

Fire resistance test report

Issuing laboratory: Warringtonfire Testing and Certification Limited

Test standard: BS EN 1634-1:2014+A1:2018

Test sponsor: Panel Technologies Limited

Report number: 527422

Test date: Friday 25th August 2023

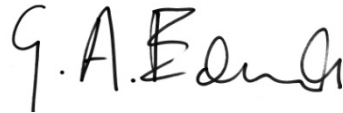
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			Prepared by	Authorised by
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		Signature		

Signed for and on behalf of Warringtonfire Testing and Certification Limited

Executive summary

This report documents the findings of the fire resistance test of doorsets in accordance with BS EN 1634-1:2014+A1:2018 with deviations as described in Table 3.

Warringtonfire Testing and Certification Limited (Warringtonfire) performed the test on Friday 25th August 2023 at the request of Panel Technologies Limited.

Table 1 provides a summary of the test specimen, Table 2 gives details of the supporting construction and Table 3 describes the summary of the test results.

Table 1 Test specimen

Item	Detail	Opening direction
Doorset A	Doorset A	Towards the furnace
Doorset B	Doorset B	Away from the furnace
Latching conditions	Engaged 3 point locking system engaged	

Table 2 Supporting construction

Item	Detail		
Supporting construction	A plasterboard clad EI 120 steel stud supporting construction with steel 'C' studs meeting the specification of Group A within table 1 of EN 1363-1: 2020.		
Dimensions	Width	3000 mm	
	Height	3000 mm	
	Thickness	130 mm	
Aperture dimensions		Width	Height
	Doorset A	910 mm	2410 mm
	Doorset B	910 mm	2410 mm
Restraint conditions	Restrained on top and bottom edges		

Table 3 Summary of test results

Item	Criteria		Results
Doorset A	Integrity		52 minutes
	Insulation	I ₁	11 minutes
		I ₂	24 minutes
	Radiation of 15 kW/m²		Radiation intensity of 15 kW/m² was not reached after 132 minutes
Doorset B	Integrity		55 minutes
	Insulation	I ₁	4 minutes
		I ₂	7 minutes
	Radiation of 15 kW/m²		105 minutes
Notes:			
The test results for the specimen only apply to the tested orientation. The test was discontinued after 132 minutes. ‘*’ indicates failure due to integrity failure.			

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1. Introduction

This report documents the findings of the fire resistance test of doorsets in accordance with BS EN 1634-1:2014+A1:2018.

Warringtonfire performed the test on Friday 25th August 2023 at the request of the test sponsor listed in Table 4.

Table 4 Test sponsor(s) details

Test sponsor(s)	Address
Panel Technologies Limited	49-61 Jodrell Street Nuneaton, Warwickshire, CV11 5EG United Kingdom

2. Test specimen and supporting construction

2.1 Drawings of test assembly

The description of the test specimen and supporting construction are detailed in Section 0 and illustrated in Figure 1 to Figure 5. All measurements are in millimetres – unless indicated otherwise.

The drawings were supplied by the test sponsor and were amended and verified by Warringtonfire (unless stated otherwise in Section 2.2).

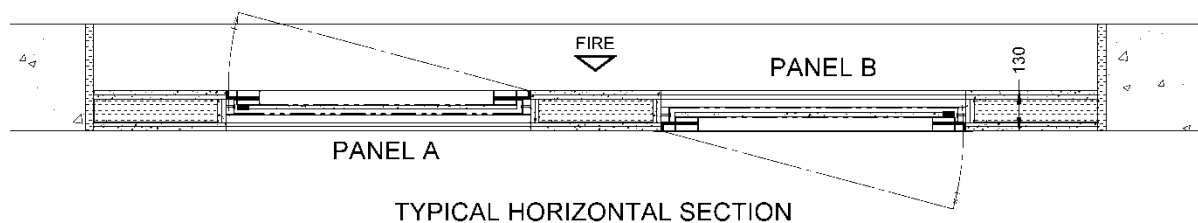
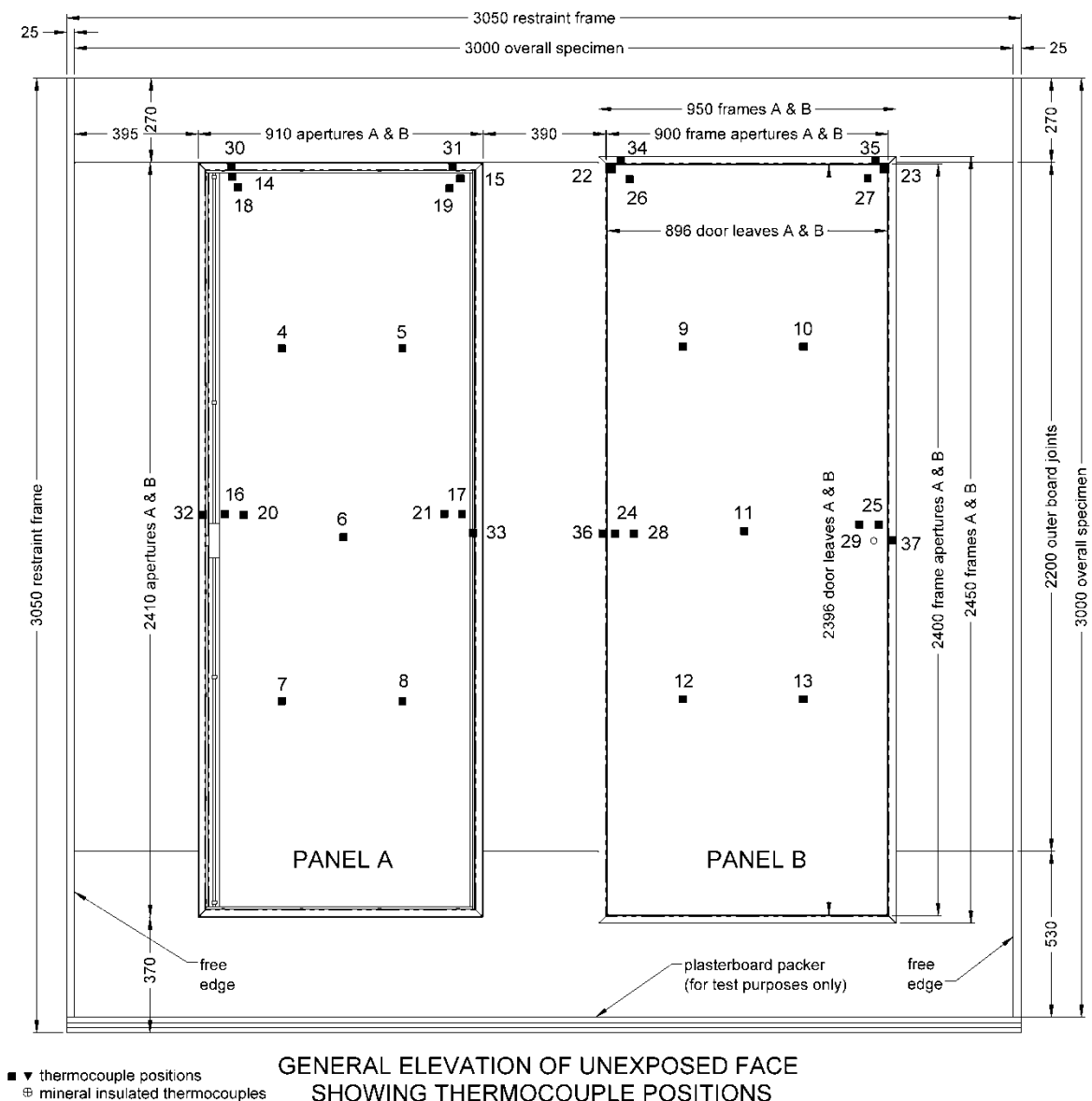
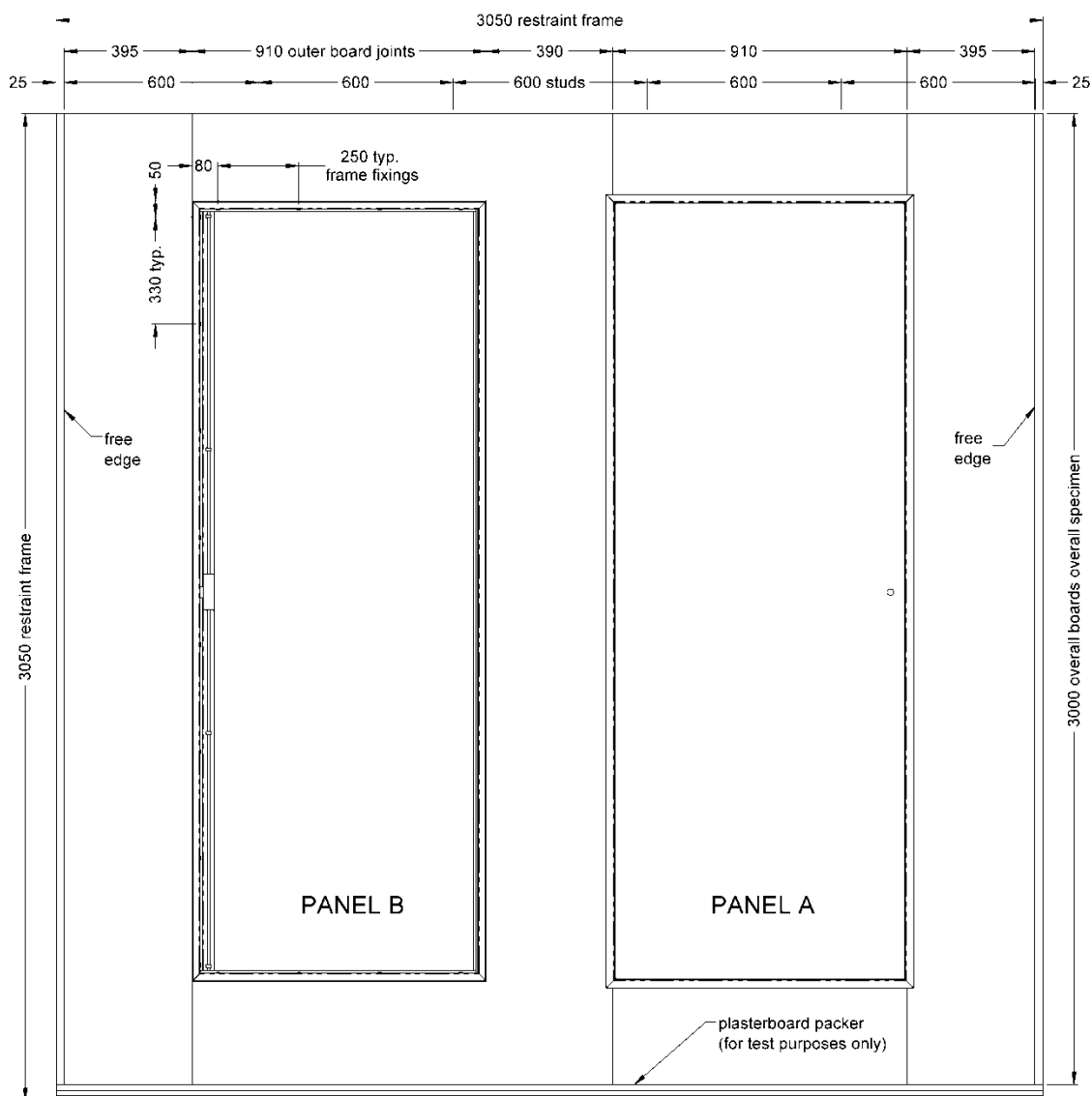
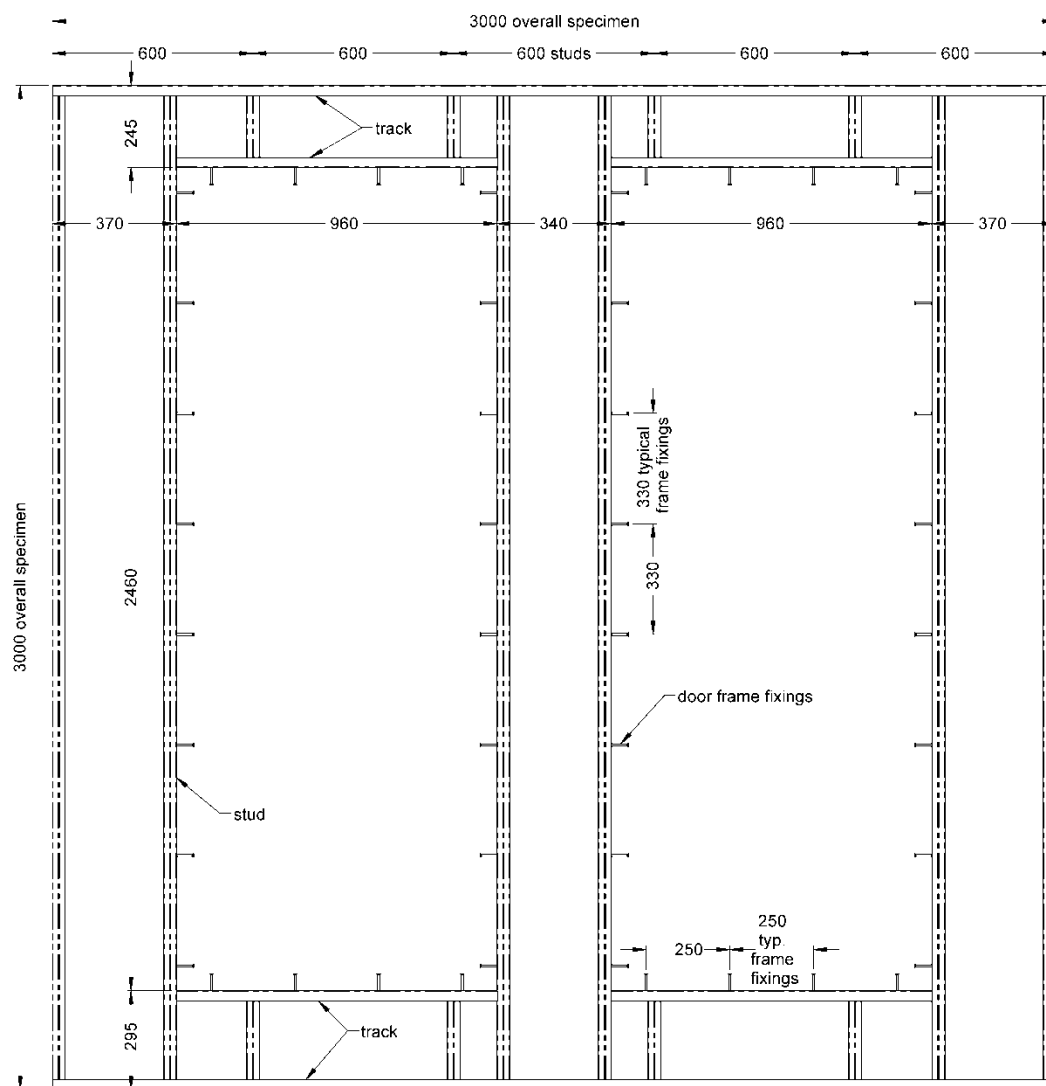


Figure 1 General Elevation of Test Construction – Unexposed face



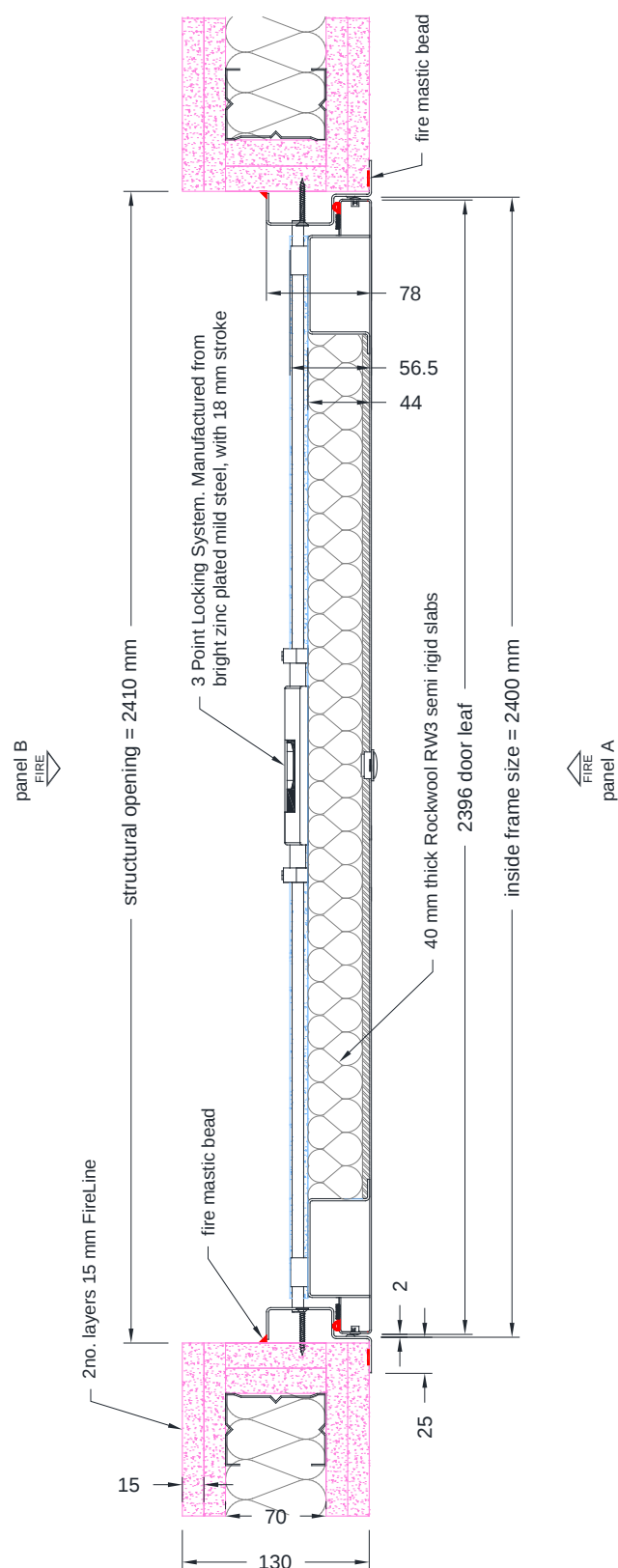
GENERAL ELEVATION OF EXPOSED FACE

Figure 2 General Elevation of Test Construction – Exposed face



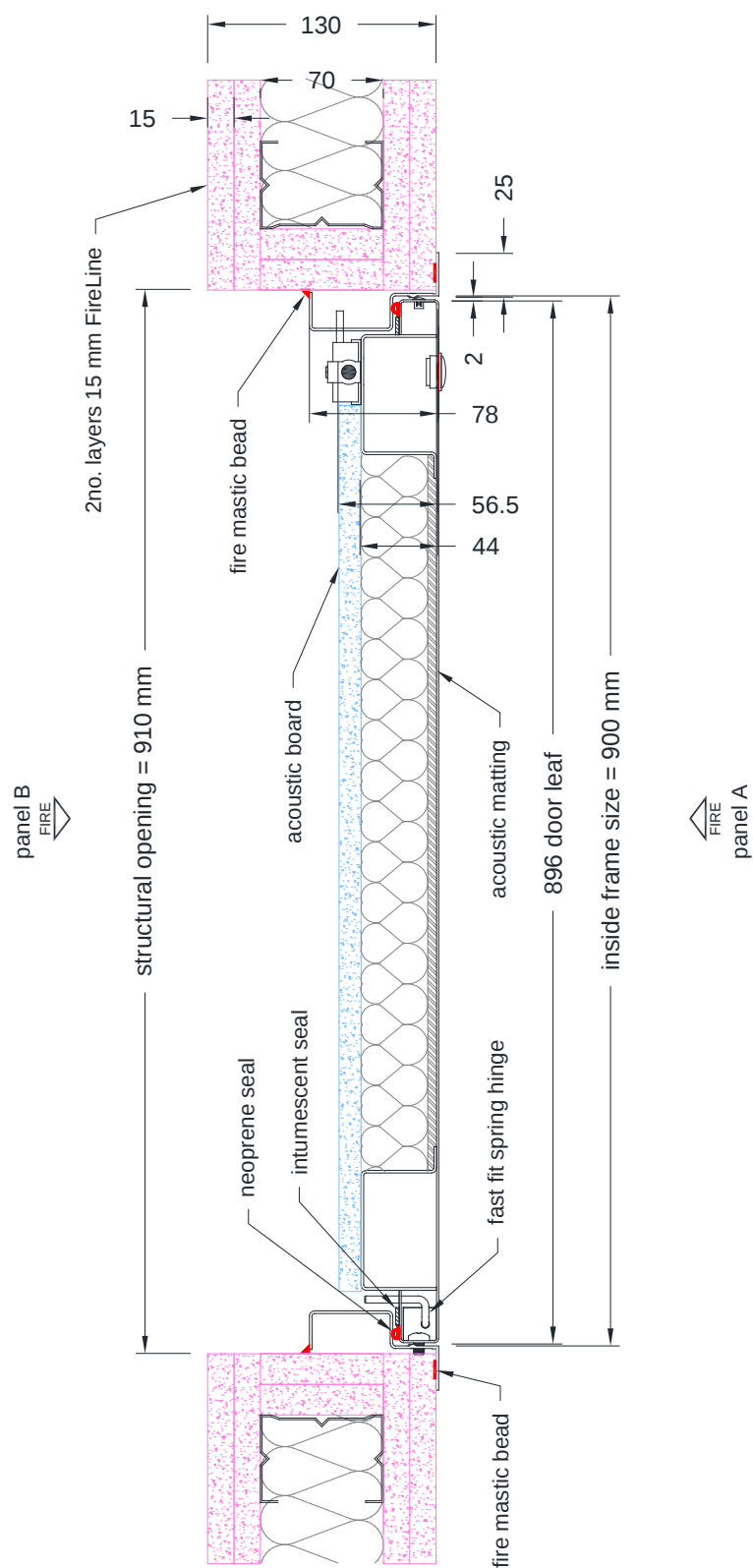
GENERAL ELEVATION OF UNEXPOSED FACE
SHOWING INTERNAL FRAMEWORK

Figure 3 General Elevation of Test Construction – Unexposed face



TYPICAL VERTICAL (LONGITUDINAL) SECTION THROUGH DOOR PANEL

Figure 4 Typical Vertical Section (Longitudinal) through Test Construction



TYPICAL VERTICAL (TRANSVERSE) SECTION THROUGH DOOR PANEL

Figure 5 Typical Vertical Section (Transverse) through Test Construction

Schedule of components

Table 5 details the schedule of components which describes the test specimen and lists the components used in the construction of the test specimen. These were provided by the test sponsor and surveyed by Warringtonfire.

All measurements were verified by Warringtonfire unless stated otherwise in the schedule of components. All components marked with an "*" have not been verified by Warringtonfire.

Table 5 Schedule of components

Door Leaf

1. Active Leaf Assembly	
Manufacturer	Panel Technologies
Reference	Single Door Riser Door
Part Number	(51-FR-MD-PF-3WL-DB)
Material	Zintec steel & plasterboard insert
Overall size	2396 mm height x 896 mm width x 56.5 mm thick (measured)
Door Leaf construction	See Figures 4 and 5 for details
Doors fitted	Opening towards furnace (Panel A). Opening away from furnace (Panel B)

Door Frame

2. Frame Assembly	
Manufacturer	Panel Technologies
Reference	Frame Assembly
Part Number	(51-FR-MD-PF-3WL-DB)
Material	Zintec steel
Overall Sizes	2450 mm height x 950 mm width x 78 mm
Frame Section Size	78 mm x 45 mm x 1.7 mm thickness (measured)
Frame construction	See Figures 4 and 5 for details
Fixing method	Frame through fixed to internal framework of partition via aperture linings with 120 mm long x 6 mm diameter multi-purpose steel screws at 250 mm (head and base) and 330 mm (vertical edges)
Gap Filling	Gaps between the specimen and the restraint frame on both faces sealed with bead of Rockwool Firepro® Firestop Acoustic Intumescent
Packing Material	Zintec frame shim
Packing Material Dimension	110 mm x 60 mm x various thicknesses to suit
Packing Material Location	Behind vertical fixing points in Panel A only

Hardware

3. Hinge	
Type	Fast Fit Spring Hinge
Material	Electroplated steel
Overall size	19 mm long x 19 mm wide x 40 mm deep with 8 mm diameter pin
Fixing method to door	Welded
4. Lock	
Type	3 Point Locking System (bright zinc plated mild steel, with 18 mm stroke)
Material	Bright zinc plated mild steel
Overall Size	162 mm long x 37 mm wide x 8 mm diameter bar
Fixing method to door	Bolted with M5 x 25 mm BZP Hexagon Head Bolts

Additional components

5. Acoustic matting	
Manufacturer	Custom Audio Designs
Reference	IsoBase R50
Material	Closed cell foam
Thickness	5 mm
Fixing method to door	Laid inside the door panel and overlaid with Rockwool RW3 mineral fibre infill
6. Panel insulation	
Manufacturer	Rockwool
Reference	RW3 semi rigid slabs
Material	Stone mineral wool
Thickness	40 mm
Density	60 kg/m ³ (stated)
Fixing method to door	Laid inside the door panel and overlaid with plasterboard insert

7. Plasterboard insert

Manufacturer	Siniat
Reference	dB Board
Material	Aerated high-density gypsum core encased in strong paper liners
Thickness	12.5 mm
Density	824 kg/m ³ (stated)
Fixing method to door	Laid inside the door panel and fixed with 25 mm long x 3.5 mm diameter screws at 200 mm – 300 mm centres around the edge of the board

8. Seal

Manufacturer	C.R.A. International Limited
Reference	18693
Type	White 'P' Profile Compression Self Adhesive Neoprene Seal
Material	Neoprene
Overall Size	9.4 mm wide x 3.6 mm deep
Fixing method to door	Self-adhered to the edge of the door panel

9. Intumescent strip

Manufacturer	Envirograph
Reference	G10/10
Type	Compressible graphite-based intumescent strip
Overall size	10 mm long x 2 mm wide
Fixing method to door	Self-adhered to the edge of the door panel

130 mm Flexible partition

10. Head and base track	
Manufacturer	British Gypsum
Reference	Gypframe 72 FEC 50
Material	Galvanised steel
Thickness	0.5 mm
Section size	29 mm deep x 72 mm wide
Fixing method	Through fixed to restraint frame via plasterboard packer with 70 mm long x 7.5 mm diameter concrete screws and washers at 600 mm centres
11. Stud	
Manufacturer	British Gypsum
Reference	Gypframe 70 S 50
Material	Galvanised steel
Thickness	0.5 mm
Section size	39 / 37 mm deep x 70 mm wide
Fixing method	Through fixed to horizontal track with once 13 mm long x 4.1 mm diameter wafer head screw per joint. Studs were spaced at 600 mm centres
12. Insulation	
Manufacturer	Rockwool
Reference	ProRox SL960
Material	Stone mineral wool
Thickness	50 mm (uncompressed)
Density	100 kg/m ³ (stated)
Fixing method	Cut to size and laid between studs

13. Plasterboard facings

Manufacturer	British Gypsum
Reference	Gyproc FireLine
Material	Gypsum plasterboard with glass fibre and additional additives
Thickness	30 mm (2 layers of 15 mm)
Density	776 kg/m ³ (stated)
Fixing method	Through fixed to the internal framework with zinc-coated 25 mm long x 3.5 mm diameter screws (inner layer) and 40 mm long x 3.5 mm diameter screws (outer layer). Both layers were fixed at 300 mm centres throughout. Board joints were staggered with respect to the adjacent layer. Joints and screw heads were taped and filled with scrim tape and Gyproc ProMix Lite joint filler. Additionally, each aperture was lined with two layers of board.

Supporting construction

Table 6 details the supporting construction used for this fire resistance test.

Table 6 Supporting construction

Item	Detail		
Supporting construction	A plasterboard clad EI 120 steel stud supporting construction with steel 'C' studs meeting the specification of Group A within table 1 of EN 1363-1: 2020.		
Dimensions	Width	3000 mm	
	Height	3000 mm	
	Thickness	130 mm	
Aperture dimensions		Width	Height
	Doorset A	910 mm	2410 mm
	Doorset B	910 mm	2410 mm
Restraint conditions	Restrained on top and bottom edges		

3. Test procedure

Table 7 details the test procedure for this fire resistance test.

Table 7 Test procedure

Item	Detail	
Test standard	The test was performed in accordance with BS EN 1634-1:2014+A1:2018.	
Product standard and/or EAD	EN 16034: 2014	
EGOLF agreements and/or recommendations	Certain aspects of some fire test specifications are open to different interpretations. EGOLF have identified a number of these areas and have agreed on resolutions which define a common agreement of interpretations between fire test laboratories that are members of the group. If such resolutions apply to this test, they have been followed.	
Deviations from test method	None	
Instrumentation and equipment	The instrumentation was provided in accordance with BS EN 1634-1:2014+A1:2018, BS EN 1363-1:2020, and where appropriate BS EN 1363-2:1999.	
Pre-test conditioning	The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 5 days. 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 19°C to 31°C and 39% to 69.5% respectively.	
Pre-test measurements	Gap measurements	According to clause 10.1.2 of BS EN 1634-1:2014+A1:2018, these measurements were completed before the start of the fire test. They are shown in Figure and Table 22 and Table 23 in Appendix C.
	Operability test	According to clause A.2.2 of EN 16034, the door(s) were subjected to a series of 25 opening and closing cycles of at least 90° for side-hung doorset(s).
	Final setting	According to clauses 10.1.4 of BS EN 1634-1: 2018 and A.2.2 of EN 16034, the door(s) were subjected to 1 cycle which was completed.
		Doorset A
	Latching force	N/A
		Doorset B
	Latching force	N/A
Installation details	Delivery date of the test specimen	
	Start date for construction of supporting construction	21st August 2023
	Completion date for construction of supporting construction	23rd August 2023
	Start date for installation of test specimen	24th August 2023
	Completion date for installation of test specimen	24th August 2023
	Supporting construction constructed by	Representatives of Warringtonfire
	Doorset installed by	Representatives of the test sponsor

Item	Detail	
Symmetry	Asymmetrical: - Doorset A opened into the furnace. - Doorset B opened away from the furnace The direction of exposure was decided by the test sponsor.	
Ambient laboratory temperature	Start of the test	19.0 °C
	Minimum temperature	17.0 °C
	Maximum temperature	23.0 °C
Sampling / specimen selection	Warringtonfire was not involved in the sampling of the tested specimen or any of the components. The results obtained during the test only apply to the test samples as provided by the test sponsor.	

4. Test measurements and results

Table 8 summarises the results achieved by the test specimen against the performance criteria listed in BS EN 1634-1:2014+A1:2018 for the following parameters:

- Integrity – The specimen must retain its separating function, without causing either ignition of a cotton pad when applied, or permitting the penetration of a gap gauge as specified in BS EN 1634-1: 2014 + A1:2018, or resulting in sustained flaming on the unexposed surface.
- Insulation (I_1) – The test specimen must be evaluated against the maximum temperature rise criteria specified in EN 1363-1: 2020 (180°C).
- Insulation (I_2) – The mean temperature rise (ΔT_m) of the unexposed surface must not be greater than 140°C and the maximum temperature rise (ΔT_M) must not be greater than 180°C, with the exception that the limit for temperature rise for any frame member or transom member adjacent to the leaf/leaves of the doorset or openable window must be 360°C. Insulation failure also occurs simultaneously with integrity failure as specified in BS EN 1634-1: 2014 + A1:2018.
- Radiation – Elements for which the radiation criteria is evaluated must be given by the time for the measured radiation to exceed the value of 5, 10, 15, 20, 25 kW/m² as specified in BS EN 1363-2: 1999.

If a measurement device is defective, or has detached from the test specimen, the data is no longer given. From that moment on, the temperature measurements are taken by means of the roving thermocouple.

Appendix A includes observations of any significant behaviour of the specimen and details of the occurrence of the relevant performance criteria.

Appendix B details the location of the instrumentation used during the test.

Appendix C includes details of the measurements taken during the test.

Appendix D includes photographs of the test specimen before, during and after the test.

Table 8 Detailed test results

Criteria		Doorset A	Doorset B
Thermal insulation			
Supplementary procedure – I ₁			
$\Delta T_M = 180^\circ\text{C}$		25 minutes	4 minutes
$\Delta T_M = 180^\circ\text{C}$ on the frame		11 minutes	7 minutes
Normal procedure – I ₂			
$\Delta T_m = 140^\circ\text{C}$		59 minutes	35 minutes
$\Delta T_M = 180^\circ\text{C}$		39 minutes	7 minutes
$\Delta T_M = 360^\circ\text{C}$ on the frame		24 minutes	17 minutes
Integrity		52 minutes	55 minutes
Sustained flaming		No integrity failure for this criteria at the termination of the test	No integrity failure for this criteria at the termination of the test
Failure with gap gauge		No integrity failure for this criteria at the termination of the test	No integrity failure for this criteria at the termination of the test
Cotton pad failure		52 minutes	55 minutes
Radiation			
Radiation intensity	15 kW/m ²	Radiation intensity of 15 kW/m ² was not reached after 132 minutes	105 minutes
Notes:			
The test results for the specimen only apply to the tested orientation. The test was discontinued after 132 minutes. '*' indicates failure due to integrity failure.			

5. Application of test results

5.1 Field of direct application

EN 1634-1:2014+A1:2018 states that “The field of direct application may only be defined following the identification of classification(s)” and that “The field of (direct and, where applicable, extended) application should be included in the classification report”. For these reasons, the field of direct application in is not covered by this test report.

5.2 Validity

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The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire hazard of the product in use, nor can the results be extrapolated and applied to other products.

Reports are statements of fact(s) prepared in accordance with the referenced version of the standard(s) stated in Section 3 of this report. Reports are based upon the information provided to Warringtonfire. Warringtonfire takes no responsibility for the accuracy or completeness of such information.

The results stated in this report apply to the test specimens as received.

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 1634-1:2014+A1:2018, BS EN 1363-1:2020, 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.

Any differences in relation to the aforementioned characteristics may significantly affect the performance and will therefore invalidate the application of the test results to the variant product. It is recommended that any proposed variation to the tested configuration or product should be referred to the test sponsor. The test sponsor should then obtain appropriate documentary evidence of compliance from Warringtonfire or another accredited testing authority. The supplier of the product is responsible for ensuring that the product which is supplied for use is identical to the test specimens that were tested.

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5.3 Uncertainty of measurement

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.

Appendix A Test observations

Table 9 shows the observations of any significant behaviour of the specimen during the test.

Table 9 Test observations

Min	Sec	System	Observation
00	00		Commencement of test
01	14		Smoke release from the head of Doorset A (opening In)
02	22		Glowing on the left side of Doorset A (opening In)
03	48		Smoke release from the perimeter of both Doorsets- the head and both vertical edges
11	10		Discolouration at the head of Doorset B (opening out)
12	38		Doorset A (opening In) deflecting towards the heating conditions forming a small gap at the sill
15	00		Smoke release from the sill of Doorset A (opening in)
17	47		The top and bottom leading edge frame of Doorset B (opening out) are starting to deflect away from the heating conditions
20	10		Slight discolouration along the leading edge of Doorset B (opening out) and the head of Doorset A (opening In)
25	07		Discolouration along the leading edge of Doorset A (opening In)
28	00		Flushbolt bar is starting to melt away just below the centre lock
31	04		Brown discolouration at the sill of Doorset A (opening In)
32	40		Outer layer is coming away from the top right of Doorset A (opening In). The door is deflecting away from the heating conditions forming a gap in this area
40	37		Slight brown discolouration a third of the way down from the head of Doorset A (opening in)
43	05		Gap forming at the leading edge of Doorset A (opening In)
44	17		Screw positions at the head of Doorset A (opening In) glowing red
44	55		Cotton pad applied to the head of Doorset A (opening In). Cotton pad failed to ignite
46	00		Doorset B (opening out) turning yellow in colour
52	02	Doorset A	Cotton pad applied to the top right corner of Doorset A (opening In). Cotton pad ignited
55	00	Doorset B	Cotton pad applied to Doorset B near thermocouple 10. Cotton pad ignited
58	51		Brown discolouration at the sill of Doorset B (opening out)
61	27		Discolouration of the partition at the head
63	89		Glowing on Doorset A (opening In) half way down and one quarter of the way down
65	00		Doorset B (opening out) turning red at the centre
67	23		Outer paper layer on Doorset A (opening in) flaking away/charring
104	50		Plasterboard on Doorset A (opening out) has a split through the centre (Horizontally)
132	00		Test discontinued at request of the test sponsor

Appendix B Instrumentation locations

Figure shows the instrumentation locations for this fire resistance test.

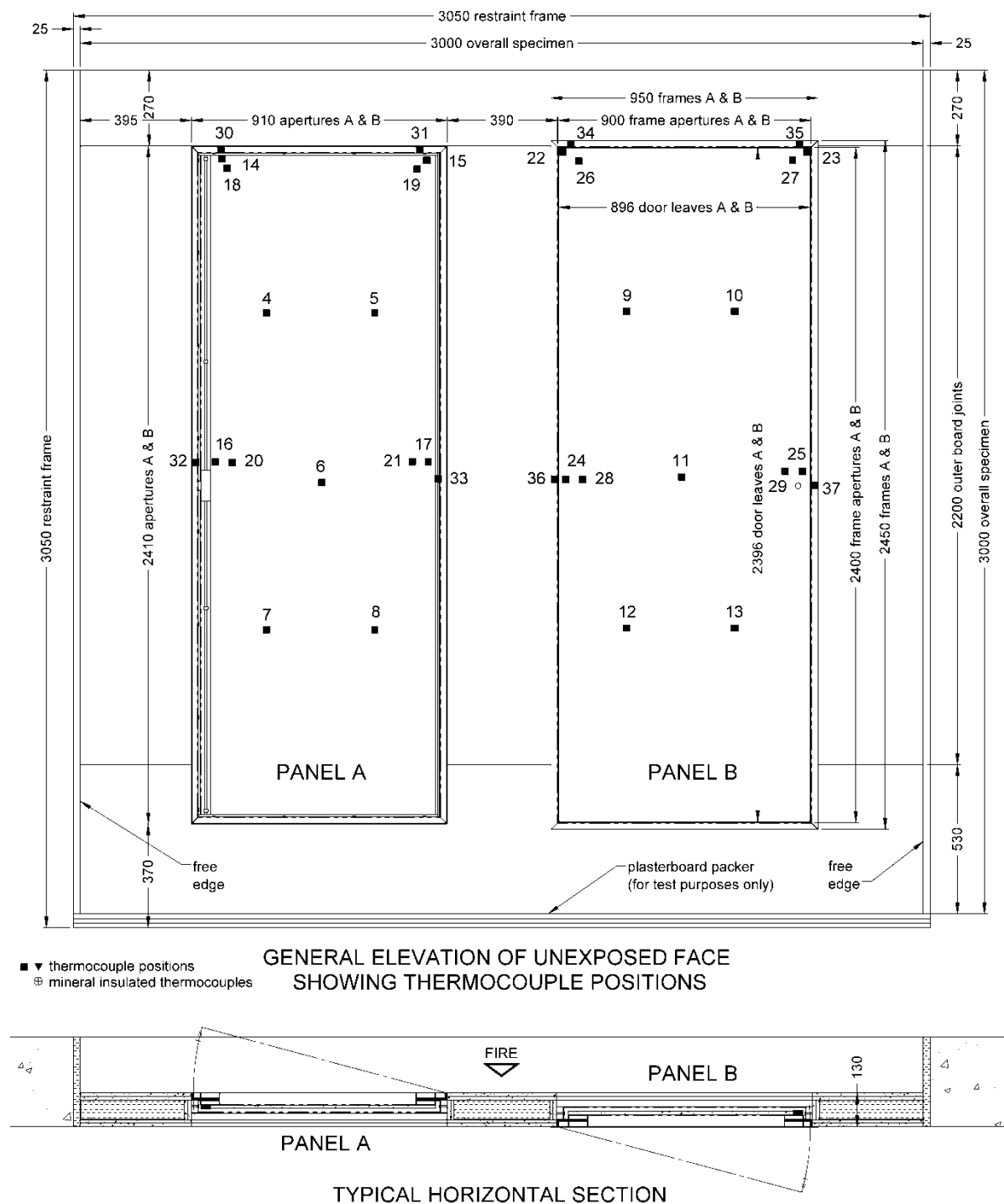


Figure 6 Instrumentation locations

Appendix C Test data

C.1 Furnace temperature and deviation

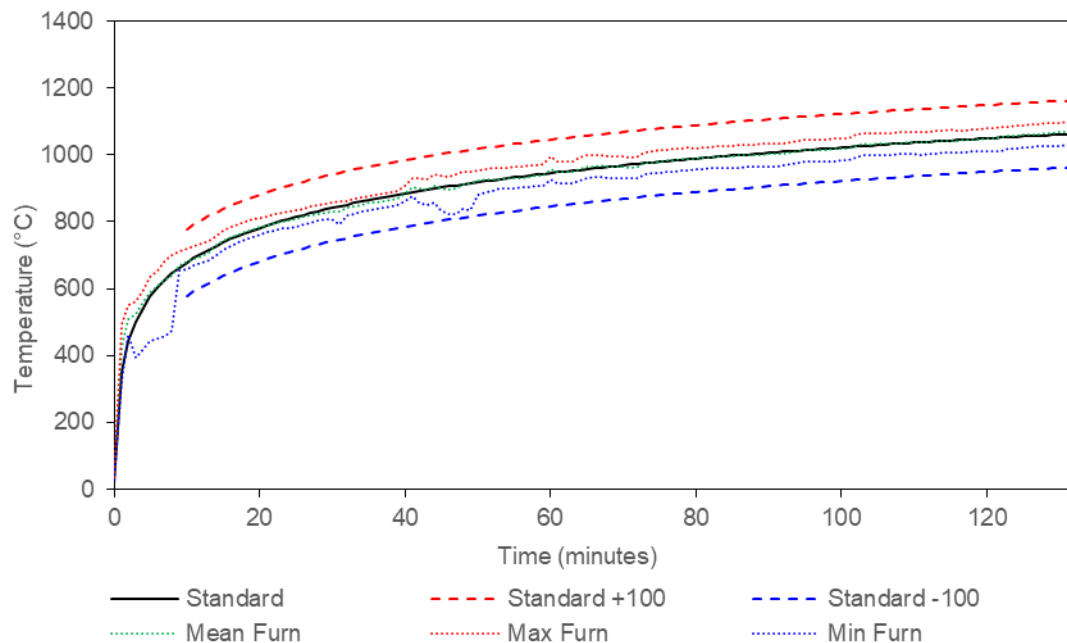


Figure 7 Furnace thermocouple temperature vs time

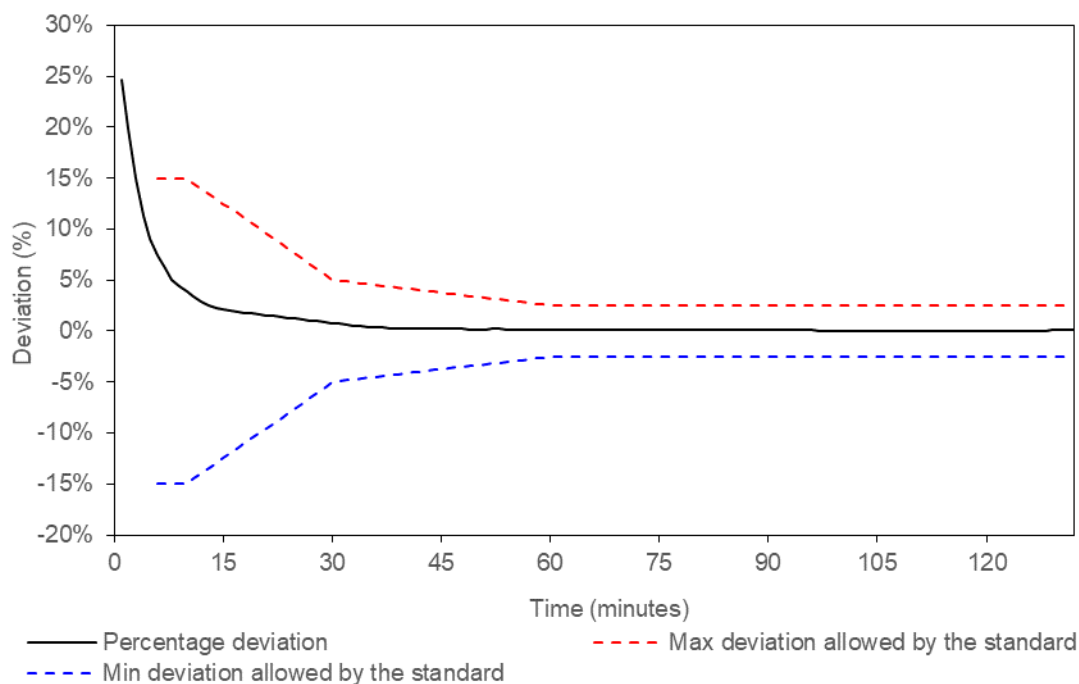


Figure 8 Percentage deviation of exposure severity vs time

C.2 Furnace pressure

The furnace pressure was taken at approximately 2700 mm above the sill of the test specimen.

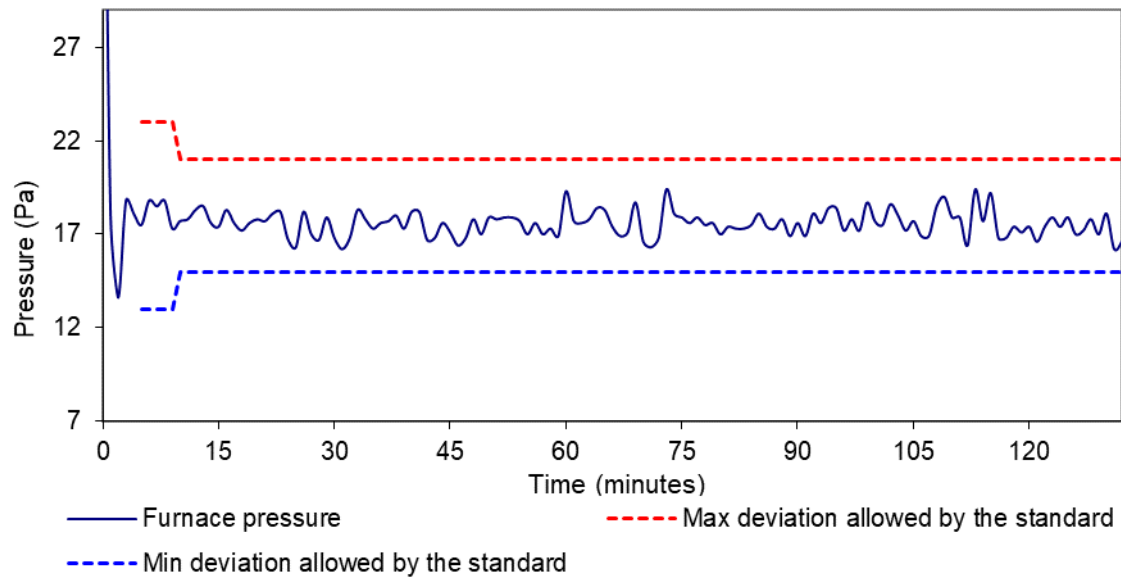


Figure 9 Furnace pressure

C.3 Specimen temperatures

Table 10 Individual & Mean Temperatures Recorded on The Unexposed Face of Doorset A

Time (mins)	Tc 004 (°C)	Tc 005 (°C)	Tc 006 (°C)	Tc 007 (°C)	Tc 008 (°C)	Average (°C)
0	19.0	19.0	19.0	20.0	19.0	19.2
4	20.0	20.0	20.0	21.0	20.0	20.2
8	26.0	29.0	29.0	33.0	34.0	30.2
12	43.0	50.0	48.0	56.0	59.0	51.2
16	61.0	69.0	64.0	71.0	76.0	68.2
20	75.0	81.0	79.0	83.0	83.0	80.2
24	81.0	85.0	83.0	87.0	85.0	84.2
28	84.0	86.0	85.0	89.0	88.0	86.4
32	85.0	87.0	88.0	92.0	90.0	88.4
36	87.0	89.0	90.0	95.0	93.0	90.8
40	90.0	93.0	93.0	99.0	97.0	94.4
44	96.0	98.0	97.0	103.0	102.0	99.2
48	102.0	106.0	102.0	108.0	108.0	105.2
52	106.0	112.0	107.0	112.0	115.0	110.4
56	116.0	120.0	113.0	121.0	132.0	120.4
60	137.0	151.0	127.0	158.0	222.0	159.0
64	209.0	240.0	182.0	242.0	258.0	226.2
68	245.0	279.0	274.0	264.0	260.0	264.4
72	258.0	284.0	397.0	260.0	255.0	290.8
76	262.0	280.0	*	253.0	251.0	261.5
80	259.0	291.0	*	256.0	253.0	264.8
84	256.0	278.0	*	262.0	258.0	263.5
88	252.0	274.0	*	269.0	276.0	267.8
92	250.0	273.0	*	275.0	294.0	273.0
96	258.0	273.0	*	281.0	313.0	281.3
100	263.0	272.0	*	284.0	303.0	280.5
104	264.0	272.0	*	289.0	292.0	279.3
108	262.0	275.0	*	315.0	283.0	283.8
112	276.0	277.0	*	325.0	273.0	287.8
116	272.0	278.0	*	312.0	275.0	284.3
120	268.0	278.0	*	294.0	280.0	280.0
124	268.0	280.0	*	285.0	286.0	279.8
128	268.0	283.0	*	286.0	294.0	282.8
132	269.0	286.0	*	293.0	297.0	286.3

***Thermocouple Malfunction**

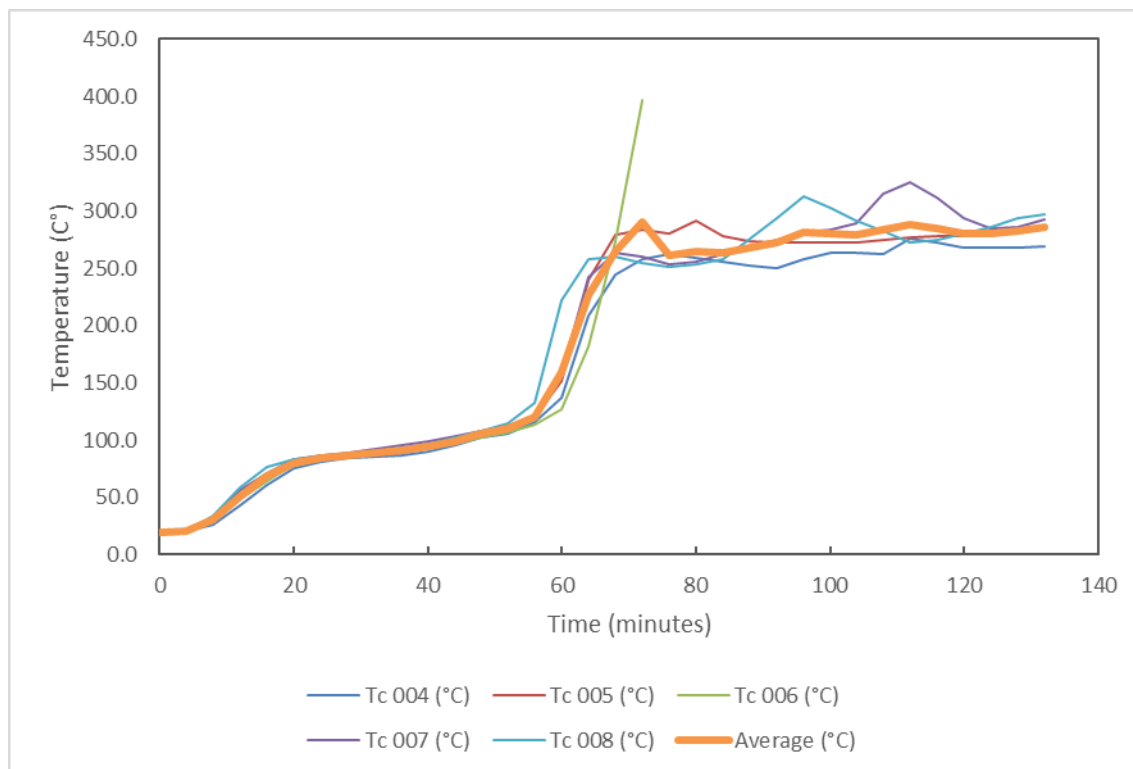


Figure 10 Individual & Mean Temperatures Recorded on The Unexposed Face of Doorset A

Table 11 Individual & Mean Temperatures Recorded on The Unexposed Face of Doorset B

Time (mins)	Tc 009 (°C)	Tc 010 (°C)	Tc 011 (°C)	Tc 012 (°C)	Tc 013 (°C)	Average (°C)
0	19.0	21.0	21.0	21.0	21.0	20.6
4	21.0	27.0	29.0	28.0	27.0	26.4
8	24.0	44.0	39.0	43.0	43.0	38.6
12	25.0	51.0	44.0	50.0	50.0	44.0
16	33.0	52.0	45.0	50.0	51.0	46.2
20	46.0	52.0	49.0	48.0	51.0	49.2
24	51.0	63.0	58.0	55.0	56.0	56.6
28	77.0	107.0	95.0	93.0	87.0	91.8
32	99.0	155.0	142.0	142.0	133.0	134.2
36	93.0	187.0	177.0	174.0	175.0	161.2
40	122.0	202.0	206.0	196.0	206.0	186.4
44	268.0	351.0	396.0	253.0	281.0	309.8
48	291.0	679.0	728.0	704.0	676.0	615.6
52	310.0	694.0	745.0	716.0	705.0	634.0
56	317.0	754.0	754.0	724.0	715.0	652.8
60	326.0	768.0	779.0	748.0	736.0	671.4
64	317.0	770.0	783.0	752.0	740.0	672.4
68	327.0	786.0	799.0	766.0	753.0	686.2
72	322.0	790.0	803.0	770.0	757.0	688.4
76	328.0	810.0	825.0	795.0	782.0	708.0
80	335.0	819.0	833.0	803.0	793.0	716.6
84	335.0	827.0	840.0	812.0	800.0	722.8
88	340.0	831.0	844.0	818.0	806.0	727.8
92	342.0	835.0	848.0	823.0	810.0	731.6
96	348.0	844.0	855.0	833.0	818.0	739.6
100	350.0	849.0	858.0	833.0	821.0	742.2
104	362.0	861.0	870.0	847.0	834.0	754.8
108	363.0	863.0	870.0	849.0	836.0	756.2
112	362.0	866.0	872.0	850.0	838.0	757.6
116	367.0	870.0	881.0	855.0	844.0	763.4
120	370.0	874.0	887.0	858.0	849.0	767.6
124	370.0	880.0	897.0	866.0	857.0	774.0
128	377.0	885.0	905.0	870.0	864.0	780.2
132	376.0	889.0	909.0	871.0	869.0	782.8

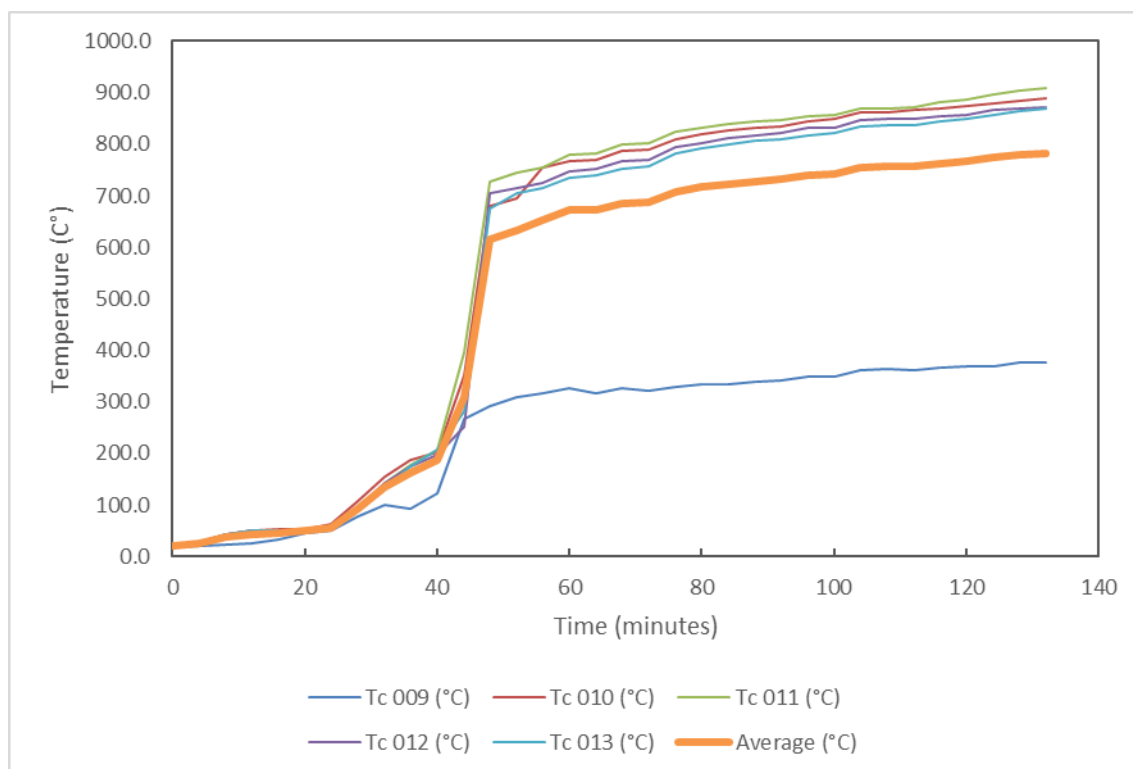


Figure 11 Individual & Mean Temperatures Recorded on The Unexposed Face of Doorset B

Table 12 Individual Temperatures Recorded 25 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset A

Time (mins)	Tc 014 (°C)	Tc 015 (°C)	Tc 016 (°C)	Tc 017 (°C)
0	24.0	23.0	23.0	23.0
4	32.0	31.0	40.0	33.0
8	61.0	78.0	85.0	88.0
12	87.0	93.0	92.0	93.0
16	100.0	97.0	111.0	96.0
20	111.0	110.0	121.0	102.0
24	120.0	158.0	140.0	132.0
28	152.0	293.0	224.0	237.0
32	264.0	367.0	280.0	300.0
36	338.0	383.0	323.0	324.0
40	372.0	383.0	342.0	328.0
44	376.0	382.0	342.0	319.0
48	376.0	*	357.0	322.0
52	370.0	*	375.0	333.0
56	369.0	*	*	357.0
60	371.0	*	*	*
64	375.0	*	*	*
68	379.0	*	*	*
72	378.0	*	*	*
76	376.0	*	*	*
80	*	*	*	*
84	*	*	*	*
88	*	*	*	*
92	*	*	*	*
96	*	*	*	*
100	*	*	*	*
104	*	*	*	*
108	*	*	*	*
112	*	*	*	*
116	*	*	*	*
120	*	*	*	*
124	*	*	*	*
128	*	*	*	*
132	*	*	*	*

***Thermocouple Malfunction**

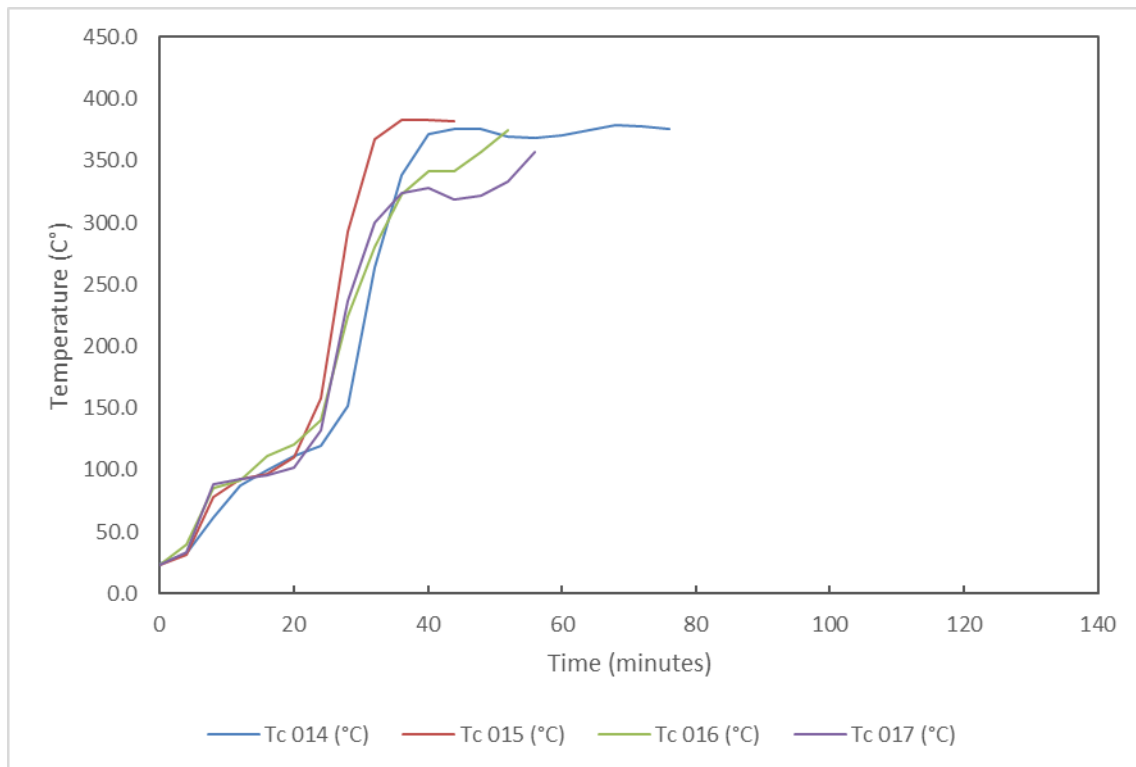


Figure 12 Individual Temperatures Recorded 25 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset A

Table 13 Individual Temperatures Recorded 100 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset A

Time (mins)	Tc 018 (°C)	Tc 019 (°C)	Tc 020 (°C)	Tc 021 (°C)
0	22.0	21.0	21.0	21.0
4	25.0	23.0	22.0	22.0
8	35.0	34.0	29.0	48.0
12	57.0	59.0	49.0	76.0
16	73.0	76.0	68.0	82.0
20	84.0	89.0	81.0	87.0
24	95.0	93.0	86.0	90.0
28	102.0	96.0	90.0	95.0
32	107.0	105.0	95.0	102.0
36	113.0	131.0	100.0	111.0
40	118.0	203.0	105.0	126.0
44	139.0	290.0	110.0	177.0
48	229.0	344.0	118.0	259.0
52	280.0	335.0	150.0	317.0
56	339.0	341.0	242.0	347.0
60	406.0	354.0	305.0	*
64	*	358.0	386.0	*
68	*	*	*	*
72	*	*	*	*
76	*	*	*	*
80	*	*	*	*
84	*	*	*	*
88	*	*	*	*
92	*	*	*	*
96	*	*	*	*
100	*	*	*	*
104	*	*	*	*
108	*	*	*	*
112	*	*	*	*
116	*	*	*	*
120	*	*	*	*
124	*	*	*	*
128	*	*	*	*
132	*	*	*	*

***Thermocouple Malfunction**

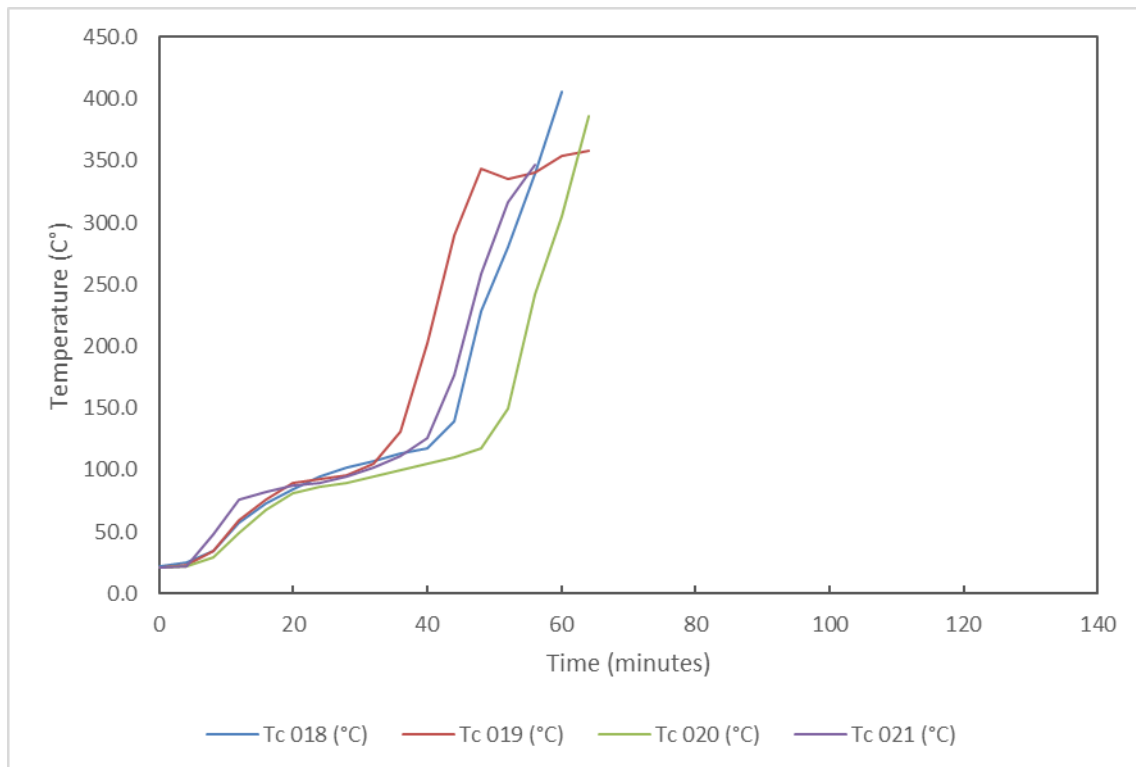


Figure 13 Individual Temperatures Recorded 100 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset A

Table 14 Individual Temperatures Recorded 25 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset B

Time (mins)	Tc 022 (°C)	Tc 023 (°C)	Tc 024 (°C)	Tc 025 (°C)
0	21.0	21.0	20.0	19.0
4	203.0	177.0	76.0	74.0
8	269.0	248.0	102.0	123.0
12	311.0	314.0	130.0	169.0
16	356.0	370.0	160.0	211.0
20	387.0	366.0	195.0	265.0
24	410.0	389.0	234.0	319.0
28	434.0	415.0	269.0	370.0
32	460.0	427.0	306.0	404.0
36	481.0	441.0	345.0	430.0
40	495.0	454.0	366.0	448.0
44	509.0	470.0	390.0	479.0
48	493.0	458.0	507.0	532.0
52	495.0	454.0	526.0	547.0
56	528.0	497.0	534.0	555.0
60	544.0	509.0	544.0	563.0
64	553.0	519.0	553.0	571.0
68	565.0	529.0	567.0	584.0
72	570.0	531.0	572.0	586.0
76	580.0	543.0	584.0	601.0
80	588.0	552.0	593.0	608.0
84	595.0	559.0	601.0	617.0
88	601.0	566.0	607.0	623.0
92	605.0	570.0	614.0	628.0
96	612.0	578.0	623.0	636.0
100	617.0	581.0	630.0	640.0
104	626.0	591.0	642.0	650.0
108	631.0	597.0	649.0	652.0
112	634.0	600.0	657.0	656.0
116	638.0	604.0	664.0	661.0
120	641.0	606.0	672.0	663.0
124	643.0	611.0	679.0	669.0
128	649.0	614.0	686.0	675.0
132	652.0	618.0	689.0	680.0

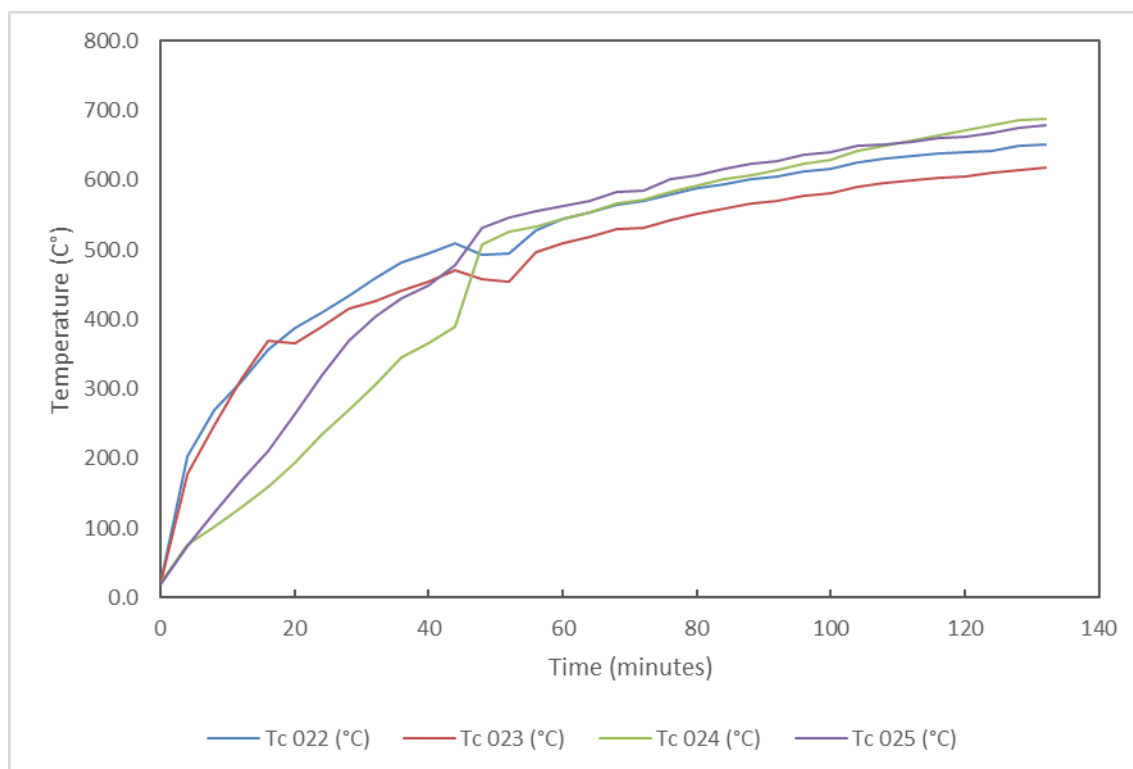


Figure 14 Individual Temperatures Recorded 25 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset B

Table 15 Individual Temperatures Recorded 100 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset B

Time (mins)	Tc 026 (°C)	Tc 027 (°C)	Tc 028 (°C)	Tc 029 (°C)
0	20.0	20.0	19.0	23.0
4	163.0	98.0	83.0	70.0
8	211.0	138.0	85.0	93.0
12	239.0	166.0	90.0	104.0
16	276.0	224.0	96.0	138.0
20	328.0	318.0	126.0	183.0
24	370.0	403.0	179.0	229.0
28	397.0	445.0	230.0	271.0
32	432.0	463.0	274.0	316.0
36	461.0	482.0	317.0	344.0
40	496.0	515.0	328.0	359.0
44	530.0	545.0	387.0	414.0
48	507.0	526.0	639.0	635.0
52	513.0	536.0	660.0	650.0
56	644.0	627.0	666.0	655.0
60	658.0	639.0	682.0	666.0
64	663.0	645.0	688.0	669.0
68	674.0	656.0	705.0	684.0
72	674.0	655.0	707.0	683.0
76	686.0	671.0	725.0	697.0
80	688.0	676.0	736.0	707.0
84	689.0	681.0	742.0	713.0
88	693.0	681.0	749.0	719.0
92	699.0	687.0	753.0	723.0
96	707.0	695.0	764.0	732.0
100	711.0	700.0	770.0	737.0
104	721.0	711.0	784.0	748.0
108	723.0	713.0	785.0	751.0
112	725.0	715.0	788.0	756.0
116	731.0	720.0	794.0	760.0
120	735.0	723.0	800.0	765.0
124	739.0	728.0	806.0	772.0
128	748.0	733.0	813.0	779.0
132	752.0	739.0	818.0	785.0

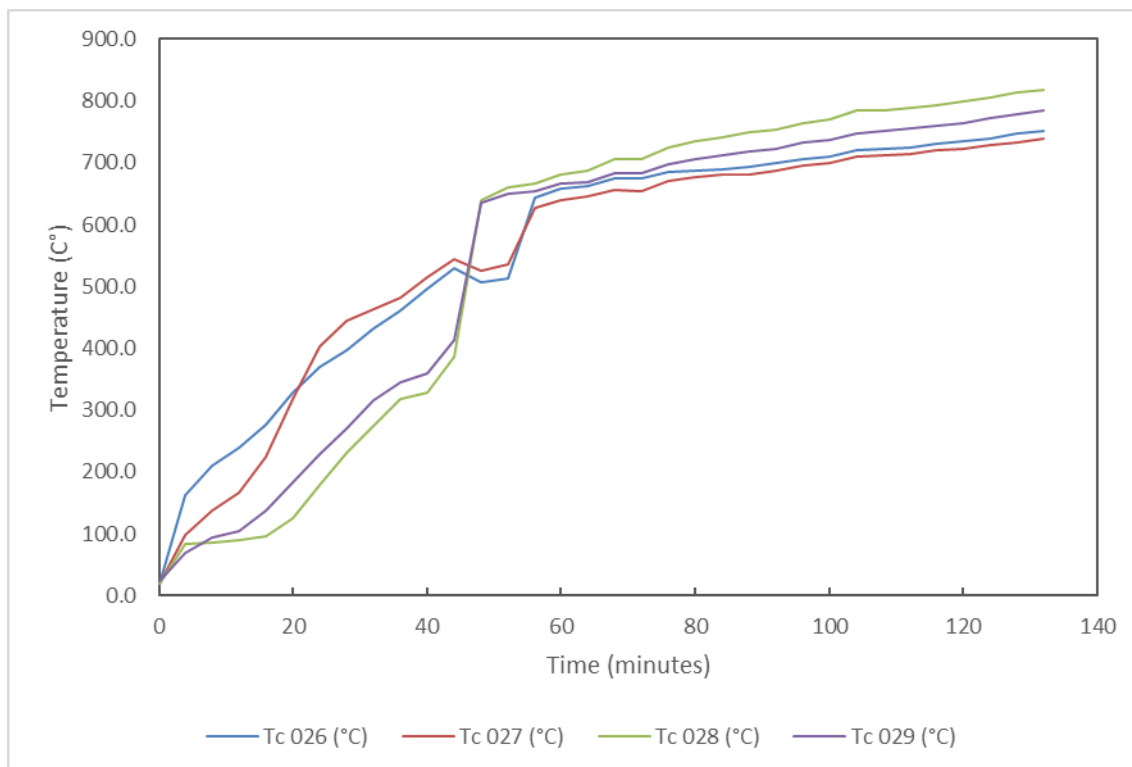


Figure 15 Individual Temperatures Recorded 100 mm Away From the Door Leaf Edges on The Unexposed Face of Doorset B

Table 16 Individual Temperatures Recorded on The Unexposed Face of The Frame on Doorset A

Time (mins)	Tc 030 (°C)	Tc 031 (°C)	Tc 032 (°C)	Tc 033 (°C)
0	26.0	25.0	24.0	24.0
4	93.0	101.0	71.0	72.0
8	149.0	162.0	124.0	119.0
12	201.0	234.0	177.0	195.0
16	250.0	273.0	213.0	234.0
20	296.0	326.0	249.0	260.0
24	320.0	373.0	278.0	282.0
28	344.0	410.0	302.0	302.0
32	368.0	430.0	323.0	323.0
36	387.0	451.0	349.0	342.0
40	402.0	469.0	376.0	359.0
44	421.0	490.0	403.0	381.0
48	438.0	479.0	423.0	411.0
52	450.0	497.0	439.0	440.0
56	464.0	532.0	452.0	456.0
60	475.0	553.0	462.0	473.0
64	521.0	581.0	471.0	486.0
68	566.0	606.0	482.0	489.0
72	590.0	618.0	487.0	487.0
76	608.0	629.0	493.0	489.0
80	615.0	642.0	501.0	494.0
84	632.0	656.0	506.0	496.0
88	646.0	671.0	509.0	497.0
92	660.0	677.0	514.0	503.0
96	675.0	683.0	521.0	504.0
100	690.0	691.0	523.0	507.0
104	705.0	700.0	526.0	517.0
108	712.0	706.0	533.0	529.0
112	719.0	709.0	538.0	536.0
116	725.0	713.0	549.0	554.0
120	729.0	716.0	559.0	593.0
124	731.0	720.0	563.0	606.0
128	734.0	724.0	572.0	613.0
132	736.0	730.0	595.0	628.0

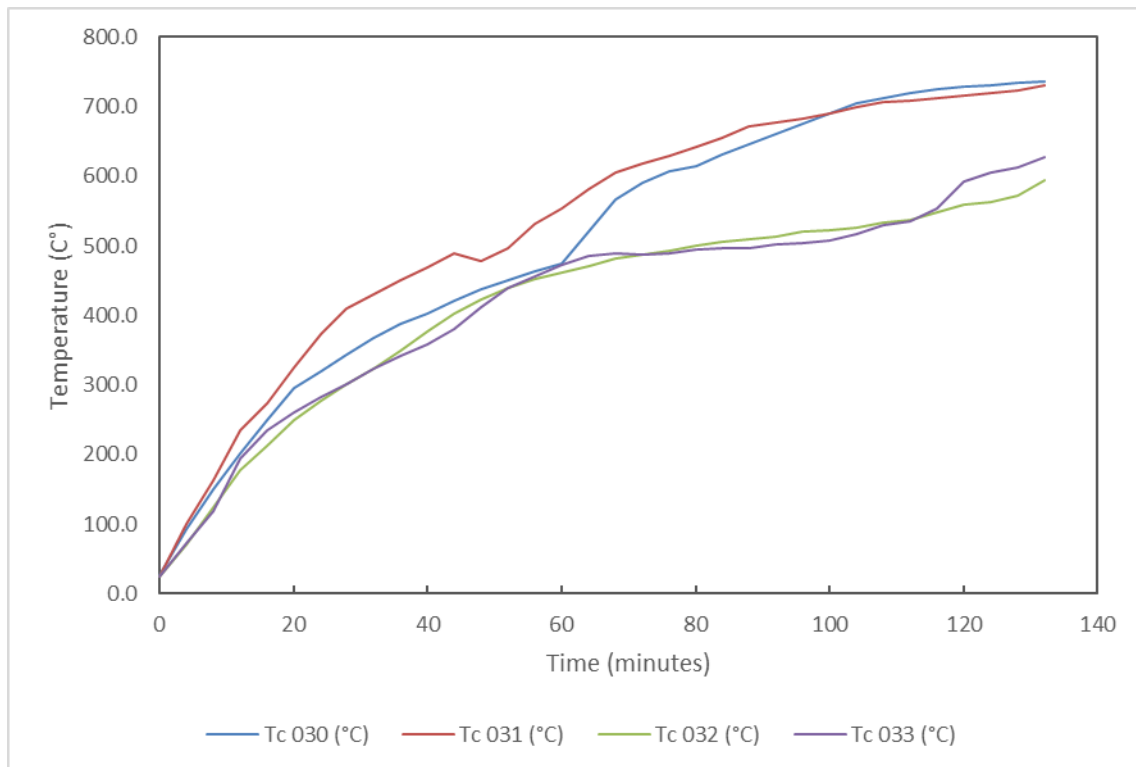


Figure 16 Individual Temperatures Recorded on The Unexposed Face of The Frame on Doorset A

Table 17 Individual Temperatures Recorded on The Unexposed Face of The Frame on Doorset B

Time (mins)	Tc 034 (°C)	Tc 035 (°C)	Tc 036 (°C)	Tc 037 (°C)
0	25.0	26.0	25.0	24.0
4	100.0	126.0	96.0	85.0
8	168.0	210.0	134.0	136.0
12	222.0	278.0	162.0	172.0
16	259.0	326.0	184.0	209.0
20	290.0	411.0	214.0	255.0
24	319.0	433.0	247.0	297.0
28	346.0	461.0	276.0	335.0
32	371.0	464.0	304.0	363.0
36	389.0	465.0	323.0	382.0
40	404.0	465.0	342.0	393.0
44	416.0	475.0	359.0	408.0
48	412.0	444.0	398.0	469.0
52	413.0	435.0	414.0	480.0
56	430.0	454.0	421.0	485.0
60	443.0	469.0	429.0	489.0
64	452.0	476.0	435.0	494.0
68	461.0	485.0	442.0	501.0
72	466.0	488.0	448.0	521.0
76	472.0	494.0	458.0	541.0
80	478.0	501.0	464.0	547.0
84	483.0	506.0	471.0	560.0
88	488.0	512.0	478.0	570.0
92	491.0	516.0	486.0	575.0
96	495.0	522.0	496.0	581.0
100	499.0	527.0	506.0	586.0
104	504.0	532.0	516.0	592.0
108	508.0	539.0	526.0	594.0
112	510.0	544.0	536.0	596.0
116	512.0	546.0	542.0	597.0
120	514.0	547.0	549.0	600.0
124	515.0	550.0	555.0	603.0
128	518.0	553.0	561.0	608.0
132	520.0	556.0	561.0	613.0

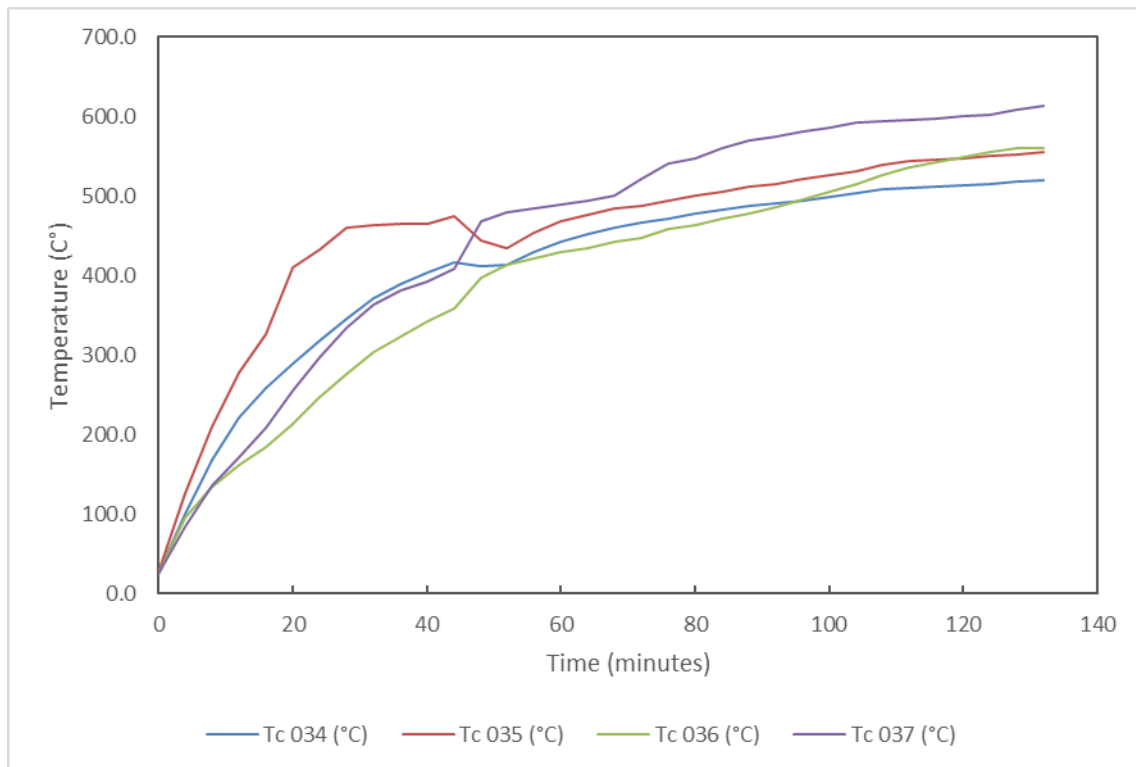


Figure 17 Individual Temperatures Recorded on The Unexposed Face of The Frame on Doorset B

C.4 Specimen deflections

Table 18 and Table 19 detail the deflection measurements of the test specimen at locations given in Figure .

Negative measurements show movement of the test specimen away from the furnace. Positive measurements show movement of the test specimen towards the furnace.

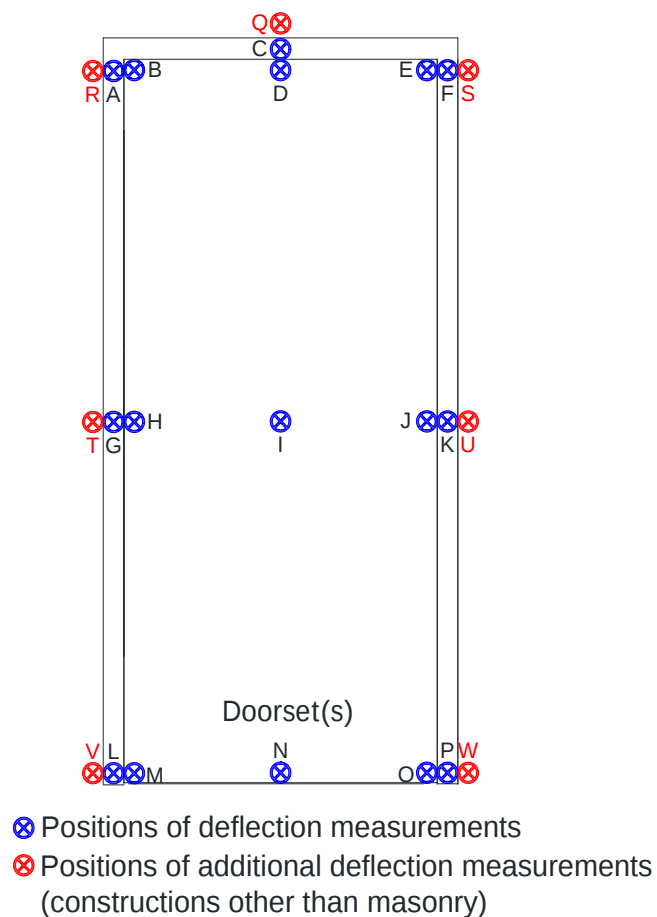


Figure 18 Position of deflection measurements

Table 18 Deflections – Doorset A

Time (mins)	Deflections											
	A	B	C	D	E	F	G	H	I	J	K	L
0	0	0	0	0	0	0	0	0	0	0	0	0
10	6	2	7	9	-27	-12	38	44	42	31	30	13
20	5	4	10	7	-14	10	43	51	50	50	35	10
30	1	-4	0	0	27	5	24	31	31	28	18	10
40	22	-19	-10	-12	35	-24	13	21	18	15	5	12
50	-22	-11	-3	-6	35	-3	13	28	21	27	18	14
60	-22	-28	-18	-21	45	2	29	12	15	24	18	18
70	-16	-21	8	-1	55	11	37	43	37	14	36	24
80	31	40	30	19	55	32	59	66	57	76	69	51
90	36	39	32	24	61	37	69	80	54	57	62	25
100	37	39	35	24	57	37	78	84	24	62	68	26
110	36	50	40	32	59	38	76	79	24	64	73	28
120	41	52	42	29	63	43	68	90	19	74	85	36
130	29	52	32	33	60	35	71	70	13	66	67	27
Max	41	52	42	33	63	43	78	90	57	76	85	51

Time (mins)	Deflections										
	M	N	O	P	Q	R	S	T	U	V	W
0	0	0	0	0	0	0	0	0	0	0	0
10	17	20	18	20	1	-1	5	10	0	2	7
20	8	13	9	8	-5	29	7	14	-4	3	14
30	-1	1	6	-3	-15	27	7	11	-15	-7	13
40	0	5	8	5	-4	28	4	5	-13	1	13
50	-3	-1	-5	1	-2	32	4	0	-18	-7	6
60	-17	-15	-10	-11	1	36	8	-6	-22	-2	-11
70	23	25	34	19	-11	36	1	14	-10	-1	-18
80	23	21	28	26	10	36	-9	11	37	-4	-8
90	25	25	31	29	14	32	0	14	30	-8	-6
100	28	31	34	32	17	35	0	15	42	-3	-2
110	28	33	35	29	15	37	-1	16	42	-5	-2
120	36	36	41	58	21	38	3	14	35	-10	2
130	32	26	38	35	17	37	-2	14	43	-10	2
Max	36	36	41	58	21	38	-9	16	43	-10	-18

Table 19 Deflections – Doorset B

Time (mins)	Deflections											
	A	B	C	D	E	F	G	H	I	J	K	L
0	0	0	0	0	0	0	0	0	0	0	0	0
10	9	6	7	3	-12	-4	31	33	22	29	36	8
20	3	-2	1	-10	-44	-12	36	39	12	34	34	-2
30	-13	-20	-7	-19	-54	-15	27	34	20	23	20	-17
40	-3	-9	-4	-15	-53	-18	28	38	23	28	22	-7
50	-8	-16	-10	-18	-54	-19	25	39	30	-12	-2	-23
60	-15	-22	-18	-22	-60	-30	28	39	20	-10	-7	-23
70	23	19	-2	-12	-32	-8	28	29	23	17	26	-2
80	28	31	25	22	-13	15	63	64	26	37	70	26
90	30	23	21	26	-5	19	71	69	29	38	68	23
100	26	19	25	24	-10	21	64	78	30	41	78	31
110	25	20	21	24	-5	24	81	80	35	43	71	28
120	29	24	27	22	-7	22	83	80	40	43	77	31
130	32	19	36	24	-9	23	87	83	37	48	80	16
Max	32	31	36	26	-60	-30	87	83	40	48	80	31

Time (mins)	Deflections										
	M	N	O	P	Q	R	S	T	U	V	W
0	0	0	0	0	0	0	0	0	0	0	0
10	11	6	-2	-4	9	16	10	7	17	0	1
20	-1	-2	-14	-10	-5	26	0	-4	19	-4	0
30	-16	-12	-29	-25	0	29	9	3	20	-5	-4
40	-6	-2	-19	-15	2	-1	10	10	21	-5	6
50	-22	-17	-30	-29	-10	-4	11	11	23	-3	10
60	-21	-17	-31	-31	-4	-3	12	9	22	0	1
70	1	3	-13	-10	-20	3	32	44	28	23	26
80	27	28	21	18	3	29	55	66	76	51	28
90	27	31	14	21	2	25	56	61	73	50	44
100	30	35	16	21	5	17	61	64	88	60	57
110	29	34	20	20	10	24	57	64	80	59	56
120	33	35	21	22	-6	25	59	66	89	57	58
130	32	40	25	19	-7	21	53	61	89	52	57
Max	33	40	-31	-31	-20	29	61	66	89	60	58

C.5 Heat flux measurements

The heat flux was measured 1000 mm away from the specimen and is based on the maximum levels.

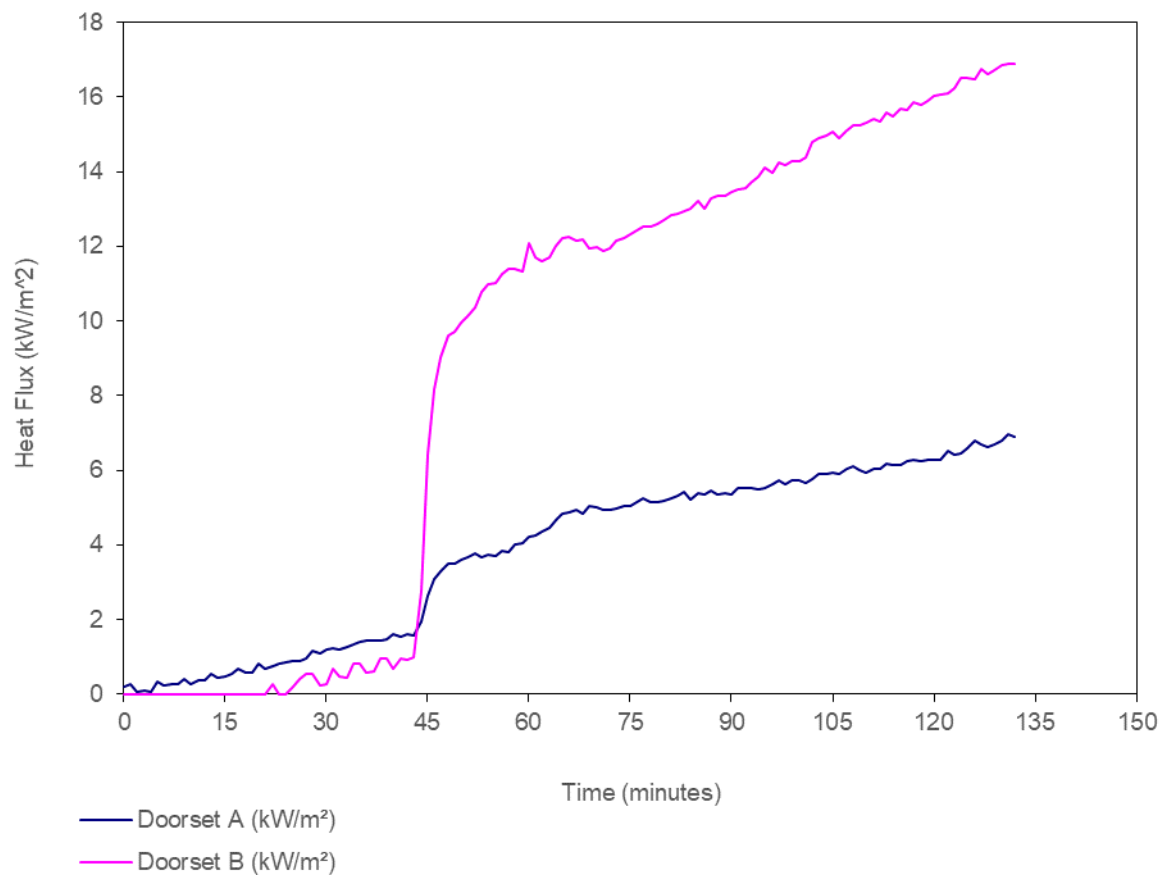


Figure 19 Heat flux measurements of the test specimen vs time

Table 20 Heat flux measurements of the test specimen vs time

Time (mins)	Doorset A (kW/m ²)	Doorset B (kW/m ²)
0	0.000	0.000
4	0.076	0.000
8	0.254	0.000
12	0.355	0.000
16	0.533	0.000
20	0.812	0.000
24	0.838	0.000
28	1.142	0.552
32	1.193	0.469
36	1.447	0.580
40	1.599	0.690
44	1.955	2.761
48	3.479	9.610
52	3.758	10.356
56	3.834	11.267
60	4.215	12.068
64	4.672	12.013
68	4.850	12.178
72	4.951	11.930
76	5.129	12.427
80	5.180	12.703
84	5.205	13.007
88	5.332	13.338
92	5.510	13.559
96	5.612	13.973
100	5.739	14.277
104	5.891	14.968
108	6.120	15.244
112	6.043	15.354
116	6.247	15.658
120	6.272	16.017
124	6.450	16.514
128	6.627	16.597
132	6.881	16.901

Table 21 Heat flux thresholds vs time

Radiation intensity	Doorset A	Doorset B
5 kW/m ²	69 minute(s)	45 minute(s)
10 kW/m ²	Radiation intensity not reached	51 minute(s)
15 kW/m ²	Radiation intensity not reached	105 minute(s)
20 kW/m ²	Radiation intensity not reached	Radiation intensity not reached
25 kW/m ²	Radiation intensity not reached	Radiation intensity not reached

C.6 Gap measurements

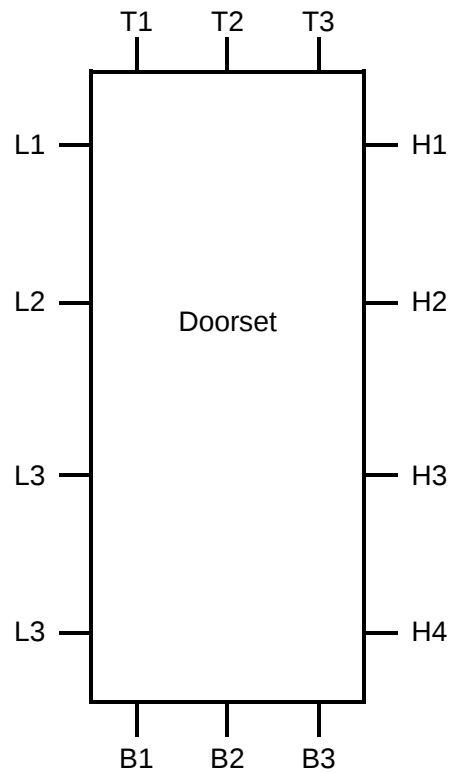


Figure 20 Gap measurements, Doorset A and B (unexposed side shown)

Table 22 Measured and calculated gap sizes for Doorset A

Doorset A (mm)					
Hinge side	Primary	Leaf to stop	Leading edge	Primary	Leaf to stop
H1	2.5	2.6	L1	2.2	2.2
H2	2.0	2.0	L2	1.6	1.7
H3	1.5	1.5	L3	1.7	1.8
H4	1.6	1.7	L4	1.2	1.2
Mean	1.9		Mean	1.7	
Max	2.5		Max	2.2	
Min	1.5		Min	1.2	
Max permitted	4.2		Max permitted	3.9	
Top edge	Primary	Leaf to stop	Threshold	Primary	
T1	2.8	2.9	B1	1.5	
T2	2.7	2.7	B2	1.6	
T3	2.5	2.4	B3	1.7	
Mean	2.7		Mean	1.6	
Max	2.8		Max	1.7	
Min	2.5		Min	1.5	
Max permitted	4.7		Max permitted	3.7	

Table 23 Measured and calculated gap sizes for Doorset B

Doorset B (mm)					
Hinge side	Primary	Leaf to stop	Leading edge	Primary	Leaf to stop
H1	4.3	4.3	L1	2.4	2.5
H2	4.2	4.3	L2	2.2	2.3
H3	2.9	2.9	L3	1.1	1.1
H4	1.7	1.7	L4	1.7	1.1
Mean	3.3		Mean	1.9	
Max	4.3		Max	2.4	
Min	1.7		Min	1.1	
Max permitted	5.8		Max permitted	4.1	
Top edge	Primary	Leaf to stop	Threshold	Primary	
T1	1.3	1.3	B1	1.5	
T2	1.5	1.5	B2	1.5	
T3	1.9	1.9	B3	1.5	
Mean	1.6		Mean	1.5	
Max	1.9		Max	1.5	
Min	1.3		Min	1.5	
Max permitted	3.7		Max permitted	3.5	

Appendix D Photographs



Figure 21 Unexposed face of the specimen before the start of the test



Figure 22 Exposed face of the specimen before the start of the test



Figure 23 Unexposed face of the specimen at 60 minutes of testing



Figure 24 Unexposed face of the specimen at 130 minutes of testing



Figure 25 Exposed face of the specimen at the end of the test



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