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Testing. Advising. Assuring.

**Title:**

The fire resistance performance of a specimen of an asymmetrical, non-loadbearing wall assembly, tested in accordance with BS 476: Part 22: 1987, Clause 5

**WF Report No:**

352737



**Prepared for:**

**International Petroleum Products Ltd**

Bradwell Hall  
Bradwell-On-Sea  
Essex  
CMO 7HX

**Date:**

24<sup>th</sup> August 2015

**Notified Body No:**

0833



0249

# Summary

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**Objective** To determine the fire resistance performance of an asymmetrical, non-loadbearing wall assembly, when tested in accordance with BS 476: Part 22: 1987.

**Sponsor** **International Petroleum Products Ltd**, Bradwell Hall, Bradwell-On-Sea, Essex, CMO 7HX

**Summary of Tested Specimen** The specimen had nominal overall dimensions 3035 mm high by 3000 mm wide by 164mm thick. It consisted of a softwood timber frame with studs positioned at 600 mm centres and noggins fitted at 2400 mm high. The exposed face of the timber frame was fitted with 9 mm thick MgO boards screw fixed to the vertical studs and noggins. The unexposed face was fitted with 15 mm thick Gyproc Fireline Board screw fixed to the timber frame. The cavity between the studs was filled with two layers of 70 mm thick Rockwool 'Flexi' insulation. The specimen incorporated one vertical free edge.

The specimen satisfied the performance requirements specified in Clause 5 of BS 476: Part 22: 1987, for a non-loadbearing wall assembly, for the following periods:

## Test Results:

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**Integrity** 91 minutes

**Insulation** 86 minutes

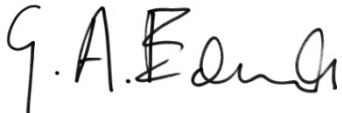
The test was discontinued after a period of 92 minutes.


**Date of Test** 3<sup>rd</sup> June 2015

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## Signatories

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Responsible Officer <b>G. Edmonds*</b> Senior Testing Officer


Approved <b>D. Hankinson*</b> Principal Certification Engineer

\* For and on behalf of **Exova Warringtonfire**.

Report Issued  Date : 24 <sup>th</sup> August 2015
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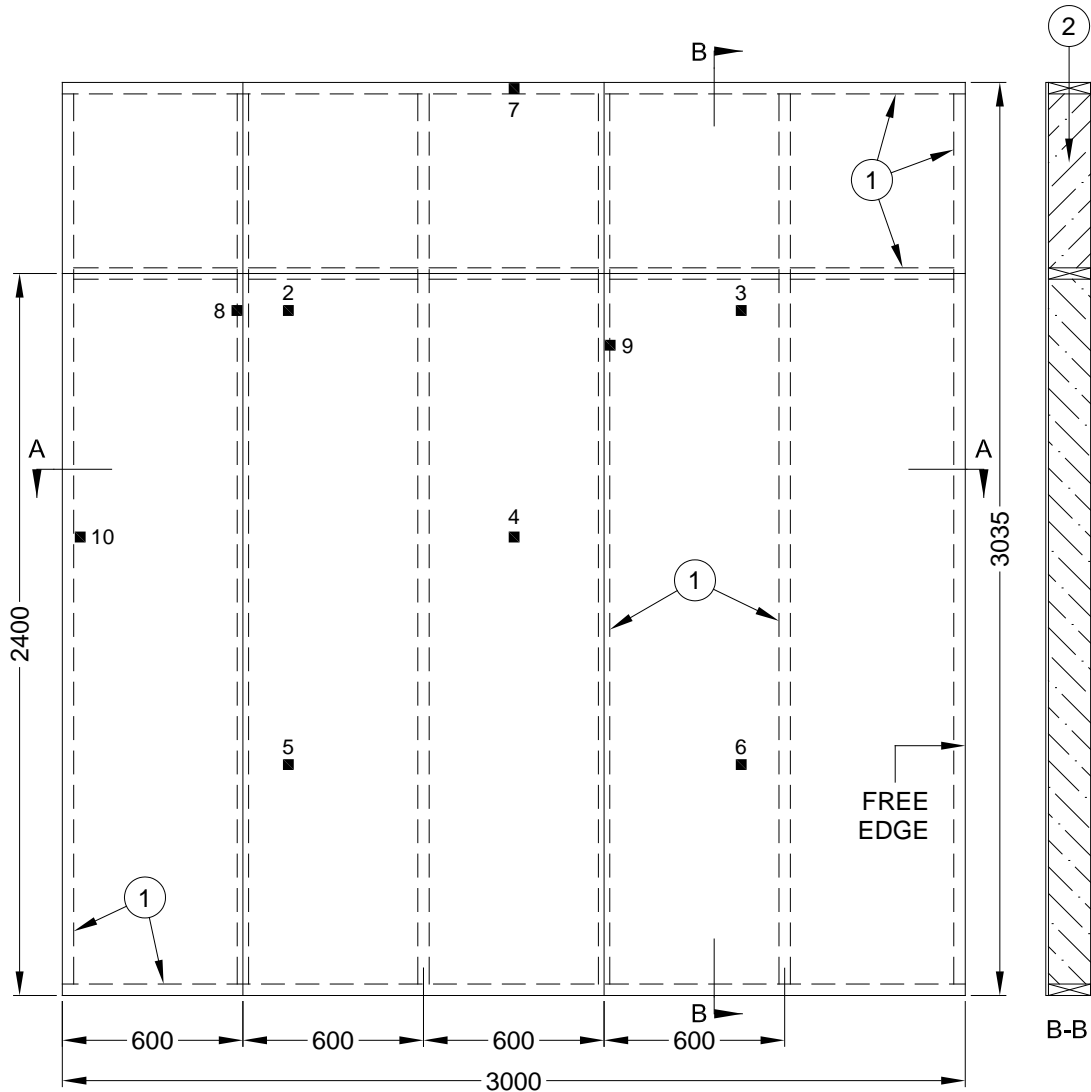
# Test Procedure

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<b>Introduction</b>	The specimen was of a non-loadbearing wall construction, and the test was conducted in accordance with Clause 5 of BS 476: Part 22: 1987 'Methods for determination of the fire resistance of non-loadbearing elements of construction'. This test report should be read in conjunction with that Standard and with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.
<b>Fire Test Study Group/EGOLF</b>	Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.
<b>Instruction To Test</b>	The test was conducted on the 3 <sup>rd</sup> June 2015 at the request of <b>International Petroleum Products Limited</b> the test sponsor.
<b>Test Specimen Construction</b>	A comprehensive description of the test construction is given in the Schedule of Components. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.
<b>Installation</b>	The assembly was installed into a refractory concrete lined, steel restraint frame. Representatives of the test sponsor conducted the installation between on the 2 <sup>nd</sup> June 2015.
<b>Sampling</b>	<b>Exova Warringtonfire</b> was not involved in the sampling or selection of the tested specimen or any of the components.
<b>Conditioning</b>	The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 2 days. Throughout this period of time both the temperature and the humidity of the laboratory were measured and recorded as being within a range of from 18°C to 23°C and 50.5% to 71.5% respectively.

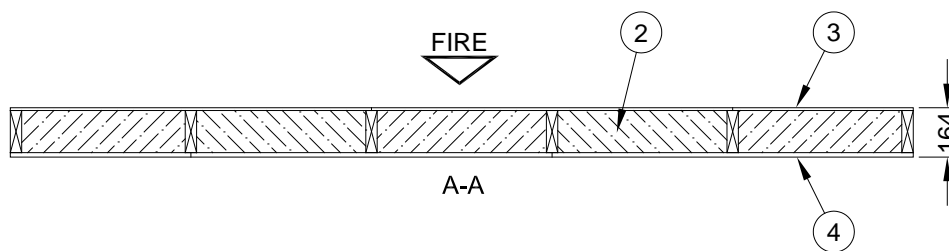
# Test Specimen

Figure 1- General elevation and details of test specimen and unexposed face thermocouples



GENERAL ELEVATION  
OF UNEXPOSED FACE

■ Positions of thermocouples



Do not scale. All dimensions are in mm

# Schedule of Components

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(Refer to Figure 1)  
(All values are nominal unless stated otherwise)  
(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
<b>1. Framework</b>	
Material	: Timber, C16 grade softwood
Section size	: Single section, 38 mm x 140 mm
Jointing method	: All framework members butt jointed and nail fixed together using 90 mm long Paslode nails.
Fixing method to masonry surround	: 4 no. pairs of 100 mm long steel screws into plastic plugs at 850 mm centres along perimeter top, bottom and one vertical edge. The remaining vertical edge was not fixed to the masonry and was kept as a free edge.
<b>2. Insulation</b>	
Manufacturer	: Rockwool
Reference	: FLEXI
Material	: Rock fibre insulation
Density	: 45 kg/m <sup>3</sup> (stated)
Overall thickness	: 140 mm (2 no. layers, each 70 mm thick)
Fixing method	: Friction fit within all voids between the timber framework members.
<b>3. Internal cladding</b>	
Material	: Magnesium oxide board
Thickness	: 9 mm
Density	: 1000 kg/m <sup>3</sup> (stated)
Fixing method	: Single layer fixed to fire side face of the timber framework using 65 mm long Paslode nails at 150 mm centres.
<b>4. External cladding</b>	
Material	: Gyproc Fireline board
Thickness	: 15 mm
Fixing method	: Single layer fixed to non-fire side face of the timber framework using 38 mm long drywall screws at 150 mm centres.

# Instrumentation

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<b>General</b>	The instrumentation was provided in accordance with the requirements of BS 476: Part 22: 1987.
<b>Furnace</b>	The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1, using nine mineral insulated, Type K thermocouples distributed over a plane 100 mm from the surface of the test construction.
<b>Thermocouple Allocation</b>	Thermocouples were provided to monitor the unexposed surface of the specimen and the output of all instrumentation was recorded at no less than one minute intervals as follows:
<b>Thermocouples 2 to 6</b>	At five positions, one approximately at the centre and one at approximately the centre of each quarter section of the specimen partition.
<b>Thermocouple 7</b>	Positioned at the head of the specimen partition at mid-width.
<b>Thermocouple 8 and 9</b>	At two positions on the unexposed surface of the specimen, adjacent to the vertical joints at $\frac{3}{4}$ height of the specimen partition.
<b>Thermocouple 10</b>	Positioned at mid-height, nominally 100 mm from the fixed edge.
	The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.
<b>Roving Thermocouple</b>	A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position which might appear to be hotter than the temperatures indicated by the fixed thermocouples.
<b>Integrity Criteria</b>	Cotton pads and gap gauges were available to evaluate the permeability of the specimen to hot gases.
<b>Furnace Pressure</b>	After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS 476: Part 20: 1987, Clause 3.2.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the specimen was 17 ( $\pm 2$ ) Pa.



# Test Observations

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Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	The ambient air temperature in the vicinity of the test construction was 13°C at the start of the test with a maximum variation of +2°C during the test.
00	00	<b>The test commences.</b>
10	00	Steam is being released from the upper joints in the partition.
12	00	Light flaming visible at the joint partitions on the exposed face.
14	00	Steam release continues from the joints in the specimen.
20	00	Generally, there are no visible significant changes to the unexposed face. The partition remains flat and stable.
28	00	Steam/smoke is being released but in relatively small volumes.
30	00	The specimen is maintaining its integrity and insulation.
40	00	The exposed face of the specimen is radiating an orange colour.
45	00	Flaming visible at the joint positions in the partition owing to the timber studs flaming.
50	00	There is evidence of any loss of any board material on the exposed face.
60	00	The specimen is maintaining its integrity and insulation.
70	00	Steam/smoke is being released from a cross joint in the partition.
75	00	Central section of board material falls away on the exposed face.
84	00	Scorch marks are appearing in a central area of the plasterboard on the unexposed face which coincides with the board material that has fallen away on the exposed face.
86	00	Thermocouple No.4 records a temperature rise in excess of the maximum allowable. <b>Insulation failure of the specimen partition occurs.</b>
89	00	Scorching of the central area of the plasterboard, previously mentioned at 84 minutes, increases. A cotton wool pad is applied over this area. The pad but does not ignite nor the fibres of the pad glow.
91	30	Sustained flaming occurs at a horizontal joint position in the partition. <b>Integrity failure of the specimen partition occurs.</b>
92	00	<b>Test Discontinued.</b>

## Test Photographs

The unexposed face of the test construction as the test commences



The unexposed face of the test construction after 30 minutes of testing



The unexposed face of the test construction after 60 minutes of testing



The unexposed face of the test construction after 70 minutes of testing



The unexposed face of the test construction after 85 minutes of testing



The unexposed face of the test construction after 91 minutes of testing showing the flaming at the joint of the partition.



The exposed face  
of the test  
construction  
immediately after  
testing



# Temperature and Deflection Data

Mean furnace temperature, together with the temperature/time relationship specified in BS 476: Part 22

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	57
3	502	523
6	603	589
9	663	653
12	706	707
15	739	749
18	766	761
21	789	780
24	809	803
27	826	825
30	842	845
33	856	852
36	869	869
39	881	881
42	892	890
45	902	900
48	912	907
51	921	922
54	930	932
57	938	938
60	945	944
63	953	951
66	960	954
69	966	964
72	973	973
75	979	986
78	985	1003
81	990	994
84	996	998
87	1001	1003
90	1006	1003
91	1008	1009
92	1009	1014

**Individual and mean temperatures recorded on the unexposed surface**

Time Mins	T/C Number 2 Deg. C	T/C Number 3 Deg. C	T/C Number 4 Deg. C	T/C Number 5 Deg. C	T/C Number 6 Deg. C	Mean Temp Deg. C
0	14	14	14	14	14	14
3	14	14	14	14	15	14
6	14	14	14	14	14	14
9	14	17	17	15	15	15
12	20	39	33	29	20	28
15	36	48	48	50	28	42
18	44	49	51	56	34	46
21	45	47	51	54	36	46
24	45	46	50	51	37	45
27	44	45	48	48	37	44
30	44	44	46	46	36	43
33	43	44	45	44	36	42
36	43	44	46	43	35	42
39	44	45	50	43	37	43
42	46	46	55	46	41	46
45	48	47	60	49	45	49
48	50	50	64	54	53	54
51	52	53	66	57	58	57
54	53	55	68	60	63	59
57	55	56	70	63	66	62
60	56	57	71	65	67	63
63	57	58	73	67	68	64
66	58	59	74	70	72	66
69	60	60	76	73	74	68
72	67	61	77	76	76	71
75	92	61	95	74	77	79
78	94	62	96	78	81	82
81	94	64	97	97	84	87
84	94	67	119	97	86	92
85	101	68	137	97	87	98
86	108	69	184	97	88	108
87	121	70	253	100	89	126
90	307	72	369	128	92	193
91	351	72	392	165	93	214
92	385	73	*	249	94	200

\*Thermocouple malfunction

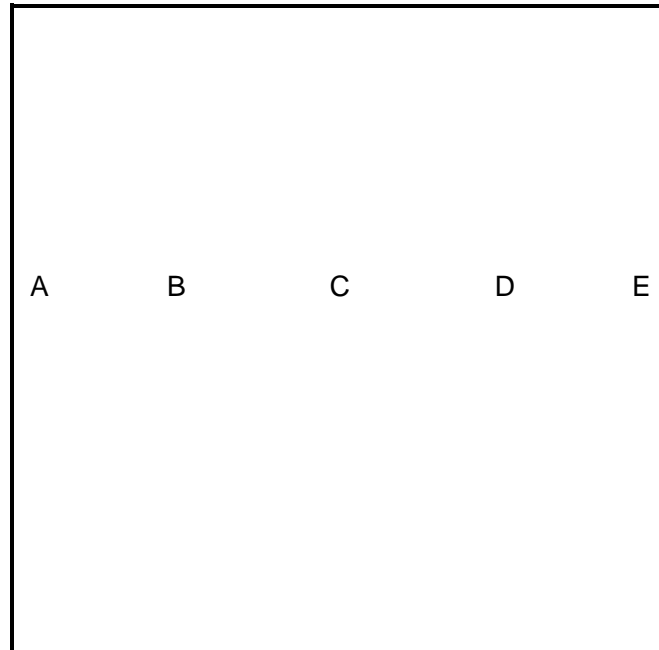
**Individual temperatures recorded on the unexposed surface**

Time Mins	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C	T/C Number 10 Deg. C
0	14	16	16	16
3	15	16	16	*
6	15	16	16	*
9	15	16	41	*
12	55	30	56	*
15	71	46	58	*
18	72	51	56	*
21	71	53	53	*
24	70	54	51	*
27	69	54	49	*
30	69	53	48	*
33	69	53	48	*
36	68	52	48	*
39	68	51	49	*
42	68	52	50	*
45	68	53	52	*
48	68	53	53	*
51	69	54	55	*
54	70	55	56	*
57	70	56	57	*
60	70	57	58	*
63	71	57	58	*
66	71	58	59	*
69	70	58	59	*
72	69	59	59	*
75	70	60	61	*
78	70	63	64	*
81	73	65	67	*
84	74	69	73	*
87	76	75	76	*
90	82	85	84	*
91	83	91	86	*
92	85	97	89	*

\*Thermocouple malfunction



**Deflections of the unexposed face of the specimen during the test**



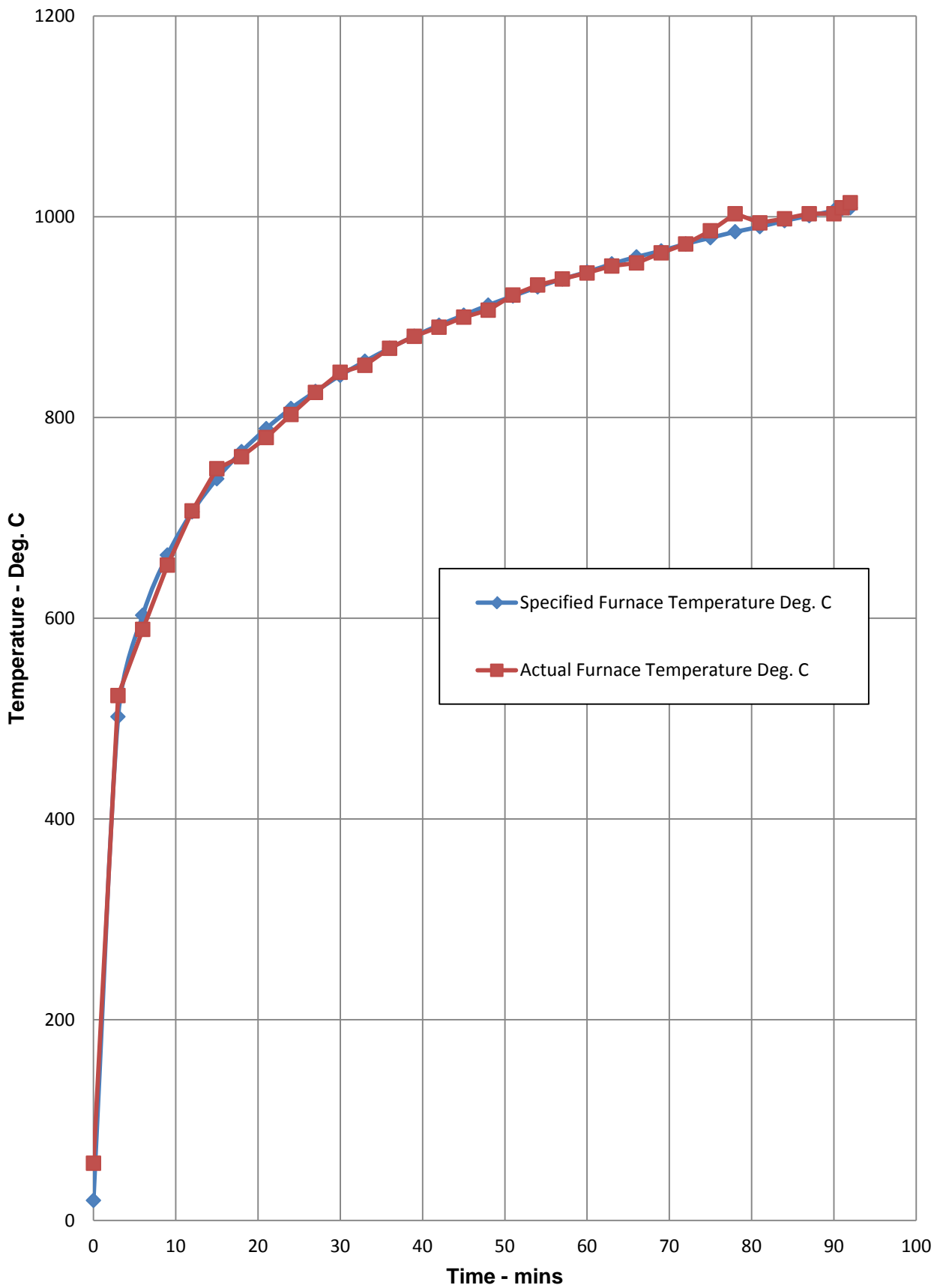
TIME mins	A	B	C	D	E
0	0	0	0	0	0
10	1	4	3	1	1
20	2	2	-1	-3	0
30	-2	0	-4	0	-3
40	-1	2	-3	-3	*
50	-1	0	-3	-6	*
60	-1	-2	-3	-4	*
70	2	-4	-5	-8	*
80	1	-11	-18	-15	*

All deflections in mm

\* Deflection reading not possible

Note: Positive values indicate deflection towards the furnace chamber

Graph showing mean furnace temperature, together with the temperature/time relationship specified in BS 476: Part 22



## Performance Criteria and Test Results

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**Integrity** It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of permeability. These requirements were satisfied for a period of 91 minutes after which time sustained flaming occurred at a horizontal joint position.

**Insulation** It is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure. These requirements were satisfied for a period of 86 minutes after which time insulation failure occurred owing to thermocouple T/C 4 recording a temperature rise in excess of 180°C.

## Ongoing Implications

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**Limitations** The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

The tested assembly was symmetrical and was tested such that the internal face Magnesium Oxide boards faced the heating conditions of the test. The test results may not be appropriate to situations where the opposite side of the assembly faces the heating conditions of the test.

The test results relate only to the specimen tested. Appendix A of BS 476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to assemblies of different dimensions or incorporating different components should be the subject of a design appraisal.

**Review** 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 five 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.

# Conclusions

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**Evaluation  
against objective**

A specimen of an asymmetrical, non-loadbearing, wall assembly has been subjected to a fire resistance test in accordance with BS 476: Part 22: 1987, Clause 5.

The specimen satisfied the performance requirements specified in Clause 5 of BS 476: Part 22: 1987, for a non-loadbearing wall assembly, for the following periods:

**Test Results:**

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**Integrity**

91 minutes

**Insulation**

86 minutes

The test was discontinued after a period of 92 minutes.