

Title:

Fire resistance test utilising the general principles of BS 476: Part 20: 1987 on two specimens of penetrating sealing systems.

WF Report No:

175941

Prepared for:

Culimeta-Saveguard Ltd

Tame Valley Mill,
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Date: 8th January 2009


Summary

Objective	To evaluate the ability of two penetrating sealing systems incorporating various services to reinstate the fire resistance performance in terms of integrity and insulation (as defined in BS 476: Part 20: 1987) of a woven fabric fire barrier construction. The test utilised the general principles and performance criteria of BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)	
Test Sponsor	Culimeta-Saveguard Ltd , Tame Valley Mill, Wainwright Street, Dunkinfield, Cheshire, SK16 5NB	
Summary of Tested Specimens	<p>The construction had overall dimensions of 1000 mm high by 1000 mm wide and was formed from a woven glass fabric fire barrier referenced 'FireHalt Gold'. The fire barrier comprised four equal sized sections that were attached together horizontally and vertically using steel staples. The fabric fire barrier was mechanically fixed to a 40 mm x 40 mm steel channel section which was mechanically fixed around the perimeter of the concrete aperture.</p> <p>Two penetrations were included and these were referenced 'Specimen A' and 'Specimen B'</p> <p>Specimen A comprised a mild steel cable tray with four cables of various sizes attached.</p> <p>Specimen B comprised a 3 mm thick, 60 mm diameter steel pipe.</p> <p>Both penetrations were protected with 'FireHalt Penetration Seal' on both sides of the construction. The penetrations were supported on both sides of the construction.</p> <p>Full details of the construction are given in the Schedule of Components section in this report.</p>	
Test Results: Integrity performance	Specimen A	Specimen B
	66 minutes*	66 minutes*
	* The test duration.	
Insulation performance	Specimen A	Specimen B
	16 minutes	15 minutes
	* Maximum temperature rise only	
	The test was discontinued after a period of 66 minutes.	
Date of Test	31 st October 2008	

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Signatories


Responsible Officer S. Whatham* Testing Officer


Approved A. Kearns* Technical Manager

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

Report Issued
Date : 8 th January 2009

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Test Procedure

Introduction

At the request of the sponsor this test was carried out utilising the general principles of BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)' to determine the integrity performance of the specimens as defined in that standard. Additional guidelines were taken from BS EN 1366-3: 2004 with respect to the determination of the insulation performance of the specimens.

BS 476: Part 20: 1987 has been used historically to determine the fire resistance performance of penetration seals prior to the introduction of 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 31st October 2008 at the request of Culimeta-Saveguard Ltd 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

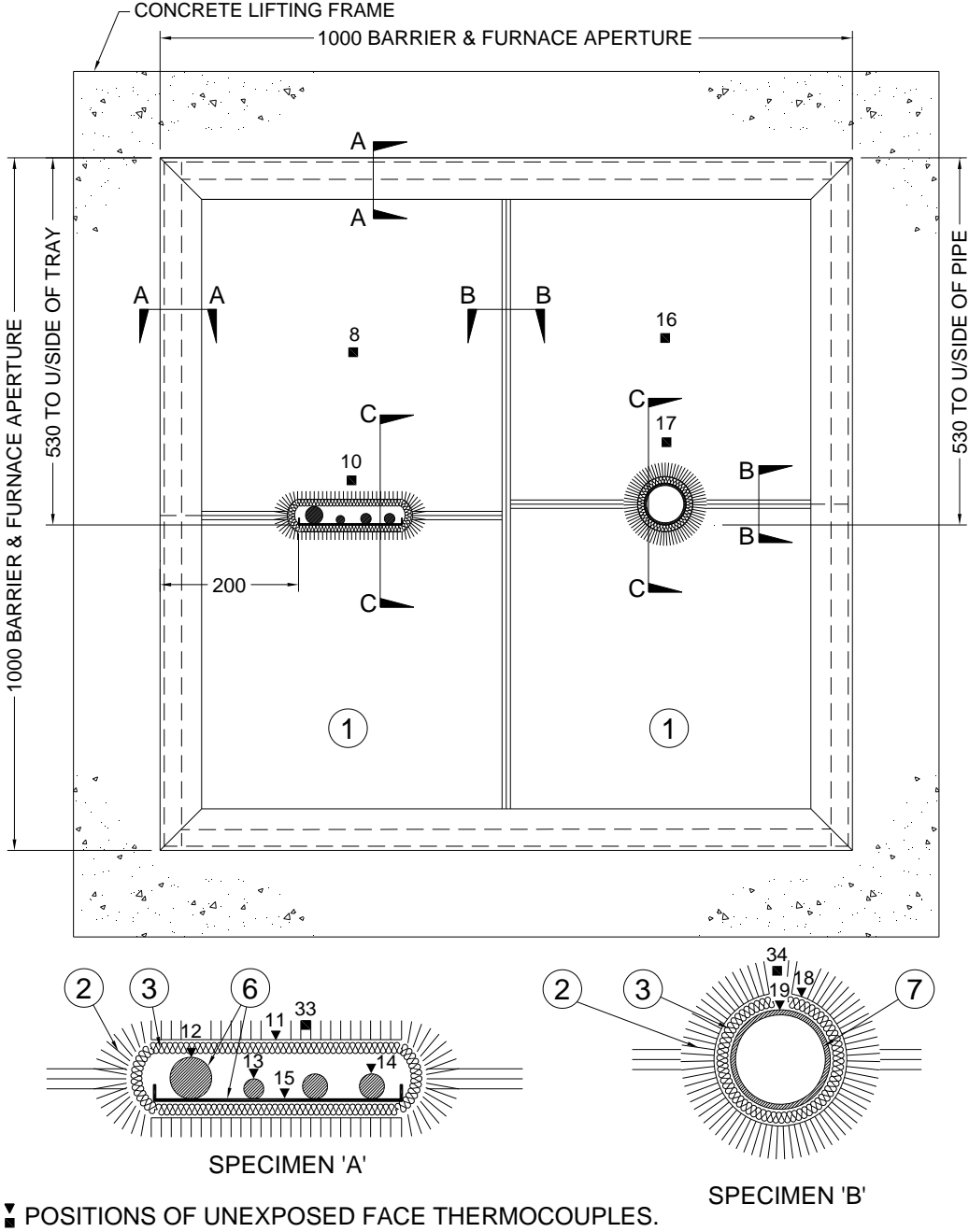
The test assembly was constructed by representatives of Culimeta-Saveguard on the 30th October 2008.

Sampling

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

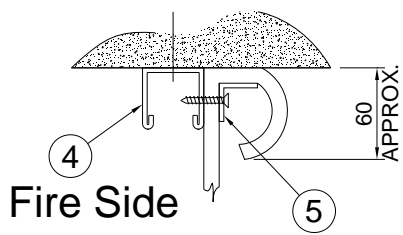
Test Specimen

Figure 1- Elevation of unexposed face of barrier and penetration seals built into a concrete specimen restraint frame

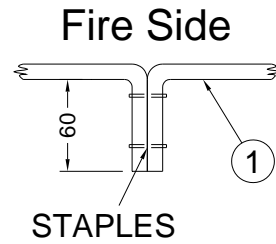


Do not scale. All dimensions are in mm

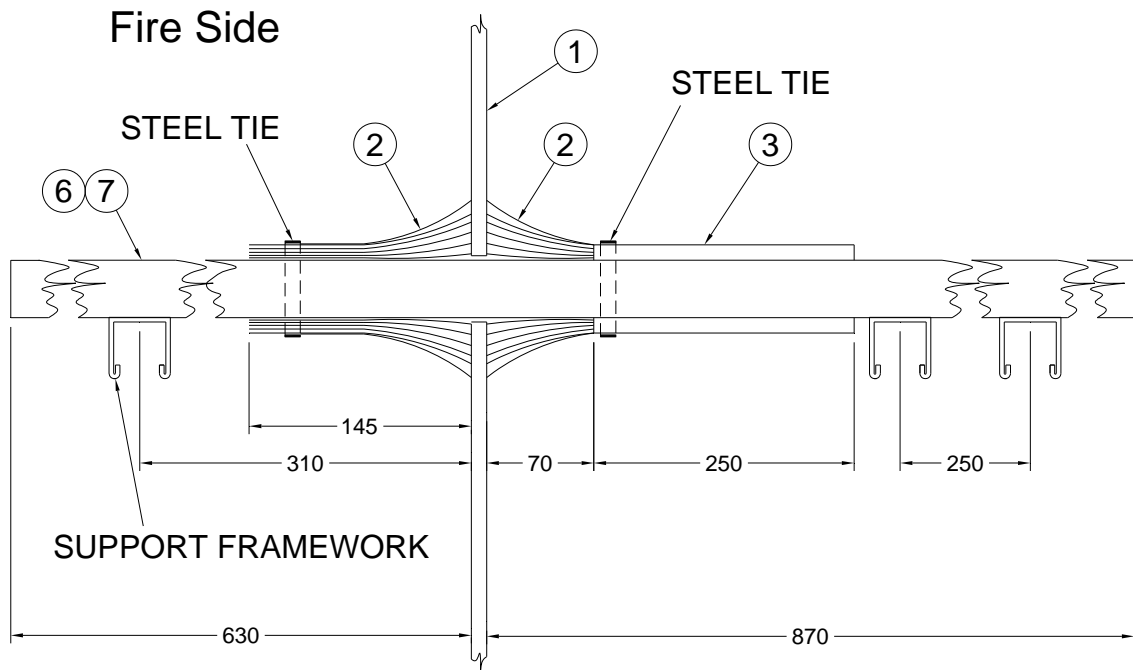
Figure 2 – Typical sections through barrier and penetration seals



SECTION 'A-A'



SECTION 'B-B'



SECTION 'C-C'

Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 2)

(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Fire barrier	
Manufacturer	: Saveguard (UK) Limited
Reference	: FireHalt Gold
Materials	
i. outer layer	: A symmetrical proprietary chemically treated woven glass fabric
ii. adjacent layer	: Duplex aluminium foil. 0.06 mm thick
iii. core	: Non woven glass material, 6 mm thick x 130 kg/m ³ density
iv. adjacent layer	: Duplex aluminium foil. 0.06 mm thick
Nominal barrier weight	: 2.1 kg/m ²
Nominal barrier width	: 1000 mm before folding edges
Fixing	
i. perimeter to concrete frame	: 60 mm folds and clamped as shown in Figure 2
ii. vertical joints	: 60 mm folds, fixed with 2 rows of size 10 galvanised steel staples at 100 mm staggered vertical centres, see Figure 2.
Nominal thickness	: 7.1 mm
2. Penetration seal	
Manufacturer	: Saveguard (UK) Limited
Reference	: FireHalt Penetration Seal
Material	: ECR-glass textile fibre. Polyethylene thread
Dimension	: 145 mm wide nominally x 3 mm thick x 325 g/lm
Number of wraps	: 5
Fixing	: 6 mm wide stainless steel tie fitted with an adjustment screw (jubilee type clamp)
3. Penetration cuff	
Manufacturer	: Saveguard (UK) Limited
Reference	: FireHalt Gold
Materials	: The materials for the cuffs were the same as for the barrier item 1
Fixing	: The cuffs were fixed with the stainless steel ties used to fix the penetration seal item 2
4. Perimeter channel	
Material	: Galvanised mild steel
Size	: 40 mm x 40 mm x 2 mm thick
Channel length	: Continuous
Fixing to concrete	
i. type	: Expanding anchor bolts
ii. size	: 6 mm diameter
iii. frequency	: 250 mm

<u>Item</u>	<u>Description</u>
5. Perimeter angle	
Material	: Galvanised mild steel
Size	: 25 mm x 25 mm x 0.5 mm thick
Angle length	: Continuous
Fixing to channel	
i. type	: Countersunk steel self drilling screws
ii. size	: 38 mm x 4 mm diameter
iii. frequency	: 250 mm
6. Electric cables and cable tray penetrations – Specimen 'A'	
Cable tray	
i. material	: Galvanised mild steel
ii. thickness	: 1.5 mm
iii. size	: 150 mm wide x 10 mm folded edges
iv. length	: Continuous length
Cables	
i. type	: Electrical copper core cables
ii. sizes (left to right viewed from unexposed face)	: 1 No. 25 mm overall diameter 1 No. 12 mm overall diameter 2 No. 15 mm overall diameter
Fixing	: Cables fixed with ties to cable tray. Cable tray supported by a framework of steel channels at centres shown in Figure 2
7. Pipe penetration – Specimen 'B'	
Material	: Mild steel pipe
Thickness	: 3 mm
Diameter	: 60 mm
Length	: Continuous length
Fixing	: Pipe fixed with steel wire a framework of steel channels at centres shown in Figure 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 four mineral insulated thermocouples distributed over a plane 100 mm from the surface of the wall construction.
General	<p>Thermocouples were provided to monitor the unexposed surface of the specimens. The output of all instrumentation was recorded at not 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 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 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 at a mid point between the upper and lower seals, the differential pressure was calculated to be between 15 Pa and 19 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 18°C at the start of the test with a maximum variation of 2°C during the test.
00	00	The test commences.
10	00	The material in the wall construction has started to discolour.
15	05	Maximum temperature rise recorded on Thermocouple No. 17. Insulation failure is deemed to have occurred.
30	00	All of the specimens continue to satisfy the integrity criteria of the test.
45	00	No further significant visible change.
60	00	All of the specimens continue to satisfy the integrity criteria of the test.
63	00	Glowing areas are visible in the fabric near to thermocouple No. 8.
66	00	The test is discontinued.

Test Photographs

The exposed face of the seals prior to testing



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



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	17
2	445	409
4	544	531
6	603	617
8	645	645
10	678	675
12	705	704
14	728	723
16	748	750
18	766	763
20	781	784
22	796	798
24	809	812
26	820	814
28	832	833
30	842	851
32	851	868
34	860	872
36	869	879
38	877	887
40	885	894
42	892	911
44	899	913
46	906	915
48	912	919
50	918	928
52	924	925
54	930	936
56	935	937
58	940	947
60	945	949
62	950	952
64	955	959
66	960	966

Individual Temperatures Recorded On The Unexposed Surface Of The Fire Barrier

Time Mins	T/C Number 8 Deg. C	T/C Number 10 Deg. C	T/C Number 16 Deg. C	T/C Number 17 Deg. C
0	15	16	16	16
2	17	18	16	21
4	33	36	24	45
6	60	62	42	74
8	88	92	64	107
10	110	122	85	137
12	124	148	102	164
14	136	172	116	186
16	143	193	125	205
18	148	211	138	221
20	152	228	151	235
22	156	241	164	247
24	160	253	175	259
26	163	264	188	270
28	166	274	196	280
30	174	285	203	288
32	184	300	210	295
34	194	316	215	301
36	204	334	218	304
38	212	355	218	306
40	220	377	220	305
42	227	382	222	304
44	233	393	225	305
46	236	402	229	309
48	243	412	230	311
50	253	422	230	314
52	269	433	233	318
54	289	439	238	327
56	319	446	242	336
58	386	455	245	343
60	548	465	250	353
62	567	476	252	364
64	582	519	257	375
66	604	579	284	382

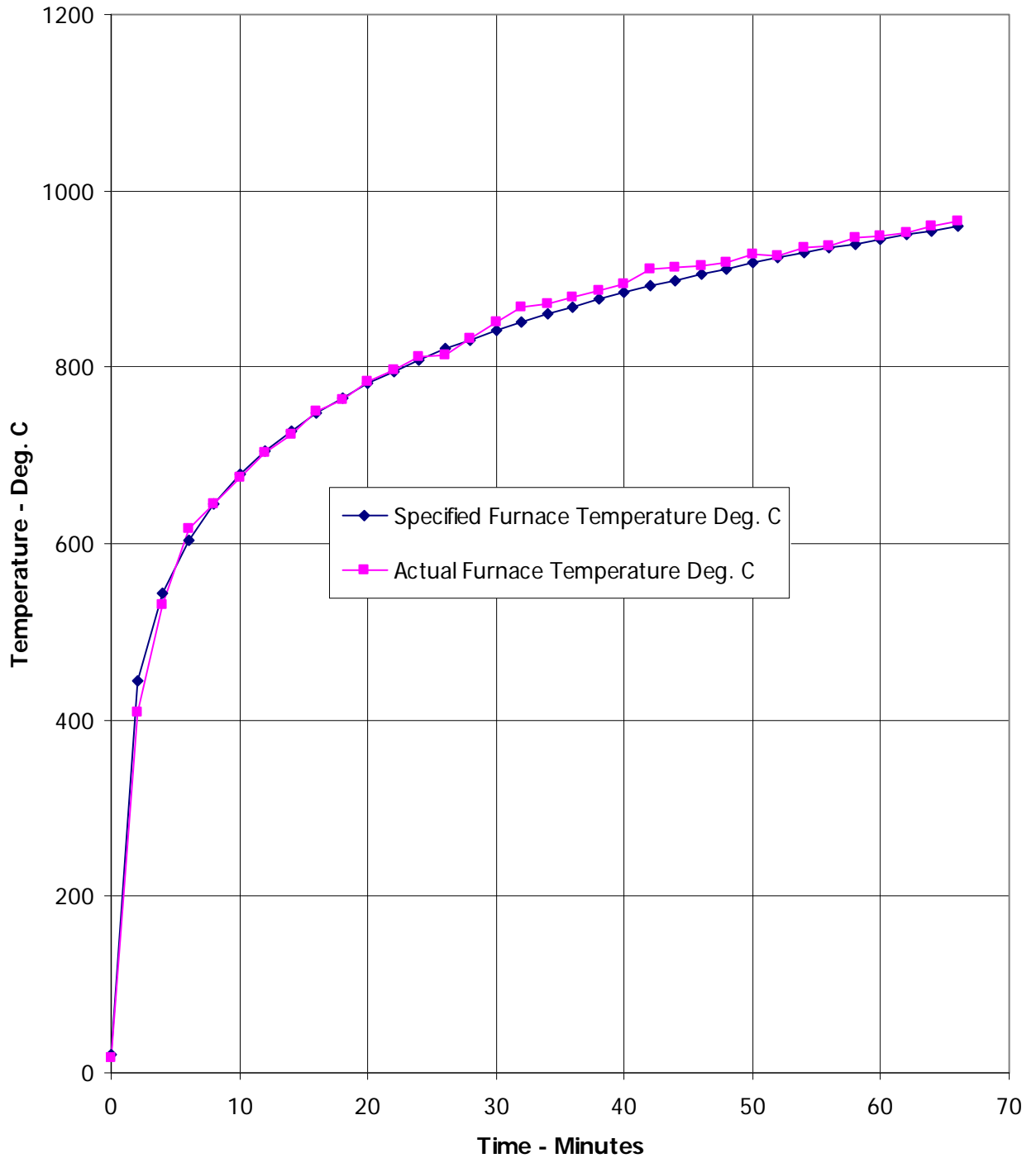
Individual Temperatures Recorded On The Unexposed Surface Of Specimen A

Time Mins	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	T/C Number 33 Deg. C
0	16	14	14	15	14	15
2	15	14	13	14	14	14
4	16	15	14	15	14	16
6	18	15	14	15	14	17
8	20	15	15	15	14	21
10	23	16	15	16	15	24
12	26	16	16	17	15	28
14	29	17	17	18	16	32
16	32	18	18	19	16	36
18	35	19	20	21	17	41
20	38	20	22	22	18	45
22	40	22	24	24	19	50
24	44	24	27	27	21	55
26	46	26	28	29	22	61
28	48	28	30	32	24	66
30	51	30	33	34	25	72
32	54	33	35	36	26	78
34	56	36	36	39	27	85
36	58	38	38	41	28	91
38	61	41	40	43	29	97
40	63	43	42	45	31	104
42	65	45	44	48	32	110
44	67	48	46	50	32	117
46	69	51	48	52	34	122
48	71	53	50	54	34	127
50	74	56	52	56	35	134
52	77	59	53	58	36	143
54	81	62	56	60	38	152
56	83	65	59	63	39	159
58	86	67	61	65	40	168
60	90	71	64	69	42	179
62	95	75	67	71	44	189
64	101	78	70	75	45	203
66	106	82	72	78	47	216

Individual Temperatures Recorded On The Unexposed Surface Of Specimen B

Time Mins	T/C Number 18 Deg. C	T/C Number 19 Deg. C	T/C Number 34 Deg. C
0	17	17	15
2	16	17	15
4	17	17	16
6	17	17	17
8	20	18	20
10	22	19	23
12	24	22	28
14	27	24	32
16	30	26	37
18	33	29	43
20	36	32	48
22	40	36	54
24	43	39	61
26	46	43	68
28	49	47	75
30	52	50	82
32	56	54	89
34	60	57	94
36	63	60	100
38	65	64	106
40	69	68	115
42	72	72	120
44	74	75	125
46	77	78	131
48	79	80	135
50	82	84	141
52	85	86	149
54	87	90	155
56	90	92	160
58	93	94	166
60	97	98	171
62	100	100	174
64	103	103	180
66	108	106	185

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 shown below:**

Specimen A

66 minutes*

Specimen B

66 minutes*

* The test duration.

Insulation

The mean and maximum temperature rise allowable on the unexposed face of a specimen by BS 476: Part 20: 1987 are 140°C and 180°C respectively, as per the additional guidance taken from BS EN 1366-3: 2004, only the maximum temperature rise criterion was utilised. **These requirements were satisfied for the periods shown below:**

Specimen A

16 minutes

Specimen B

15 minutes

The test was discontinued after 66 minutes.

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 results obtained are applicable only to the specimens tested using the components detailed in this report. Application of the results to seals of differing sizes and materials, or mounted within a different wall construction should be the subject of a design appraisal.

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 1366-3: 2004. 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

Two specimens of penetration sealing system have been evaluated as to their ability to reinstate the fire resistance performance in terms of integrity and insulation (as defined in BS 476: Part 20: 1987) of a fabric fire barrier construction. The test utilised the general principles and performance criteria of BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles).

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:

Test Results:

Integrity performance

Specimen A
66 minutes*

Specimen B
66 minutes*

* The test duration.

Insulation performance

Specimen A
16 minutes

Specimen B
15 minutes

The test was discontinued after 66 minutes.



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