

test report

Title:

The fire resistance performance of a single-acting, single-leaf doorset, incorporating various items of building hardware, in accordance with BS EN 1634-1: 2000

Report No:

161209

**Prepared for:**

Frelan Hardware
Unit 10,
Mitcham Industrial Estate,
Mitcham,
Surrey,
CR4 2AP

Date:

28th February 2007

Notified Body No:

0833



0249

Summary

Objective To determine the effects of various items of building hardware on the fire resistance performance of a single-acting, single-leaf doorset, mounted within a low density rigid supporting construction, in accordance with BS EN 1634-1: 2000.

Test Sponsor **Frelan Hardware**, Unit 10, Mitcham Industrial Estate, Mitcham, Surrey CR4 2AP

Summary of Tested Specimen The doorset had overall dimensions of 2080 mm high by 1010 mm wide and incorporated a door leaf of overall dimensions of 2040 mm high by 940 mm wide by 44 mm thick. The door leaf comprised softwood stiles and rails, a flaxboard core, hardwood lippings to the vertical edges and MDF outer facings. The leaf was hung within a softwood frame on three steel spring hinges referenced 'J9800' polished chrome. The upper and lower hinges were tensioned so that it closed the door A latch referenced 'JL666' was provided at approximately mid height of the door leaf which was engaged for the duration of the test.

The doorset was orientated such that the door leaf opened towards the heating conditions.

Prior to commencement of the test the doorset was opened and closed 25 times.

Test Results:


Integrity performance	Sustained flaming	41 minutes
	Gap gauge	42 minutes*
	Cotton Pad	41 minutes
Insulation performance		41 minutes

* The test duration. The test was discontinued after a period of 42 minutes.

Date of Test 30th January 2007

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Signatories


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

Report Issued
Date : 28 th February 2007

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Test Procedure

Introduction

The doorset was required to provide a fire separating function and were therefore tested in accordance with BS EN 1634-1: 2000 'Fire resistance tests for doors and shutter assemblies - Part 1: Fire doors and shutters'. 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' and BS EN 1363-2: 1999, 'Fire resistance tests - Part 2: Alternative and additional procedures'.

The specimen was judged on its ability to comply with the performance criteria for integrity and insulation, as required by BS EN 1634-1: 2000.

The specific purpose of the test was to evaluate the effects of the inclusion of various items of building hardware into a previously tested doorset construction. Because of this, no direct field of application for the doorset is included in this report.

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 30th January 2007 on behalf of Frelan Hardware, 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.

The doorset's storage, installation, and test preparation took place in the test laboratory between the 26th and 30th January 2007.

Installation

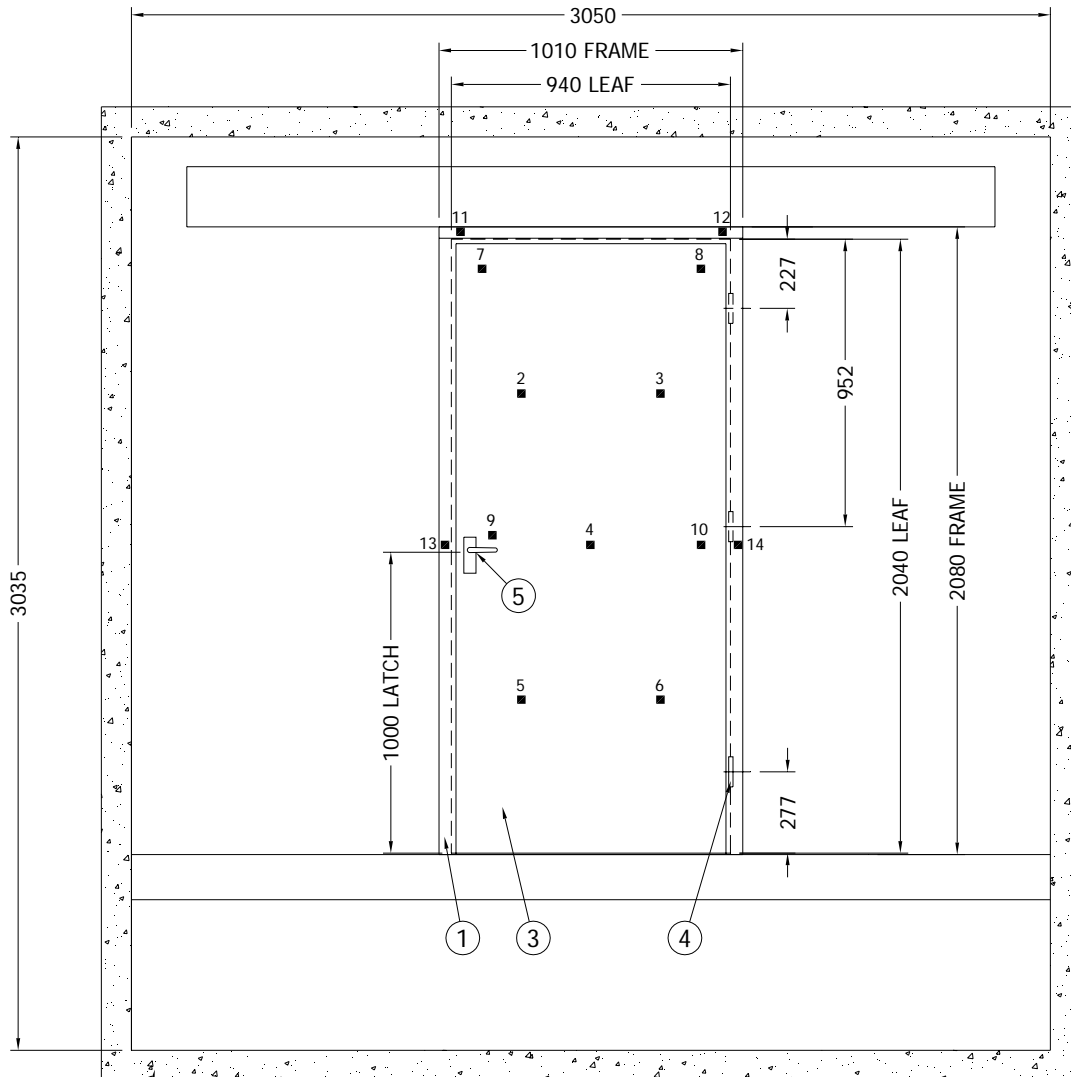
The doorset was mounted within an aperture provided within a low density rigid supporting construction such that the leaf opened towards the heating conditions of the test. Representatives of **warringtonfire** conducted installation on the 29th January 2007.

Sampling

warringtonfire was not involved in any selection or sampling procedures of the hardware or any of their components.

Test Specimen

Figure 1- Elevation of unexposed face of doorset



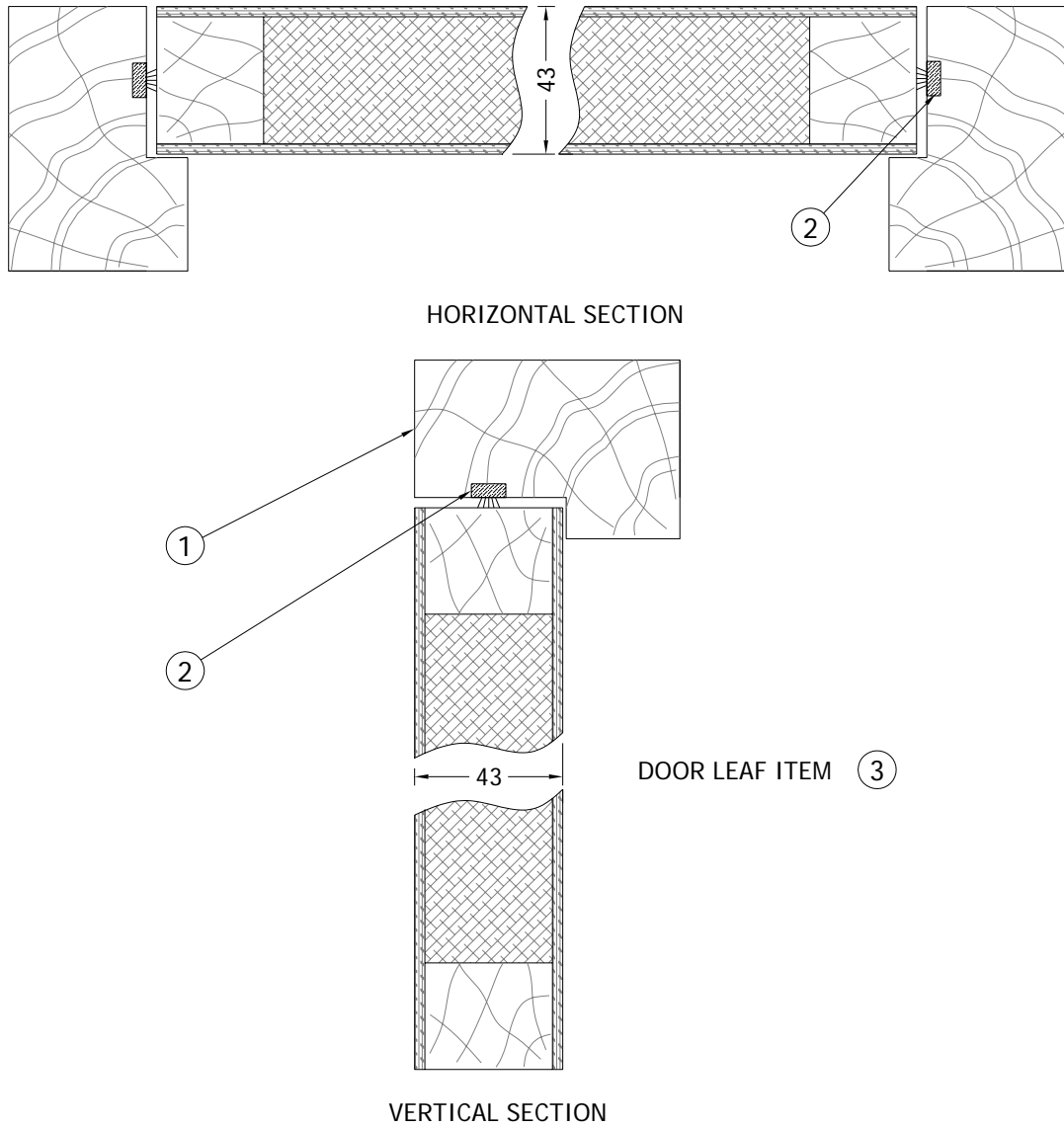
SPECIMEN RESTRAINT FRAME

- POSITIONS OF UNEXPOSED FACE THERMOCOUPLES.

SPECIMEN BUILT INTO A MASONRY WALL CONSISTING OF AAC (AUTOCLAVED AERATED CONCRETE) BLOCKWORK WALL, LINTEL AND BASE, NOMINALLY 200 THICK. DOOR LEAF OPENS AWAY TOWARDS THE HEATING CONDITIONS OF THE TEST.

Do not scale. All dimensions are in mm

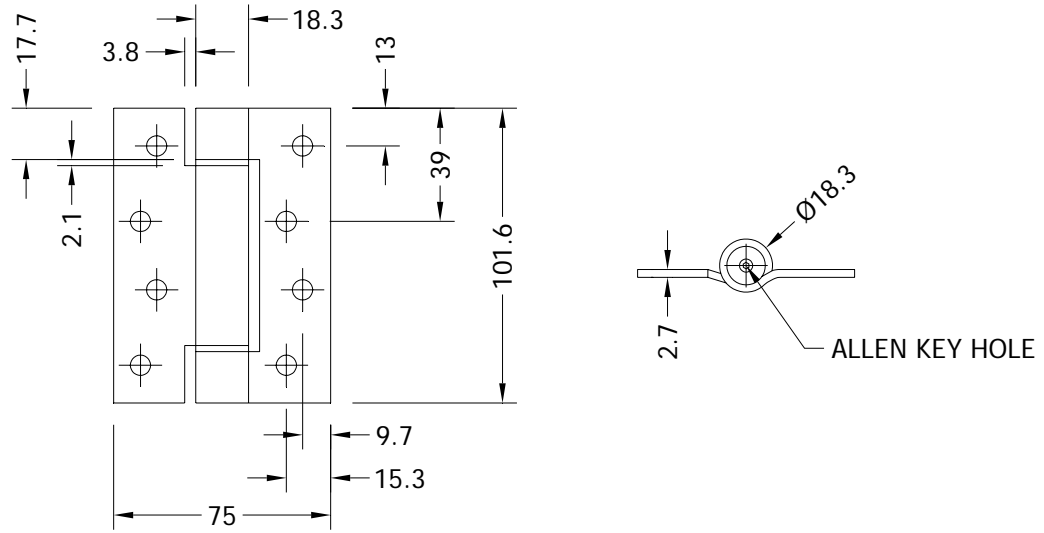
Figure 2 – Horizontal and vertical sections through doorset



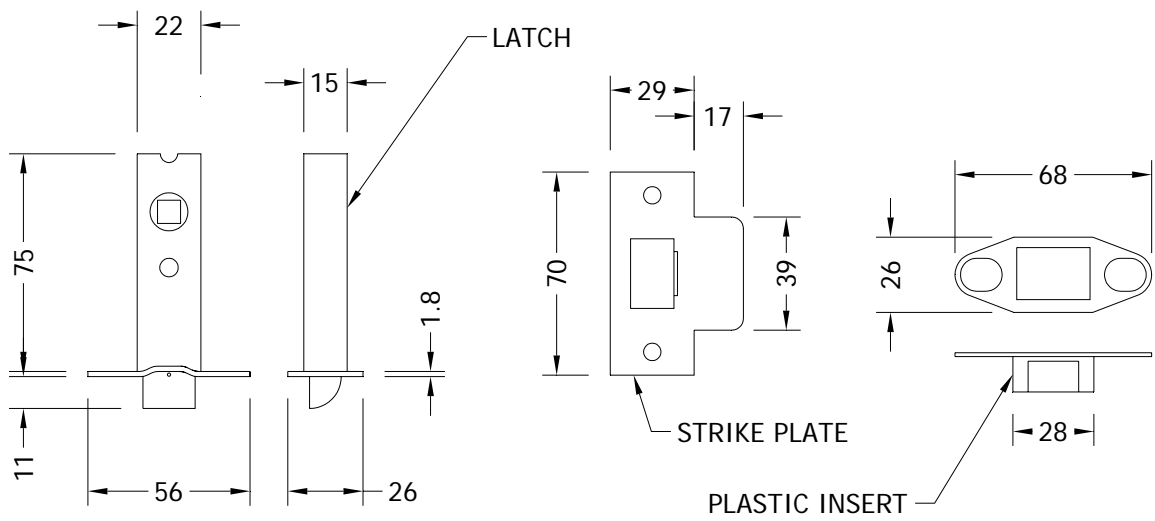
DOOR LEAF - OPENS TOWARDS THE HEATING CONDITIONS OF THE TEST.

Do not scale. All dimensions are in mm

Figure 3 – Details of doorset furniture



HINGE - ITEM 4



LATCH - ITEM 5

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. Door Frame	
Material	: Softwood
Density	: 500 kg/m ³ nominal
Average moisture content	: 8.9% (measured with a Protimeter moisture meter).
Overall size	: 44 mm x 93 mm, with 12 mm deep rebate
Jambs to head jointing method	: Mortice & tenon and screwed
Fixing	
i. method	: Countersunk steel screws and plugs through jambs
ii. size	: 125 mm long x 5 mm diameter
iii. frequency	: 6 no. to hinge side jamb, with 1 no. each side of hinge. 4 no. to latch side jamb
2. Intumescent Seal	
Manufacturer	: Intumescent Seals Ltd
Reference	: Therm-A-Flex
Material	: Graphite based intumescent seal within a plastic sheath, fitted with a brush type smoke seal
Overall size	: 10 mm by 4 mm
Fixing method	: Self-adhesive within a groove in the door frame rebate
3. Door Leaf	
Manufacturer	: Noberne Doors Limited.
Reference	: Series 2, solid core flush door
Door leaf thickness	: 44 mm
Construction	
i. general	: Construction details of the door leaf are known and are retained in our confidential file relating to this investigation
ii. stiles and rails	: Softwood timber
iii. core	: Flaxboard
iv. faces	: Medium density fibreboard
v. lippings	: Hardwood to vertical edges
4. Hinges	
Manufacturer	: Frelan Hardware
Reference	: J9800, self closing hinges
Material	: Mild steel with polished chrome finish
Overall sizes	
i. knuckle	: 101.6 mm long x 18.3 mm diameter
ii. blades	: 101.6 mm long x 75 mm wide overall x 2.7 mm thick
Fixings	
i. type	: Countersunk screws
ii. material	: Steel
iii. size	: 38 mm long x 4.8 mm diameter

<u>Item</u>	<u>Description</u>
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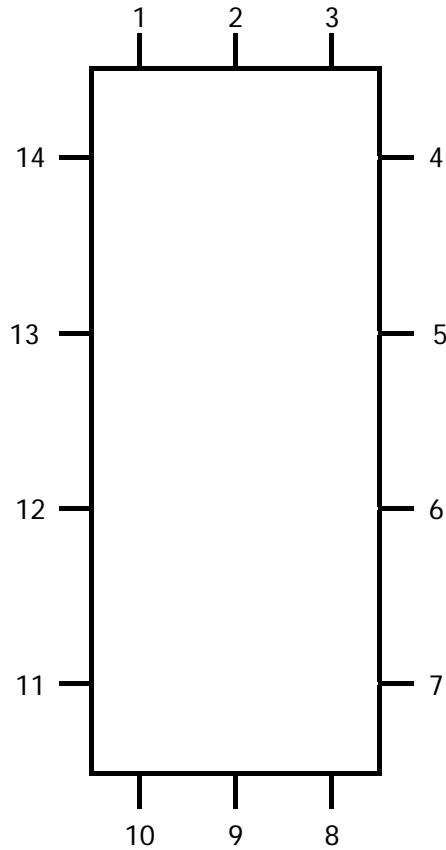
4. Continued

iv. number off per blade	: 4 off
v. maximum distance of fixing screws from exposed face of door leaf	: Approximately 18 mm
Bedding material	
i. reference / material	: Interdens intumescent seal behind each hinge flap
ii. size	: 1 mm thick x blade size
Maximum opening moments	: 21 Newton metre (Nm), of three hinges combined
Maximum closing moments	: 6 Nm, of three hinges combined

5. Latchset

Manufacturer	: Frelan Hardware
Reference	: JL6666
Material	: Mild steel latch and strike plate with plastics insert behind the strike plate
Overall size	
i. latch casing	: 75 mm long x 22 mm deep x 15 mm wide
ii. latch bolt throw	: 11 mm
ii. strike plate	: 70 mm x 29 mm
iii. plastics insert	: 68 mm x 26 mm
Operation of latch bolt	: Engaged
Fixings	
i. type	: Countersunk screws
ii. material	: Steel
iii. size	: 25 mm long x 4 mm diameter
iv. number off	: 2 off each for the latch & strike plate
Bedding material	
i. reference	: Firestop 400
ii. material	: Intumescent mastic
Lever handles	
i. manufacturer	: Magnet
ii. material	: Brass
iii. reference	: Victorian 0220
iv. overall size	: 104 mm long x 19 mm diameter tapering to 11 mm, complete with 120 mm x 41 mm backing plate

Doorset clearance gaps



View from unexposed face

Gap Dimension in mm at Position													
1	2	3	4	5	6	7	8*	9*	10*	11	12	13	14
2.4	2.7	2.6	3.6	3.6	3.6	3.8	10.0	10.0	10.0	3.5	3.0	3.2	2.7
Mean			3.2		Maximum			3.8		Minimum			2.4

Gap Between Face of Leaf and Doorstop in mm at Position													
1	2	3	4	5	6	7	8#	9#	10#	11	12	13	14
0.5	0.5	0.5	1.0	1.0	1.0	1.0	-	-	-	0.95	0.95	0.85	0.85

* Dimension not included in calculations

Gap not measured

Specimen Supporting Construction

Blocks

Manufacturer	:	Celcon
Reference	:	Standard
Material	:	Solid aerated concrete blocks
Density	:	620 (± 50) kg/m ³
Strength	:	
Mean	:	4.0 N/mm ²
Minimum	:	3.6 N/mm ²
Thickness	:	150 mm
Length	:	440 mm
Height	:	215 mm
Block configuration	:	Half lap, stretcher bond with no finishes

Mortar

Material	:	Cement, sand
Mix ratio	:	1 : 4

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 six plate thermometers, distributed over a plane 100 mm from the surface of the test construction.
General	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:
Thermocouples 2 to 6	At five positions on the doorset, one approximately at the centre and one at approximately the centre of each quarter section of the doorset.
Thermocouples 7 to 10	At four positions on the doorset, positioned at 100 mm in from the door leaf vertical edges, two at mid-height, and two at 100 mm below the top edge of the leaf.
Thermocouples 11 to 14	At four positions on the door frame, one positioned 50 mm away from both vertical edges of the door leaf on the top horizontal frame member and one positioned on each vertical frame member at mid-height. The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.
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 specimen.
Furnace Pressure	The furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 1999. Clause 5.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the doorset was 13.4 (± 3) Pa.

Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	
00	00	The test commences.
01	40	Smoke issue commences from the head and fixed edge of the doorset, (fixed edge from the top hinge position to the head).
03	30	Smoke issue has ceased from the areas mentioned at 1 minute, 40 seconds.
06	30	Smoke issue resumes at the head and top hinge position and at one area of the leading edge at $\frac{3}{4}$ height next to thermocouple No.2.
08	00	Discolouration of the door leaf at positions of smoke issue.
09	00	Smoke issue has started above and below the latch position on the leading edge.
11	00	Smoke issue has slowed at the head and at the top hinge position.
15	00	The leading edge is beginning to move away from the doorstop at the threshold up to approximately 300 mm. The gap at the threshold is approximately 15-20 mm.
16	00	The same has happened at the head of the leading edge, the gap is approximately 300 mm. The movement extends across the head to approximately mid-span of the leaf and approximately 300 mm down the leading edge.
19	00	Discolouration is occurring on the door leaf at the bottom hinge position.
20	00	The threshold of the door leaf at its hinged edge has moved away from the stop by approximately 5-10 mm.
21	00	Smoke issue is increasing from the latch position.
22	00	The gaps between leaf and stop at the threshold and head of the leading edge are increasing, approximately 15 mm at threshold and 10 mm at head.
23	00	Gaps between leaf and stop at the threshold and head of the hinged edge are increasing both approximately 5mm.
28	00	Reacted intumescent is visible at the threshold of the leading edge as a result of the movement previously mentioned.

Time		
mins	secs	
30	00	The specimen continues to satisfy all integrity and insulation criteria.
30	30	Smoke issue is increasing at the head of the specimen.
32	00	All gaps between the leaf and stop on both vertical edges continue to increase. Leading edge approximately 30 mm, hinged edge approximately 15 mm.
34	00	The area of door leaf between the handle and the door frame is blackening.
36	00	A small area of glowing is becoming visible at the latch position.
37	00	The leading edge of the threshold is starting to burn through approximately 30 mm up from threshold.
38	00	Glowing is visible at the bottom hinge position.
40	50	Flickering flames at latch position and bottom hinge.
41	10	Sustained flaming at latch and lower hinge position sustained flaming. Sustained flaming Integrity failure is deemed to have occurred.
41	40	Sustained flaming at the head.
42	00	The test is discontinued.

Test Photographs

The exposed face of the doorset prior to testing



The unexposed face of the doorset prior to testing



The unexposed face of the doorset after 10 minutes of testing



The unexposed face of the doorset after 20 minutes of testing



The unexposed face of the doorset after 30 minutes of testing



The unexposed face of the doorset after 40 minutes of testing



**Sustained
flaming integrity
failure of the
doorset after a
duration of 41
minutes**



**The exposed
face of the
doorset
immediately
after the test**



Temperature, Deflection & Pressure Data

Mean furnace temperature, together with the temperature/time relationship specified in the Standard

Time Minutes	Specified Furnace Temperature Deg. C	Mean Furnace Temperature Deg. C
0	20	21
2	445	523
4	544	546
6	603	615
8	645	628
10	678	704
12	705	701
14	728	717
16	748	732
18	766	757
20	781	777
22	796	794
24	809	805
26	820	816
28	832	826
30	842	835
32	851	847
34	860	858
36	869	865
38	877	873
40	885	881
42	892	887

Individual and mean temperatures recorded on the unexposed surface of the doorset

Time Minutes	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 Temperature Deg. C
0	15	16	16	16	15	16
2	15	16	16	15	15	15
4	15	16	15	15	15	15
6	15	16	15	15	15	15
8	15	15	15	15	15	15
10	15	16	16	16	15	16
12	16	16	17	17	16	16
14	19	17	18	20	17	18
16	23	20	21	25	19	22
18	28	23	25	29	23	26
20	32	27	29	34	27	30
22	35	31	33	37	31	33
24	39	34	36	40	35	37
26	41	37	39	43	37	39
28	44	40	42	45	40	42
30	46	42	44	47	43	44
32	49	44	47	50	45	47
34	51	46	49	52	47	49
36	53	48	51	54	49	51
38	55	50	54	57	52	54
40	58	52	57	59	54	56
42	62	54	61	62	56	59

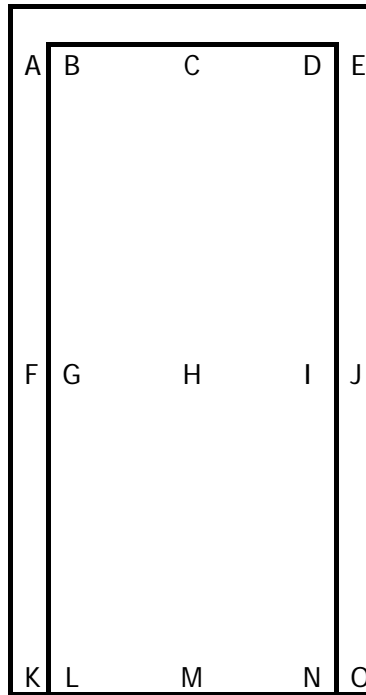
Individual temperatures recorded on the unexposed surface of the doorset

Time Minutes	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C	T/C Number 10 Deg. C
0	16	17	16	17
2	16	16	16	17
4	16	16	16	16
6	16	16	16	16
8	16	16	16	16
10	17	17	16	17
12	18	17	17	17
14	21	18	20	18
16	25	21	25	20
18	30	25	29	24
20	34	29	33	29
22	38	33	37	33
24	41	37	39	38
26	44	40	42	41
28	46	43	44	43
30	48	46	46	46
32	51	48	49	48
34	53	50	51	50
36	55	53	53	53
38	58	55	55	55
40	60	58	57	57
42	66	62	60	60

Individual temperatures recorded on the unexposed surface of the door frame

Time Minutes	T/C Number 11 Deg. C	T/C Number 12 Deg. C	T/C Number 13 Deg. C	T/C Number 14 Deg. C
0	15	15	15	15
2	15	15	15	15
4	16	15	15	15
6	21	17	15	15
8	26	18	14	15
10	21	26	15	15
12	18	22	15	15
14	18	19	15	15
16	17	19	15	15
18	17	18	15	15
20	18	19	16	16
22	18	19	17	16
24	19	20	18	17
26	20	22	19	18
28	21	24	20	19
30	22	26	21	20
32	24	28	23	21
34	27	30	24	23
36	29	32	25	24
38	31	34	26	26
40	34	36	28	27
42	49	47	30	28

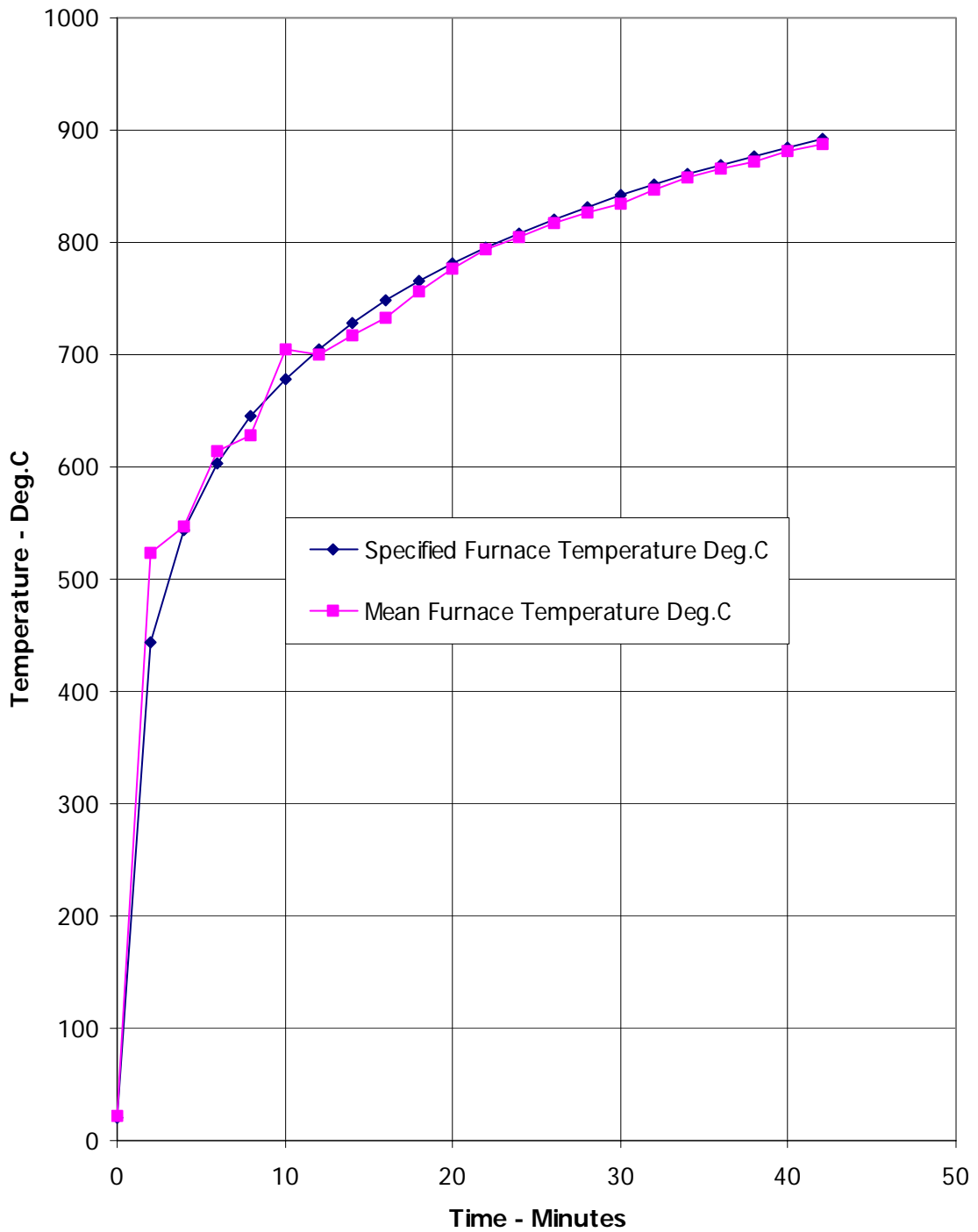
Deflections of the Door Leaf and Frame During the Test



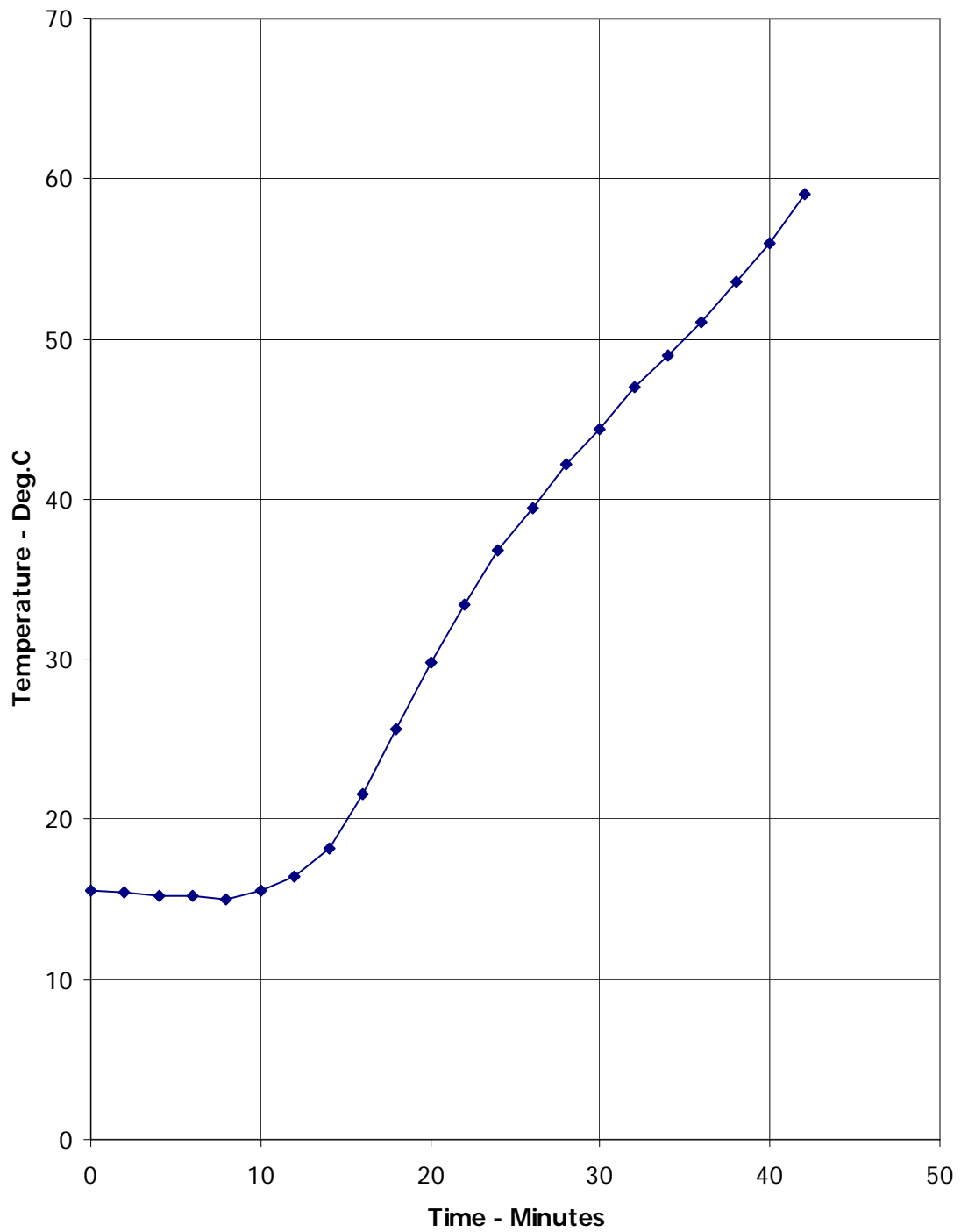
Deflections - mm															
TIME mins	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	6	3	1	1	0	-1	-1	-2	-1	0	1	0	1	2	1
10	3	6	4	3	2	-1	-1	-4	-2	-1	0	3	2	2	1
15	1	11	3	6	1	-1	-1	-4	-3	-1	1	4	4	4	5
20	4	13	5	7	1	-1	-1	-5	-2	-1	2	7	7	6	8
25	3	13	4	10	2	-1	-1	-7	-2	-1	2	14	10	12	1
30	4	15	5	12	2	-1	-1	-8	-3	0	1	-3	11	14	1

Negative values indicate movement away from the furnace

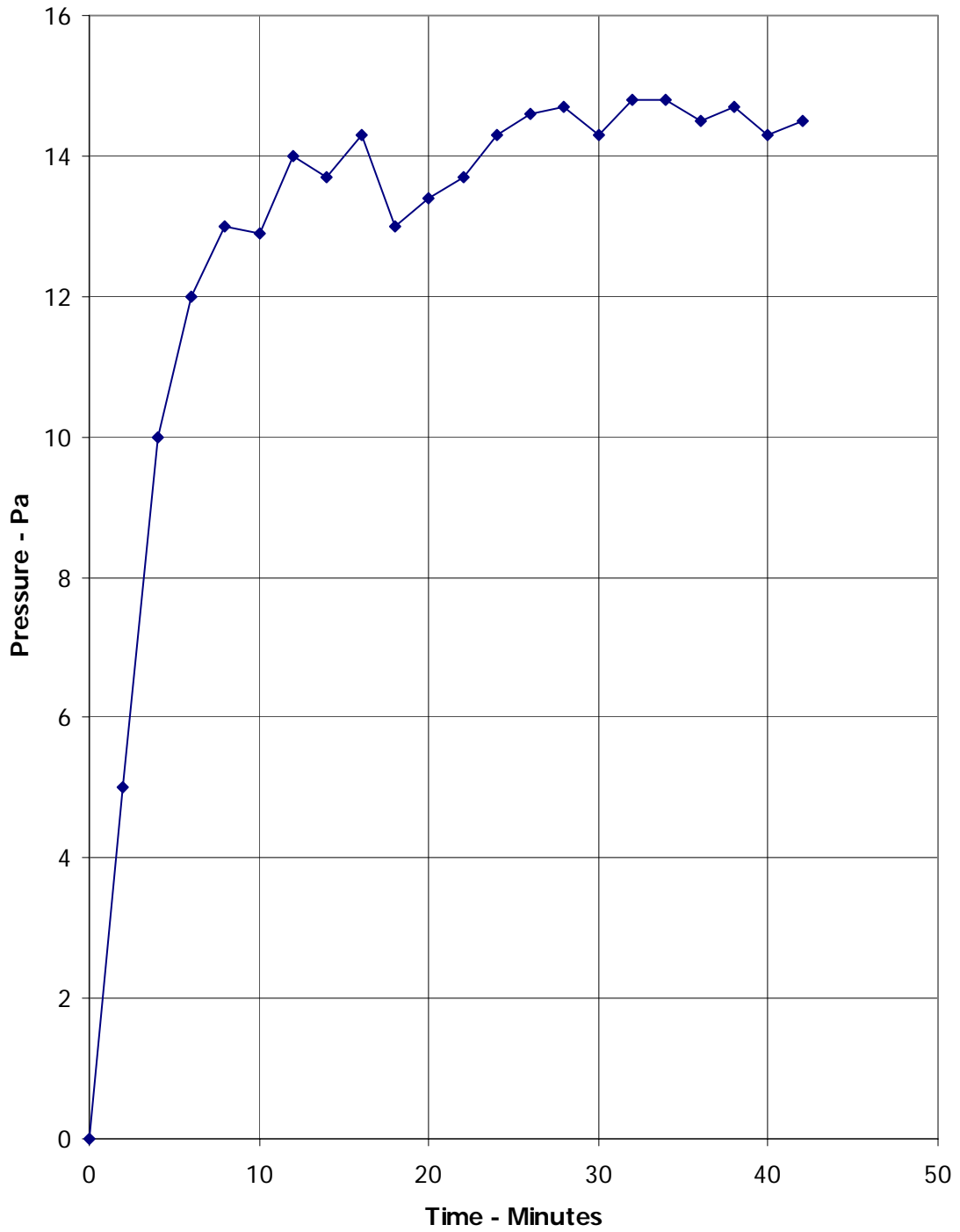
Graph showing mean furnace temperature, together with the temperature/time relationship specified in the Standard



Graph showing mean temperatures recorded on the unexposed surface of the doorset



Graph showing recorded furnace pressure at the head of the doorset



Performance Criteria and Test Results

Integrity It is required that the specimen retain its separating function, without either causing ignition of a cotton pad when applied, or permitting the penetration of a gap gauge as specified in BS EN 1634-1: 2000, or resulting in sustained flaming on the unexposed surface. **These requirements were satisfied for the periods shown below:**

Sustained flaming 41 minutes

Gap gauge 42 minutes*

Cotton pad 41 minutes

* The test duration. The test was discontinued after 42 minutes.

Insulation 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 (except on the door frame, where the maximum temperature rise shall not exceed 360°C). Insulation failure also occurs simultaneously with integrity failure as specified in BS EN 1634-1: 2000. **These requirements were satisfied for the period shown below:**

Insulation 41 minutes

Ongoing Implications

Limitations This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in BS EN 1363-1: 1999, and where appropriate BS EN 1363-2: 1999. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report. Annex A of BS EN 1363-1: 1999, provides guidance information on the application of fire resistance tests and the interpretation of test data.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

Conclusions

Evaluation against objective

A single-acting, single-leaf doorset has been subjected to a fire resistance test in accordance with BS EN 1634-1: 2000, Fire resistance tests for door and shutter assemblies, BS EN 1363-1: 1999, General requirements and BS EN 1363-2: 1999, Alternative and additional procedures.

The evaluation of the doorset against the requirements of BS EN 1634-1: 2000 showed that the doorset satisfied the requirements for the following periods.

Test Results:

Integrity performance

Sustained flaming	41 minutes
Gap gauge	42 minutes*
Cotton Pad	41 minutes

Insulation

41 minutes



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