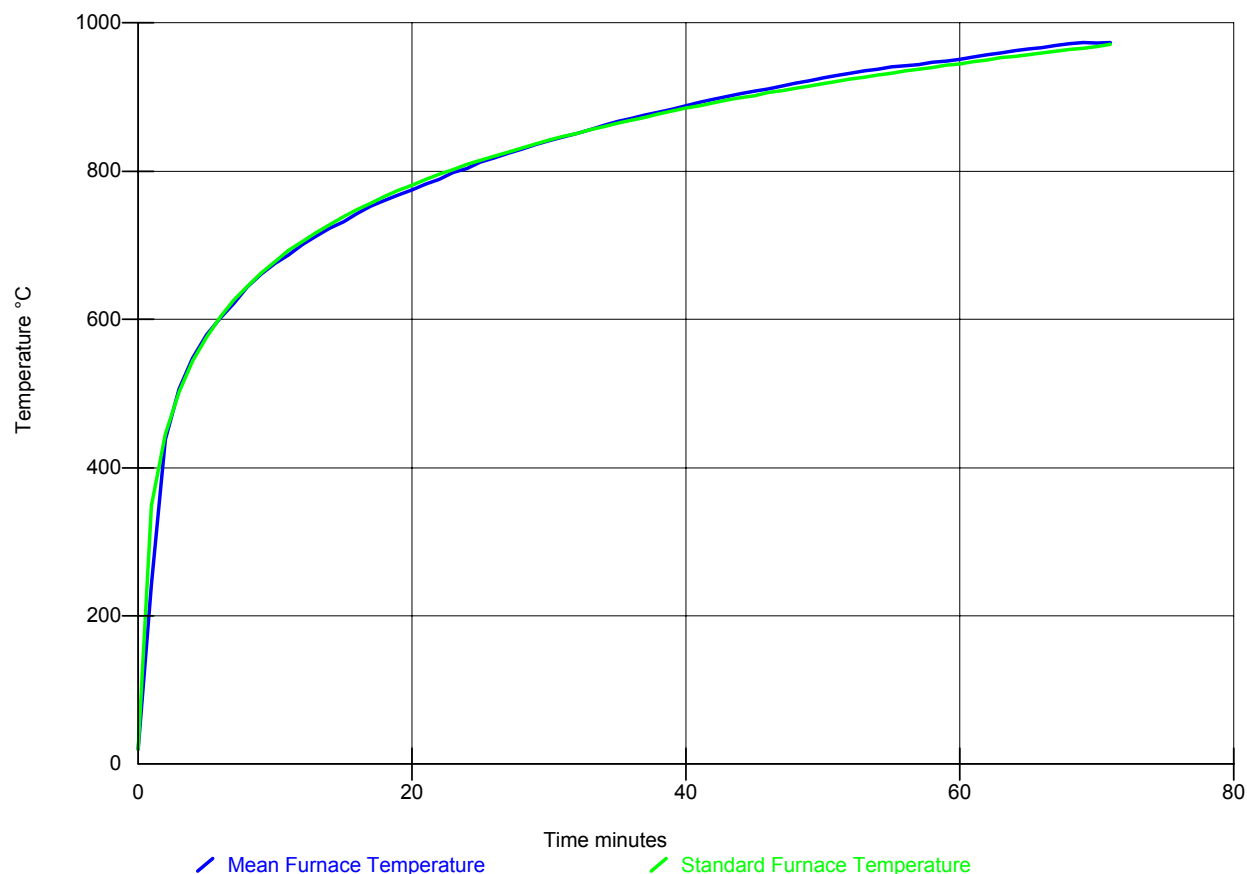
Customer: British Gypsum Limited



Time		Observations
hrs	mins	
1	05	<p>All observations refer to the exposed face unless otherwise stated.</p> <p>The left-hand longitudinal board joint had opened by approximately 5mm. The right-hand longitudinal board joint had opened by approximately 3-4mm.</p> <p>The left-hand corner of the first row centreboard adjacent to the lateral board joint fell into the furnace.</p> <p><i>Unexposed face</i></p> <p>The insulation slabs had started to discolour in line with the inner layer board joints.</p>
1	08	<p><i>Unexposed face</i></p> <p>A glow was visible between the insulation slab and the metal framework approximately 1600mm from the viewing platform and 900mm from the left-hand side of the specimen.</p> <p>The metal framework had started buckle at the same position.</p>
1	10	<p>A section, approximately 800mm x 1200mm, of the first row centreboard adjacent to the lateral board joint had fallen into the furnace.</p>
1	11	<p><i>Unexposed face</i></p> <p><b>INTEGRITY FAILURE.</b> The cotton pad glowed when placed approximately 1600mm from the viewing platform and approximately 900mm from the left-hand side of the specimen.</p> <p><b>TEST TERMINATED</b> at the request of the customer.</p>



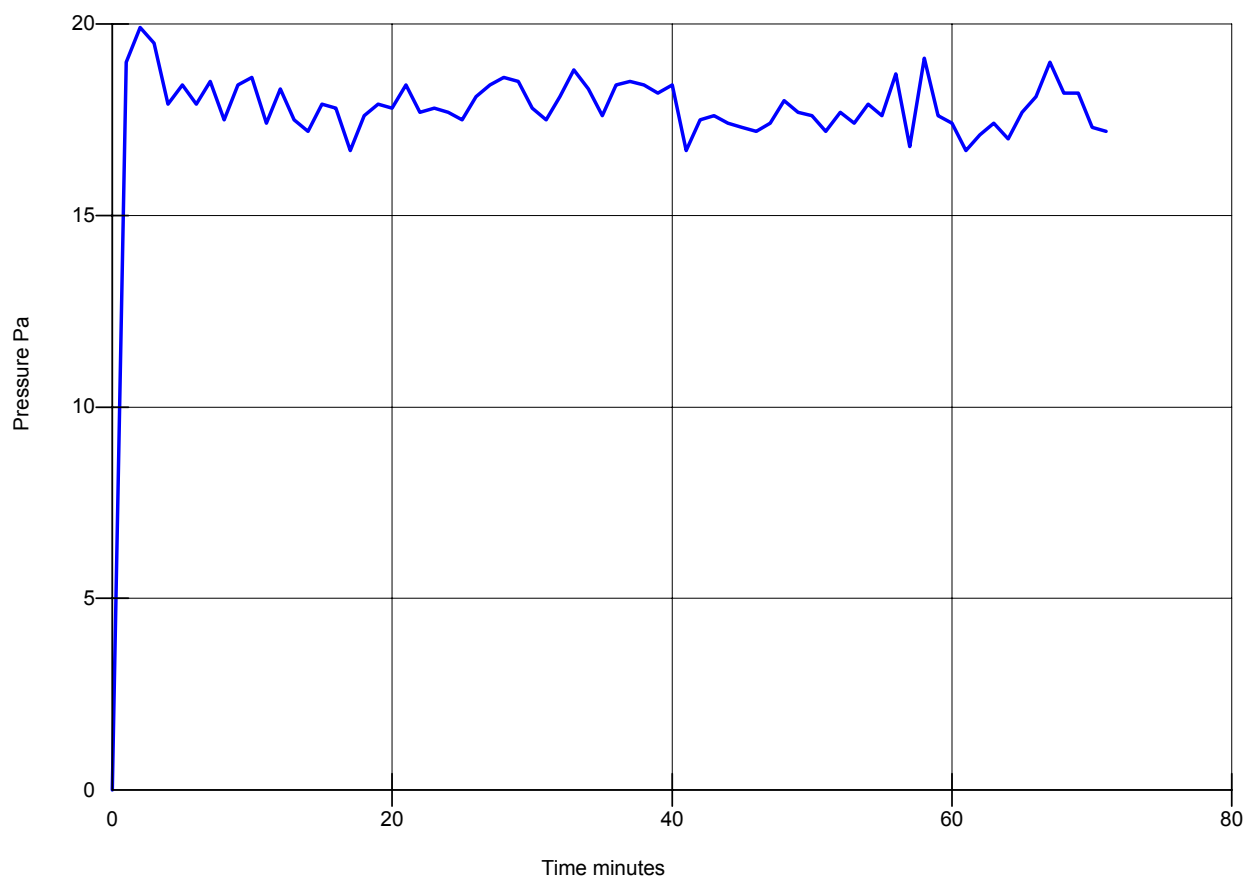
### Furnace Temperature Graph



**Figure 3.** Furnace temperature graph.



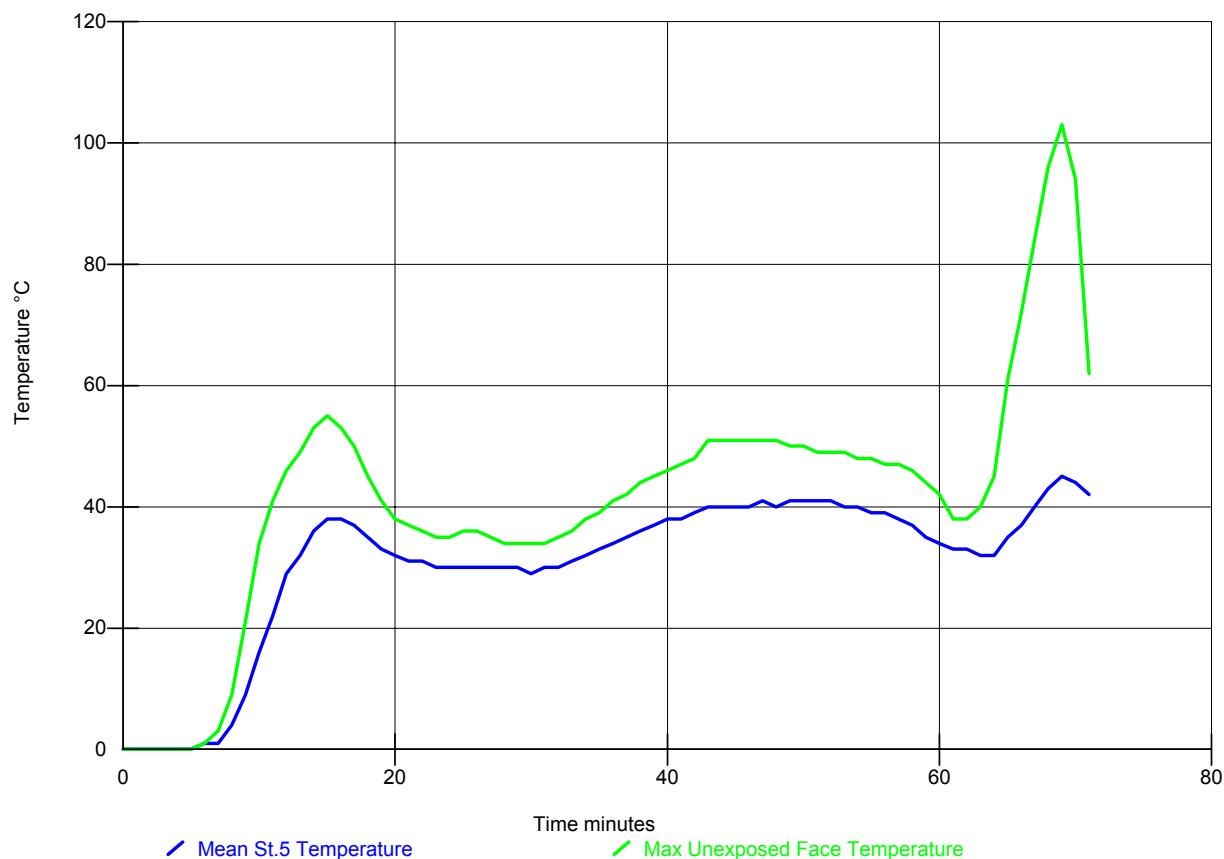
### Furnace Pressure Graph



**Figure 4.** Furnace pressure graph.



### Unexposed Face Temperature Graph

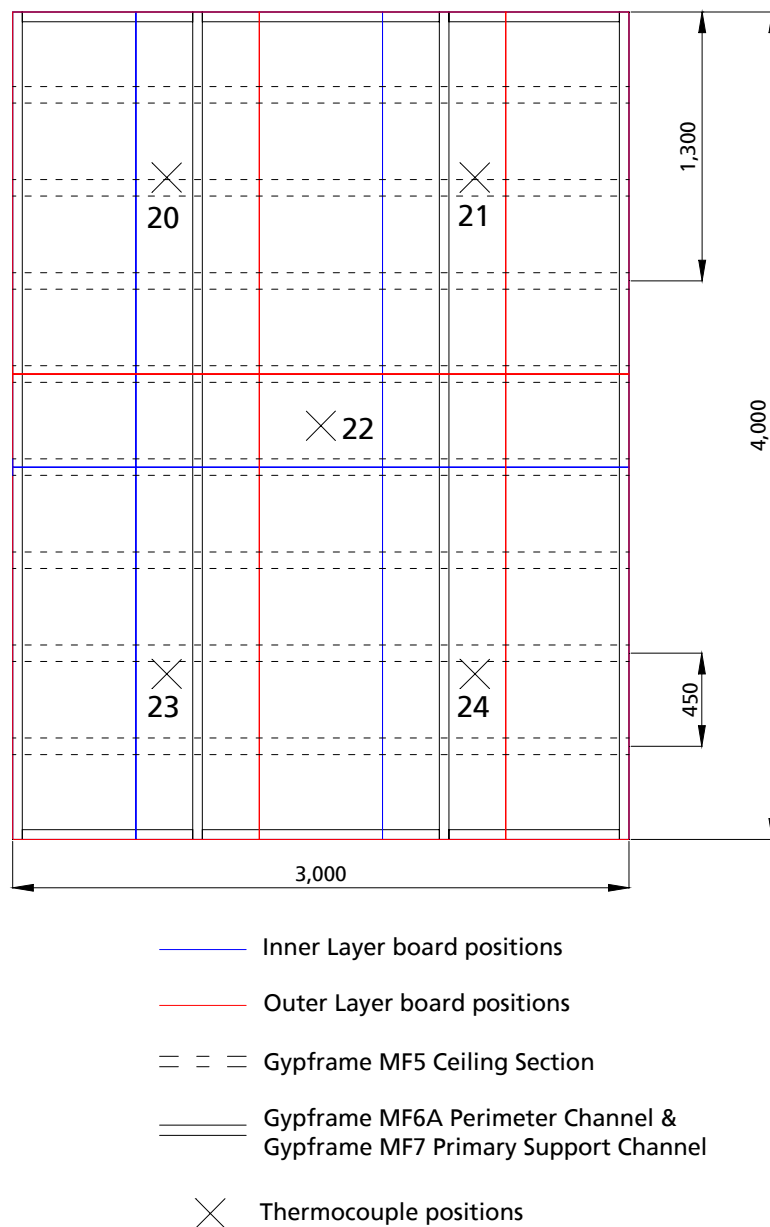


**Figure 5.** Unexposed face temperature graphs.





### Unexposed Face Thermocouple Layout



**Figure 6.** Unexposed face thermocouple layout.



Unexposed Face Standard Five Thermocouple Data

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



Time (mins)	Temperature Rise (°C)				
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24
36	31	28	41	36	37
37	31	29	42	37	38
38	31	29	44	38	39
39	33	30	45	38	41
40	34	30	46	39	41
41	35	30	47	39	42
42	36	30	48	40	43
43	35	30	51	41	43
44	35	30	51	40	45
45	35	30	51	40	45
46	36	30	51	41	46
47	36	31	51	41	47
48	36	30	51	41	46
49	37	30	50	42	47
50	37	31	50	41	48
51	37	32	49	41	48
52	37	31	49	41	48
53	36	30	49	40	48
54	36	30	48	40	47
55	35	29	48	39	47
56	35	30	47	38	47
57	34	29	46	37	47
58	33	29	45	36	46
59	32	28	39	35	44
60	31	28	36	34	42
61	31	27	36	35	38
62	30	27	38	35	36
63	29	26	40	35	32
64	29	25	45	35	30
65	29	23	61	34	31
66	28	22	72	35	31
67	26	20	84	37	34
68	25	20	96	38	39
69	25	19	103	39	42
70	26	19	94	40	45
71	27	21	60	42	62

See figure 6 for the location of the thermocouples.

Customer: **British Gypsum Limited**

## PHOTOGRAPHS



**Photograph 1.** Exposed face prior to test.

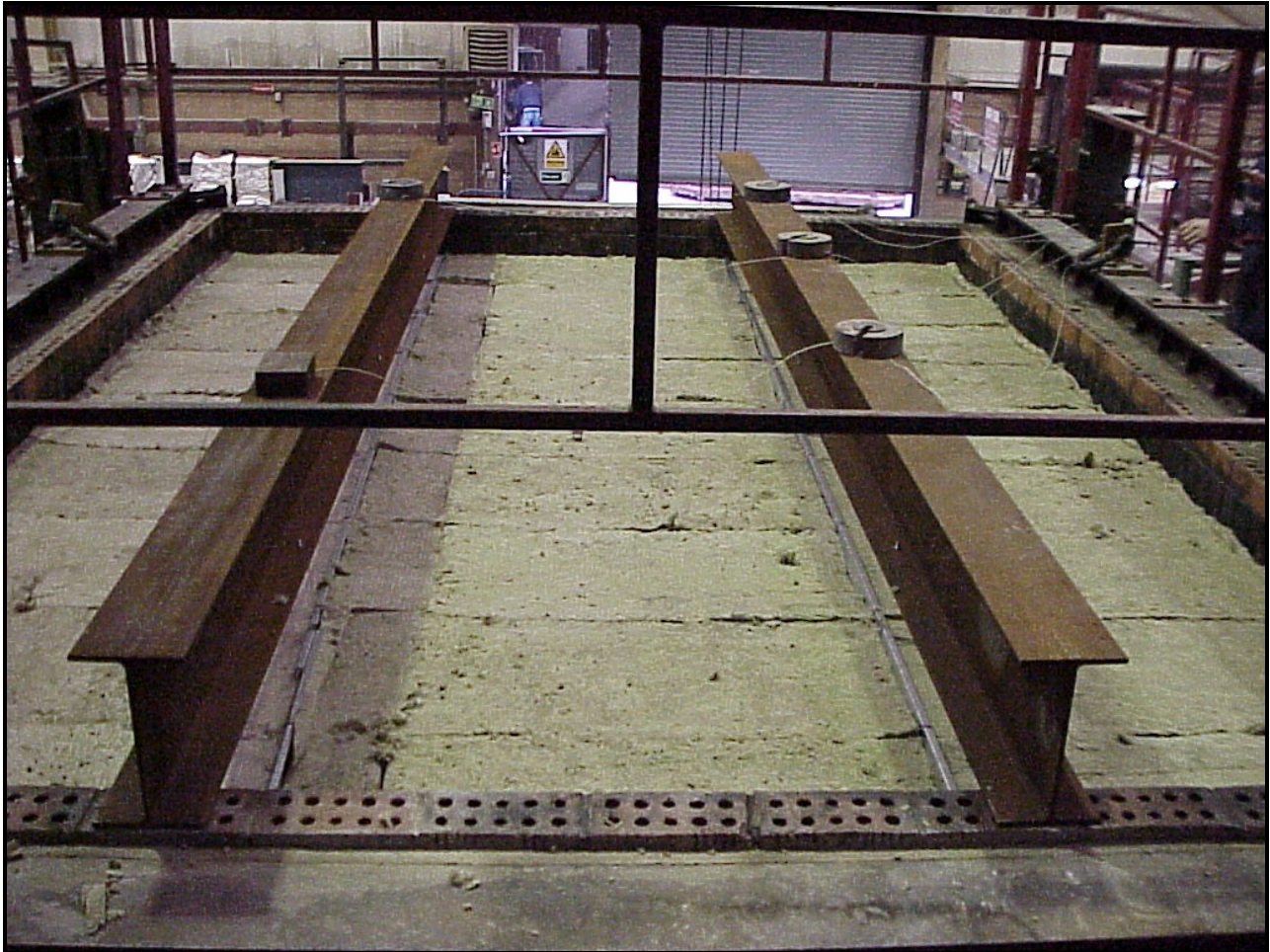




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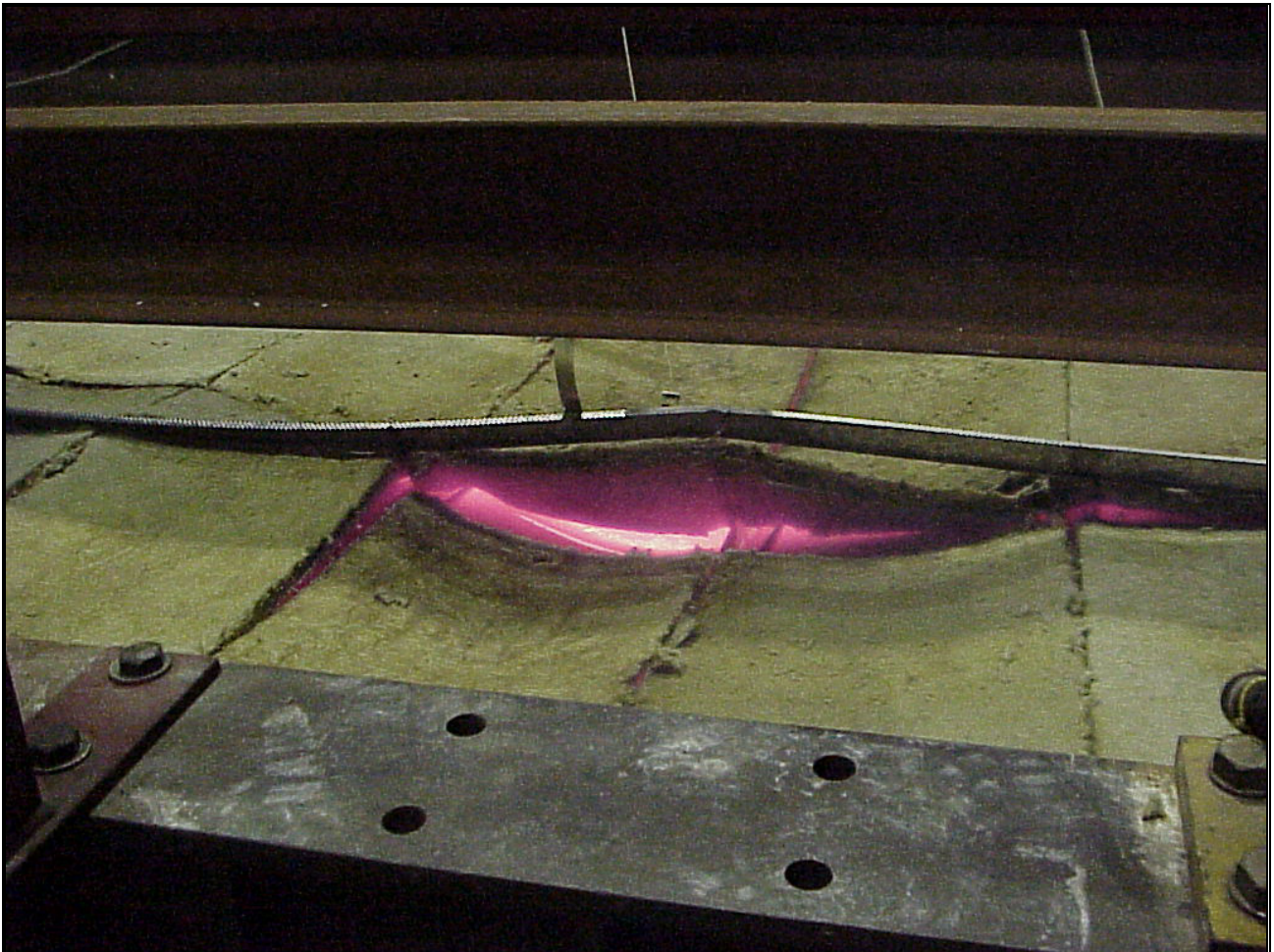
Photograph 2. Unexposed face prior to test.

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BTC 13189F: Page 21 of 24



0296



**Photograph 3.** Position of integrity failure at 71 minutes.





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**Photograph 4.** Exposed face after test termination.

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BTC 13189F: Page 23 of 24



0296

## **FIELD OF DIRECT APPLICATION**

The applicability of the test results shall be restricted to other constructions where the installation of the ceiling is carried out from below.

Suspended ceilings with fire from below:

- i) Size:
  - Test results obtained on a (4 x 3) m, or greater, test specimen may be applied to ceilings of any dimension, provided that the distance between the suspension devices is not increased, and that provisions for expansion are increased accordingly.
- ii) Fittings:
  - Test results on ceilings containing fittings with their own suspension devices may be applied to ceilings containing such suspension devices provided the distribution does not exceed those tested.
- iii) Cavity:
  - The test results are valid for cavities of any height.