

test report

Title:

Fire resistance test utilising the general principles of BS 476: Part 20: 1987 on four specimens of wall mounted linear gap seals

WF Report No:

160902

**Prepared for:****Everbuild Building Products**

Site 41,
Knowsthorpe Way,
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Estate,
Leeds.
LS9 0SW

Date:

12th March 2007

Notified Body No:

0833



Summary

Objective

A fire resistance test has been conducted to assess the ability of four specimens of a linear gap sealing system, to reinstate the integrity and insulation performance of simulated wall constructions where adjacent structures abut. The performances of the specimens were assessed, with respect to the integrity and insulation (maximum temperature rise only) performance criteria, as defined in BS 476: Part 20: 1987.

Sponsor

Everbuild Building Products, Site 41, Knowsthorpe Way, Cross Green Industrial Estate, Leeds. LS9 0SW

Summary of the Tested Specimens

For the purpose of the test the specimens were referenced A to D.

The section of wall had overall dimensions of 1000 mm high by 1000 mm wide by 250 mm thick and was provided with four gaps each nominally 900 mm high.

Each gap was sealed with a polyurethane (PUR) foam referenced (Everbuild Fire Foam B2). Each of the seals was nozzle applied into the gaps. Specimen A incorporated a softwood timber gap facing and Specimen B incorporated a hardwood timber gap facing. Specific details of each of the seals is given in the table below:

Specimen Reference	Gap width	Gap Depth
A, B, C	15 mm	250 mm
D	50 mm	100 mm each face with a 50 mm depth of Mineral rock fibre

Test Results

If the performance of the specimens were assessed against the integrity and insulation (maximum temperature rise only) performance criteria of BS 476: Part 20: 1987. The results obtained could be expressed as follows:

Specimen Reference	Integrity Minutes	Insulation Minutes
A	120*	120*
B	120*	120*
C	120*	120*
D	120*	120*

*Indicates the test duration. The test was discontinued after a period of 120 minutes.

Date of Test

23rd January 2007

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Signatories



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

Report Issued

Date : 12th March 2007

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Test Procedure

Introduction

Walls and floors often incorporate gaps to accommodate expansion, contraction or other movement of the structure. The fire resistance of such elements is only as good as their weakest point and it is, therefore, important that any gaps or apertures are adequately sealed, such that weaknesses are not created at these positions.

There is a specified Standard referenced BS EN 1366-4: 2006 regarding the fire test method for evaluating gap seals which are designed to act as an effective barrier to the penetration of fire and to reinstate the necessary fire resistance performance of the separating element. However, historically and at the request of the client the test was performed utilising the general principles given in BS 476: Part 20: 1987, to evaluate the performance of gap sealing systems. Some additional guidelines were adopted from the European document referenced BS EN 1366-4, relating to the testing of these types of sealing systems. This report should be read in conjunction with the above mentioned documents.

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 23rd January 2007 at the request Everbuild Building Products, the sponsor of 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 specimens and information supplied by the sponsor of the test.

Installation

The wall construction was supplied by Bodycote **warringtonfire**. The gap sealing systems were provided and installed by a representative of the test sponsor on the 15th January 2007.

Sampling

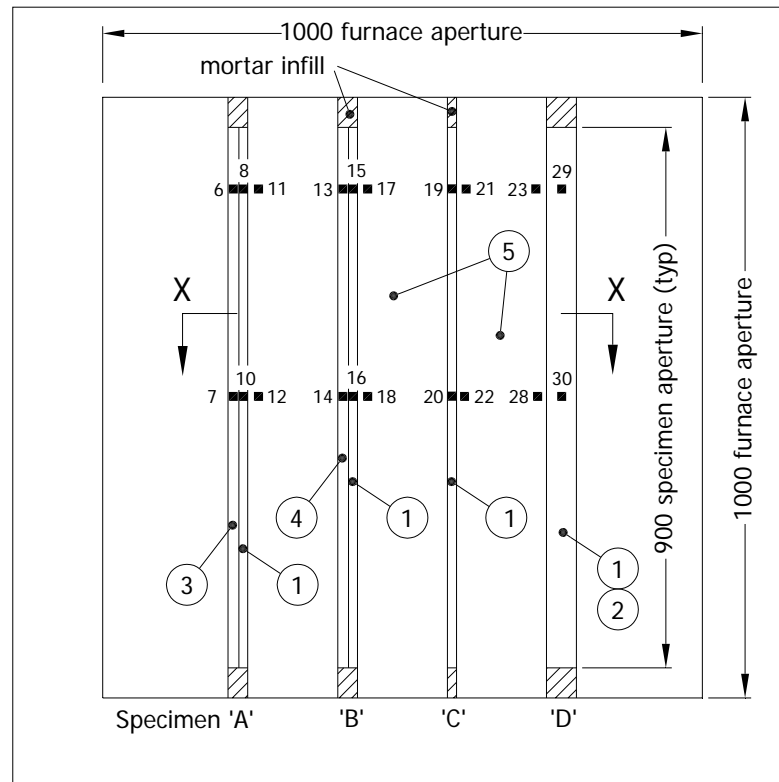
Bodycote **warringtonfire** was not involved in any sampling or selection procedure of the sealing system components.

Instrumentation

General	The instrumentation and measuring equipment provided was in accordance with BS 476: Part 20: 1987 and the draft European document, where appropriate.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1, using four mineral insulated thermocouples distributed over a plane 100 mm from the surface of the wall construction.
Thermocouple Allocation	<p>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:</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 surface of the specimens at any position which 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 specimens.
Furnace Pressure	After the first five minutes of testing, the furnace pressure was controlled to maintain a slightly positive pressure relative to the pressure of the laboratory. The furnace atmospheric pressure was measured and controlled such that, at a point mid height of the wall assembly, the differential pressure was calculated to be between 14 Pa and 16 Pa.

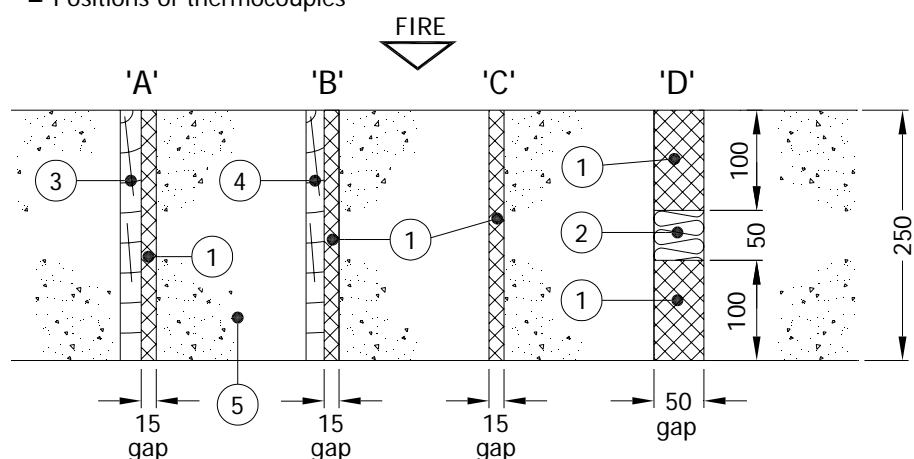
Test Specimen

Figure 1- General Elevation of Wall Specimen and Unexposed Face Thermocouples



ELEVATION VIEW OF UNEXPOSED FACE

■ Positions of thermocouples



Do not scale. All dimensions are in mm

Schedule of Components

(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>
1. Foam Joint Seal	
Reference	: Everbuild Fire Foam B2
Material	: One part Polyurethane (PUR) foam
Application method	: Nozzle applied
2. Foam Joint Seal Insulation (Specimen 'D' only)	
Material	: Mineral rock fibre
Density	: 160 kg/m ³
Overall section size	: 50 mm x 50 mm (uncompressed)
Fixing method	: Friction fit
3. Gap Facing (Specimen 'A' only)	
Material	: Timber, Softwood
Density	: 437.95 kg/m ³
Overall section size	: 250 mm wide x 21 mm thick
Fixing method to concrete	: 3 no. countersunk head steel screws into plastic plugs
4. Gap Facing (Specimen 'B' only)	
Material	: Timber, Hardwood
Density	: 680.76 kg/m ³
Overall section size	: 250 mm wide x 18 mm thick
Fixing method to concrete	: 3 no. countersunk head steel screws into plastic plugs
5. Masonry Wall	
Material	: Autoclaved aerated concrete lintels
Density	: 670 kg/m ³
Overall section size	: 250 mm deep x 150 mm wide
Fixing method	: Ordinary sand/cement mortar mix

Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	
00	00	The test commences.
05	00	Slight smoke release issues from the timber of Specimens A & B.
12	15	Smoke release increases slightly at mid height of Specimen B adjacent to the timber.
16	00	Flames issue from the timber on the exposed face of Specimen A. All specimens have charred on the exposed face.
28	00	Flames continue to issue from the timber on the exposed face of Specimen A. Flames issue from the timber on the exposed face of Specimen B.
30	00	All specimens continue to satisfy integrity and insulation requirements of the test.
41	00	Slight smoke release continues at the head of both Specimens A & B adjacent to where the timber meets the blockwork. The smoke release at mid height of Specimen B as mentioned at 12:15 minutes has stopped.
60	00	All specimens continue to satisfy integrity and insulation requirements of the test.
62	00	The timber to Specimen A has charred more significantly than the timber to Specimen B on the exposed face. Both specimens continue to flame adjacent to the timber on the exposed face.
66	00	Moisture release is visible at the head of Specimen A, coincidence with the timber.
83	00	The exposed layer of B2 foam of Specimen D has fallen into the furnace chamber, exposing the Rockwool layer.
90	00	No further significant visible change.
118	00	No further significant visible change to all specimens.
120	00	All specimens continue to satisfy integrity and insulation requirements of the test. The test is discontinued.

Test Photographs

The exposed face of the wall construction prior to testing



The unexposed face of the wall construction after a duration of 30 minutes



The unexposed face of the wall construction after a duration of 60 minutes



The unexposed face of the wall construction after a duration of 120 minutes and discontinuation of the test



The exposed face
of the specimens
immediately after
the test



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	22
5	576	564
10	678	668
15	739	726
20	781	751
25	815	797
30	842	854
35	865	870
40	885	892
45	902	930
50	918	933
55	932	941
60	945	955
65	957	960
70	968	988
75	979	990
80	988	1003
85	997	1009
90	1006	1029
95	1014	1044
100	1022	1021
105	1029	1045
110	1036	1046
115	1043	1048
120	1049	1052

**Individual Temperatures Recorded On And Adjacent To The Unexposed Surface Of
Specimen A**

Time Mins	T/C Number 6 Deg. C	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C
0	13	13	14	14	14	13
5	14	13	14	14	14	13
10	13	12	14	14	14	13
15	12	12	14	14	14	12
20	13	12	13	13	14	12
25	13	12	13	13	14	12
30	12	12	13	13	14	12
35	13	13	14	13	14	12
40	13	12	14	13	14	12
45	13	12	14	13	14	12
50	13	12	14	14	14	12
55	13	12	14	14	14	12
60	13	12	14	14	14	12
65	13	12	14	14	14	12
70	13	13	14	14	15	13
75	13	13	14	14	15	13
80	13	13	15	14	15	13
85	13	13	15	14	15	12
90	14	13	15	14	15	13
95	14	13	15	14	15	13
100	14	13	15	14	15	13
105	14	13	15	14	16	13
110	14	13	15	14	16	13
115	15	13	15	14	17	13
120	15	13	16	15	17	14

**Individual Temperatures Recorded On And Adjacent To The Unexposed Surface Of
Specimen B**

Time Mins	T/C Number 13 Deg. C	T/C Number 14 Deg. C	T/C Number 15 Deg. C	T/C Number 16 Deg. C	T/C Number 17 Deg. C	T/C Number 18 Deg. C
0	13	13	13	14	14	14
5	13	13	13	14	14	14
10	13	13	13	14	14	14
15	12	12	12	13	13	13
20	12	12	12	13	13	13
25	12	12	12	13	14	13
30	12	12	12	13	14	13
35	13	12	12	14	14	14
40	13	12	12	14	14	14
45	12	12	12	14	14	14
50	13	12	12	14	14	14
55	13	13	13	14	14	14
60	12	12	12	13	13	13
65	13	13	13	14	14	14
70	13	13	13	14	14	14
75	13	13	13	14	14	14
80	13	13	13	14	14	14
85	13	13	13	14	14	13
90	14	13	13	14	15	14
95	13	13	13	14	14	14
100	13	13	13	14	14	14
105	14	13	13	14	14	14
110	14	13	14	14	15	14
115	15	14	14	14	15	14
120	16	14	15	15	17	15

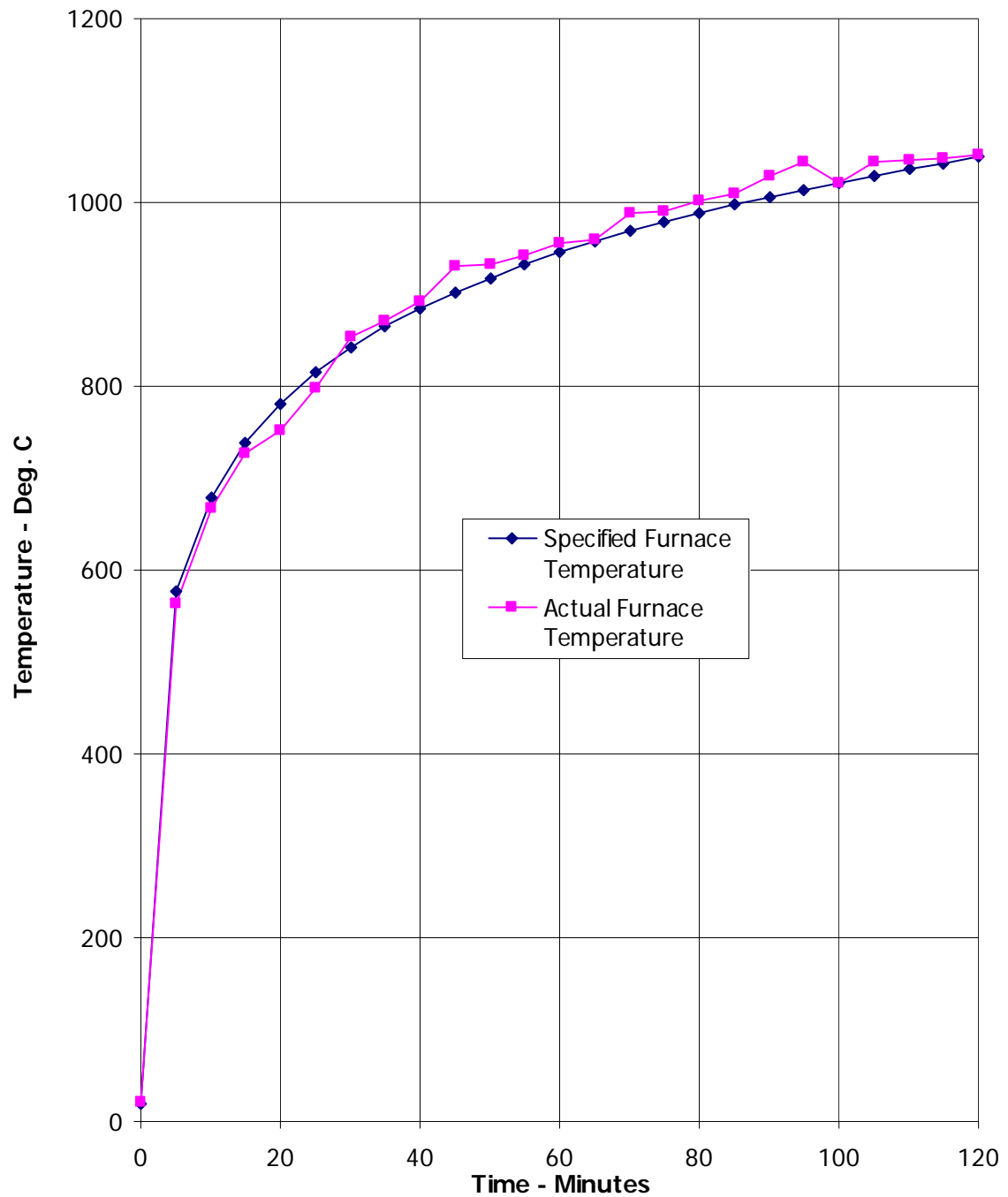
**Individual Temperatures Recorded On And Adjacent To The Unexposed Surface Of
Specimen C**

Time Mins	T/C Number 19 Deg. C	T/C Number 20 Deg. C	T/C Number 21 Deg. C	T/C Number 22 Deg. C
0	14	14	13	13
5	14	14	13	13
10	14	13	13	13
15	14	13	13	12
20	14	13	13	13
25	14	13	13	13
30	14	13	13	13
35	14	13	13	13
40	14	13	13	13
45	14	13	13	13
50	14	13	13	13
55	14	13	13	13
60	13	13	13	13
65	14	13	13	13
70	14	14	14	13
75	14	14	14	13
80	14	14	14	14
85	14	14	14	13
90	15	14	14	14
95	14	14	14	14
100	14	14	14	14
105	15	14	15	14
110	15	14	15	14
115	15	14	15	14
120	16	15	16	15

**Individual Temperatures Recorded On and Adjacent To The Unexposed Surface Of
Specimen D**

Time Mins	T/C Number 23 Deg. C	T/C Number 28 Deg. C	T/C Number 29 Deg. C	T/C Number 30 Deg. C
0	13	14	14	14
5	13	14	14	14
10	13	14	14	14
15	13	13	13	14
20	13	13	14	14
25	13	13	14	14
30	13	13	14	13
35	13	13	14	14
40	13	13	14	14
45	13	12	13	13
50	14	12	14	14
55	14	12	14	14
60	14	12	14	14
65	14	13	14	14
70	14	13	15	14
75	14	14	15	15
80	15	14	15	15
85	15	13	15	15
90	16	15	16	15
95	16	15	16	15
100	17	15	16	16
105	17	15	17	16
110	18	17	18	16
115	18	16	18	16
120	19	18	19	17

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



Performance Criteria and Test Results

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 the periods given in the table below.

Insulation

The mean and maximum temperature rise allowable on the unexposed face of the specimen by BS 476: Part 20: 1987 are 140°C and 180°C respectively, however, due to the reduced size of the specimens only the maximum temperature rise criterion was utilised. These requirements were satisfied for the periods given in the table below.

Specimen Reference	Integrity Minutes	Insulation Minutes
A	120*	120*
B	120*	120*
C	120*	120*
D	120*	120*

*Indicate the test duration. The test was discontinued after a period of 120 minutes.

Ongoing Implications

Limitations

The results relate only to the behaviour of the specimens 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 results may not be applicable to situations where the joint widths, orientations and supporting construction vary from those tested.

As no movement was induced into the specimens during the test there can be no evaluation of the performance of the seals where movement is induced in a building under actual fire conditions.

Review

This report covers a test which was conducted to a procedure which is not the subject of any British Standard specification, but the test utilised the general principles of fire resistance testing given in BS 476: Part 20: 1987 and BS EN 1366-4: 2006. Since fire tests are the subject of a continuing Standardisation process, and because existing standards are the subject of review and possible amendment and new interpretations, it is recommended that the report be referred back to the test laboratory after a period of two years to ensure that the methodology adopted and the results obtained remain valid in the light of the situation prevailing at that time.

Conclusions

Evaluation against objective

A fire resistance test which utilised the general principles of BS 476: Part 20: 1987, in conjunction with additional guidelines adopted from BS EN 1366-4: 2006, has been conducted to assess the ability of four different wall mounted specimens of linear joint sealing system to reinstate the integrity and insulation performance (as defined in BS 476: Part 20: 1987) of simulated floor and wall constructions where adjacent structures abut.

Test Results

If the performance of the specimens were assessed against the integrity and insulation (maximum temperature rise only) performance criteria of BS 476: Part 20: 1987. The results obtained could be expressed as follows:

Specimen Reference	Integrity Minutes	Insulation Minutes
A	120*	120*
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*Indicates the test duration. The test was discontinued after a period of 120 minutes.



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