

# test report

**Title:**

The fire resistance performance of two fully insulated, single-acting, single-leaf doorsets, in accordance with BS 476: Part 22: Clause 6.

**WF Report No:**

164432

**Prepared for:**

**Sauerlander  
Spanplatten GmbH**  
Postfach 5553  
59805 Arnsberg  
Germany

**Date:**

3<sup>rd</sup> July 2007

**Notified Body No:**

0833



# Summary

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**Objective** To determine the fire resistance performance of two specimens of fully insulated, single-acting, single-leaf doorsets when tested in accordance with BS 476: Part 22: 1987.

**Sponsors** Sauerlander Spanplatten GmbH, Postfach 5553, 59805 Arnsberg, Germany

**Summary of Tested Specimen** For the purposes of the test the doorsets were referenced 'A and B'.

Both doorsets had overall dimensions of 2078mm high by 992 mm wide and incorporated a door leaf of overall dimensions of 2040 mm high by 926 mm wide by 44 mm thick.

**Door leaf A** comprised an extruded solid board core referenced '38 S3K, a hardwood perimeter framework and 3 mm thick hardboard facings referenced 'Homadur Typ 5'. The leaf was hung within a softwood frame on three steel hinges.

**Door leaf B** comprised an extruded solid board core referenced '38 S2, a hardwood perimeter framework and 3 mm thick hardboard facings referenced 'Homadur Typ 5'. The leaf was hung within a softwood frame on three steel hinges.

Both door leaves were orientated such that they opened towards the heating conditions of the test. The doorsets included a mortice latch which was positioned at the approximate mid-height of each doorset. Each doorset was rendered latched for the test duration.

<b>Test Results:</b>	<b>Doorset A</b>	<b>Doorset B</b>
<b>Integrity</b>	40 minutes	31 minutes
<b>Insulation</b>	39 minutes	31 minutes


The test was discontinued after a period of 41 minutes.

**Date of Test** 6<sup>th</sup> June 2007

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## Signatories

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Responsible Officer <b>N. Howard*</b> Testing Officer


Approved <b>D. Hankinson*</b> Technical Consultant

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

Report Issued
Date : 3 <sup>rd</sup> July 2007

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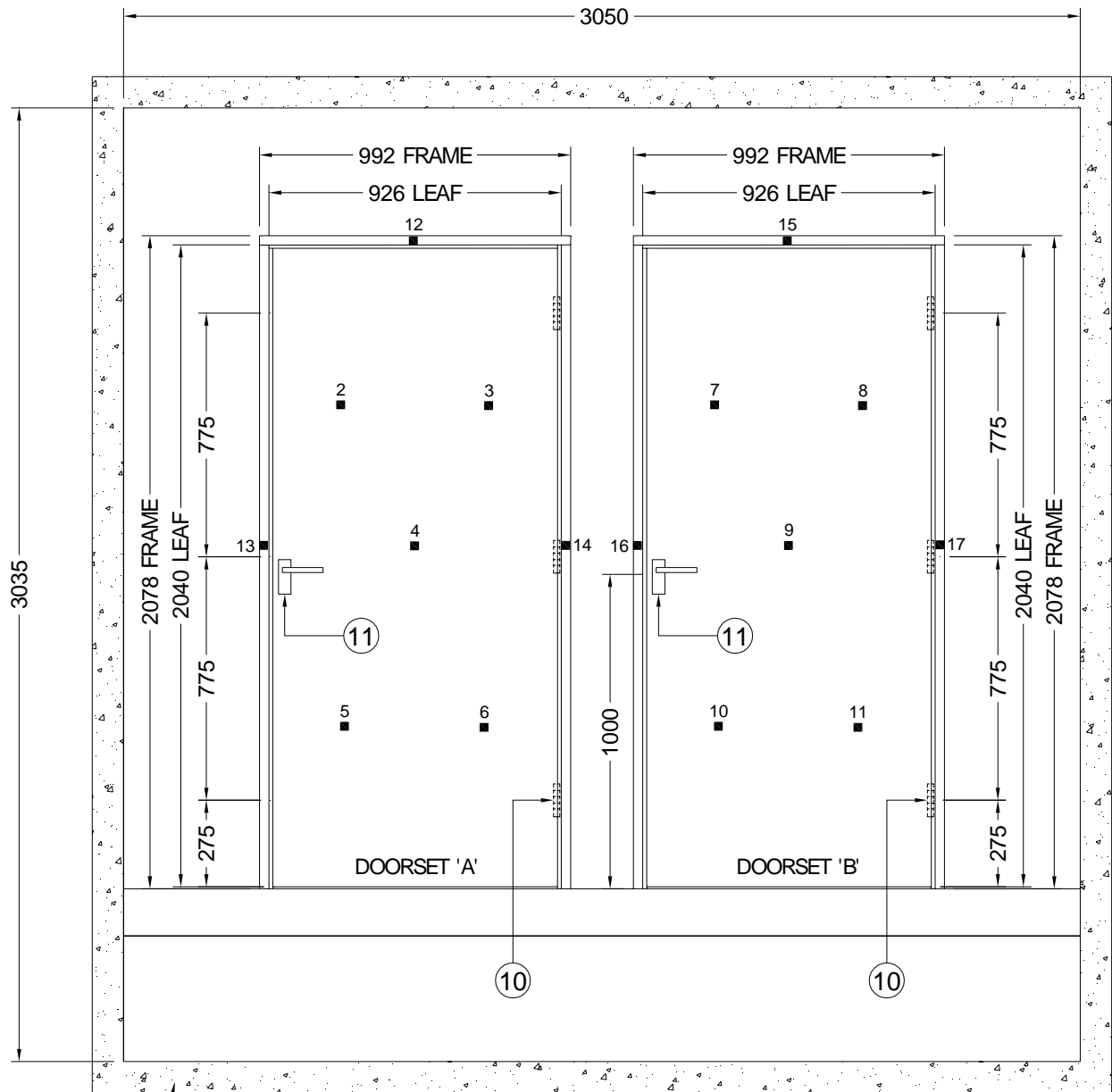
# Test Procedure

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- Introduction** The doorsets were of a fully insulated construction and the test was therefore conducted in accordance with Clause 6 of BS 476: Part 22: 1987 'Methods for determination of the fire resistance of non-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 specimens were judged on their ability to comply with the performance criteria for integrity and insulation, as required by BS 476: Part 22: 1987, Clause 6.
- 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 6<sup>th</sup> June 2007 on behalf of **Sauerlander Spanplatten GmbH**.
- Mr R. Kanzler, a representative of **Sauerlander Spanplatten GmbH**, 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 doorsets were mounted within an aperture provided in a masonry wall construction such that the door leaves opened towards the heating conditions of the test. A representative of Bodycote **warringtonfire** conducted the installation of the doorset on the 5<sup>th</sup> June 2007.
- Conditioning** The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 3 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 16°C to 21°C and 40% to 68% respectively.

# Test Specimen

**Figure 1- General Elevation of Test Specimens**



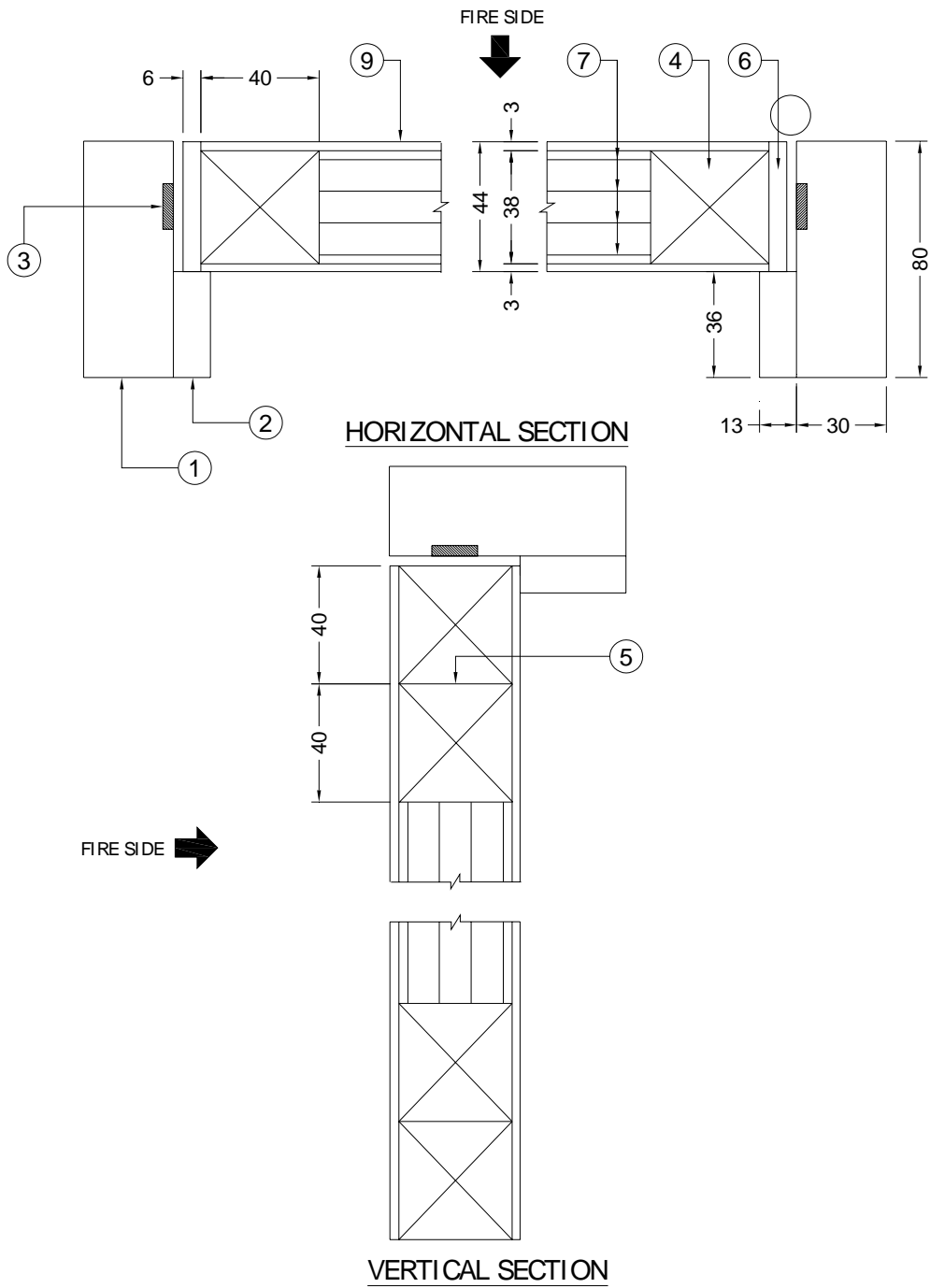
SPECIMEN RESTRAINT FRAME

- POSITIONS OF UNEXPOSED FACE THERMOCOUPLES.

SPECIMEN BUILT INTO A MASONRY WALL CONSISTING OF AAC (AUTOCLAVED AERATED CONCRETE) BLOCKWORK WALLS, LINTEL AND BASE, NOMINALLY 150 THICK. BOTH DOOR LEAVES OPEN TOWARDS THE HEATING CONDITIONS OF THE TEST.

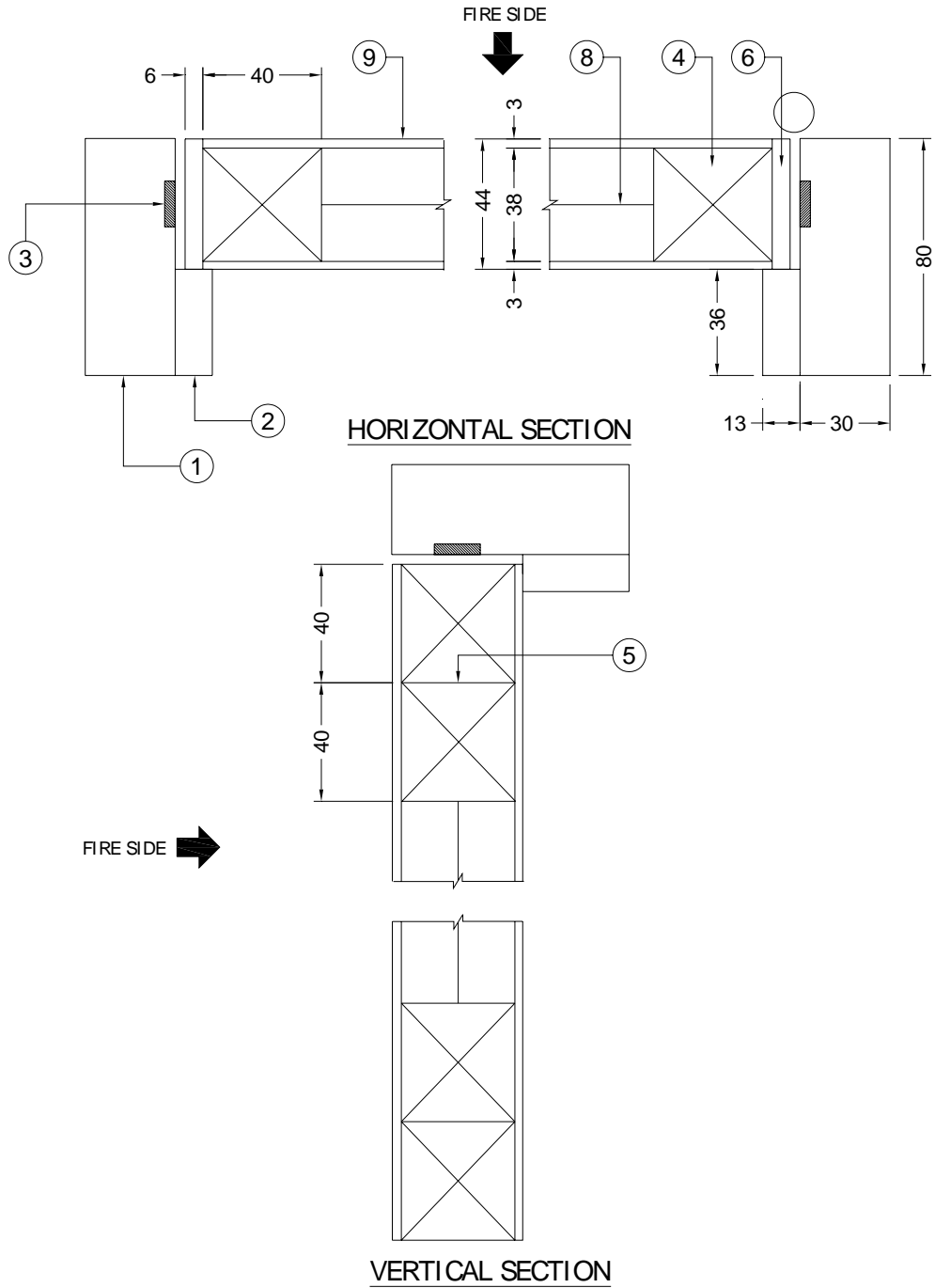
Do not scale. All dimensions are in mm

**Figure 2 – Details of Doorset 'A'**



Do not scale. All dimensions are in mm

**Figure 3 – Details of Doorset 'B'**



Do not scale. All dimensions are in mm



# Schedule of Components

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

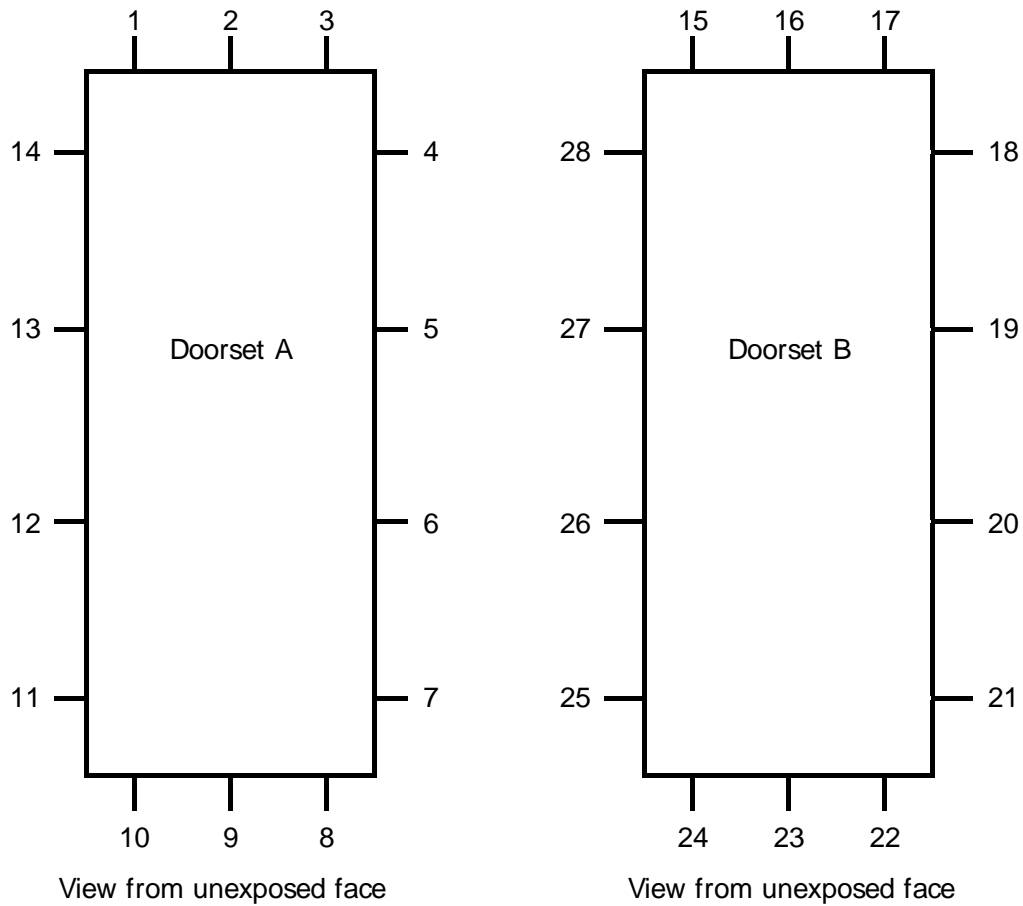
<u>Item</u>	<u>Description</u>
<b>1. Door Frame</b>	
Material	: Softwood
Density	: 490 kg/m <sup>3</sup> , stated
Average moisture content	: 12 % average measured with a Protimeter moisture meter
Overall size	: 80 mm x 30 mm
Jambs to head jointing method	: Butted and screwed
Fixing method	: Through screwed to blockwork
Fixings	
i. type	: Countersunk head wood screws
ii. material	: Steel screws with 2 off plastics plugs
iii. overall size	: 150 mm long by 5.8 mm diameter
<b>2. Door Frame Stop</b>	
Material	: Softwood
Density	: 490 kg/m <sup>3</sup> , stated
Overall size	: 36 mm x 13 mm
<b>3. Intumescent Seal</b>	
Manufacturer	: BASF; foil facing by Rolf Kuhn GmbH
Reference	: Palusol T
Material	: Palusol intumescent sheet with a foil facing
Overall size	: 15 mm wide x 2 mm thick
Fixing method	: Self adhered into a groove located centrally within the rebate of the frame sections along the vertical edges and head
<b>4. Door Leaf Perimeter Framework</b>	
<b>Stiles</b>	
Material	: Hardwood
Density	: 660 kg/m <sup>3</sup> , stated
Overall size	: 40 mm x 38 mm
<b>5. Rails</b>	
Material	: Hardwood
Density	: 660 kg/m <sup>3</sup> , stated
Overall size	: 2 x 40 mm x 38 mm
<b>6. Lipping</b>	
Material	: Hardwood
Density	: 660 kg/m <sup>3</sup> , stated
Overall size	: 6 mm x 44 mm

<u>Item</u>	<u>Description</u>
<b>7. Door Leaf Core – Doorset ‘A’</b>	
Manufacturer	Sauerland Spanplatte
Reference	38 S3K
Material	: Extruded solid board: 3 layer at 10.6 mm, stapled with 2 x 3 mm cork faces bonded to solid board
Density	: Solid board: 560 kg/m <sup>3</sup> ; cork: 250 kg/m <sup>3</sup> nominal, stated
Thickness	: 38 mm
Fixing method	: Retained in place by fixing of leaf faces
<b>8. Door Leaf Core – Doorset ‘B’</b>	
Manufacturer	Sauerland Spanplatte
Reference	38 S2
Material	: Extruded solid board: 2 layer at 19 mm, stapled
Density	: 520 kg/m <sup>3</sup> , nominal, stated
Thickness	: 38 mm
Fixing method	: Retained in place by fixing of leaf faces
<b>9. Door Leaf Facings</b>	
Manufacturer	: Homanit GmbH & Ko. KG
Material	: HDF: Homadur Typ 5
Density	: 900 kg/m <sup>3</sup> , stated
Thickness	: 3 mm
Fixing method	: Bonded to perimeter framework and core of each leaf
Adhesive	
i. manufacturer	: BASF
ii. type	: Urea formaldehyde
iii. reference	: Kaurit 122
iv. curing method	: Hot pressed
v. application method	: Rolled
vi. application rate	: 0.120 Kg/m <sup>2</sup> , stated
<b>10. Hinges</b>	
Type	: Butt hinge
Materials	: Steel
Overall sizes	
i. knuckle	: 103 mm long x 9.4 mm diameter
ii. blades	: 100 mm long x 30 mm wide x 1.7 mm thick
Fixings	
i. type	: Countersunk head screws
ii. material	: Steel
iv. size	: 30 mm long x 4.0 mm diameter
v. number off per blade	: 4
vi. maximum distance of fixing screws from exposed face of door leaf	: 19 mm
Bedding material	
i. manufacturer	: Dr. Wolmann
ii. material	: Interdens
iii. reference	: Typ 15
iv. overall size	: 100 mm long x 30 mm wide x 1 mm thick
v. fitting	: Fitted to blade to leaf only

**Item****Description****11. Latch**

Manufacturer	:	NT Legge
Type	:	Tubular mortice latch
Reference	:	3721 NP 64 mm
Material	:	Mild steel
Overall size		
i. fore plate	:	57 mm x 25 mm
ii. strike plate	:	57 mm x 25 mm
iii. casing	:	64 mm long x 20 mm high x 16 mm wide
iv. latch bolt	:	12.8 mm x 10.8 mm with 9.5 mm throw
Operation of latch bolt	:	Engaged
Fixing method	:	Screwed
Lever handles		
i. material	:	Aluminium
ii. overall size	:	104 mm x 41 mm backing plate, complete with 103 mm long x 15 mm wide handles

# Doorset Clearance Gaps



Door Ref	Gap Dimension in mm at Positions													
	1	2	3	4	5	6	7	8*	9*	10*	11	12	13	14
A	2.3	1.9	1.8	1.6	1.8	1.6	1.3	5	5	5	2.9	2.7	2.8	3.0
	15	16	17	18	19	20	21	22*	23*	24*	25	26	27	28
B	2.5	2.4	2.3	1.8	1.2	1.1	1.0	5	5	6	3.2	3.3	3.4	3.4
A	Mean		2.0		Maximum			3.0			Minimum			1.3
B	Mean		2.0		Maximum			3.4			Minimum			1.0

\* Dimension not included in calculations

DO NOT SCALE  
ALL DIMENSIONS ARE IN mm

# Instrumentation

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<b>General</b>	The instrumentation was provided in accordance with the requirements of the Standard.
<b>Furnace</b>	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.
<b>Thermocouple Allocation</b>	Thermocouples were provided to monitor the unexposed surface of the specimen and the output of all instrumentation was recorded at no less than one minute intervals as follows:
<b>Thermocouples 2 to 6 Doorset A and 7 to 11 Doorset B</b>	At five positions on each doorset, one approximately at the centre and one at approximately the centre of each quarter section of the doorset.
<b>Thermocouples 12 to 14 Doorset A and 15 to 17 Doorset B</b>	At three positions at the approximate centre of each frame member.  The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.
<b>Roving Thermocouple</b>	A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position, which might appear to be hotter than the temperatures indicated by the fixed thermocouples.
<b>Integrity Criteria</b>	Cotton pads and gap gauges were available to evaluate the impermeability of the specimen to hot gases.
<b>Furnace Pressure</b>	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 doorsets was 9.2 ( $\pm 2$ ) 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 15°C at the start of the test with a maximum variation of +1°C during the test.
00	00	<b>The test commences.</b>
01	20	Slight smoke/steam release is evident from the head of the leaf of each doorset and the latch of Doorset B.
03	00	The smoke release previously mentioned increases in volume.
04	00	Large volumes of smoke issue from the leading edge of Doorset A and the head of both Doorsets A & B.
09	00	Moisture release is evident from the head of each Doorset.
10	00	The facing to the exposed surface of each doorset chars and begins to fall away into the furnace chamber.
10	30	Large amounts of flaming occurs within the furnace chamber.
14	40	Doorset B visibly distorts towards the furnace chamber at its approximate centre.
15	00	The smoke release mentioned at 4 minutes decreases in volume.
20	00	No further significant visible changes are evident at this time.
25	00	The smoke release re-commences from the top two corners of the leaves of each Doorset.
26	30	The leaf of Doorset A distorts away from the furnace chamber at its approximate centre.
28	30	Pulses of smoke issue from the leading edge of the leaf of Doorset B coincident with the latch position.
30	00	Both Doorsets A & B continue to satisfy the integrity and insulation criteria of the test.
31	30	Sustained flames issue from the top left hand corner of the door leaf of Doorset B. <b>Integrity failure of Doorset B is deemed to occur.</b>
33	00	Smoke issues from the latch position of Doorset A.
34	00	Areas of discolouration are evident at the top of the door leaf of Doorset A.

**Time**

**mins    secs**

- |           |           |   |
|-----------|-----------|---|
| <b>35</b> | <b>00</b> | The discolouration mentioned at 34 minutes spreads downwards over the top 3 <sup>rd</sup> of the leaf of Doorset A. The facing begins to blister. |
| <b>40</b> | <b>00</b> | No further significant visible change.  |
| <b>40</b> | <b>50</b> | Sustained flames issue from the facing of Doorset A. <b>Integrity failure of Doorset A is deemed to occur.</b>                                    |
| <b>41</b> | <b>00</b> | <b>The test is discontinued.</b>  |

# Test Photographs

The exposed face of the doorset prior to testing

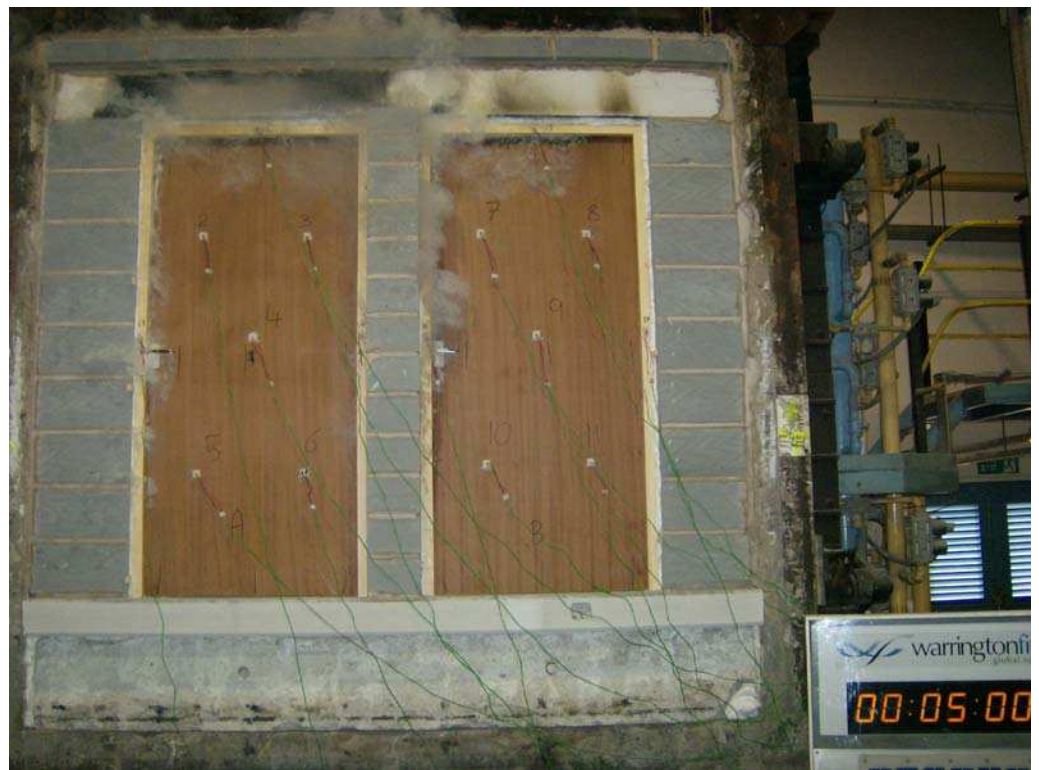


The unexposed face of the doorsets prior to testing

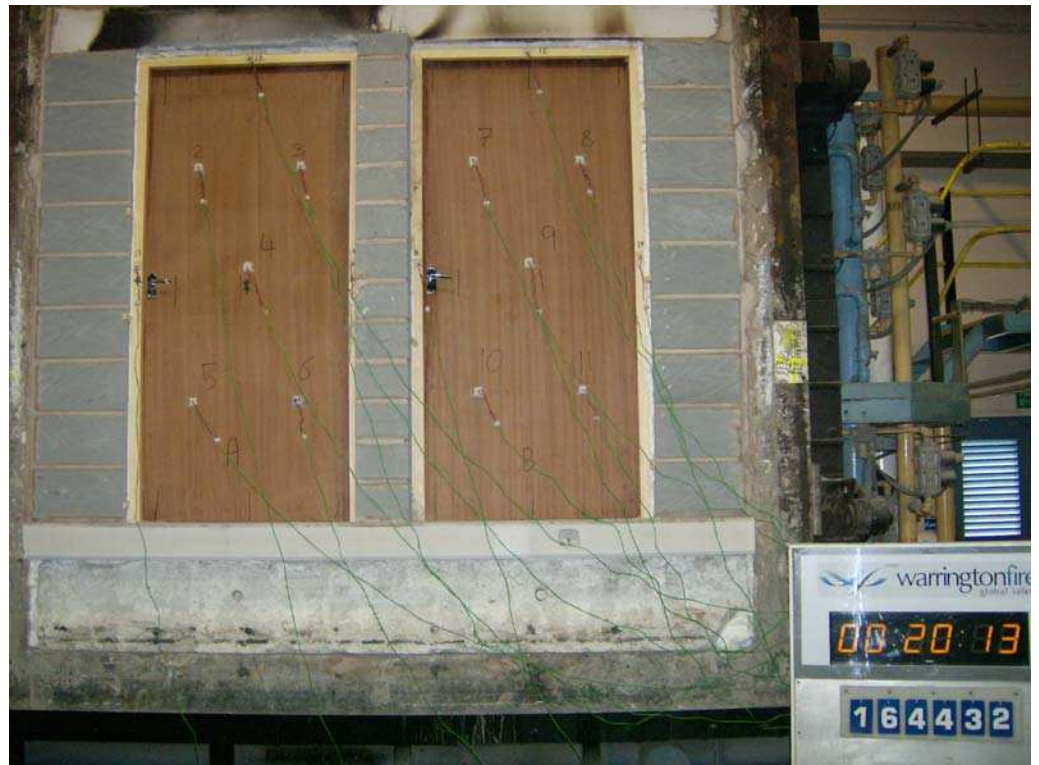




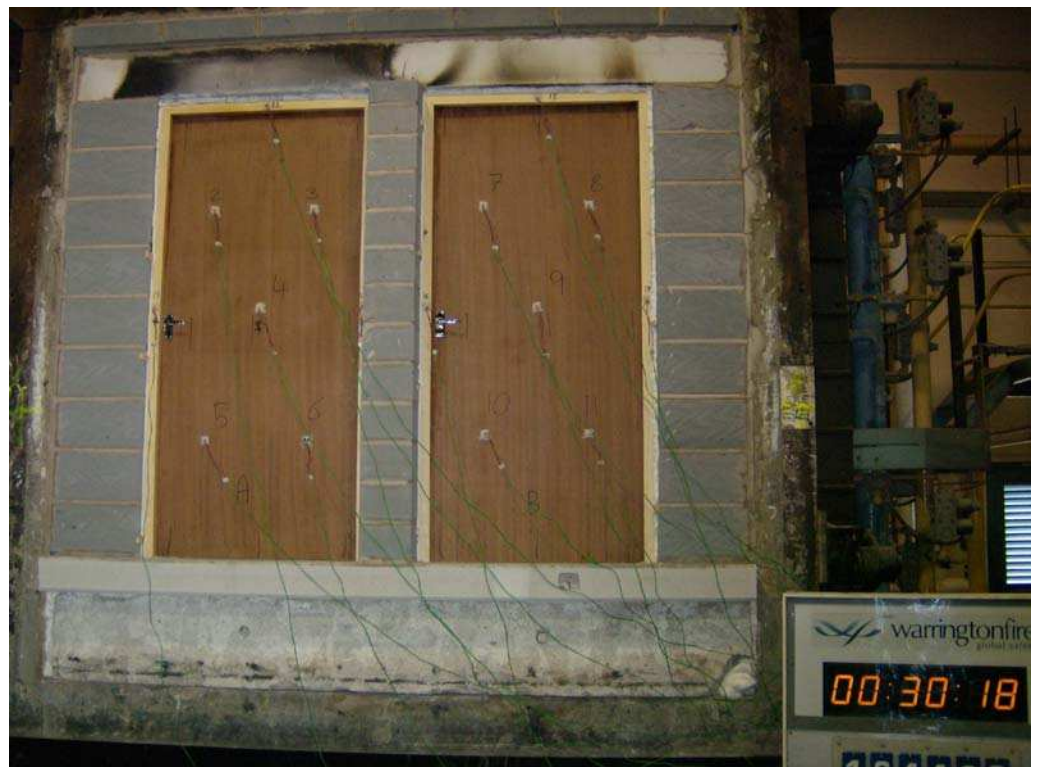
The unexposed face of the doorsets after 5 minutes of testing



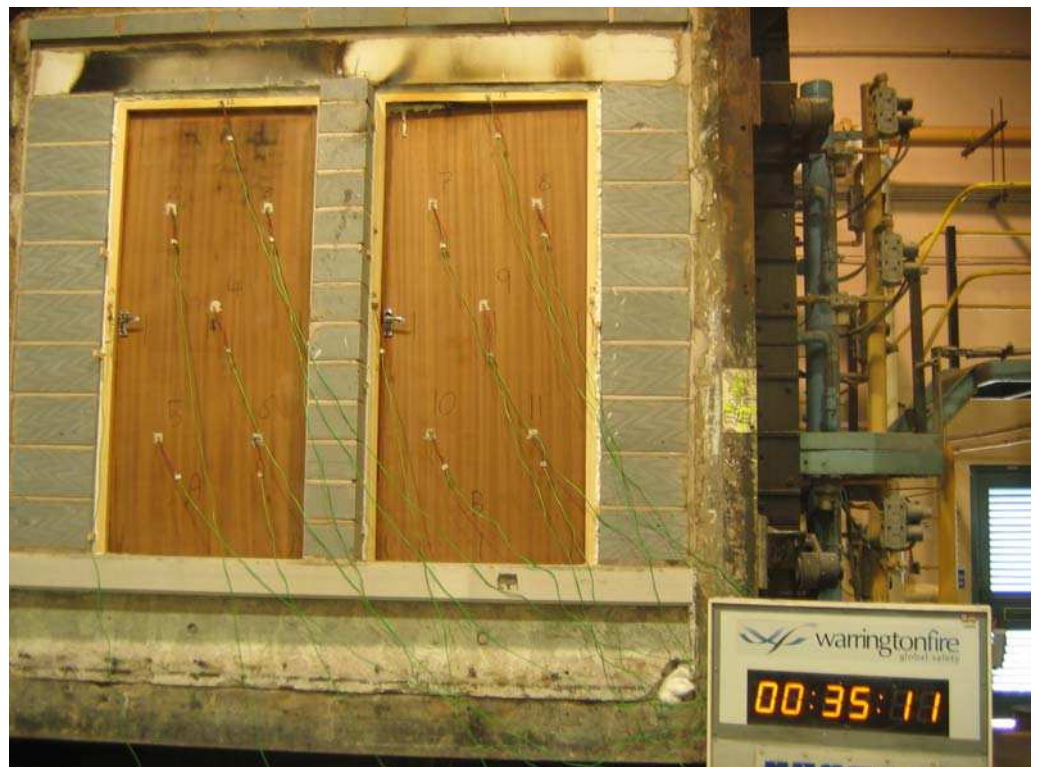
The unexposed face of the doorsets after 20 minutes of testing



The unexposed face of the doorsets after 30 minutes of testing



The unexposed face of the doorsets after 35 minutes of testing



# 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	29
2	445	459
4	544	532
6	603	663
8	646	626
10	678	659
12	706	720
14	728	727
16	748	759
18	766	777
20	781	790
22	796	806
24	809	816
26	820	828
28	832	822
30	842	845
32	852	842
34	860	854
36	869	875
38	877	880
40	885	885
41	888	889



**Individual And Mean Temperatures Recorded On The Unexposed Surface Of Doorset A**

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	15	15	16	16	16	16
2	15	15	16	16	*	16
4	15	15	16	16		16
6	15	15	16	16		16
8	15	15	16	16		16
10	15	15	16	16		16
12	15	15	17	16		16
14	14	14	16	17		15
16	19	20	19	17		19
18	24	26	27	21		25
20	29	30	32	26		29
22	33	35	36	30		34
24	37	40	38	34		37
26	43	47	41	38		42
28	48	54	48	44		49
30	58	67	57	53		59
32	79	82	77	63		75
34	75	83	81	87		82
36	102	109	91	84		97
38	145	151	130	114		135
40	194	189	183	167		183
41	191	190	207	195		196

\* Thermocouple Malfunction

**Individual And Mean Temperatures Recorded On The Unexposed Surface Of Doorset B**

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 11 Deg. C	Mean Temp. Deg. C
0	16	18	18	18	18	18
2	16	18	18	18	18	18
4	16	18	18	18	18	18
6	16	18	18	18	18	18
8	16	18	18	18	18	18
10	16	19	18	18	19	18
12	19	20	21	22	23	21
14	23	23	26	25	27	25
16	28	31	33	31	31	31
18	32	36	37	36	35	35
20	36	39	41	40	39	39
22	38	41	44	43	42	42
24	40	44	46	46	45	44
26	44	46	49	48	48	47
28	49	49	51	51	51	50
30	55	51	53	54	54	53
32	58	56	57	58	59	58
34	52	58	62	*	64	59
36	49	60	63		66	60
38	63	74	71		68	69
40	62	73	70		79	71
41	64	73	72		77	72

\* Thermocouple Malfunction

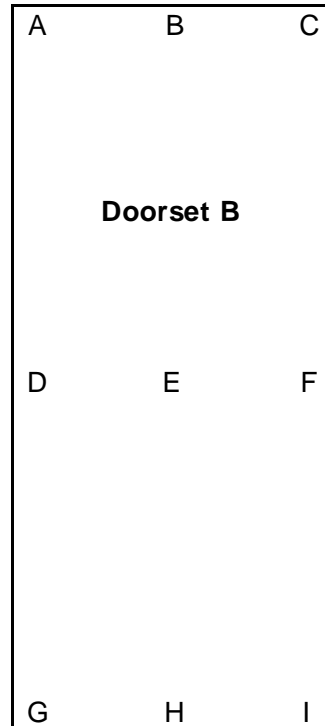
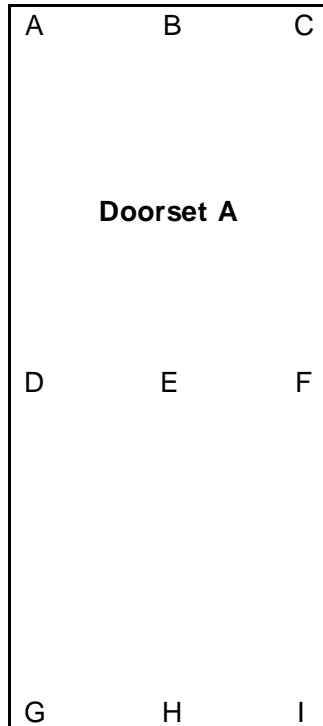
**Individual Temperatures Recorded On The Frame of Doorset A**

Time Mins	T/C Number Deg. C	T/C Number Deg. C	T/C Number Deg. C
0	18	18	18
2	18	18	18
4	15	18	18
6	12	18	18
8	14	18	18
10	15	18	18
12	15	18	18
14	16	19	18
16	16	19	19
18	17	20	19
20	17	21	19
22	18	23	20
24	19	24	20
26	20	25	20
28	21	26	21
30	22	28	22
32	20	29	23
34	24	31	23
36	36	33	23
38	50	35	27
40	67	37	38
41	89	39	46

**Individual Temperatures Recorded On The Frame of Doorset B**

Time Mins	T/C Number 15 Deg. C	T/C Number 16 Deg. C	T/C Number 17 Deg. C
0	14	15	14
2	14	15	14
4	14	14	14
6	14	14	14
8	14	14	14
10	14	14	14
12	14	14	14
14	16	14	15
16	16	14	15
18	16	15	15
20	17	15	15
22	18	16	15
24	19	16	15
26	20	16	15
28	21	16	15
30	21	16	15
32	22	16	15
34	23	15	15
36	23	16	15
38	23	18	17
40	22	20	18
41	22	21	20

**Deflection Of The Door Leaves During The Test**



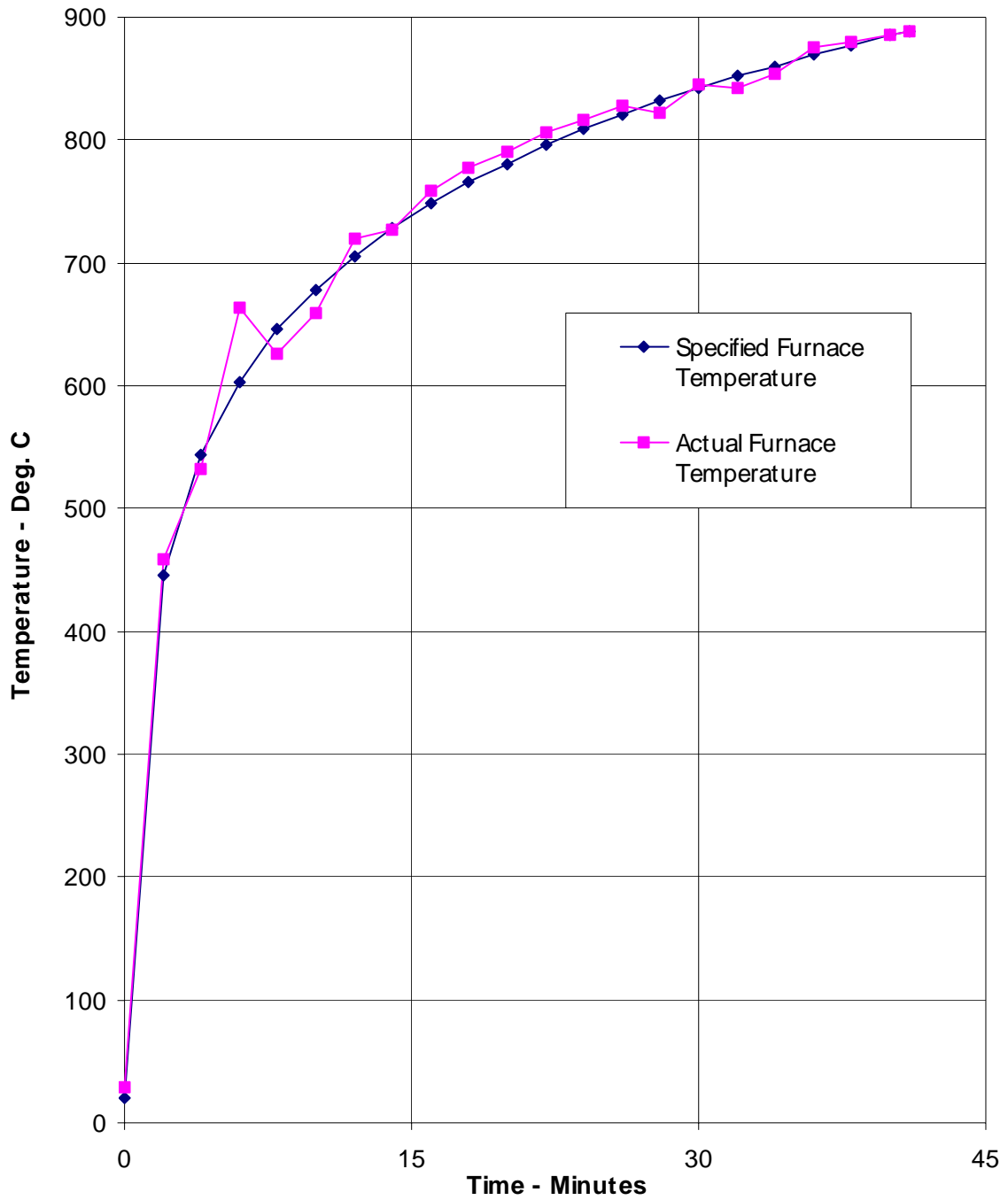
<b>Doorset A</b>									
Deflections – mm									
TIME mins	A	B	C	D	E	F	G	H	I
0	0	0	0	0	0	0	0	0	0
5	-1	-2	-1	-1	-2	1	-4	-2	0
10	0	-1	0	0	4	2	-3	-2	0
15	4	1	1	5	12	5	0	-2	1
20	6	4	4	12	21	7	1	-2	1
25	6	2	0	11	13	5	-1	-3	-1

<b>Doorset B</b>									
Deflections – mm									
TIME mins	A	B	C	D	E	F	G	H	I
0	0	0	0	0	0	0	0	0	0
5	-3	0	0	3	4	2	-1	-1	-1
10	1	3	3	9	14	4	0	-1	0
15	5	8	7	17	25	7	2	0	0
20	8	12	10	26	33	8	5	1	1
25	8	10	7	24	31	4	4	-2	-3

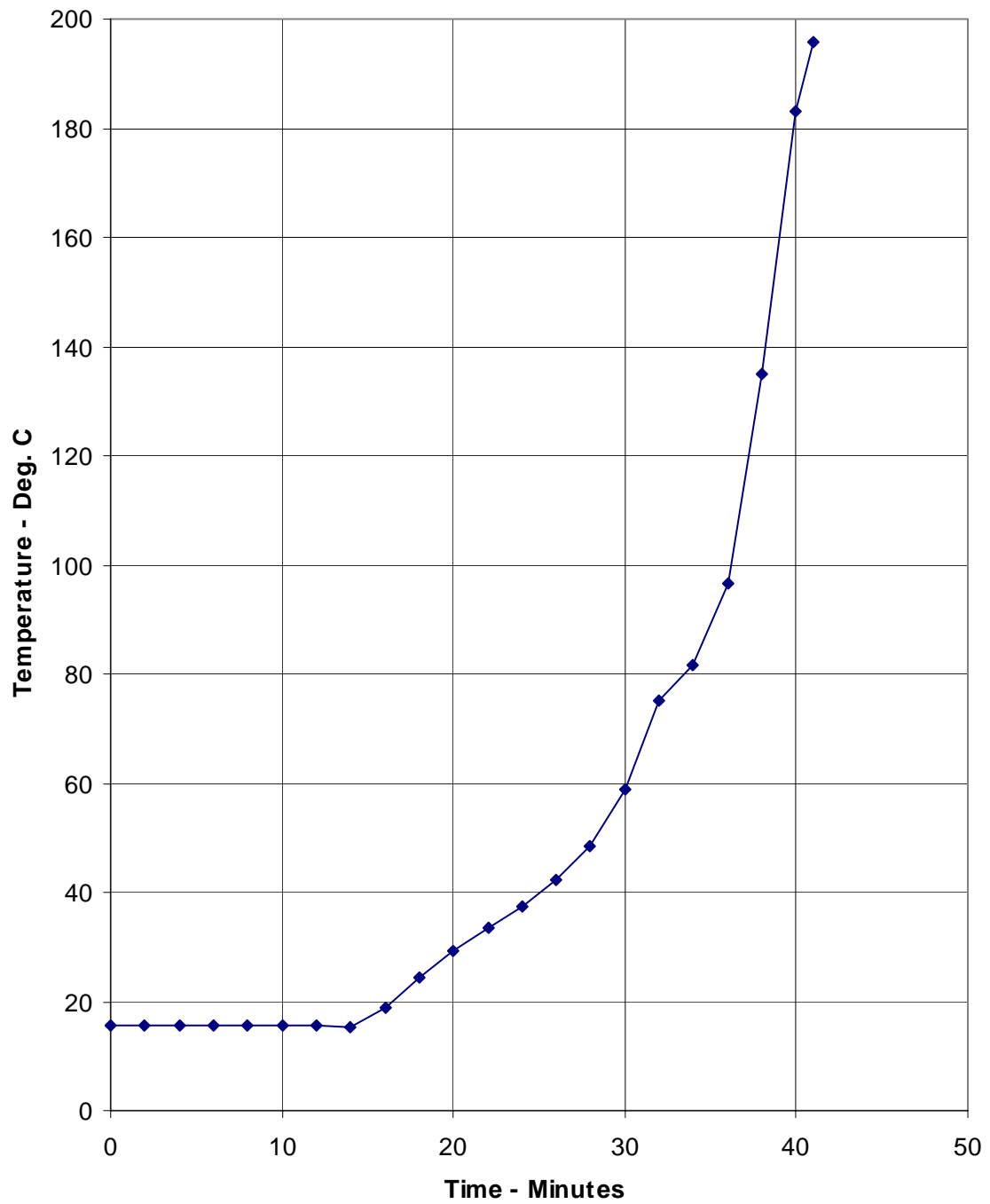
Positive values indicate movement towards the furnace



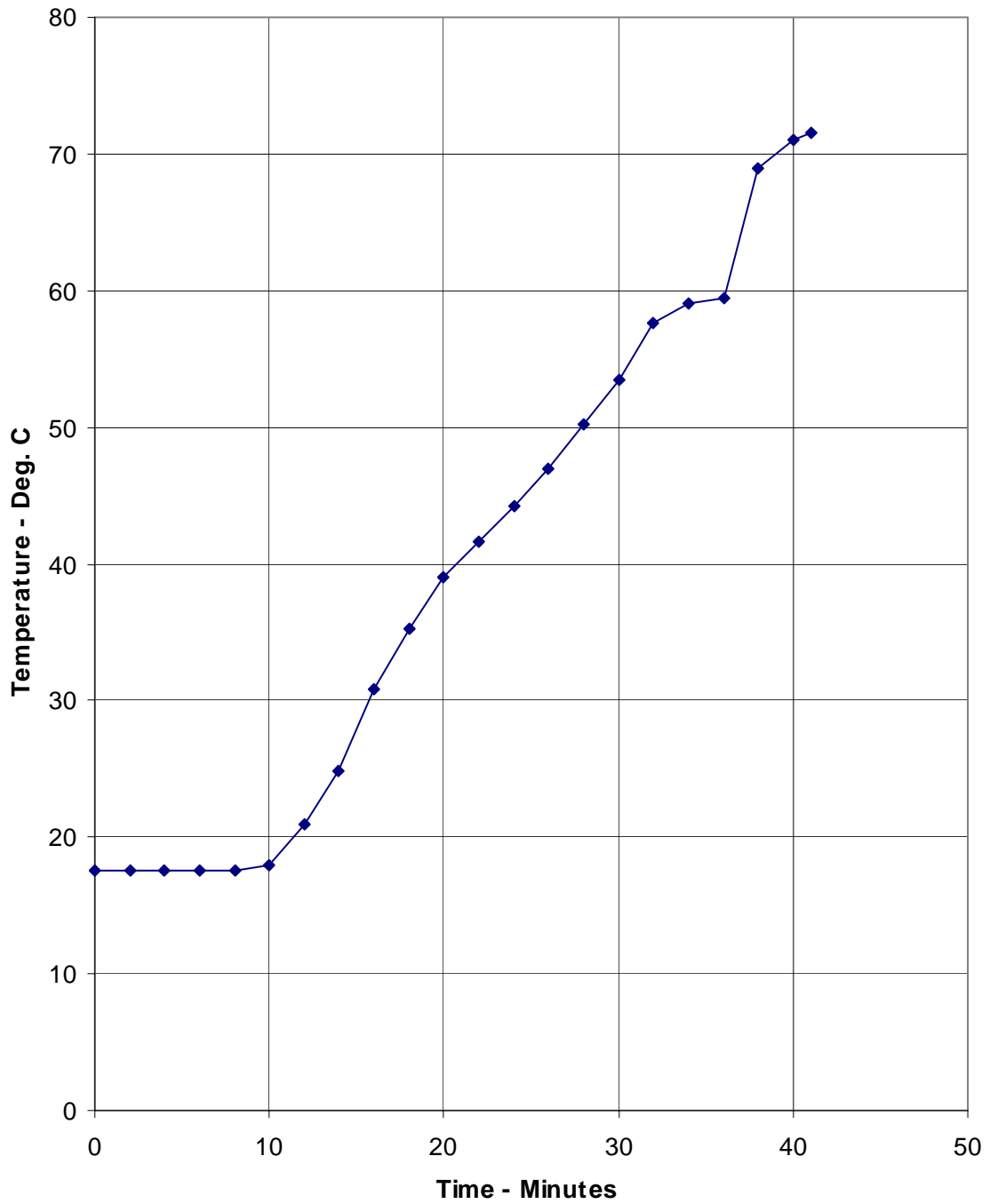
**Graph Showing Mean Furnace Temperature, Together With The Temperature/ Time Relationship Specified In The Standard**



Graph Showing Mean Temperatures Recorded On The Unexposed Surface Of Doorset A



Graph Showing Mean Temperatures Recorded On The Unexposed Surface Of Doorset B



## Performance Criteria and Test Results

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### Integrity

It is required that there is no collapse of the specimens, no sustained flaming on the unexposed surface and no loss of impermeability. These requirements were satisfied for a period of 40 minutes by Doorset A and 31 minutes by Doorset B, failure at these times was due to sustained flaming on the unexposed surface of each doorset.

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### 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 a period of 39 minutes by Doorset A and 31 minutes by Doorset B after which times integrity failure occurred.

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## Ongoing Implications

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### 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 doorsets of different dimensions or supported other than by a masonry wall or incorporating different components should be the subject of a design appraisal.

The tested assemblies were asymmetrical and were tested such that the door leaves opened towards the heating conditions of the test. The test results may not be appropriate to situations where the door leaf opens away from the heating conditions.

### 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

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**Evaluation  
against  
objective**

Two specimens of fully insulated, single-acting, single-leaf doorsets, mounted within a masonry wall have been subjected to a fire resistance test in accordance with BS 476: Part 22: 1987, Clause 6.

The evaluation of the doorsets against the requirements of BS 476: Part 22: 1987, Clause 6 showed that it satisfied the requirements the periods stated below:

<b>Test Results:</b>	<b>Doorset A</b>	<b>Doorset B</b>
<b>Integrity</b>	40 minutes	31 minutes
<b>Insulation</b>	39 minutes	31 minutes

The test was discontinued after a period of 41 minutes.



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