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Testing. Advising. Assuring.

Title:

The Fire Resistance Performance Of Six Specimens Of Wall Mounted Linear Gap Sealing Systems Tested In Accordance With BS EN 1366-4: 2006

Report No:

199291



Prepared for:

Tremco illbruck Ltd
Coupland Road
Hindley Green
Wigan
WN2 4HT

Date:

7th March 2011

Notified Body No:

0833



Summary

Objective A fire resistance test has been conducted to assess the ability of six vertically orientated specimens of linear gap sealing systems, to reinstate the fire resistance of a blockwork wall when tested in accordance with BS EN 1366-4: 2006.

Sponsor Tremco illbruck Ltd, Coupland Road, Hindley Green, Wigan, WN2 4HT.

Summary of the Tested Specimen For the purpose of the test the specimens were referenced A to F.

The section of wall had overall dimensions of 1500 mm high by 1500 mm wide by 210 mm thick and was made up of aerated blockwork arranged to provide two 10 mm wide by 1000 mm long, two 20 mm wide by 1000 mm long and two 30 mm wide by 1000 mm long linear gaps.

Each gap was sealed with a polyurethane (PU) foam referenced (Webbflex B1 Foam). Each of the seals was nozzle applied into the gaps. Specific details of each of the seals is given in the table below:

Specimen	Gap width	Seal details
A	10 mm	210 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam", cartridge gunned flush with both faces of the wall construction
B	20 mm	210 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam", cartridge gunned flush with both faces of the wall construction
C	30 mm	210 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam", cartridge gunned flush with both faces of the wall construction
D	10 mm	10 mm deep Acrylic based intumescent sealant referenced "M701" each face with a 190 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam".
E	20 mm	10 mm deep Acrylic based intumescent sealant referenced "M701" each face with a 190 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam".
F	30 mm	10 mm deep Acrylic based intumescent sealant referenced "M701" each face with a 190 mm depth of polyurethane (PU) foam referenced "Webbflex B1 Foam".

Full details of the specimens and installation methods are given in the schedule of components.

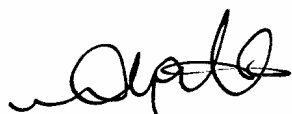
Test Results

Specimen	Integrity (mins)		Insulation (mins)
	Cotton Pad	Sustained flaming	
A	244 minutes*	244 minutes*	244 minutes*
B	152 minutes#	152 minutes#	152 minutes#
C	105 minutes#	105 minutes#	105 minutes#
D	244 minutes*	244 minutes*	244 minutes*
E	244 minutes*	244 minutes*	244 minutes*
F	244 minutes*	244 minutes*	244 minutes*

* The test duration. The test was discontinued after a period of 244 minutes. # The Specimen was blanked off to allow the test to continue.

Date of Test10th January 2011

Signatories



Responsible Officer

D. Yates*

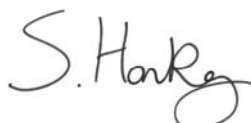
Testing Officer



Approved

C. Johnson*

Principal Certification Engineer



Head of Department

S. Hankey*

Operations Manager

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

Report Issued

Date : 7th March 2011

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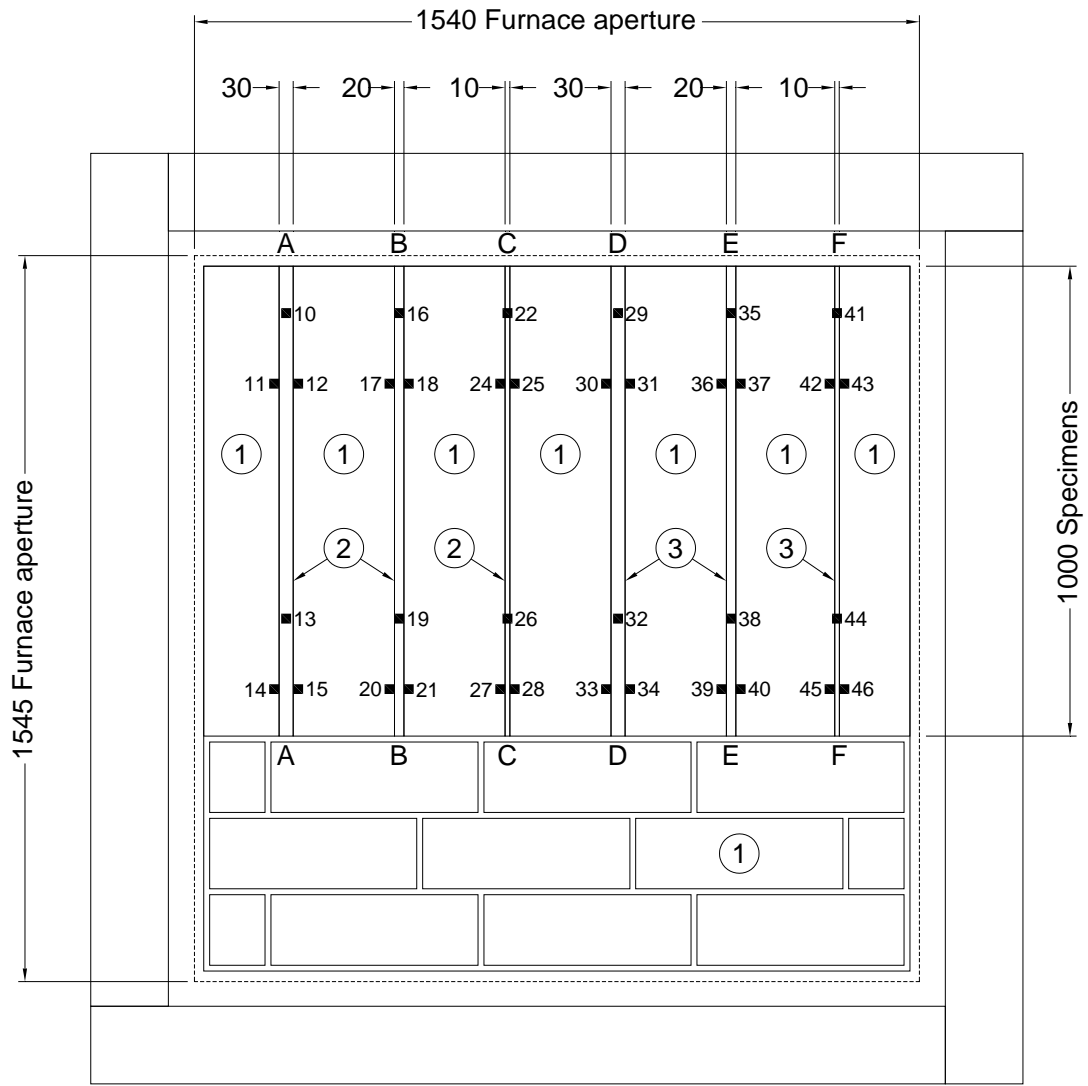
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Test Procedure

Introduction	<p>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. The linear gap sealing systems were therefore tested in accordance with BS EN 1366-4: 2006 'Fire resistance tests for service installations - Part 4: Linear joint seals' This test report should be read in conjunction with that Standard and with BS EN 1363-1: 1999, Fire resistance tests - Part 1: General requirements'</p> <p>The specimens were judged on their ability to comply with the performance criteria for integrity and insulation, as required by BS EN 1366-4: 2006.</p>
Fire Test Study Group/EGOLF	<p>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.</p>
Instruction To Test	<p>The test was conducted on the 10th January 2011 at the request of Tremco illbruck Ltd, the sponsor of the test.</p> <p>The test was witnessed by Mr. J. Newbury, a representative of the test sponsor.</p>
Test Specimen Construction	<p>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.</p>
Installation	<p>Exova Warringtonfire supplied the wall constructions. The gap sealing systems were provided and installed by a representative of the test sponsor on the 24th November 2011.</p>
Sampling	<p>Exova Warringtonfire was not involved in any sampling or selection procedure of the sealing system components.</p>
Conditioning	<p>The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 48 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 0°C to 16°C and 31% to 72% respectively.</p>

Test Specimen

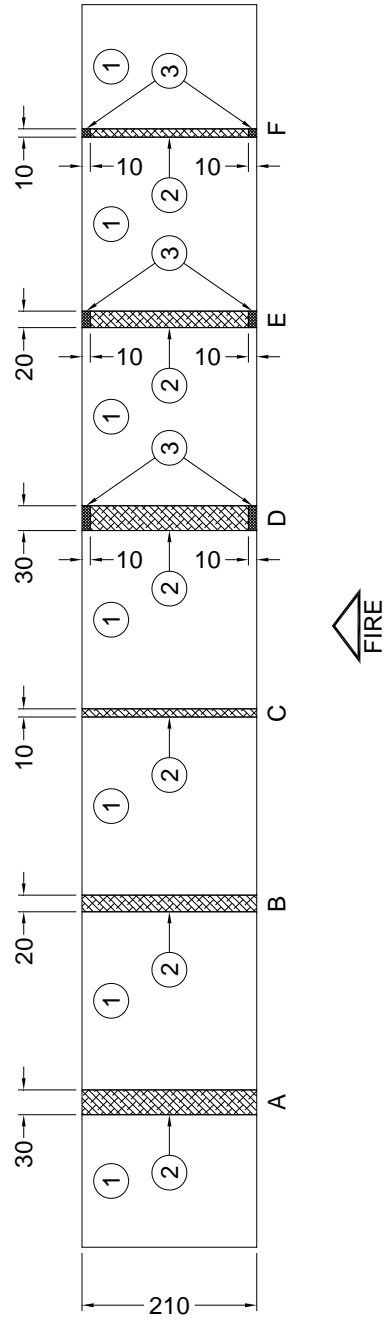
Figure 1- General Elevation of Test Specimen



■ Positions of thermocouples

Do not scale. All dimensions are in mm

Figure 2 – Horizontal Section Through Wall Specimens



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. Supporting Construction	
Material	: Autoclaved aerated blocks
Nominal density / densities	: 670 kg/m ³
Thicknesses	: 210 mm
2. Gap Sealant	
Manufacturer	: Tremco illbruck Ltd
Material	: Fire retardant expanding polyurethane foam
Reference	: Webbflex B1 foam
Overall sizes	
i. specimen A	: 10 mm wide x 210 mm deep
ii. specimen B	: 20 mm wide x 210 mm deep
iii. specimen C	: 30 mm wide x 210 mm deep
iv. specimen D	: 10 mm wide x 190 mm deep
v. specimen E	: 20 mm wide x 190 mm deep
vi. specimen F	: 30 mm wide x 190 mm deep
Application method	
i. specimens A-C	: Cartridge gunned into gaps, allowed to expand then cut back flush with each face of the supporting construction when cured
ii. specimen D-F	: Cartridge gunned into gaps, allowed to expand then cut back to a nominal depth of 10 mm from each face of the supporting construction when cured
3. Gap Sealant	
Manufacturer	: Nullifire
Material	: Water- borne intumescent acrylic sealant
Reference	: M701
Product code	: 704313
Overall sizes	
i. specimen D	: 10 mm wide x 10 mm deep
ii. specimen E	: 20 mm wide x 10 mm deep
iii. specimen F	: 30 mm wide x 10 mm deep
Application method	: Cartridge gunned into gaps, then smoothed flush with a spatula on each face of the supporting construction and allowed to cure

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 three plate thermometers, distributed over a plane 100 mm from the surface of the test 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 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 at mid height of the specimens in the wall assembly, the differential pressure was calculated to be 15 (± 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 12°C at the start of the test with a maximum variation of +4°C during the test.
00	00	The test commences.
05	15	Slight smoke release is evident from the perimeter edges of Specimens D and E at approximately at mid-height.
37	00	No significant visible change.
58	00	The exposed face of Specimens D, E and F appears unchanged and remain intact. Specimens A, B and C have blackened in colour.
60	00	Smoke release mentioned previously appears to have stopped. A slight smoke release is evident from the perimeter edge of Specimen C at approximate 1/3 height.
101	30	Glowing and discolouration is evident at approximate 1/3 height of Specimen C.
105	40	Glowing mentioned previously increases in size. A cotton pad is applied, however sustained flames issue from the specimen as it begins to degrade away due to a large hole forming within the seal. Integrity failure of Specimen C is deemed to occur. The specimen is blacked off at the sponsors request to allow the test to continue.
130	30	Slight smoke release is evident from the perimeter edges of Specimen B.
147	15	A small area of discolouration begins to form within Specimen B at an area approximately 100 mm below surface thermocouple number 19.
149	30	A small area of glowing can be seen within the Specimen B at the area of discolouration mentioned previously.
152	35	A cotton pad is applied to the area mentioned previously but fails to ignite. On removal of the pad, a large hole approximately 150 - 200 mm long has formed within the seal and furnace gases can be seen venting through the hole. Integrity failure of Specimen B is deemed to occur. The specimen is blacked off at the sponsors request to allow the test to continue.
183	50	Slight smoke and steam release issues from the perimeter edge of Specimen E directly below surface thermocouple number 37.
205	00	Slight smoke and steam release issues from the perimeter edge of Specimen F adjacent to surface thermocouple number 44.
240	00	No significant visible change. Specimens A, D, E and F continue to satisfy the test criteria.
244	00	No significant visible change. Specimens A, D, E and F continue to satisfy the test criteria. The test is discontinued at the sponsor's request.

Test Photographs

The exposed face of the construction prior to testing



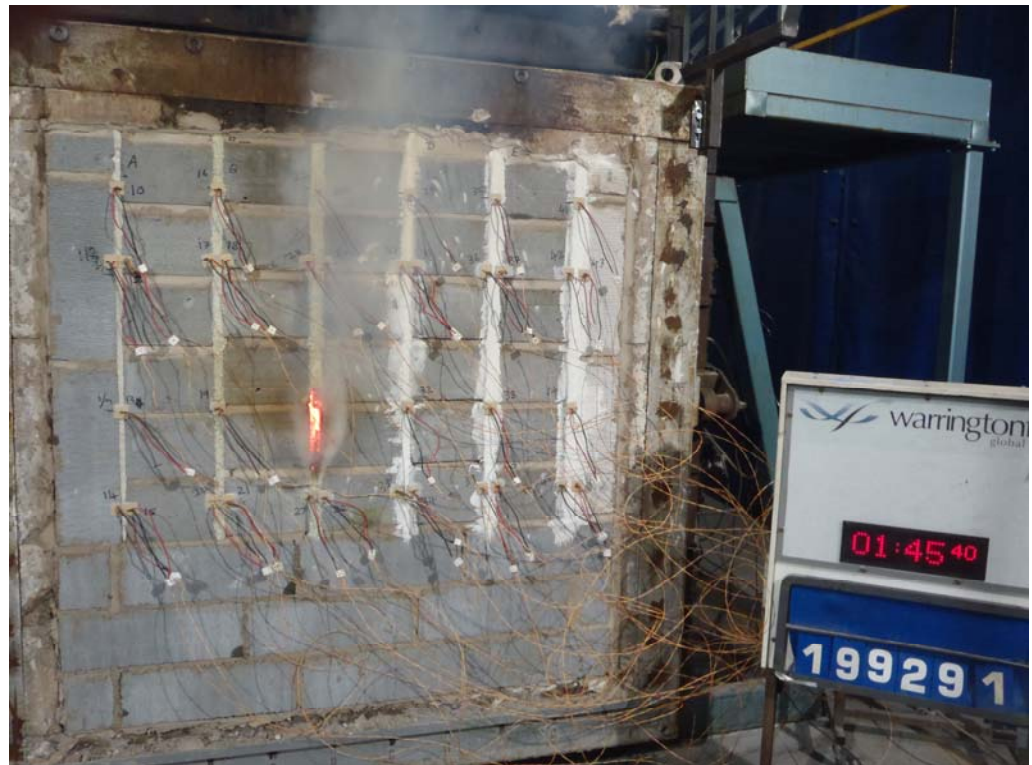
The unexposed face of the construction prior to testing



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



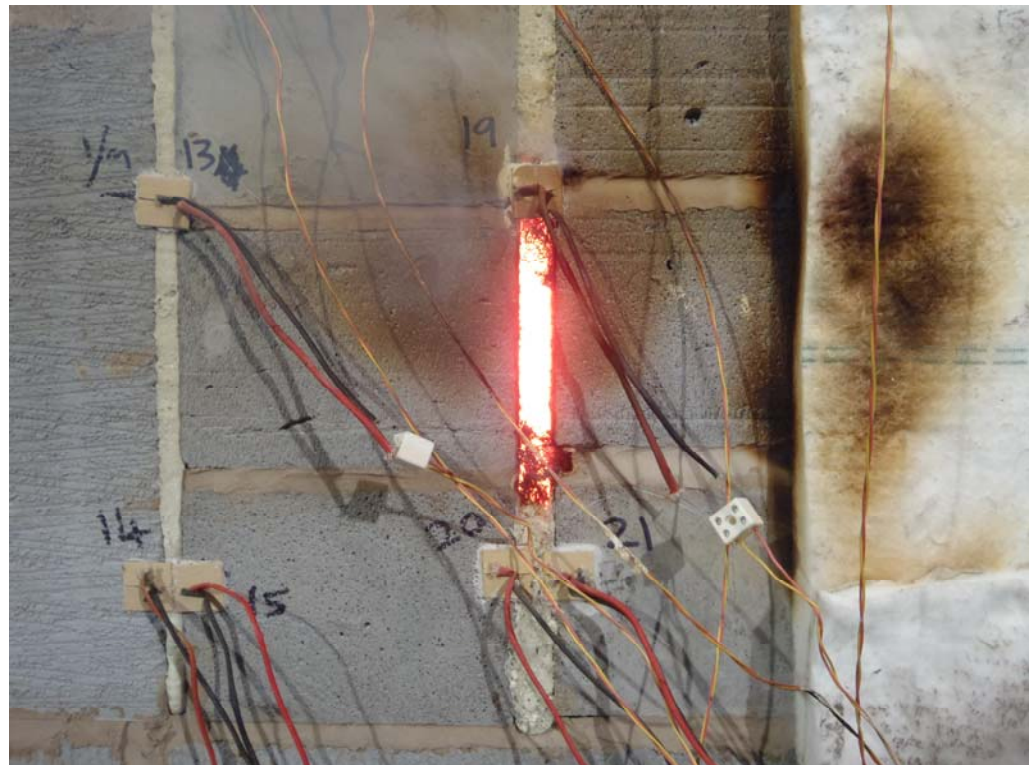
The unexposed face of the construction after a duration of 105 minutes as integrity failure occurred to Specimen C



The unexposed face of the construction after a duration of 120 minutes



Integrity failure of Specimen B after a test duration of 152 minutes



The unexposed face of the construction after a duration of 181 minutes



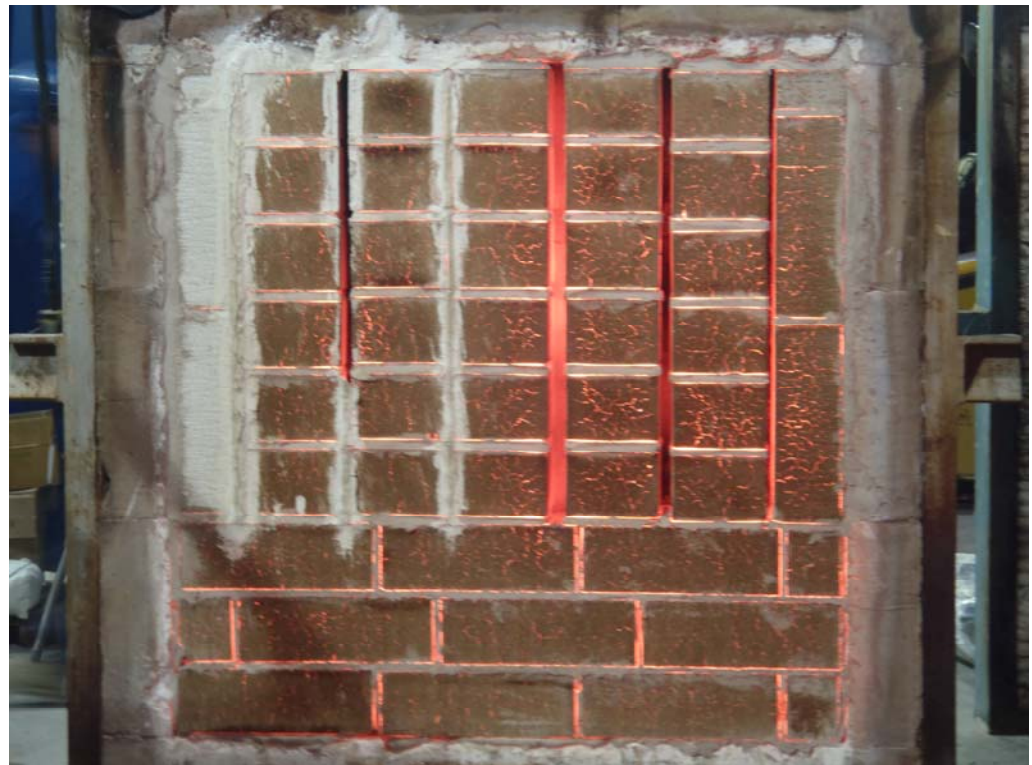
The unexposed face of the construction after a duration of 240 minutes



The unexposed face of the construction after a duration of 244 minutes



The exposed face of the test construction 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	12
10	678	659
20	781	784
30	842	839
40	885	890
50	918	916
60	945	950
70	968	973
80	988	992
90	1006	1010
100	1022	1021
110	1036	1034
120	1049	1047
130	1061	1060
140	1072	1070
150	1082	1081
160	1092	1090
170	1101	1099
180	1110	1107
190	1118	1114
200	1126	1123
210	1133	1136
220	1140	1141
230	1146	1145
240	1153	1153
244	1155	1154

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

Time Mins	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C	T/C Number 13 Deg. C	T/C Number 14 Deg. C	T/C Number 15 Deg. C
0	12	12	12	12	12	12
10	12	12	11	12	11	11
20	11	12	11	11	11	11
30	12	12	11	11	11	11
40	12	12	11	11	11	11
50	12	12	11	11	11	11
60	12	12	12	11	11	11
70	12	12	12	12	11	11
80	14	12	13	12	12	12
90	18	13	14	12	12	12
100	25	14	15	13	13	13
110	32	17	20	15	14	14
120	35	18	21	17	17	16
130	38	22	26	19	20	20
140	42	27	31	22	23	23
150	46	33	37	27	28	27
160	47	39	43	30	33	32
170	48	44	48	34	38	38
180	48	49	53	38	43	43
190	48	52	57	42	47	47
200	49	55	61	45	51	53
210	49	57	63	47	54	55
220	50	60	66	49	57	59
230	52	63	69	52	59	60
240	54	65	72	54	61	62
244	55	66	73	54	61	63

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

Time Mins	T/C Number 16 Deg. C	T/C Number 17 Deg. C	T/C Number 18 Deg. C	T/C Number 19 Deg. C	T/C Number 20 Deg. C	T/C Number 21 Deg. C
0	12	12	12	12	11	11
5	11	12	12	12	11	11
10	11	12	12	11	11	11
15	12	12	12	11	11	11
20	11	12	11	11	11	11
25	11	12	12	11	11	11
30	11	11	11	11	11	11
35	11	12	11	11	11	11
40	11	11	11	11	11	11
45	11	11	11	11	11	11
50	12	12	12	11	11	11
55	12	12	13	12	11	11
60	12	12	14	12	12	12
65	12	12	16	12	12	12
70	12	13	18	12	12	12
75	13	13	20	13	12	12
80	13	14	22	14	13	13
85	13	14	25	15	13	14
90	14	15	28	16	15	15
95	16	17	32	19	16	16
100	18	19	36	23	19	19
105	21	21	40	31	24	23
110	31	30	45	49	31	29
115	33	31	45	54	38	35
120	39	33	49	58	43	41
125	46	36	55	62	48	46
130	54	42	60	66	53	52
135	60	48	63	69	57	57
140	63	53	66	72	60	62
145	66	57	67	74	62	66
150	70	60	68	79	63	69
151	71	60	68	81	63	69
152	#	#	#	#	#	#

#Specimen blanked off to allow the test to continue

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

Time Mins	T/C Number 22 Deg. C	T/C Number 24 Deg. C	T/C Number 25 Deg. C	T/C Number 26 Deg. C	T/C Number 27 Deg. C	T/C Number 28 Deg. C
0	12	12	12	11	12	12
5	12	*	12	11	11	11
10	11		12	11	11	11
15	12		12	11	11	11
20	11		11	11	11	11
25	11		11	11	11	11
30	11		11	11	11	11
35	12		11	11	11	11
40	12		11	11	11	11
45	11		11	11	11	11
50	12		11	11	11	11
55	12		12	11	12	11
60	12		12	12	12	12
65	12		12	12	13	12
70	12		12	13	14	14
75	13		12	16	18	17
80	14		13	19	23	22
85	16		14	24	29	28
90	19		15	32	35	35
95	25		17	47	42	42
100	35		19	61	49	49
104	43		23	70	56	55
105	#	#	#	#	#	#

*Thermocouple malfunction

#Specimen blanked off to allow the test to continue

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

Time Mins	T/C Number 29 Deg. C	T/C Number 30 Deg. C	T/C Number 31 Deg. C	T/C Number 32 Deg. C	T/C Number 33 Deg. C	T/C Number 34 Deg. C
0	12	12	12	12	12	12
10	12	12	12	11	11	11
20	12	12	11	11	11	11
30	12	12	12	11	11	11
40	12	12	12	11	11	11
50	12	11	11	11	11	11
60	12	12	12	12	11	11
70	12	12	12	12	11	12
80	12	12	12	13	12	12
90	12	12	12	14	12	13
100	13	13	13	16	13	14
110	15	15	14	20	16	17
120	16	16	16	23	17	20
130	19	18	18	27	20	23
140	23	21	20	31	25	28
150	28	24	24	36	31	33
160	35	28	27	42	40	40
170	43	32	32	48	49	47
180	49	38	37	53	56	53
190	53	43	45	57	60	57
200	56	50	55	60	63	61
210	58	55	63	62	64	62
220	60	60	69	64	65	63
230	61	63	75	66	66	64
240	63	72	84	68	67	66
244	64	76	86	69	67	66

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

Time Mins	T/C Number 35 Deg. C	T/C Number 36 Deg. C	T/C Number 37 Deg. C	T/C Number 38 Deg. C	T/C Number 39 Deg. C	T/C Number 40 Deg. C
0	12	12	12	12	12	12
10	12	12	12	12	11	11
20	12	12	12	12	11	11
30	13	11	12	11	11	11
40	14	11	12	11	11	11
50	17	11	12	12	11	11
60	19	12	12	12	11	11
70	21	12	12	13	11	11
80	23	12	13	14	12	12
90	26	13	14	16	12	12
100	28	14	16	18	13	14
110	32	16	19	21	15	16
120	35	19	22	24	18	19
130	39	22	27	28	22	23
140	43	26	35	32	27	29
150	47	31	48	37	32	35
160	52	37	57	42	39	42
170	57	43	64	48	45	49
180	60	49	70	53	51	55
190	63	56	74	58	55	60
200	65	63	79	66	59	63
210	67	71	82	73	61	65
220	69	79	86	76	64	68
230	72	85	89	81	67	71
240	77	88	92	84	72	75
244	79	90	93	84	74	77

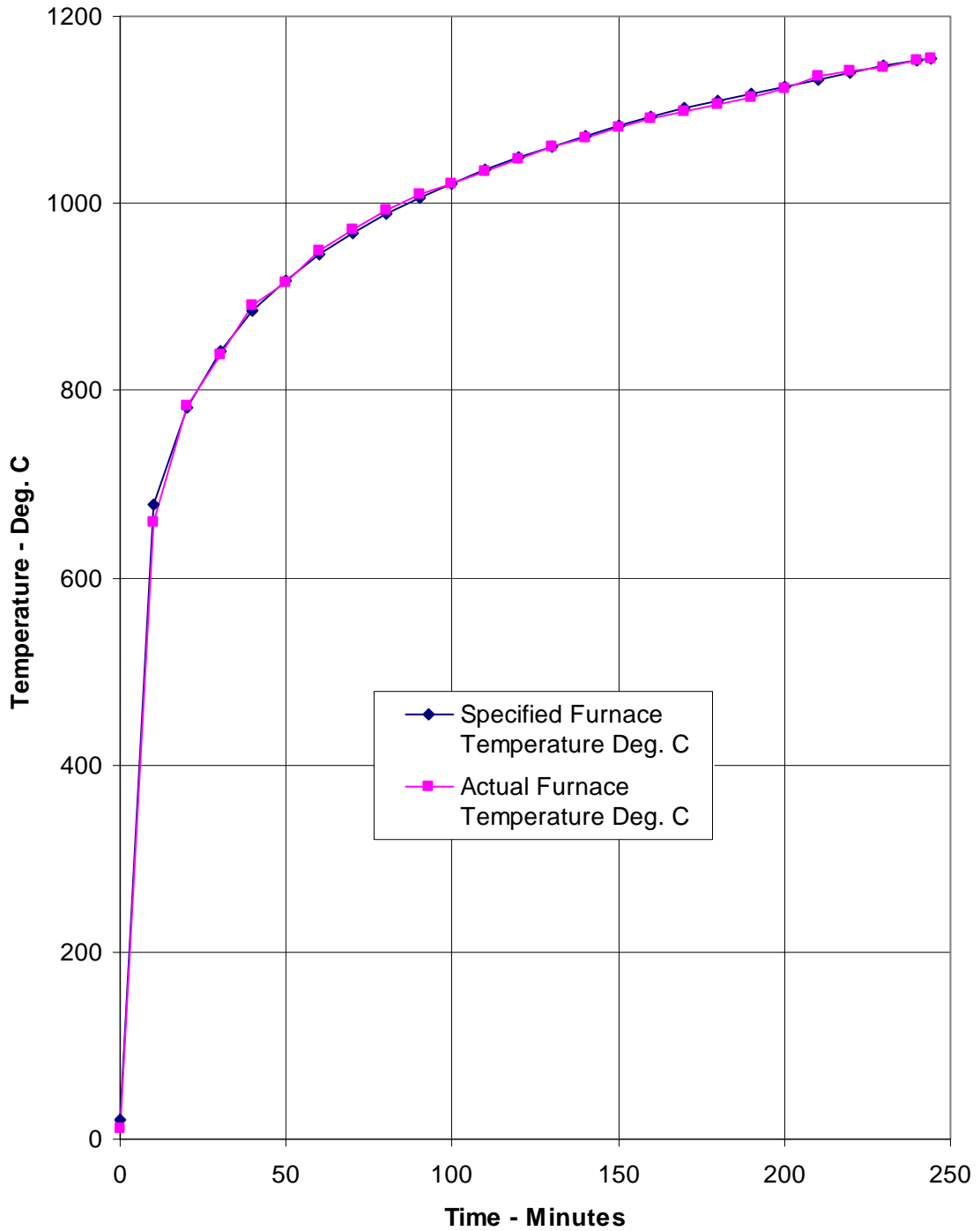
**Individual Temperatures Recorded On The Unexposed Surface Of Specimen F
And Adjacent To Specimen F**

Time Mins	T/C Number 41 Deg. C	T/C Number 42 Deg. C	T/C Number 43 Deg. C	T/C Number 44 Deg. C	T/C Number 45 Deg. C	T/C Number 46 Deg. C
0	12	12	12	12	12	12
10	12	12	12	12	11	11
20	12	12	12	12	11	11
30	12	12	12	12	11	11
40	12	12	12	12	11	11
50	12	12	12	11	11	11
60	12	12	12	12	11	11
70	12	12	12	12	11	11
80	12	12	12	12	12	12
90	13	13	13	13	12	13
100	14	14	14	14	13	14
110	16	16	16	16	15	17
120	19	18	19	19	18	20
130	25	20	23	23	22	24
140	33	24	28	28	26	29
150	43	28	34	34	32	35
160	51	32	40	40	37	41
170	59	36	46	48	43	48
180	64	41	52	56	49	54
190	67	46	57	67	55	59
200	70	51	60	77	59	63
210	72	54	63	81	62	66
220	74	58	66	81	66	68
230	73	62	68	80	70	71
240	73	65	71	81	74	75
244	73	67	72	81	75	76

Table Showing Recorded Furnace Pressure at mid height of the specimens

Time Mins	Recorded Pressure Pa
0	0
10	13
20	15
30	15
40	15
50	16
60	15
70	15
80	15
90	16
100	16
110	16
120	16
130	15
140	15
150	15
160	15
170	15
180	15
190	15
200	15
210	14
220	15
230	15
240	15
244	15

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 the specimen retains its 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	Integrity (mins)	
	Cotton Pad	Sustained flaming
A	244 minutes*	244 minutes*
B	152 minutes#	152 minutes#
C	105 minutes#	105 minutes#
D	244 minutes*	244 minutes*
E	244 minutes*	244 minutes*
F	244 minutes*	244 minutes*

Insulation

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 (mins)
A	244 minutes*
B	152 minutes#
C	105 minutes#
D	244 minutes*
E	244 minutes*
F	244 minutes*

* The test duration. The test was discontinued after a period of 244 minutes. # The Specimen was blanked off to allow the test to continue.

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, sealant depths, orientations, supporting construction and backing material vary from those tested.

Conclusions

Evaluation against objective

A fire resistance test has been conducted to assess the ability of six wall mounted specimens of linear joint sealing systems, to reinstate the integrity and insulation performance (as defined in BS EN 1366-4: 2006) of a simulated wall construction, where adjacent structures abut.

Test Results:

Specimen	Integrity (mins)		Insulation (mins)
	Cotton Pad	Sustained flaming	
A	244 minutes*	244 minutes*	244 minutes*
B	152 minutes#	152 minutes#	152 minutes#
C	105 minutes#	105 minutes#	105 minutes#
D	244 minutes*	244 minutes*	244 minutes*
E	244 minutes*	244 minutes*	244 minutes*

* The test duration. The test was discontinued after a period of 244 minutes. # The Specimen was blanked off to allow the test to continue.

Field of Direct Application

Orientation The field of application regarding the orientation of the linear joint is given in Table 1.

Table 1 – Field of application regarding orientation

Tested orientation	Application
A	A, D, E ^a
B	B
C	C, D ^b
^a Orientation E will only be covered by test orientation A if shear movement was chosen and one face of the joint was fixed and the other face was moved. ^b Orientation D will only be covered by test orientation C if shear movement was chosen and one face of the joint was fixed and the other face was moved.	

Key

- A. Linear joint in a horizontal test construction.
- B. Vertical linear joint in a vertical test construction.
- C. Horizontal linear joint in a vertical test construction.
- D. Horizontal wall joint abutting a floor, ceiling or roof.
- E. Horizontal floor joint abutting a wall.

Table 1 only applies when both the supporting construction and the location of the seal within the linear joint remain unchanged.

Supporting construction Test results obtained with autoclaved aerated concrete standard supporting constructions apply to concrete, block work and masonry separating elements of a thickness and density equal to or greater than that tested.

Seal position Test results are valid only for the position in which the seal was tested, except that where the linear joint seal was fitted flush with the surface of the supporting construction and is exposed to the fire.

Mechanically induced movement The linear gap sealing systems were not tested for mechanically induced movement, therefore the movement capability of the linear joint seal must be less than $\pm 7.5\%$