Exova Warringtonfire
Chiltern House
Stocking Lane
Hughenden Valley
High Wycombe
Buckinghamshire
HP14 4ND

T: +44 (0) 1494 569 800
F: +44 (0) 1494 564 895
E: globalfire@exova.com
W: www.exova.com

Testing, calibrating, advising.

Title:

The fire resistance performance of two single leaf single acting doorsets with glazing, when tested in accordance with BS 476: Part 20/22: 1987

WF Report No:

391843

Prepared for:

Falcon Panel Products Ltd

Clock House
Station Approach
Shepperton
Middlesex
TW17 8AN

Test date:

11th November 2017

1762

Contents

Page No

Summary of Performance 3
1 Introduction 4
2 Specification 4
2.1 Door leaves 4
2.2 Door perimeter gaps 4
2.3 Closer forces 4
3 Description of Construction 5
4 Test Conditions 10
5 Test results 11
5.1 Furnace Temperature Curve 11
5.2 Unexposed Face Temperature Curves 11
5.3 Door Distortion Data 13
5.4 Observations 15
5.5 Times to Failure 15
6 Limitations 18
Photographs 19
Appendix - Figures 1 to 4 24

Summary of Performance

The following performance was achieved from the specimens tested. Full details of the testing and specimen construction are described in the report.

Results:

Fire resistance test in accordance with BS476: Part 20/22: 1987

Times to failure:

	Doorset A	Doorset B
Integrity	**51 (fifty one) minutes**	**47 (forty seven) minutes**
Insulation	**36 (thirty six) minutes**	**39 (thirty nine) minutes**

Summary of specimens:

Two latched, glazed single leaf single acting doorsets, both hung opening in towards the furnace

Leaf size: –

Doorset A:
2235mm high x
1050mm wide x
44mm thick

Doorset B:
2140mm high x
916mm wide x
44mm thick

1 Introduction

The doorsets were manufactured and supplied for test by the client and delivered during November 2017. Exova Warringtonfire constructed a plasterboard clad timber stud supporting construction and installed the specimens into the wall.

2 Specification

Details of the specimens are shown in the Appendix.

2.1 Door leaf

The left doorset was designated doorset A and the leaf measured 2235mm high x 1050mm wide x 44mm thick. The right doorset was designated doorset B and the leaf measured 2140mm high x 916mm wide x 44mm thick. The doorsets were hung to open in towards the furnace. The results of this test were obtained from doorsets fitted with a latch which was engaged for the test.

2.2 Door perimeter gaps

The gaps between the edge of the door and frame were measured prior to test. A total of 24 readings were taken. The measurements (in mm) are given in Figure 4 of the Appendix.

2.3 Closer forces

Measured in accordance with FTSG Resolution No 63.

	Opening force (Nm)	Closing force (Nm)
Doorset A	10	7
Doorset B	12	7

3 Description of Construction (Refers to Figures 1 to 4 of the Appendix)

Leaf – doorset A - identified as being produced from a Falcon Panel Products Strebord door blank

		Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails		None fitted	-	-	-	-
Core		Falcon Panel Products Ltd Strebord particleboard	44 thick	540-660*	7.9	1
Facings		None fitted	-	-	-	-
Adhesive	Lippings	Norbond CaberFix D4 Polyurethane*	-	-	-	-
Lippings – closing edge		Sapele	18 thick	640**	9.3	2
Lippings – hanging edge, head and leaf bottom edge		Sapele	6 thick	640**	9.3	3

* Stated by client, not verified by laboratory ** Nominal density – TRADA Timber database

Leaf – doorset B - identified as being produced from a Falcon Panel Products Stredor door blank

		Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails		None fitted	-	-	-	-
Core	Inner	Poplar Ply Core*	2.1 thick*	510*	-	4
	Outer	Vertically orientated butt jointed spruce lamels*	18 thick x 28 - 30 wide	480*	-	5
Facings	Inner	Cross grain poplar*	1.4 thick*	510*	-	6
	Outer	Beech veneer*	0.6 thick*	640*	9.8	7
Adhesive	Lippings	Norbond CaberFix D4 Polyurethane*	-	-	-	-
	Core	PVAc-D2* – Glue Reference held on file by Exova Warringtonfire	-	-	-	-
	Facings	MUF* – Glue Reference held on file by Exova Warringtonfire	-	-	-	-
Lippings – all edges		Sapele	6 thick	640**	9.4	8

* Stated by client, not verified by laboratory ** Nominal density – TRADA Timber database

Door frame – both doorsets

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Head and jambs	European Redwood	44 wide x 100 deep including a 52 deep x 15 wide integral stop	510**	9.8-10.2	9
Stop – integral	-	-	-	-	-
Head to jamb jointing detail	Half-lapped and screwed using 2No. 80mm long steel wood screws per jamb*	-	-	-	-
Frame to supporting construction fire stopping detail	Sealed Tight Solutions ST88 intumescent acrylic mastic applied to both faces leaving a void between the mastic beads	12.5 wide x nominally 10-15 deep to each face	-	-	-
Frame to supporting construction fixing detail	4No. steel screws per jamb	5Ø x 100 long	-	-	-
Architrave	European Redwood fitted on both faces	45 wide x 18 thick on exposed face 35 wide x 18 thick on unexposed face	510**	10.4	-
Threshold	Non combustible	-	-	-	-

* Stated by client, not verified by laboratory ** Nominal density – TRADA Timber database

Intumescent and sealing materials – Both doorsets

	Make/type	Size (mm)	Location	Key to figures
Leaf edge	None fitted	-	-	-
Frame reveal – head and jambs	2No. Sealed Tight Solutions STS 104FO	10 x 4	Fitted 8mm apart, 8mm from the exposed face in the frame reveal	10
Glazing perimeter	Sealed Tight Solutions STS 105GT-3-DS*	10 x 3*	Fitted between the glass and bead on both faces	11

* Stated by client, not verified by laboratory

Intumescent interruptions and additional hardware protection – both doorsets

	Make/type	Size (mm)	Location
Around hinge blade	Fully interrupted	-	Hinge blade fully interrupts both seals in frame reveal
Under hinge blades	None fitted	-	-
Around closer reaction plate	Fully interrupted	-	Closer reaction plate fully interrupts both seals in frame reveal
Under closer reaction plate	None fitted	-	-
Encasing centre latch body only	Sealed Tight Solutions Ltd raw Graphite	1 thick	Fitted fully covering each of the cheeks of the centre latch body
Encasing top and bottom hook bolt bodies	European Redwood	1.8 thick	Fitted fully covering each of the cheeks of the top and bottom hook bolts bodies*
Under latch forend	None fitted	-	-
Around latch keeps	Fully interrupted	-	Latch keeps fully interrupts both seals in frame reveal
Under latch keeps	Sealed Tight Solutions Ltd raw Graphite	1 thick	Fitted under the top, bottom and centre keeps

*The rebate for the hook bolt bodies was routed wider than required and infilled using European Redwood which was laminated to each side of the cheeks of the hook bolt body.

Hardware – both doorsets

	Make/type	Size (mm)	Location	Key to figures
Hinges	3No. Royde and Tucker, steel Hi-Load 101 lift off type hinge fixed with 5No. 32mm long wood screws per blade	100 x 35 (blade size)	Doorset A - fitted 140mm, 1050mm and 1956mm from the head of the leaf	12
			Doorset B - fitted 150mm, 1005mm and 1860mm from the head of the leaf	13
Closer	Astra 4000 series* jamb fitted concealed closer	110 x 32 (forend size) 264 x Ø32 (body size)	Doorset A fitted at 1175mm from the leaf head	14
			Doorset B fitted at 1130mm from the leaf head	15
Latch – engaged at all three locations	ERA Surefire MPL DLSF-609-45-85*	1630 x 20 (forend size)	Latch nib fitted 1035mm from the bottom of the leaf	16
		185 x 25 (centre keep size)		
		150 x 25 (top and bottom keep size)	Fitted 287mm and 1683mm from the leaf bottom to the centre of each hook bolt keep	17
Furniture	Fab & Fix Balmoral lever type handle Hardex coated Zinc*	245 x 30 (footprint)	Fitted appropriate to the latch	18
Cylinder	ERA 3* Fortress 70mm BS-FOR-3535-DC-1*	-	Fitted appropriate to the latch	-

* Stated by client, not verified by laboratory

Glazing – both doorsets

	Make/type	Size (mm)	Location	Key to figures
Glass type	AGC Flat Glass - Pyrobelite	12 thick	Doorset A - fitted 240mm from the leaf head, 400mm from the closing edge Doorset B - fitted 230mm from the leaf head, 334mm from the closing edge	19
Glass size	-	778 high x 228 wide	-	-
Sight size	-	755 high x 206 wide	-	-
Aperture size	-	784 high x 234 wide*	-	-
Glazing Liner – Doorset A only*	Sapele*	6 thick*	Fitted lining the glazing aperture of doorset A only*	22
Expansion allowance	-	3 all round	-	-
Beading	Profiled Sapele (640kg/m^3 density, 9.4-11.3% m.c.)	22 high x 21 deep including an 8 x 7 bolection return and a 16° chamfer	Fitted around the glazing aperture on both faces	20
Beading fixings	Steel pins	40 long	Doorset A - Fitted 7mm from corners at 150mm centres at 35° to the face of the glass Doorset B - Fitted 17mm from corners at 150mm centres at 35° to the face of the glass	21

* Stated by client, not verified by laboratory

4 Test Conditions

Where areas of the test specification are ambiguous or open to interpretation the Fire Test Study Group Resolutions No's 51, 63, 70, 71, 72 and 78 have been followed (further specific details are available on request). These Resolutions provide basis of common agreements between the fire test laboratories which are members of this Group.

The ambient temperature of the test area at commencement of test was 10°C.

After the first 5 minutes of the test, the furnace pressure was maintained at -4.25 ± 2 Pa with respect to atmosphere, at a point 0.5m from the notional floor level, equating to 0Pa at a point 1m above the notional floor level.

The furnace was controlled to follow the temperature/time relationship specified in BS 476: Part 20: 1987 as closely as possible, using the average of nine thermocouples suitably distributed within the furnace. The temperatures recorded are shown graphically in Section 5.1.

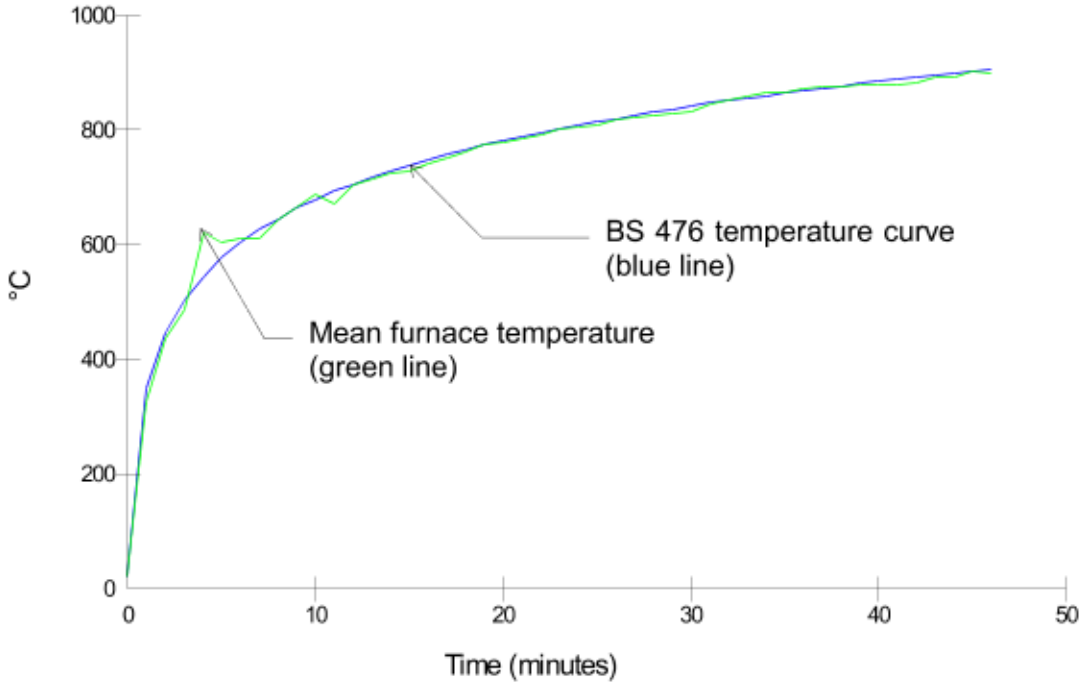
The temperature of the unexposed face of both doorsets was monitored by means of five thermocouples fixed to the surface of the door leaf, and three thermocouples attached to the frame, one at midheight on each jamb and one centrally located above the leaf on the frame head. Two additional thermocouples were attached to the glazing.

The thermocouple positions are shown in Figure 4 of the appendix. The average temperature of the door leaves and maximum temperature of the doorsets are shown graphically in Section 5.2.

5 Test results

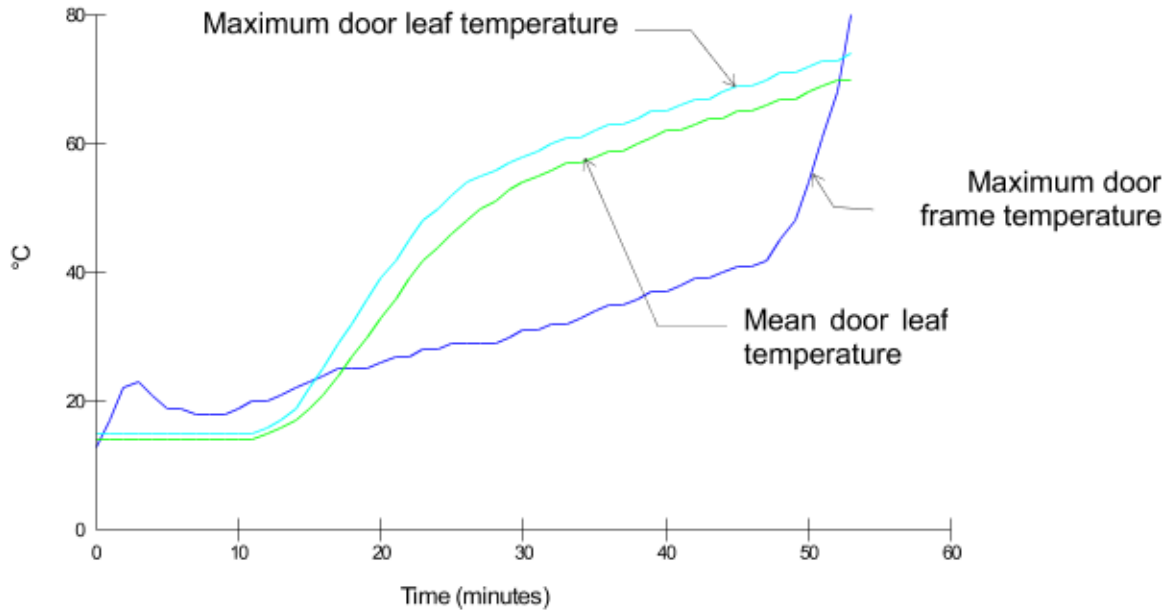
The following data and observations were recorded during the test.

5.1 Furnace Temperature Curve

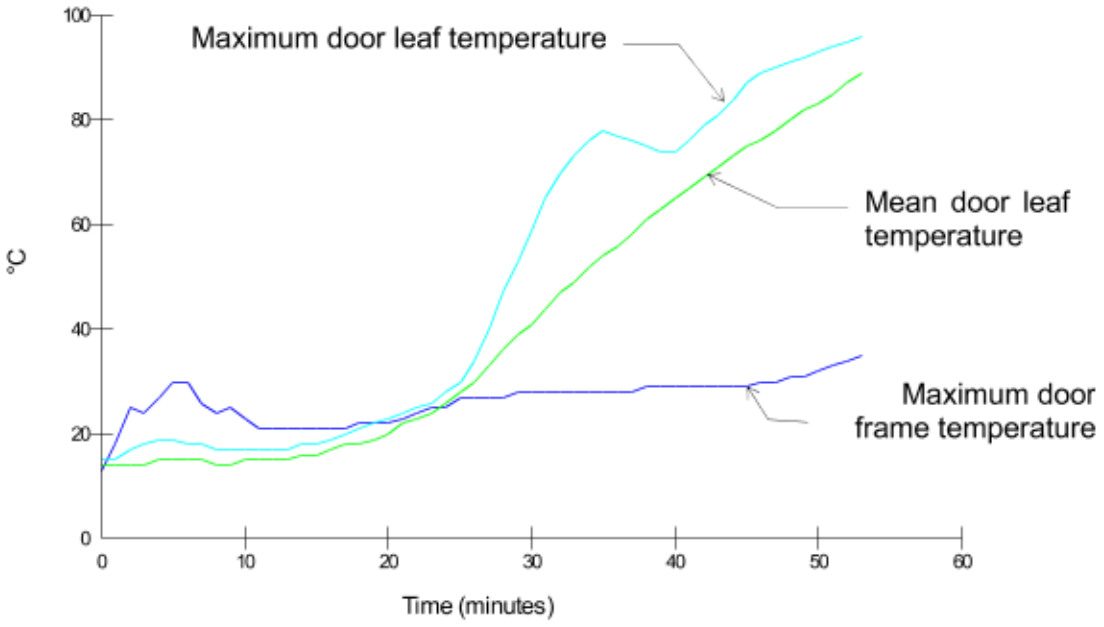


5.2 Unexposed Face Temperature Curves

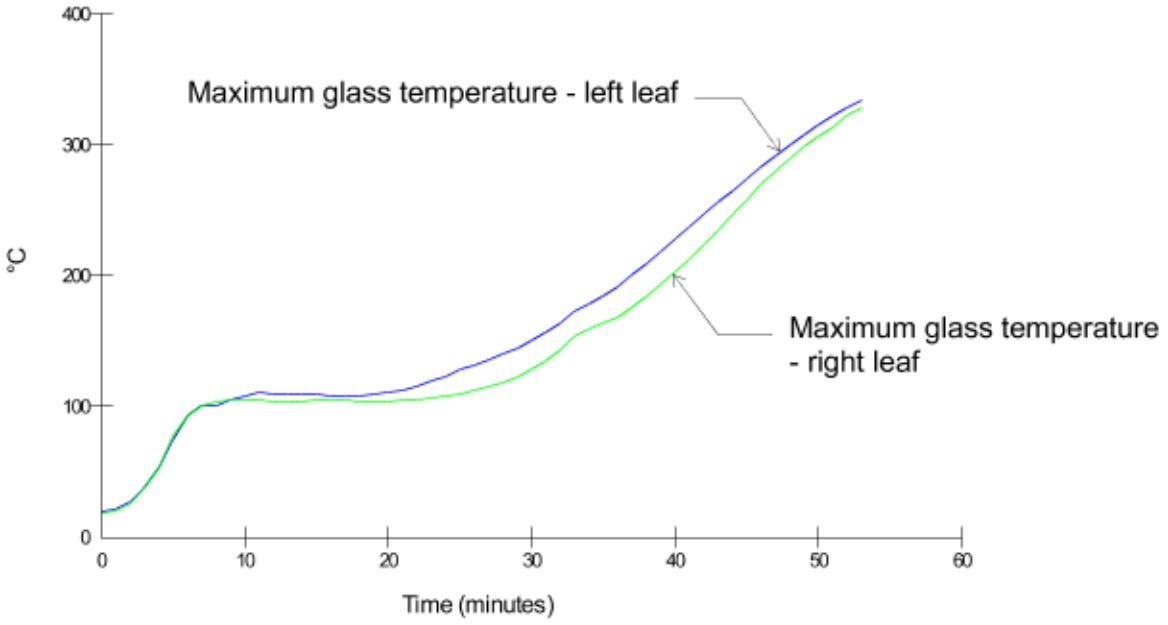
Doorset A



Doorset B

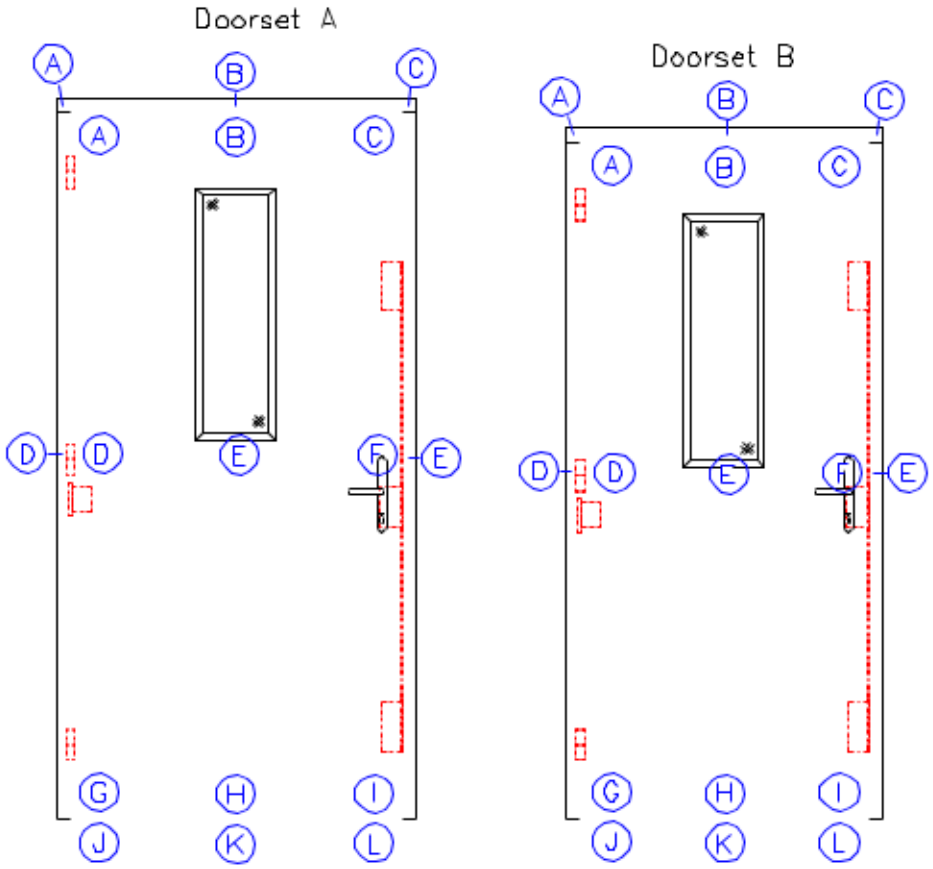


Glazing – Both Doorsets



5.3 Door leaf and frame distortion data

The following tables show the distortion of the door in mm with an accuracy of ±1mm.
A positive measurement indicates distortion towards the furnace.
A negative measurement indicates distortion away from the furnace.
J, K and L give vertical movement of the door, a negative reading indicates that the door has dropped.



Doorset A - leaf (hung on the left and opening in towards the furnace)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	2	0	6	0	-5	-1	1	-1	1	-1	-1	-2
20	5	-1	10	-2	-11	-2	1	-4	0	-1	-2	-2
30	9	-2	11	-4	-20	-3	2	-6	-1	-1	-2	-2
40	9	-3	14	-5	-21	-6	2	-9	-1	-2	-2	-2

Doorset A – frame

Time	A	B	C	D	E
10	0	2	2	-1	2
20	1	2	2	-1	1
30	0	2	2	-1	1
40	1	2	2	-1	1
50	-	1	2	-2	-1

Doorset B - leaf (hung on the left and opening in towards the furnace)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	4	5	4	0	1	0	0	2	0	-1	-2	-2
20	6	7	6	-1	-1	-3	2	5	4	-1	-3	-2
30	8	4	8	-2	-7	-4	3	4	5	-2	-3	-3
40	10	5	12	-3	-9	-4	6	5	5	-2	-3	-3

Doorset B – frame

Time	A	B	C	D	E
10	3	2	2	1	0
20	2	2	3	0	1
30	2	2	2	0	1
40	2	2	2	0	0

Where a dash (-) applies, a distortion measurement could not be taken

5.4 Observations

All comments relate to the unexposed face unless otherwise specified.

Time (minutes)	Comments
00:00	Test started
00:57	A, there is smoke issuing from the top half perimeter door gaps.
01:10	B, there is smoke issuing from the top half perimeter door gaps.
02:00	A and B, the glazing is starting to crack.
02:37	A and B, there is smoke issuing from the latch position.
03:20	A and B, there is increasing smoke issuing at the top half perimeter door gaps.
03:46	A and B, the glazing is starting to react at the top half.
04:55	A and B, the glazing has fully reacted.
05:24	B, there is discolouration to the leaf at the top hinge position, middle hinge position, and latch, also the top latch position.
05:40	A, there is discolouration to the leaf at the top hinge position.
06:30	B, there is discolouration to the head of the leaf.
06:53	The smoke issuing has reduced at all the previously mentioned positions
08:54	A, there is smoke issuing from the middle hinge position.
09:35	A, there is smoke issuing through the cracks in the glazing.
10:30	A, there is discolouration to the closing edge.
11:19	A, there is discolouration to the top hanging corner.
12:15	A, there is discolouration to the middle hinge position.
13:20	B, there is increasing smoke issuing and further discolouration to the head.
14:06	A and B, there is discolouration to the glazing.
14:56	A, there is discolouration to the leaf above the glazing.
17:00	A, there is increasing smoke issuing from the top half perimeter door gaps.
17:30	B, there is smoke issuing through the cracks in the glazing.
19:20	A, there is discolouration to the head approximately 200mm from the top closing corner.

20:20	B, there is further discolouration to the top half perimeter.
21:35	A, there is discolouration at the latch position.
22:05	A and B, there is discolouration to the frame head above the top hanging corner.
24:27	A, there is charring to the leaf at the top hinge position.
26:30	A, there is a glow visible at the top hinge position.
27:00	B, there is charring to the leaf at the top hinge position.
28:26	B, there is a glow at the top hinge position.
29:28	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
30:16	B, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
31:00	The unexposed face intumescent around the glazing is starting to react.
33:26	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
34:17	A, there is increasing smoke issuing at the latch position.
35:20	A and B, there is increasing smoke issuing through the cracks in the glazing.
36:30	B, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
37:20	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
38:11	B, there is charring to the leaf at the top latch position.
38:47	B, there is a glow visible at the middle hinge position.
39:20	B, there is charring to the middle hinge position.
39:30	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
39:58	B, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
41:38	B, a cotton pad integrity test was performed at the middle hinge position which did not result in the ignition of the cotton pad. No failure.
42:42	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.

43:00	B, there is a glow visible at the top closing corner.
43:50	A and B, there is increasing smoke issuing from the perimeter of the glazing.
44:20	There is a glow visible at the top hanging corner of both doorsets.
44:53	B, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
45:31	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
46:00	B, there is intermittent flaming at the bottom hinge position.
46:35	B, a cotton pad integrity test was performed at the bottom hinge position which did not result in the ignition of the cotton pad. No failure.
47:09	B, a cotton pad integrity test was performed at bottom hinge position which did not result in the ignition of the cotton pad. No failure.
47:24	B, a cotton pad integrity test was performed at the bottom hinge position which resulted in the ignition of the cotton pad thereby constituting **integrity failure.**
48:23	A, a cotton pad integrity test was performed at the top hinge position which did not result in the ignition of the cotton pad. No failure.
49:00	B, there is continuous flaming at the bottom hinge position thereby constituting **further integrity failure**.
50:00	A, a cotton pad integrity test was performed at the top hanging corner which did not result in the ignition of the cotton pad. No failure.
50:20	B, a cotton pad integrity test was performed at the top closing corner which did result in the ignition of the cotton pad thereby constituting **further integrity failure**.
51:05	A, there is a glow visible at the top closing corner.
51:16	B, there is intermittent flaming at the bottom latch.
51:21	A, a cotton pad integrity test was performed at the top closing corner which did not result in the ignition of the cotton pad. No failure.
51:40	A, there is continuous flaming at the top hinge position thereby constituting **integrity failure**.
51:50	A, there is continuous flaming at the bottom hinge position thereby constituting **further integrity failure.**
53:16	Test terminated.

5.5 Times to Failure

When tested in accordance with BS 476: Part 22: 1987, Method 6, determination of fire resistance of insulated doorsets and shutter assemblies, the requirements of the standards were satisfied for the following periods:

	Doorset A	Doorset B
Integrity	**51 (fifty one) minutes**	**47 (forty seven) minutes**
Insulation	**36 (thirty six) minutes**	**39 (thirty nine) minutes**

6 Limitations

The results only relate to the behaviour of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

The results of this test were obtained using the door to frame gaps recorded in Figure 4 of the appendix. The fire resistance performance of doors of this design may change if substantially different gaps are employed.

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 5 years old should be considered by the user. Exova Warringtonfire 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.

	Written and checked by:	**Authorised by:**
Signature:		
Name:	Nikolas Whitelock	Jonathan Osborn
Title:	Lead Technical Officer	Technical Director
Date of issue:	09/04/2018	09/04/2018

Photographs

Intumescent interruptions by hardware – both doorsets

Around hinge blade – both doorsets

Around latch keeps – both doorsets

Around concealed closer – both doorsets

At start of test

After 10 minutes

At 20 minutes

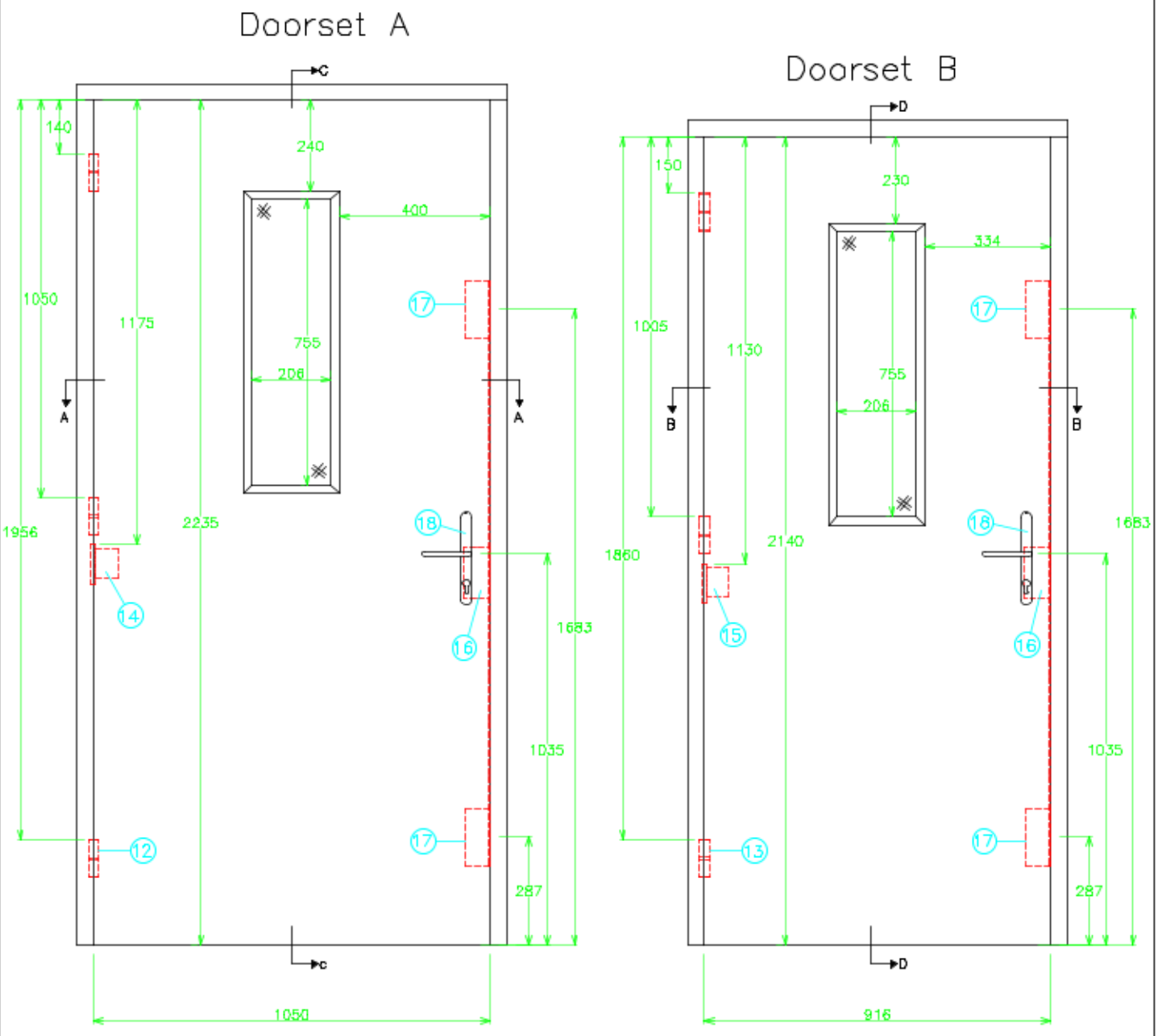
After 30 minutes

After 40 minutes

After 50 minutes

Exposed face – post test

Appendix - figures 1 to 4



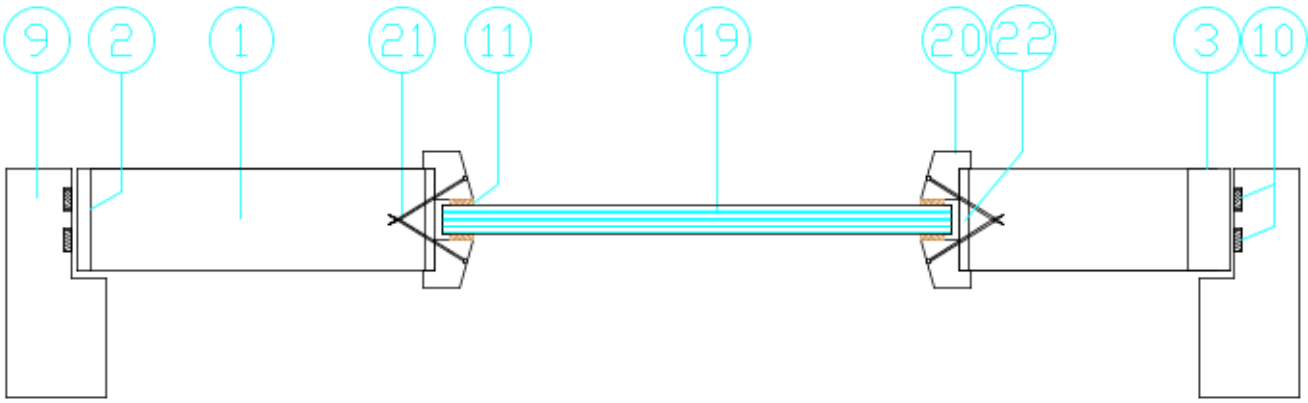
Exova Warringtonfire, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569800
Fax: +44 (0)1494 564895

Title: Unexposed face elevation showing hardware positions (All dimensions in mm)

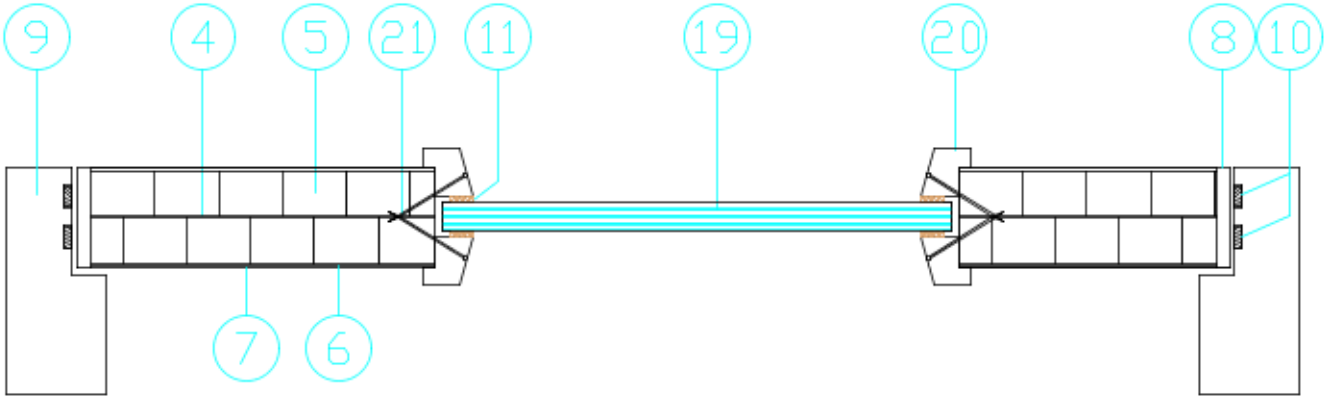
Date Drawn	Drawn By	Scale
17/11/17	ARD	NTS

Project No.	
WF 391843	Appendix

Section A–A



Section B–B



Exova Warringtonfire, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND, UK.

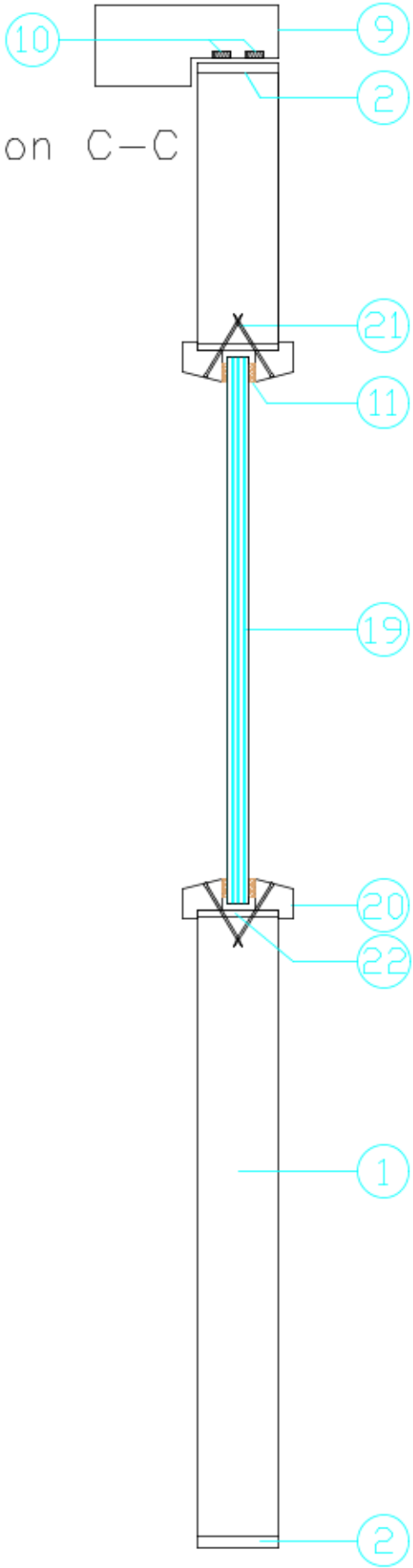
Tel: +44 (0)1494 569800
Fax: +44 (0)1494 564895

Title: Horizontal cross–sections
(All dimensions in mm)

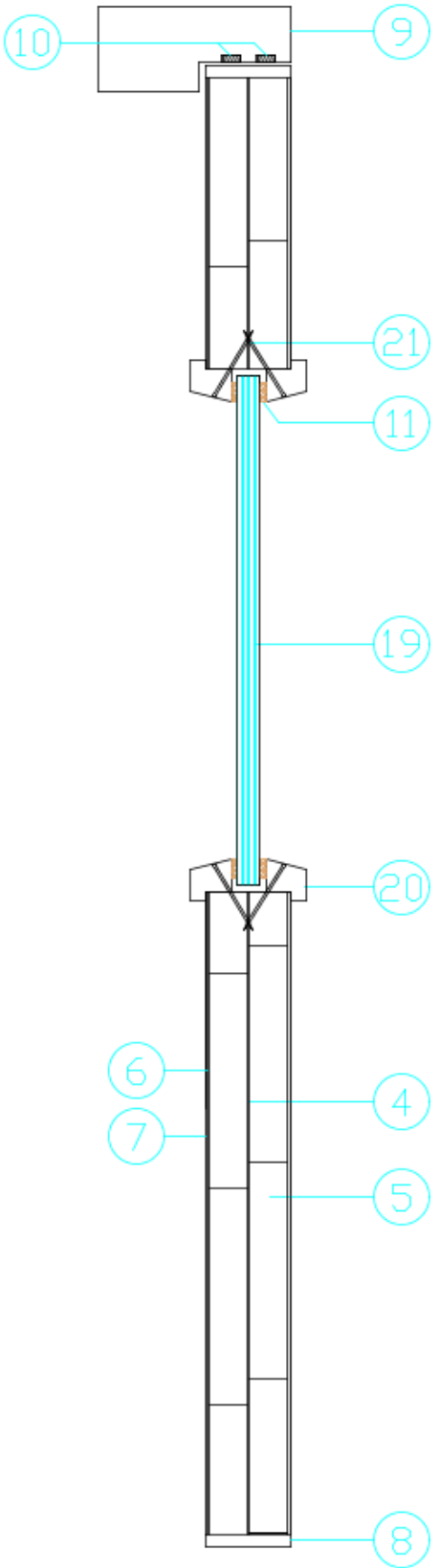
Date Drawn	Drawn By	Scale
17/11/17	ARD	NTS

Project No.	
WF 391843	Appendix

Section C–C



Section D–D

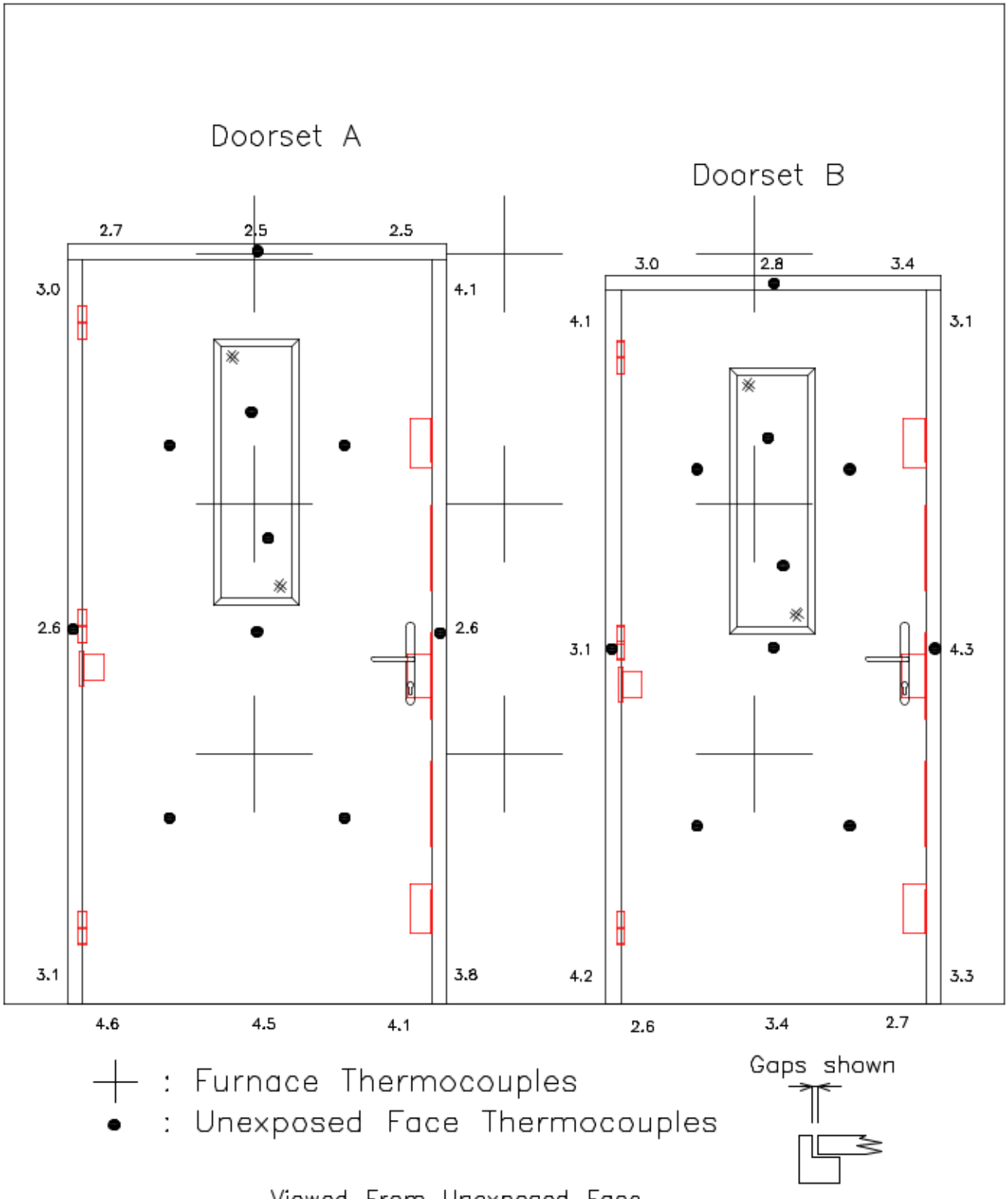


Exova Warringtonfire, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND, UK.

Tel: +44 (0)1494 569800
Fax: +44 (0)1494 564895

Title
Vertical cross–sections
(All dimensions in mm)

Date Drawn	Drawn By	Scale
17/11/17	ARD	NTS
Project No. WF 391843		Appendix



Exova Warringtonfire, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569800
Fax: +44 (0)1494 564895

Title: Thermocouple positions and leaf/frame gaps
(All dimensions in mm)

Date Drawn	Drawn By	Scale
17/11/17	ARD	NTS
Project No. WF 391843		Appendix