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Testing. Advising. Assuring.

Title:

The fire resistance performance of two single-acting, single-leaf doorsets fitted with intumescent air transfer grilles when tested generally in accordance with BS EN 1634-1: 2014

Report No:

391351

Prepared for:

Mann Mcgowan Fabrications Ltd

4 Brook Trading Estate,
Deadbrook Lane,
Aldershot,
Hants,
GU12 4XB

Date: 8th March 2018

Notified Body No:

0833

UKAS TESTING
0249

Summary

Objective

To determine the fire resistance performance two single-acting, single-leaf timber based doorset fitted with intumescent air transfer grilles, when tested in accordance with BS EN 1634-1: 2014.

Test Sponsor

Mann Mcgowan Fabrications Ltd, 4 Brook Trading Estate, Deadbrook Lane, Aldershot, Hants, GU12 4XB

Summary of Tested Specimen

For the purpose of the test the doorsets were referenced Doorset A and Doorset B.

Doorset A had overall dimensions of 2078 mm high by 996 mm wide incorporating a door leaf with overall dimensions 2040 mm high by 926 mm wide by 44 mm thick. The door leaf was of a solid graduated density chipboard construction, with 6 mm hardwood lippings to the vertical edges and was hung within a softwood frame.

The doorset was installed such that it opened towards the heating conditions of the test and was latched for the duration of the test. The doorset incorporated a 600 mm x 600 mm aperture; the top edge of the aperture was located nominally 853 mm from the threshold of the doorset. An Intumescent air transfer grille referenced ‘PYROGRILLE 100’ was installed in the aperture.

Doorset B had overall dimensions of 2078 mm high by 996 mm wide incorporating a door leaf with overall dimensions 2040 mm high by 926 mm wide by 54 mm thick. The door leaf was of a solid graduated density chipboard construction, with 6 mm hardwood lippings to the vertical edges and was hung within a hardwood frame.

The doorset was installed such that it opened towards the heating conditions of the test and was latched for the duration of the test. The doorset incorporated a 600 mm x 600 mm aperture; the top edge of the aperture was located nominally 853 mm from the threshold of the doorset. An Intumescent air transfer grille referenced ‘PYROGRILLE 100’ was installed in the aperture.

Prior to testing, the doorsets were subjected to 25 manually operated opening and closing cycles as specified in EN 14600: 2005.

Test Results:		Doorset A	Doorset B
Integrity performance	Sustained flaming	40 minutes	69 minutes
	Gap gauge	40 minutes#	69 minutes#
	Cotton Pad	40 minutes#	69 minutes#
Insulation performance	Door Leaf	40 minutes#	69 minutes#
	Time to Grille Closure	8 minutes, 50 seconds	8 minutes, 50 seconds

Test was discontinued after a period of 70 minutes.

The failure criteria of each specimen was measured after the air transfer grilles had sealed by the means of their intumescent properties.

Date of Test 9th December 2017

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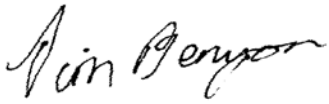
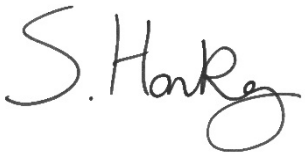
Signatories

Responsible Officer
N. Howard*
Technical Officer



Approved
T. Benyon*
Certification Engineer



Head of Department
S. Hankey*
Business Unit Head

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

Report Issued

Date: 8th March 2018

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Test Procedure

Introduction

The doorset assemblies are required to provide a fire separating function and were therefore tested in accordance with BS EN 1634-1: 2014 'Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows'. This test report should be read in conjunction with that Standard and with BS EN 1363-1: 2012, 'Fire resistance tests - Part 1: General requirements' and BS EN 1363-2: 1999, 'Fire resistance tests - Part 2: Alternative and additional procedures'.

Prior to testing, the doorsets were subjected to 25 manually operated opening and closing cycles as specified in EN 14600: 2005.

The specimens were judged on their ability to comply with the performance criteria for integrity and insulation, as required by BS EN 1634-1: 2014. The radiation from the doorsets was measured in accordance with the requirements of BS EN 1363-2: 1999.

Due to the open state nature of the installed intumescent grilles the failure criteria of each specimen was measured after the intumescent grilles had sealed by means of their intumescent properties, as such, the test is reported as generally in accordance.

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 9th December 2017 on behalf of **Mann McGowan Fabrications Ltd** the sponsor of the test.

Mr. D. Boulton, Mr R. Smith and Mr. J. Scott representatives 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.

The doorsets' storage, installation, and test preparation took place in the test laboratory between the 5th and 9th December 2017

Installation

The doorsets were mounted within apertures provided within a low-density rigid supporting construction, the doorsets were installed opening towards the heating conditions of the test and representatives of the test sponsor conducted the installation on the 8th December 2017

Sampling

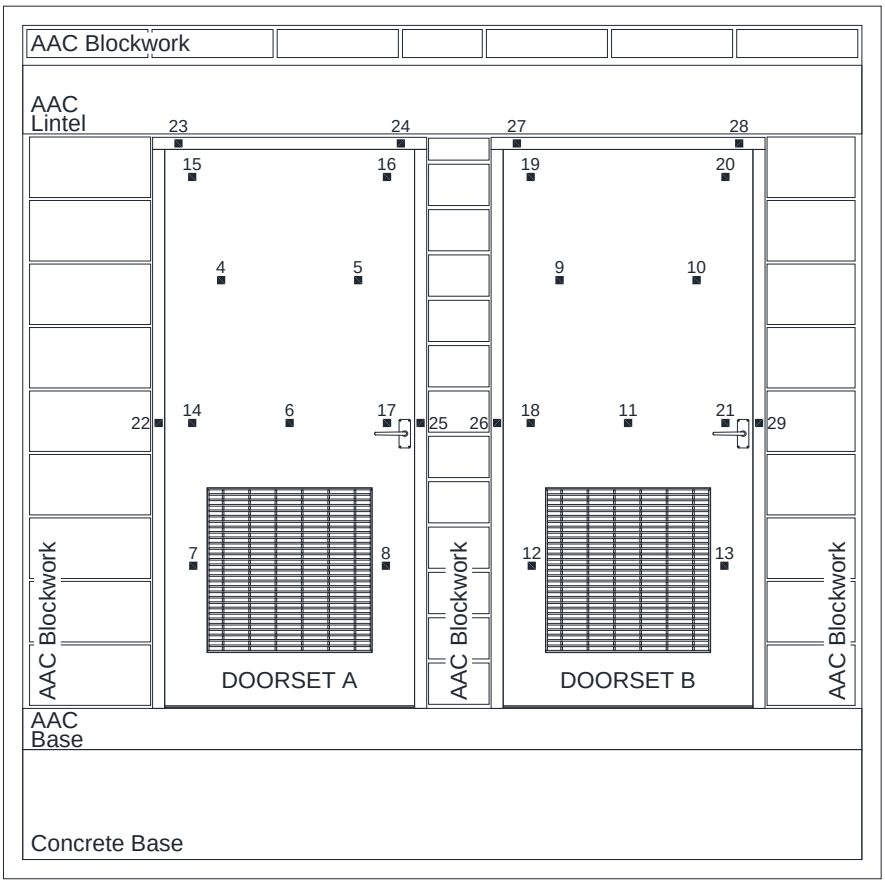
Exova Warringtonfire was not involved in any selection or sampling procedures of the specimen or any of the components.

Conditioning

The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 5 day. 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 15°C to 21°C and 64% to 87% respectively.

Test Construction

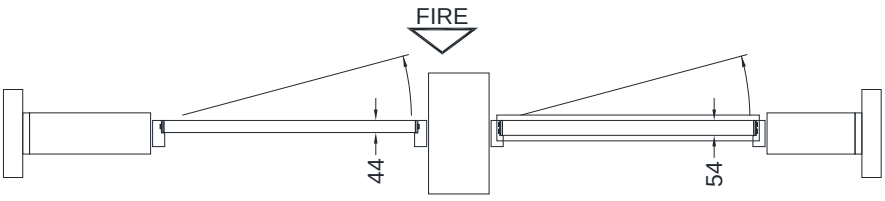
Figure 1- General Elevation of the Unexposed Face of the Test Construction



■ Positions of thermocouples

AAC = Autoclaved aerated concrete

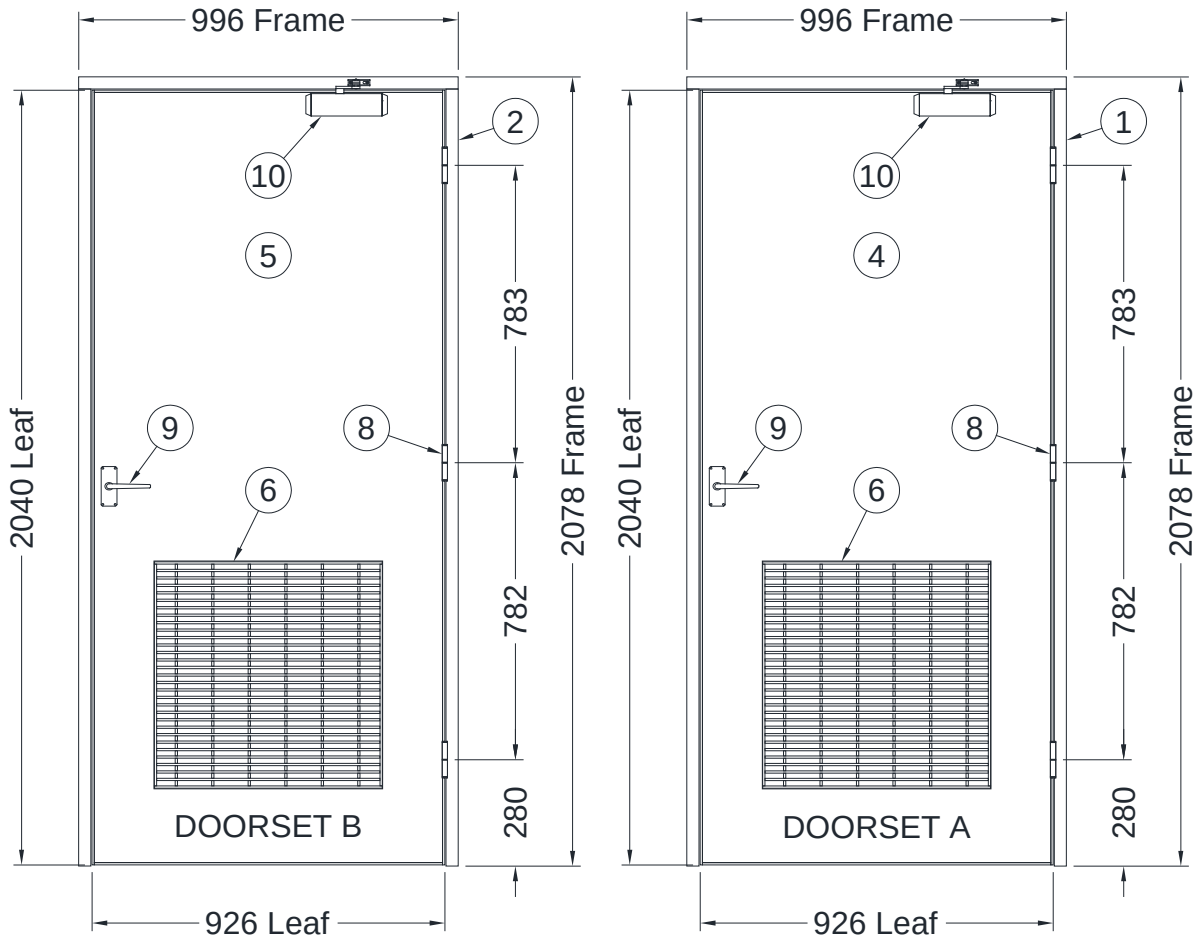
GENERAL ELEVATION
OF UNEXPOSED FACE



HORIZONTAL SECTION

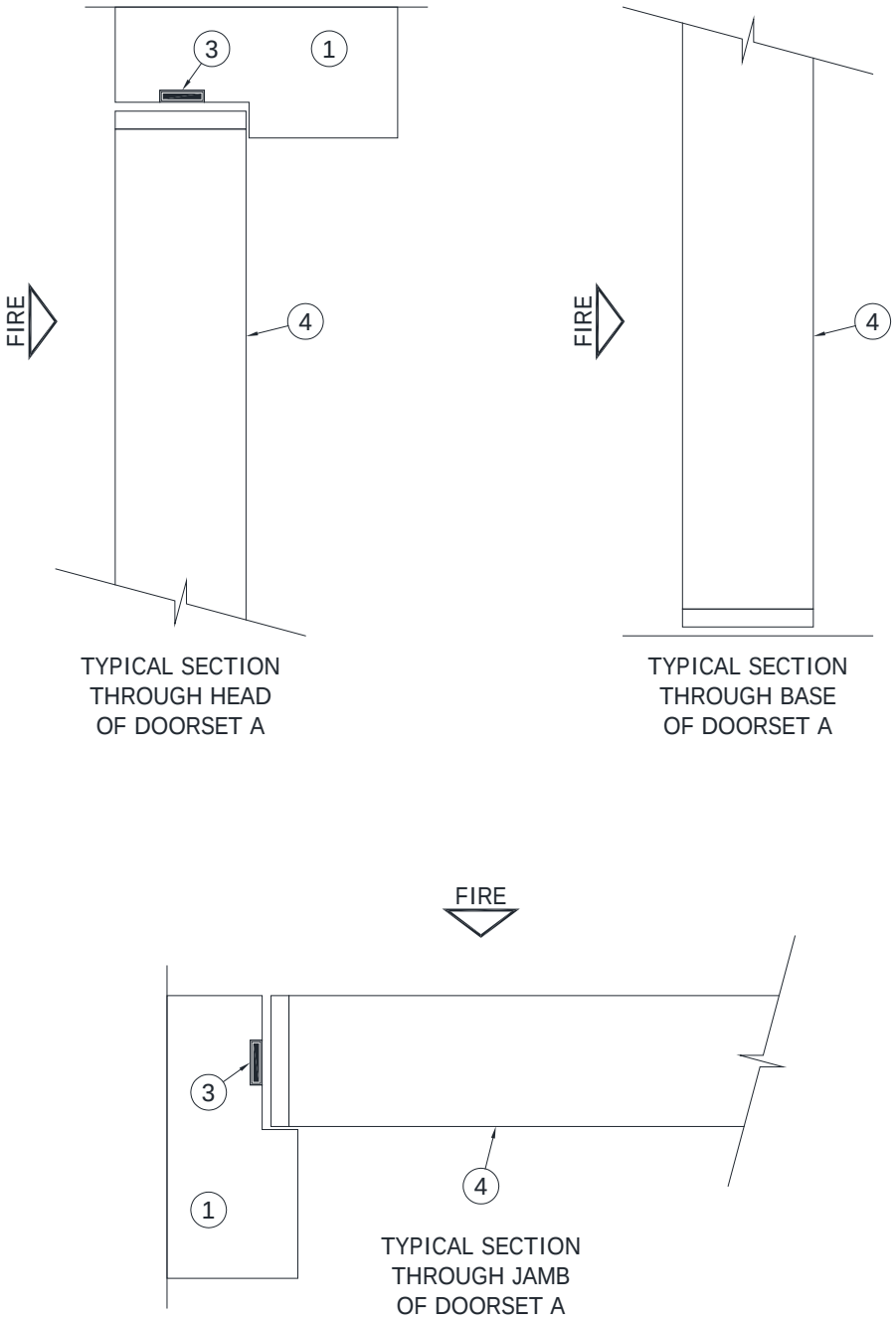
Do not scale. All dimensions are in mm

Figure 2 - General Elevation of the Exposed Face of the Test Construction



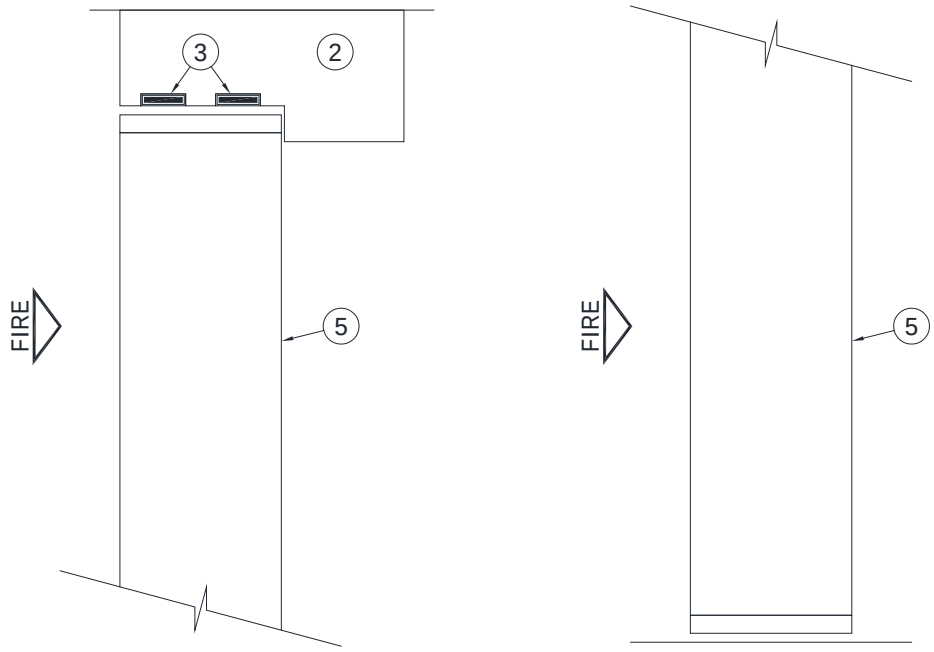
Do not scale. All dimensions are in mm

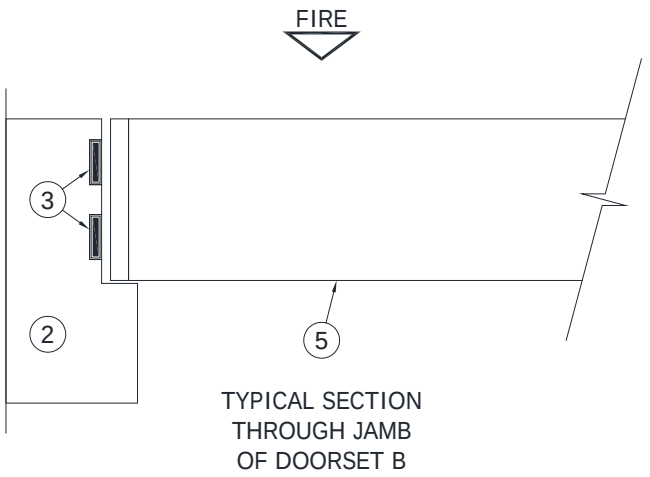
Figure 3 – Details of Doorset A



Do not scale. All dimensions are in mm

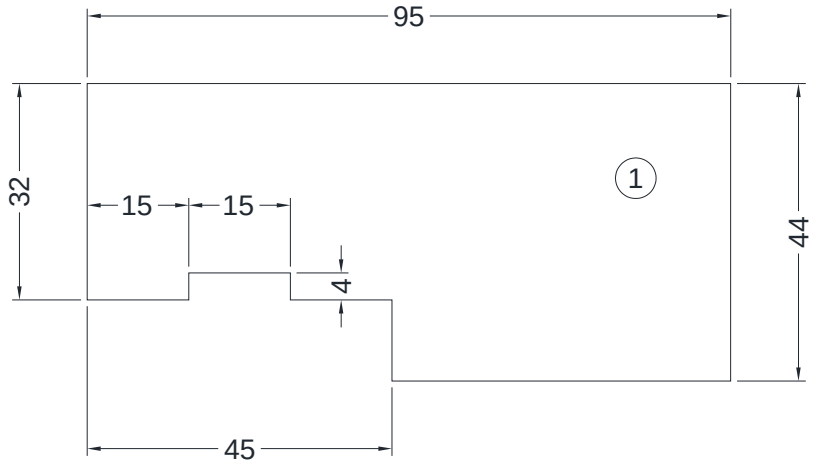
Figure 4 – Details of Doorset B



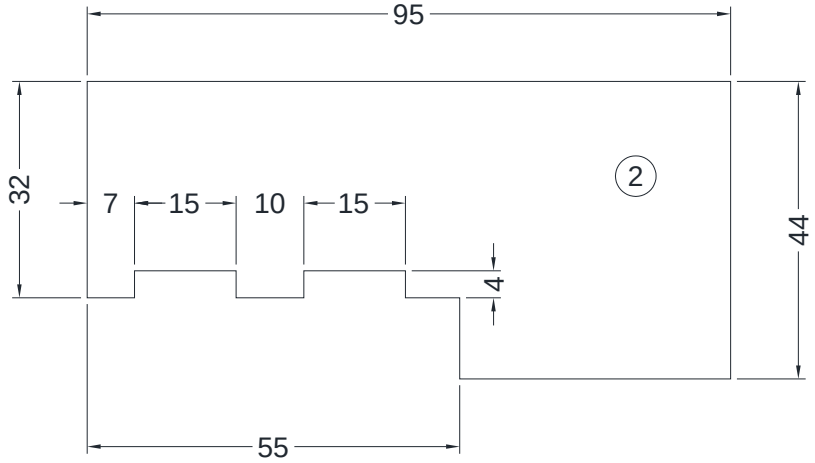


Do not scale. All dimensions are in mm

Figure 5 – Details of Door Frames



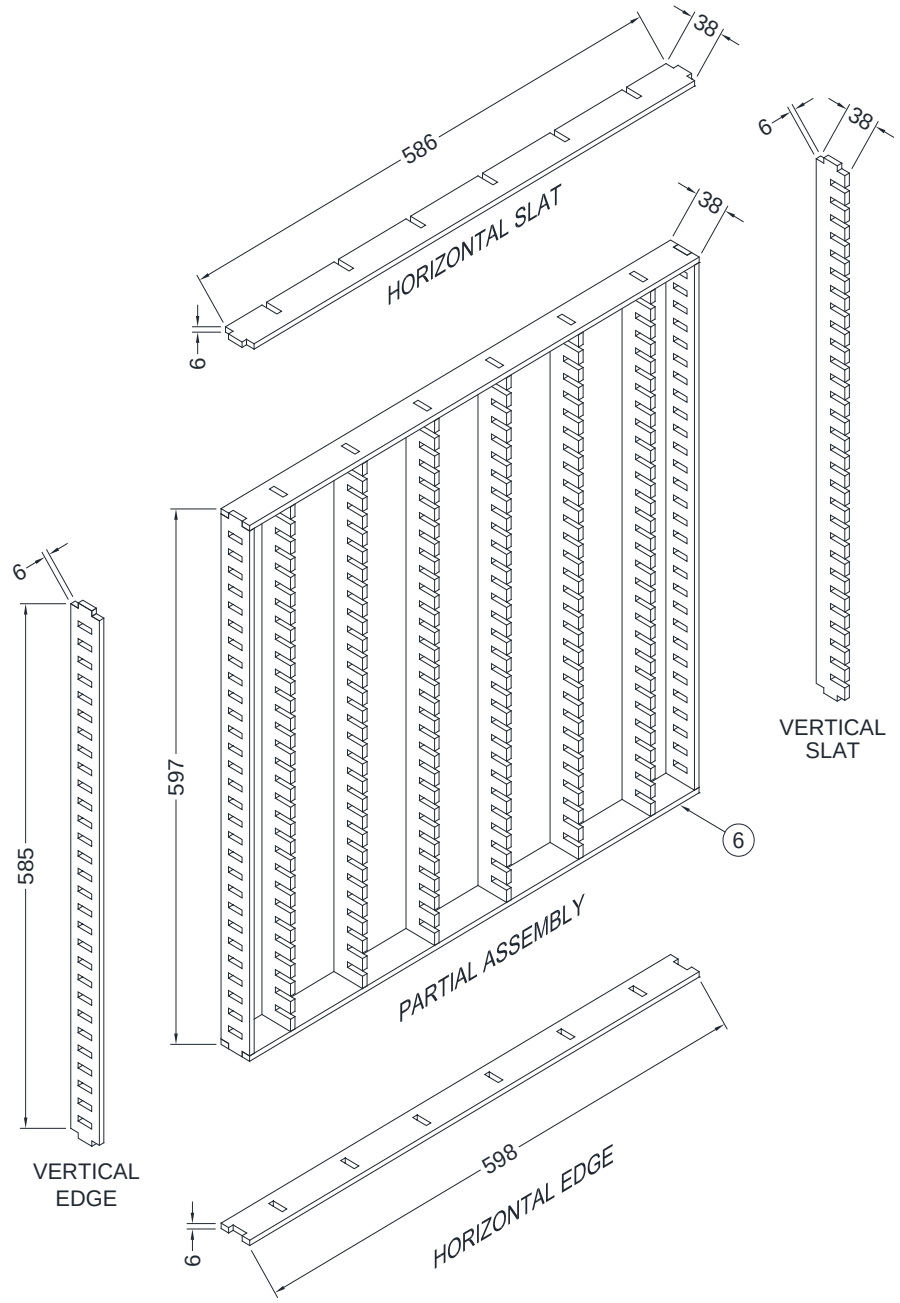
TYPICAL DETAILS
OF DOOR FRAME
OF DOORSET A



TYPICAL DETAILS
OF DOOR FRAME
OF DOORSET B

Do not scale. All dimensions are in mm

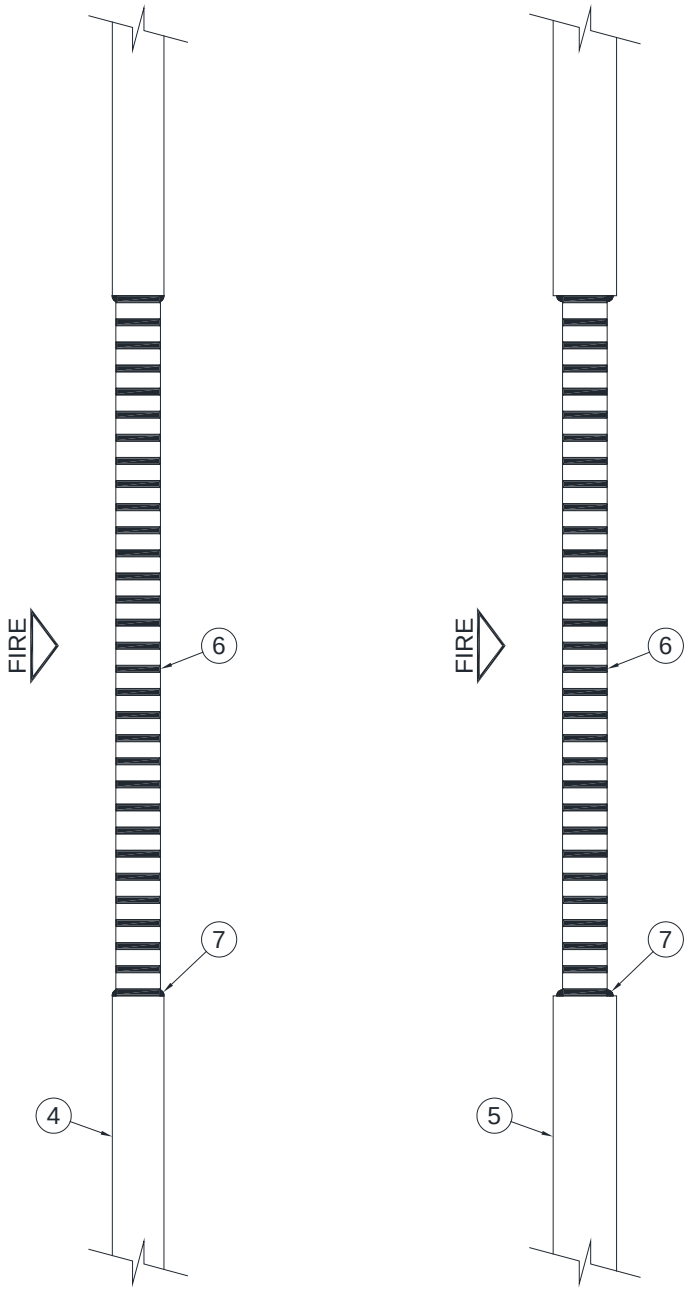
Figure 6 – Details of Grille



EXPLODED VIEW OF
SPECIMEN F

Do not scale. All dimensions are in mm

Figure 7 – Details of Grille



TYPICAL SECTION
THROUGH GRILLE
IN DOORSET A

TYPICAL SECTION
THROUGH GRILLE
IN DOORSET B

Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 7)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

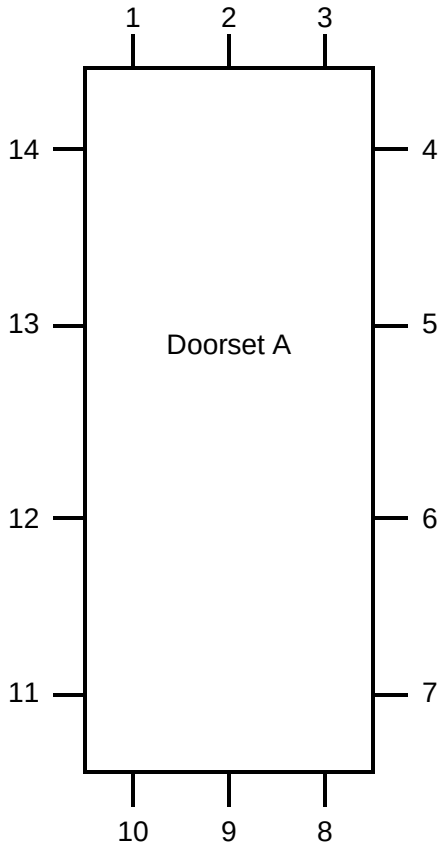
Item		Description
1. Door Frame Doorset A		
Material	:	Redwood softwood
Density	:	450 kg/m^3, stated
Average moisture content	:	7.2% (measured with a Protimeter moisture meter by Exova Warringtonfire)
Overall size	:	95 mm x 44 mm, with 45 mm x 12 mm deep rebate. For further dimensions, please see Figure 5
Jambs to head jointing method	:	Butted with the head running the full width of the frame
Fixing method	:	Through screwed to the 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
2. Door Frame Doorset B		
Material	:	Sapele hardwood
Density	:	640 kg/m^3, stated
Average moisture content	:	8.4% (measured with a Protimeter moisture meter by Exova Warringtonfire)
Overall size	:	95 mm x 44 mm, with 55 mm x 12 mm deep rebate. For further dimensions, please see Figure 5
Jambs to head jointing method	:	Butted with the head running the full width of the frame
Fixing method	:	Through screwed to the 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
3. Intumescent Seal		
Manufacturer	:	Mann M^{c}Gowan
Reference	:	500 PSA
Material	:	Graphite based intumescent within a polyvinyl chloride, PVC, carrier
Overall size	:	15 mm x 4 mm
Fixing method	:	Self adhered into grooves within the rebates of each frame. Please see Figures 3 & 4
4. Door Leaf		
Manufacturer	:	Halspan Ltd
Reference	:	Optima 44mm
Material		
i. core	:	Chipboard
ii. lippings	:	Sapele hardwood
Thickness		
i. core	:	44 mm
ii. lippings	:	6 mm

Item		Description
4. Door Leaf (Continued)		
Lipping fixing method	:	Bonded around the of the core an all four edges
Adhesive		
i. manufacturer	:	Wűrth
ii. type	:	Polyurethane, PU, adhesive
iii. reference	:	D4
iv. curing method	:	Air cured
v. application method	:	Spatula and clamped
5. Door Leaf		
Manufacturer	:	Halspan Ltd
Reference	:	Optima 54mm
Material		
i. core	:	Chipboard
ii. lippings	:	Sapele hardwood
Thickness		
i. core	:	54 mm
ii. lippings	:	6 mm
Lipping fixing method	:	Bonded around the of the core an all four edges
Adhesive		
i. manufacturer	:	Wűrth
ii. type	:	PU adhesive
iii. reference	:	D4
iv. curing method	:	Air cured
v. application method	:	Spatula and clamped
6. Grille		
Manufacturer	:	Mann M^{c}Gowan
Reference	:	Pyrogrille 100
Materials		
i. vertical slats	:	Polyvinyl chloride, PVC, carrier with palusol intumescent and perforated galvanised mild steel strip inserts
ii. horizontal slats	:	PVC, carrier with palusol intumescent strip insert
iii. perimeter edges	:	PVC, carrier with palusol intumescent strip insert
Overall sizes		
i. vertical slats	:	38 mm wide x 6 mm thick carrier with 36 mm wide x 2 mm thick palusol and 36 mm wide x 0.8 mm thick perforated galvanised mild steel strip inserts
ii. horizontal slats	:	38 mm wide x 6 mm thick carrier with 36 mm wide x 4mm thick palusol insert
iii. perimeter edges	:	38 mm wide x 6 mm thick carrier with 36 mm wide x 4mm thick palusol insert
iv. assembled grille	:	598 mm wide x 596 mm high
Assembly method		The vertical and horizontal slats contained notches along their lengths so that they interlocked with each other to form a grid. The ends of the slats were cut to form a tongue which located into corresponding slots in the perimeter edge sections. The perimeter of the grille was wrapped with duct tape. Please see Figure 6
Fixing method	:	Screw fixed through vertical edges to the door leaves, items 4 & 5

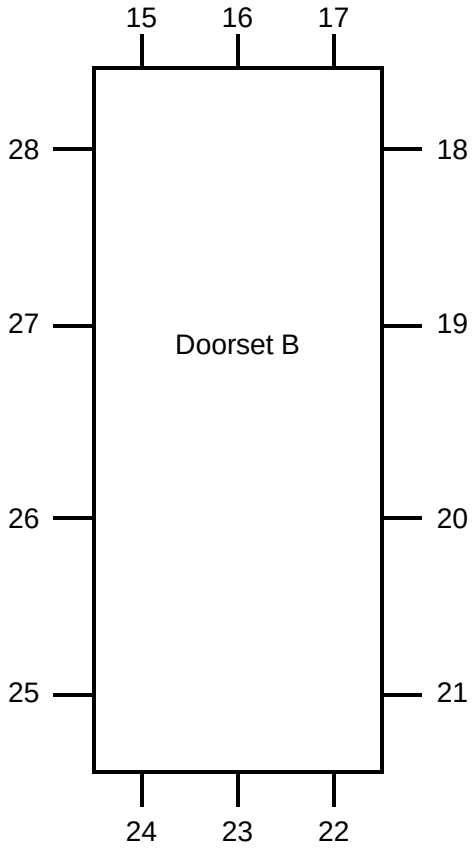
Item		Description
6. Grille (Continued)		
Fixings		
i. type	:	Drywall screws
ii. material	:	Steel
iii. overall size	:	75 mm long x 4.3 mm diameter
iv. centres	:	Nominally 100 mm from each corner
7. Perimeter Sealant		
Manufacturer	:	Mann McGowan
Reference	:	Pyromas A
Material	:	Intumescent acrylic sealant
Application method	:	Cartridge gunned around the perimeter of each grille on both faces
8. Hinges		
Manufacturer	:	Royde & Tucker
Reference	:	Hi Load 105 Lift-off
Materials	:	316 grade stainless steel
Overall sizes		
i. knuckle	:	102 mm long x 14 mm diameter
ii. blades	:	96 mm long x 34/22 mm wide x 3 mm thick
Fixings		
i. type	:	Countersunk head screws
ii. material	:	Steel
iii. size	:	30 mm long x 4 mm diameter
iv. number off per blade	:	3
v. maximum distance of fixing screws from exposed face of door leaf	:	21 mm
Bedding material doorset A		
i. manufacturer	:	Mann M^{c}Gowan
ii. material	:	Interdens sheet
iii. overall size	:	To suit hinge blades x 1 mm thick
Bedding material doorset B		
i. manufacturer	:	Mann M^{c}Gowan
ii. material	:	Interdens sheet
iii. overall size	:	To suit hinge blades x 2 mm thick
9. Latch		
Manufacturer	:	Smith & Locke Ltd
Reference	:	3006K
Material	:	Steel
Overall size		
i. fore plate	:	60 mm x 25 mm
ii. strike plate	:	65 mm x 25/41 mm
iii. casing	:	25 mm x 63 mm
iv. latch bolt	:	15.3 mm x 11 mm with 9 mm throw
Latch force		
i. doorset A	:	6.7 Newton metres (Nm)
ii. doorset B	:	6.9 Nm
Operation of latch bolt	:	Engaged
Fixing method	:	Screwed

Item		Description
9. Latch (Continued)		
Bedding material doorset A		
i. manufacturer	:	Mann McGowan
ii. material	:	Interdens sheet
iii. overall size	:	To suit casing and back of fore & strike plates x 1 mm thick
Bedding material doorset B		
i. manufacturer	:	Mann McGowan
ii. material	:	Interdens sheet
iii. overall size	:	To suit casing and back of fore & strike plates x 2 mm thick
Lever handles		
i. manufacturer	:	Locke & Co. Ltd
ii. reference	:	2000 Series Lever on backplate
iii. material	:	Aluminium
iv. overall size	:	120 mm long x 8.9 mm lever handles complete with 104 mm x 41.4 mm backing plate
v. fixing method	:	Screwed on each face of leaves
10. Door Closer		
Manufacturer	:	Rutland Trading Co. Ltd
Reference	:	TS3204
Material		
i. body	:	Cast alloy
ii. closer arm	:	Steel
Overall size	:	220 mm long x 59 mm high x 48 mm deep
Fixing method	:	Exposed face
Maximum opening moments		
i. door leaf ‘A’	:	54.2 Nm
ii. door leaf ‘B’	:	43.1 Nm
Maximum closing moments		
i. door leaf ‘A’	:	22.5 Nm
ii. door leaf ‘B’	:	21.0 Nm

Doorset clearance gaps



View from unexposed face



View from unexposed face

Door Ref	Gap Dimension in mm at Positions													
A	1	2	3	4	5	6	7	8*	9*	10*	11	12	13	14
	2.7	2.8	2.6	2.7	2.8	2.2	1.7	6.2	6.1	6.3	2.3	2.3	2.8	2.7
B	15	16	17	18	19	20	21	22*	23*	24*	25	26	27	28
	2.9	2.8	2.4	2.5	2.4	2.3	2.4	6.1	6.5	6.1	2.3	2.5	2.2	2.4
A	Mean		2.5		Maximum			2.8		Minimum			1.7	
B	Mean		2.5		Maximum			2.9		Minimum			2.2	

Door Ref	Gap Between Face of Leaf and Doorstop in mm at Position													
A	1	2	3	4	5	6	7	8*	9*	10*	11	12	13	14
	0.9	1	0.8	0.2	0.3	0.5	0.5	n/a	n/a	n/a	1.1	1.3	1.3	0.4
B	15	16	17	18	19	20	21	22*	23*	24*	25	26	27	28
	2.2	1.6	1.1	1.1	1.1	0.9	0.8	n/a	n/a	n/a	1.3	1.5	2.3	2.5

* 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 BS EN 1363-1: 2012.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of BS EN 1363-1: 2012 Clause 5.1 using six plate thermometers, 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 4 to 8 (Doorset A) and 9 to 13 (Doorset B)	At five positions on the unexposed surface of the doorset, one approximately at the centre and one at the approximate centre of each quarter section of each doorset.
Thermocouples 14 to 17 (Doorset A) and 18 to 21 (Doorset B)	At four positions on the unexposed surface of the door leaf, 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 22 to 25 (Doorset A) and 26 to 29 (Doorset B)	At four positions on the unexposed surface of the door frame, one positioned approximately 50 mm from each vertical edge 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 specimen 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	The furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 2012. Clause 5.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the doorsets was 13.4 (±3) 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 13ºC at the start of the test with a maximum variation of -2ºC during the test.
00	**00**	**The test commences.**
00	**10**	Smoke release from the grilles of each doorset is evident.
01	**40**	The exposed face of each doorset ignites. The top half of the grille of each doorset reacts and closes leaving the bottom half open.
06	**00**	Approximately 70% of each grille has reacted and closed.
07	**00**	The smoke release lessens and is now confined to the head of each diameter.
08	**50**	The grille of each doorset has 100% reacted.
14	**00**	Slight smoke release from the grille of Doorset A,
16	**00**	Slight smoke release from the grille of Doorset B.
30	**00**	Both doorsets continue to satisfy the integrity and insulation criteria of the test,
33	**00**	The smoke release from the grilles increase in volume particularly Doorset A.
39	**00**	The central hinge position of Doorset A begins to glow.
40	**00**	Sustained flames issues from the central hinge position of Doorset A. **Sustained flame integrity failure of Doorset A is deemed to occur**. The doorset is blanked off to allow for further examination of Doorset B.
51	**00**	A roving thermocouple is used and placed on the grille of Doorset B. The roving thermocouple records a temperature of 131^{o}C.
60	**00**	Doorset B continues to satisfy the integrity and insulation criteria of the test.
65	**30**	An area of glowing at top left corner of the leaf of Doorset B is evident.
69	**10**	Sustained flames issue from the grille of Doorset B. **Sustained flame integrity failure of Doorset B is deemed to occur.**
70	**00**	**The test is discontinued.**

Test Photographs

The exposed face of the doorsets prior to testing

The unexposed face of the doorsets prior to testing

The unexposed face of the doorsets after 2 minutes of testing

The unexposed face of the doorsets after 9 minutes of testing

The unexposed face of the doorsets after 29 minutes of testing

The unexposed face of Doorset B after 60 minutes of testing

Flaming seen from the top of the grille on Doorset B after 69 minutes of testing

The exposed face of the doorsets immediately after the test

Temperature and Deflection Data

Mean furnace temperature, together with the temperature/time relationship specified in BS EN 1363-1: 2012

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	20
2	445	461
4	544	543
6	603	570
8	646	649
10	678	679
12	706	705
14	728	725
16	748	749
18	766	766
20	781	778
22	796	792
24	809	806
26	820	820
28	832	831
30	842	840
32	852	846
34	860	860
36	869	867
38	877	881
40	885	886
42	892	890
44	899	894
46	906	899
48	912	904
50	918	914
52	924	923
54	930	936
56	935	963
58	940	952
60	945	941
62	950	953
64	955	963
66	960	965
68	964	965
70	968	961

Individual and mean temperatures recorded on the unexposed surface of Doorset A

Time Mins	T/C Number 4 Deg. C	T/C Number 5 Deg. C	T/C Number 6 Deg. C	T/C Number 7 Deg. C	T/C Number 8 Deg. C	Mean Temp Deg. C
0	15	16	15	14	14	15
2	30	31	52	16	15	29
4	25	25	39	15	15	24
6	22	23	34	15	15	22
8	21	22	31	17	15	21
10	22	23	31	22	17	23
12	24	25	33	30	20	26
14	28	28	36	38	24	31
16	31	32	40	44	30	35
18	36	36	43	49	36	40
20	40	40	47	53	41	44
22	43	44	50	57	46	48
24	47	48	53	59	51	52
26	50	52	56	61	55	55
28	54	55	59	63	58	58
30	57	58	63	64	61	61
32	60	61	65	66	64	63
34	63	63	68	68	66	66
36	65	66	71	69	68	68
38	68	67	73	71	70	70
40	*	*	*	*	*	*

*Doorset Blanked Off

Individual and mean temperatures recorded on the unexposed surface of Doorset B

Time Mins	T/C Number 9 Deg. C	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C	T/C Number 13 Deg. C	Mean Temp Deg. C
0	16	16	15	14	14	15
2	27	33	48	15	15	28
4	23	26	36	15	15	23
6	21	24	32	15	15	21
8	20	22	29	15	15	20
10	19	21	28	15	15	20
12	19	21	27	15	16	20
14	19	21	27	16	17	20
16	20	21	28	18	19	21
18	21	22	29	20	21	23
20	22	22	30	23	24	24
22	24	24	32	26	26	26
24	25	25	34	30	29	29
26	27	27	36	33	32	31
28	29	29	38	37	34	33
30	31	31	40	40	36	36
32	33	33	42	43	38	38
34	36	36	44	46	41	41
36	38	38	47	49	44	43
38	41	41	48	52	46	46
40	43	43	51	54	49	48
42	46	46	53	56	51	50
44	49	48	55	58	53	53
46	51	51	57	60	55	55
48	54	53	59	61	57	57
50	56	56	61	63	59	59
52	59	58	63	64	61	61
54	62	61	65	66	62	63
56	64	63	67	67	64	65
58	66	65	69	69	65	67
60	69	67	70	70	66	68
62	71	69	72	71	68	70
64	73	71	74	73	70	72
66	76	73	77	74	71	74
68	78	75	81	76	72	76
70	80	77	87	77	73	79

Individual temperatures recorded on the unexposed surface of Doorset A
100 mm in from door leaf edge

Time	T/C Number	T/C Number	T/C Number	T/C Number
Mins	14	15	16	17
	Deg. C	Deg. C	Deg. C	Deg. C
0	15	16	16	15
2	21	27	23	22
4	19	30	21	20
6	18	26	20	19
8	19	24	20	20
10	21	24	22	24
12	25	27	26	29
14	29	31	30	35
16	33	34	35	39
18	37	38	39	44
20	41	41	43	48
22	44	45	46	51
24	48	48	49	54
26	51	50	52	56
28	54	54	55	59
30	58	55	58	61
32	61	58	60	64
34	64	61	63	66
36	67	63	65	69
38	70	66	68	71
40	*	*	*	*

*Doorset Blanked Off

Individual temperatures recorded on the unexposed surface of Doorset B
100 mm in from door leaf edge

Time	T/C Number	T/C Number	T/C Number	T/C Number
Mins	18	19	20	21
	Deg. C	Deg. C	Deg. C	Deg. C
0	15	16	17	16
2	21	24	26	27
4	19	25	23	23
6	18	22	22	21
8	18	20	21	21
10	18	20	20	21
12	18	20	20	22
14	19	20	21	23
16	20	21	21	25
18	21	23	23	28
20	23	25	25	31
22	25	28	27	33
24	28	30	30	36
26	30	33	32	39
28	32	36	34	41
30	35	39	36	42
32	37	41	38	44
34	40	44	40	46
36	42	47	43	48
38	45	49	45	49
40	47	52	48	51
42	50	54	50	53
44	52	56	52	55
46	54	58	54	56
48	56	60	56	58
50	59	62	58	60
52	61	63	60	62
54	63	65	62	64
56	65	66	64	65
58	67	67	66	67
60	69	69	68	69
62	71	71	70	70
64	73	72	71	72
66	75	74	73	74
68	77	75	75	76
70	79	77	77	78

Individual temperatures recorded on the unexposed surface of Door Frame A

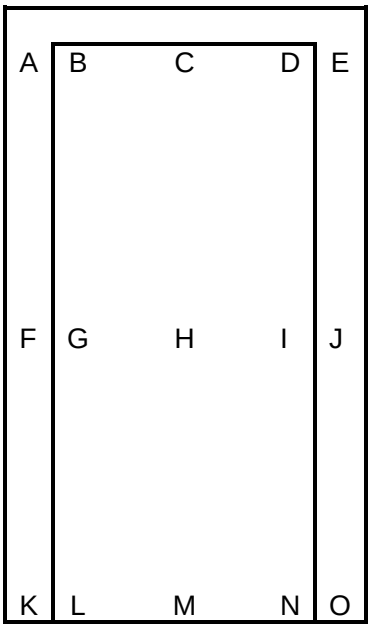
Time Mins	T/C Number 22 Deg. C	T/C Number 23 Deg. C	T/C Number 24 Deg. C	T/C Number 25 Deg. C
0	14	15	15	8
2	16	33	29	13
4	16	38	34	11
6	16	36	36	10
8	15	33	36	*
10	15	*	29	*
12	15	*	26	*
14	15	*	24	*
16	16	*	23	*
18	16	*	23	*
20	16	*	23	*
22	17	*	24	*
24	18	*	25	*
26	18	*	26	*
28	19	*	27	*
30	20	*	28	*
32	21	*	30	*
34	22	*	32	*
36	23	*	33	*
38	24	*	34	*
40	*	*	*	*

*Thermocouple Malfunction

Individual temperatures recorded on the unexposed surface of Door Frame B

Time Mins	T/C Number 26 Deg. C	T/C Number 27 Deg. C	T/C Number 28 Deg. C	T/C Number 29 Deg. C
0	14	16	16	15
2	16	29	28	18
4	18	36	30	18
6	17	34	27	17
8	16	31	24	17
10	16	30	23	17
12	16	28	22	17
14	16	27	21	17
16	16	26	21	17
18	16	26	21	17
20	16	26	21	17
22	17	26	22	18
24	18	27	22	18
26	19	29	23	19
28	19	32	24	20
30	20	33	26	20
32	21	35	27	21
34	22	35	28	22
36	23	35	29	23
38	24	34	28	24
40	25	33	29	24
42	26	33	29	25
44	27	33	30	26
46	28	34	31	27
48	30	34	32	29
50	31	35	33	30
52	32	36	35	31
54	33	37	36	32
56	34	38	37	34
58	35	40	39	35
60	36	42	40	36
62	37	43	42	37
64	38	46	44	38
66	39	48	48	39
68	40	51	54	40
70	41	52	64	41

Horizontal deflections of Doorset A

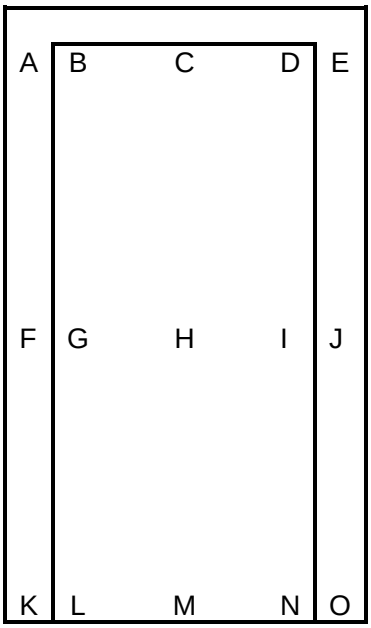


Doorset A															
Deflections – mm															
TIME mins	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	4	-4	-3	3	15	-2	1	1	1	1	2	2	0	-1	2
10	9	-4	-4	2	6	-4	-1	-2	1	0	0	1	1	3	0
15	6	0	-2	4	3	0	1	0	3	2	2	4	-2	4	1
20	4	-2	-5	*	2	0	4	3	1	3	3	5	0	8	1
25	6	-1	2	7	4	2	1	-8	-1	0	3	5	0	8	3
30	5	1	-4	8	3	-1	-1	-18	-2	0	2	5	-3	8	14
35	7	1	-3	9	4	5	-1	-20	-4	5	4	8	-2	8	3

Positive values indicate movement towards the furnace

*Laser reading malfunction

Horizontal deflections of Doorset B

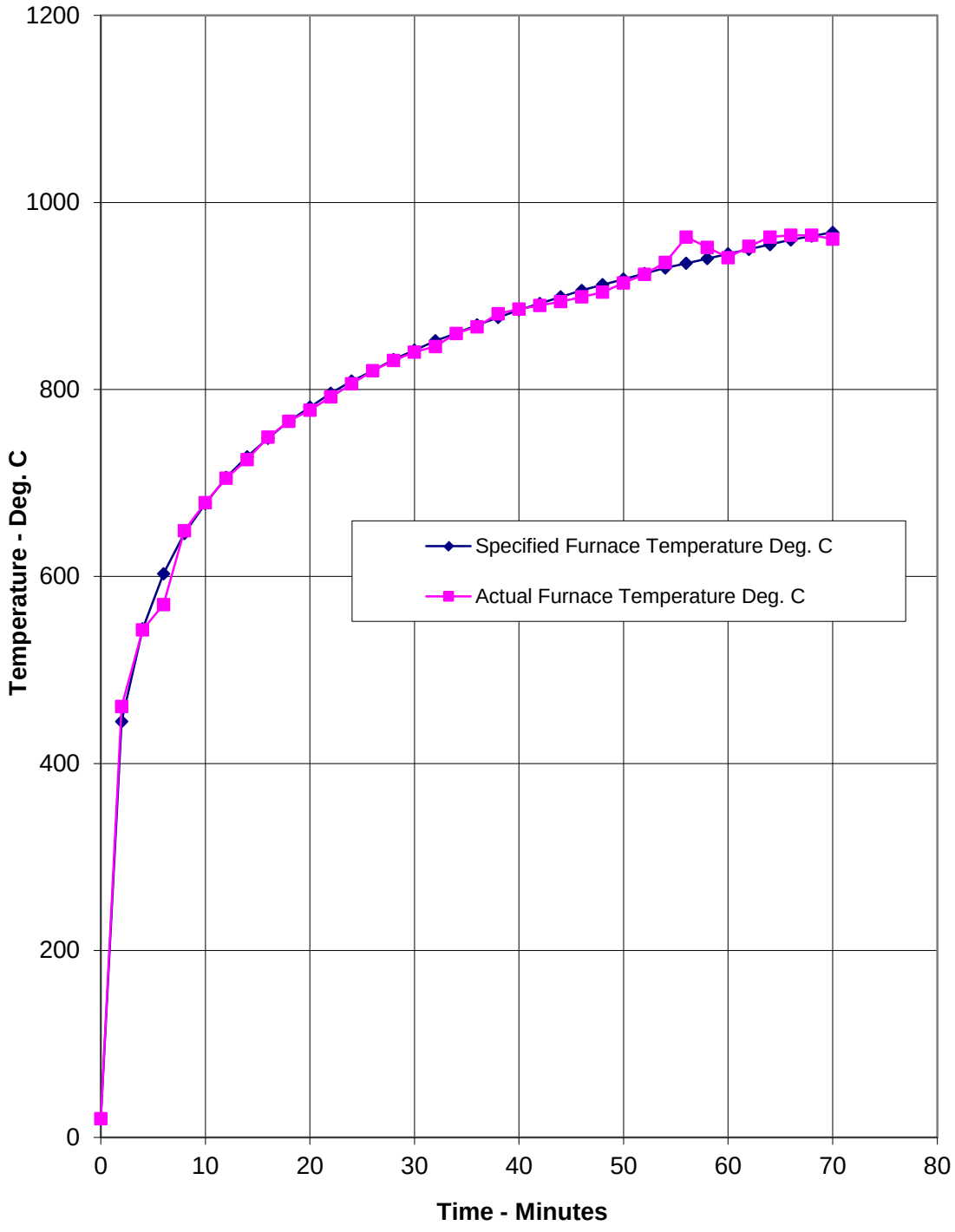


Doorset B															
Deflections – mm															
TIME mins	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	4	4	5	0	1	2	-1	*	0	1	0	1	1	3
20	0	3	8	7	1	4	4	-1	2	2	0	3	-1	5	1
30	1	9	1	12	0	-1	-1	-8	-2	0	1	4	2	3	1
40	4	9	5	12	4	4	1	-11	-1	0	2	5	3	4	3
50	5	10	4	13	5	5	2	-10	-1	21	3	6	5	5	5
60	6	8	5	15	6	3	3	-25	-4	24	3	8	*	5	4

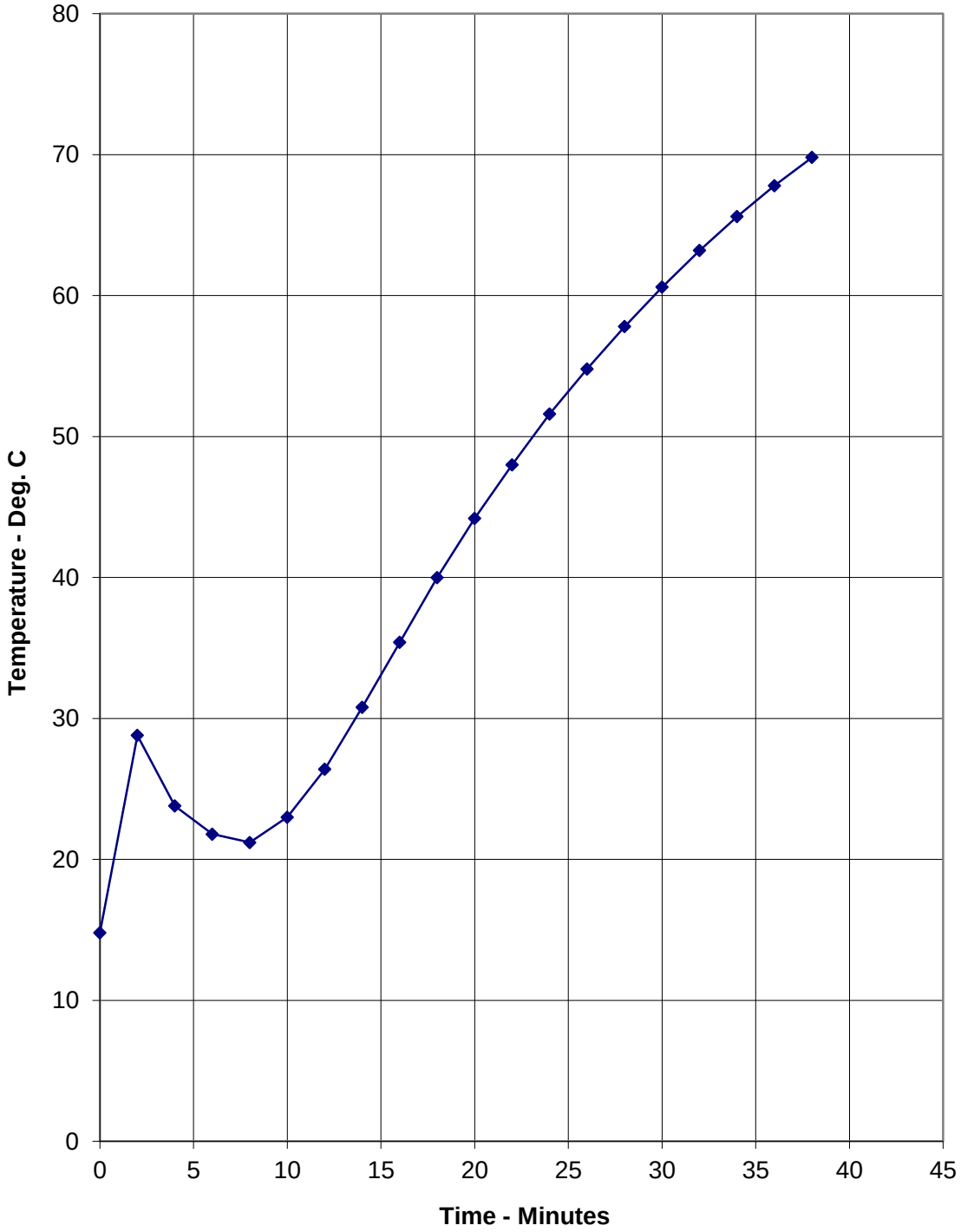
Positive values indicate movement towards the furnace

*Laser reading malfunction

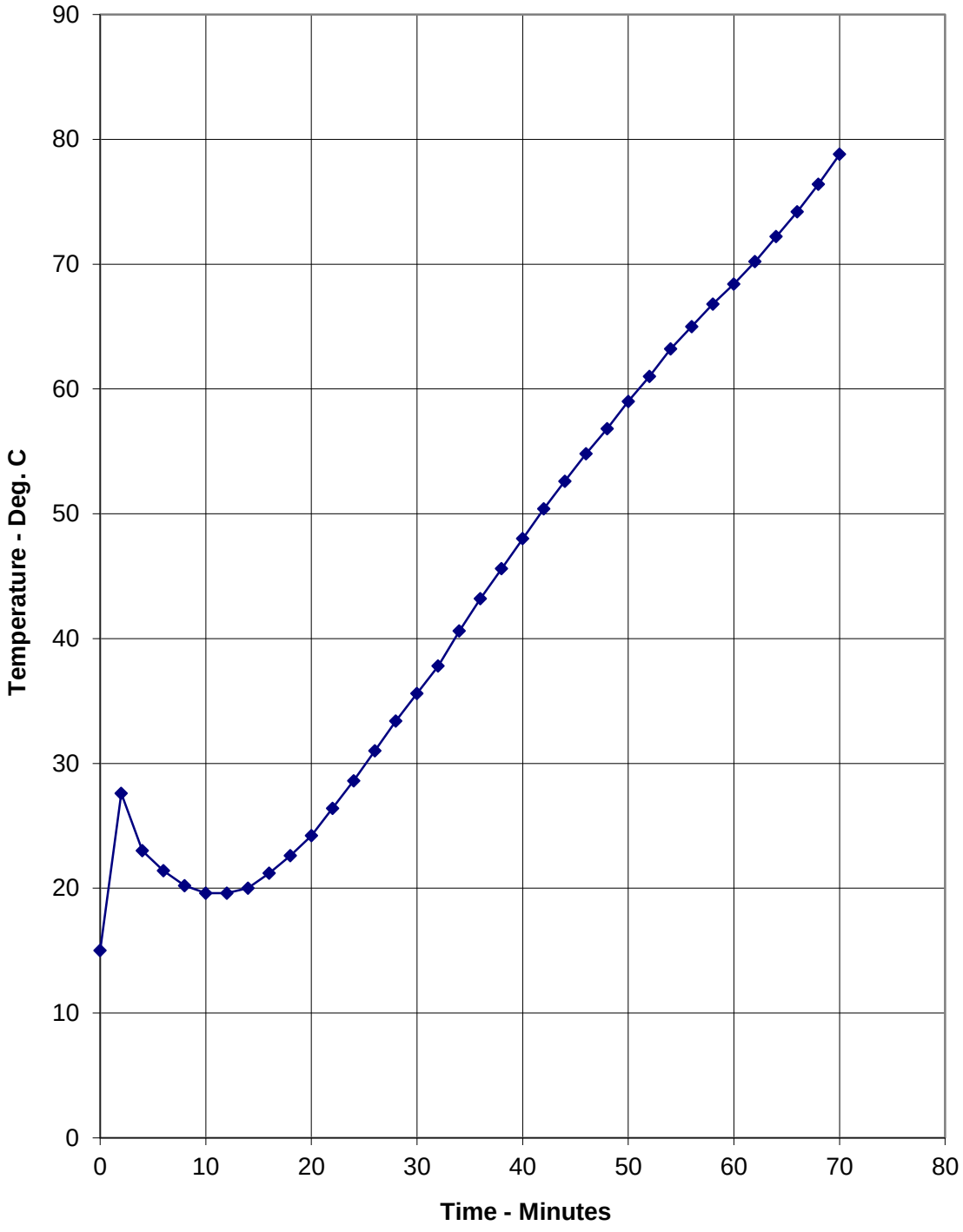
Graph showing mean furnace temperature, together with the temperature/time relationship specified in BS EN 1363-1: 2012



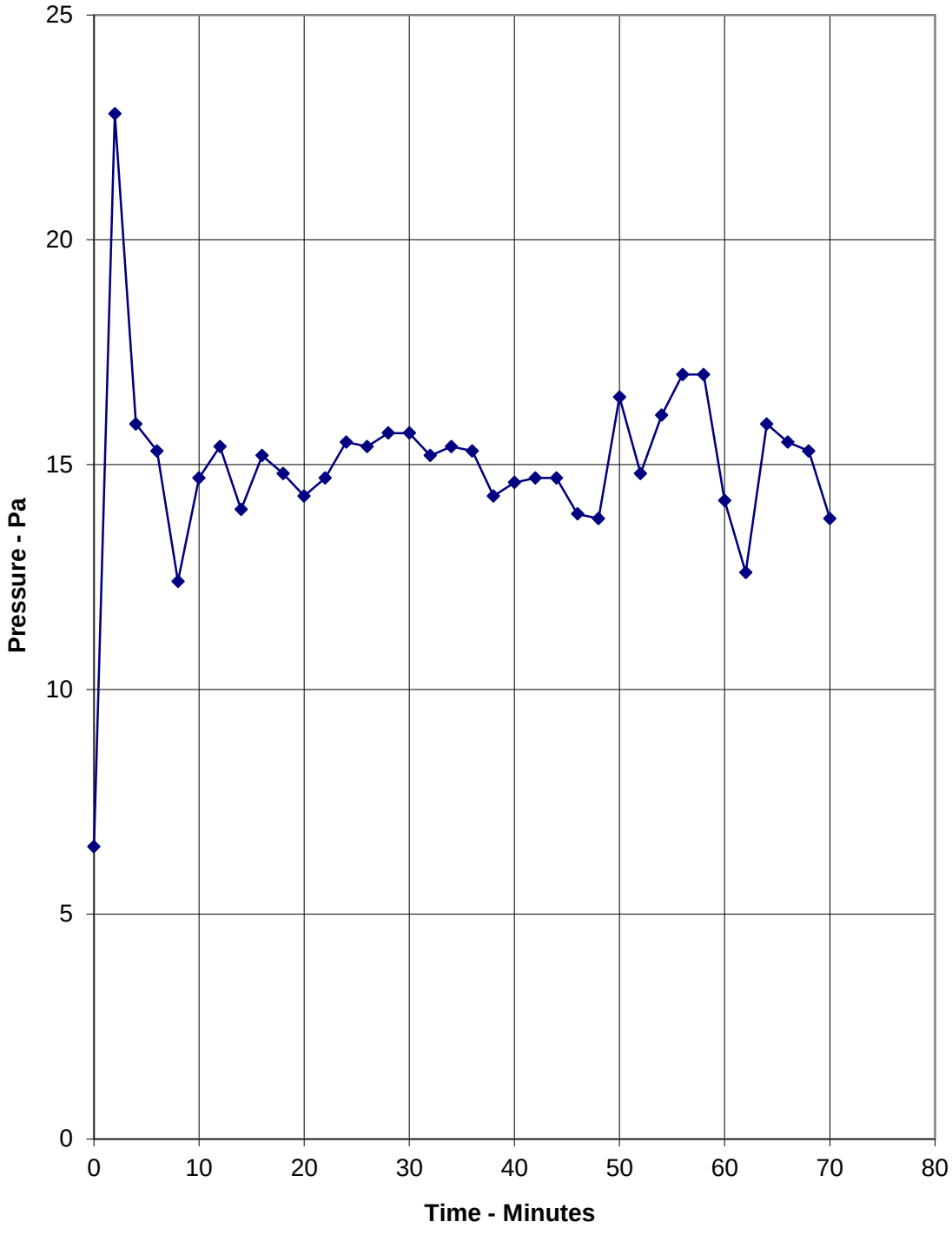
Graph showing mean temperatures recorded on the unexposed surface of Doorset A



Graph showing mean temperatures recorded on the unexposed surface of Doorset B



Graph showing recorded furnace pressure at the head of the Doorsets



Performance Criteria and Test Results

Integrity

It is required that the specimens retain their 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: 2014, or resulting in sustained flaming on the unexposed surface. **These requirements were satisfied for the periods shown below:**

	Doorset A	Doorset B
Sustained flaming	40 minutes	69 minutes
Gap gauge	40 minutes#	69 minutes#
Cotton pad	40 minutes#	69 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: 2014. **These requirements were satisfied for the periods shown below:**

Doorset	40 minutes#	69 minutes#
Time to Grille Closure	8 minutes, 50 seconds	8 minutes, 50 seconds

Test was discontinued after a period of 70 minutes.

The failure criteria of each specimen was measured after the air transfer grilles had sealed by the means of their intumescent properties.

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: 2012, 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: 2012, 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

Two specimens of a single-acting single-leaf doorset fitted with intumescent air transfer grilles have been subjected to a fire resistance test generally in accordance with BS EN 1634-1: 2014, 'Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows', BS EN 1363-1: 2012, General requirements and BS EN 1363-2: 1999, Alternative and additional procedures.

The evaluation of the doorsets against the requirements of BS EN 1634-1: 2014 showed that the doorsets satisfied the requirements for the following periods.

Test Results:		**Doorset A**	**Doorset B**
Integrity performance	Sustained flaming	40 minutes	69 minutes
	Gap gauge	40 minutes#	69 minutes#
	Cotton Pad	40 minutes#	69 minutes#
Insulation	Doorset	40 minutes#	69 minutes#
	Time to Grille Closure	8 minutes, 50 seconds	8 minutes, 50 seconds

Test was discontinued after a period of 70 minutes.

The failure criteria of each specimen was measured after the air transfer grilles had sealed by the means of their intumescent properties.

Field of Direct Application

General

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be applied automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

Materials And Constructions, General

Unless otherwise stated in the following text, the materials and construction of the doorset or openable window shall be the same as that tested. The number of leaves and the mode of operation (e.g. sliding, single action or double action) shall not be changed.

Specific Restrictions On Materials And Construction

The thickness of the door panel(s) shall not be reduced but may be increased.

The door panel thickness and/or density may be increased provided the total increase in weight is not greater than 25 %.

For timber based board products (e.g. particle board, blockboard, etc), the composition (e.g. type of resin) shall not change from that tested. The density shall not be reduced but may be increased.

The cross-sectional dimensions and/or the density of the timber frames (including rebates) shall not be reduced but may be increased.

Glazed Constructions

The type of glass and the edge fixing technique, including type and number of fixings per metre of perimeter, shall not be changed from those tested.

The number of glazed apertures and each of the dimensions (width and height) of glass in each pane included within a test specimen may be:

— decreased in proportion with size reductions; or

— decreased by a maximum of 25 % for integrity only and/or radiation control constructions and for insulation specimens where the unexposed surface temperature for both the construction and the glazing have been maintained for the classification period; or

— reduced for doorsets, without restriction, providing that the total area of the tested pane(s) is less than 15 % of the door leaf or side/over panel area.

The number of glazed apertures and each of the dimensions of glass in each pane included within a test specimen shall not be increased.

The distance between the edge of glazing and the perimeter of the door leaf, or the distance between glazed apertures shall not be reduced from those incorporated in test specimens. Other positioning within the door can only be modified if this does not involve the removal or re-positioning of structural members relative to the glazing.

Decorative Finishes (Paint)

Where the paint finish is not expected to contribute to the fire resistance of the door, alternative paints are acceptable and may be added to door leaves or frames for which unfinished test specimens were tested. Where the paint finish contributes to the fire resistance of the door (e.g. intumescent paints) then no change shall be permitted.

Decorative Finishes (Laminates)

Decorative laminates and timber veneers up to 1,5 mm thickness may be added to the faces (but not the edges) of doors that satisfy the insulation criteria (normal or supplementary procedure).

Decorative laminates and timber veneers applied to door leaves that do not satisfy the insulation criteria (normal or supplementary procedure) and/or those in excess of 1,5 mm thickness shall be tested as part of the test specimen. For all doorsets tested with decorative laminate faces, the only variations possible shall be within similar types and thicknesses of material (e.g. for colour, pattern, supplier).

Fixings

The number of fixings per unit length used to attach doorsets to supporting constructions may be increased, but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

Building Hardware

The number of hinges and dog bolts may be increased but shall not be decreased.

NOTE 1 The number of movement restrictors such as locks and latches is not covered by direct application.

Where a doorset has been tested with a door closing device fitted, but with the retention force released in accordance with 10.1.4, the doorset may be provided either with or without that closing device, i.e. where self closing characteristics are not required.

NOTE 2 Interchange of building hardware is not covered by the field of direct application.

Permissible Size Variations

Doorsets of sizes different from those of tested specimens are permitted within certain limitations, but the variations are dependent on product type and the length of time that the performance criteria are fulfilled.

The increase and decrease of dimensions permitted by the field of direct application are applicable to the overall size and to each door leaf, each side panel and each over panel independently.

In accordance with 13.2.2.3, the dimensions (width and height) of any glass pane cannot be increased.

Test periods

The amount of variation of size permitted is dependent on whether the classification time was just reached (Category 'A') or whether an extended time (Category 'B') in accordance with the values shown in Table 1 were fulfilled before the test was concluded.

For category 'B':

Table 1 — Category B overrun requirements

Classification time (min)	All performance criteria fulfilled for at least minutes
15	18
20	24
30	36
45	52
60	68
90	100
120	132
180	196
240	260

Size variation related to product type

The rules to cover increase or decrease of size without additional considerations are applicable only to six main product groups:

a) hinged and pivoted doorsets and openable windows;

General

b) horizontally sliding and vertically sliding doorsets including sectional doorsets;

c) steel single skin folding shutters doorsets (uninsulated);

d) other sliding and folding doorsets (insulated);

e) rolling shutter doorsets;

f) openable fabric curtains.

No increases in size are permitted for doorsets which are required to satisfy radiation control levels unless the insulation criteria are also satisfied. This is because any increase in size will increase the radiation received at a fixed distance away from the door. There are calculation methods which can be used to determine acceptable size increases for such doors; however, these are beyond the scope of direct application. Doors that satisfy both the radiation control levels and insulation criteria may have their sizes increased as outlined in Annex B. This is accepted because the increase in radiation resulting from a size increase allowed under this section, for an insulated door, will be such that it will still satisfy the required radiation control levels. Size decreases are permitted for both doors which satisfy radiation control levels and those which satisfy insulation criteria and radiation control levels.

Permissible variations for each product group are detailed in Annex B which also contains some examples relating to hinged/pivoted doorsets.

Size increases for doorsets which do not fall into one of the six groups given above are the subject of extended application.

Hinged and pivoted doorsets and openable windows

For Category 'A' tests with no overrun of classification period, no increase is allowed. Unlimited reductions from the tested specimen are permitted with the exception of insulated metal doors where the size reduction is limited.

For Category 'B' tests (with specified overrun of classification period) all smaller sizes are permitted and increases in height and width are permitted as stated in Annex B.

Other changes

For smaller doorset sizes the relative positioning of movement restrictors (e.g. hinges and latches) shall remain the same as tested or any change to the distances between them will be limited to the same percentage reduction as the decrease of test specimen size.

For larger doorset sizes the following shall also apply:

a) the height of the latch above floor level shall be equal to or greater than the tested height, and such increase in height shall be at least proportional to the increase in door height;

b) the distance of the top hinge from the top of door leaf shall be equal to or less than that tested;

c) the distance of the bottom hinge from bottom of door leaf shall be equal to or less than that tested;

d) where three hinges or distortion preventers are used, the distance between the bottom of the door leaf and centre restraint shall be equal to or greater than that tested.

Timber Constructions

The number, size, location and orientation of any joints in the timber framing shall not be changed.

Where decorative veneers of 1,5 mm or greater thickness, or other claddings which themselves provide constructive benefits, are part of the test specimen, they shall not be substituted with alternatives of lesser thickness or strength.

Gaps

The maximum size of the primary gaps identified in 7.3 is restricted to the following sizes in practice:

$$x = (a + b)/2 + 2 \text{ mm}$$

where

x is the maximum permitted gap size;

a is the maximum measured gap size;

b is the mean measured gap size.

The minimum size of the primary gaps may be reduced.

The permitted gap size may be different for different parts of the door or window.

Asymmetrical assemblies

EN 1363-1 states that for separating elements required to be fire resisting from both sides, two test specimens shall be tested (one from each direction) unless the element is fully symmetrical, i.e. the construction of the doorset is identical on both sides of the centre line when viewed in plan (from above). However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical door assembly tested in one direction can apply when the fire exposure is from the other direction. The possibility to develop such rules increases if the consideration is limited to certain types of door assembly and on the criteria being applicable (e.g. integrity only doors). The following rules represent the minimum level of common agreement which shall be followed. The rationale behind the rules is given in Annex C.

Specific Rules

The rules governing the applicability of tests carried out in one direction to other directions are given in Table 2 and are based on the following premises:

— that each of the door leaves are themselves of symmetrical construction with the exception of the edges (e.g. lock/leading edge and hinge edge or double rebated doors);

— that any restraining/supporting elements of building hardware has been included in a test to EN 1634-1 when exposed in both directions so that they will retain their function when exposed to the heat of the test;

— that there is no change in the number of leaves or the mode of operation (e.g. sliding, swinging, single action or double action);

— that side, over and transom panels are excluded from Table 2 unless they are fully symmetrical.

Table 2 lists the type of door assembly for which rules can be generated and gives the direction in which it should be tested to cover the opposite direction. The separate columns for the integrity and insulation criteria reflect the different ability to make rules for integrity only doors as opposed to those which satisfy both criteria. A 'Yes' means that it is possible to identify the direction of test which covers the opposite direction. A 'No' indicates that it is not possible to identify the direction which will cover the opposite direction.

Table 2 — Type of doorset and direction to be tested to cover the opposite direction

Type of doorset	Direction to be tested to cover opposite direction	Integrity	Insulation	Radiation
Hinged or pivoted, timber leaf, timber frame	Opening into the furnace	yes	yes	yes
Hinged or pivoted, timber leaf, metal frame (no transom)	Opening into the furnace	yes	no	yes
Hinged, metal leaf, metal frame (not pivoted)	Opening away from Furnace	yes	no	yes
Rolling shutter	Barrel and supporting components fixed on the face of the supporting wall on the fire side	yes	no	no
Sliding/folding	Sliding/folding supporting components fixed on the face of the supporting wall on the fire side	yes	no	no
Operable fabric curtains	Not possible to define a scenario			
[a] This only applies to doors without insulation in the core and with a movement restrictor at approximately mid-height on the hinge side.				

Supporting Constructions

The fire resistance of a door assembly tested in one form of standard supporting construction may or may not apply when it is mounted in other types of construction. Generally, the rigid and flexible types are not interchangeable and rules governing the direct application within each group are given in 13.5.2 to 13.5.4. However, in some cases it is possible for the result of a test on a particular type of door assembly tested in one form of standard supporting construction to be applicable to that door assembly when mounted in a different type of standard supporting construction. Specific rules governing the situation for hinged and pivoted door assemblies are given in 13.5.4. The rationale behind the rules is given in Annex C.

Rigid standard supporting constructions (high or low density)

The fire resistance of a doorset tested in a high or low density rigid standard supporting construction as specified in EN 1363-1 can be applied to a doorset mounted in the same manner in a wall provided the density and the thickness of the wall are equal to or greater than that in which the doorset was tested.

Specific rules for hinged or pivoted doorsets

a) For timber door leaves hung in timber frames, the result of a test in a rigid standard supporting construction is applicable to that door assembly mounted in a flexible construction.

b) For timber door leaves hung in timber frames, the result of a test in a flexible standard supporting construction is applicable to that door assembly mounted in a rigid construction.

c) For timber door leaves hung in metal frames, the result of a test in a flexible standard supporting construction is applicable to that door assembly mounted in a rigid construction but not vice versa.

d) For insulated metal door leaves hung in metal frames, there is no applicability of results in rigid standard supporting construction to flexible constructions or vice versa; to cover rigid and flexible types, tests shall be undertaken in each type of standard supporting construction.

e) For uninsulated metal doors, the result of a test in a rigid standard supporting construction is applicable to that door assembly mounted in a flexible construction, but not vice versa.

The rules above assume that the fixing methods used in each type of supporting construction are appropriate to that construction. Thus for example in a), the test on the timber door leaf in a timber frame will have been carried out with appropriate fixings for timber frames in rigid constructions. The result is applicable to a timber door leaf in a timber frame mounted into a flexible construction with appropriate fixings for timber frames in flexible constructions.