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Title:

The fire resistance performance of two single leaf single acting doorsets when tested in accordance with BSEN 1634-1: 2014 and BSEN 1363-1: 2012

WF Report No:
BMT/FEP/F14080 AR2

Prepared for:

Gianni Industries, Inc.

No. 13, Zhongxing Rd.
Tucheng Dist
New Taipei City 236
Taiwan

Test date:

19th May 2014

The details of the sponsor of test report BMT/FEP/F14080 are held on file by Warringtonfire. This report is additional to that issued as BMT/FEP/F14080 on the 13th June 2014. The original report shall remain valid and is not replaced by the additional report BMT/FEP/F14080 AR2.

1762

Page No

Contents

1 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 BSEN 1634-1: 2014 and BSEN 1363-1: 1999

Doorset A

Integrity	
Cotton pad	43 (forty three) minutes
Continuous flaming	43 (forty three) minutes
Gap gauges	54 (fifty four) minutes*
Insulation - 1 discrete area	
Discrete area - timber	
Average set	43 (forty three) minutes**
Maximum ≥ 100mm in from leaf edge	43 (forty three) minutes**
Door frame ≥ 180ºc temp rise	43 (forty three) minutes**
Door frame ≥ 360ºc temp rise	43 (forty three) minutes**
Radiation – time to 15kW/m^2	54 (fifty four) minutes*

* No failure of the test criteria had occurred at termination of the test on this specimen at 54 minutes
** Failure by virtue of integrity failure at 43 minutes

Doorset B

Integrity	
Cotton pad	57 (fifty seven) minutes***
Continuous flaming	68 (sixty eight) minutes
Gap gauges	70 (seventy) minutes*
Insulation – discrete area	
Discrete area - timber	
Average set	57 (fifty seven) minutes**
Maximum ≥ 100mm in from leaf edge	57 (fifty seven) minutes**
Door frame ≥ 180ºc temp rise	57 (fifty seven) minutes**
Door frame ≥ 360ºc temp rise	57 (fifty seven) minutes**
Radiation – time to 15kW/m^2	70 (seventy) minutes*

* No failure of the test criteria had occurred at termination of the test at 70 minutes
** Failure by virtue of integrity failure at 57 minutes
*** Failure via bottom latch of the doorset. No further failures witnessed until 68 minutes

Summary of specimens:

Two latched single leaf single acting doorsets

Leaf size: doorset A -
2133mm high x 930mm wide x 44mm thick

Doorset B -
2135mm high x 928mm wide x 54mm thick

2 Introduction

The doorsets were installed into a flexible supporting construction. In accordance with BS EN 14600: 2005 the leaves were pre-cycled before the fire test. The doorsets were instrumented with the standard set of thermocouples. Both doorsets were installed opening in towards the furnace.

3 Specimen verification

The doorsets were produced from commercially sourced door blanks and timber, and hardware supplied/specified by the client, and were constructed by Craig Brown Furniture with respect to the following:

Doorset A	Doorset B
Hardwood lippings	Hardwood lippings
Softwood door frame	Hardwood frame
Intumescent materials	Intumescent materials
Hardware	Hardware

The component parts of the doorsets were identified based on nominal information provided by the client. The conformity of the specimens against these nominal values has been verified and agreed by the laboratory insofar as the structure of the specimen allowed verification to take place. If possible, additional moisture content readings, species verification and density checks were performed on either the original specimen, or, samples provided by the sponsor. These details are outlined in the construction section of this report (section 6).

3.1 Conditioning

Warringtonfire stored the specimens in climatic conditions approximate to those in normal service.

3.2 Sampling

Warringtonfire was not involved in factory sampling of the components used for the specimen subject to this report.

4 Description of supporting construction

The supporting construction comprised a British Gypsum steel stud partition built in accordance with Clause 7.2.2.4 of BSEN 1363: Part 1, for a flexible supporting construction. The vertical studs surrounding the apertures created for the doorsets incorporated a 67mm x 29mm softwood timber infill to facilitate the fixings for the specimens. The specimens tested are 30 and 60 minute products with an anticipated Category B performance, therefore intended fire resistance is 36 and 68 minutes minutes and three layers of Gypsum plasterboard type F are required. The supporting construction was only fixed on the horizontal edges, the vertical edges remained free.

5 Description of specimens

Details of the specimens are shown in Figures 1 to 6 of Appendix 1.

5.1 Door leaves

The left doorset was designated doorset A and the leaf measured 2133mm high x 930mm wide x 44mm thick; the right doorset was designated doorset B and the leaf measured 2135mm high x 928mm wide x 54mm thick.

6 Description of construction (refers to Figures 1 to 6 of Appendix 1)

Leaf – doorset A (identified as being produced from a Halspan FD30 door blank)

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails	None fitted	-	-	-	-
Core	Halspan	44 thick with a Ø10mm wire way 980mm up from the threshold of the leaf	630-635*	11.3	1
Facings	None fitted	-	-	-	-
Lippings – vertical edges only	Sapele	6 thick	640**	8.2	2
Adhesives - Lippings	PU	-	-	-	-

* Stated by door blank manufacturer, accuracy agreed by the laboratory ****** Nominal density

Leaf – doorset B (identified as being produced from a Halspan FD60 door blank)

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails	None fitted	-	-	-	-
Core	Halspan	54 thick with a Ø10mm wire way 980mm up from the threshold of the leaf	630-635*	9.2	3
Facings	None fitted	-	-	-	-
Lippings – vertical edges only	Sapele	6 thick	640**	7.8	4
Adhesives - Lippings	PU	-	-	-	-

* Stated by door blank manufacturer, accuracy agreed by the laboratory ****** Nominal density

Door frame – doorset A

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Head and jambs	European Redwood	32 wide x 70 deep	510**	11.8	5
Stop – planted (pinned)	European Redwood	20 wide x 12 thick	510**	10	6
Frame jointing detail	Mortise and tenon - screwed	-	-	-	-
Architrave	MDF	45 wide x 18 thick	-	-	-
Threshold	Non combustible	-	-	-	-
Frame fixings	4No. steel screws per jamb	80Ø x 100 long	-	-	-
Frame to supporting construction fire stopping	Rockwool mineral fibre capped with intumescent mastic	Nominally 10-15 wide x full depth of frame	-	-	-

Door frame – doorset B

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Head and jambs	Sapele	32 wide x 70 deep	640**	8.1	7
Stop – planted (pinned)	European Redwood	15 wide x 12 thick	640**	7.7	8
Frame jointing detail	Mortise and tenon - screwed	-	-	-	-
Architrave	MDF	45 wide x 18 thick	-	-	-
Threshold	Non combustible	-	-	-	-
Frame fixings	4No. steel screws per jamb	80Ø x 100 long	-	-	-
Frame to supporting construction fire stopping	Rockwool mineral fibre capped with intumescent mastic	Nominally 10-15 wide x full depth of frame	-	-	-

Intumescent and sealing materials – doorset A

	Make/type	Size (mm)	Location	Key to figures
Leaf edge	None fitted	-	-	-
Frame reveal – head and jambs	Pyroplex Rigid Box Seal FO8700	15 x 4	Fitted 15mm from the exposed face	9

Intumescent and sealing materials – doorset B

	Make/type	Size (mm)	Location	Key to figures
Leaf edge	None fitted	-	-	-
Frame reveal – head and jambs	2No. Pyroplex Rigid Box Seal FO8700	15 x 4	Fitted 10mm apart 7mm from the exposed face	10

Intumescent interruptions and additional protection – doorset A

	Make/type	Size (mm)	Location
Around hinge blade	Fully interrupted	-	Hinge blade fully interrupts seal in leaf edge
Under hinge blade	Interdens	1 thick	Fitted under hinge blade on frame and leaf
Encasing all latch bodies	Interdens	1 thick	Fitted around the body of the all latches
Around latch forend – top latch only	Fully interrupted	-	Top latch forend fully interrupts seal
Under all latch forends	Interdens	1 thick	Fitted under all latch forends
Around middle and bottom latch keeps	Fully interrupted	-	Middle and bottom latch keeps fully interrupt seal in frame reveal
Under all latch keeps	Interdens	1 thick	Fitted under all latch keeps

Intumescent interruptions and additional protection – doorset B

	Make/type	Size (mm)	Location
Around hinge blade	Partially interrupted	-	Hinge blade fully interrupts 1st seal leaving 2nd seal continuous
Under hinge blade	Interdens	1 thick	Fitted under hinge blade on frame and leaf
Encasing all latch bodies	Interdens	1 thick	Fitted around the body of the all latches
Around latch forend – top latch only	Partially interrupted	-	Top latch forend partially interrupts both seals with 8mm of each remaining continuous
Under all latch forends	Interdens	1 thick	Fitted under all latch forends
Around middle latch keep	Partially interrupted	-	Middle latch keep partially interrupts both seals with 7mm of the 1st seal and 8mm of the 2nd seal remaining continuous
Around bottom latch keep	Partially interrupted	-	Bottom latch keep fully interrupts 1st seal and partially interrupts 2nd seal with 4mm remaining continuous
Under all latch keeps	Interdens	1 thick	Fitted under all latch keeps

Hardware – doorset A

	Make/type	Size (mm)	Location	Key to figures
Hinges	3No. Jedo stainless steel bearing butt hinge Ref. J500SSS	101 x 30 x 3 (blade size)	Fitted 148mm, 1000mm and 1850mm from the head of the leaf	11
Closer	Frelan Hardware JD200 overhead type closer	270 x 70 (footprint size)	Fitted in the frame head as per the manufacturer's instructions	12
Top lock – disengaged	Gianni Industries ML-350M-PL-12	200 x 25 (forend size)	Lock fitted in the frame head, keep fitted appropriate to the latch in the leaf head 200mm from the closing edge	13
		200 x 26 x 3 (keep size)		
Middle lock – disengaged	SSP night latch lockset	235 x 25 (forend size)	Fitted 1420mm from the threshold of the leaf	14
	Gianni Industries GK23IM-L-PL-12 electric strike	200 x 25 (keep size)		15
Bottom lock – engaged	Access Cards and Readers electric lock HL555	235 x 24 (forend size)	Fitted 980mm from the threshold of the leaf	16
		180 x 25 (keep size)		
Furniture	Gianni Industries SPD L03 cable chain connector	48 x 40 (footprint size)	Fitted 980mm from the leaf threshold fitted on leaf and frame on the unexposed face	17

Hardware – doorset B

	Make/type	Size (mm)	Location	Key to figures
Hinges	3No. Jedo stainless steel bearing butt hinge Ref. J500SSS	101 x 30 x 3 (blade size)	Fitted 148mm, 1000mm and 1850mm from the head of the leaf	18
Closer	Frelan Hardware JD200 overhead type closer	270 x 70 (footprint size)	Fitted in the frame head as per the manufacturer's instructions	19
Top lock – disengaged	Gianni Industries ML-350M-PL-12	200 x 25 (forend size)	Lock fitted in the frame head, keep fitted appropriate to the latch in the leaf head 200mm from the closing edge	20
		200 x 26 x 3 (keep size)		
Middle lock – disengaged	SSP night latch lockset	235 x 25 (forend size)	Fitted 1420mm from the threshold of the leaf	21
	Gianni Industries GK23IM-L-PL-12 electric strike	200 x 25 (keep size)		22
Bottom lock – engaged	Access Cards and Readers electric lock HL555	235 x 24 (forend size)	Fitted 980mm from the threshold of the leaf	23
		180 x 25 (keep size)		
Furniture	Gianni Industries SPD L03 cable chain connector	489 x 40 (footprint size)	Fitted 98mm from the leaf threshold fitted on leaf and frame on the unexposed face	24

7 Pre-test measurements

7.1 Pre-cycling

Operability test of 25 manual cycles was completed on each doorset in accordance with BSEN 14600, section 5.1.1.1.

Minimum angle of opening	90º
Number of operation cycles completed	25

Specimen self closing of doorset A, in accordance with BSEN 14600, section 5.1.1.3. was completed prior to test.

	Angle of measurement	10º ± 2º
Doorset A	Closing speed	1.2 seconds
Doorset B	Closing speed	1.3 seconds

7.2 Door perimeter gaps

The manufacturer did not declare a working range so the doors were installed to open and close freely, maintaining gaps, where possible, to a range of 2-4mm along all edges except the threshold, and 3-8mm along the threshold. The gaps between the edge of the doors and frame were measured prior to test. A total of 24 readings were taken. The measurements (in mm) are given in Figure 5 of Appendix 1.

7.3 Closer forces

Measured in accordance with BSEN 1634-1: 2014 Section 10.1.3.

	Opening Force (Nm)
Doorset A	65 @ handle position
Doorset B	69 @ handle position

7.4 Method of installation

The doorsets were fixed into a pre-prepared opening. The details of the fixings and fire stopping between frame and supporting construction are outlined in the construction section and Figure 4 of Appendix 1. The exposed face of the doorset was flush with the exposed face of the supporting construction.

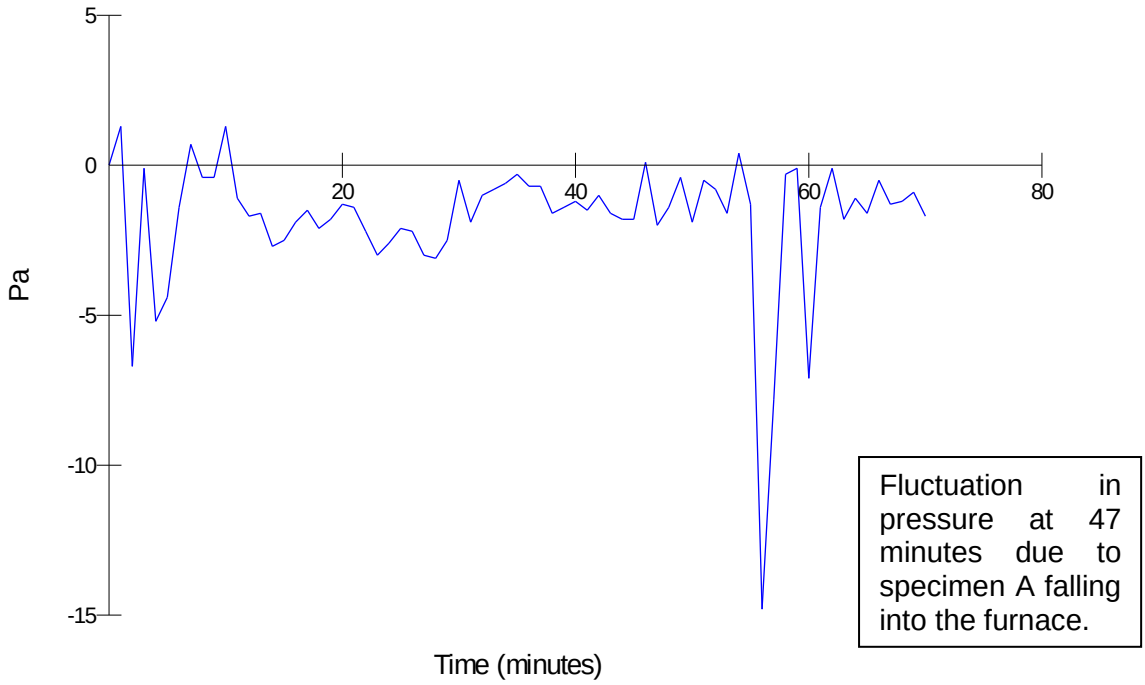
8 Test conditions

8.1 Ambient temperature

The ambient temperature of the test area at commencement of test was 15°C.

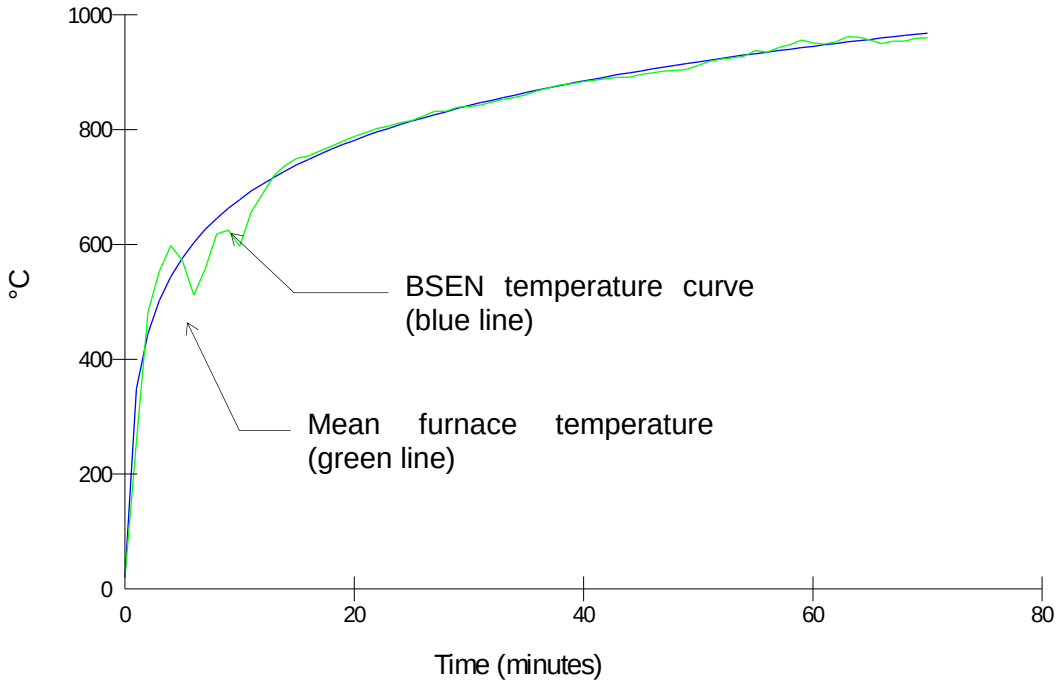
8.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 0 ± 5 Pa and after 10 minutes was maintained at 0 ± 3 Pa with respect to atmosphere, at a point 0.5m from the notional floor level. The pressure readings were recorded and tabulated in Appendix 2 and are shown graphically below:



8.3 Furnace temperature

The furnace was controlled to follow the temperature/time relationship specified in BSEN 1363: Part 1: 1999 Section 5.1.1 as closely as possible, using the average of eight plate thermometers suitably distributed within the furnace. The temperatures were recorded and are tabulated in Appendix 2 and are shown graphically below:



8.4 Unexposed face temperatures

The temperature of the unexposed face was monitored by means of the following thermocouples:

Doorset A

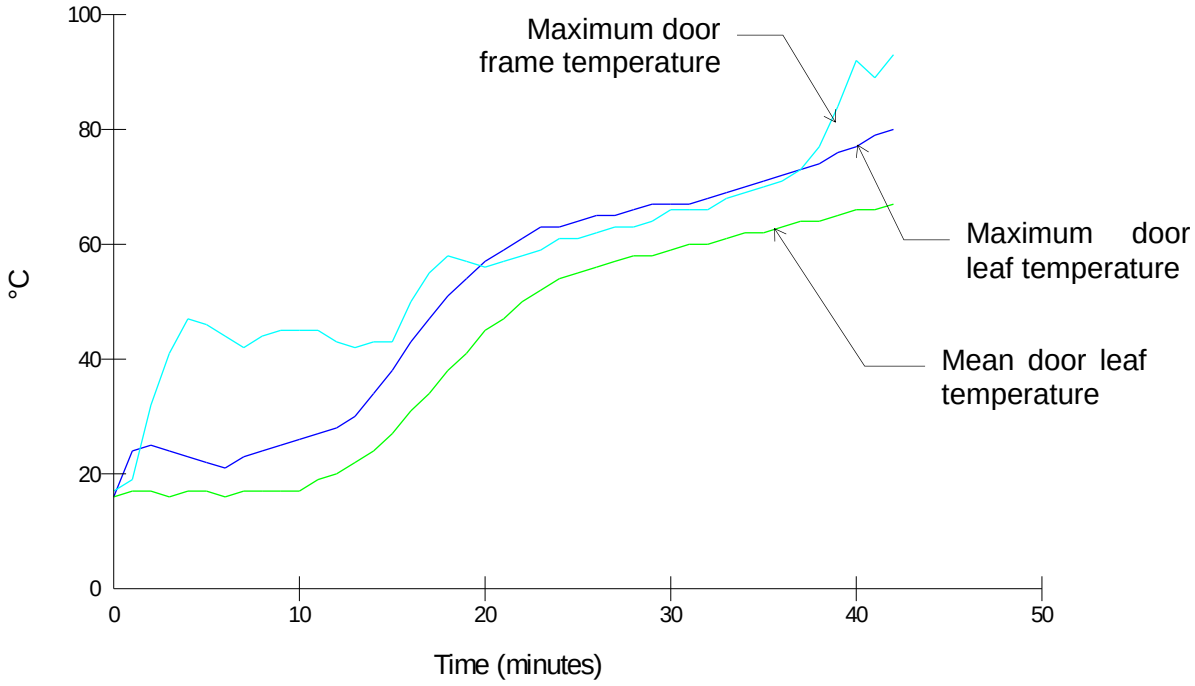
	1 discrete area	
Leaf	Discrete area (timber)	5 measuring mean temperature rise.
		4 measuring maximum temperature rise, standard set 100mm in from the door leaf edges.
Frame		5 measuring maximum temperature rise.

Doorset B

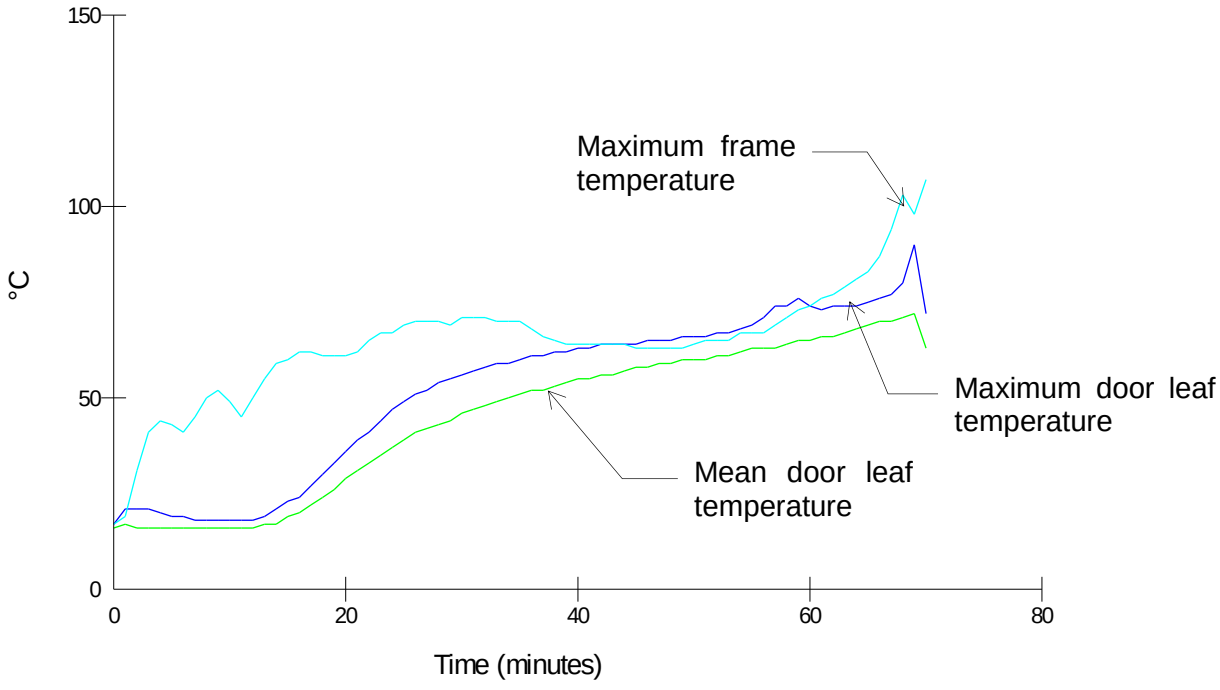
	1 discrete area	
Leaf	Discrete area (timber)	5 measuring mean temperature rise.
		4 measuring maximum temperature rise, standard set 100mm in from the door leaf edges.
Frame		5 measuring maximum temperature rise.

The location of the thermocouples are shown in Figure 6 of Appendix 2. The temperatures were recorded and tabulated in Appendix 2 and are shown graphically below:

Doorset A



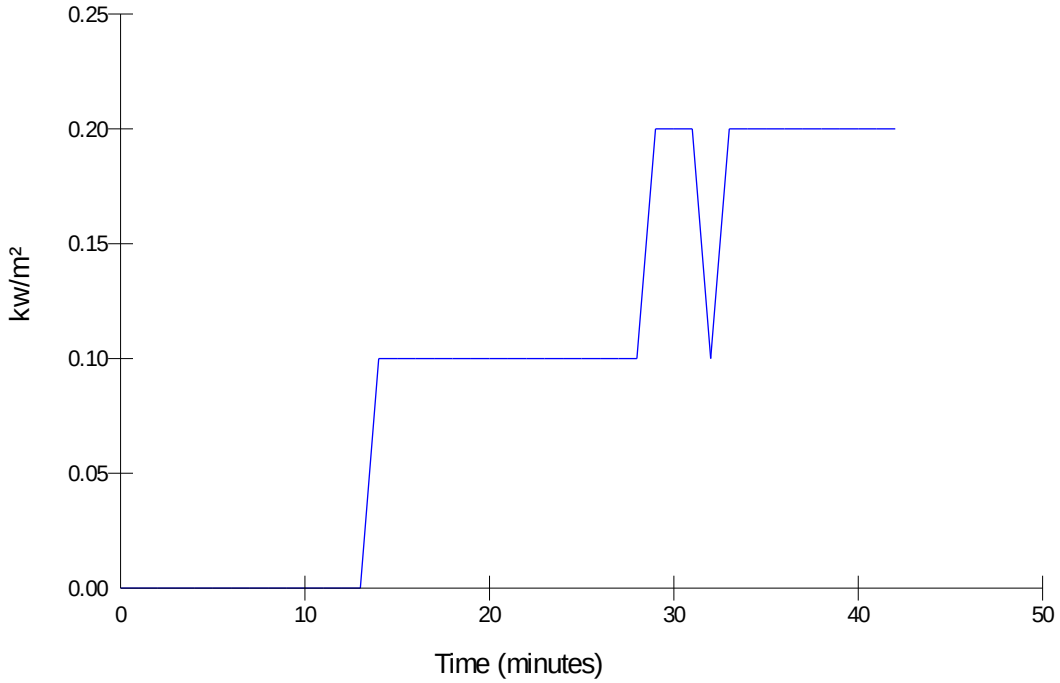
Doorset B



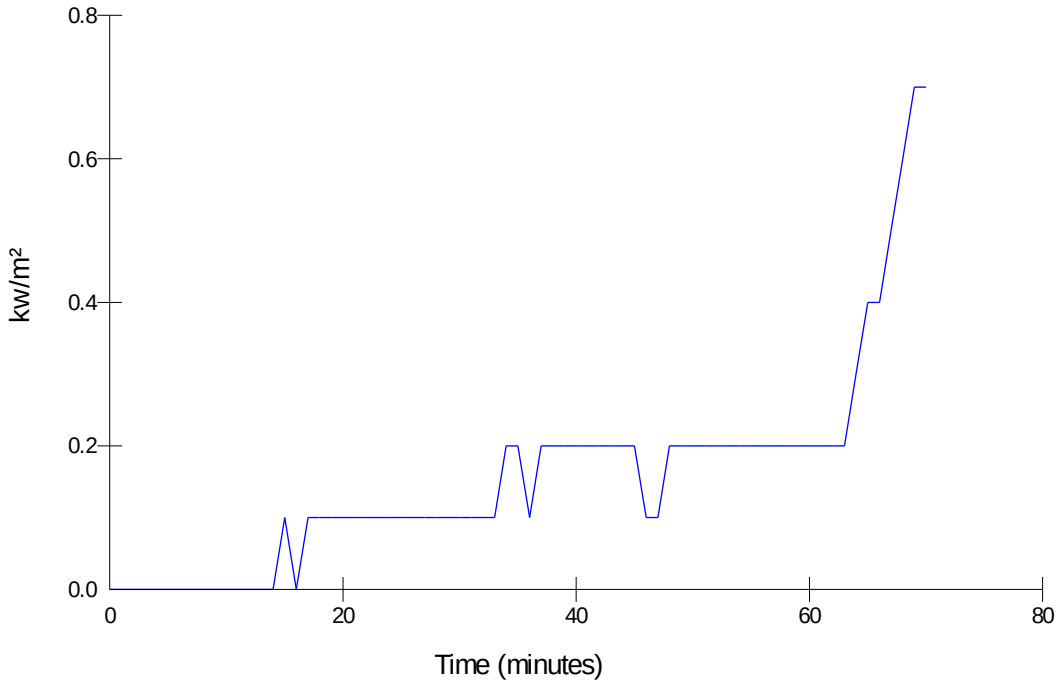
8.5 Radiation

A radiometer was used to measure the radiation 1m away from the specimens. The results of the radiometer were recorded and tabulated in Appendix 2 and are shown graphically below:

Doorset A

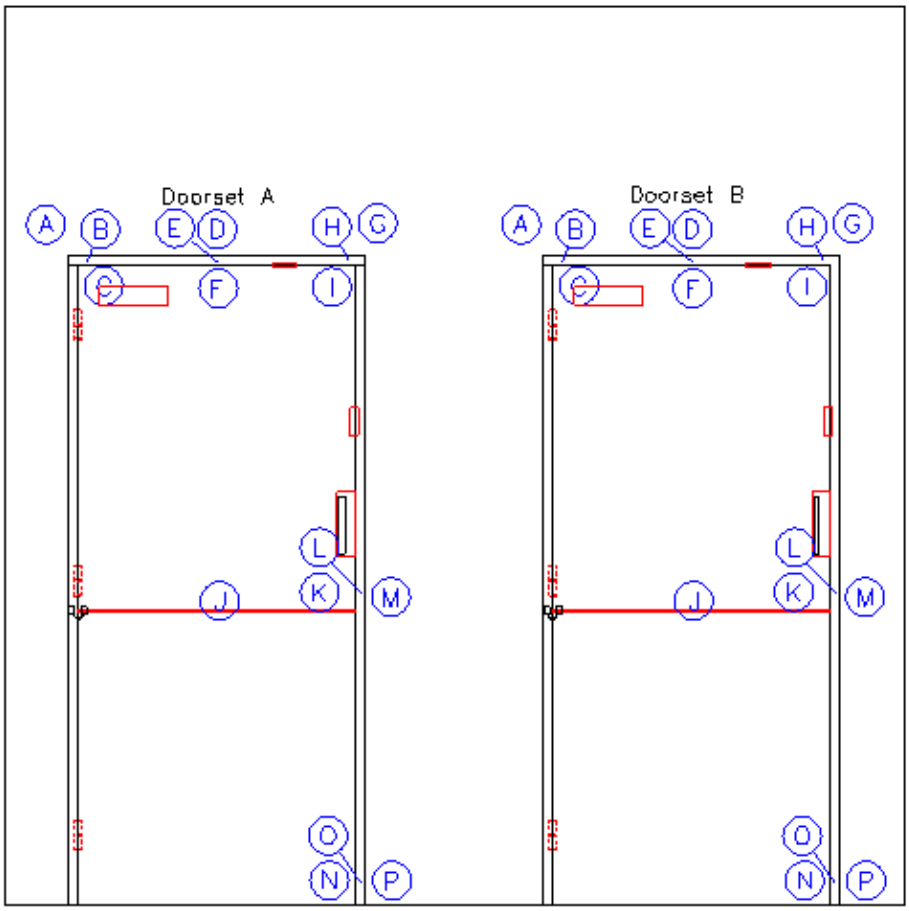


Doorset B



8.6 Leaf and frame distortion data

The following tables show the distortion in mm with an accuracy of ±1mm.
A positive measurement indicates distortion towards the furnace.
A negative measurement indicates distortion away from the furnace.



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	M	N	O	P
10	3	5	5	6	7	7	9	9	11	0	3	6	6	7	1	0
20	0	3	4	2	3	2	4	4	7	-8	-2	2	3	9	0	0
30	-3	0	2	-1	-1	-3	1	0	8	-1	-7	-1	-1	11	0	-1
40	-6	-2	1	-2	-3	-6	-2	-2	8	-33	-9	-3	-2	13	0	-2

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	M	N	O	P
15	8	2	8	4	3	4	2	2	3	-3	-4	-1	0	-2	-3	19
30	-1	0	3	-2	-3	-3	-3	-3	-1	-15	-10	-7	-6	-1	-4	-2
45	-3	-2	3	-3	-5	-5	-5	-4	-1	-22	-12	-9	-8	-3	-3	-4
60	11	18	21	12	8	4	3	7	7	-30	-7	0	-1	0	-2	-5

9 Observations

All comments relate to the unexposed face unless otherwise specified.

Time (minutes)	
00.00	Test started.
01.25	Both doorsets, there is smoke issuing from the top half of the closing edges.
03.30	Both doorsets, there is continuous smoke issuing from the top half of the closing edges. Doorset B has smoke issuing from the centre of the head.
05.43	Both doorsets, there is smoke issuing from the top latch. There is a decrease in smoke issuing from previously mentioned places.
07.54	Both doorsets, there is smoke issuing from the top hanging corners of the leaves. There is discolouration to the top closing corners and the top half of the closing edges.
13.11	Doorset A, there is an increase in smoke issuing from the top closing corner and the top hanging corner. There is an increase in discolouration to the top closing corner.
16.59	Doorset A, there is charring to the top closing corner.
22.33	Doorset A, there is charring across the head of the leaf and an increase in charring to the top closing corner.
24.41	Doorset A, there is glow visible at the head, approximately 100mm from the top closing corner.
26.00	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.
26.49	Doorset A, the door stop is eroding at the glow mentioned above.
27.48	Doorset A, there is an increase in smoke issuing from the glow, at the head, approximately 100mm from the top closing centre.
28.35	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.
29.32	Doorset A, a second glow has appeared at the centre of the head of the leaf.
32.25	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.
35.30	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.

38.00	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.
40.00	Doorset A, there is an additional glow visible at the right hand side of the head of the leaf.
41.15	Doorset A, a cotton pad integrity test was performed at the head, approximately 100mm from the top closing corner, which failed to ignite the cotton pad. No failure.
43.02	Doorset A has glow visible at the top hanging corner of the leaf.
43.48	Doorset A, a cotton pad integrity test was performed at the top closing corner, which resulted in the ignition of the cotton pad, thereby constituting **integrity failure.**
43.58	Doorset A, there is continuous flaming at the top closing corner of the leaf, thereby constituting **further integrity failure.**
46.30	Doorset A, a cotton pad integrity test was performed at the top hanging corner, which resulted in the ignition of the cotton pad, thereby constituting **further integrity failure.**
46.56	Doorset A, there is continuous flaming at the top hanging corner of the leaf, thereby constituting **further integrity failure.**
50.09	Doorset A, there is continuous flaming at the latch position, thereby constituting **further integrity failure.**
54.00	Doorset A has been sealed off to continue with the test for doorset B.
56.05	Doorset B, there is glow visible at the bottom latch position.
56.34	Doorset B, there is intermittent flaming at the bottom latch position.
57.26	Doorset B, a cotton pad integrity test was performed at the bottom latch position, which resulted in the ignition of the cotton pad, thereby constituting **integrity failure.**
58.50	Doorset B, mastic sealant was applied at the bottom latch to continue the test.
61.50	Doorset B, there is glow visible at the top hinge position.
63.45	Doorset B, a cotton pad integrity test was performed at the top hinge position, which failed to ignite the cotton pad. No failure.
67.17	Doorset B, a cotton pad integrity test was performed at the top hinge position, which failed to ignite the cotton pad. No failure.
68.00	Doorset B, there is intermittent flaming at the top hinge position and the top hanging corner.
68.45	Doorset B, there is continuous flaming at the top hinge position and the top hanging corner, thereby constituting **further integrity failure.**
70.00	Test terminated

10 Expression of results

Doorset A

Integrity	
Cotton pad	43 forty three) minutes
Continuous flaming	43 forty three) minutes
Gap gauges	54 (fifty four) minutes*
Insulation - 1 discrete area	
Discrete area - timber	
Average set	43 forty three) minutes**
Maximum ≥ 100mm in from leaf edge	43 forty three) minutes**
Door frame ≥ 180ºc temp rise	43 forty three) minutes**
Door frame ≥ 360ºc temp rise	43 forty three) minutes**
Radiation – time to 15kW/m^2	54 (fifty four) minutes*

* No failure of the test criteria had occurred at termination of the test on this specimen at 54 minutes
** Failure by virtue of integrity failure at 43 minutes

Doorset B

Integrity	
Cotton pad	57 (fifty seven) minutes***
Continuous flaming	68 (sixty eight) minutes
Gap gauges	70 (seventy) minutes*
Insulation – 1 discrete area	
Discrete area - timber	
Average set	57 (fifty seven) minutes**
Maximum ≥ 100mm in from leaf edge	57 (fifty seven) minutes**
Door frame ≥ 180ºc temp rise	57 (fifty seven) minutes**
Door frame ≥ 360ºc temp rise	57 (fifty seven) minutes**
Radiation – time to 15kW/m^2	70 (seventy) minutes*

* No failure of the test criteria had occurred at termination of the test at 70 minutes
** Failure by virtue of integrity failure at 57 minutes
*** Failure via bottom latch (Access Cards and Readers electric lock HL555). No further failures witnessed from Gianni Industries ML-350M-PL-12 or GK23IM-L-PL-12 until 68 minutes

11 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 specimens provided for testing, and the door to frame gaps recorded in Figure 5 of Appendix 1 of this report. Further, where information in relation to the specimen has been provided to us but not verified by us, we have assumed that it is correct; and where comments above identify particular materials or substances comprised in the specimen those comments are based on information supplied to us and/or on general visual inspection undertaken during the process of testing of the sample, and in either case have not been verified by reference to materials testing or documentary evidence except as described above. The fire resistance performance of doors of this design may be different if any aspect of the design or construction differs from that tested. This includes, by way of example only, any difference as a result of (i) any deviation from the information supplied to us, or (ii) the employment of different door to frame gaps. The tested assembly was asymmetrical and was tested such that the door leaf opened into the heating conditions of the test. The test result may not be appropriate to situations where by the samples tested have been installed in a different configuration to that which they are tested.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. No assurance can be given that this test or its results will reflect current practice, and/or be consistent with prevailing legislative / regulatory requirements, at any time after the date of this report. Warringtonfire will be able to offer the addressee of this report, at any time on request, 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. It is strongly recommended that, at the latest, such a review be sought at intervals of no more than five years.

Signature:		
Name:	Eliot Power	Nikolas Whitelock
Title:	Technical Officer	Technical Manager
Date of issue:	15/02/2019	15/02/2019

12 Field of direct application of test results

The results of the test are directly applicable to similar constructions where one or more of the changes listed in BS EN 1634-1: 2014, Clause 13, are made and the construction continues to comply with that appropriate design code for its stiffness and stability. Other changes are not permitted by the document. A copy of the field of direct application is available from Warringtonfire upon request.

Photographs

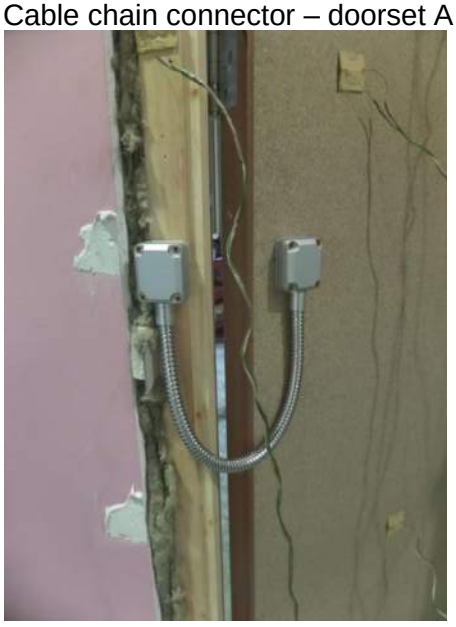
Intumescent interruptions by hardware

Hinge – doorset A

Middle and bottom latch keeps – doorset A

Top latch forend in frame head – doorset A

Cable chain connector – doorset A



Middle latch keep – doorset B

Bottom latch keep – doorset B

Top latch forend in frame head – doorset B

Cable chain connector – doorset B

At start of test

At 10 minutes

Doorset B at 15 minutes

At 20 minutes

At 30 minutes

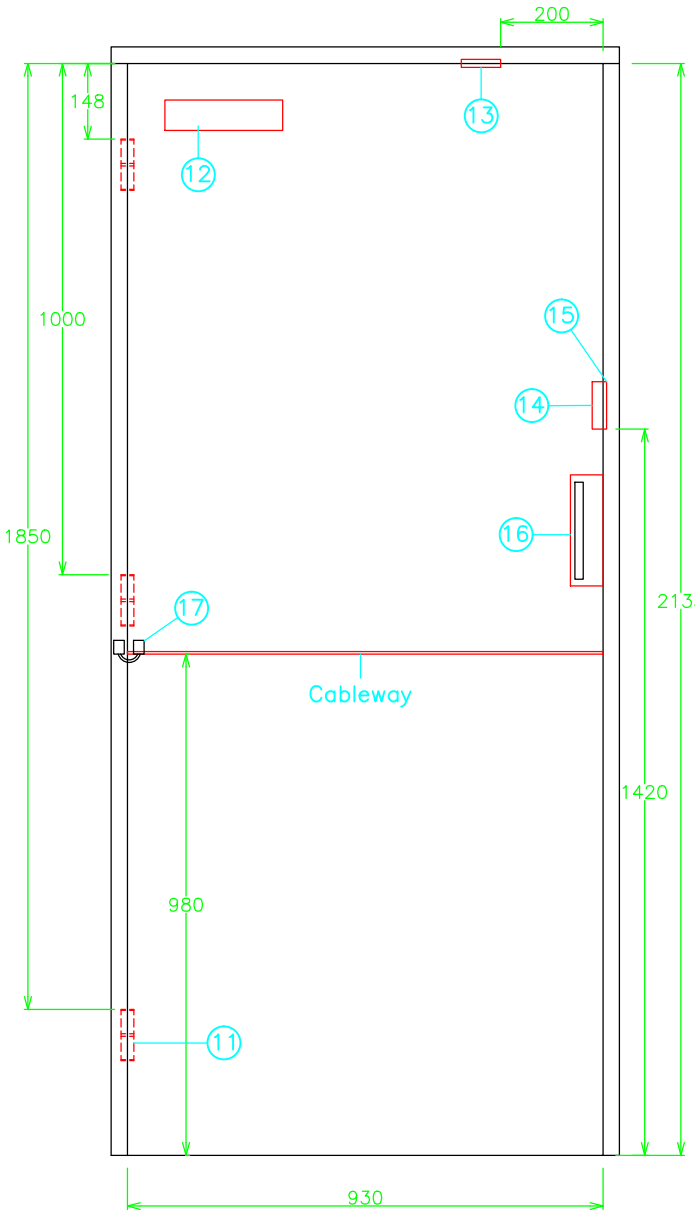
At 40 minutes

Doorset B at 45 minutes

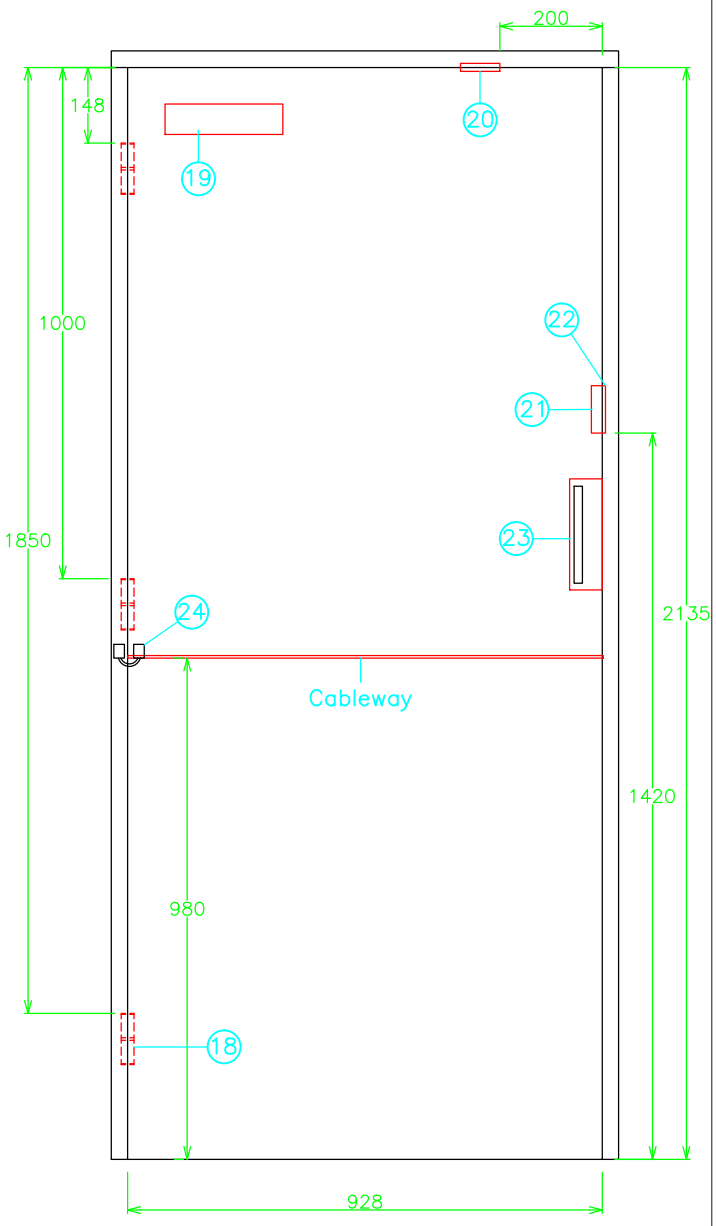
Doorset B at 60 minutes

Appendix 1 – figures 1 to 6

Doorset A



Doorset B



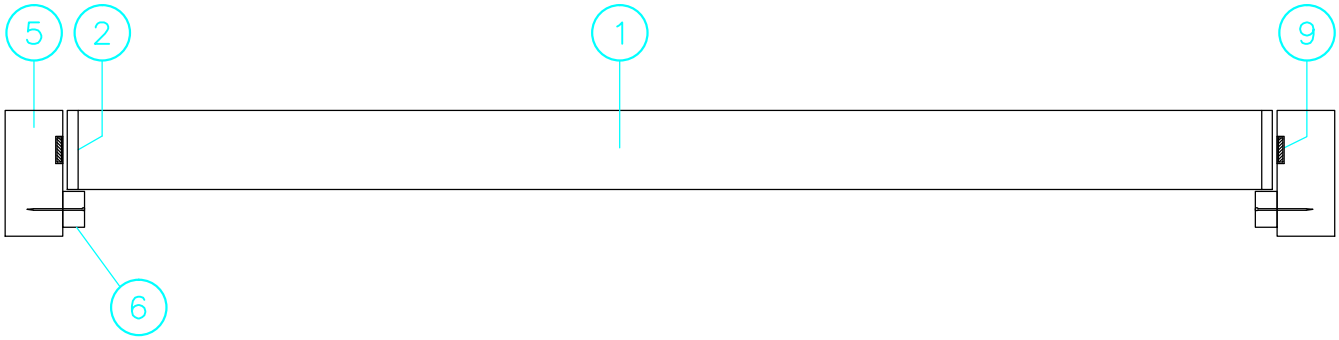
warringtonfire
Proud to be part of element
Warringtonfire, Stocking Lane,
Hughenden Valley, High Wycombe,
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

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

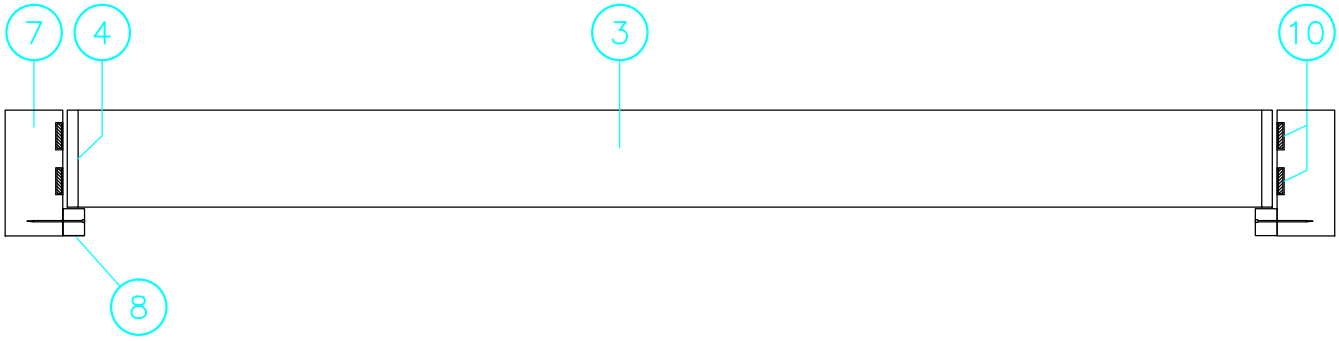
Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1

Section A–A



Section B–B



warringtonfire
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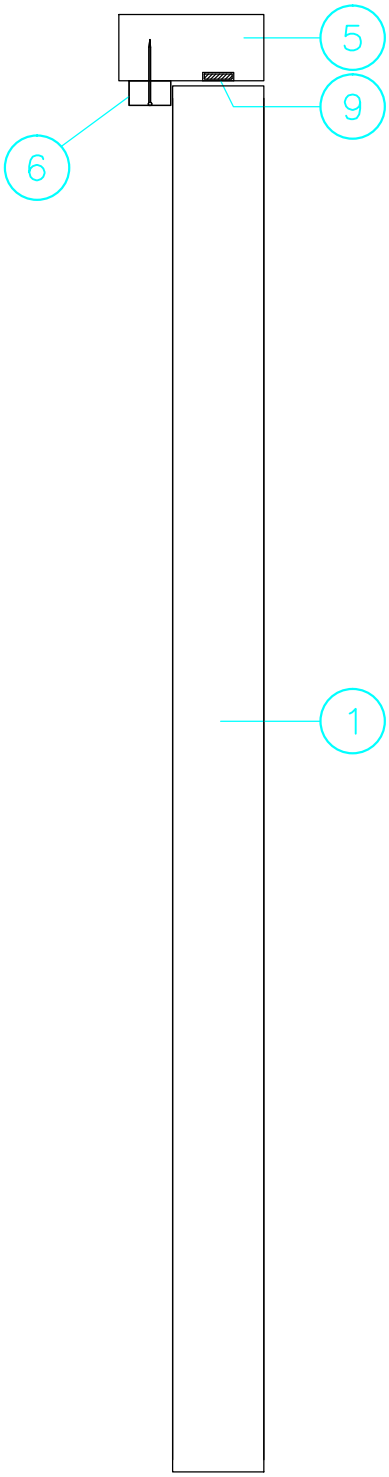
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

Title
Horizontal cross sections
(All dimensions in mm)

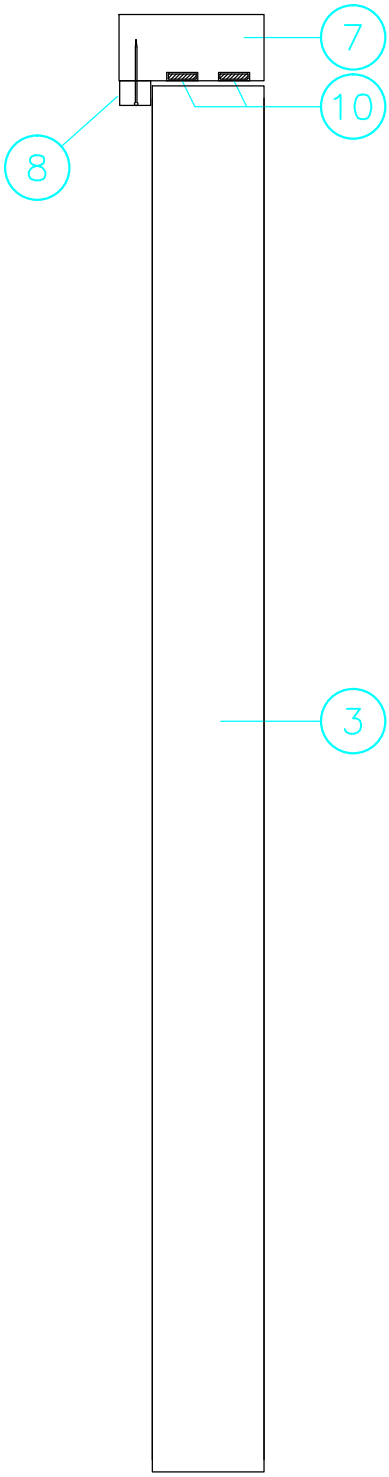
Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1

Section C–C



Section D–D



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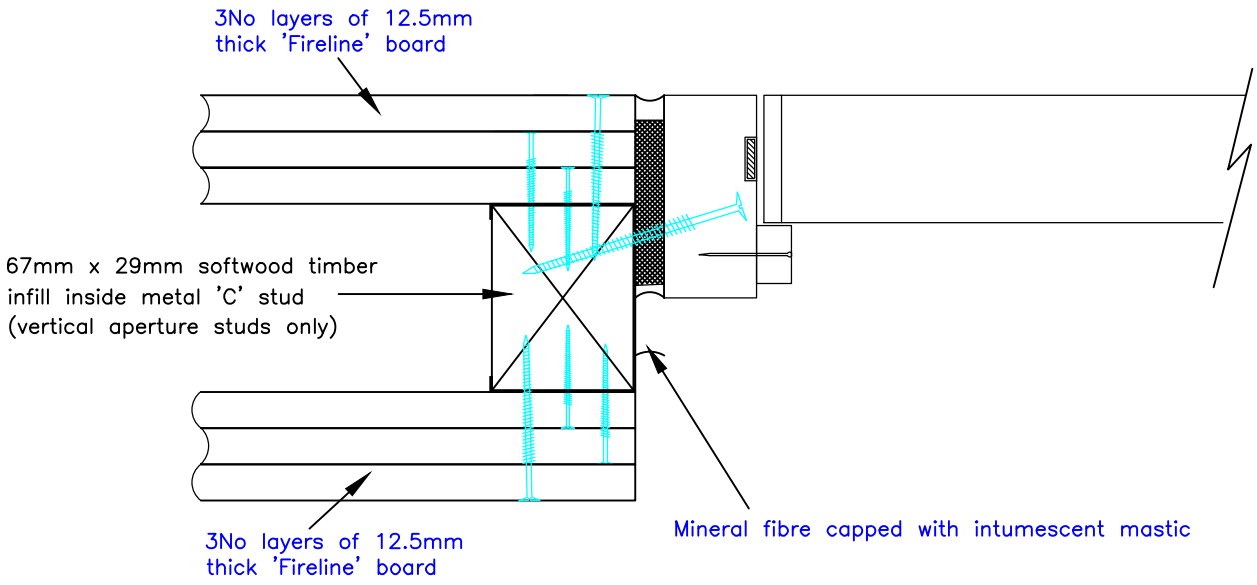
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

Title
Vertical cross section
(All dimensions in mm)

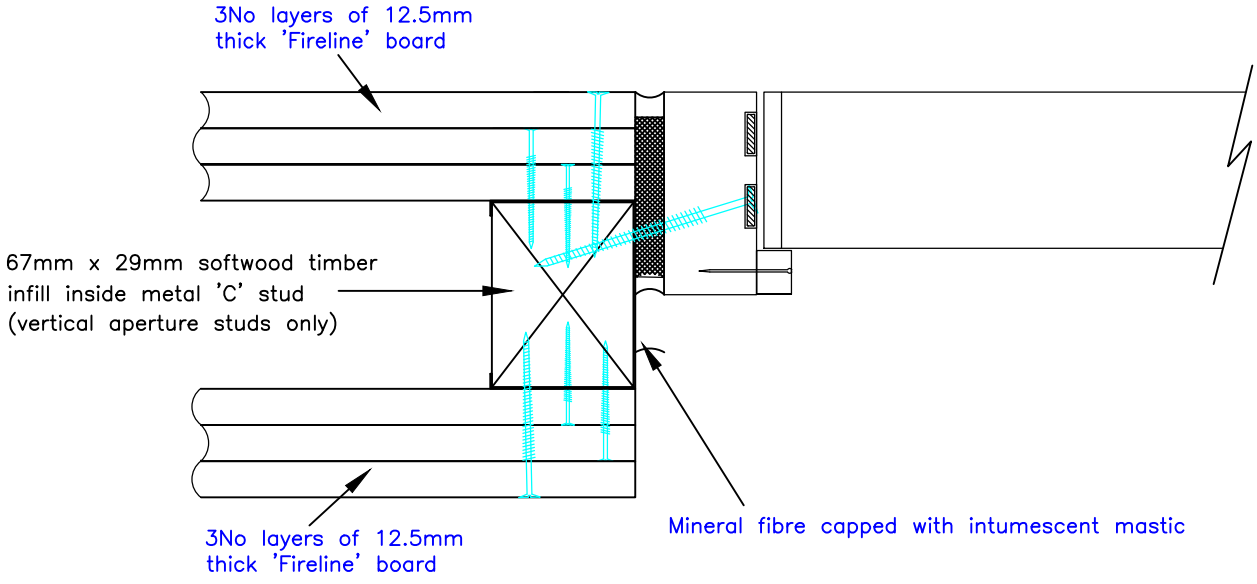
Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1

Doorset A



Doorset B



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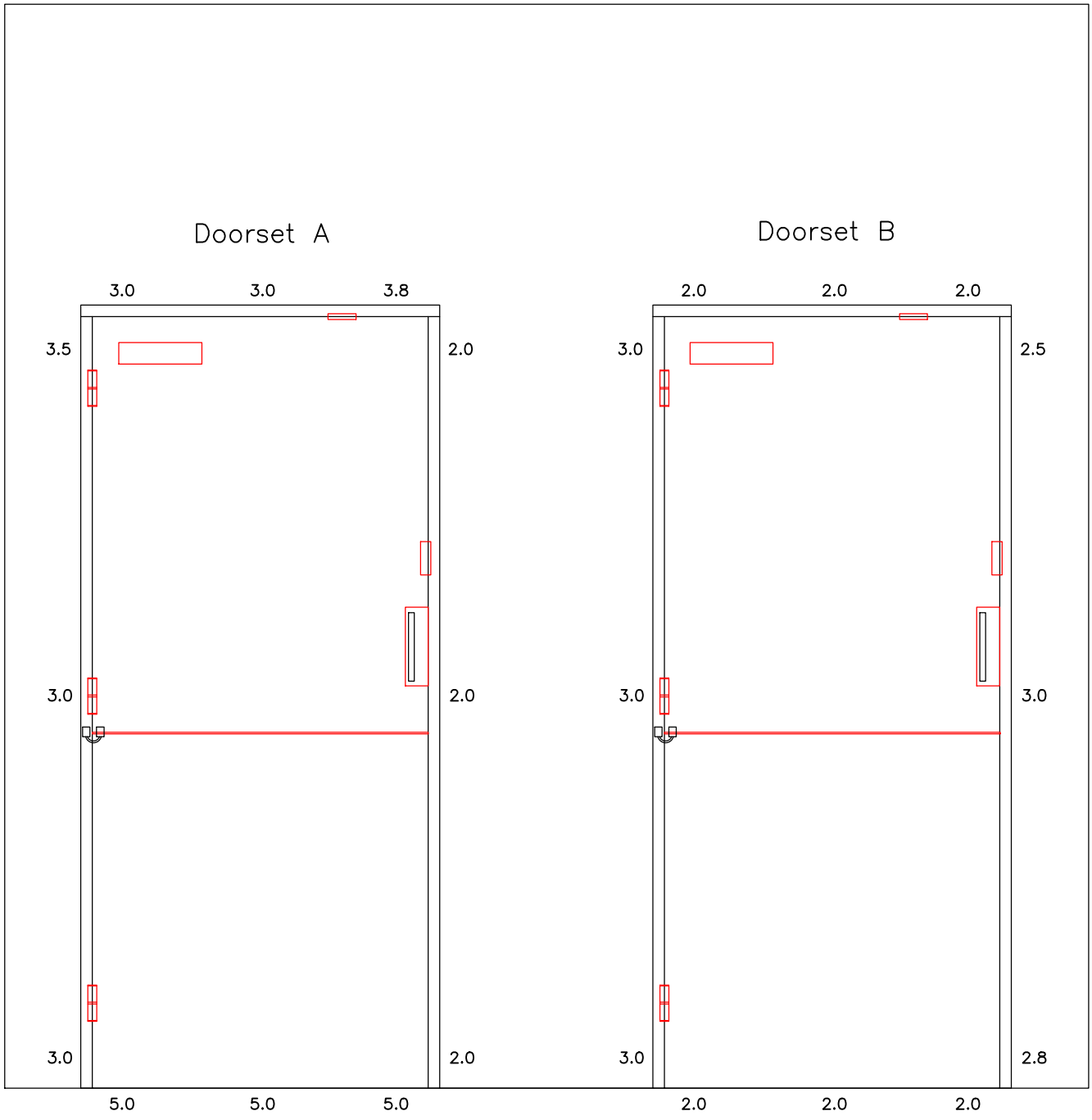
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

Title
Frame to supporting construction fixing detail
(All dimensions in mm)

Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1



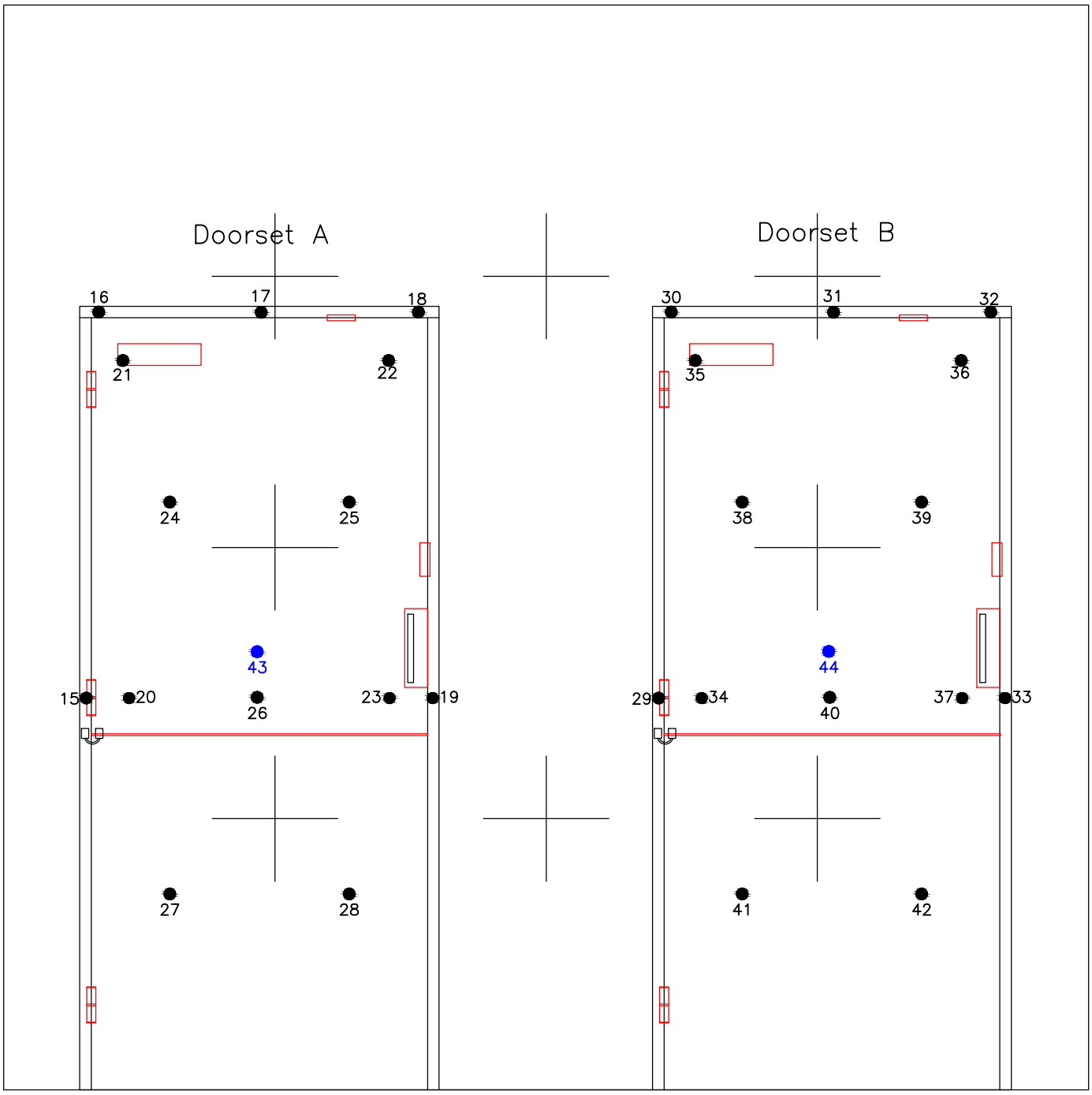
Viewed From Unexposed Face

warringtonfire
Proud to be part of element
Warringtonfire, Stocking Lane,
Hughenden Valley, High Wycombe,
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

Title
Door leaves/frame gaps
(All dimensions in mm)

Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1



: Furnace Thermocouples

: Unexposed Face Thermocouples

: Radiometer

Viewed From Unexposed Face

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Proud to be part of element
Warringtonfire, Stocking Lane,
Hughenden Valley, High Wycombe,
Buckinghamshire, HP14 4ND, UK.
Tel: +44 (0)1494 569750

Title: Thermocouple positions

(All dimensions in mm)

Date Drawn	Drawn By	Scale
23/05/14	ARD	NTS

Project No.	
BMT/FEP/F14080 AR2	Appendix 1

Appendix 2 - raw test data (6 pages)

(see figure 6 of appendix 1 for channel locations)

Furnace thermocouples

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 8	Chan 9	Chan 11	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23	Chan 24	Chan 25	Chan 26
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0	18	17	19	19	19	17	19	18	15	16	16	16	17	16	16	16	16	16	16	16	16
1	1.3	300	239	287	294	186	201	275	261	15	16	17	17	19	18	16	16	24	16	17	17	17
2	-6.7	500	361	535	581	454	335	561	409	15	16	18	17	32	18	16	16	25	17	16	17	17
3	-0.1	537	341	569	630	576	402	636	524	15	16	19	17	41	18	16	16	24	18	16	17	16
4	-5.2	558	382	582	643	625	502	653	626	15	16	20	17	47	18	16	17	23	19	16	17	17
5	-4.4	500	346	561	585	606	550	608	598	15	16	20	17	46	18	16	16	22	20	16	17	17
6	-1.4	428	334	486	519	566	521	535	534	15	16	21	17	44	18	16	17	21	21	16	17	16
7	0.7	512	385	543	550	580	571	565	579	15	16	22	17	42	19	16	17	21	23	16	17	17
8	-0.4	563	466	584	631	625	635	627	662	15	16	25	17	44	20	16	17	21	24	17	17	17
9	-0.4	564	473	610	627	634	646	636	662	15	16	28	17	45	20	16	17	22	25	17	17	17
10	1.3	518	457	583	592	618	623	616	635	15	17	31	18	45	21	17	18	24	26	17	18	17
11	-1.1	606	573	641	674	668	678	654	674	15	17	35	19	45	22	17	19	25	27	18	19	18
12	-1.7	629	621	660	714	702	704	688	721	15	18	38	20	43	24	18	22	27	28	20	20	19
13	-1.6	662	677	696	761	737	733	715	742	15	19	40	23	42	25	20	25	30	29	22	22	20
14	-2.7	681	694	709	778	753	749	737	760	15	23	41	27	43	30	22	30	34	30	25	26	22
15	-2.5	705	718	732	785	764	762	744	763	15	28	43	30	43	36	25	35	38	31	29	29	25
16	-1.9	708	721	736	789	766	770	750	762	15	30	50	33	43	34	28	40	43	32	32	33	28
17	-1.5	718	735	751	793	775	779	760	766	15	33	55	35	44	35	31	45	47	34	36	38	31
18	-2.1	736	753	746	789	789	798	767	773	15	37	58	36	45	33	34	49	51	35	40	42	34
19	-1.8	748	764	752	804	800	805	781	773	15	38	57	39	47	34	38	53	54	36	44	47	38
20	-1.3	758	776	764	813	807	813	789	777	15	39	56	40	47	35	42	56	57	37	48	50	41
21	-1.4	767	780	772	820	813	813	798	782	15	38	57	41	48	36	45	59	59	38	51	53	44
22	-2.2	772	787	778	822	818	818	823	784	15	39	58	42	49	36	47	60	61	39	54	56	47

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 8	Chan 9	Chan 11	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23	Chan 24	Chan 25	Chan 26
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
23	-3	781	793	779	829	826	821	819	789	15	41	59	43	50	39	50	62	63	45	56	58	50
24	-2.6	790	795	781	835	831	830	823	795	15	42	61	44	51	40	52	62	63	48	58	60	52
25	-2.1	796	804	789	836	837	834	828	798	15	43	61	45	52	40	53	63	64	50	59	61	53
26	-2.2	796	807	777	834	841	849	845	824	15	44	62	46	52	41	55	64	65	52	61	62	55
27	-3	821	806	776	832	844	863	851	843	15	44	63	46	53	42	56	64	65	54	62	62	56
28	-3.1	814	806	772	834	843	858	856	848	15	44	63	47	54	42	57	64	66	55	63	63	57
29	-2.5	832	805	772	835	842	860	879	855	15	45	64	48	54	42	58	65	67	56	63	64	58
30	-0.5	835	812	774	840	846	865	863	859	15	45	66	49	55	44	59	65	67	58	64	64	59
31	-1.9	843	815	780	841	848	865	868	862	15	45	66	51	56	45	59	65	67	59	65	65	59
32	-1	850	818	782	846	851	874	871	867	15	45	66	52	58	46	60	66	68	60	65	65	60
33	-0.8	856	822	790	847	854	875	880	872	15	46	68	54	60	47	61	66	69	61	66	66	61
34	-0.6	860	824	793	854	855	878	879	876	15	46	69	56	61	49	62	67	70	63	66	67	62
35	-0.3	864	830	795	858	861	885	888	881	15	46	70	58	63	50	62	67	71	64	67	67	62
36	-0.7	870	837	806	867	869	890	892	882	15	46	71	60	67	50	63	68	72	64	68	68	63
37	-0.7	873	842	810	871	872	895	908	887	15	47	73	62	72	51	63	68	73	65	68	68	64
38	-1.6	880	846	814	873	873	897	918	893	15	47	75	66	77	50	64	69	74	66	69	68	64
39	-1.4	883	852	817	879	878	900	906	897	15	48	78	67	84	51	65	70	76	67	69	69	65
40	-1.2	888	856	821	884	881	906	910	899	15	48	82	67	92	52	65	70	77	68	70	70	65
41	-1.5	889	861	827	888	886	908	908	902	15	48	89	68	89	51	66	71	79	69	70	70	66
42	-1	896	864	829	891	889	909	906	904	15	49	93	68	87	51	66	72	80	70	71	71	66
43	-1.6	900	867	833	893	890	911	910	906	15	49	92	68	86	51	66	73	82	71	71	71	67
44	-1.8	899	872	832	893	891	909	908	909	15	50	92	69	92	52	67	74	87	72	72	72	68
45	-1.8	903	872	837	899	894	916	914	910	15	50	90	66	76	52	67	77	74	73	72	71	67
46	0.1	907	876	843	901	895	919	917	913	15	51	88	65	73	53	68	79	70	74	73	72	68
47	-2	911	880	846	906	901	920	918	914	15	51	111	62	67	54	69	84	67	74	72	72	68
48	-1.4	912	884	848	905	900	922	918	916	15	46	13	22	28	53	67	68	68	74	69	67	64
49	-0.4	914	884	850	906	902	926	922	918	16	43	13	16	17	54	68	66	65	75	71	65	65
50	-1.9	917	894	859	916	911	931	928	923	15	42	13	16	16	56	69	63	68	77	73	66	67
51	-0.5	924	902	866	930	920	940	930	926	16	42	14	16	16	57	70	61	66	79	75	68	69
52	-0.8	929	906	869	931	924	945	937	932	16	13	15	16	16	28	28	25	40	53	26	52	-854

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 8	Chan 9	Chan 11	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22	Chan 23	Chan 24	Chan 25	Chan 26
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
53	-1.6	931	908	872	931	926	942	938	935	16	14	16	16	15	14	16	16	17	19	16	19	-1208
54	0.4	937	915	875	933	930	946	941	940	16	15	16	16	15	14	15	16	16	16	16	17	-965
55	-1.3	939	921	888	945	939	959	952	945	16	16	17	16	15	14	16	16	15	16	16	17	303
56	-9.8	929	926	929	966	909	949	926	941	16	16	16	16	15	14	16	16	15	16	16	17	298
57	-7.8	925	928	939	971	910	949	956	952	16	16	17	16	15	15	16	16	15	16	16	17	33
58	-0.3	928	933	949	975	926	958	938	963	16	16	16	16	15	15	16	16	15	16	16	14	234
59	-0.1	934	933	971	976	935	967	936	976	16	16	16	16	15	14	15	16	15	16	16	14	220
60	-7.1	907	916	984	960	947	965	919	976	16	16	16	16	15	15	16	16	15	16	16	14	215
61	-1.4	895	912	975	957	951	963	930	976	16	16	16	16	15	15	16	16	16	16	16	15	200
62	-0.1	907	925	968	970	954	979	922	972	16	16	16	16	15	15	16	16	16	16	16	15	207
63	-1.8	917	922	990	957	961	988	951	971	16	16	17	16	15	15	16	16	16	16	16	15	207
64	-1.1	934	896	985	944	952	991	956	965	16	16	16	16	16	15	16	16	16	17	16	15	197
65	-1.6	944	900	973	934	944	987	950	961	16	16	16	16	16	15	16	16	16	16	16	15	193
66	-0.5	942	906	964	928	938	982	944	957	16	16	16	16	16	15	16	16	16	16	16	16	190
67	-1.3	964	924	963	929	943	982	943	958	16	16	17	16	16	15	16	16	16	17	16	16	190
68	-1.2	968	932	963	932	943	978	942	957	16	296	18	16	17	17	17	18	17	18	17	17	57
69	-0.9	974	938	967	936	947	984	946	960	16	45	19	16	18	17	18	18	17	18	19	18	-1095
70	-1.7	975	944	969	939	949	987	947	960	16	20	20	16	18	17	18	20	17	18	20	18	-1105

Time	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	kw/m²	kw/m²
0	16	16	17	16	16	16	16	16	16	17	16	16	16	16	16	16	0	0
1	17	17	17	16	18	19	17	16	17	21	21	17	18	16	16	16	0	0
2	16	17	17	16	20	31	17	16	17	21	19	17	17	16	16	16	0	0
3	16	17	17	16	22	41	17	16	17	21	18	17	17	16	16	16	0	0
4	16	17	17	18	27	44	17	16	17	20	17	17	17	16	16	16	0	0
5	16	17	17	21	38	43	17	16	17	19	17	17	17	16	16	16	0	0
6	16	17	17	23	41	40	17	16	17	19	17	17	17	16	16	16	0	0
7	16	17	17	23	45	43	18	16	17	18	17	17	17	16	16	16	0	0

Time	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	kw/m²	kw/m²
8	16	17	17	25	50	43	19	16	17	18	17	17	17	16	16	16	0	0
9	17	17	17	28	52	39	20	16	17	18	17	17	17	16	16	16	0	0
10	17	18	17	36	49	37	21	16	17	18	17	17	17	16	16	16	0	0
11	18	20	18	45	45	37	23	16	17	18	17	17	17	16	16	16	0	0
12	20	20	18	50	45	36	23	16	17	18	18	17	17	16	16	16	0	0
13	22	22	19	55	44	35	24	17	18	19	18	18	18	16	16	16	0	0
14	24	24	20	59	47	35	24	17	19	21	20	19	19	17	16	16	0.1	0
15	28	26	20	60	46	35	24	18	20	23	21	20	21	18	17	17	0.1	0.1
16	31	29	21	62	44	35	27	19	22	24	22	22	23	19	18	18	0.1	0
17	34	32	22	62	45	36	28	21	25	27	24	24	26	21	19	20	0.1	0.1
18	37	35	23	61	45	36	30	22	28	30	26	26	28	23	20	22	0.1	0.1
19	40	38	24	61	46	37	31	24	31	33	28	29	31	25	22	24	0.1	0.1
20	43	41	25	61	47	37	32	26	35	36	31	32	34	27	24	26	0.1	0.1
21	45	43	26	62	47	38	35	29	38	39	33	34	36	30	26	28	0.1	0.1
22	47	45	28	65	46	39	36	31	41	41	35	36	39	32	27	30	0.1	0.1
23	49	47	30	67	46	40	36	33	44	44	37	39	41	34	29	33	0.1	0.1
24	51	49	32	67	46	41	37	35	47	47	39	41	42	36	31	35	0.1	0.1
25	51	50	34	69	45	42	38	37	49	49	41	43	44	38	33	36	0.1	0.1
26	53	51	36	70	44	43	39	38	51	51	43	45	46	40	34	38	0.1	0.1
27	53	51	37	70	44	44	40	40	52	52	45	47	48	41	36	39	0.1	0.1
28	54	52	39	70	44	45	41	42	54	53	46	48	49	43	37	40	0.1	0.1
29	55	52	40	69	43	46	42	43	55	55	48	49	50	44	38	41	0.2	0.1
30	55	53	41	71	43	47	43	44	56	56	49	51	51	46	39	42	0.2	0.1
31	56	54	43	71	43	48	44	46	57	57	50	52	52	47	40	43	0.2	0.1
32	56	54	44	71	43	48	45	47	57	58	52	53	53	48	41	44	0.1	0.1
33	58	55	45	70	43	50	46	48	59	59	53	54	54	49	43	46	0.2	0.1
34	58	57	47	70	43	50	47	50	59	59	54	55	55	51	44	46	0.2	0.2
35	59	57	48	70	43	51	48	51	60	60	55	56	55	52	45	47	0.2	0.2
36	60	58	49	68	43	52	49	51	61	60	56	57	56	52	46	48	0.2	0.1
37	61	58	50	66	43	52	49	52	61	61	57	57	57	53	46	49	0.2	0.2

Time	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	kw/m²	kw/m²
38	61	59	51	65	43	53	50	53	62	61	57	58	57	54	47	49	0.2	0.2
39	62	60	52	64	43	54	51	54	62	61	58	59	58	55	48	50	0.2	0.2
40	62	61	53	64	43	54	52	55	63	62	59	59	58	56	49	51	0.2	0.2
41	63	61	54	64	43	55	53	56	63	62	60	60	59	56	50	52	0.2	0.2
42	64	61	55	64	43	55	54	57	64	62	60	60	60	57	51	52	0.2	0.2
43	64	62	55	64	43	55	54	57	64	62	61	60	60	58	51	53	0.1	0.2
44	65	63	56	64	44	54	55	58	64	62	62	61	61	59	52	54	0.2	0.2
45	66	63	57	63	44	49	56	58	64	63	62	62	61	59	53	55	0.2	0.2
46	66	64	57	63	44	46	56	59	65	63	63	62	59	60	54	55	0.3	0.1
47	67	65	58	63	44	44	57	60	65	63	64	63	61	60	54	56	0.3	0.1
48	67	64	58	63	44	43	58	60	65	63	64	63	62	60	54	56	0.2	0.2
49	68	64	59	63	44	43	58	61	66	64	65	64	63	61	56	57	0.1	0.2
50	68	65	60	64	45	43	59	61	66	64	65	63	63	62	55	58	0.2	0.2
51	69	66	61	65	45	42	60	62	66	64	66	63	63	62	56	58	0.2	0.2
52	55	55	62	65	45	42	61	62	67	65	67	63	64	63	57	59	0.3	0.2
53	24	22	62	65	46	43	62	63	67	65	67	63	64	63	57	59	0.1	0.2
54	19	17	64	67	47	43	64	63	68	65	68	64	65	64	58	60	0.1	0.2
55	18	17	65	67	48	43	66	64	69	66	69	65	65	65	58	60	0.1	0.2
56	17	16	66	67	49	43	66	64	69	66	71	65	66	65	59	60	0.2	0.2
57	17	16	67	69	49	43	67	65	69	67	74	66	66	65	59	61	0.2	0.2
58	17	16	67	71	49	44	69	65	70	67	74	67	67	66	60	61	0.5	0.2
59	17	15	68	73	50	44	71	65	70	68	76	68	68	67	61	62	1.2	0.2
60	17	15	69	74	49	45	72	66	71	68	74	68	68	67	61	62	1.3	0.2
61	16	15	70	76	50	46	75	66	71	68	73	69	69	68	62	62	0.3	0.2
62	16	16	71	77	51	47	76	67	72	69	74	70	69	68	62	63	0.3	0.2
63	16	16	72	79	51	48	76	68	73	70	74	71	70	69	63	64	-0.2	0.2
64	16	16	73	81	51	49	77	68	74	70	74	71	70	69	64	64	0.9	0.3
65	16	16	74	83	51	50	80	69	75	71	75	72	71	70	65	65	0.1	0.4
66	16	16	76	87	52	52	84	70	76	71	76	73	72	71	66	66	1.2	0.4
67	16	16	78	94	53	53	89	70	77	72	77	74	72	71	66	67	1.1	0.5

Time	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	kw/m²	kw/m²
68	150	17	80	103	54	57	91	71	80	73	78	75	73	72	67	67	1.5	0.6
69	24	17	82	72	57	60	98	72	90	74	79	75	74	73	68	68	1.3	0.7
70	19	17	84	23	29	65	107	72	49	61	68	51	63	66	69	68	2.4	0.7