TEST REPORT NUMBER CFR2008041_1

CAMBRIDGE FIRERESEARCH

FIRE RESISTANCE TEST IN ACCORDANCE WITH BS 476: PART 22: 1987

Sponsor:	Astra DC Limited
Address:	Unit 4, Astra Business Centre Roman Way Preston PR2 5AP
Date of test:	4th August 2020

Results:

	Left-hand doorset	Right-hand doorset
Test duration:	38 minutes*	38 minutes*
Integrity:	38 minutes*	33 minutes
Insulation:	38 minutes*	33 minutes

* discontinued at the request of the sponsor

Summary of test specimen:

2No. single leaf timber doorsets, the left-hand doorset opening into the furnace and the right-hand doorset opening away from the furnace. Both doorsets tested as latched, insulated doorsets.

Left-hand doorset
Frame size (h x w): 2076 x 992
Leaf size (h x w x d): 2043 x 926 x 44

Right-hand doorset
Frame size (h x w): 2075 x 991
Leaf size (h x w x d): 2043 x 925 x 44

This test report is only valid when presented in full.

Cambridge Fire Research Ltd Brewery Road Pampisford Cambridge CB22 3HG
Tel. +44 (0) 1223 834752 **Fax.** +44 (0) 1223 837208 **Email.** testing@cambridge-fire.co.uk

Registered in England No. 5602112 Registered Office Brewery Road, Pampisford, Cambridge CB22 3HG

UKAS TESTING
4319

CAMBRIDGE FIRERESEARCH

0 CONTENTS PAGE

0 CONTENTS PAGE 2
1 PREPARATION FOR TESTING 3
1.1 Specimen conditioning 3
1.2 Associated construction 3
1.3 Specimen construction 3
1.4 Specimen verification 3
1.5 Specimen installation and fixity 3
2 PRE-TEST MEASUREMENTS AND SETTING 4
2.1 Gap measurements 4
2.2 Gap measurements frame to supporting construction 6
2.3 Closer force measurement 8
3 TEST CONDITIONS, INSTRUMENTATION AND MEASURING 9
3.1 Furnace temperature 9
3.2 Furnace pressure 10
3.3 Ambient temperature 10
3.4 Unexposed face specimen thermocouples 11
3.5 Deflection 12
4 TEST OBSERVATIONS 14
5 LIMITATIONS 16
APPENDIX 1 SPECIMEN CONSTRUCTION 17
Appendix 1 Table 1 Left-hand doorset 17
Appendix 1 Table 2 Right-hand doorset 20
Appendix 1 Figure 1 – Elevation left-hand doorset – unexposed face incl. hidden detail 23
Appendix 1 Figure 2 – Section A – A 24
Appendix 1 Figure 3 – Section B – B 25
Appendix 1 Figure 4 – Section C – C 25
Appendix 1 Figure 5 – Elevation right-hand doorset – unexposed face incl. hidden detail 26
Appendix 1 Figure 6 – Section D – D 27
Appendix 1 Figure 7 – Section E – E 28
Appendix 1 Figure 8 – Section F – F 28
APPENDIX 2 PHOTOGRAPHS 29
Appendix 2.1 Pre-test photos 29
Appendix 2.2 During test photos 33
Appendix 2.3 Post-test photos 37
APPENDIX 3 POSITIONING OF INSTRUMENTATION 39
APPENDIX 4 RECORDED THERMOCOUPLE DATA 40

1 PREPARATION FOR TESTING

1.1 Specimen conditioning

The specimen was received by Cambridge Fire Research on 27/07/2020. During the final 7 days the specimen was on site, the temperature and relative humidity were recorded to be within the range of 21 to 33°C and 30 to 50% respectively.

1.2 Associated construction

Cambridge Fire Research constructed a softwood timber-stud partition, which was clad with 1No.British Gypsum FireLine board of 15mm thickness on the exposed side and 1No. British Gypsum FireLine board of 12.5mm thickness on the unexposed side. This provided an aperture of 2085 mm high x 1005 mm wide for each specimen.

In accordance with Fire Test Study Group Resolution No. 51 continuity of the threshold was simulated by the installation of a solid non-combustible threshold extension by Cambridge Fire Research, such that the extension was flush with the threshold onto which the specimen was positioned.

1.3 Specimen construction

The complete specimen was supplied by the sponsor.

1.4 Specimen verification

Cambridge Fire Research carried out a detailed survey of the specimen to verify the information provided by the Sponsor. This included verifying the weight, densities, materials, and dimensions of construction components wherever possible.

Details and drawings of the construction are shown in Appendix 1.

Photographs of details of the construction taken before the test are shown in Appendix 2.

1.5 Specimen installation and fixity

Cambridge Fire Research installed the specimens into the associated construction. The specimens were asymmetrical and fitted such that the left-hand doorset opened towards and the right-hand doorset away from the heating conditions of the test. The leaves were latched prior to the start of the test.

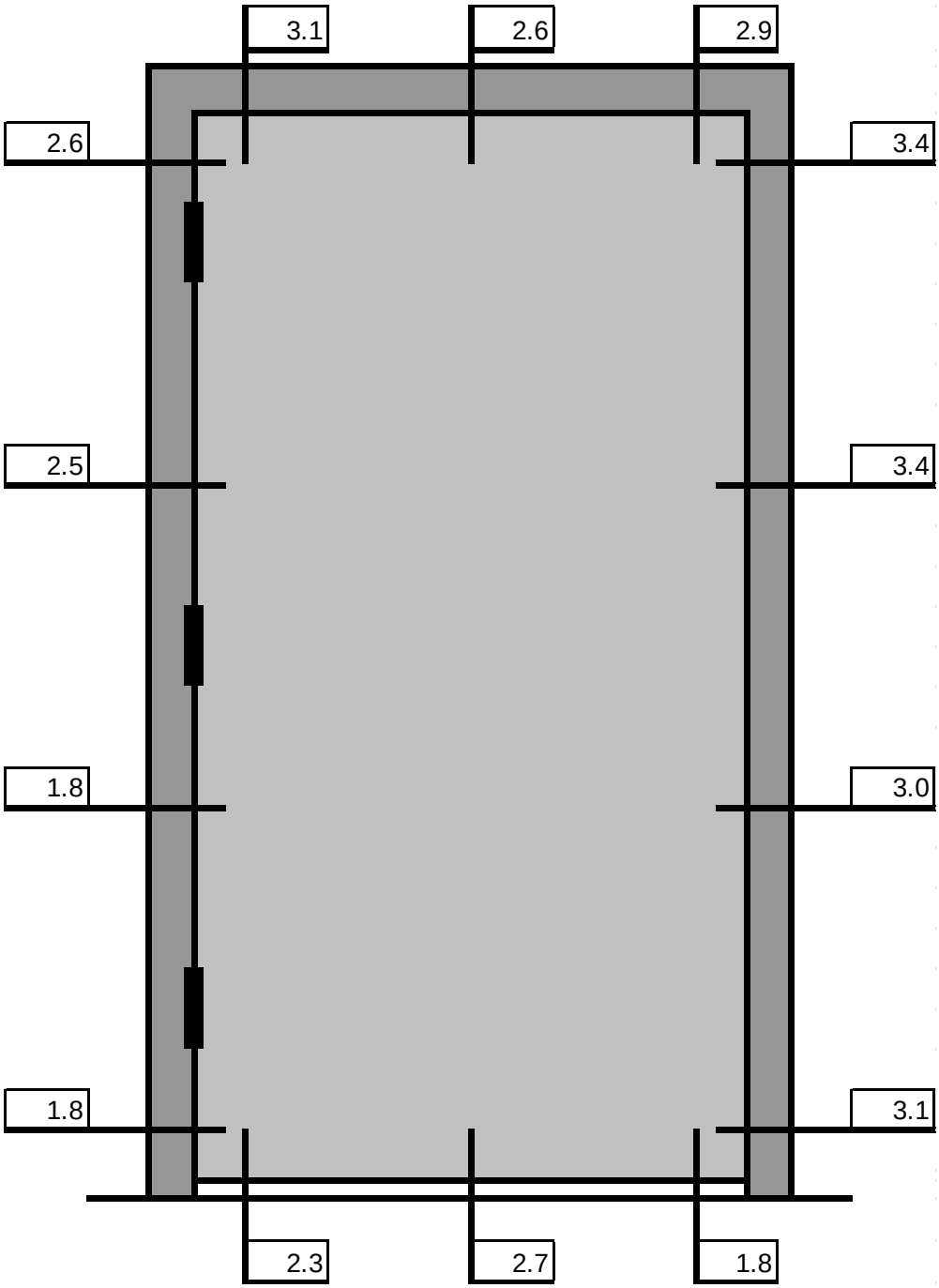
The specimens were affixed to the associated construction as described in Appendix 1.

2 PRE-TEST MEASUREMENTS AND SETTING

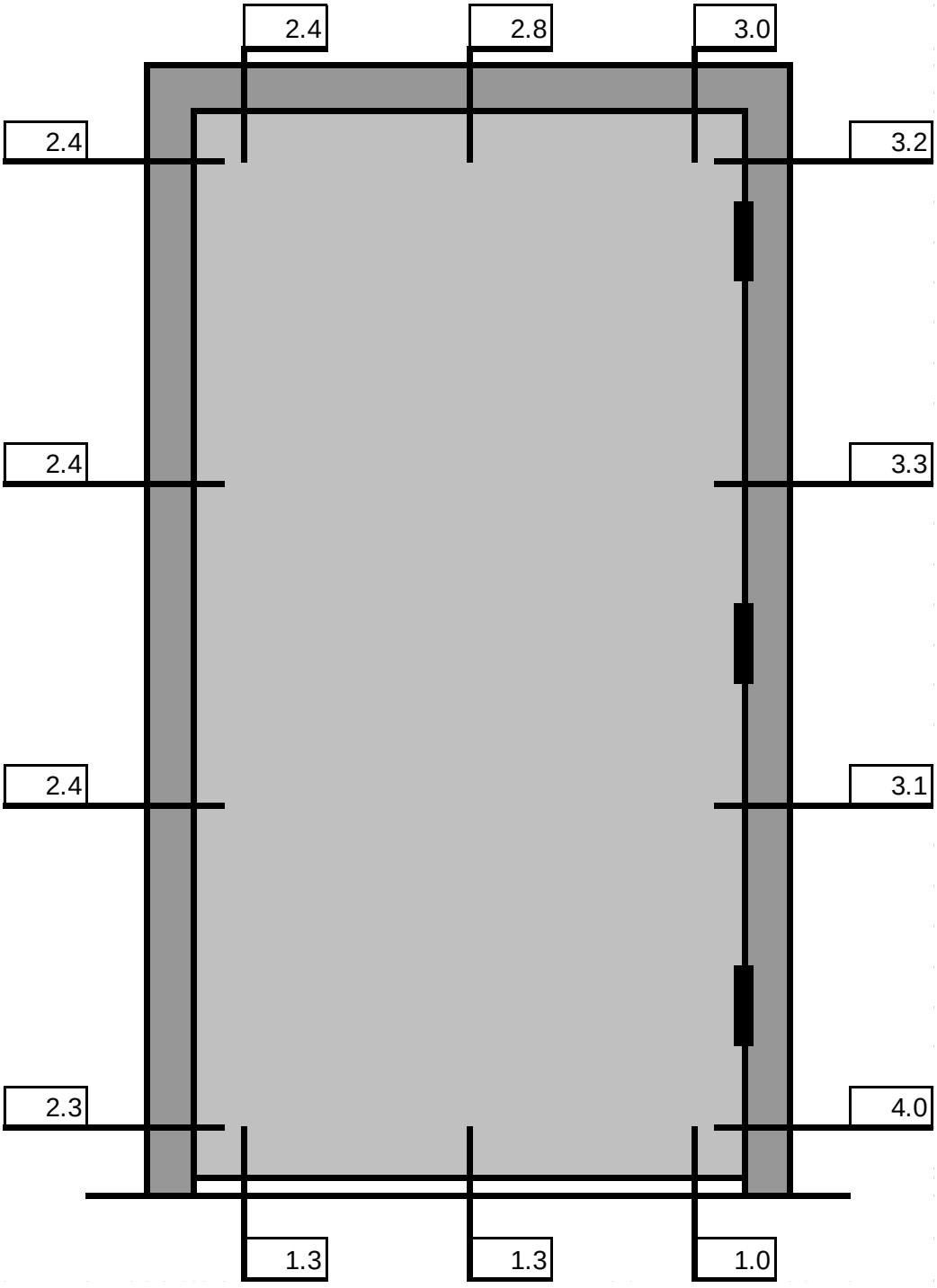
2.1 Gap measurements

The gaps between the leaf edges and the frame and at the threshold were measured on the exposed face of the left-hand doorset and on the unexposed face of the right-hand doorset prior to the start of the test. The following figures show the position at which the measurements were made and the recorded gap (mm) at those positions.

Left-hand doorset



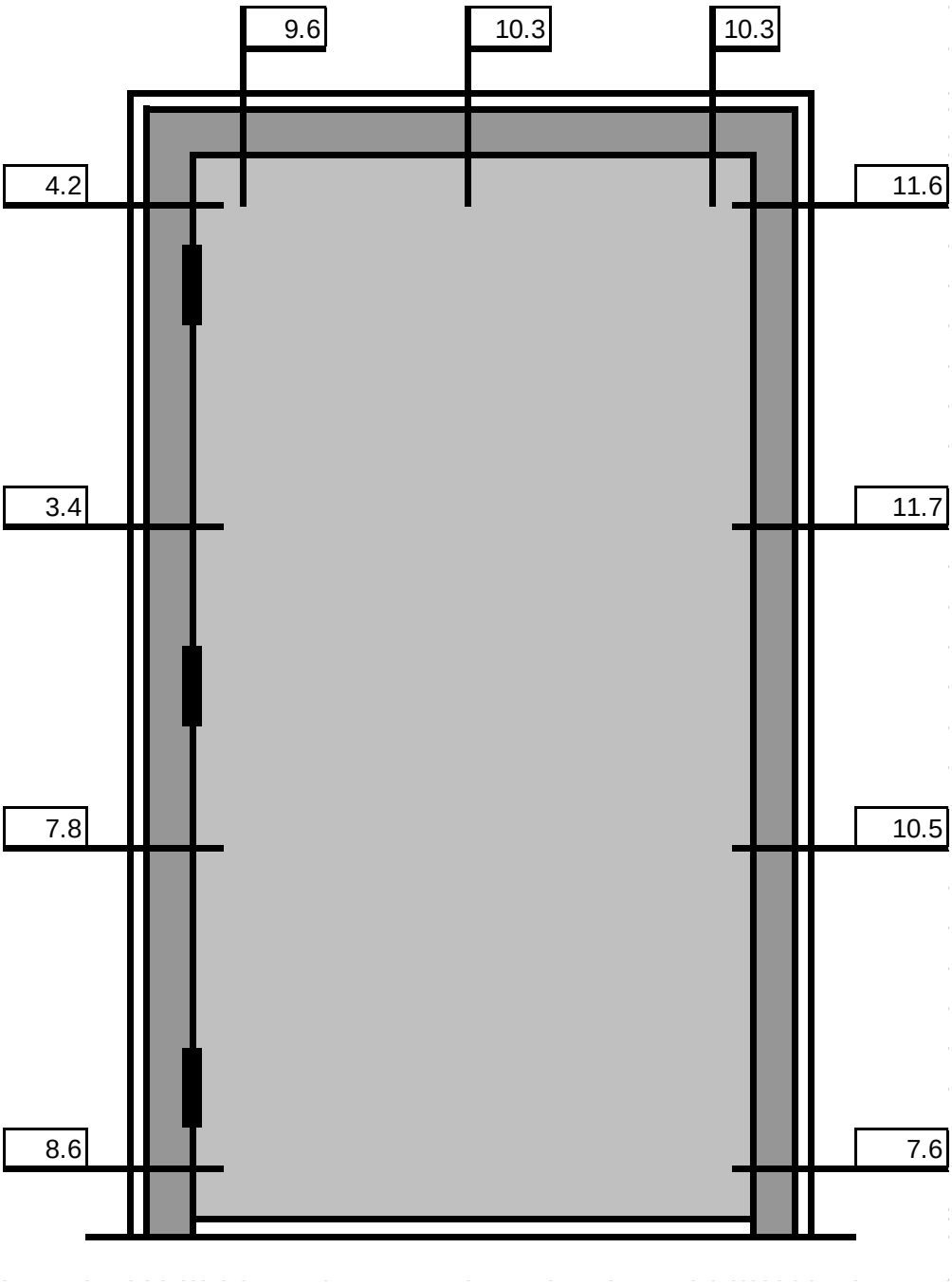
Right-hand doorset



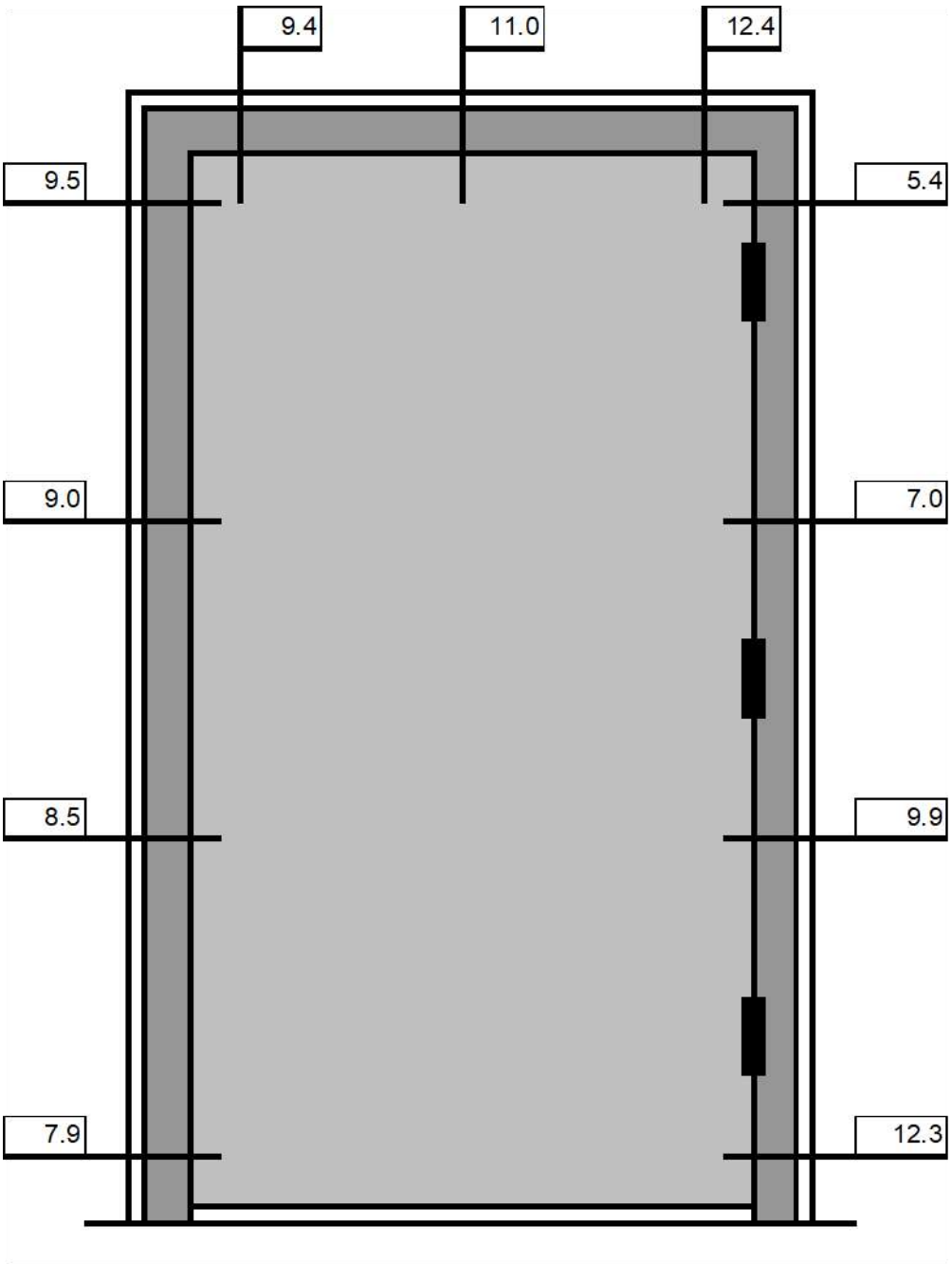
2.2 Gap measurements frame to supporting construction

The gap between the specimen frame and the supporting construction was measured on the exposed face prior to the start of the test. The following figure shows the position at which the measurements were made and the recorded gap (mm) at those positions.

Left-hand doorset



Right-hand doorset



2.3 Closer force measurement

The door opening and closing forces for both leaves were measured in accordance with Fire Test Study Group Resolution No. 63 and the calculated moments are shown in the following tables.

Left-hand doorset:

Direction	Closing force (N)	Closing moment (Nm)	Opening force (N)	Opening moment (Nm)
Opening towards heating Conditions	14.6	11.0	40.9	30.7

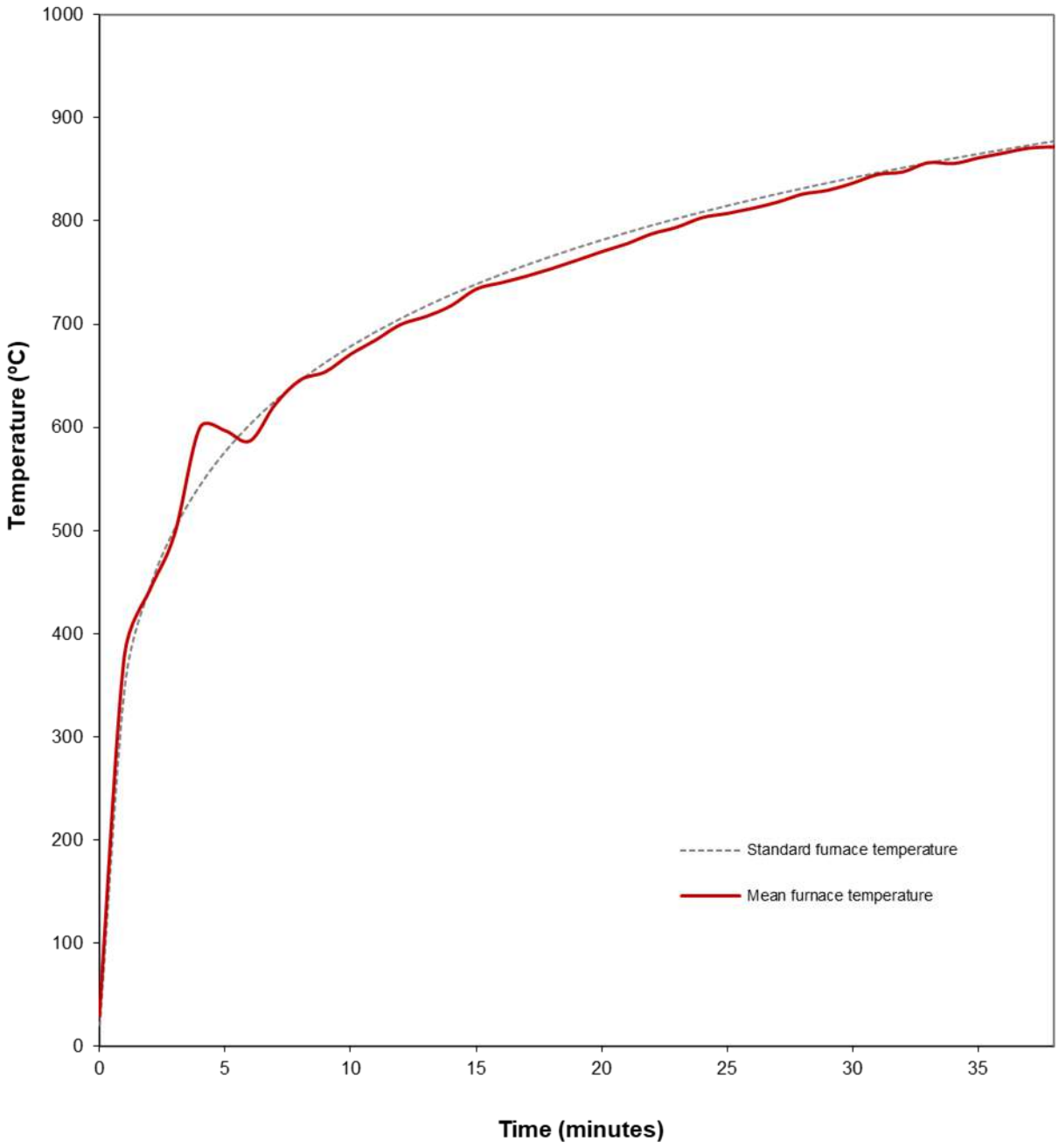
Right-hand doorset:

Direction	Closing force (N)	Closing moment (Nm)	Opening force (N)	Opening moment (Nm)
Opening away from heating Conditions	18.9	14.2	43.0	32.3

3 TEST CONDITIONS, INSTRUMENTATION AND MEASURING

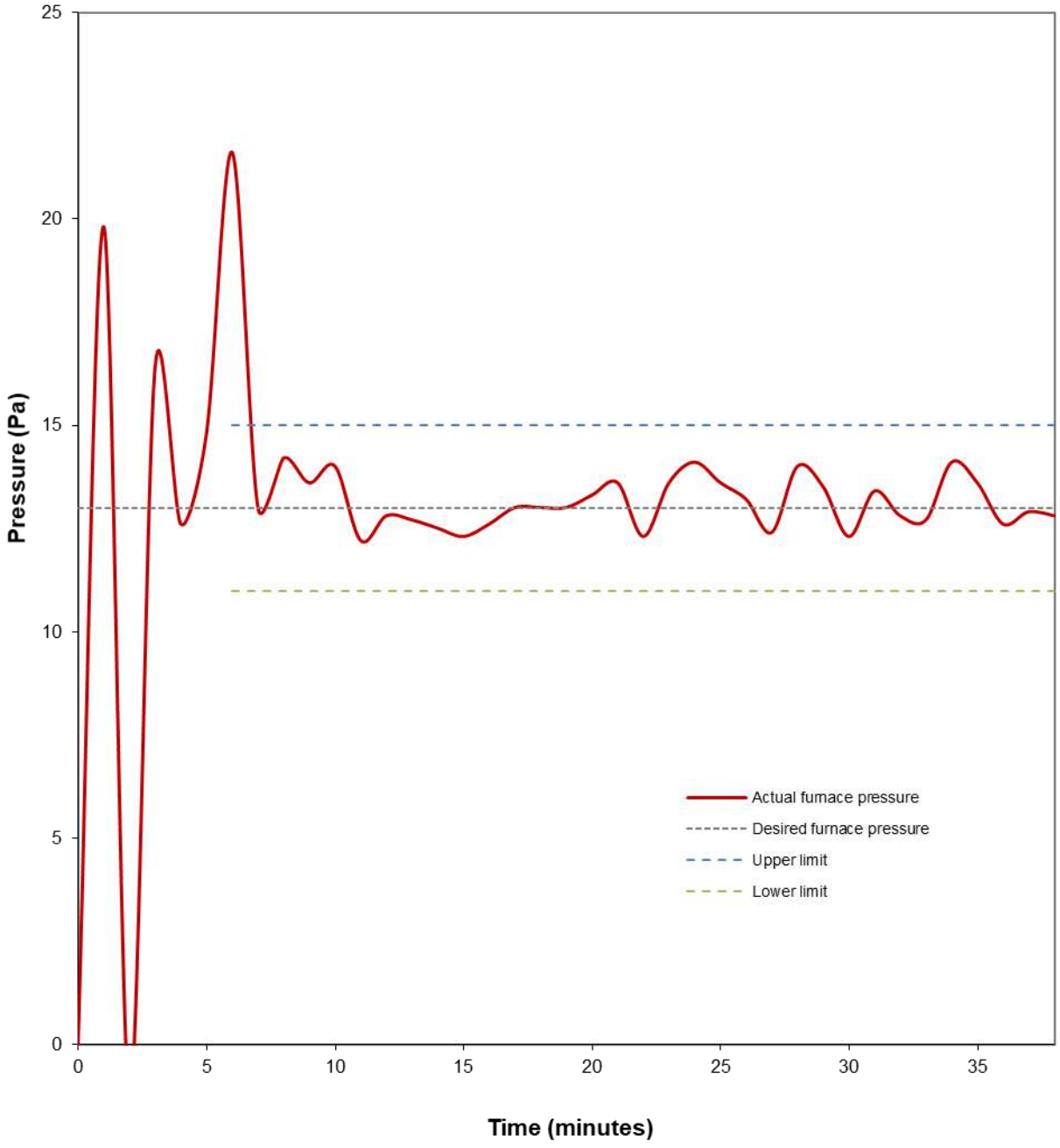
3.1 Furnace temperature

Furnace temperature was controlled so as to follow the standard temperature/time curve defined in the test standard and within the tolerances permitted. The furnace mean temperature was calculated from the output recorded using five furnace thermocouples of the design specified in the test standard. The following graph shows the standard and mean furnace temperature/time data.



3.2 Furnace pressure

Furnace pressure was maintained for the duration of the test at a nominal + 13.0 measured at the pressure sensing head. When a linear pressure gradient of 8.5 Pa/m is applied this equates to + 0 Pa at 1 m above the notional floor level. The furnace pressure was controlled within the tolerances permitted in the test standard except for 1 instantaneous occasion which was considered to be transient events. The following graph shows the actual and desired furnace pressure/time data.



3.3 Ambient temperature

Ambient temperature at the start of the test was 23°C.
Ambient temperature ranged between 23°C and 24°C during the test.

3.4 Unexposed face specimen thermocouples

Surface temperature measuring thermocouples of the design specified in the test standard were affixed to the unexposed face of the specimen to monitor the temperature rise as follows:

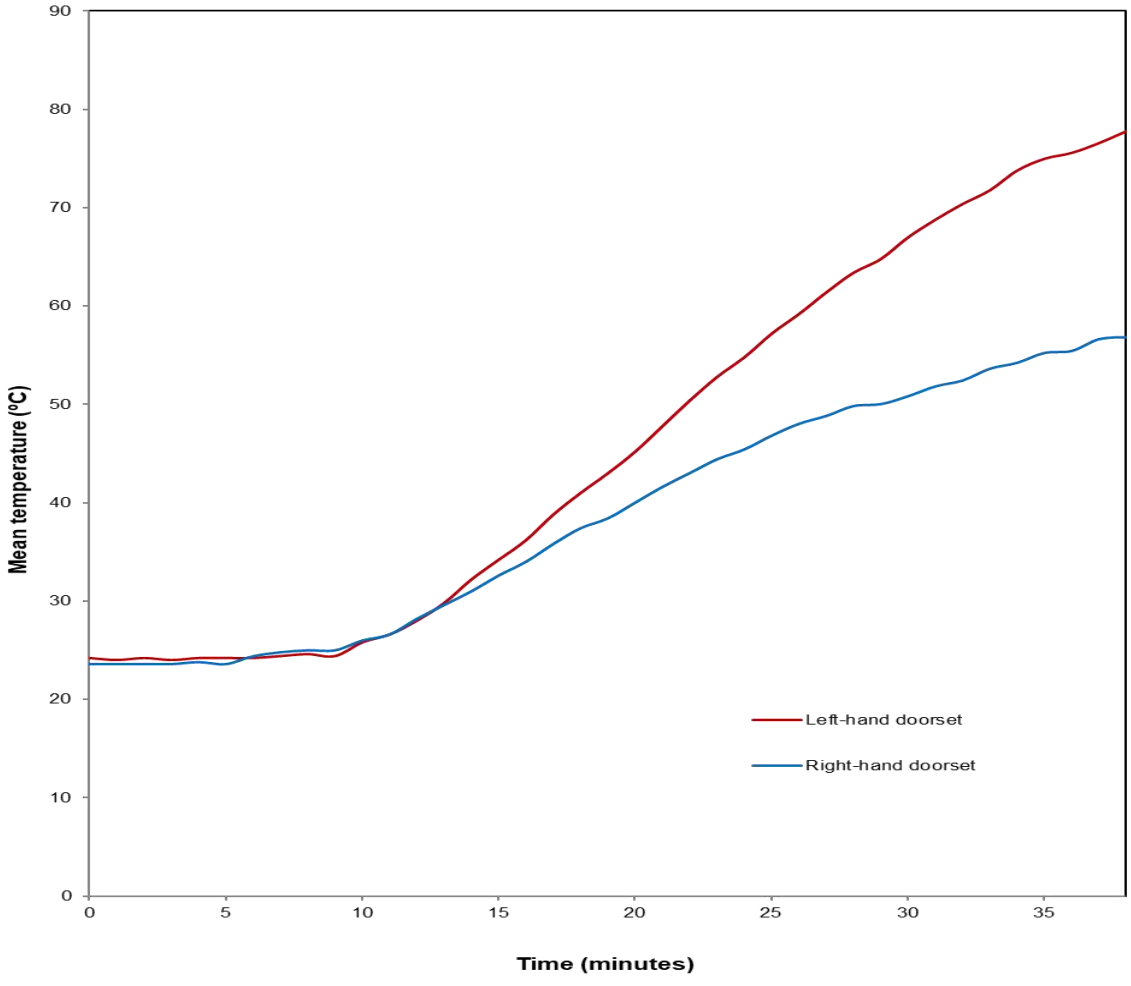
Left-hand specimen		
Doorset leaf	Channels 16 to 20	(mean & maximum)
Doorset frame	Channels 21 to 23	(maximum only)
Right-hand specimen		
Doorset leaf	Channels 24 to 28	(mean & maximum)
Doorset frame	Channels 29 to 31	(maximum only)

The positions of these thermocouples are shown in Appendix 3.

A roving thermocouple was available for measurement of any specific hotspots. Any instances of the use of the roving thermocouple are noted in the observations in Section 4.

The recorded data of all individual thermocouples is shown in the tables in Appendix 4.

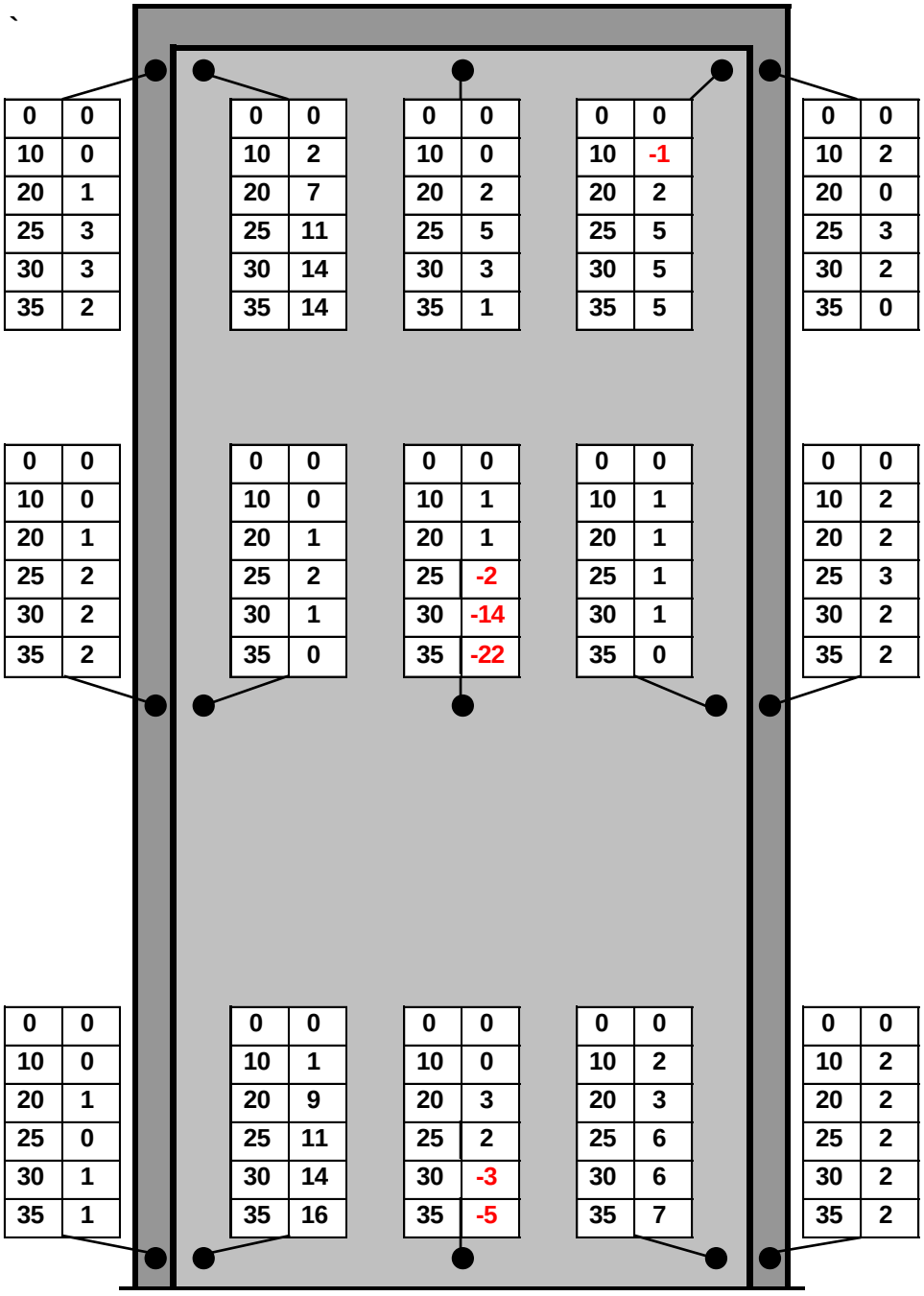
The following time/temperature graph shows the mean leaf temperature.



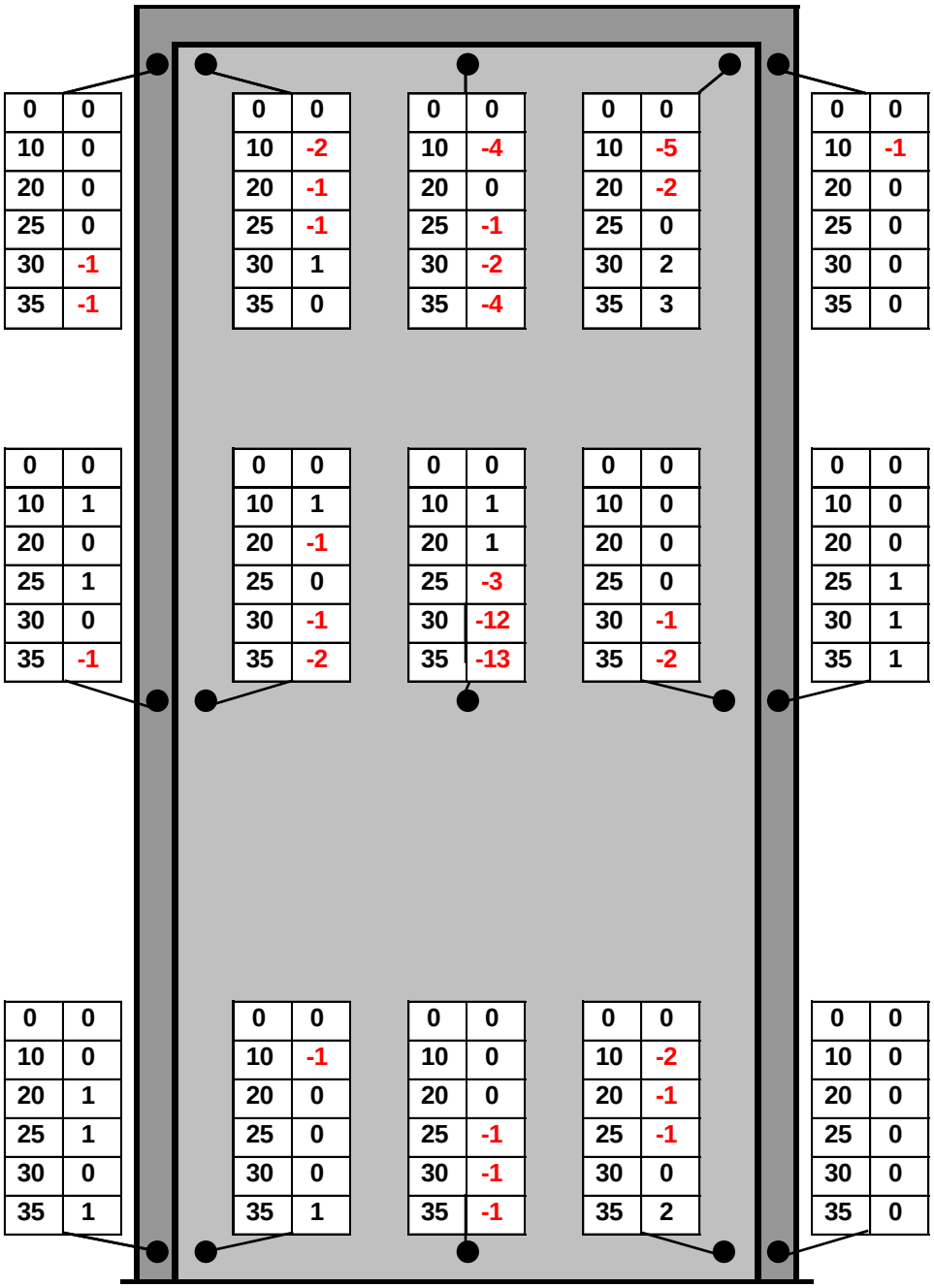
3.5 Deflection

Taut stainless-steel wires were anchored horizontally across the unexposed face of the specimen such that any deflection experienced by the test specimen could be measured. One wire was positioned 10 mm vertically below the head of the leaf, the second at mid-height and the third 10 mm vertically above the threshold. The following figure shows these positions with the elapsed time (minutes) in the left-hand column and the recorded deflection (mm) in the right-hand column. Positive values indicate deflection towards the heating conditions of the test**.**

Left-hand doorset



Right-hand doorset



4 TEST OBSERVATIONS

Photographs taken during and after the test are shown in Appendix 2.

Left-hand specimen

TEST OBSERVATIONS (E = Exposed face: U = Unexposed face)		
Time	Face	Observation
(min:sec)		
00:00		Start of the test.
05:04	U	Smoke/steam issues at closing stile at nominally 600mm below head and at top hinge position.
05:29	U	Smoke/steam issues at hanging stile mid-height.
06:23	U	Smoke/steam issues at closing stile head corner.
06:58	U	Smoke/steam issues at hanging stile head corner.
08:50	U	Smoke/steam issues at closing stile nominally mid-height.
09:26	E	Facing missing at multiple positions, core and architrave fissured.
17:22	U	Smoke/steam issues at hanging stile nominally 150 above threshold.
27:18	U	Architrave missing at multiple positions, frame timber fissured.
31:21	U	Smoke/steam issues at the concealed closer position.
38:16	U	The test is terminated.

Right-hand specimen

TEST OBSERVATIONS (E = Exposed face: U = Unexposed face)		
Time	Face	Observation
(min:sec)		
00:00		Start of the test.
05:04	U	Smoke/steam issues at top and centre hinge positions, at concealed closer position and at closing stile above mid height.
07:00	U	Smoke/steam issues at head between closing stile head corner and mid-width and at closing stile above mid-height.
16:00	E	Facing is missing, core is fissured.
28:15	E	Architrave missing at multiple locations.
29:30	U	Glow at strike position.
31:20	U	Smoke/steam issues at head at nominally mid-width.
32:10	U	Smoke/steam issues at concealed closer position.
33:02	U	Glow at closing stile nominally 30mm above leaf base.
33:20	U	Flash flaming occurs at closing stile nominally 30mm above leaf base.
33:35	U	A cotton pad is applied at closing stile nominally 50mm up from leaf base.
33:42	U	**INTEGRITY FAILURE** due to ignition of cotton pad. **INSULATION FAILURE** due to integrity failure.
36:35	U	Flash flaming occurs at nominally 200mm below strike position.
37:23	U	Glow at concealed closer position.
38:16	U	The test is terminated.

5 LIMITATIONS

1. The test results relate only to the specimen tested. Appendix A of BS476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to specimens of different dimensions, orientation or incorporating different components should be the subject of a design appraisal or further testing.

2. The results relate only to the behaviour of the specimen 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.

3. The doorsets were asymmetrical and was tested such that the left hand leaf opened towards the heating conditions of the test and the right hand leaf opened away from the heating conditions of the test at the request of the sponsor.

4. The results apply to the specimen(s) as received from the sponsor.

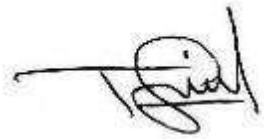
5. Cambridge Fire Research is not responsible for the content of this report where information has been identified (using **) as supplied by the sponsor.

This report is the property of the test sponsor and may not be reproduced or passed to a third party without their prior agreement.

Report prepared by:

P Swinfield
Technical Officer

Report checked by:



T Smith
Deputy Head of Testing

Report issued: **14th October 2020**

APPENDIX 1 SPECIMEN CONSTRUCTION

The item numbers listed in Appendix 1 Table 1 and shown in the figures in Appendix 1 refer to the components of the specimen construction. Any photo numbers refer to those in Appendix 2.

Please note that unless otherwise indicated the following applies:

a) All dimensions and materials of construction were verified by the laboratory.
b) Figures are not to scale.
c) All dimensions are given in mm.

Appendix 1 Table 1 Left-hand doorset

Item	Component	Information
1L	**Door frame**	
	Manufacturer:	Vindelans Snickerifabrik AB**
		3 sided Redwood** frame with integral stops and 30h x 16w rebated joints affixed vertically with 2No. Ø4.9 x 79 steel countersunk screws at 66-69 centres.
	Density (kg/m^3):	>450*
	Fixing to supporting construction (Ø x l):	Ø5 x 80 steel countersunk screws set 190 up from threshold and 190 down from frame head with 3 No. equi-spaced.
	Overall size (h x w x d):	2076 x 992
	Cross section size (h x d):	42 x 100
	Integral stop (h x d):	12 x 54
2L	**Leaf**	
	Manufacturer:	Premdor Ltd
	Reference:	CF198 4 Line horizontal
	Description:	A particle board core with timber stiles and rails, MDF facing with 4No. horizontal grooves (11*h x 1*d) across full width of leaf set 425 below leaf head and 383-385 vertical centres.
	Overall size (h x w x t):	2043 x 926 x 44
	Weight (kg):	53.2
	Sub-components:	
	Core:	
	Type:	Particle board
	Thickness (h x w x t):	1953* x 896 x 38
	Stiles:	
	Description:	Whitewood**
	Overall size (w x d):	30 x 38
	Rails:	
	Description:	Whitewood**
	Overall size (h x w x d):	30‡ x 38‡
	Facings:	
	Description:	MDF facings with 4No. horizontal grooves.

Item	Component	Information
2L cont.	Overall size (t):	3.1
3L	**Hinges** Supplier: Description: Blade size (h x w x t): Knuckle size (Ø): Fixings to frame (Ø x l): Fixings to leaf (Ø x l):	 Frisko UK** 3No Eclipse grade 11 radius corner stainless steel butt hinge with bearings set 200, 970 and 1740 from the top of the leaf to the top of the blade. 101 x 31 x 2.0 13 4No. Ø4.5 x 12 steel countersunk screws 4No. Ø4.5 x 50 steel countersunk screws
4L	**Closer** Manufacturer: Description: Fixings to leaf: Fixings to frame: Overall size: Body (Ø x l): Leaf forend: (h x d x t): Frame forend: (h x d x t):	 Astra Door Controls Ltd. Astra 4000** Series steel concealed door closer fitted in the hanging stile central to the leaf thickness, set 843 above leaf base. 6No. Ø3.8 x 38 stainless steel countersunk screws 6No. Ø3.8 x 24 brass countersunk screws 28‡ x 216‡ 106 x 32 x 3.5‡ 106 x 32 x 3.5‡
5L	**Latch/Lock** Manufacturer: Reference: Description: Height of spindle: Overall size: Body (h x w x d): Fixings (Ø x l): Forend (h x d x t): Strike plate (h x w x d x t): Strike box (h x w x d): Fixings (Ø x l):	 Eurospec Architectural Hardware TLS8030** Steel mortice lock with brass finish with stainless steel strike and plastic strike box. 1025 23 x 73 x 16 2No. Ø3.5 x 25 steel countersunk screws. 60 x 25 x 1.5 65 x 25 x 1.5 (including a 40h x 16w tongue) 28 x 15 x 24 2No. Ø3.5 x 25 steel countersunk screws
6L	**Handleset** Supplier: Part Number: Description: Overall size: Handle (l x Ø): Rose (Ø x d): Rose cover (Ø x d x t): Fixings (Ø x l):	 Zoo Architectural Hardware ZCS080SS Satin stainless steel ‘d’ lever handle with rose. 144 x 22 50 x 7 x 1.3 52 x 8 x 0.8 4No. Ø3.8 x 25 stainless steel countersunk screws

Item	Component	Information
7L	**Architrave** Manufacturer: Reference: Description: Overall size (h x w): Cross-section (w x d): Fixings (Ø x l):	 Sam Moulding Ltd** SP 601** MDF with mitred joints, on exposed face, set 12 from frame reveal. 2115* x 1070* 69 x 15 18 swg nails set at nominally 200 centres.
8L	**Intumescent - Frame** Supplier: Reference: Description: Overall size (h x w x d):	 Pyroplex Ltd 1540FW A graphite based intumescent in a white pvc holder with flipper seal set 8 from exposed face, fully interrupted at hinges, strike and closer. 15 x 4
9L	**Intumescent - Hinge** Supplier: Reference: Description: Overall size (h x w x d):	 Norseal** Norseal type 15 White ammonium phosphate based intumescent pads with self-adhesive beneath all blades. 100 x 30 x 1
10L	**Fire stopping detail** Description:	 Gaps between the frame and the supporting construction were packed with Unifrax Insulfrax LTX blanket and capped with Firewise Intumescent & Acoustic Acrylic Sealant.

Key:
* Nominal value;
** Sponsor declared value or detail, not verified by laboratory
‡ Identified post test from remains of specimen

Appendix 1 Table 2 Right-hand doorset

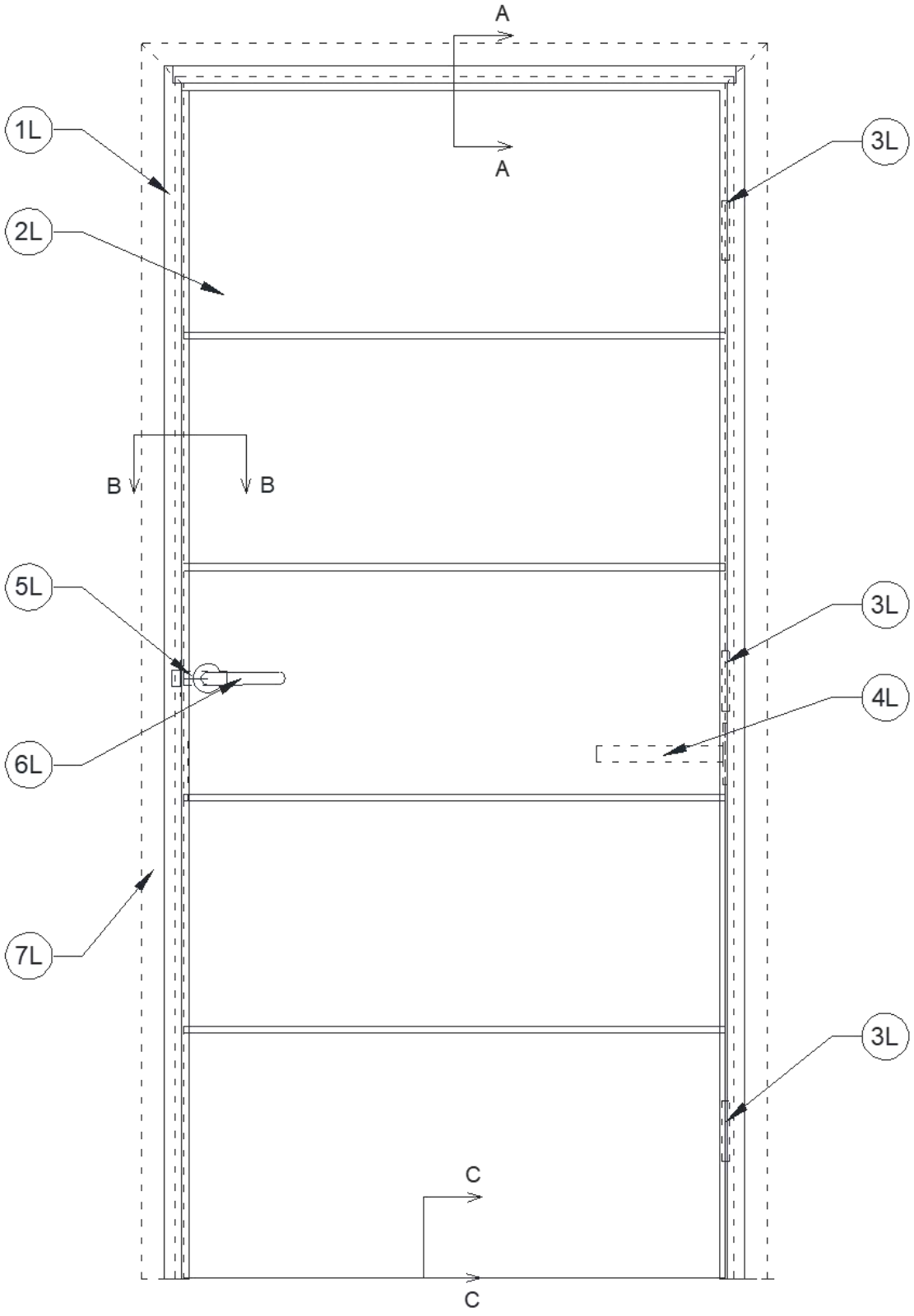
Item	Component	Information
1R	**Door frame**	
	Manufacturer:	Vindelans Snickerifabrik AB**
		3 sided Redwood** frame with integral stops and 30h x 16w rebated joints affixed vertically with 2No. Ø4.9 x 79 steel countersunk screws at 66-69 centres.
	Density (kg/m^3):	>450*
	Fixing to supporting construction (Ø x l):	Ø5 x 80 steel countersunk screws set 190 up from threshold and 190 down from frame head with 3 No. equi-spaced.
	Overall size (h x w x d):	2076 x 992
	Cross section size (h x d):	42 x 100
	Integral stop (h x d):	12 x 54
2R	**Leaf**	
	Manufacturer:	Premdor Ltd
	Reference:	CF198 4 Line horizontal
	Description:	A particle board core with timber stiles and rails, MDF facing with 4No. horizontal grooves (11*h x 1*d) across full width of leaf set 425 below leaf head and 383-385 vertical centres.
	Overall size (h x w x t):	2043 x 925 x 44
	Weight (kg):	52.8
	Sub-components:	
	Core:	
	Type:	Particle board
	Thickness (h x w x t):	1953* x 896 x 38
	Stiles:	
	Description:	Whitewood**
	Overall size (w x d):	30 x 38
	Rails:	
	Description:	Whitewood**
	Overall size (h x w x d):	30‡ x 38‡
	Facings:	
	Description:	MDF facings with 4No. horizontal grooves.
	Overall size (t):	3.1
3R	**Hinges**	
	Supplier:	Frisko UK**
	Description:	3No Eclipse grade 11 radius corner stainless steel butt hinge with bearings set 200, 970 and 1740 from the top of the leaf to the top of the blade.
	Blade size (h x w x t):	101 x 31 x 2.0
	Knuckle size (Ø):	13
	Fixings to frame (Ø x l):	4No. Ø4.5 x 12 steel countersunk screws
	Fixings to leaf (Ø x l):	4No. Ø4.5 x 50 steel countersunk screws

Item	Component	Information
4R	**Closer**	
	Manufacturer:	Astra Door Controls Ltd.
	Description:	Astra 4000** Series steel concealed door closer fitted in the hanging stile central to the leaf thickness, set 843 above leaf base.
	Fixings to leaf:	6No. Ø3.8 x 38 stainless steel countersunk screws
	Fixings to frame:	6No. Ø3.8 x 24 brass countersunk screws
	Overall size:	
	Body (Ø x l):	28‡ x 216‡
	Leaf forend: (h x d x t):	106 x 32 x 3.5‡
	Frame forend: (h x d x t):	106 x 32 x 3.5‡
5R	**Latch/Lock**	
	Manufacturer:	Eurospec Architectural Hardware
	Reference:	TLS8030**
	Description:	Steel mortice lock with brass finish with stainless steel strike and plastic strike box.
	Height of spindle:	1025
	Overall size:	
	Body (h x w x d):	23 x 73 x 16
	Fixings (Ø x l):	2No. Ø3.5 x 25 steel countersunk screws.
	Forend (h x d x t):	60 x 25 x 1.5
	Strike plate (h x w x d x t):	65 x 25 x 1.5 (including a 40h x 16w tongue)
	Strike box (h x w x d):	28 x 15 x 24
	Fixings (Ø x l):	2No. Ø3.5 x 25 steel countersunk screws
6R	**Handleset**	
	Supplier:	Zoo Architectural Hardware
	Part Number:	ZCS080SS
	Description:	Satin stainless steel ‘d’ lever handle with rose.
	Overall size:	
	Handle (l x Ø):	144 x 22
	Rose (Ø x d):	50 x 7 x 1.3
	Rose cover (Ø x d x t):	52 x 8 x 0.8
	Fixings (Ø x l):	4No. 3.8 x 25 stainless steel countersunk screws
7R	**Architrave**	
	Manufacturer:	Sam Moulding Ltd**
	Reference:	SP 601**
	Description:	MDF with mitred joints, only on exposed face, set 12 from frame reveal.
	Overall size (h x w x t):	2115* x 1070*
	Cross-section (w x d):	15 x 69
	Fixings (Ø x l):	18 swg nails set at nominally 200 centres

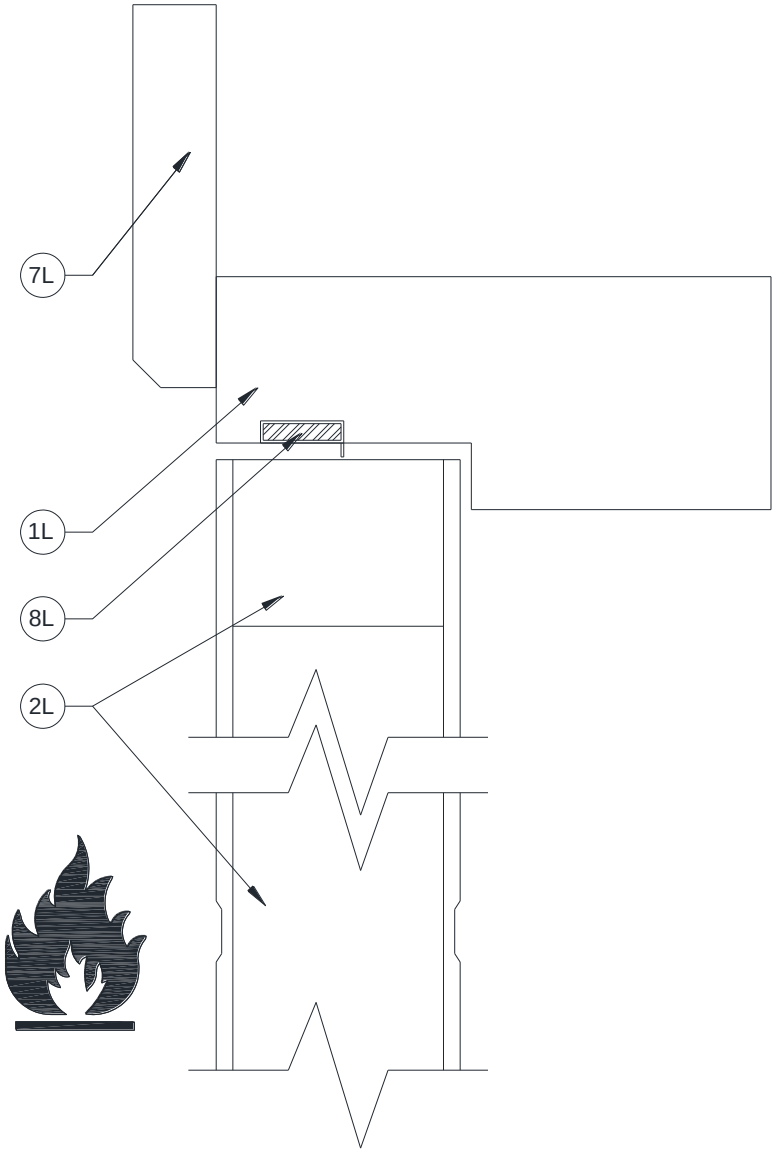
Item	Component	Information
8R	**Intumescent - Frame** Supplier: Reference: Description: Overall size (h x w x d):	 Pyroplex Ltd 1540FW A graphite based intumescent in a white pvc holder with flipper seal set 8 from unexposed face. Fully interrupted at hinges, strike and closer. 15 x 4
9R	**Intumescent - Hinge** Supplier: Reference: Description: Overall size (h x w x d):	 Norseal** Norseal type 15 White ammonium phosphate based intumescent pads with self-adhesive beneath all blades. 100 x 30 x 1
10R	**Fire stopping detail** Description:	 Gaps between the frame and the supporting construction were packed with Unifrax Insulfrax LTX blanket and capped with Firewise Intumescent & Acoustic Acrylic Sealant.

Key:
* Nominal value;
** Sponsor declared value or detail, not verified by laboratory
‡ Identified post test from remains of specimen

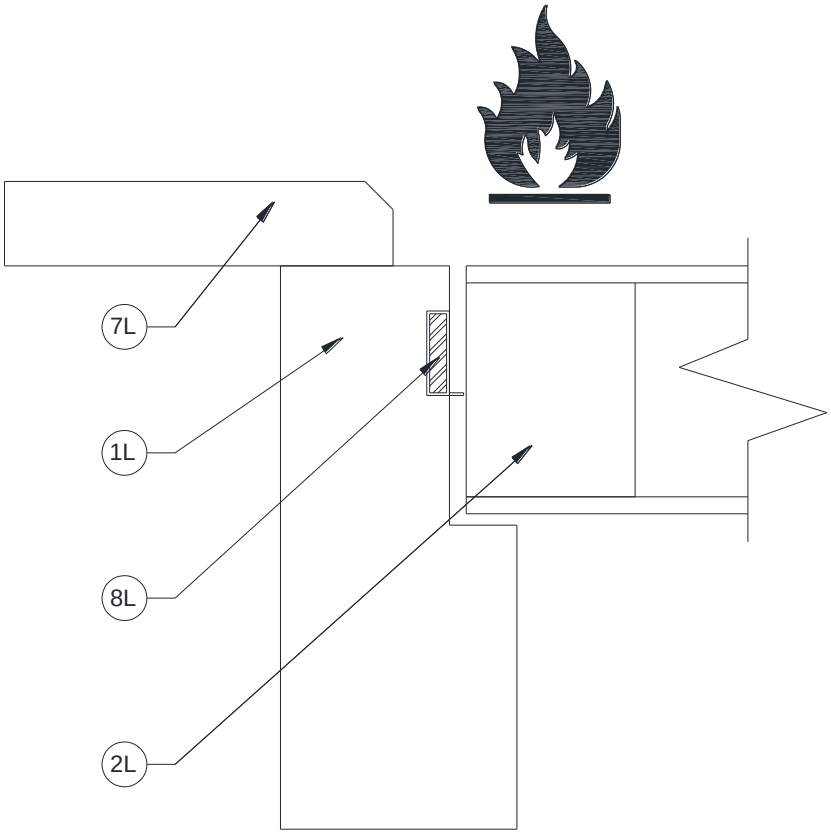
Appendix 1 Figure 1 – Elevation left-hand doorset – unexposed face incl. hidden detail



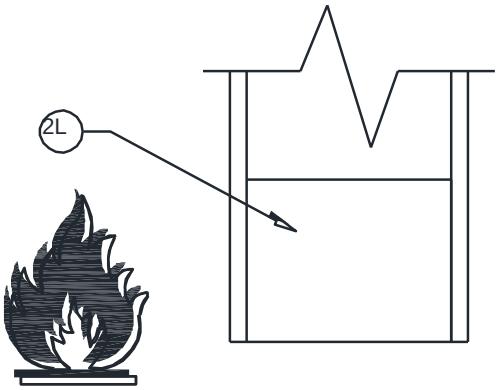
Appendix 1 Figure 2 – Section A – A



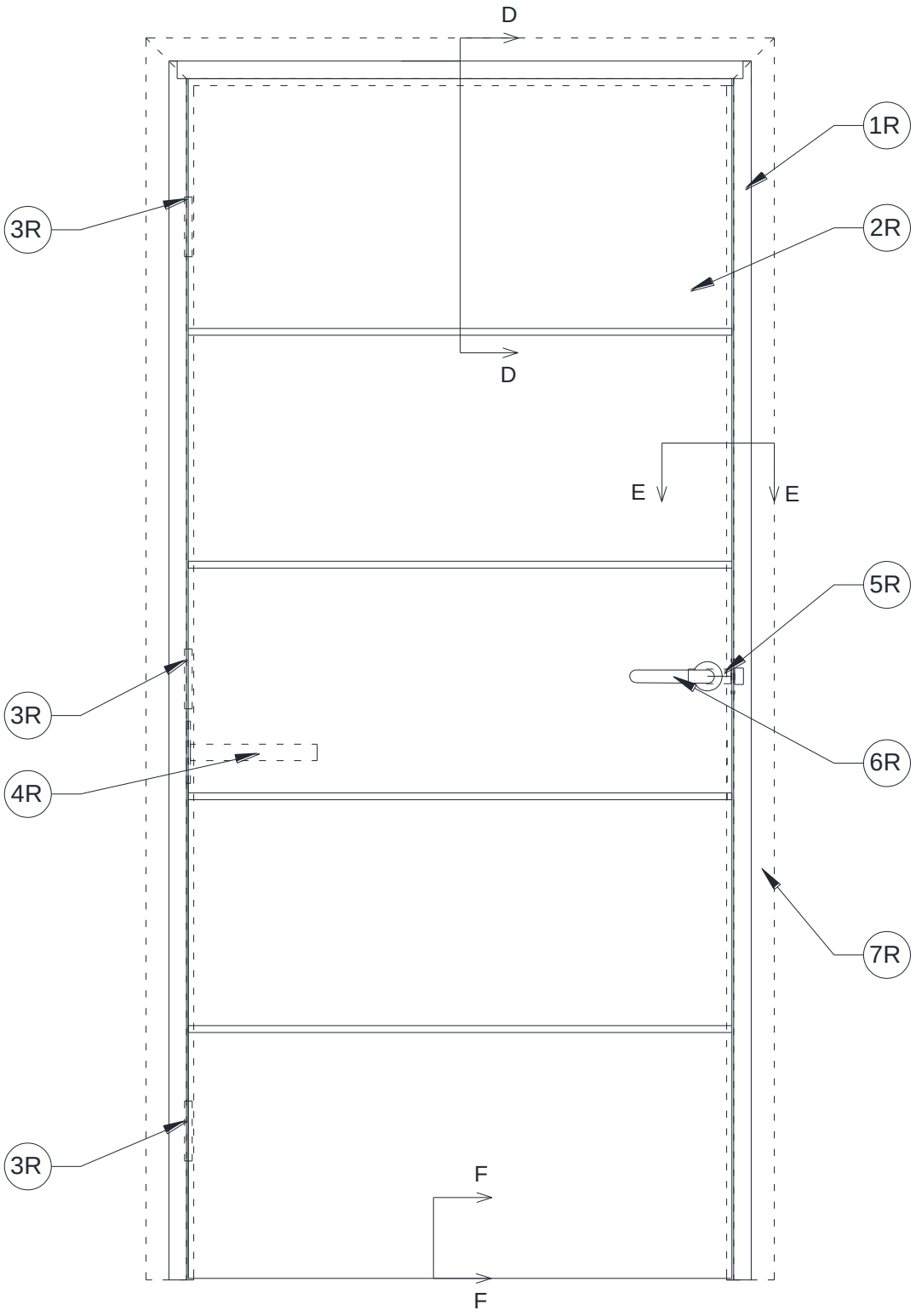
Appendix 1 Figure 3 – Section B – B



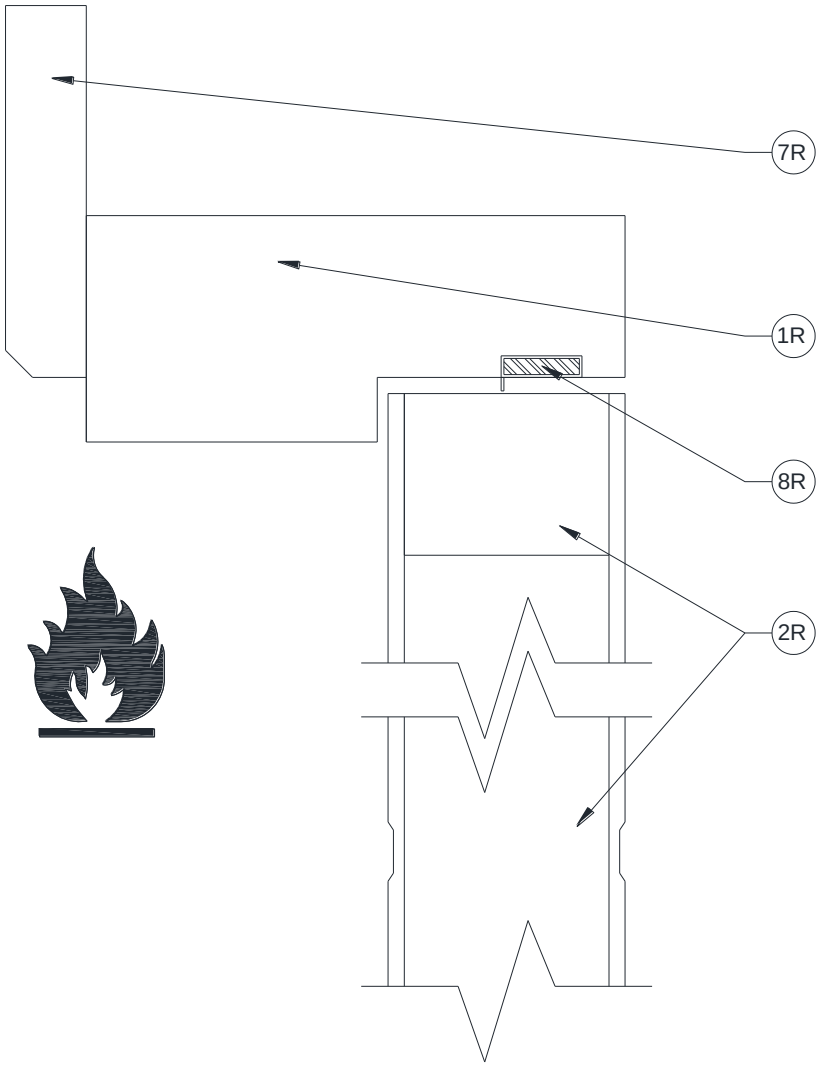
Appendix 1 Figure 4 – Section C – C



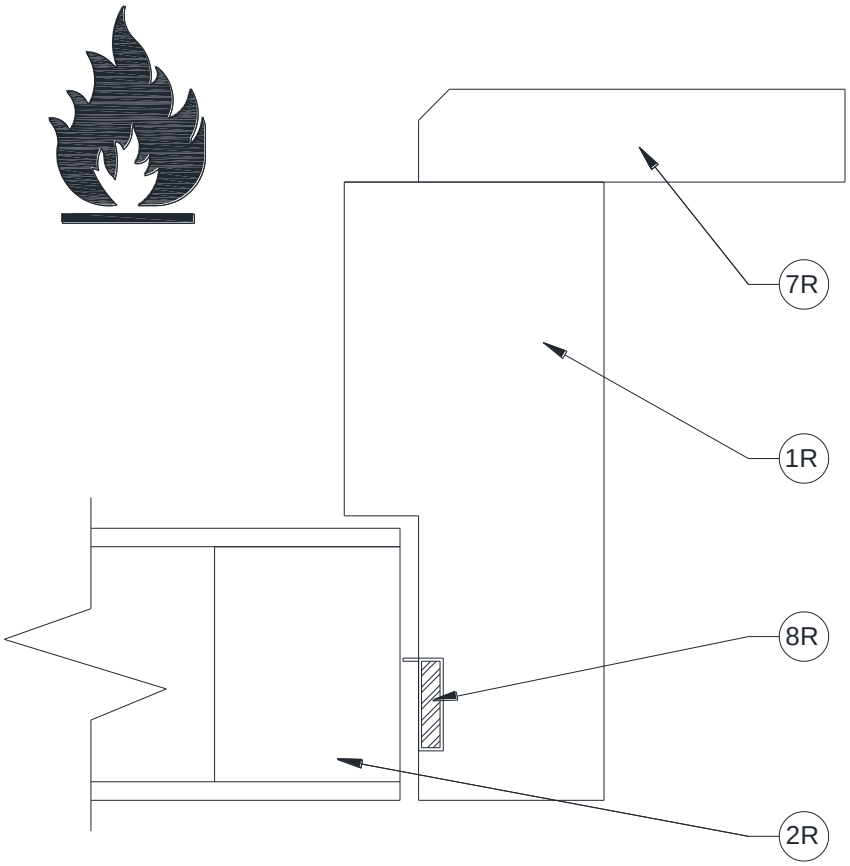
Appendix 1 Figure 5 – Elevation right-hand doorset – unexposed face incl. hidden detail



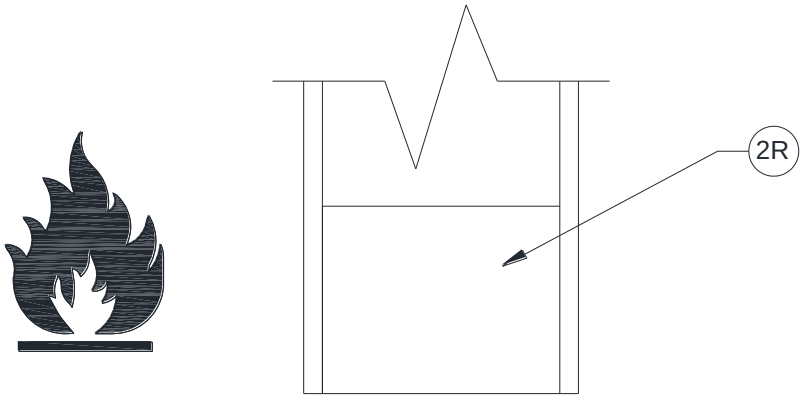
Appendix 1 Figure 6 – Section D – D



Appendix 1 Figure 7 – Section E – E



Appendix 1 Figure 8 – Section F – F



APPENDIX 2 PHOTOGRAPHS

Appendix 2.1 Pre-test photos

Photo 2.1.1 Left-hand specimen

Photo 2.1.2 Left-hand specimen

Photo 2.1.3 Left-hand specimen

Photo 2.1.4 Left-hand specimen

Photo 2.1.5 Left-hand specimen

Photo 2.1.6 Left-hand specimen

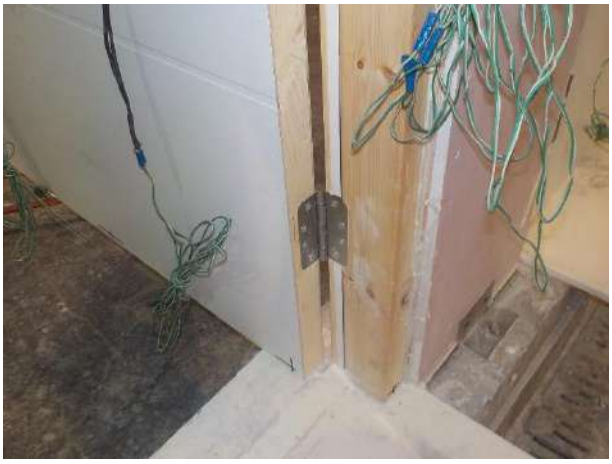


Photo 2.1.7 Left-hand specimen

Photo 2.1.8 Left-hand specimen

Photo 2.1.9 Left-hand specimen

Photo 2.1.10 Right-hand specimen

Photo 2.1.11 Right-hand specimen

Photo 2.1.12 Right-hand specimen

Photo 2.1.13 Right-hand specimen

Photo 2.1.14 Right-hand specimen

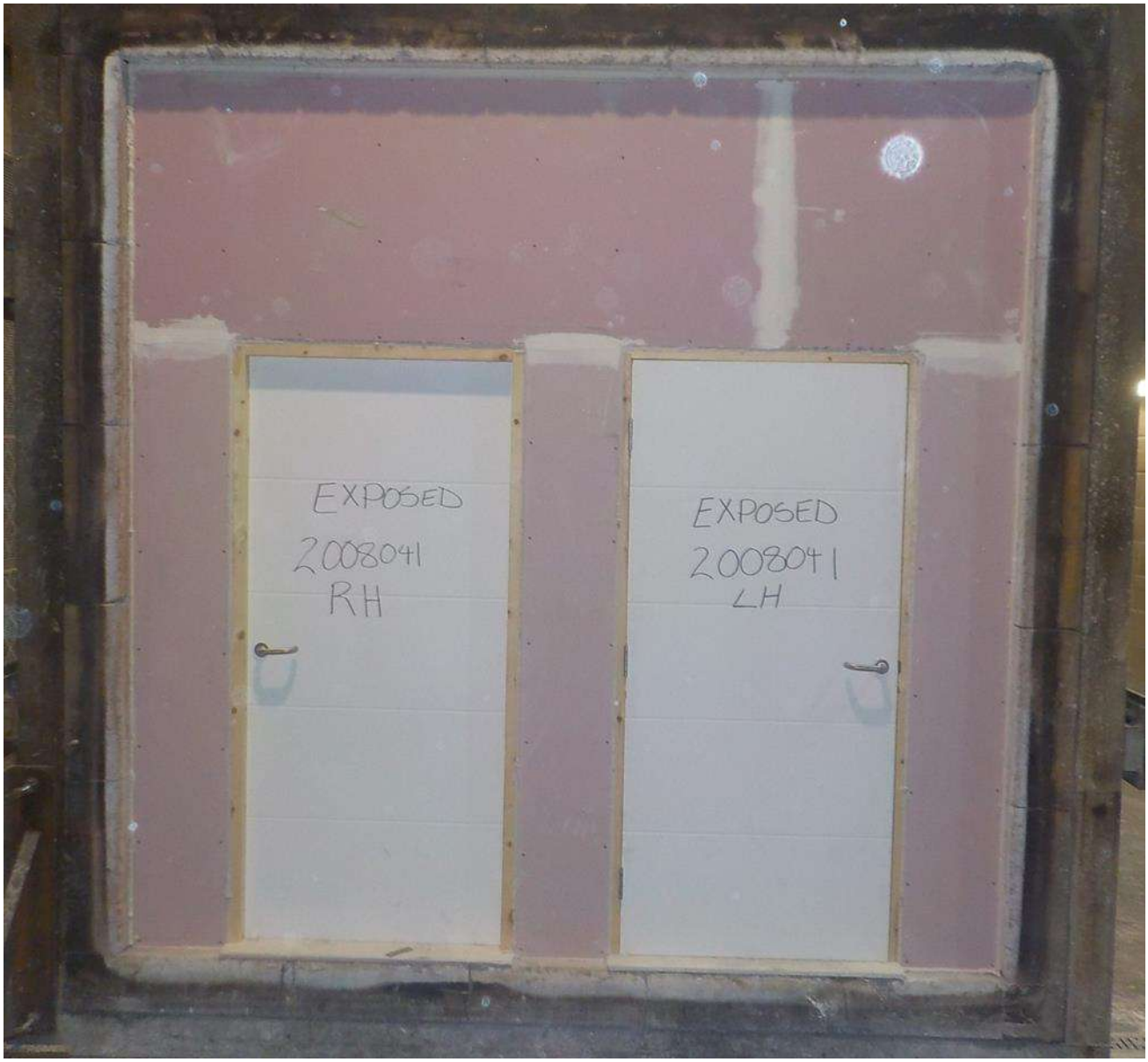
Photo 2.1.15 Right-hand specimen

Photo 2.1.16 Right-hand specimen

Photo 2.1.17 Right-hand specimen

Photo 2.1.18 Right-hand specimen

Photo 2.1.19



Appendix 2.2 During test photos

Photo 2.2.1

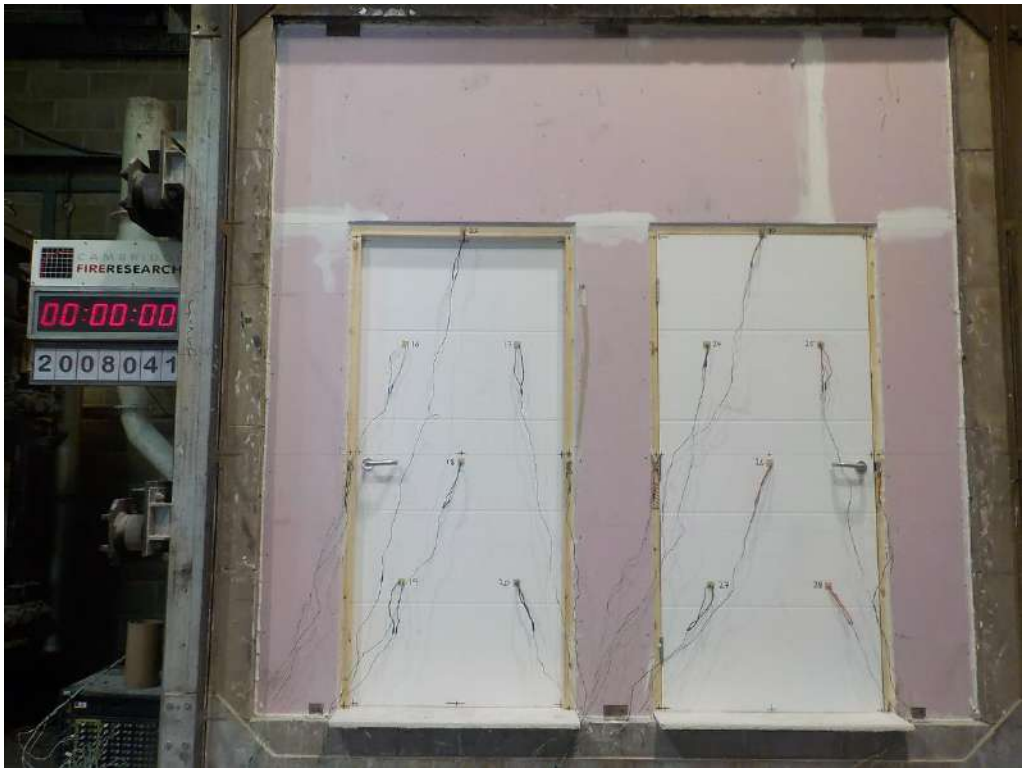


Photo 2.2.2

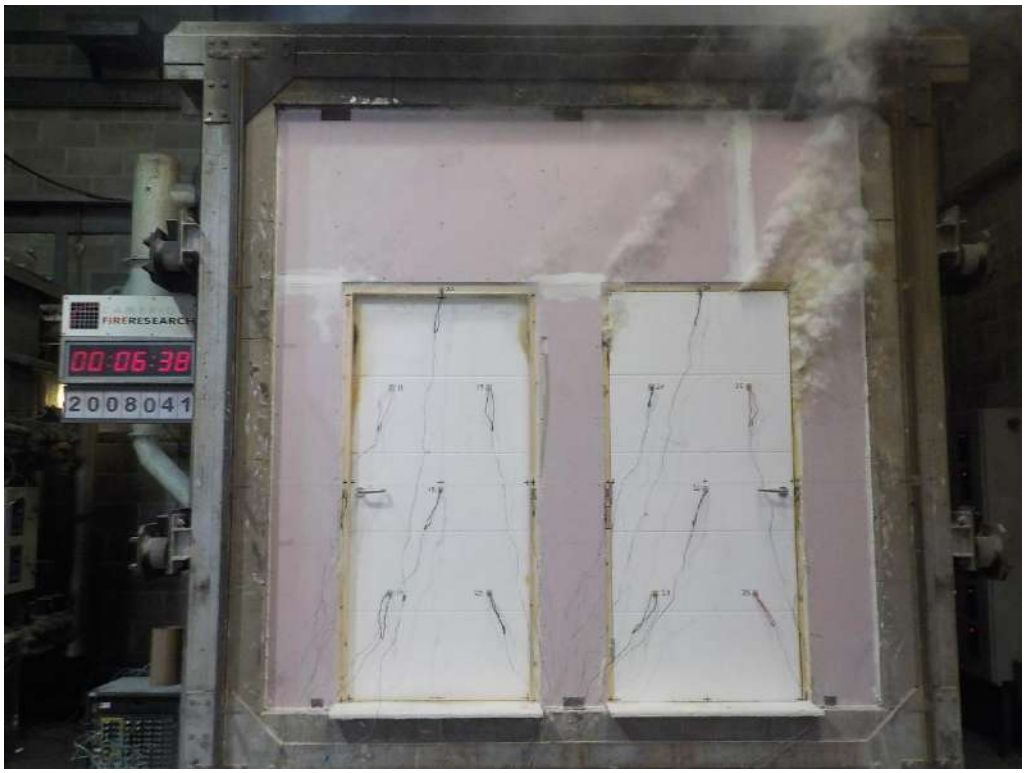


Photo 2.2.3

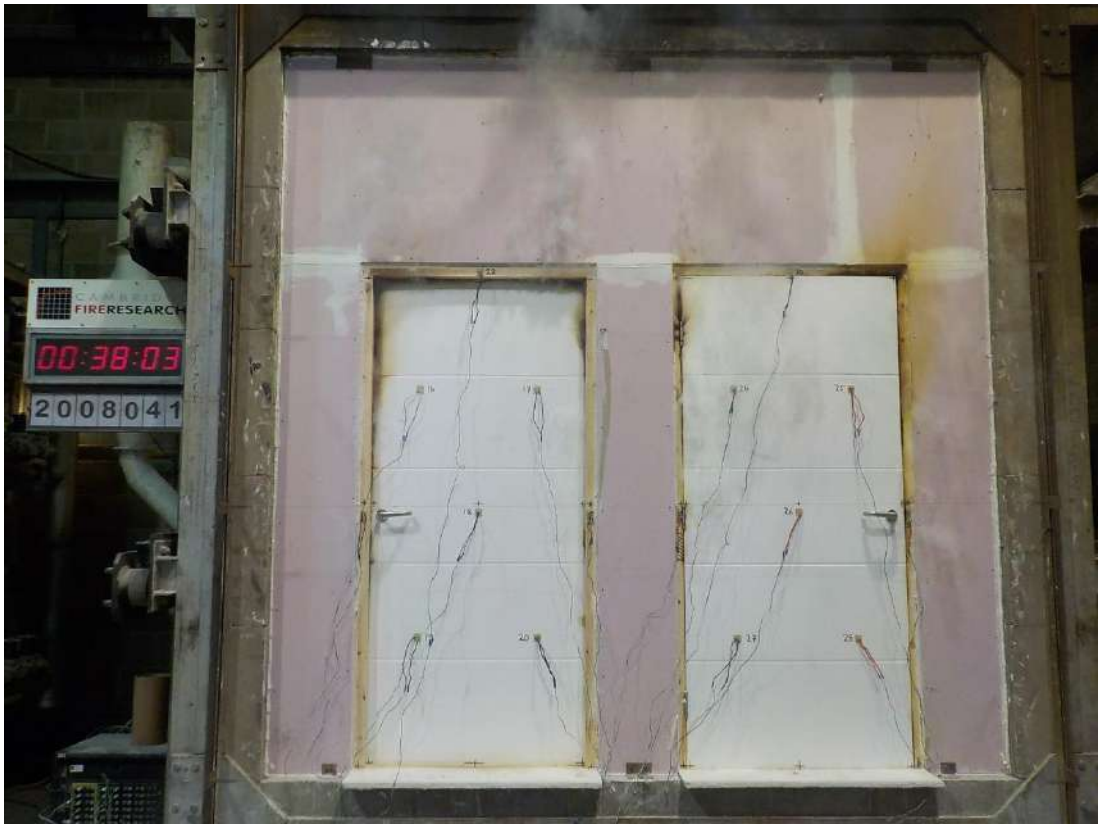
Photo 2.2.4

Photo 2.2.5

Photo 2.2.6

Photo 2.2.7 – Right-hand leaf after 33 minutes

Photo 2.2.8

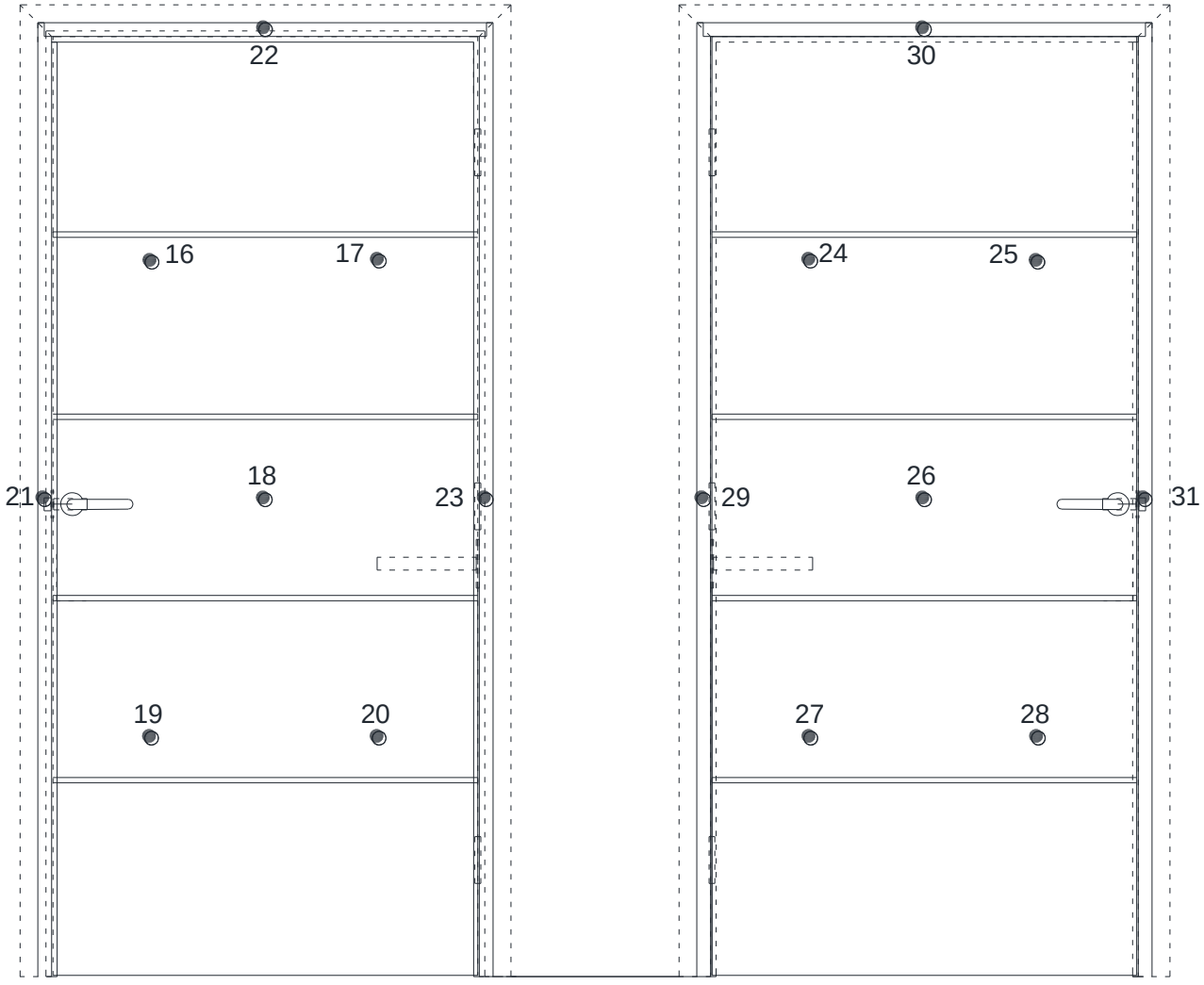


Appendix 2.3 Post-test photos

Photo 2.3.1- Left-hand leaf

Photo 2.3.2- Right-hand leaf

APPENDIX 3 POSITIONING OF INSTRUMENTATION



Unexposed face specimen thermocouple

CAMBRIDGE FIRERESEARCH

APPENDIX 4 RECORDED THERMOCOUPLE DATA

Time	T/C 16	T/C 17	T/C 18	T/C 19	T/C 20	T/C 21	T/C 22	T/C 23	T/C 24	T/C 25	T/C 26	T/C 27	T/C 28
min	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C
0	24	25	24	24	24	24	24	24	24	24	24	22	24
1	24	24	24	24	24	24	24	24	24	24	24	22	24
2	24	25	24	24	24	24	24	24	24	24	24	22	24
3	24	24	24	24	24	24	24	24	24	24	24	22	24
4	24	25	24	24	24	24	24	24	24	25	24	22	24
5	24	25	24	24	24	24	24	24	24	24	24	22	24
6	24	25	24	24	24	24	26	24	24	25	25	24	24
7	24	25	25	24	24	24	25	24	25	25	25	24	25
8	25	25	25	24	24	24	25	24	26	26	25	23	25
9	24	25	24	25	24	24	24	24	27	27	25	22	24
10	25	27	25	27	25	24	25	24	29	29	25	22	25
11	25	29	25	28	26	24	24	24	30	30	26	22	25
12	26	31	26	30	27	25	25	24	32	33	28	21	27
13	27	34	26	32	30	25	25	24	34	35	29	21	29
14	29	37	27	35	33	25	25	24	36	37	31	20	31
15	30	40	28	37	36	26	25	24	38	39	32	20	34
16	32	42	30	39	38	25	25	24	40	41	34	19	36
17	35	45	32	41	41	26	26	24	42	44	36	18	39
18	37	47	34	44	43	26	26	25	44	46	39	16	42
19	40	49	36	45	45	25	27	25	46	48	40	14	44
20	42	51	39	47	47	26	27	24	48	50	43	13	46
21	45	54	42	49	49	26	27	25	50	52	45	12	49
22	48	56	45	51	52	27	28	25	52	55	48	9	51
23	51	58	48	53	54	27	29	25	54	57	50	8	53
24	53	60	50	55	56	27	29	25	56	59	52	5	55
25	56	62	53	57	58	27	30	26	58	61	55	3	57
26	58	64	56	58	60	27	30	26	60	63	57	1	59
27	61	66	59	60	61	28	31	26	61	65	59	*	61
28	63	68	61	62	63	28	31	26	64	64	61	*	63
29	65	69	63	63	64	28	32	26	65	65	63	*	64
30	67	71	66	65	66	28	33	26	67	66	65	*	66
31	69	73	68	67	67	28	33	27	69	66	67	*	68
32	71	74	70	68	69	28	34	27	70	68	68	*	69
33	72	75	72	70	70	28	35	27	72	69	70	*	71
34	74	77	74	72	72	29	36	28	73	70	72	*	72
35	75	78	76	73	73	29	36	28	75	72	73	*	74
36	76	78	77	73	74	29	37	28	75	73	74	*	75
37	77	79	78	74	75	30	38	29	77	75	76	*	76
38	78	80	79	76	76	30	38	29	77	76	77	*	77

Time	T/C 29	T/C 30	T/C 31
min	˚C	˚C	˚C
0	24	24	24
1	26	24	25
2	25	24	26
3	26	24	28
4	27	24	32
5	26	24	30
6	33	24	47
7	36	25	46
8	35	25	41
9	35	24	40
10	35	25	39
11	36	25	39
12	36	26	40
13	36	26	41
14	37	27	43
15	37	28	43
16	37	28	45
17	37	29	46
18	38	30	48
19	37	31	48
20	38	32	49
21	39	33	51
22	40	35	52
23	41	36	53
24	42	37	55
25	43	39	57
26	44	41	59
27	45	43	60
28	45	45	62
29	46	46	64
30	48	48	66
31	49	51	67
32	52	54	69
33	55	58	72
34	56	60	75
35	57	62	78
36	58	64	82
37	62	67	86
38	64	69	90