

Title:

The Fire Resistance Performance Of Six Specimens Of Electrical Sockets And Sealing Systems, Utilising The General Principles Of BS EN 1364-1: 1999 In Conjunction With Additional Guidelines From BS EN 1366-3: 2004

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Summary

Objective To evaluate the ability of six specimens of electrical sockets and sealing systems to reinstate the integrity and insulation performance of a drywall construction, when tested utilising the general principles of BS EN 1364-1: 1999 in conjunction with additional guidelines from BS EN 1366-3: 2004.

The specimens were referenced 'A/E, B/F, C, D, G and H', for the purposes of the test.

The assembly comprised a drywall construction of overall dimensions 3050 mm wide by 3035 mm high by 100 mm thick, constructed utilising the material specification given in BS EN 1366-3: 2004. The wall incorporated six specimens comprising a range of electrical sockets. Further details are provided in the Test Specimen, Figures 1 to 3.

Test results

Specimen	Cotton pad	Sustained flaming	Insulation
A/E	126 minutes*	126 minutes*	126 minutes*
B/F	126 minutes*	126 minutes*	126 minutes*
C	126 minutes*	126 minutes*	126 minutes*
D	126 minutes*	126 minutes*	126 minutes*
G	126 minutes*	126 minutes*	126 minutes*
H	126 minutes*	126 minutes*	126 minutes*

* The test duration. The test was discontinued after a period of 126 minutes.

Date of Test 17th March 2009

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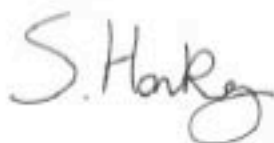
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* For and on behalf of Bodycote **warringtonfire**.

Report Issued

Date : 29th April 2009

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Test Procedure

Introduction

Partition walls often incorporate apertures to allow the installation of electrical sockets. The fire resistance of such elements is only as good as their weakest point and it is, therefore, important that any such installations are adequately sealed, such that weaknesses are not created at these positions.

The specimens were tested utilising the general principles given in BS EN 1364-1:1999, in conjunction with additional guidelines from BS EN 1366-3: 2004 for penetration sealing systems. This report should be read in conjunction with the above mentioned documents.

The specimens were judged on their ability to comply with the performance criteria for integrity and insulation, as required by BS EN 1364-1: 1999 and BS EN 1366-3: 2004.

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 17th March 2009

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 specimens and information supplied by the sponsor of the test.

Installation

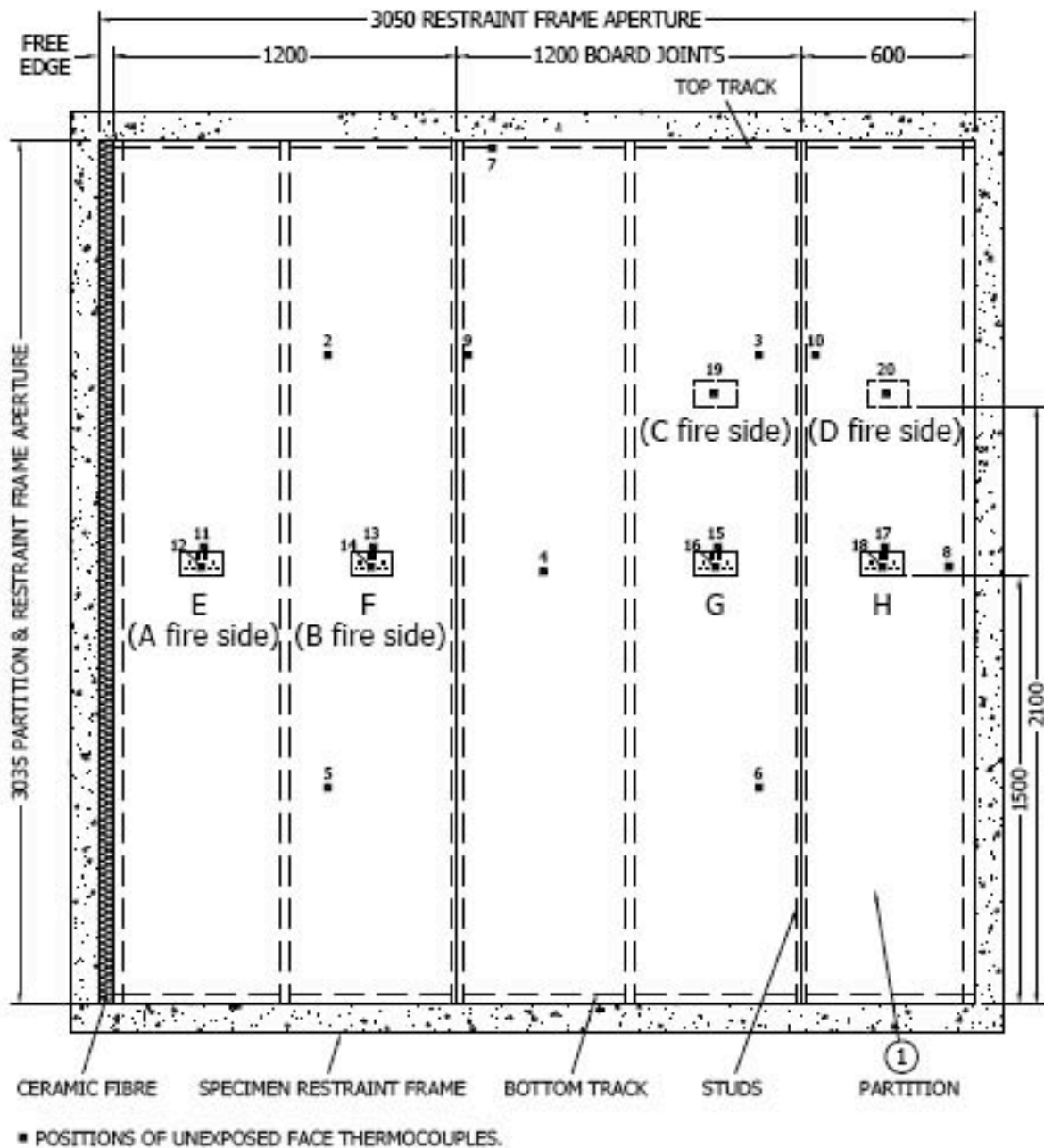
The assembly was constructed by representatives of the test sponsor on the 12th and 13th March 2009.

Sampling

Bodycote **warringtonfire** was not involved in any selection or sampling procedures of the specimens or any of the components.

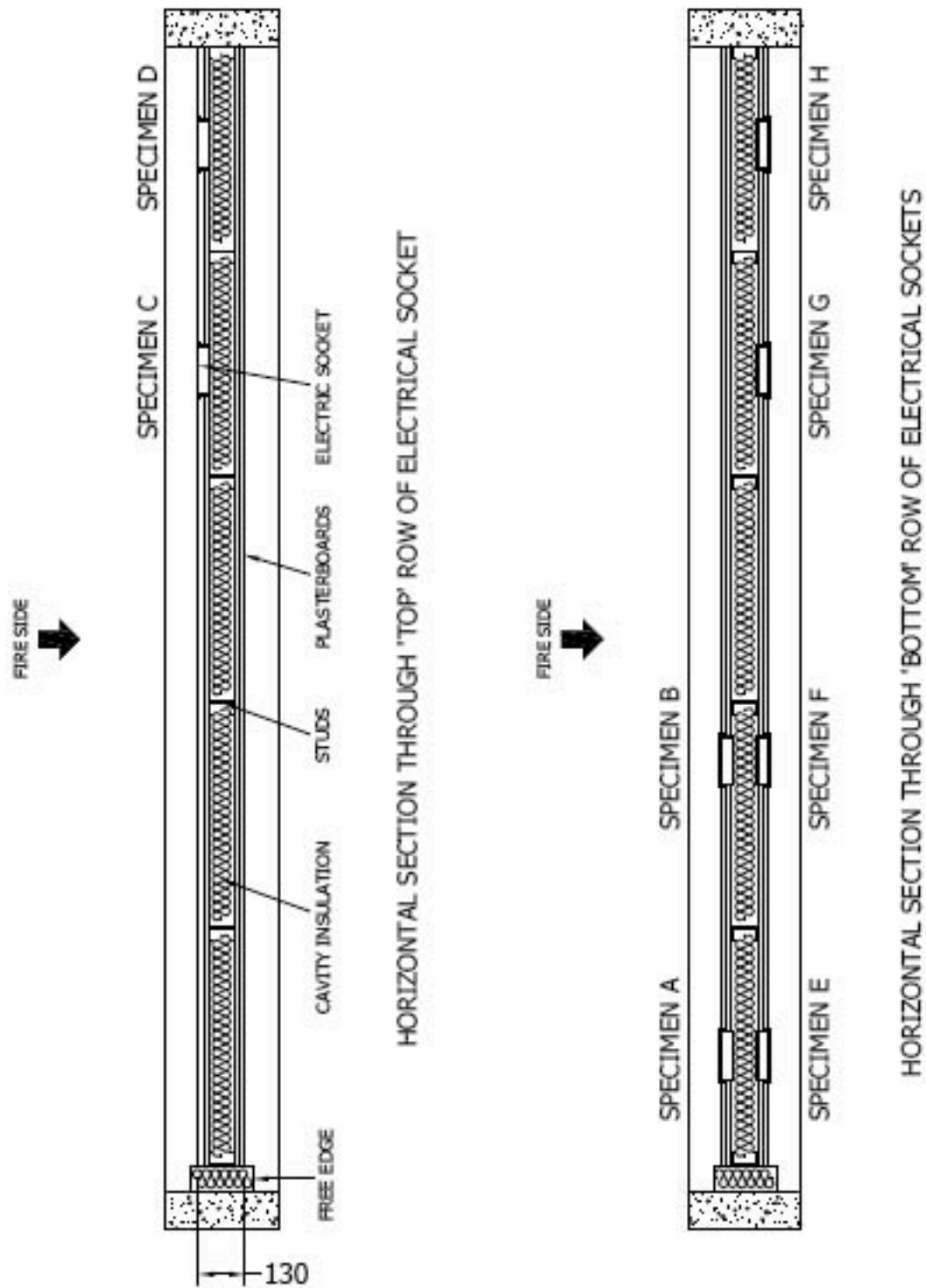
Test Specimen

Figure 1- General elevation of the unexposed face of the partition and electrical sockets



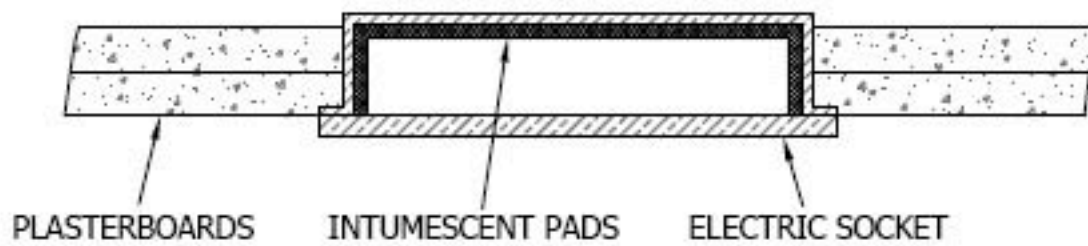
Do not scale. All dimensions are in mm

Figure 2 – Horizontal sections through the partition showing the electrical socket positions

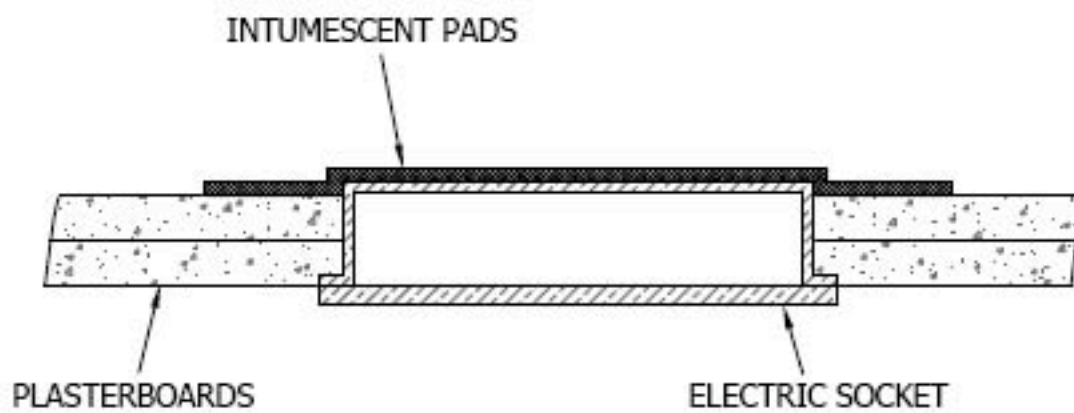


Do not scale. All dimensions are in mm

Figure 3 – Sections through the electrical sockets showing the positions of the putty pads



POSITION OF INTUMESCENT PADS
TO SPECIMENS : B, D, E, G



POSITION OF INTUMESCENT PADS
TO SPECIMENS : A, C, F, H

Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 3)
 (All values are nominal unless stated otherwise)
 (All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Partition / drywall construction	
General description	: The test assembly consisted of a gypsum plasterboard wall assembly with an insulated cavity
Overall size and thickness	: 3035 mm high by 3000 mm wide by 130 mm thick
Relevant requirements	: The construction of the wall was in accordance with EN 1363-1:1999
Materials	:
i. top and bottom track, studs	: Galvanised mild steel
ii. plasterboards	: Gypsum based plasterboards, to F-EN520
iii. cavity insulation	: Rockwool mineral wool based slabs
iv. mastic	: Intumescent acrylic sealant
References	:
i. top & bottom track	: 72 C 50
ii. studs	: 72 S 50
iii. cavity insulation	: Rockwool slabs (69 kg/m ³ recorded density)
iv. plasterboards	: Gyproc Fireline board (836 kg/m ³ recorded density)
v. mastic	: Intumescent Acrylic Sealant
Thickness	:
i. top & bottom track	: 0.55 mm
ii. studs	: 0.6 mm
iii. cavity insulation	: 75 mm
iv. plasterboards	: 15 mm x 2 layers
v. mastic	: Not applicable
Overall sizes	:
i. top & bottom track	: 72 mm wide x 32 mm deep.
ii. studs	: 70 mm wide x 32 mm deep
iii. cavity insulation	: Cut to full height of partition
iv. plasterboards	: 1200 mm wide x 2400 mm high for uncut boards
v. mastic	: Not applicable
Fixing methods	:
i. top & bottom track	: The channels were fixed with steel screws and plugs to the concrete lining of the specimen restraint frame. The screws were fitted centrally between each stud

- ii. studs : The studs were positioned at 600 mm nominal centres and were friction fitted into the channels, allowing approximately 20 mm at the head for expansion during the heating conditions of the test
- iii. cavity insulation : The insulation was friction fitted between the studs
- iv. plasterboards : Two layers of boards were fixed to each face of the partition with steel drywall screws 3.5 mm diameter x 25 mm and 42 mm long respectively for the inner and outer layer of boards at 300 mm nominal centres. All board joints were staggered with respect to the adjacent board layer and the boards on the opposite face of the partition. The outer board joints were finished with tape and plaster scrim
- v. mastic : The mastic was applied around the perimeter edges of the assembled partition

2. Electrical double gang sockets

- Type : Back box - standard dry lining electrical box, 13 A, 2 gang.
Cover plate - switched moulded socket outlet to BS 1363
- Material : Polyvinyl chloride (PVC)
- Overall sizes :
 - i. back box : 132 mm x 73 mm
 - ii. cover plate : 145 mm x 85 mm
- Fixing : The back boxes were fitted into apertures cut into the plasterboards and fixed with two steel screws. The apertures were central between the studs and at a minimum distance of 250 mm from the perimeter edges of the partition. The cover plates were fixed with steel screws onto the back boxes
- Positions : Specimen A was fitted opposite to Specimen E
Specimen B was fitted opposite to Specimen F
Specimen C was fitted staggered to Specimen G
Specimen D was fitted staggered to Specimen H

3. Putty pads 'new build' fitted onto the back face of the sockets – Unexposed face specimens F, H Exposed face specimens A, C

- Reference : Intumescent Putty Pads
- Material : Intumescent non-setting mouldable putty pads
- Sizes : 210 mm wide x 180 mm high x 3 mm thick
- Fixing : Fitted over the back box and overlapping the plasterboards during assembly of the partition
- Shape of pads : Rectangle

**4. Putty pads 'retro' fitted into the sockets –
Unexposed face specimens E, G
Exposed face specimens B, D**

Reference	:	Intumescent Putty Pads
Material	:	Intumescent non-setting mouldable putty pads
Sizes	:	230 mm wide x 170 mm high x 3 mm thick
Fixing	:	Inserted into the back boxes after they were fitted into the assembled partition
Shape of pads	:	Cross

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 EN 1363-1: 1999 Clause 5.1 using nine plate thermometers, distributed over a plane 100 mm from the surface of the test construction.
General	<p>Thermocouples were provided to monitor the unexposed surface of the specimens. The output of all instrumentation was recorded at no less than one minute intervals.</p> <p>The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.</p>
Roving Thermocouple	A roving thermocouple was available to measure temperatures on the unexposed surfaces of the specimens at any position, which might appear to be hotter than the temperatures indicated by the fixed thermocouples.
Integrity criteria	Cotton pads were available to evaluate the integrity of the specimens.
Furnace Pressure	The furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 1999, Clause 5.2.

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 13°C at the start of the test with a maximum variation of 1°C during the test.
00	00	The test commences.
02	21	The exposed faces of the partition and socket covers have blackened.
09	17	The exposed socket covers have cracked and the paperface of the plasterboard chars and starts to peel away.
13	37	All the exposed socket covers are still in place some flaming is visible around specimens B and D.
21	00	Viewed from the exposed side, A gap starts to form along the top edges of specimens A and C as the socket covers slump down. The socket covers of specimens C & D are being pushed out as the intumescent reacts.
23	29	The exposed socket cover of Specimen C has fallen away; flaming can be seen from the aperture.
30	00	All the exposed socket covers have fallen away; intumescent material can be seen to have filled the voids of specimens B and D.
37	01	Viewed from the exposed side flaming is visible from specimens D and B.
40	00	Viewed from the exposed side, intumescent material is visible in the void of Specimen C, however there doesn't appear to be any material in the void of Specimen A.
43	00	The joints in the outer exposed plasterboard layer start to open up approx 10-20mm. The partition glows orange.
48	00	No significant visual change to the unexposed face.
51	00	Intumescent material has filled B & D but some dark voids are visible, flaming is visible from both sockets.
67	14	Flaming is still visible on the exposed face from specimens B and D; the outer layer of exposed plasterboard is still in place.
67	26	The partition starts to bow in across its horizontal axis at mid height. Steam/smoke release is visible at the head of the partition just to the left of mid-span.
72	30	The outer layer of exposed plasterboard starts to come away on its vertical joints where the board has shrunk past the screw fixings.
74	00	Flaming is visible on the exposed face from specimens A and C.

mins	secs	
80	00	The outer layer of exposed plasterboard is still in place, it's peeling open and bulging out as it starts to fall away.
91	00	The outer layer of exposed plasterboard has fallen away on the right hand side; some sections still remain attached on the left hand side. On the right hand side the rock wool core is also visible where the inner layer of plasterboard has also come away in places.
94	00	Moisture runs from the bottom right hand corner of Specimen F.
96	31	Viewed from the exposed side, both layer of plasterboard have fallen away at the centre of the partition, the rock wool cone is visible. Plasterboard remains attached on the left hand side and at the right hand perimeter.
100	00	Slight smoke release visible from the top edge of Specimen F.
103	00	The central section of exposed rockwool core falls away.
105	00	Smoke release starts to increase slightly from the top edge of Specimen F.
112	00	The top edge of socket cover on Specimen F is slumping away from the plasterboard very slightly.
113	00	Slight smoke release now also visible from Specimen H.
119	30	A cotton pad is applied to Specimen F where smoke release has increases over the top edge; the cotton pad fails to ignite.
120	00	The assembly continues to satisfy the test criteria.
123	11	A gap is now visible at the top edge of Specimen F where the socket cover has slumped forward; the plasterboard discolours around the top half of the socket.
126	06	A cotton pad is applied to Specimen F over the top edge; the cotton pad discolours but fails to ignite.
126	57	The test is discontinued at the sponsors' request.

Test Photographs

The exposed face of the specimens prior to testing



The unexposed face of the specimens after 20 minutes of testing



The unexposed face of the specimens after 30 minutes of the test



The unexposed face of the specimens after 40 minutes of the test



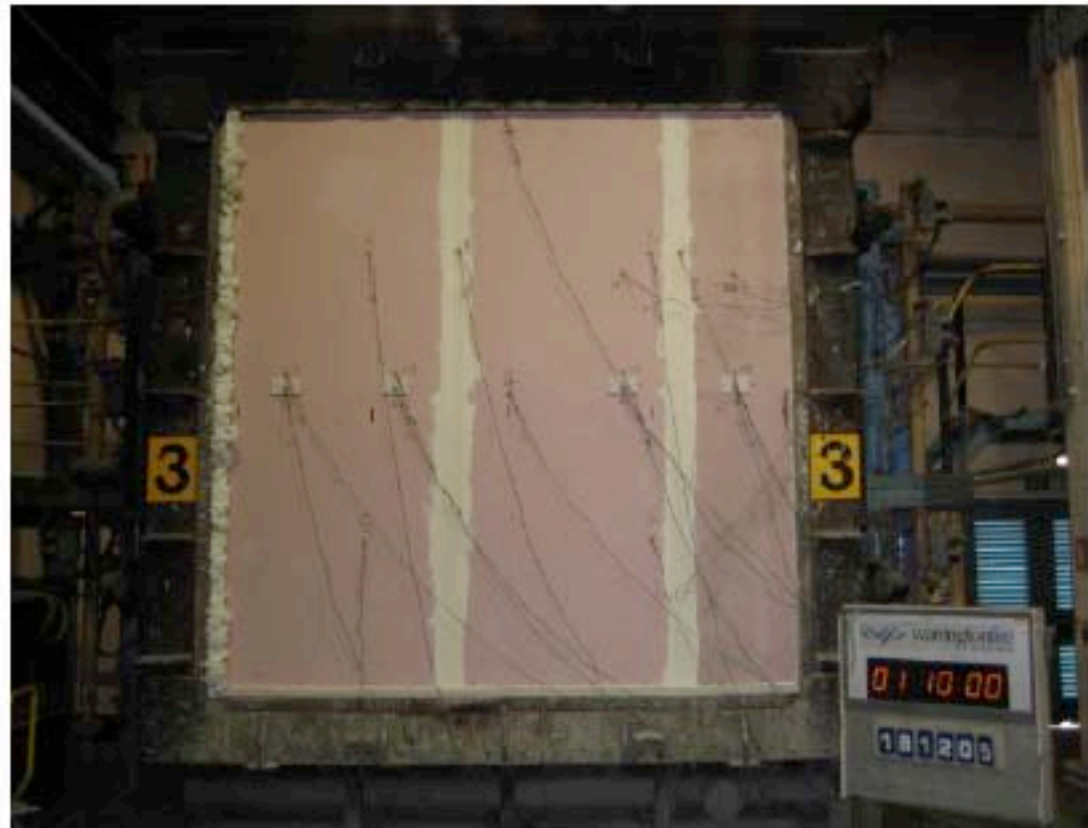
The unexposed face of the specimens after 50 minutes of the test



The unexposed face of the specimens after 60 minutes of the test



The unexposed face of the specimens after 70 minutes of the test



The unexposed face of the specimens after 90 minutes of the test



The unexposed face of the specimens after 100 minutes of the test



The unexposed face of the specimens after 111 minutes of the test



The unexposed face of the specimens after 127 minutes of the test



The exposed face of the specimens shortly after testing



Temperature 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	20
5	576	575
10	678	681
15	739	746
20	781	780
25	815	818
30	842	852
35	865	874
40	885	892
45	902	908
50	918	924
55	932	939
60	945	953
65	957	967
70	968	981
75	979	993
80	988	997
85	998	1006
90	1006	1020
95	1014	1019
100	1022	1037
105	1029	1027
110	1036	1024
115	1043	1048
120	1049	1063
125	1055	1071
126	1056	1072

Individual and Mean Temperatures Recorded On The Unexposed Surface Of The Partition

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	16	16	16	16	16	16
5	16	16	16	16	16	16
10	16	16	16	16	16	16
15	16	16	16	16	16	16
20	16	18	16	17	17	17
25	19	27	18	19	19	20
30	23	36	21	22	22	25
35	28	43	26	27	27	30
40	34	47	31	32	32	35
45	39	49	37	38	38	40
50	44	52	42	42	43	45
55	48	53	46	47	48	48
60	51	54	49	50	52	51
65	51	53	50	50	53	51
70	49	51	48	48	52	50
75	47	48	46	46	49	47
80	45	46	45	45	47	46
85	44	45	44	44	46	45
90	45	46	44	45	47	45
95	48	49	46	48	50	48
100	52	52	50	52	54	52
105	62	57	68	63	66	63
110	72	69	81	73	83	76
115	75	76	80	77	82	78
120	75	78	88	80	87	82
125	76	79	91	79	90	83
126	78	79	91	79	91	84

Individual Temperatures Recorded On The Unexposed Surface Of The Partition

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	T/C Number 19 Deg. C	T/C Number 20 Deg. C
0	16	16	17	17	14	13
5	17	16	17	17	14	13
10	22	16	17	17	14	14
15	27	17	21	19	14	19
20	33	18	30	27	14	37
25	39	21	42	38	17	50
30	44	25	49	46	21	54
35	48	29	52	51	24	53
40	52	33	54	53	28	51
45	56	36	53	53	32	50
50	58	40	53	53	36	49
55	59	43	52	54	39	49
60	60	45	53	54	42	49
65	58	46	53	54	44	49
70	55	46	53	54	45	47
75	55	46	53	55	45	46
80	55	46	55	57	46	45
85	56	46	57	60	48	46
90	57	48	60	63	51	48
95	60	51	64	66	54	52
100	63	53	72	70	56	55
105	68	55	77	75	66	60
110	75	58	78	81	74	71
115	76	62	80	85	76	74
120	77	68	81	87	75	74
125	78	74	84	91	78	77
126	79	74	84	91	79	79

Individual Temperatures Recorded On The Unexposed Surface Of Specimen A/E

Time Mins	T/C Number 11 Deg. C	T/C Number 12 Deg. C
0	18	18
5	18	18
10	18	17
15	18	18
20	18	18
25	19	18
30	22	19
35	26	22
40	31	26
45	37	29
50	41	32
55	44	35
60	47	38
65	48	39
70	48	40
75	48	41
80	47	41
85	47	42
90	48	43
95	51	45
100	54	46
105	59	49
110	70	55
115	75	57
120	77	58
125	78	60
126	79	61

Individual Temperatures Recorded On The Unexposed Surface Of Specimen B/F

Time Mins	T/C Number 13 Deg. C	T/C Number 14 Deg. C
0	18	18
5	18	18
10	18	18
15	20	20
20	29	24
25	39	28
30	43	32
35	45	35
40	46	38
45	47	40
50	48	42
55	50	44
60	51	46
65	51	49
70	50	50
75	48	48
80	46	46
85	46	45
90	46	46
95	50	51
100	60	70
105	74	82
110	81	85
115	78	81
120	82	82
125	130	142
126	157	154

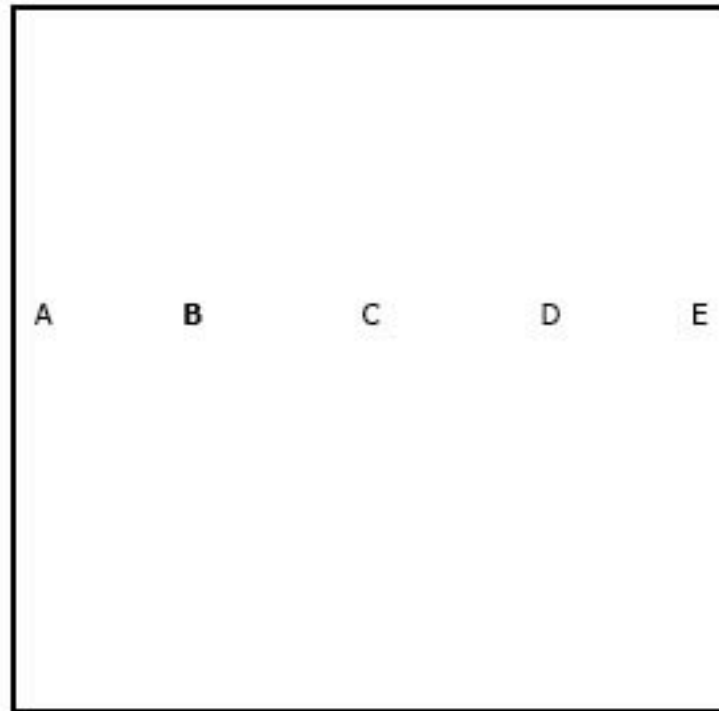
Individual Temperatures Recorded On The Unexposed Surface Of Specimen G

Time Mins	T/C Number 15 Deg. C	T/C Number 16 Deg. C
0	14	14
5	14	14
10	14	14
15	14	14
20	14	14
25	17	15
30	20	16
35	25	19
40	30	22
45	35	25
50	40	28
55	44	30
60	46	33
65	46	34
70	44	34
75	42	34
80	41	34
85	41	34
90	42	35
95	46	36
100	49	38
105	60	42
110	71	49
115	72	55
120	74	60
125	75	63
126	75	63

Individual Temperatures Recorded On The Unexposed Surface Of Specimen H

Time Mins	T/C Number 17 Deg. C	T/C Number 18 Deg. C
0	14	14
5	14	14
10	14	13
15	14	13
20	14	14
25	15	15
30	17	16
35	20	19
40	25	22
45	28	25
50	32	29
55	35	32
60	37	35
65	38	36
70	39	37
75	38	37
80	38	36
85	37	36
90	37	35
95	37	36
100	39	38
105	42	44
110	52	66
115	66	77
120	78	79
125	79	79
126	77	79

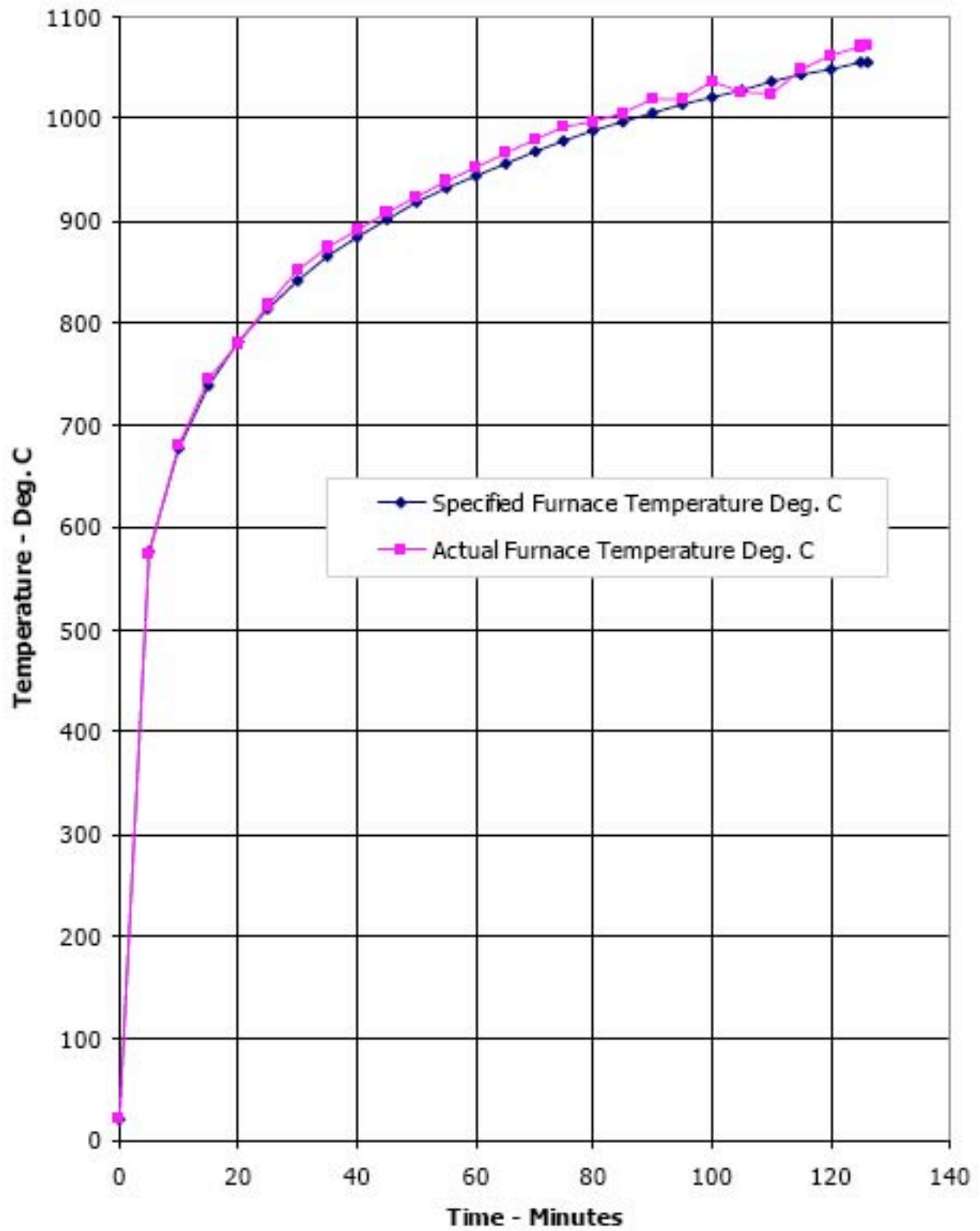
Recorded Deflections of the Partition during the test
Annex B (continued)



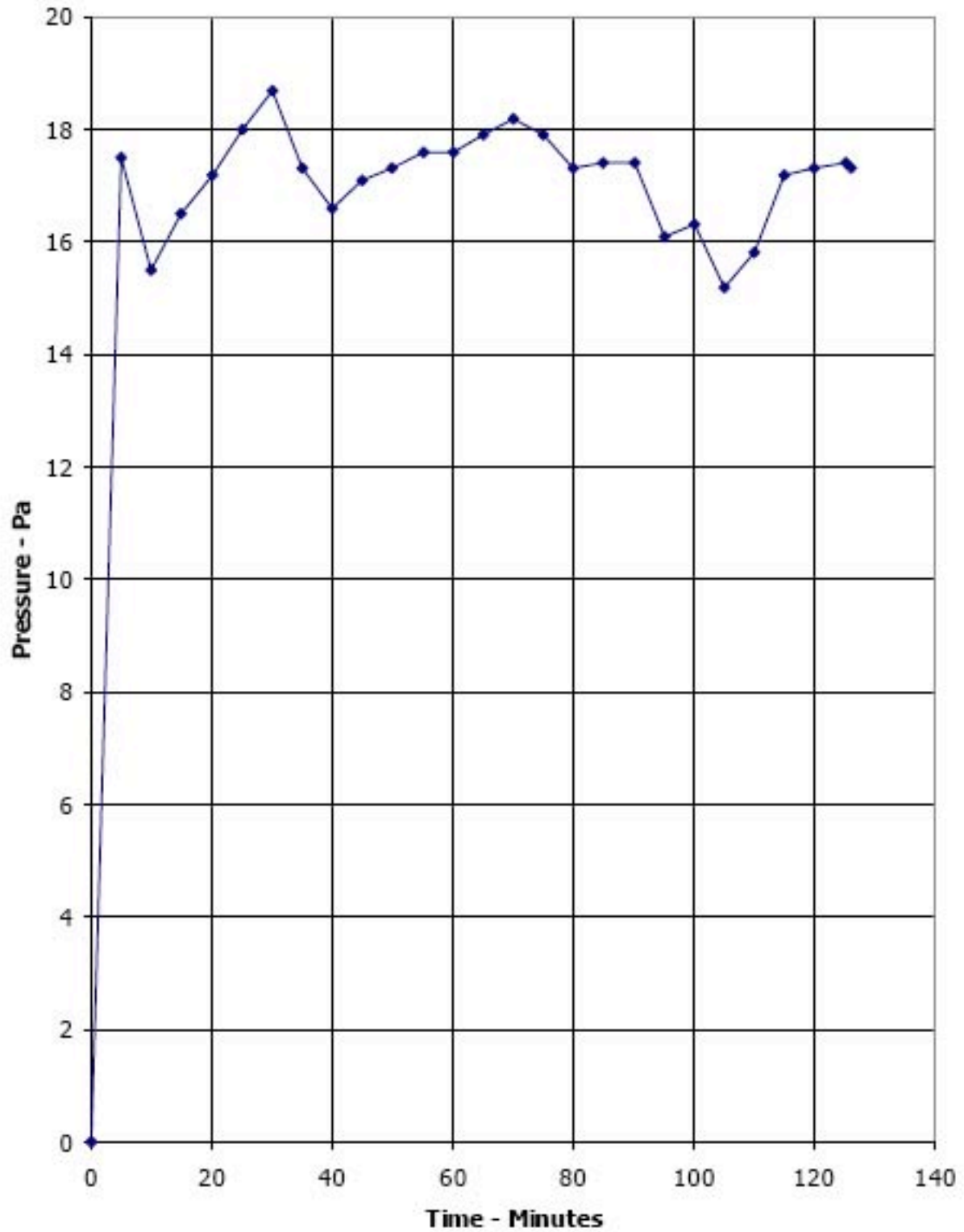
TIME mins	A	B	C	D	E
0	0	0	0	0	0
10	2	8	10	5	0
20	2	8	8	4	0
30	3	6	5	3	0
40	3	3	5	2	0
50	2	4	7	2	0
60	3	5	12	9	0
75	0	6	11	7	-1
90	2	8	13	6	-2
105	-2	0	10	5	-5
120	-7	-19	-10	-20	-15

Positive values indicate deflection towards the heating conditions

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



Graph Showing Recorded Furnace Pressure At 300 mm Below The Top Of The Partition Construction



Performance Criteria and Test Results

Integrity Performance

It is required that the specimens retain their separating function, without either causing ignition of a cotton pad when applied as specified in BS EN 1363-1:1999, or resulting in sustained flaming on the unexposed surface. **These requirements were satisfied for the periods shown below:**

Specimen	Cotton pad	Sustained flaming
A/E	126 minutes*	126 minutes*
B/F	126 minutes*	126 minutes*
C	126 minutes*	126 minutes*
D	126 minutes*	126 minutes*
G	126 minutes*	126 minutes*
H	126 minutes*	126 minutes*

* The test duration. The test was discontinued after a period of 126 minutes.

Insulation performance

The requirements of the standard are that the maximum temperature rise shall not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure as specified in BS EN 1363-1:1999. **These requirements were satisfied for the periods shown below:**

Specimen	Insulation
A/E	126 minutes*
B/F	126 minutes*
C	126 minutes*
D	126 minutes*
G	126 minutes*
H	126 minutes*

Ongoing Implications

Limitations

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 procedure outlined in BS EN 1364-1: 1999. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report. Annex A of BS EN 1363-1: 1999, provides guidance information on the application of fire resistance tests and the interpretation of test data.

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.

Conclusions

Evaluation against objective

Six specimens of electrical sockets and sealing systems, have been tested to evaluate their ability to reinstate the integrity and insulation performance of a partition wall, when tested utilising the general principles of BS EN 1364-1: 1999 in conjunction with additional guidelines from BS EN 1366-3: 2004.

The evaluation of the specimens against the requirements of BS EN 1364-1: 1999 showed that they satisfied the requirements for the periods shown below.

Specimen	Cotton pad	Sustained flaming	Insulation
A/E	126 minutes*	126 minutes*	126 minutes*
B/F	126 minutes*	126 minutes*	126 minutes*
C	126 minutes*	126 minutes*	126 minutes*
D	126 minutes*	126 minutes*	126 minutes*
G	126 minutes*	126 minutes*	126 minutes*
H	126 minutes*	126 minutes*	126 minutes*

* The test duration. The test was discontinued after a period of 126 minutes.



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