

WFRC TEST REPORT NO. 139085

**The fire resistance performance of
a specimen of a fully insulated,
single-acting, single-leaf doorset,
in accordance with BS 476: Part 22:
Clause 6.**

Summary

Objective To determine the fire resistance performance of a specimen of a fully insulated, single-acting, single-leaf doorset when tested in accordance with Clause 6 of BS 476: Part 22: 1987.

Sponsor **W Howard Limited**, Lower Green Lane, Astley, Manchester, M29 7JZ

Summary of Tested Specimens The doorset had overall dimensions of 2020 mm high by 892 mm wide and incorporated a door leaf with dimensions of 1980 mm high by 838 mm wide by 44 mm thick. The door leaf was of a flaxboard core construction with softwood stiles and rails and MDF facings. The door leaf was hung within an MDF frame of overall section size 75 mm by 25 mm and having a nominal density of 750 kg/m³. The frame was fitted with an MDF 'plant on' stop, 25 mm wide by 12 mm deep that was glued and pinned. The frame incorporated a 10 mm x 4 mm 'Pyrostrip 100' intumescent seal.

The doorset incorporated a latch and handles at approximately mid-height and an overhead door closer fitted on the exposed face. For the purpose of the test the doorset was rendered unlatched. The leaf was orientated such that it opened towards the heating conditions.

Test Results:

Integrity 37 minutes

Insulation 37 minutes

The test was discontinued after a period of 38 minutes.

Date of Test 27th April 2004

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Signatories

Responsible Officer R. Wakefield* Technical Officer

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* For and on behalf of Warrington Fire Research Centre.

Report Issued
Date : 26 th May 2004
Issue 2: Date: 7 th June 2004

Issue 2: Amendments to Text.

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Test Procedure

Introduction

The doorset was 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 specimen was judged on its 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 27 April 2004 at the request of W Howard Limited, the test sponsor.

Mr. C. Piper a representative of the test sponsor witnessed the test.

Test Specimen Construction

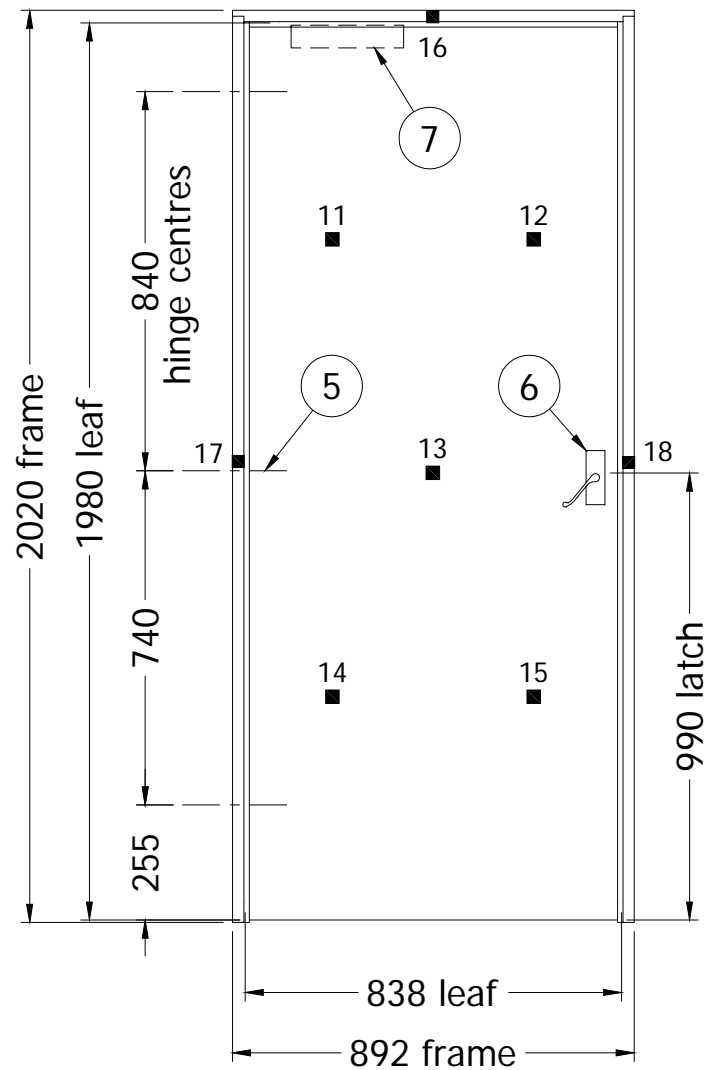
A comprehensive description of the test construction is given in the Schedule of Components. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.

Installation

The doorset was mounted within an aperture provided within a masonry wall construction such that the door leaf opened towards the heating conditions of the test. Representatives of the test sponsor conducted the installation on the 26th April 2004

Test Specimen

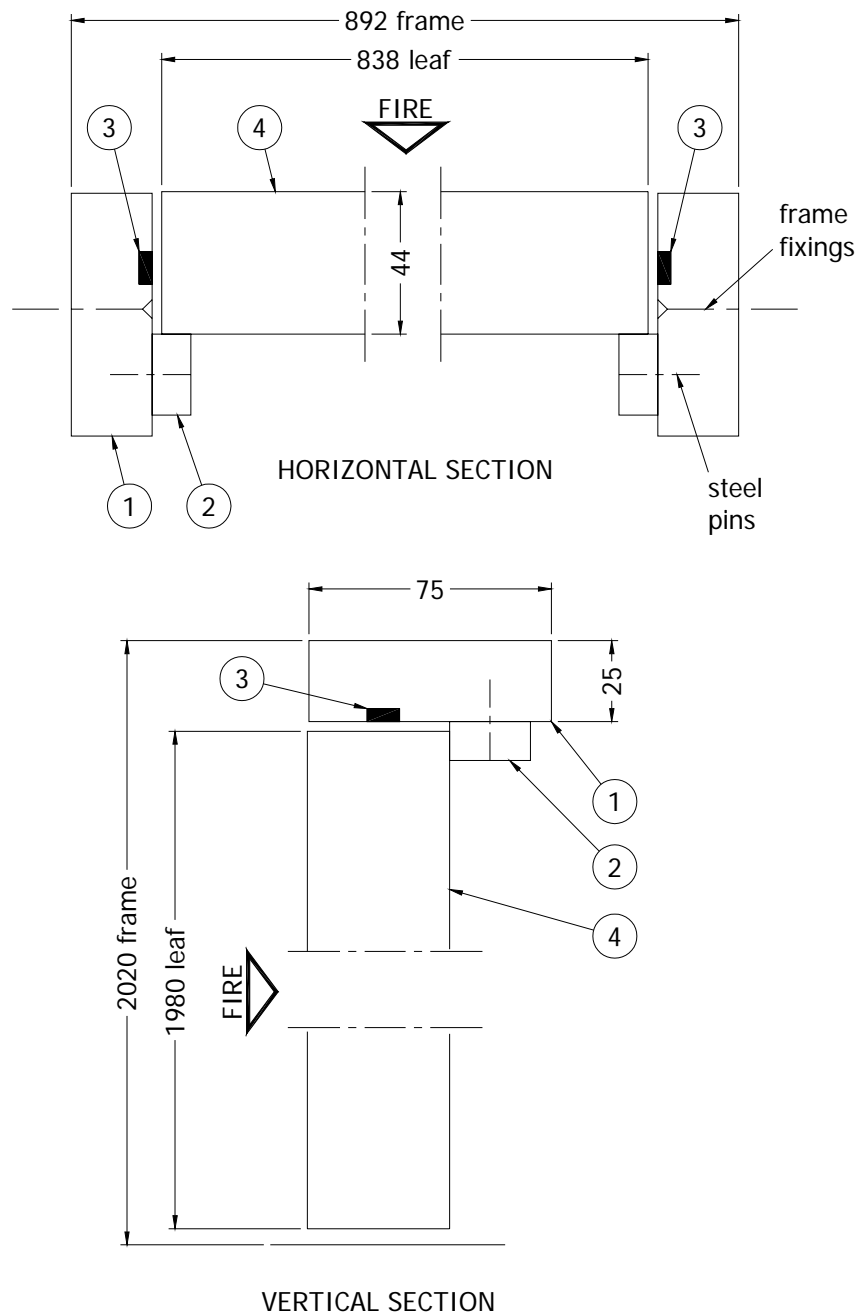
Figure 1- General Elevation of Test Specimen and Unexposed Face Thermocouples



■ Positions of thermocouples

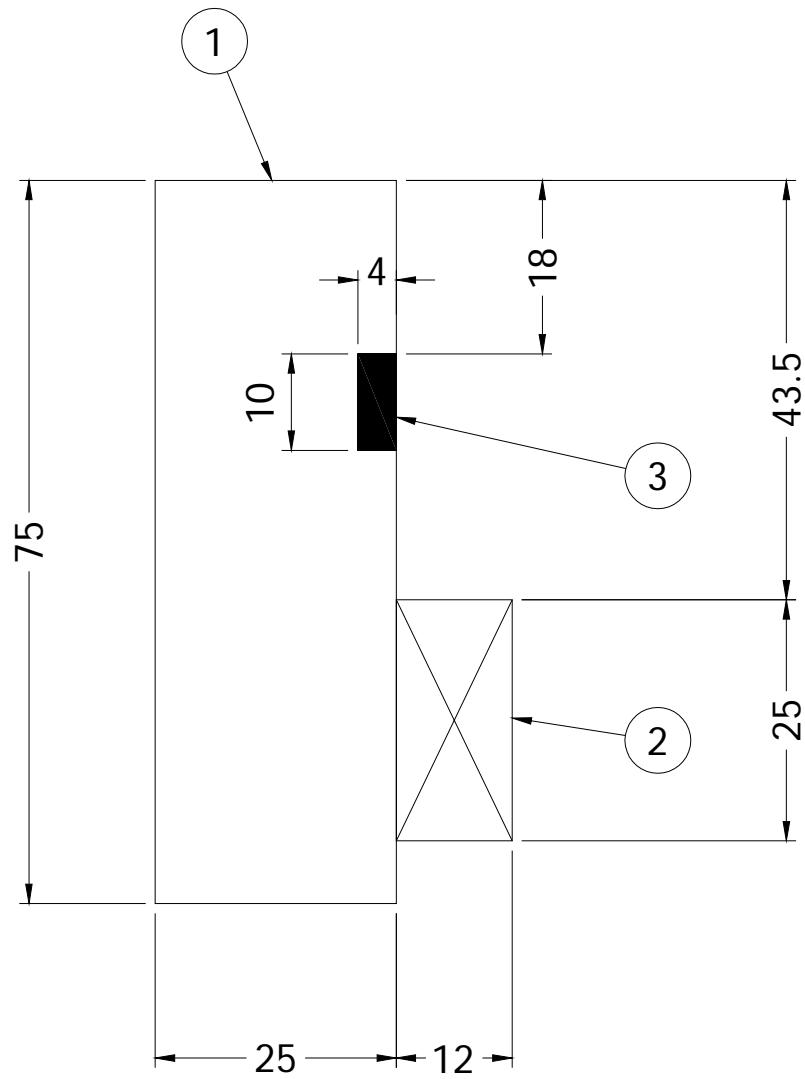
Do not scale. All dimensions are in mm

Figure 2 – Sections Through Doorset



Do not scale. All dimensions are in mm

Figure 2 – Typical Section Through Door Frame Jambs and Head



Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 3)

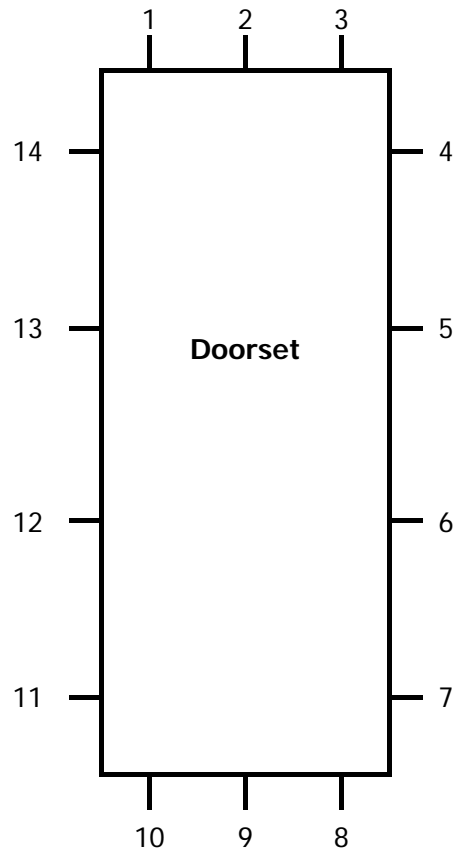
(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

Item	Description
1. Door Frame (Jambs & Head)	
Manufacturer	: W.Howard Ltd.
Material	: Medium Density Fibreboard (moisture resistant)
Density	: 750 kg/m ³
Overall section size	: 75 mm x 25 mm
Jambs to head jointing method	: Jointed (half lap) and screwed using 2 no. countersunk head woodscrews per joint.
Fixing method to masonry	
i. type	: Countersunk head woodscrews into plastic plugs
ii. overall size	: M5 x 80 mm long
iii. centres	: 4 no. along hinged jamb at 400 mm – 800 mm centres. 7 no. along closing jamb at 250 mm – 500 mm centres.
2. Planted Stop	
Material	: Medium Density Fibreboard (moisture resistant)
Density	: 750 kg/m ³
Overall section size	: 25 mm wide x 12 mm deep
Fixing method	: Glued with PVA adhesive and pinned using steel pins 25 mm long at 170 mm – 380 mm centres along jambs and head.
3. Door Frame Intumescent Seal	
Type	: Pyrostrip 100 (brush seal not fitted)
Reference	: P55
Material	: Sodium silicate core to BS 467, EN 1634
Overall Size	: 10 mm wide x 4 mm thick
Fixing method	: Self adhered into a groove located within the rebate of jambs and head sections of the frame. The seal was interrupted at the strike plate and continuous under the hinge positions.
4. Door Leaf	
Manufacturer	: Jeld -Wen UK Ltd
CERTIFIRE Reference	: CF160
Construction	
i. stiles and rails	: Softwood 40 mm x 34 mm
ii. core	: Flaxboard 40 mm thick
iii. faces	: Veneer faced MDF, 2 mm thick
iv. lippings	: Hardwood 8 mm thick to vertical edges only

Item	Description
5. Hinges	
Type	: Butt hinge
Material	: Mild steel
Sizes	
i. blades	: 100 mm long x 32 mm wide
ii. knuckle	: 9 mm diameter x 102 mm long
Quantity	: 3 no. hinges at centres shown on Figure 1
Fitting method	: Blades recessed into door leaf and butted onto door frame.
Fixing details	
i. type	: Countersunk head woodscrews
ii. material	: Steel
iii. size	: 30 mm long x 3.8 mm diameter
iv. number off per blade	: 4 no. screws
v. maximum distance of fixing screws from exposed face of door leaf	: 22 mm
Bedding material	: None
6. Latch/Lever handle set	
Manufacturer	: E.S
Reference	: HOPPE AR 103
Material	
i. latch foreplate	: Steel
ii. strike plate	: Steel
iii. handle set	Chrome plated
Sizes	
i. latch foreplate	: 58 mm x 25 mm
ii. strike plate	: 58 mm x 25 mm
Latch operation	: Disengaged
Fixing method	
i. latch foreplate	: 2 no. woodscrews 3.6 mm diameter x 20 mm long
ii. strike plate	: 2 no. woodscrews 3.6 mm diameter x 20 mm long
Bedding material	: None
7. Door Closer	
Manufacturer	: Architectural Hardware
Reference	: Briton 2000E
Overall size	: 250 mm x 47 mm x 58 mm deep casing
Location	: Fire side face of doorset
Maximum opening moment by WFRC	: 36.4 Newton metre (Nm)
Maximum closing moment by WFRC	: 15.4 Nm

Doorset Clearance Gaps



Viewed from the exposed face

Gap Dimension in mm at Positions													
1	2	3	4	5	6	7	8*	9*	10*	11	12	13	14
2.3	2.8	2.5	1.9	1.3	1.6	1.4	6.1	6.4	6.4	2.4	1.8	2.3	3.3
Mean		2.2		Maximum			3.3		Minimum			1.3	

* Dimension not included in calculations

DO NOT SCALE
ALL DIMENSIONS ARE IN mm

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 six mineral insulated thermocouples distributed over a plane 100 mm from the surface of the test construction.
Thermocouple Allocation	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:
Thermocouples 11 to 15	At five positions on the doorset, one approximately at the centre and one at approximately the centre of each quarter section of each doorset.
Thermocouples 16 to 18	<p>At three positions on the door frame, one at the approximate mid-height of each of the vertical frame members and one at approximately mid-width above the door leaf.</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 impermeability of the specimens to hot gases.
Furnace Pressure	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 doorset was 8.7 (± 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 13°C at the start of the test with a maximum variation of 1°C during the test.
00	00	The test commences.
02	00	Smoke has begun to issue around the perimeter of the leaf.
03	30	There is a gap between the stop and the head of the leading edge of approximately 4 mm.
04	30	Large volumes of flames issue on the exposed face.
07	30	The door leaf core has now become exposed and has begun to char.
09	00	The gap between the stop and the leaf at the head of the leading edge is approximately 10 mm. The gap at the base is approximately 5 mm. The leaf remains flush with the stop at mid-height.
11	00	Flames continue on the exposed face. The closer is releasing oil, which subsequently ignites on the exposed face of the leaf.
13	00	The smoke release has decreased. There is a small amount of discolouration at the mid and upper hinge positions. Smoke release continues from the upper hinge position.
18	30	The bottom of the leading edge has moved away from the stop by approximately 20 mm.
21	00	The base of the hinged edge of the leaf has moved away from the stop by approximately 8 mm the head has moved by approximately 10 mm. The unexposed face of the leaf has begun to char at the upper hinge position.
23	00	The MDF frame is heavily charred with small sections of it falling away.
26	40	The base of the leading edge has begun to burn away.
27	30	The upper corners of the leaf have blackened although there is no glowing.
28	20	Intermittent flames issue from area of burn through at the base of the leading edge.

- 29 30 A cotton pad is applied to the area of burn through, which fails to ignite.
- 30 00 The specimen continues to meet the integrity and insulation criteria of the test.
- 32 20 A cotton pad is applied to the small area of glowing at the upper right hand corner of the leaf, which fails to ignite.
- 33 00 There is glowing at the upper hinge position.
- 34 00 The base of the leading edge has moved away from the stop by approximately 32 mm. Glowing increases at the upper corners of the leaf.
- 37 30 Sustained flames issue from the upper left hand corner of the doorset. **The specimen is deemed to have failed the integrity criteria of the test.**
- 38 20 A through gap has formed at the base of the leading edge in excess of 150 mm x 6 mm.
- 38 00 **The test is discontinued.**

Test Photographs

The exposed face of the test construction prior to testing



The unexposed face of the test construction prior to testing



The unexposed face of the test construction after a test duration of 12 minutes



The unexposed face of the test construction after a test duration of 29 minutes



The unexposed face of the test construction after a test duration of 37 minutes



The exposed face of the test construction immediately after the test



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	15
2	445	417
4	544	525
6	603	653
8	645	647
10	678	656
12	705	713
14	728	718
16	748	756
18	766	763
20	781	776
22	796	791
24	809	814
26	820	817
28	832	835
30	842	843
32	851	845
34	860	854
36	869	860
38	877	876

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

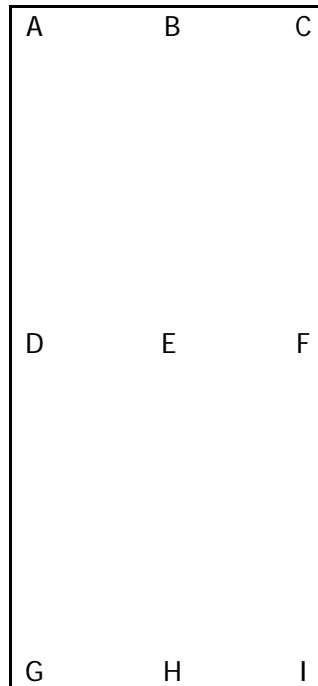
Time Mins	T/C Number 11 Deg. C	T/C Number 12 Deg. C	T/C Number 13 Deg. C	T/C Number 14 Deg. C	T/C Number 15 Deg. C	Mean Temp Deg. C
0	15	15	15	15	12	14
2	15	15	15	15	12	14
4	16	15	15	15	12	15
6	16	15	15	15	12	15
8	16	16	16	16	12	15
10	16	16	16	16	13	15
12	18	19	17	17	14	17
14	21	23	20	20	19	21
16	25	29	24	24	25	25
18	30	35	29	30	31	31
20	35	40	34	35	37	36
22	41	45	40	41	42	42
24	46	50	45	48	47	47
26	52	54	50	53	52	52
28	57	59	55	59	56	57
30	62	63	60	64	61	62
32	67	67	65	69	65	67
34	72	72	70	74	70	72
36	76	76	75	78	74	76
38	81	80	80	82	78	80

Individual Temperatures Recorded On The Frame Of The Doorset

Time	T/C	T/C	T/C
Mins	Number	Number	Number
	16	17	18
	Deg. C	Deg. C	Deg. C
0	12	12	12
2	12	12	12
4	*	12	12
6		12	12
8		12	12
10		12	12
12		12	13
14		13	14
16		14	16
18		16	18
20		20	21
22		24	24
24		28	26
26		34	29
28		39	31
30		45	34
32		52	37
34		63	40
36		78	44
38		89	47

* Thermocouple malfunction

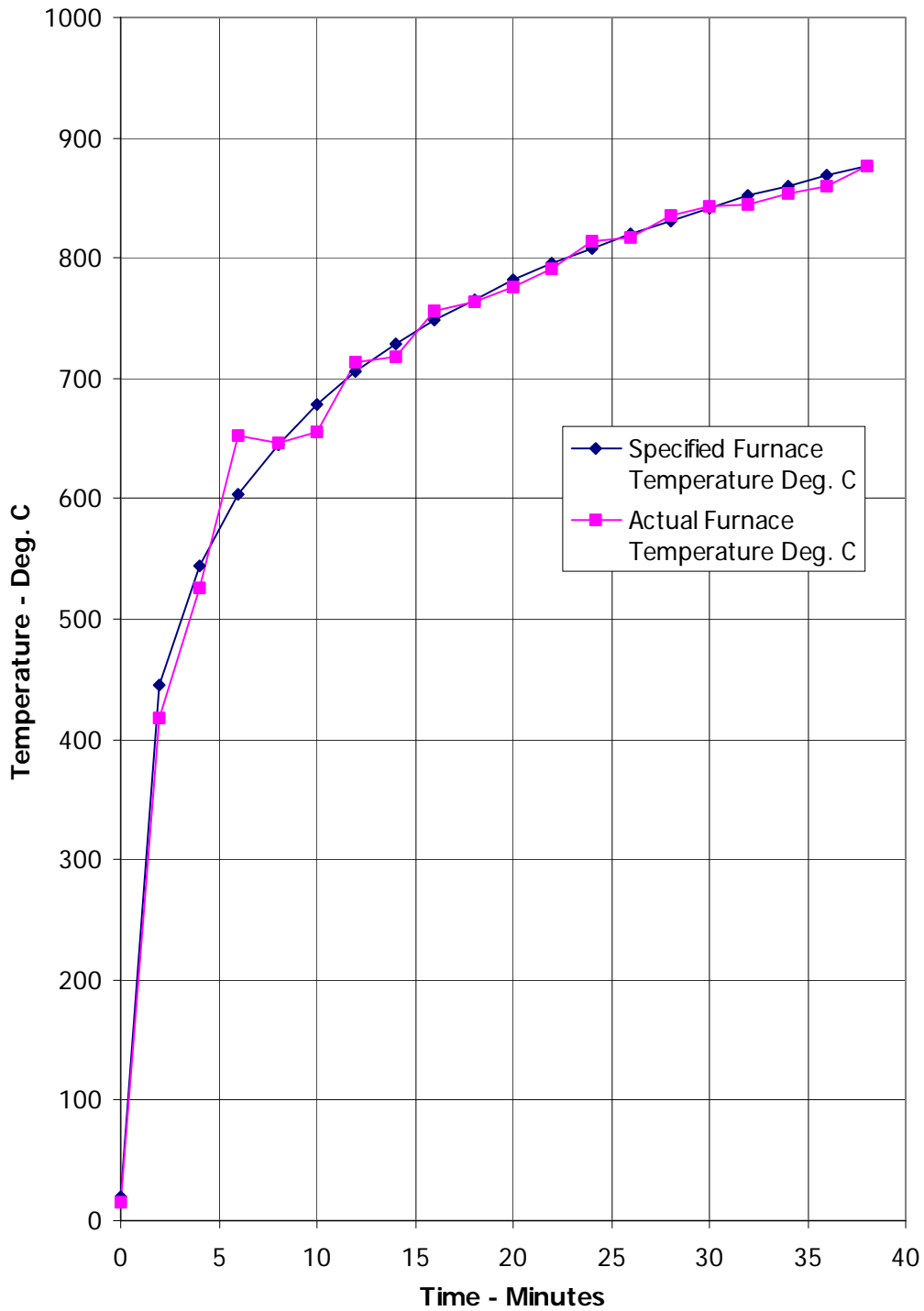
Deflections Of The Doorset During The Test



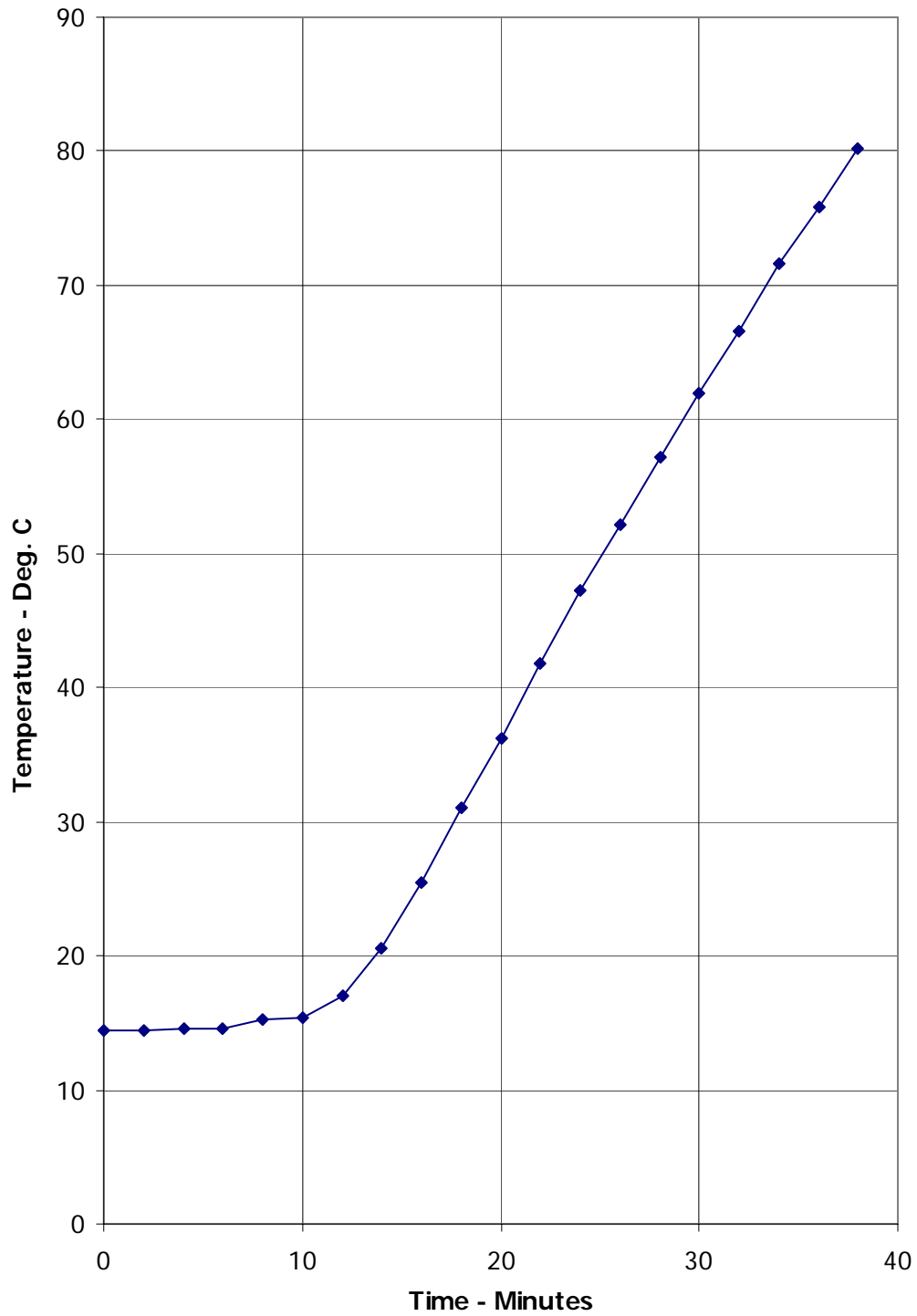
Deflections – mm									
TIME mins	A	B	C	D	E	F	G	H	I
0	0	0	0	0	0	0	0	0	0
5	-1	1	4	-1	-4	-1	0	0	0
10	1	1	4	-3	-5	-2	3	5	10
15	1	2	6	-3	-9	-2	5	10	15
20	6	6	10	-3	-3	-3	10	12	20
25	6	6	13	-4	-17	-2	10	15	25

Negative values indicate movement away from 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 The Doorset



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 a period of 37 minutes after which time sustained flaming occurred.

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 37 minutes. Failure of the doorset was deemed to occur with integrity failure.

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 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 assembly was asymmetrical and was tested such that the door leaf opened towards the heating conditions of the test. The test results may not be appropriate to situations where the door leaf open 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

**Evaluation
against
objective**

A specimen of fully insulated, single-acting, single-leaf doorset, mounted within a masonry wall has been subjected to a fire resistance test in accordance with BS 476: Part 22: 1987, Clause 6.

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

Test Results:

Integrity

37 minutes

Insulation

37 minutes

The test was discontinued after a period of 38 minutes