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Report Number BTC 13304F

A FIRE RESISTANCE TEST ON A BRITISH GYPSUM GYPWALL PARTITION CLAD WITH A SINGLE LAYER OF 15mm GYPROC WALLBOARD EACH SIDE OF GYPFRAME 70S50 STUDS AND 50mm ISOWOOL 1200 IN THE CAVITY, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1: 1999.

Test Date: 21st June 2004

www.btconline.co.uk

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

UKAS TESTING
0296

The Building Test Centre
Fire Acoustics Structures

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FIELD OF DIRECT APPLICATION _____ *32*

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FOREWORD

This test report details a fire resistance test conducted on a sheet and stud partition system. The test sponsor was British Gypsum Limited.

The test specimen was installed by British Gypsum Limited. The construction of the specimen took place on the 9th June 2004. British Gypsum Limited designed the partition system and selected the materials for the test specimen.

The test was carried out on the 21st June 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 1364-1 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.

REPORT AUTHORISATION

Report Author	Authorised by
James McLavy BSc. (Hons.), AMIOA, AIFireE *Project Leader*	**Eur Ing. Paul Howard** BSc. (Hons.), CEng., MIOA *Head of Laboratory*

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TEST CONSTRUCTION

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

Gypframe 72C50 Standard Floor & Ceiling Channels were fixed to the head and base of the test aperture at 600mm centres with 60mm fire resistant fixings. Gypframe 70S50 'C' Studs were positioned at 600mm centres between the channels. The right hand stud viewed from unexposed face was not fixed to the perimeter test frame, and the gap between the stud and the frame lining was filled with a 25mm rock mineral fibre gasket. At the left-hand end a Gypframe 70S50 'C' Stud was used to fix the partition to the test frame with 60mm fire resistant fixings at 600mm centres.

50mm Isowool Acoustic Partition Roll (1200) was positioned in the partition cavity.

The framework was lined both sides with a single layer of 15mm Gyproc WallBoard fixed around the perimeter and within the field of the board with 25mm Gyproc drywall screws at 300mm centres. All vertical joints were staggered.

Horizontal joints were positioned 2700mm from the base on both the exposed and unexposed faces of the construction. A Gypframe GFS1 Fixing Strap was used behind the horizontal board joint.

All joints were taped and filled using Gyproc Paper Joint Tape and Gyproc Joint Filler. All screw heads were spotted using Gyproc Joint Filler.

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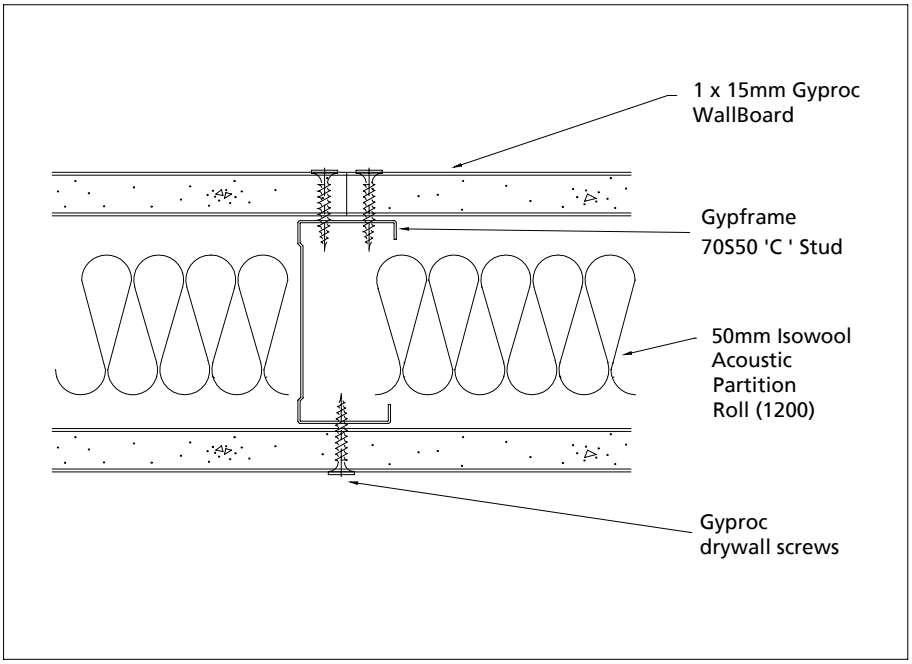

Figure 1. Cross-section of partition specimen.

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

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TEST MATERIALS

Gyproc WallBoard

Nominally, 3000mm (long) x 1200mm (wide) x 15mm (thick), Gyproc WallBoard plasterboard manufactured and supplied by British Gypsum Limited, ex East Leake works.

Actual surface density:	10.11kg/m^2.
Actual thickness:	14.88mm.
Board identification numbers:	18 077 4 06:21
Actual moisture content:	0.44%.

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

Metal components

i) Gypframe 70S50'C' Studs manufactured from galvanised mild steel using the 'UltraSTEEL' process.
ii) Gypframe 72C50 Standard Floor & Ceiling Channel manufactured from galvanised mild steel using the 'UltraSTEEL' process.
iii) Gypframe GFS1 Fixing Strap.

All metal components supplied by British Gypsum Limited.

Insulation

Nominally 50mm (thick) Isowool Acoustic Partition Roll (1200) glass mineral wool manufactured and supplied by British Gypsum – Isover Limited.

Measured density:	13.46kg/m^3
Measured surface density:	0.67kg/m^2

The density was calculated using the insulation roll used in the test specimen.

Fasteners

i) 25mm Gyproc drywall screws supplied by British Gypsum Limited.
ii) 60mm fire resistant fixings.

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Miscellaneous components

i) Gyproc Paper Joint Tape.
ii) Gyproc Joint Filler.

All miscellaneous components were supplied by British Gypsum Limited.

TEST PROCEDURE

The test was conducted fully in accordance with BS EN 1364-1:1999. The specimen was subjected to fire from one side, as specified in BS EN 1364-1:1999. As the test specimen is considered to be symmetrical one test is adequate to cover the fire resistance performance in both directions.

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

The ambient temperature at the commencement of the test was 19°C.

The furnace pressure was set to control at 18 ±2 Pa positive with respect to atmosphere, at the top of the specimen, except during the first 5 minutes of the test.

The allowable tolerances are ±5 Pa from 5 minutes to 10 minutes and ±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. Furnace pressure data is shown on page 16.

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 this deviation from the documented method will not unduly effect the result of the test.

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TEST RESULTS

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

Integrity:	Sustained flaming	45 minutes (no failure test discontinued at the request of the customer)
	25mm Gap gauge	45 minutes
	6mm Gap gauge	43 minutes
	Cotton pad	41 minutes
Insulation:		38 minutes

The test was terminated at 45 minutes at the request of the customer.

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.

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TEST DATA

Observations

Observers: Unexposed face J McLavy
Exposed face L Cooper

Time		*Observations*
hrs	mins	All observations refer to exposed face unless otherwise stated.
	0	Test started.
	5	The jointing material and face paper had started to char.
	10	The jointing material and face paper continued to char.
	15	The left-hand vertical joint had opened to approximately 2mm. The right-hand vertical joint had opened to approximately 2mm. The horizontal joint had opened to approximately 3mm. Vertical cracks approximately 1mm wide had developed on the lower left-hand and lower centre boards.
	20	The left-hand vertical joint had opened to approximately 20mm. The right-hand vertical joint had opened to approximately 3-4mm. The horizontal joint had opened to approximately 3-4mm. The lower centre board had detached from its fixings on the left-hand vertical joint. Vertical and horizontal cracks approximately 3-10mm wide had developed on all boards.
	23	A section of the lower left-hand board approximately 600mm x 900mm had fallen into the furnace. A section of the lower centre board approximately 600mm x 900mm had fallen into the furnace.
	24	Further sections of the lower centre board had fallen into the furnace.

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Time		*Observations* All observations refer to exposed face unless otherwise stated.
hrs	mins	
	25	Further sections of the lower left-hand and lower centre boards had fallen into the furnace. Approximately 35% of the exposed face board had fallen into the furnace. All exposed cavity insulation still in position. *Unexposed face* The specimen had bowed out of the furnace in the region of the field line of the lower centre board at approximately 1500mm height.
	26	The cavity insulation had started to melt and fall away at the centre of the specimen.
	27	*Unexposed face* The specimen had bowed in an S-shaped fashion.
	29	*Unexposed face* The jointing material had discoloured at the screw head positions on the left-hand vertical joint at approximately 300-1800mm height.
	30	The studs had distorted at mid-height where exposed. Further sections of the lower left-hand and lower centre boards had fallen into the furnace. Approximately 60% of the exposed face board had fallen into the furnace. Approximately 40% of the cavity insulation had fallen into the furnace.
	31	*Unexposed face* The jointing material had discoloured at the screw head positions on the right-hand vertical joint at approximately 300-1800mm height. The jointing material had discoloured at the screw head positions on the centre line of the lower centre board at approximately 600-2100mm height.
	33	*Unexposed face* The free end had bowed out of the furnace at approximately 900mm height.

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Time		*Observations* All observations refer to exposed face unless otherwise stated.
hrs	mins	
	34	*Unexposed face* The jointing material had discoloured at the screw head positions along the full height of the left-hand vertical joint. The jointing material had discoloured at the screw head positions on the centre line of the lower left-hand board at approximately 600-2100mm height.
	35	Further sections of the lower centre board had fallen into the furnace. A section of the lower right-hand board had fallen into the furnace. Approximately 75% of the exposed face board had fallen into the furnace. Approximately 75% of the cavity insulation had fallen into the furnace. Hairline cracks had developed on the unexposed face boards.
	36	*Unexposed face* Cracks had developed under the paper liner on the lower left-hand and lower centre boards at approximately 1500-1800mm height.
	37	*Unexposed face* Discolouration had developed on the left-hand vertical joint at approximately 1200-1500mm height.
	38	*Unexposed face* **INSULATION FAILURE.** The temperature rise of thermocouple No. 31 exceeded 180°C.
	39	*Unexposed face* Discolouration had developed on the left-hand vertical joint at approximately 900-1800mm height. Discolouration had developed on the right-hand vertical joint at approximately 1200mm height. Flash flaming was visible on the left-hand vertical joint at approximately 1200mm height.

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Time		*Observations* All observations refer to exposed face unless otherwise stated.
hrs	mins	
	40	Further sections of the lower left-hand and lower right-hand boards had fallen into the furnace. Approximately 90% of the exposed face board had fallen into the furnace. Approximately 90% of the cavity insulation had fallen into the furnace. *Unexposed face* Discolouration had developed on the lower centre board at approximately 1200-1800mm height. A glow was visible on the left-hand vertical joint at approximately 1200-1500mm height. A cotton pad was used on the above location but did not glow or ignite.
	41	*Unexposed face* **INTEGRITY FAILURE.** The cotton pad glowed when used on the left-hand vertical joint at approximately 1500mm height.
	42	*Unexposed face* Discolouration had developed on the right-hand side of the lower left-hand board at approximately 1200-1800mm height. Horizontal cracks had developed on the lower centre board at approximately 1200-1800mm height.
	43	Vertical and horizontal cracks approximately 1-2mm wide had developed on the unexposed face boards. *Unexposed face* A glow was visible on the left-hand vertical joint at approximately 300-2400mm height. Discolouration had developed on the right-hand vertical joint at approximately 300-2100mm height. **FURTHER INTEGRITY FAILURE.** The 6mm x 150mm gap gauge entered the furnace through the left-hand vertical joint at approximately 1200-1500mm height.

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Time		*Observations*
hrs	mins	All observations refer to exposed face unless otherwise stated.
	44	*Unexposed face* Horizontal cracks approximately 2mm wide had developed on the lower centre board at approximately 1200-1800mm height.
	45	*Unexposed face* **FURTHER INTEGRITY FAILURE.** The 25mm gap gauge entered the furnace through the left-hand vertical joint at approximately 1500mm height. **TEST TERMINATED** at the request of the customer.

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Furnace Temperature Graph

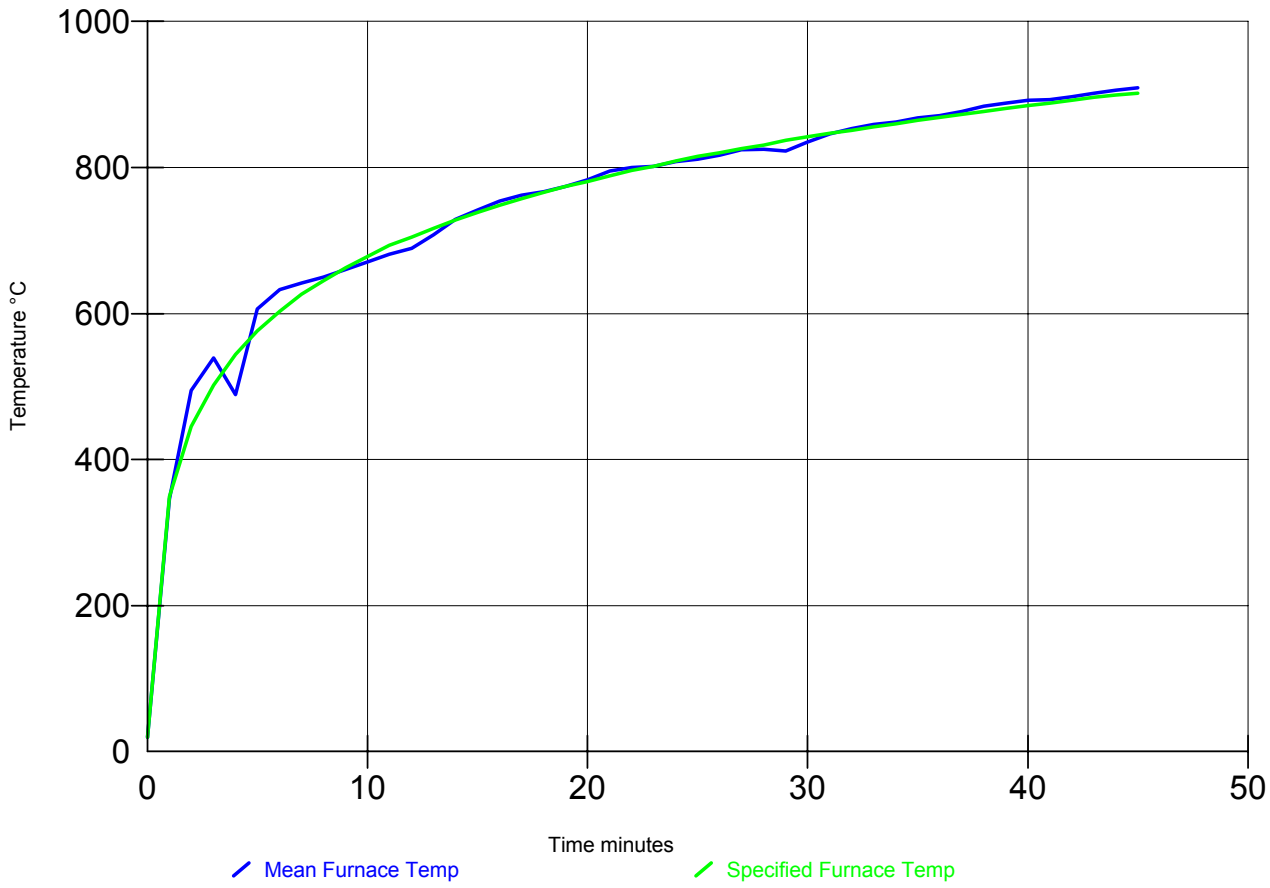

Figure 2. Furnace temperature graph.

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Furnace Pressure Graph

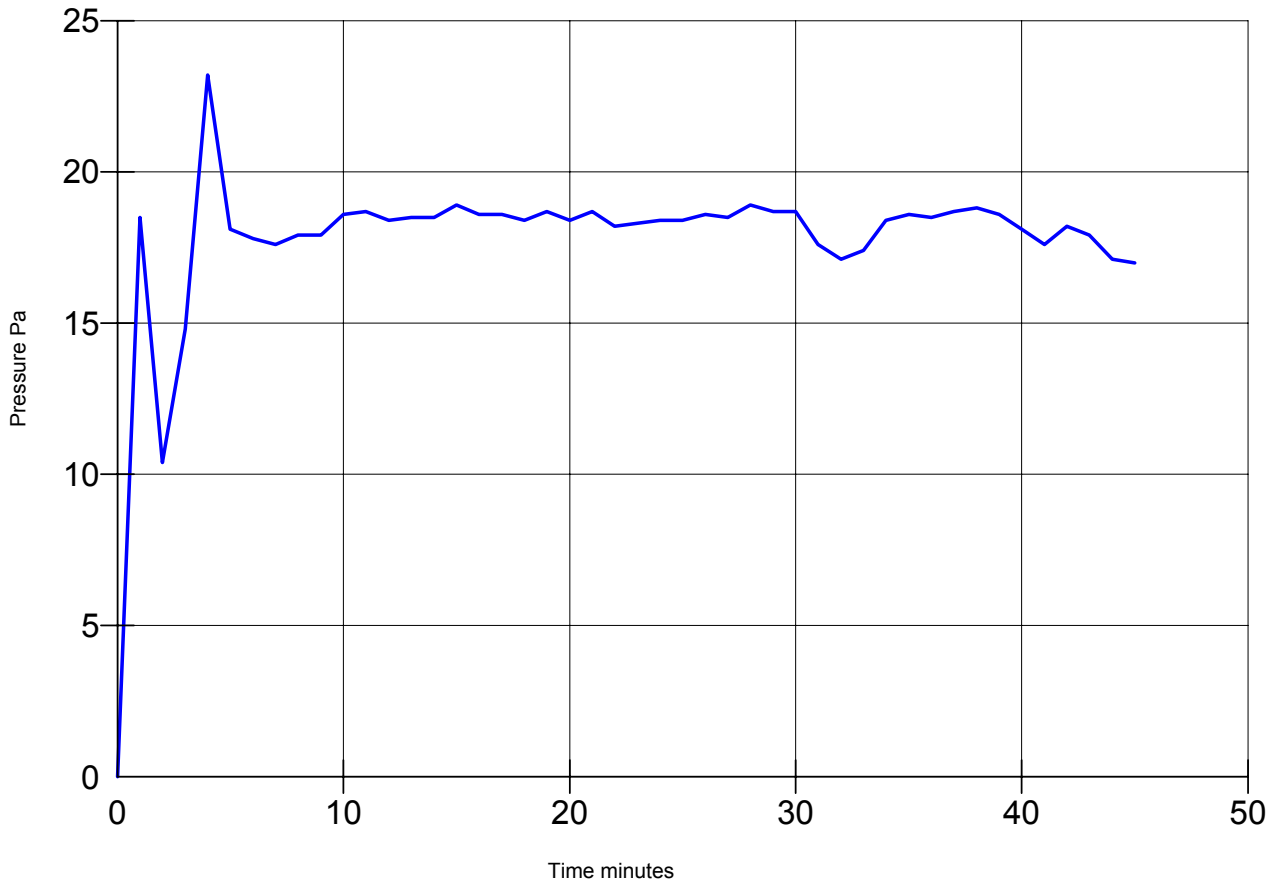

Figure 3. Furnace pressure graph.

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Unexposed Face Temperature Graph

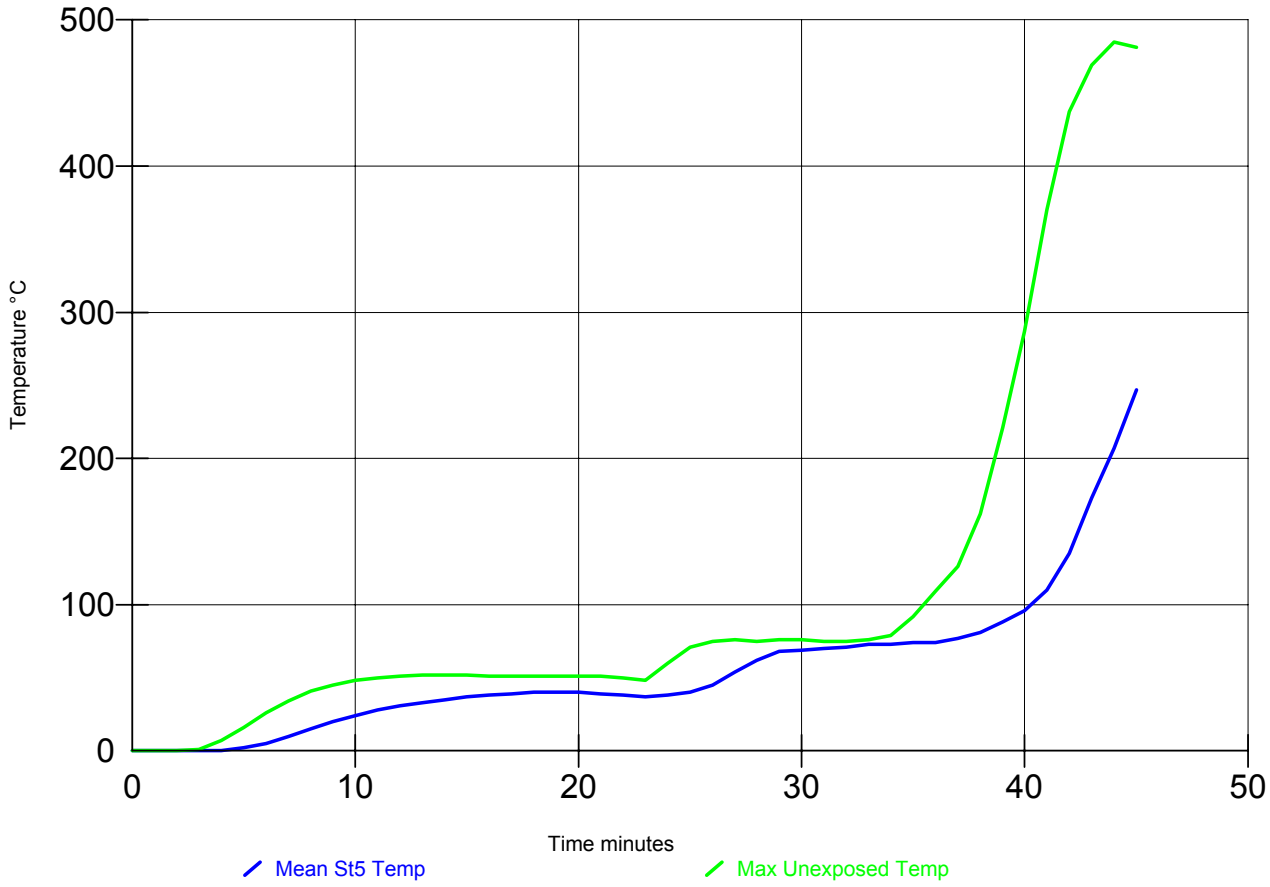

Figure 4. Unexposed face temperature graph.

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Unexposed Face Thermocouple Layout

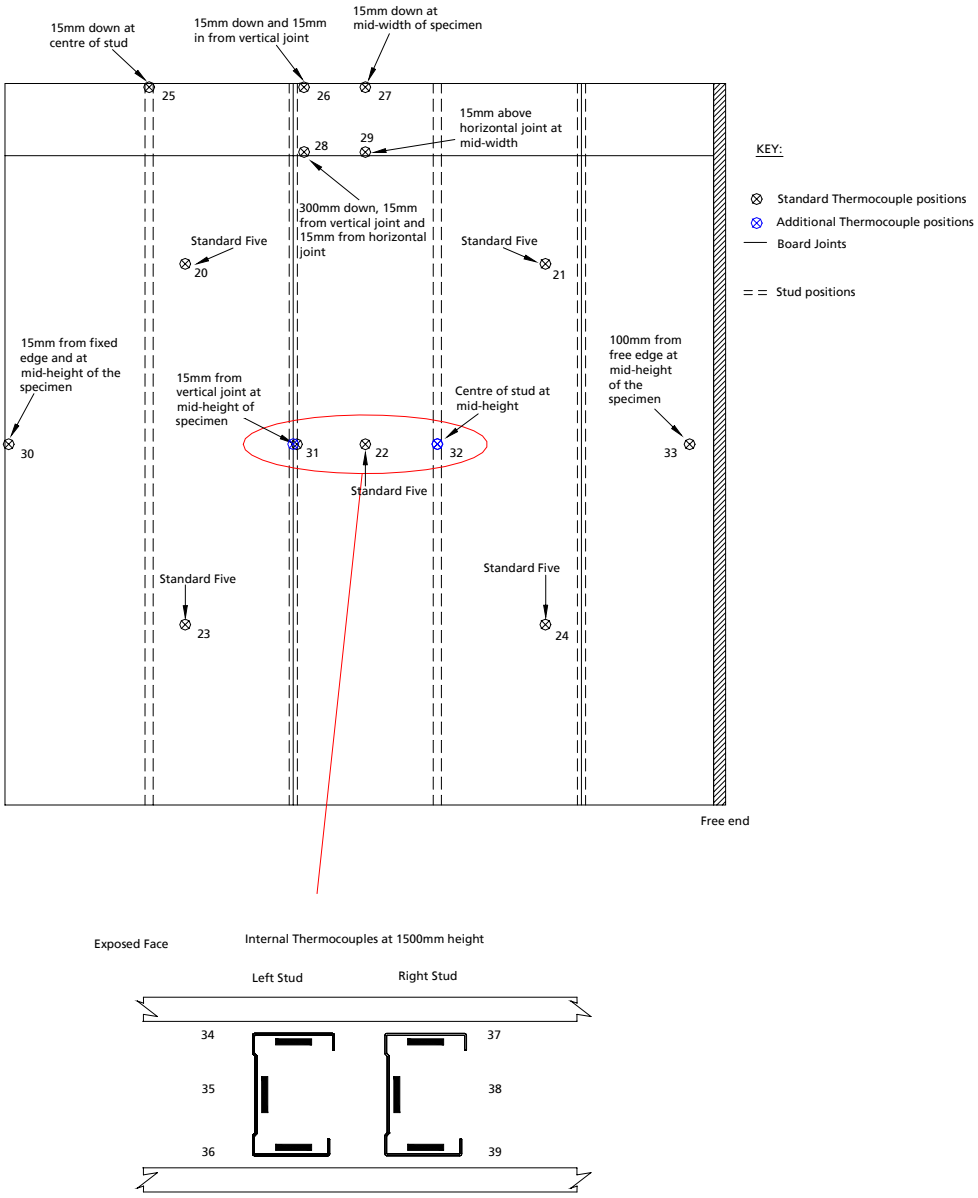

Figure 5. Unexposed face thermocouple layout.

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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	-1	-1	-1	-1	-1
2	-1	-1	-1	-1	-1
3	0	0	0	0	0
4	0	1	0	0	0
5	4	4	1	2	0
6	9	9	4	6	1
7	15	15	7	11	3
8	23	22	10	18	5
9	30	28	14	24	7
10	36	33	17	29	9
11	40	36	20	33	11
12	44	39	23	37	13
13	46	41	25	40	15
14	48	42	28	43	17
15	48	44	30	45	20
16	49	45	32	46	22
17	49	45	33	47	24
18	49	46	34	48	26
19	49	45	35	47	27
20	48	44	35	46	28
21	47	42	35	44	29
22	45	41	35	41	30
23	43	40	36	40	30
24	43	40	39	41	31
25	44	41	42	44	33
26	45	43	51	50	40
27	48	50	66	57	51
28	52	59	72	67	63
29	57	63	71	76	75
30	63	64	71	76	75
31	66	66	71	75	75
32	69	70	71	74	74
33	72	73	72	75	74

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Time (mins)	Temperature Rise (°C)				
	Thermocouple No. 20	Thermocouple No. 21	Thermocouple No. 22	Thermocouple No. 23	Thermocouple No. 24
34	73	73	73	75	74
35	73	73	74	75	75
36	73	72	76	75	75
37	73	73	86	77	77
38	74	74	98	81	81
39	74	75	107	96	92
40	75	76	120	108	102
41	76	78	169	118	111
42	79	89	224	159	128
43	96	99	268	218	185
44	109	111	313	268	236
45	120	137	384	317	281

See figure 5 for the locations of the thermocouples.

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Additional Unexposed Face Temperature Data

Time (mins)	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	-1	-1	-1	-1	-1
2	-1	-1	-1	-1	-1
3	0	1	0	0	0
4	0	7	3	3	1
5	4	16	11	9	6
6	11	26	21	16	13
7	19	34	31	22	20
8	27	41	39	28	27
9	35	45	45	33	32
10	40	48	48	37	36
11	44	50	49	40	39
12	47	51	50	42	41
13	48	52	51	44	42
14	49	52	51	44	43
15	49	52	50	45	43
16	49	51	49	45	42
17	48	51	49	44	42
18	48	51	49	44	42
19	48	51	49	44	42
20	47	51	48	44	42
21	46	51	48	42	41
22	45	50	47	41	39
23	44	48	45	40	38
24	43	47	44	39	39
25	43	46	43	40	41
26	43	47	42	42	45
27	45	48	42	47	50
28	46	50	43	52	55
29	47	51	43	55	59
30	48	54	44	60	60
31	50	56	46	66	61
32	52	58	48	71	62
33	54	59	49	75	64

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Time (mins)	Temperature Rise (°C)				
	Thermocouple No. 25	Thermocouple No. 26	Thermocouple No. 27	Thermocouple No. 28	Thermocouple No. 29
34	56	61	51	76	70
35	57	63	52	77	72
36	58	65	53	78	73
37	58	66	54	78	74
38	58	67	54	80	74
39	59	69	55	83	74
40	59	70	55	90	75
41	61	72	55	105	75
42	63	75	57	118	76
43	66	77	60	129	77
44	70	80	65	141	80
45	74	85	69	170	91

See figure 5 for the locations of the thermocouples.

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Additional Unexposed Face Temperature Data

Time (mins)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
0	0	0	0	0
1	-1	-1	-1	-1
2	-1	-1	0	0
3	0	0	0	0
4	0	1	4	0
5	3	3	10	3
6	7	6	19	7
7	11	11	26	12
8	16	15	33	19
9	21	19	38	25
10	26	23	41	30
11	31	26	43	34
12	35	30	44	37
13	38	33	44	40
14	41	36	43	42
15	43	38	43	44
16	45	40	43	45
17	45	41	42	46
18	46	42	42	46
19	46	42	41	46
20	45	41	40	45
21	45	41	39	44
22	44	40	40	43
23	42	40	47	41
24	41	41	60	40
25	39	48	71	39
26	39	74	75	40
27	38	75	76	46
28	38	74	75	53
29	39	75	75	59
30	40	75	75	61
31	40	75	74	63
32	41	75	74	70
33	42	76	75	71

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Time (mins)	Temperature Rise (°C)			
	Thermocouple No. 30	Thermocouple No. 31	Thermocouple No. 32	Thermocouple No. 33
34	43	79	76	72
35	45	92	79	72
36	47	109	94	72
37	50	126	109	72
38	52	**162**	125	73
39	56	221	164	74
40	60	287	218	75
41	64	370	267	77
42	66	437	320	82
43	68	469	374	98
44	69	485	427	109
45	71	481	457	120

See figure 5 for the locations of the thermocouples.

Figures shown in red indicate the time and position of insulation failure.

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Internal Thermocouple Data at 1500mm height

Time (mins)	Actual Temperature (°C)					
	Left-hand stud			Right-hand 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	19	19	19	19	19	19
1	20	18	18	20	19	18
2	58	30	25	67	51	41
3	87	69	62	88	86	80
4	89	82	77	96	90	87
5	91	86	81	97	92	89
6	93	90	85	98	94	91
7	94	90	86	99	94	91
8	95	90	86	100	94	92
9	95	90	86	101	94	91
10	97	90	86	103	94	91
11	100	92	87	106	95	91
12	103	93	88	109	97	91
13	106	95	89	113	98	91
14	109	97	90	117	100	91
15	112	99	90	123	102	91
16	116	102	90	132	105	91
17	121	104	89	147	110	91
18	127	106	88	173	120	92
19	137	109	85	209	137	99
20	160	115	82	251	155	100
21	207	122	80	391	225	120
22	260	140	84	527	358	188
23	321	175	94	769	692	506
24	480	269	131	809	808	793
25	720	716	554	834	828	829
26	805	815	804	839	823	831
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	-	-	-	-	-
31	-	-	-	-	-	-

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Time (mins)	Actual Temperature (°C)					
	Left-hand stud			Right-hand 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
32	-	-	-	-	-	-
33	-	-	-	-	-	-
34	-	-	-	-	-	-
35	-	-	-	-	-	-
36	-	-	-	-	-	-
37	-	-	-	-	-	-
38	-	-	-	-	-	-
39	-	-	-	-	-	-
40	-	-	-	-	-	-
41	-	-	-	-	-	-
42	-	-	-	-	-	-
43	-	-	-	-	-	-
44	-	-	-	-	-	-
45	-	-	-	-	-	-

See figure 5 for the locations of the thermocouples.

Thermocouple No. 34 did not work after 26 minutes.

Thermocouple No. 35 did not work after 26 minutes.

Thermocouple No. 36 did not work after 26 minutes.

Thermocouple No. 37 did not work after 26 minutes.

Thermocouple No. 38 did not work after 26 minutes.

Thermocouple No. 39 did not work after 26 minutes.

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Specimen Lateral Deflection

Time (mins)	Deflection at centre of the specimen (mm)	Deflection 50mm from free end of the specimen (mm)
0	0	0
1	10	1
2	10	1
3	10	1
4	8	1
5	7	1
6	7	1
7	7	1
8	6	1
9	5	1
10	5	1
11	5	1
12	6	2
13	7	1
14	7	1
15	7	1
16	8	1
17	10	1
18	13	2
19	18	3
20	25	5
21	35	15
22	41	21
23	45	31
24	47	36
25	35	43
26	23	44
27	18	43
28	18	39
29	18	39
30	20	37
31	23	36
32	27	36
33	-	-
34	28	37

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Time (mins)	Deflection at centre of the specimen (mm)	Deflection 50mm from free end of the specimen (mm)
35	28	37
36	27	36

Both deflection measurements were taken at the mid-height of the specimen.

Negative values indicate that the specimen deflected out of the furnace.

No deflection readings were available at 33 minutes.

The deflection readings were discontinued after 36 minutes.

(The lateral deflection was recorded by taking measurements relative to a fixed reference wire at 1 minute intervals due to equipment availability at the time of the test).

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PHOTOGRAPHS

Photograph 1. View of the exposed face prior to test.

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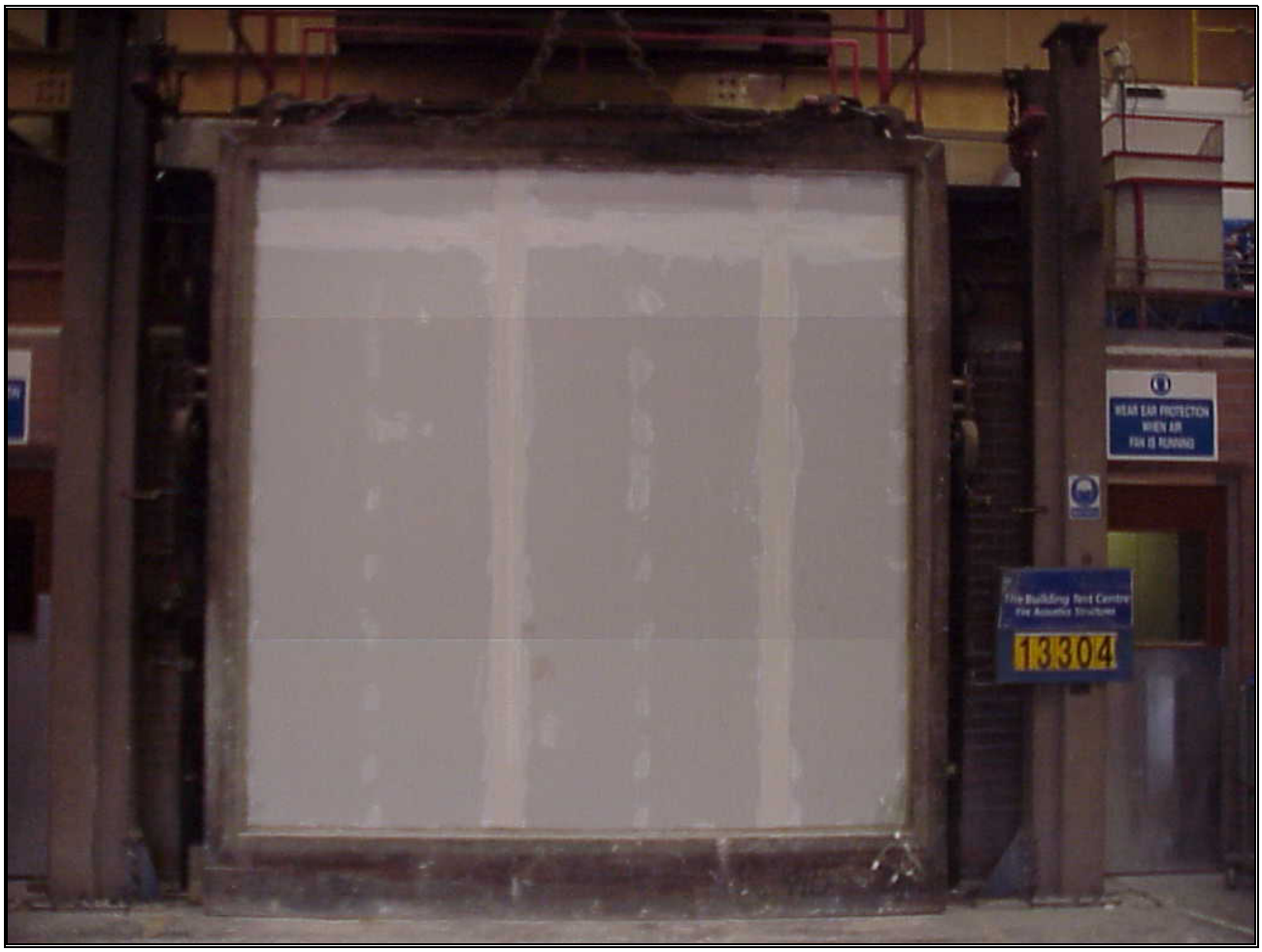

Photograph 2. View of the unexposed face prior to test.

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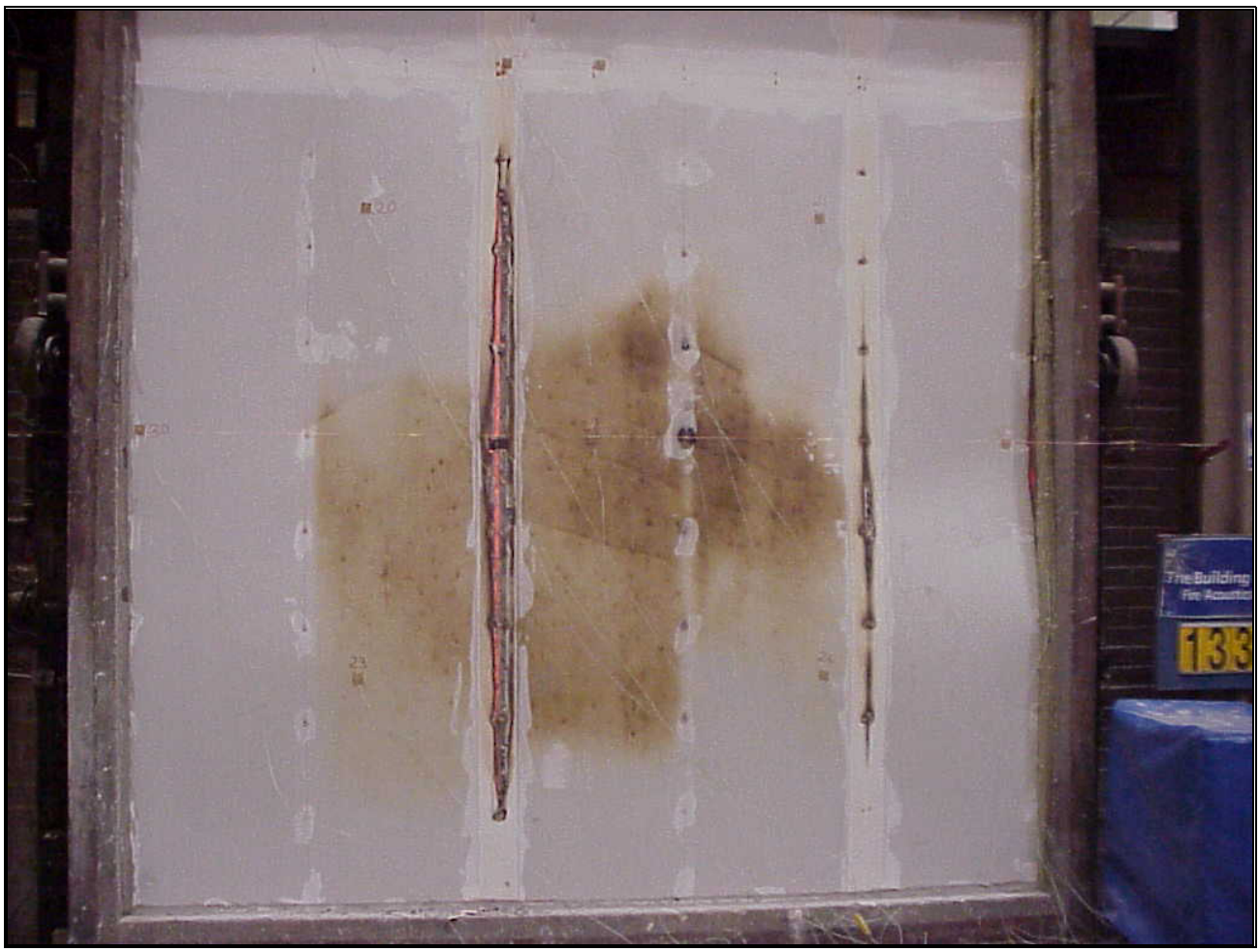

Photograph 3. View of the unexposed face at 42 minutes (after integrity failure).

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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 3000mm.

(ii) Increase in the thickness of the wall (minimum thickness 100mm).

(iii) Increase thickness of component materials (minimum Gypframe stud depth 70mm, minimum Gypframe 'C' stud gauge 0.5mm).

(iv) Decrease in the linear dimensions of the boards but not thickness (≤ 2700mm long x ≤ 1200mm wide Gyproc WallBoard).

(v) Decrease stud spacing from 600mm.

(vi) Decrease in fixing centres from 300mm.

(vii) Increase in the number of horizontal joints.

(viii) Horizontal and vertical joints, of the type tested.

Extension of Width

The width of an identical construction may be increased as the specimen was tested at nominally 3000mm wide with one vertical edge without restraint.

Extension of Height

The height of constructions tested at a minimum of 3000mm, maybe increased to 4000mm at the following fire resistance periods as the lateral deflection was below 100mm.

30 minutes
<100mm, ∴4000mm

UKAS TESTING
0296