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Testing. Advising. Assuring.



Title:

The Fire Resistance Performance Of A Loadbearing Wall Assembly, In Accordance With BS 476: Part 21: 1987: Clause 8.

WF Report No:

372077



Prepared for:

Eurosips Ltd
Unit 42 Burnt Mills
Industrial estate
Harlow
Essex
CM20 2HU



Date:

16th December 2016

Notified Body No:

0833



0249

Summary

Objective To determine the fire resistance performance of a loadbearing wall assembly when tested in accordance with Clause 8 of BS 476: Part 21: 1987.

Test Sponsor Eurosips Ltd

Address Unit 42 Burnt Mills, Industrial estate, Harlow, Essex, CM20 2HU.

Summary of the Tested Specimen The specimen had overall nominal dimensions of 2400 mm high by 3000 mm wide by 153 mm thick formed from four composite panels. Briefly, the panels comprised a softwood perimeter frame clad with 12 mm thick Magnesium Oxide (MgO) wall board facings and a closed cell polyurethane foam core, with a stated density of 45kg/m³. The panels were profiled to interlock with additional aluminium jointing splines and galvanised mild steel locking hooks at the top and bottom of the panels.

At the request of the test sponsor a total load of 10kN was applied to the specimen via a hardwood timber load spreader and hydraulic rams positioned underneath the assembly.

Test Results:

Loadbearing Capacity 102 minutes*

Integrity 102 minutes

Insulation 71 minutes

*The test duration. The test was discontinued after a period of 102 minutes


Date of Test 28th September 2016


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Signatories


Responsible Officer D. Yates* Technical Officer


Approved G. Edmonds* Senior Technical Officer

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

Report Issued Date : 16 th December 2016
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Test Procedure

Introduction

The specimen was of a loadbearing wall construction and the test was therefore conducted in accordance with Clause 8 of BS 476: Part 21: 1987 'Methods for determination of the fire resistance of 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)'.

The specimen was judged on its ability to comply with the performance criteria for loadbearing capacity, integrity and insulation, as required by BS 476: Part 21: 1987, Clause 8.

Fire Test Study Group/EGOLF

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.

Instruction to test

The test was conducted on the 28th September 2016 at the request of **Eurosips Ltd** the test sponsors.

Mr P. Queen, a representative of the test sponsor witnessed the test.

Test Specimen Construction

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.

Installation

The specimen was mounted within a refractory lined steel support frame such that both vertical edges had freedom of movement. The specimen was installed by representatives of the client in conjunction with representatives of **Exova Warringtonfire** on the 28th September 2016.

Sampling

Exova Warringtonfire was not involved in any selection or sampling procedures of the tested specimen.

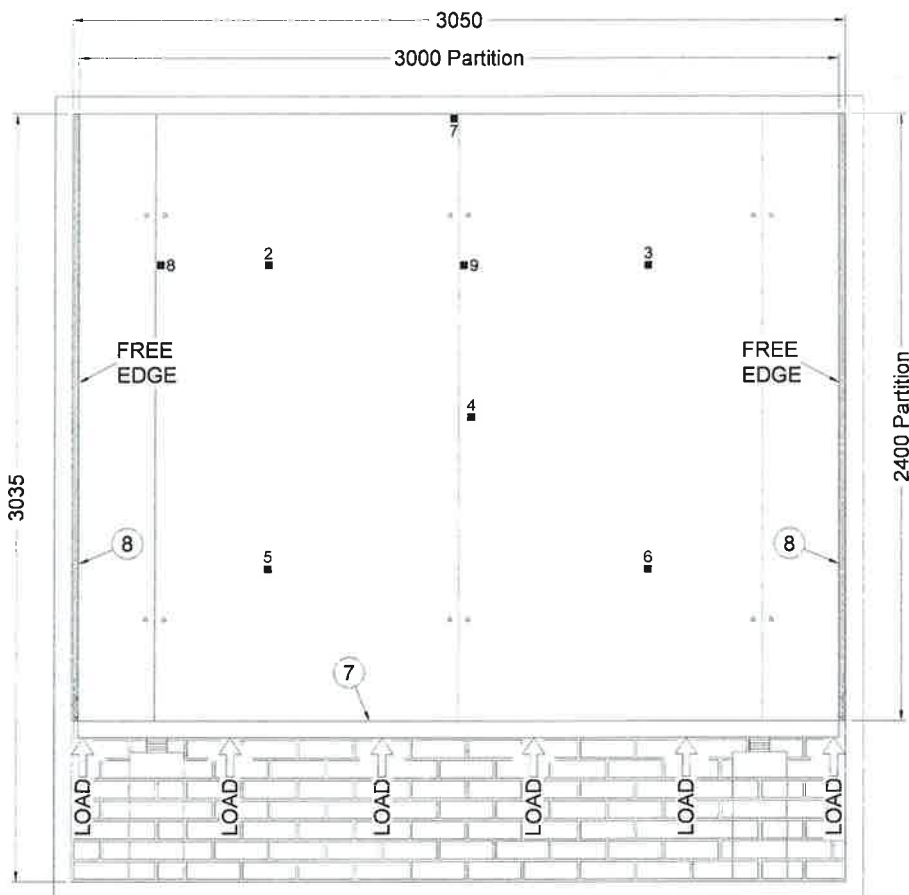
Conditioning

The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 1 day. 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 70% to 78% respectively.



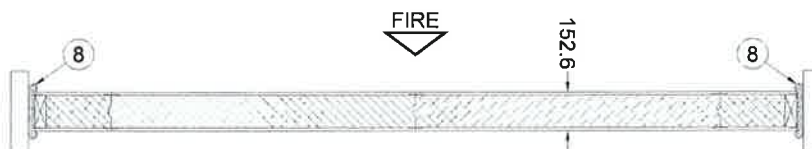
Test Specimen

Figure 1- General Elevation of Test Construction



■ Positions of thermocouples

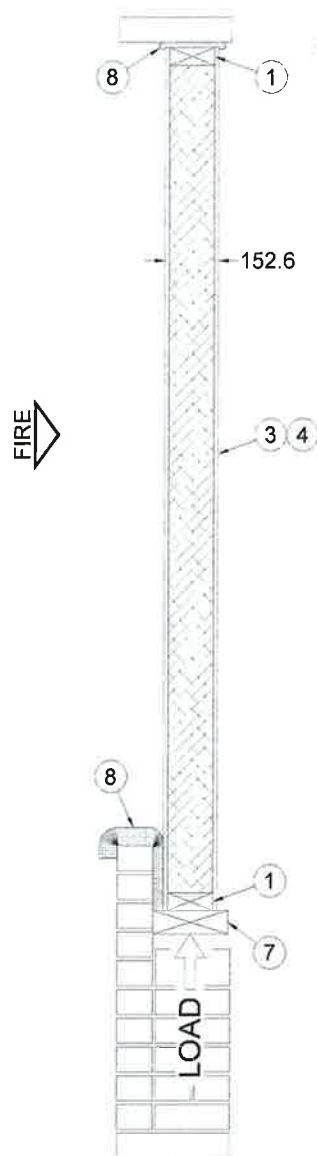
GENERAL ELEVATION
OF UNEXPOSED FACE



HORIZONTAL SECTION

Do not scale. All dimensions are in mm

Figure 2 – Vertical Section Through the Test Construction

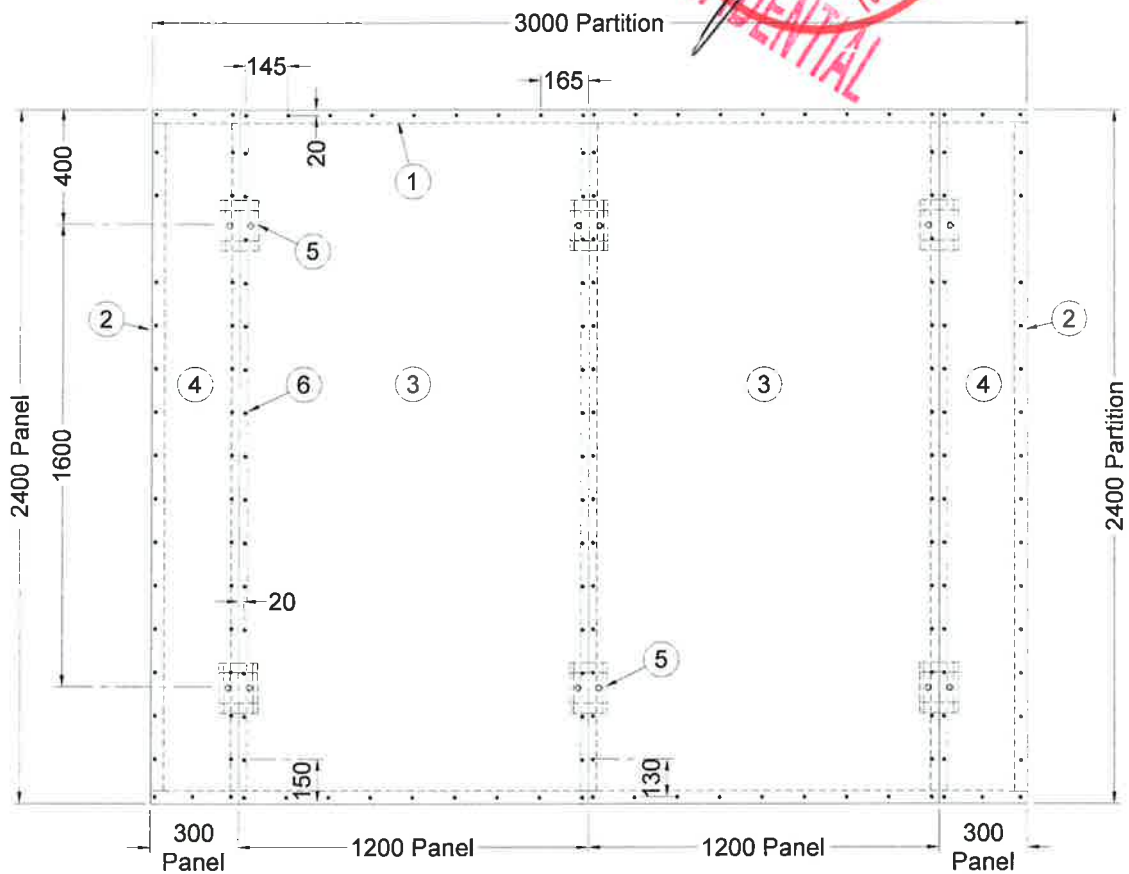


Do not scale. All dimensions are in mm





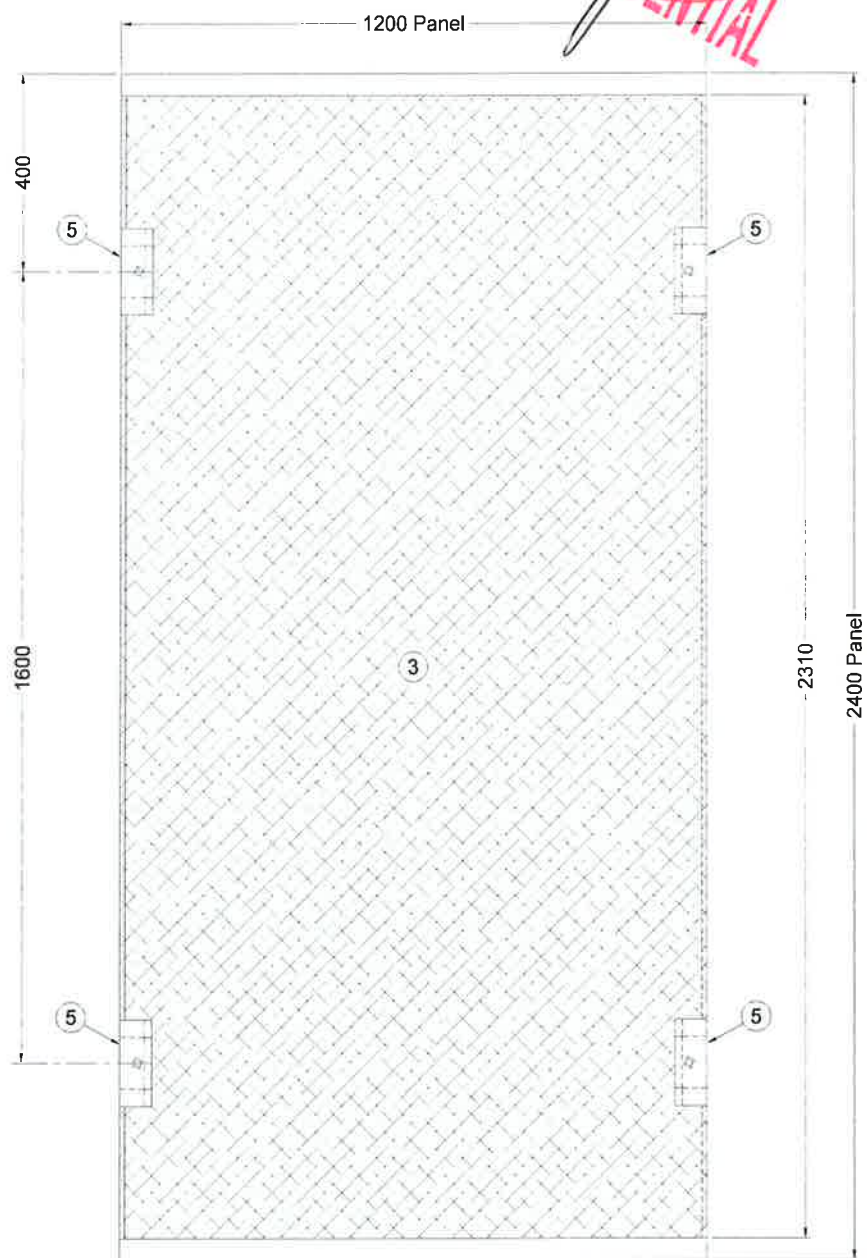
Figure 3 – Details of Partition



Do not scale. All dimensions are in mm



Figure 4 – Details of Central Panels

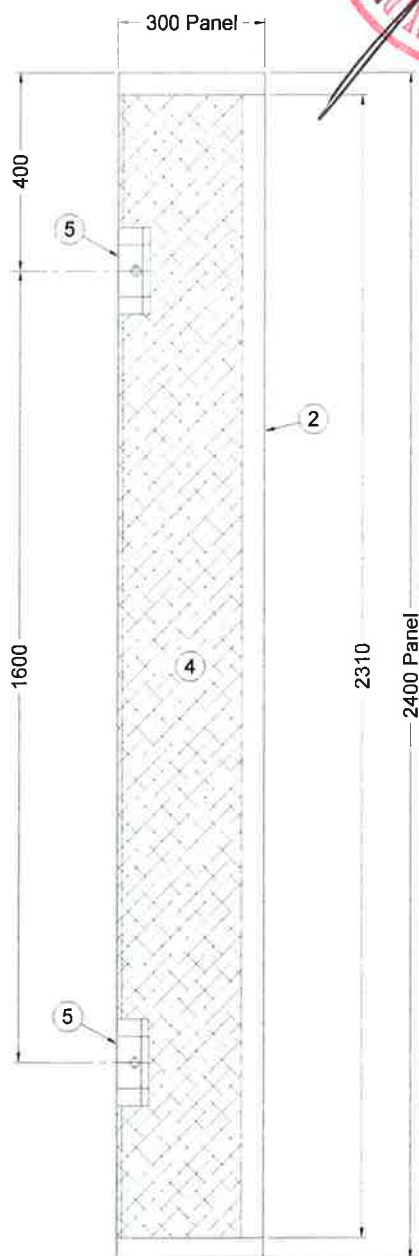


Do not scale. All dimensions are in mm



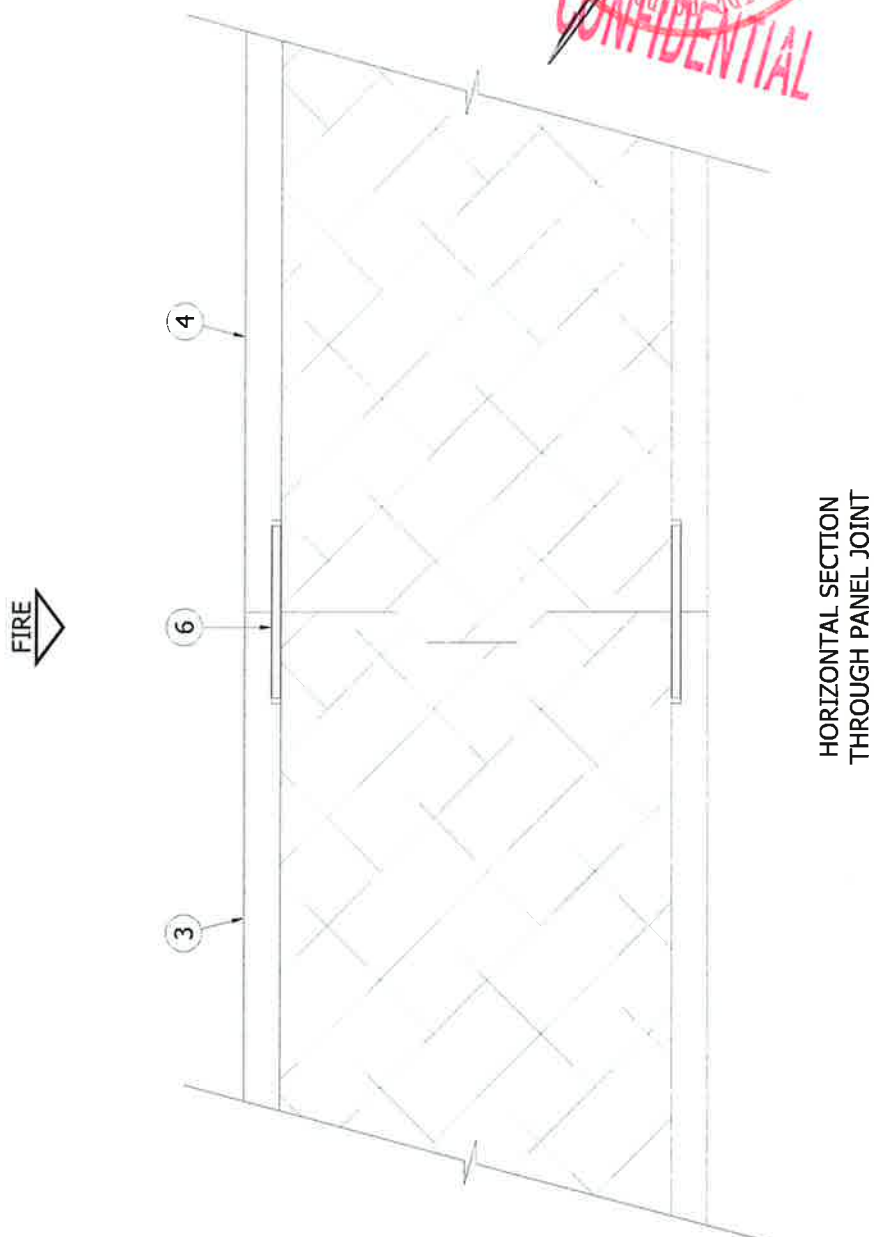


Figure 5 – Details of Outer Panels



Do not scale. All dimensions are in mm

Figure 6 – Typical Details of Vertical Panel Joint



HORIZONTAL SECTION
THROUGH PANEL JOINT



Do not scale. All dimensions are in mm



Schedule of Components

(Refer to Figures 1 to 6)
 (All values are nominal unless stated otherwise)
 (All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Horizontal Timber Wall Plate	
Material	: C24 grade softwood
Density	: 420 kg/m ³ , nominal
Overall size	: 129 mm wide x 44.8 mm thick x 3000 mm long
Fixing method	: Fitted into recess at the head and base of the panels of the assembled partition and through screwed via the panel facings
Fixings	
i. manufacturer	: Screws Limited
ii. type	: Countersunk head single thread wood screws PZ2
iii. material	: Stainless steel
iv. reference	: Ultra screw
v. overall size	: 40 mm long x 4.5 mm diameter
vi. centres	: 145 mm
2. Horizontal Timber Wall Plate	
Material	: C24 grade softwood
Density	: 420 kg/m ³ , nominal
Overall size	: 129 mm wide x 44.8 mm thick x 2310 mm long
Fixing method	: Fitted into recess along the outer edge of the outer panels of the partition and through screwed via the panel facings
Fixings	
i. manufacturer	: Screws Limited
ii. type	: Countersunk head single thread wood screws PZ2
iii. material	: Stainless steel
iv. reference	: Ultra screw
v. overall size	: 40 mm long x 4.5 mm diameter
vi. centres	: 150 mm
3. Composite Panel	
Manufacturer	: Eurosips Limited
Reference	: ResCom MgO Panels
Material	
i. panel facings	: Magnesium oxide, MgO, boards
ii. panel core	: Injected foam
Overall size	: 1200 mm wide x 2400 mm high
Thickness'	
i. panel	: 152.6 mm
ii. panel facings	: 11.8 mm
iii. panel core	: 129 mm
Densities	
i. panel facings	: 850 kg/m ³ - 950 kg/m ³ , nominal
ii. panel core	: 45 kg/m ³ , stated
Fixing method	: Butted vertically and retained by the fixings for the jointing plate, item 6



<u>Item</u>	<u>Description</u>
4. Composite Panel	
Manufacturer	: Eurosips Limited
Reference	: ResCom MgO Panels
Material	
i. panel facings	: Magnesium oxide, MgO, boards
ii. panel core	: Injected foam
Overall size	: 300 mm wide x 2400 mm high
Thickness'	
i. panel	: 152.6 mm
ii. panel facings	: 11.8 mm
iii. panel core	: 129 mm
Densities	
i. panel facings	: 850 kg/m ³ - 950 kg/m ³ , nominal
ii. panel core	: 45 kg/m ³ , stated
Fixing method	: Butted vertically and retained by the fixings for the jointing plate, item 6
5. Jointing Locks	
Manufacturer	: Manni, Italy
Reference	: Cam Lock System
Material	
i. casing	: Galvanised mild steel
ii. locking hook	: Galvanised mild steel
Overall size	
i. casing	: 70 mm wide x 170 mm high x 15 mm thick
ii. locking hook	: 45 mm high x 30 mm deep x 3 mm thick
Fixing method	: 2 off per side of central panels, item 3, and 2 off along one side of the outer panel, item 4, encapsulated within the core of the panels at the positions shown in Figures 3, 4 & 5
6. Jointing Spline	
Material	: Aluminium plate
Overall size	: 56.3 mm wide x 2.8 mm thick x 2310 mm long
Fixing method	: Fitted along the vertical edges of the panels into recesses in the panel core on both sides of the panel and through screwed via the panel facings. Please see Figure 6
Fixings	
i. manufacturer	: Screws Limited
ii. type	: Countersunk head single thread wood screws PZ2
iii. material	: Stainless steel
iv. reference	: Ultra screw
v. overall size	: 40 mm long x 4.5 mm diameter
vi. centres	: 150 mm
7. Load Spreading Beam	
Supplier	: Exova Warringtonfire
Material	: Oak
Overall size	: 214 mm wide x 66 mm thick x 3000 mm long
Fixing method	: Fitted between the underside of the partition assembly and the load applying hydraulic rams. Please see Figures 1 & 2



Item

8. Perimeter Packing

- Supplier
- Manufacturer
- Reference
- Material
- Density
- Fixing method

Description

- : Exova Warringtonfire
- : Morgan Advanced Materials
- : SW Plus
- : Alkali silicate based insulation
- : 96 Kg/m³, uncompressed
- : Laid across the head of the partition prior to being placed into the restraint frame and the load being applied. Also packed into the gaps along the vertical edges. Please see Figures 1 & 2





Instrumentation

General	The instrumentation was provided in accordance with the requirements of the Standard.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1. using six mineral insulated thermocouples distributed over a plane 100 mm from the surface of the test construction.
Thermocouple Allocation	Thermocouples were provided to monitor the unexposed surface of the specimens and the output of all instrumentation was recorded at no less than one minute intervals as follows:
Thermocouples 2 to 6	At five positions on the unexposed surface of the specimen, one approximately at the centre and one at approximately the centre of each quarter section of the specimen.
Thermocouples 8 and 9	At two positions on the unexposed surface of the specimen, at the approximate three quarter height of the wall adjacent to the vertical joints.
Thermocouple 7	At one position, approximately mid-span of the wall at its head. The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.
Roving Thermocouple	A roving thermocouple was available to measure temperatures on the unexposed surface of the specimens at any position that might appear to be hotter than the temperatures indicated by the fixed thermocouples.
Integrity criteria	Cotton pads and gap gauges were available to evaluate the integrity of the specimen.
Furnace Pressure	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 11.9 (± 2) Pa.



Test Observations

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 19°C at the start of the test with a maximum variation of +1°C during the test.
00	00	The test commences.
08	15	When viewed from the exposed face, small horizontal cracks are evident in the surface of the MgO board.
10	05	Slight smoke release begins from the head of the right joint.
19	15	When viewed from the exposed face, the surface of the assembly radiates a dull orange colour. The assembly has visibly bowed towards the furnace at its centre along the middle joint.
25	15	Smoke release has increased slightly from the head of the assembly.
31	00	When viewed from the exposed face, flames issue along the vertical joints of the assembly. Large volumes of flaming are evident within the furnace chamber.
35	30	When viewed from the exposed face, visibility within the furnace is restricted due to the amount of flaming evident within the furnace chamber.
40	00	Faint popping sounds can be heard from the vicinity of the assembly.
47	00	Smoke release has increased slightly across the head.
49	00	Smoke release issues from the head of the left vertical joint.
50	00	When viewed from the exposed face, the central joint has opened up by approximately 5mm. Large amounts of flames issue along the central and right hand joints.
52	20	Smoke release increases further from the head of both outer vertical joints and across the head of the left panel section.
53	30	Smoke release begins from the upper half of the central joint as the joint continues to open up.
54	39	Large volumes of smoke issue from the upper half of the central joint.
57	00	A cotton pad is applied to the central joint at its mid height. The cotton pad discolours but fails to ignite. Smoke release continues to increase from the central joint.
58	50	A cotton pad is applied to the central joint at its mid height. The cotton pad discolours but fails to ignite. Smoke release increases further from the central joint.
60	00	No significant visible change. The specimen continues to satisfy the test criteria.
61	15	Large volumes of light yellow smoke issues from the upper 2/3 of the central joint.



Time		
mins	secs	
63	45	A cotton pad is applied to the central joint at its mid height. The cotton pad discolours but fails to ignite. Smoke release continues to increase from the central joint.
64	20	A diagonal crack has formed at the top of the right hand panel.
68	50	Black discolouration is visibly along the central joint. Smoke release begins from the outer joints upper half.
69	80	Cracks become more evident within the boards at the upper half of the assembly.
71	00	Cracks begin to form around the screw fixed positions along the central joint.
73	00	A cotton pad is applied to the central joint at its mid height. The cotton pad discolours but fails to ignite. Smoke release continues to increase from the central joint.
76	25	The upper half of the middle right panel has discoloured a light yellow/brown colour.
77	50	Horizontal and diagonal cracks become more evident in the boards throughout the assembly. Smoke release has increased along with discolouration along the outer vertical joints.
80	45	When viewed from the exposed face, the surface of the assembly radiates a bright orange colour. Large amount of flaming continues along the vertical joints in the boards. The assembly appears heavily distorted along the vertical joints also.
84	40	Smoke release has reduced along the central joint.
90	00	No visible significant change. The specimen continues to maintain its loadbearing capacity and satisfy the integrity criteria of the test. Approximately 90% of the surface of the assembly has discoloured a light brown colour.
99	30	Smoke release appears to have increased slightly along with discolouration at mid height of the outer vertical joints.
101	00	Flashes of flames issue along the bottom half of the central joint.
102	15	The central joint opens up very quickly and sustained flames issue along the joint. Integrity failure is deemed to occur. The test is discontinued.





Test Photographs

The exposed face of the specimen prior to testing



The unexposed face of the specimen prior to testing





The unexposed face of the specimen after a test duration of 30 minutes



The unexposed face of the specimen after a test duration of 60 minutes





The unexposed face of the specimen after a test duration of 90 minutes



The unexposed face of the specimen after a test duration of 102 minutes



The exposed face
of the specimen
immediately after
the test



Temperature and Deflection Data

Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	32
3	502	501
6	603	582
9	663	658
12	706	717
15	739	746
18	766	769
21	789	792
24	809	816
27	826	826
30	842	840
33	856	859
36	869	877
39	881	896
42	892	900
45	902	897
48	912	900
51	921	900
54	930	929
57	938	937
60	945	946
63	953	948
66	960	959
69	966	974
72	973	970
75	979	979
78	985	990
81	990	997
84	996	1002
87	1001	1009
90	1006	1007
93	1011	1012
96	1016	1020
99	1020	1018
102	1025	1030



**Individual And Mean Temperatures Recorded On The
 Unexposed Surface Of The Specimen**

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	20	20	20	20	20	20
3	20	20	20	20	20	20
6	20	20	20	20	20	20
9	20	20	20	20	21	20
12	20	20	20	20	21	20
15	20	20	20	20	21	20
18	20	20	20	20	21	20
21	20	20	20	20	21	20
24	20	20	20	20	21	20
27	20	20	20	20	21	20
30	20	20	20	20	21	20
33	20	20	20	20	21	20
36	20	20	20	20	21	20
39	20	20	20	20	21	20
42	20	20	20	20	21	20
45	26	22	21	21	21	22
48	80	60	29	29	35	47
51	99	106	57	69	82	83
54	102	108	96	101	106	103
57	110	111	101	102	104	106
60	123	120	109	105	109	113
63	136	133	116	113	119	123
66	148	146	128	123	130	135
69	163	159	137	134	141	147
70	170	164	140	137	145	151
71	176	170	143	141	148	156
72	184	176	147	145	152	161
75	205	200	161	157	165	178
78	223	222	181	173	183	196
81	238	241	206	193	205	217
84	252	257	226	214	225	235
87	260	267	244	231	242	249
90	265	273	259	245	256	260
93	269	278	268	257	266	268
96	273	282	273	265	272	273
99	275	284	277	270	277	277
102	279	289	283	275	282	282



**Individual Temperatures Recorded on the
 Unexposed Surface of The Specimen**

Time Mins	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C
0	20	22	22
3	20	22	22
6	20	22	22
9	21	22	22
12	21	22	22
15	22	22	22
18	24	22	22
21	25	23	22
24	26	23	22
27	26	23	22
30	26	24	23
33	27	24	23
36	27	24	23
39	27	24	23
42	27	24	23
45	28	24	23
48	35	27	29
51	58	45	48
54	69	73	80
57	74	93	96
60	80	99	99
63	85	102	101
66	88	107	105
69	93	116	119
72	96	127	136
75	99	139	153
78	103	151	168
81	108	166	188
84	114	188	206
87	120	209	221
90	127	225	233
93	133	239	244
96	139	249	251
99	145	257	256
102	154	263	260



Recorded Deflection Of Specimen During The Test



A	B	C	D	E
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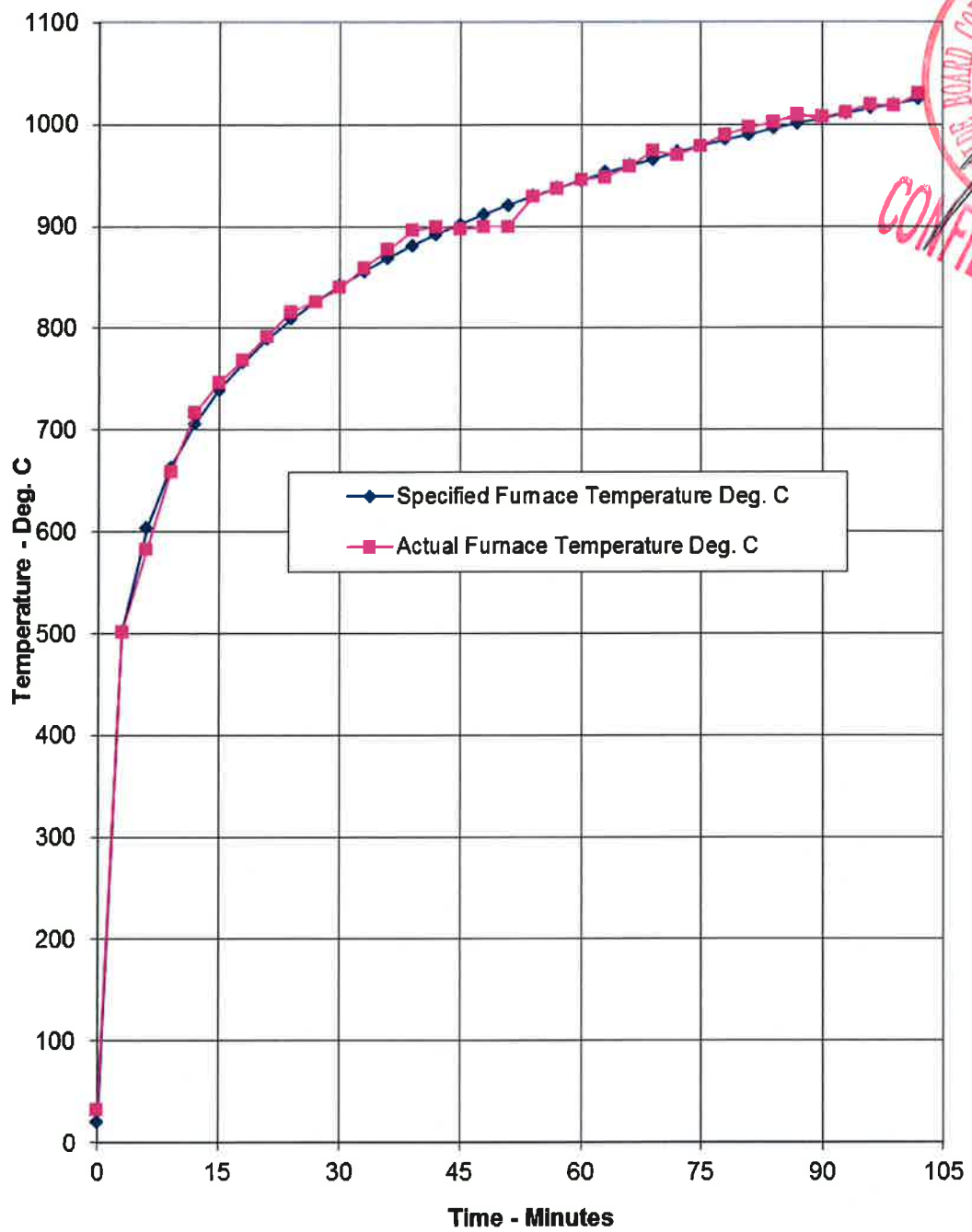
TIME mins	A	B	C	D	E
0	0	0	0	0	0
10	1	-15	-16	-12	-4
20	-3	-18	-20	-15	-5
30	-4	-22	-24	-19	-6
40	-6	-27	-34	-25	-8
50	-9	-37	-45	-26	-4
60	-11	-44	*	-47	-10
70	-9	-1	*	-5	-3
80	-6	6	*	17	-5
90	-15	-24	-57	6	-8
100	-19	-39	-73	2	-16

Positive readings indicate movement towards the heating conditions

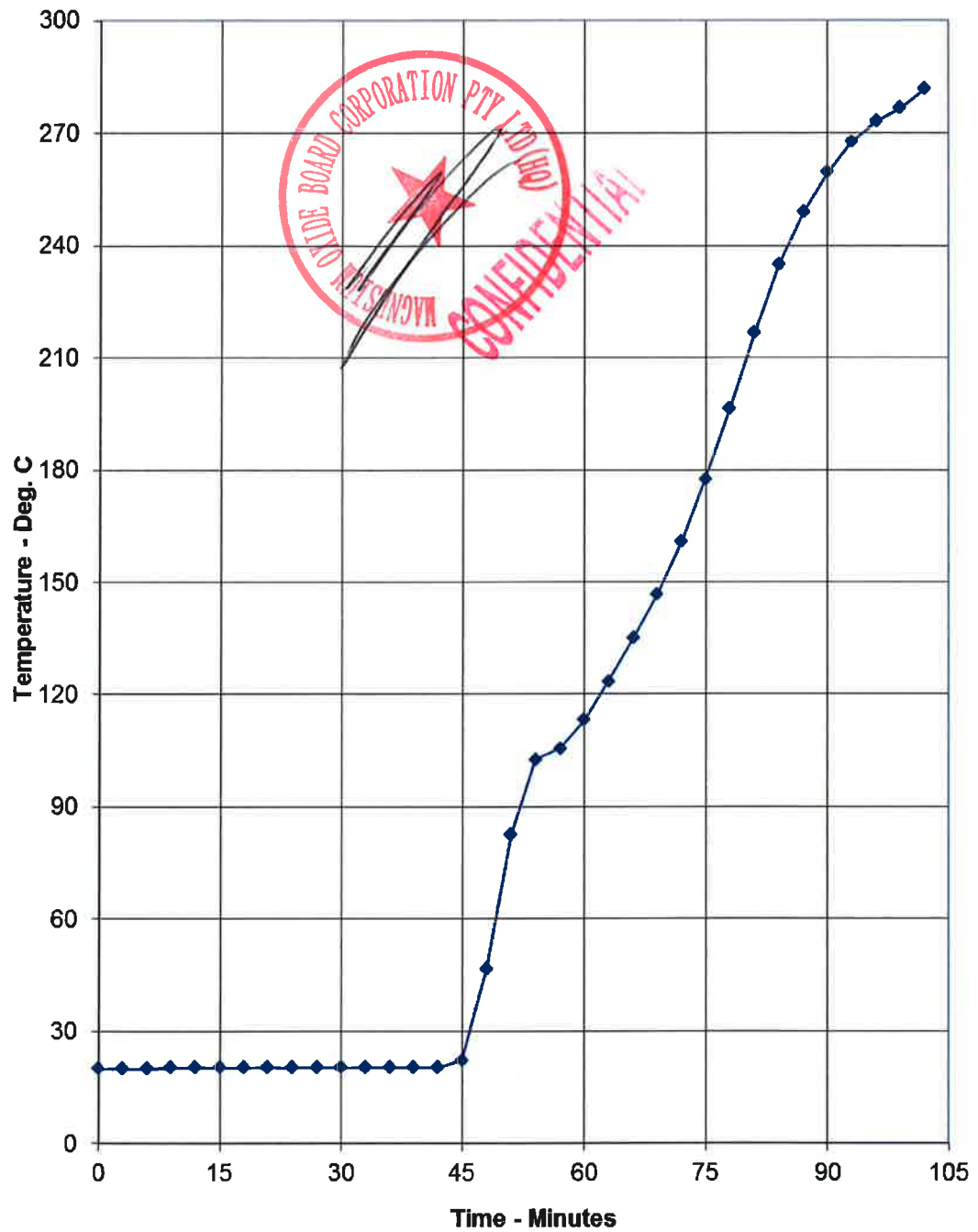
*Laser reading malfunction



Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard



**Graph Showing Mean Temperatures
Recorded On The Unexposed Surface Of The Specimen**



Performance Criteria and Test Results

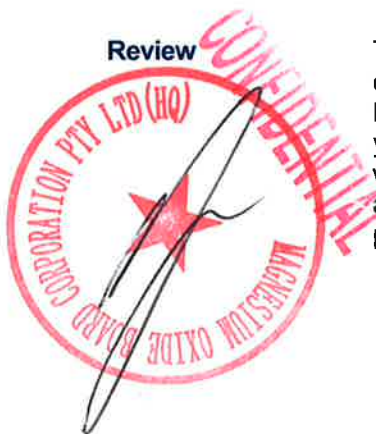
Loadbearing Capacity	The standard states that a loadbearing capacity failure is deemed to occur when the specimen fails to support the test loading, which is usually determined by a rapid change in the rate of deformation. The loadbearing capacity criterion was satisfied for a period of 102 minutes after which time integrity failure occurred.
Integrity	It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. These requirements were satisfied for a period of 102 minutes after which time sustained flames issued from the unexposed surface of the specimen.
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 the test duration of 71 minutes after which time the mean temperature rise increased by more than 140°C.

Ongoing Implications

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 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 result 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

Evaluation against objective A specimen of a loadbearing wall assembly has been subjected to a fire resistance test in accordance with BS 476: Part 21: 1987, Clause 8.

The evaluation of the specimen against the requirements of BS 476: Part 21: 1987, Clause 8 showed that the specimen satisfied the requirements for the periods stated below:

Test Results:

Loadbearing Capacity	102 minutes*
Integrity	102 minutes
Insulation	71 minutes



*The test duration. The test was discontinued after a period of 102 minutes