


C A M B R I D G E
FIRE RESEARCH

REPORT NUMBER
CFR1002031

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

Sponsor:	Sauerlander Spanplatten GmbH & Co KG
Address:	Zur Schefferei D-59821 Arnsberg Germany
Date of test:	3 rd February 2010

Results:	
Test duration:	32 minutes (discontinued at the request of the sponsor)
Integrity:	16 minutes
Insulation:	16 minutes

	<p>Summary of test specimen: Partially insulated single acting glazed double leaf timber doorset.</p> <p>Left leaf size: 2100 high x 927 wide x 54 thick overall Right leaf size: 2100 high x 926 wide x 54 thick overall</p>
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1 PREPARATION FOR TESTING

1.1 Specimen conditioning

The specimen components were at Cambridge Fire Research for a total period of 6 days, during which time they were stored, surveyed and prepared for testing. For this duration the temperature and relative humidity were measured and recorded within the range of 4 to 10 °C and 53 to 86% respectively.

1.2 Associated construction

Cambridge Fire Research constructed a softwood stud partition which was clad with British Gypsum 15 mm FireLine board on the exposed face and 12.5 mm FireLine board on the unexposed face. This provided an aperture for the specimen of nominally 2145 mm high x 1920 mm wide.

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 frame of the doorset was positioned.

1.3 Specimen construction

The door leaves and frame were supplied by the client.

1.4 Specimen verification

Cambridge Fire Research carried out a detailed survey of the specimen to verify the information provided by the sponsors. This included verifying the 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

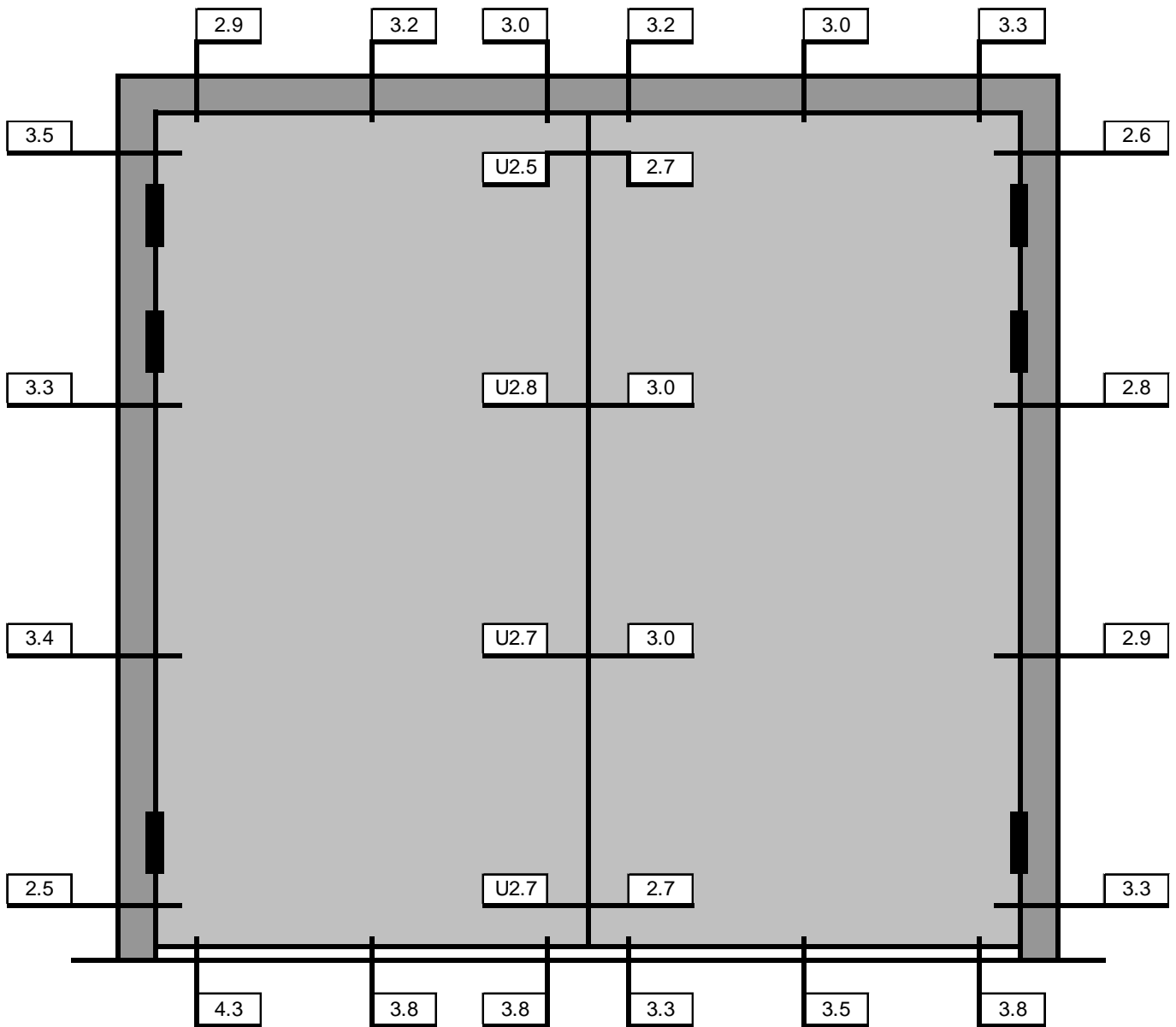
Cambridge Fire Research Ltd installed the specimen into the associated construction such that the leaves opened towards the heating conditions of the test. The lock and flush bolt were disengaged at the start of the test.

The specimen was affixed to the associated construction at the jambs with No. 10 x 3.5" countersunk steel woodscrews positioned 120 mm below the head and above the threshold with 3No. screws spaced equidistant between and 2No. at the head positioned 500 mm from the reveal.

2 PRE-TEST MEASUREMENTS AND SETTING

2.1 Gap measurements

The gap between the leaf edges and the frame, between the meeting stiles and at the threshold was measured on the exposed face prior to the start of the test. The unexposed face gap was also measured at the meeting stiles. The following figure shows the position at which the measurements were made and the recorded gap (mm) at those positions. The 'U' indicates the measurement of the gap between the meeting stiles from the unexposed face.



2.2 Closer force measurement

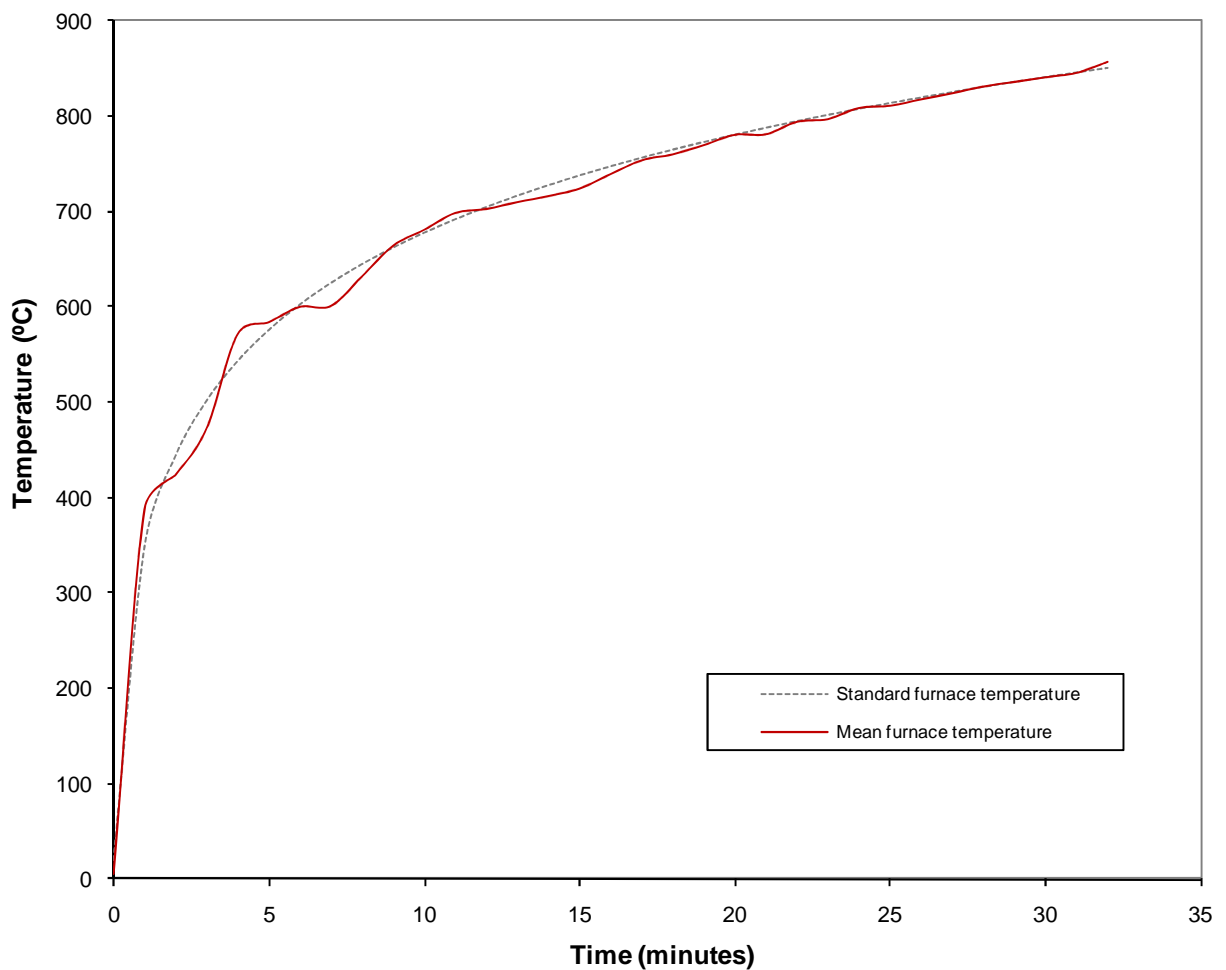
The door opening and closing forces were measured in accordance with Fire Test Study Group Resolution No. 63 and the calculated moments are shown in the following table.

Direction	Leaf	Closing force (N)	Closing moment (Nm)	Opening force (N)	Opening moment (Nm)
Opening towards heating conditions	Left Leaf	23.6	17.7	81.7	61.3
	Right Leaf	24.7	18.5	76.4	57.3

3 TEST CONDITIONS, INSTRUMENTATION AND MEASURING

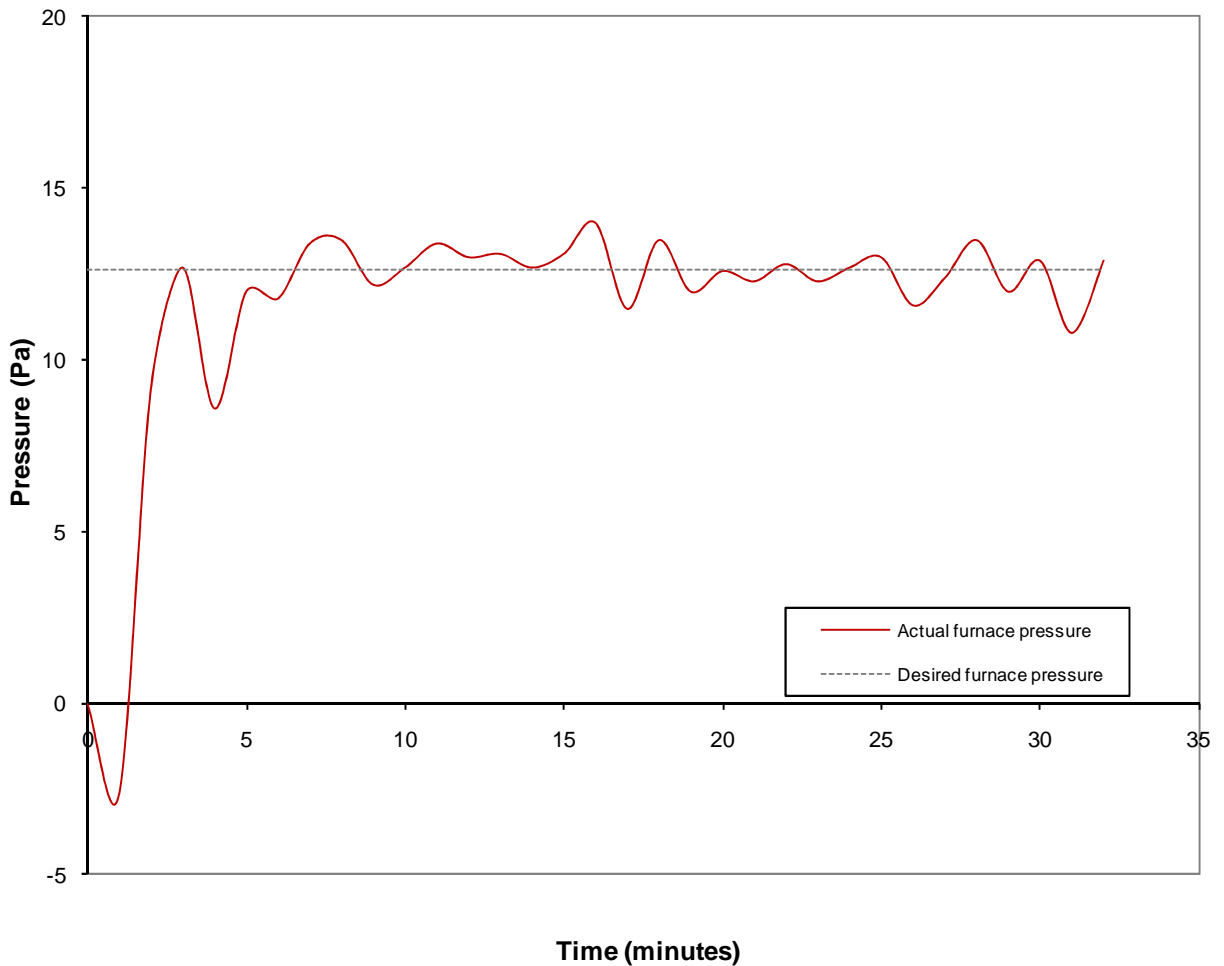
3.1 Furnace temperature

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 six 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 + 12.6 Pa 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. 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 5 °C.
Ambient temperature was measured between 3 °C and 4 °C for the duration of the test.

3.4 Unexposed face specimen thermocouples

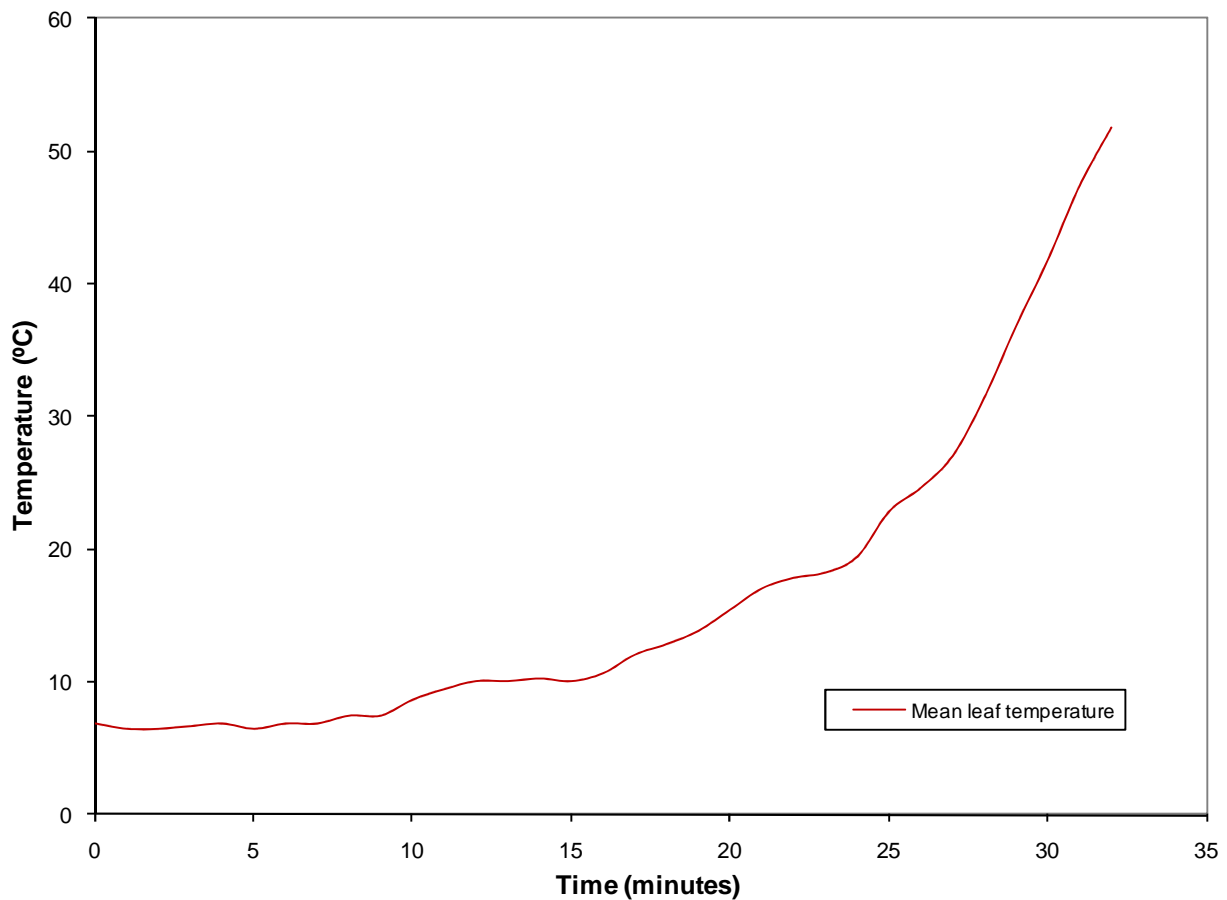
Surface temperature measuring thermocouples of the design specified in the test standard were affixed to the unexposed face of the specimen to monitor the temperature rise as follows:

Doorset leaves	Channels 16, 17, 18, 19 and 20 Channels 33 and 34	(mean & maximum) (maximum only)
Leaf glazing	Channels 25, 26, 27, 28, 29, 30, 31 and 32	(maximum only)
Doorset frame	Channels 21, 22, 23 and 24	(maximum only)

The positions of these thermocouples are shown in Appendix 3.

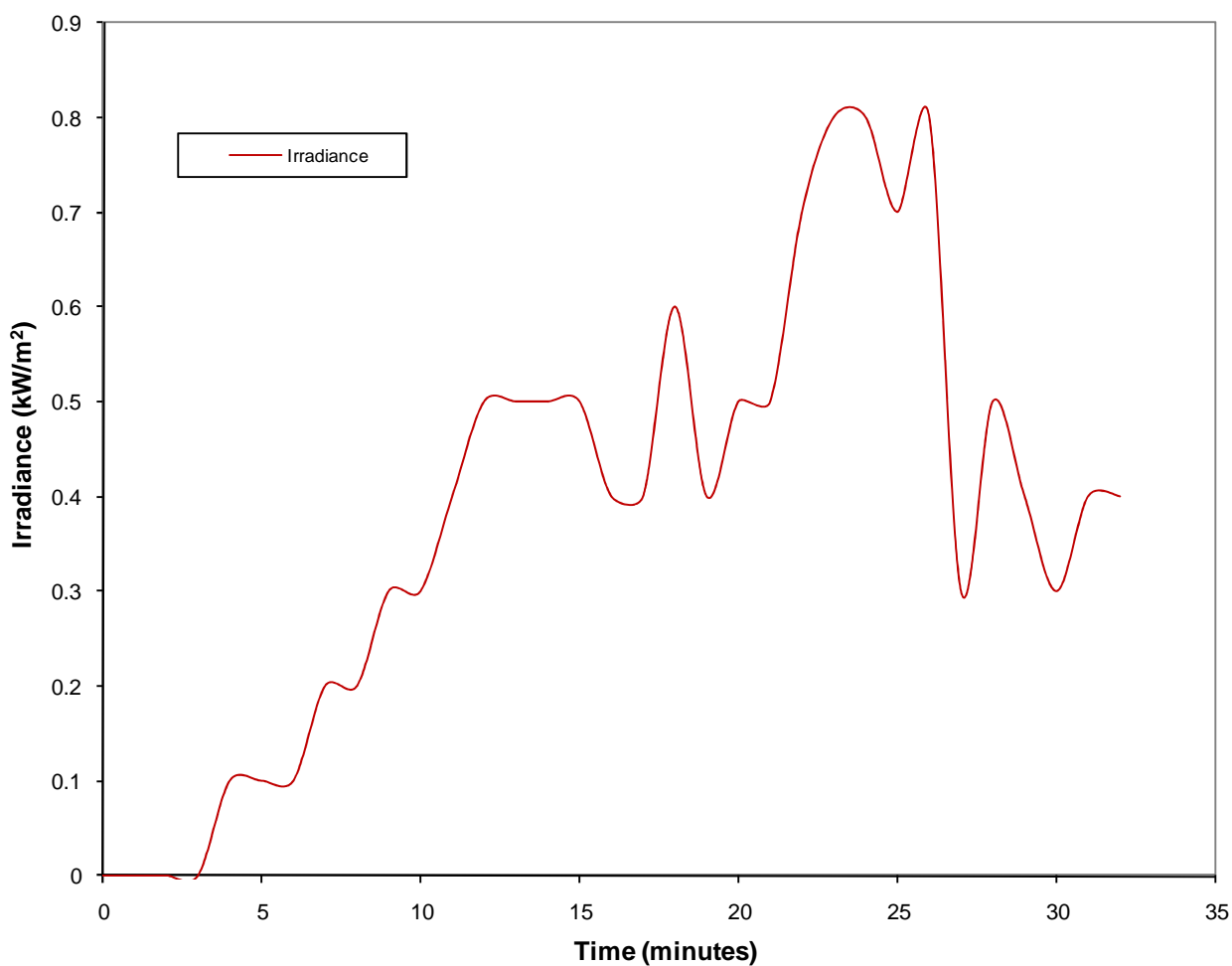
A roving thermocouple was available for measurement of any specific hotspots and was recorded on Channel 15. Any position(s) of use of the roving thermocouple are noted in the observations in Section 4.

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.



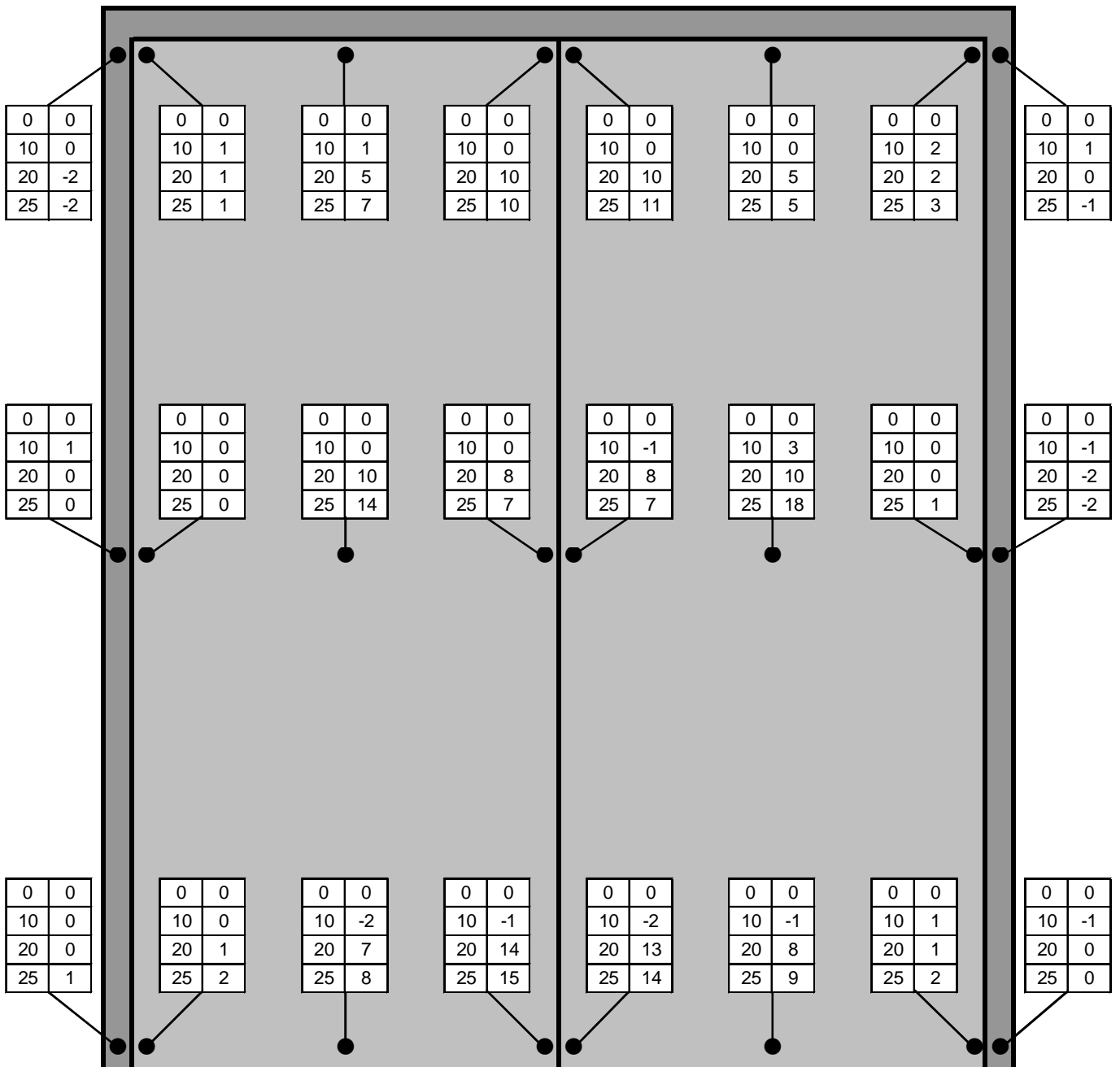
3.5 Irradiance

Irradiance from the unexposed face was monitored during the test. A 60° field of view water cooled heat flux meter was positioned with its target 1806mm from and parallel to the unexposed face of the specimen and at its geometric centre. The following graph shows the recorded irradiance/time data.



3.6 Deflection

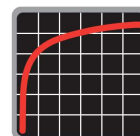
Taut stainless steel wires were anchored horizontally across the unexposed face of the specimen such that any deflection experienced by the test specimen could be measured. One wire was positioned 25 mm vertically below the head of the leaves, the second at mid-height and the third 25 mm vertically above 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. The relevance of the measurements should be considered in conjunction with the fact that restraint was applied to the leaves at 16 minutes.



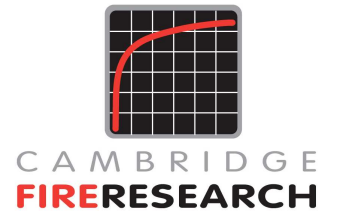
4 TEST OBSERVATIONS

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

TEST OBSERVATIONS (E = Exposed face: U = Unexposed face)		
Time (min:sec)	Face	Observation
00:00		Start of the test.
00:53	U	Cracks are apparent in all the glazing panes.
02:30	U	Cracking of all the glazing panes continues.
02:45	U	Smoke/steam issues at the top glazing aperture of the right hand leaf.
03:00	U	Smoke/steam issues at the top of the meeting stiles.
03:10		Smoke/steam issues at the lock rose.
03:20	U	Smoke/steam issues between the top of the meeting stiles and mid height.
04:00	U	Smoke/steam issues at the top of the hanging stiles. Smoke/steam issuing at the meeting stiles continues.
04:30		Cracks are apparent at the periphery of all the glazing panes.
05:00	U	Smoke/steam issues at the left hand vertical glazing bead of the top glazing aperture of the left hand leaf at the beading to leaf interface.
05:15	U	A pop emanates from the specimen.
05:30	U	Staining is apparent at the top of the meeting stiles. Smoke/steam issuing at the top of the hanging stiles continues.
06:00	E	The leaf facings have charred and fissured. The intumescent at the glazing beads has activated.
08:30	E	The leaf facings have partially detached.
12:00	U	The smoke/steam issuing at the top of the right hand hanging stile has increased in density.
13:00	U	The intumescent at all the glazing beads has activated.
14:00	U	Smoke/steam issues at the bottom glazing aperture of the right hand leaf
15:30	U	The leaves begin to open towards the heating conditions of the test.
16:15	U	INTEGRITY FAILURE is deemed to have occurred due to failure by gap gauge at the top of the meeting stiles. INSULATION FAILURE is deemed to have automatically occurred due to the occurrence of integrity failure. Note: In accordance with the note to clause 7.6.1.1 of BS 476 Part 22: 1987 the glazing was not evaluated for insulation. The leaves were manually returned to their closed position and restrained at nominally latch height to facilitate continuation of the test
17:00	U	The intumescent across the head of both leaves has partially detached.



20:00	U	Smoke/steam issues at the beading to leaf interface of all the glazing apertures. Staining is apparent above all the glazing apertures.
22:00	U	Smoke/steam issuing at the meeting stiles and across the head of both leaves has increased in density. The exposed face top glazing bead of the top glazing aperture of the left hand leaf has detached.
24:00	U	A crackle emanates from the specimen.
25:00	U	The smoke/steam issuing at all the glazing apertures has increased in density. Staining apparent above all the glazing apertures has developed.
25:38	U	Flash flaming occurs at the top glazing aperture of the right hand leaf.
26:00	U	Flash flaming at the top glazing aperture of the right hand leaf continues sporadically.
26:40	U	Flaming commences at the top aperture of the left hand leaf and at the top of the right hand leaf which tracks to the top of the meeting stiles.
26:50	U	Further integrity failure is deemed to have due to sustained flaming at the positions noted at 26:40
26:55	U	Flaming commences at the top right hand corner of the top right hand aperture.
27:05	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 26:55.
27:10	U	The flaming was extinguished.
27:20	U	The top of the meeting stiles were sealed at the failure position.
27:38	U	Re-ignition occurs at the top glazing aperture of the left hand leaf and is extinguished.
28:20	U	Re-ignition occurs at the top glazing aperture of the right hand leaf and is extinguished.
29:30	U	Re-ignition occurs at the top glazing aperture of the right hand leaf and is extinguished.
29:46	U	Flash flaming occurs at the bottom glazing aperture of the left hand leaf.
30:00	U	The top glazing aperture of the left hand leaf is covered and sealed.
30:12	U	Flaming commences at the bottom glazing aperture of the left hand leaf.
30:22	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 30:12.
30:33	U	The flaming was extinguished.
31:12	U	Flash flaming occurs at the lock rose.
32:00	U	The bottom glazing aperture of the left hand leaf and the top glazing aperture of the right hand leaf are covered and sealed.
32:30	U	Flaming commences at the bottom glazing aperture of the right hand leaf.



32:40	U	Further integrity failure is deemed to have occurred due to sustained flaming at the position noted at 32:30.
32:55		The test is terminated at the request of the sponsor.

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.
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 sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.
3. The doorset was asymmetrical and was tested such that the door leaves opened towards the heating conditions of the test. The test results may not be appropriate to situations where the door leaves open away from the heating conditions.

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Report issued:

14th December 2010

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

Item	Component	Information
1L	Left Leaf Supplier: Description: Overall size (h x w x d) Sub components: Core: Reference: Description: Density (kg/m ³): Lippings: Species: Description: Size (t): Size (t): Density (kg/m ³): Facing: Description: Size (t): Density (kg/m ³):	Sauerlander Timber based leaf incorporating a three layer core **, chipboard ** facings, sitka spruce ** rails and stiles and oak ** lippings incorporating 2No. glazing apertures. 2100 x 927 (max)/915 (min) x 54 (width range due to rebated meeting stile) Sauerlander 45S3K ** Extruded chipboard with cork layers. The core layers are free floating **. 560 ** American white oak ** The lippings are affixed to the stiles using hot melt ** adhesive. The meeting stile lipping is rebated 35 deep x 12 wide on the exposed face. Hanging edge 5 Meeting stile 22(max)/10(min) (due to rebate) 650 ** Chipboard ** bonded to the core using PVA ** adhesive. 4 650 **

Item	Component	Information
1L cont	Perimeter: Species: Description: Size (h x d x w): Size (w x d x h): Density (kg/m ³): Fixings: Size (l x d x t): Glazing apertures: Description: Overall size (h x w): Density (kg/m ³): Photo(s):	Sitka spruce ** Softwood perimeter consisting of 2 No. stiles and 2 No. rails each comprising an inner and outer component of sitka spruce ** and affixed with corrugated staples. Outer hanging stile: 2100 x 46 x 34 Inner hanging stile: 1960 * x 46 x 38 * Outer meeting stile: 2100 x 46 x 40 Inner meeting stile: 1960 * x 46 x 38 * Top rail outer: 828 * x 46 x 32 ** Top rail inner: 828 * x 46 x 38 * Bottom rail outer: 828 * x 46 x 32 ** Bottom rail inner: 828 * x 46 x 38 * 450 ** Corrugated steel staples. 20 x 12 x 2 2No. glazing apertures positioned 108 † below the leaf head and 104 † from the meeting stile (exposed face) and 216 † above the leaf bottom and 104 † from the meeting stile (exposed face) respectively. The apertures are lined with 6 ** thick American white oak ** which is held in position by the clamping action of the glazing bead bolections and the glazing bead fixings. Top: 926 † x 252 † Bottom: 702 † x 252 † 650 ** (American white oak) 2.1.1, 2.1.2, 2.1.3, 2.1.6, 2.1.9, 2.1.11, 2.1.14 and 2.1.16
1R	Right Leaf Supplier: Description: Overall size (h x w x d)	Sauerlander Timber based leaf incorporating a three layer core **, chipboard ** facings, sitka spruce ** rails and stiles and oak ** lippings incorporating 2No. glazing apertures. 2100 x 926 (max)/915 (min) x 54 (width range due to rebated meeting stile)

Item	Component	Information
1R cont	Sub components: Core: Reference: Description: Density (kg/m ³): Lippings: Species: Description: Size (t): Size (t): Density (kg/m ³): Facing: Description: Size (t): Density (kg/m ³): Perimeter: Species: Description: Size (h x d x w): Size (w x d x h): Density (kg/m ³): Fixings Size (l x d x t): Glazing aperture: Description: Overall size (h x w): Density (kg/m ³): Photo(s):	Sauerlander 45S3K ** Extruded chipboard with cork layers **. The core layers are free floating **. 560 ** American white oak ** The lippings are affixed to the stiles using hot melt ** adhesive. The meeting stile lipping is rebated 19 deep x 11 wide on the unexposed face. Hanging edge 6 Meeting stile 20(max)/9(min) (due to rebate) 650 ** Chipboard ** bonded to the core using PVA ** adhesive. 4 650 ** Sitka spruce ** Softwood perimeter consisting of 2 No. stiles and 2 No. rails comprising an inner and outer component of sitka spruce ** and affixed with corrugated staples. Outer hanging stile: 2100 x 46 x 34 Inner hanging stile: 1960 * x 46 x 38 * Outer meeting stile: 2100 x 46 x 39 Inner meeting stile: 1960 * x 46 x 38 * Top rail outer: 828 * x 46 x 32 ** Top rail inner: 828 * x 46 x 38 * Bottom rail outer: 828 * x 46 x 32 ** Bottom rail inner: 828 * x 46 x 38 * 450 ** Corrugated steel staples. 20 x 12 x 2 2No. glazing apertures are positioned 100 † below the leaf head and 106 † from the meeting stile (exposed face) and 225 † above the leaf bottom and 106 † from the meeting stile (exposed face) respectively. The apertures are lined with sitka spruce ** of thickness 6–25 † bonded to the facings using PVA ** adhesive. Top: 928 † x 270 † Bottom: 702 † x 255 † 450 ** (sitka spruce) 2.1.1, 2.1.5, 2.1.7, 2.1.8, 2.1.12 and 2.1.17 to 2.1.20

Item	Component	Information
2	Frame Species: Description: Overall size (h x w x d): Section size (w x d): Fixing size (Ø x l): Density (kg/m ³): Photo(s):	MDF ** (primed) Frame comprising head and jambs members, joined at the top corners with a mortice and tenon joint as shown in Appendix 1 Figure 7. Fixed with 2 No. vertical steel countersunk screws per joint. 2138 x 1910 x 70 31 x 70 4.75 x 70 730 ** 2.1.15, 2.1.16, 2.1.19 and 2.1.20
3	Stops Species: Description: Size (w x d): Density (kg/m ³): Photo(s):	MDF ** (primed) MDF stops positioned at the frame head and jambs on the unexposed face, horizontally butt jointed at the top corners. 13 x 15 730 ** 2.1.15 and 2.1.20
4	Stop fixings Description: Overall size (Ø x l):	Steel pins set at 200 * centres Ø1.6 † x 40 long
5	Vision panels Supplier: Description: Photo(s):	Pilkington Group Limited Pyroshield Clear glass sized 5 less than the aperture size **. 2.1.1, 2.1.5, 2.1.6, 2.1.11, 2.1.14, 2.1.17 and 2.1.18
6	Glazing beads (cloak) Species: Description: Overall size (h x d): Density (kg/m ³): Photo(s):	American white oak ** Bolected bead incorporating a 10 ⁰ * splay and 11 high x 5 deep bolection fitted to the top and bottom left hand glazing apertures.. 26 x 27 650 ** 2.1.6, 2.1.11, 2.1.14 and 2.1.16
7	Glazing beads (flush) Species: Description: Overall size (h x d): Density (kg/m ³): Photo(s):	American white oak ** Flush bead incorporating a 11 ⁰ * splay and a 3 deep x 3 high quirk fitted to the top and bottom right hand glazing apertures.. 15 x 22 650 ** 2.1.1, 2.1.5 and 2.1.16 to 2.1.18

Item	Component	Information
8	Glazing bead fixings Description: Size (Ø x l):	Steel pins set at 160 to 240 centres at a skew angle of 25 ⁰ * relative to the glass for both beading types. 1.7 † x 50 †
9	Lock Manufacturer: Reference: Description: Overall size Forend (h x w x t): Case (h x w x d): Fixings size (Ø x l): Photo(s):	Allgood ** 7186 mortice deadlock ** A mild steel cased with stainless steel forend mortice lock set 1038 above the leaf bottom to the centreline of the forend and 17.5 from the exposed face to the centreline of the forend. Affixed with 2No. steel countersunk screws. 234 x 20 x 3 165 x 90 x 15 3.5 x 16 2.1.4
10	Lock cylinder and rose Manufacturer: Description: Overall size (l x h x w): Size (Ø x d): Size (Ø x d x t): Fixing size (Ø x l): Photo(s):	Allgood ** A mainly steel Euro profile cylinder fitted with key operation on the unexposed face and thumbturn on the exposed side. The stainless steel rose is fixed with 2No. countersunk steel screws and a stainless steel escutcheon is push-fitted to the rose. Lock cylinder: 91 x 33 x 17 Rose: 45 x 2.5 Escutcheon: 47 x 3.7 x 0.7 3.5 x 16 2.1.1, 2.1.5, 2.1.11, 2.1.13, 2.1.17 and 2.1.18
11	Lock strike and box Manufacturer: Description: Size (h x w x t): (h x w x d x t): Fixing size (Ø x l):: Photo(s):	Allgood ** A stainless steel lock strike positioned in the left hand leaf appropriate to the lock and affixed with 2No. steel countersunk screws. A mild steel strike box is positioned appropriate to the strike and retained by the strike fixings. Strike: 145 x 25 x 1.7 Strike box: 140 x 17 x 23 x 1 (including fixing lugs) 4 x 30 2.1.14

Item	Component	Information
12	Flush bolt Manufacturer: Reference: Description: Overall size (h x w x d): Fixing size (Ø x l): Photo(s):	Allgood ** 48800FQ ** A lever action flush bolt comprising a stainless steel faceplate and mild steel components affixed to the top of the left hand leaf at the meeting stile 17.5 from the exposed face to the centreline of the flushbolt with 2No. steel countersunk screws 203 x 38 x 19 Ø3.5 x 16 2.1.6
13	Hinges Manufacturer: Reference: Description: Overall Size: Blade (h x w x t): Knuckle: (Ø): Fixings: Size (Ø x l): Photo(s):	Royde & Tucker Hi-Load 105 3No. BZP mild steel incorporating a non ferrous bearing, set at 150, 450 and 1850 (from the top of the leaf to the top of the blade). 98 x 32(max) / 22(min) x 3 14 3 No. countersunk steel screws per blade. 4.75 x 31 2.1.3, 2.1.16 and 2.1.20
14	Door closers Supplier: Reference: Description: Overall size Cover (l x h x d): Photo(s):	Dorma TS71 Plated mild steel arms and case incorporating a mainly aluminium body and fitted to the exposed face of the leaf positioned in accordance with the manufacturer's instructions using 4No. Ø4.75 x 50 long steel countersunk screws to the leaf and 2No. Ø4.5 x 33 long steel panhead screws to the frame and 2No. Ø5 x 9 long steel machine screws fixing the cover to the body. 230 x 67 x 45 2.1.16 and 2.1.19

Item	Component	Information
15	Door bottom seal Manufacturer: Reference: Description: Overall size: (l x d x h): Size (h x w x d x t): Fixing size (Ø x l): Photo(s):	Norsound ** NOR 810 ** A door bottom seal comprising an aluminium body and incorporating a spring loaded drop down inner profile containing a silicone insert with flexible fins positioned within a rebate of 14.5 (d) x 35 (h) in the bottom of the leaf and set 10 from the exposed face, affixed using a folded stainless steel endplate at each stile. The endplate is fixed with 1No. steel countersunk screw. Left leaf: 905 x 14 x 34 Right leaf: 917 x 14 x 34 End plate: 60 x 13 x 22 x 1.4 3.5 x 32 2.1.7 to 2.1.9
16	Frame intumescent (head & jambs) Manufacturer: Reference: Description: Overall size (w x t): Photo(s):	Pyroplex Limited 8700 A graphite based intumescent in a PVC holder with self adhesive tape to one face positioned within a groove positioned 21 from the exposed face with a . 30% interruption at the head due to the flush bolt keep and 70% interruption due to the hinges. 15 x 4 2.1.15 and 2.1.20
17	Meeting stile intumescent 1 Manufacturer: Reference: Description: Overall size (w x t): Photo(s):	Pyroplex Limited 8500 A graphite based intumescent in a PVC holder with self adhesive tape to one face positioned within a groove 5 from the exposed face of the right hand leaf with a 90% interruption by the drop seal and 80% interruption by the lock. 10 x 4 2.1.7, 2.1.12 and 2.1.19

Item	Component	Information
18	Meeting stile intumescent 2 Manufacturer: Reference: Description: Overall size (w x t): Photo(s):	Pyroplex Limited 8512 A graphite based intumescent in a PVC holder with self adhesive tape to one face and incorporating a smoke seal positioned within a groove 20 from the exposed face of the right hand leaf with a 90% interruption by the drop seal and 80% interruption by the lock. 10 x 4 2.1.7, 2.1.12 and 2.1.19
19	Latch intumescent Reference: Description: Overall Size (t): Photo(s):	Interdens ** Intumescent sheet with self adhesive tape on one face wrapped around the latch body and beneath the forend and strike. 1 2.1.4
20	Glazing intumescent 1 Manufacturer: Reference: Description: Overall Size (w x t):	Intumescent Seals Therm-A-Glaze 30 ** Strips of graphite based intumescent with self adhesive tape on one face affixed between the glass and glazing bead (both top apertures). 10 x 2
21	Glazing intumescent 2 Manufacturer: Reference: Description: Overall Size (w x t):	Intumescent Seals Therm-A-Glaze 45 ** A mono ammonium phosphate based intumescent with self adhesive tape on one face affixed between the glass and glazing bead (both bottom apertures). 10 x 2
22	Glazing intumescent 3 Manufacturer: Reference: Description:	Sealmaster ** FireGlaze compound ** An aqueous based emulsion of acrylic polymer and intumescent fillers filling the void between the glass, glazing beads and aperture (all apertures).

Item	Component	Information
23	Intumescent 4 Manufacturer: Reference: Description: Overall size (w x t):	Intumescent Seals ** Therm-A-Line ** An acrylic polymer and intumescent fillers with self adhesive tape on one face lining the bottom apertures affixed at the core perimeter of both leaves and additionally between the glazing aperture timber liner and core of the right hand leaf (flush glazing bead). 46 ** x 2 **
24	Acoustic/smoke seal Manufacturer: Reference: Description: Overall size (w x d): Photo(s):	Norsound ** NOR 710 ** A elastomeric semi rigid back with flexible blades with self adhesive tape on the base side affixed to the door stop such that the blades contact the leaf edges. 10 * x 11 * 2.1.15 and 2.1.20
25	Flush bolt intumescent Supplier: Description: Overall Size (t):	Allgood ** A graphite based Intumescent with self adhesive tape on one face affixed within the flush bolt rebate. 2
26	Fire stopping detail Description: Photo(s):	Gaps between the frame and the associated construction were packed with Unifrax Insulfrax S blanket and capped with Firewise Acrylic Acoustic Sealant. 2.1.16, 2.1.19 and 2.1.20

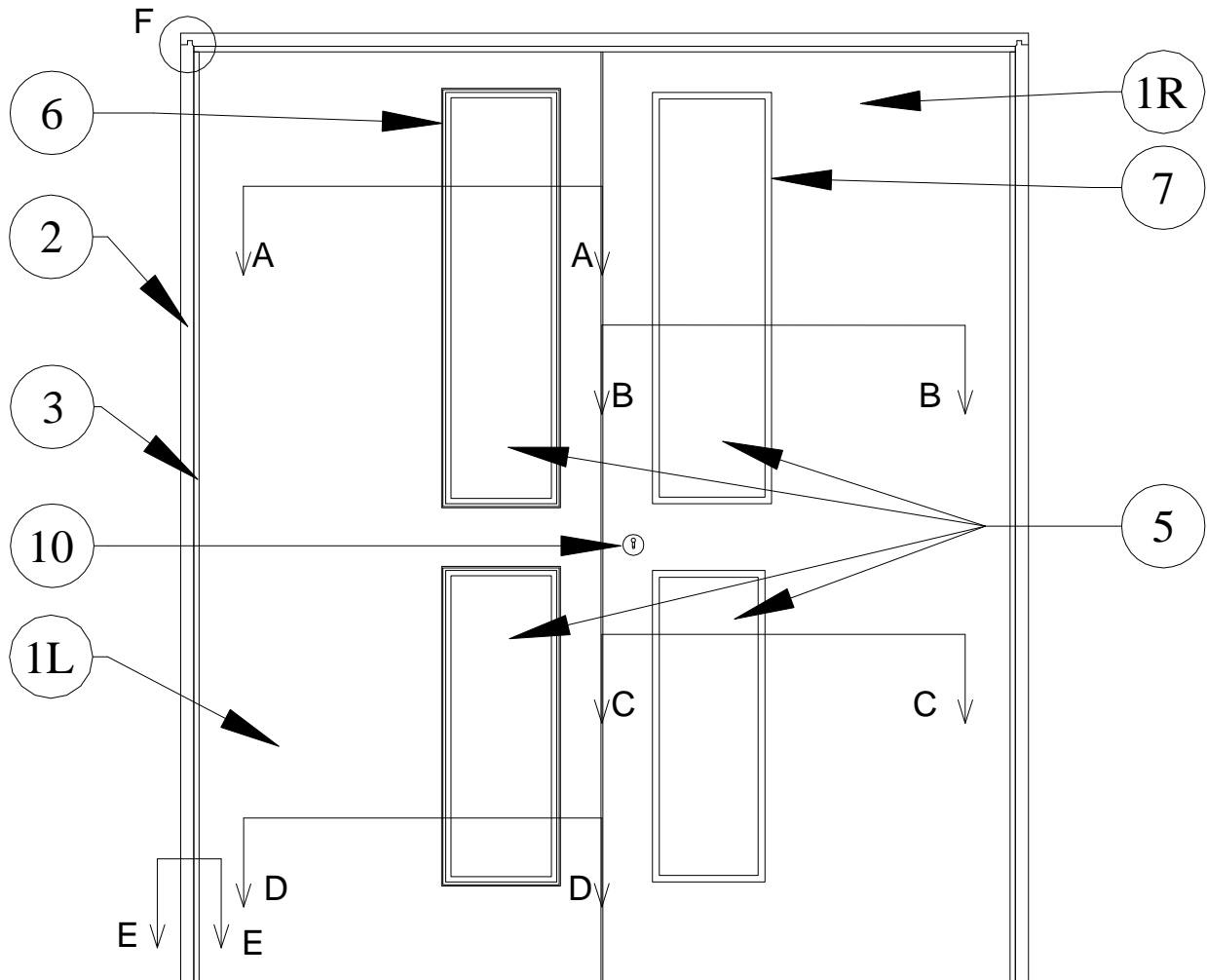
Key:

* Nominal value

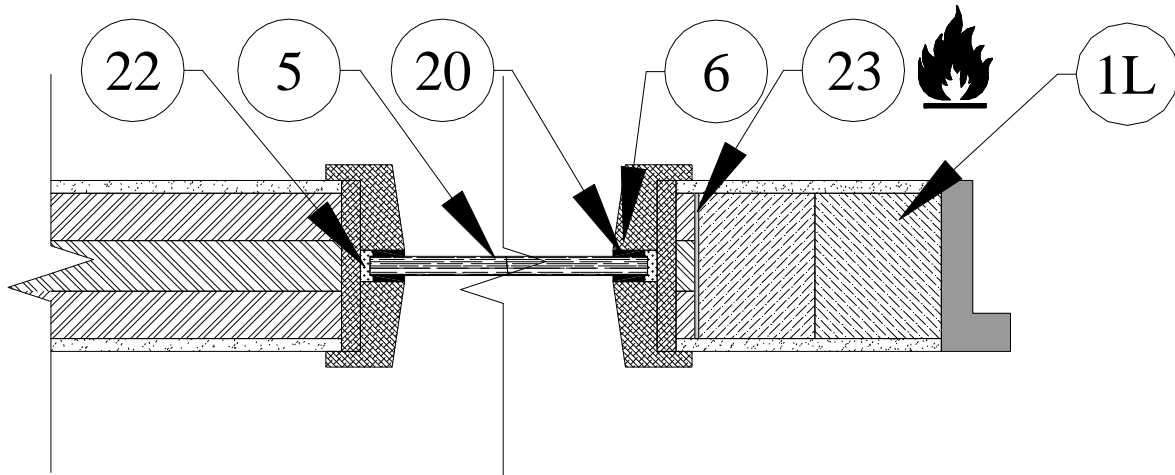
** Sponsor declared value or detail, not verified by laboratory

‡ Identified post test from remains of specimen

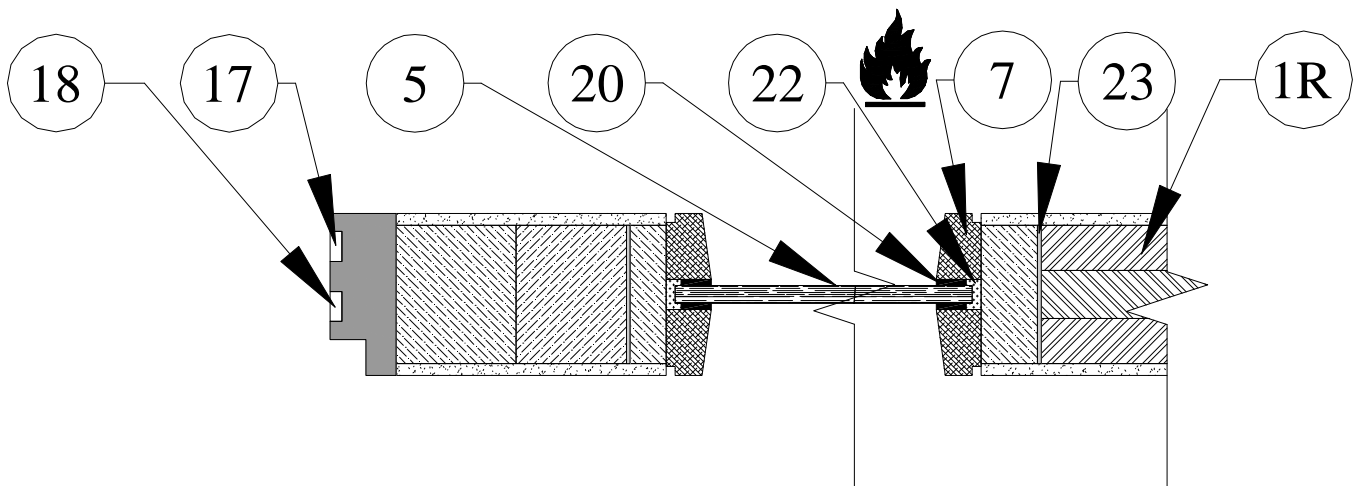
Appendix 1 Figure 1 – Elevation viewed from the unexposed side



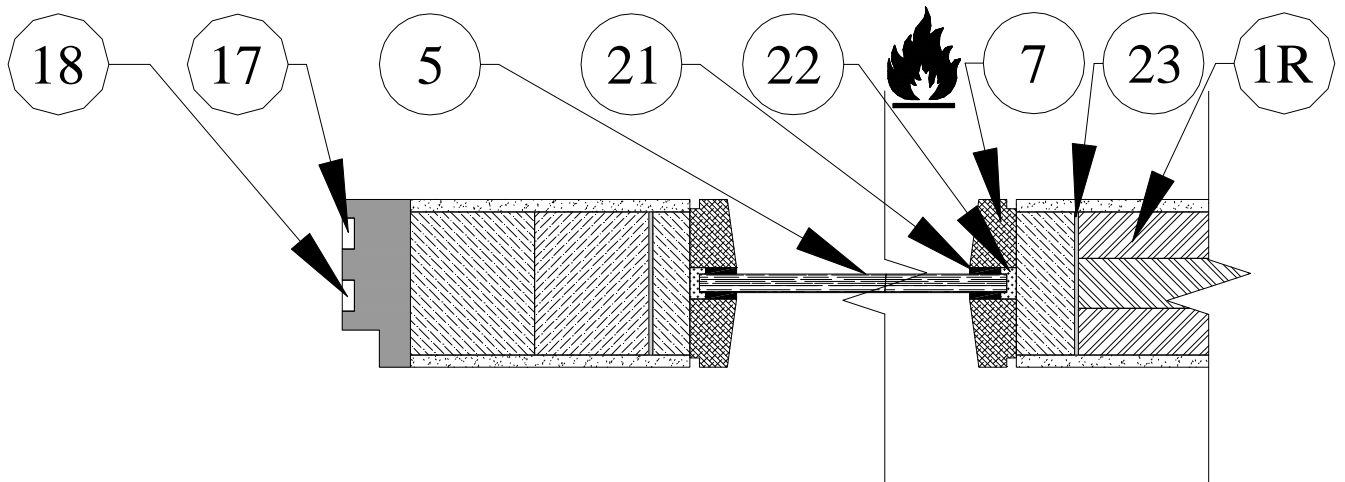
Appendix 1 Figure 2 – Section A - A



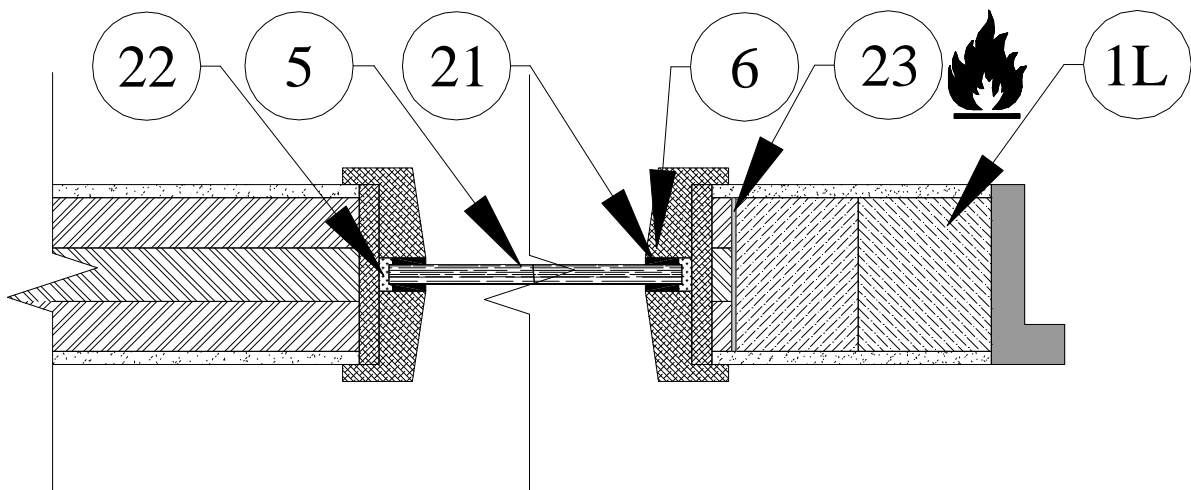
Appendix 1 Figure 3 – Section B - B



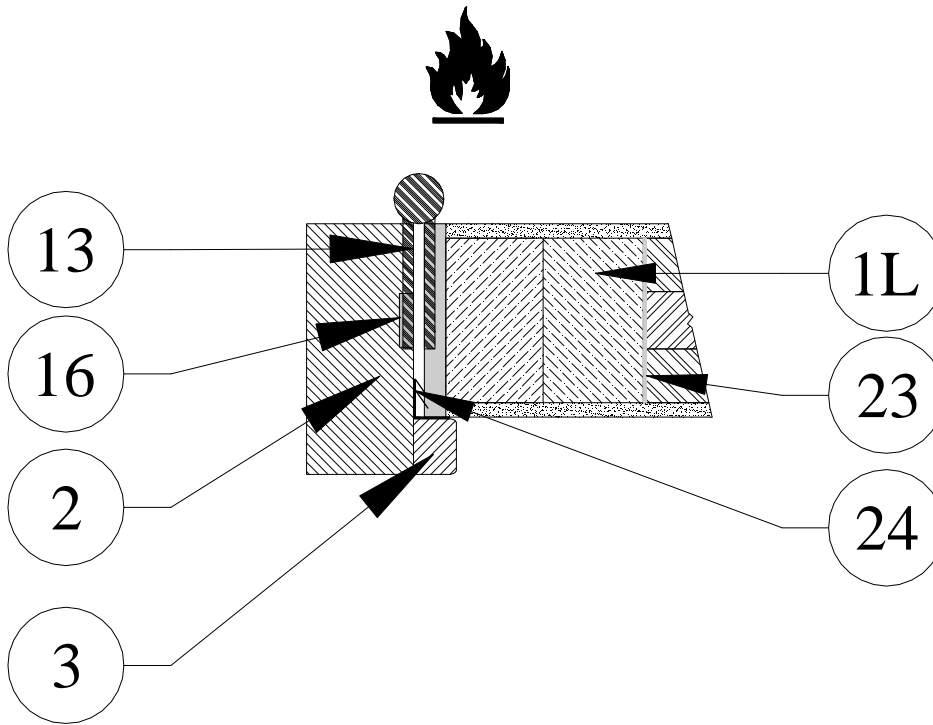
Appendix 1 Figure 4 – Section C - C



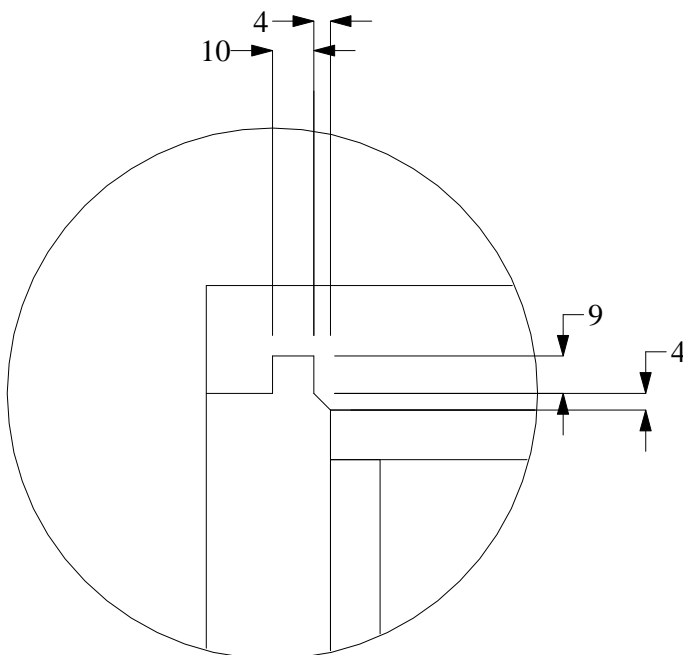
Appendix 1 Figure 5 – Section D - D



Appendix 1 Figure 6 – Section E - E



Appendix 1 Figure 7 – Detail F



APPENDIX 2 PHOTOGRAPHS

Appendix 2.1 Pre-test photos

Photo 2.1.1



Photo 2.1.2



Photo 2.1.3



Photo 2.1.4

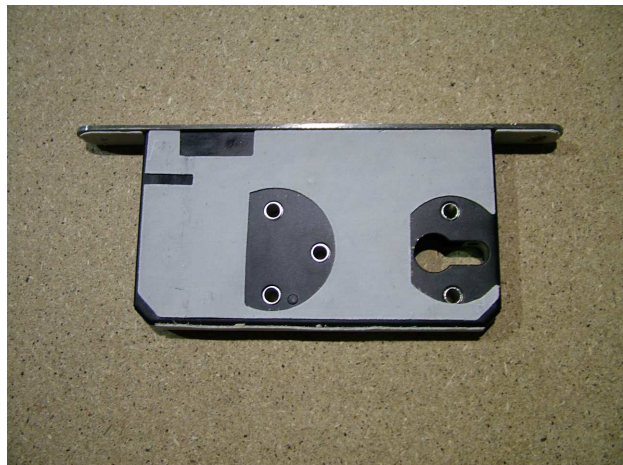


Photo 2.1.5



Photo 2.1.6



Photo 2.1.7



Photo 2.1.8



Photo 2.1.9

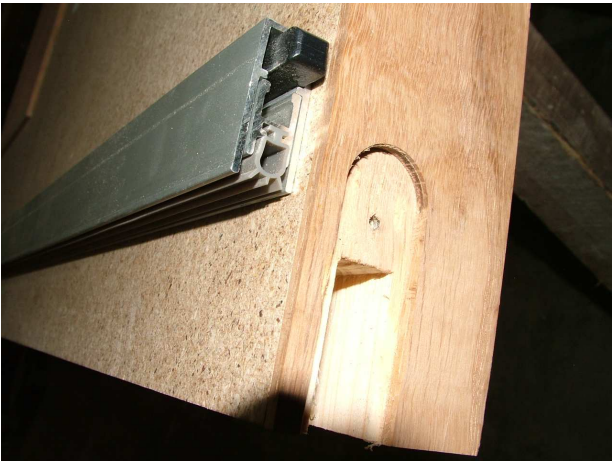


Photo 2.1.10

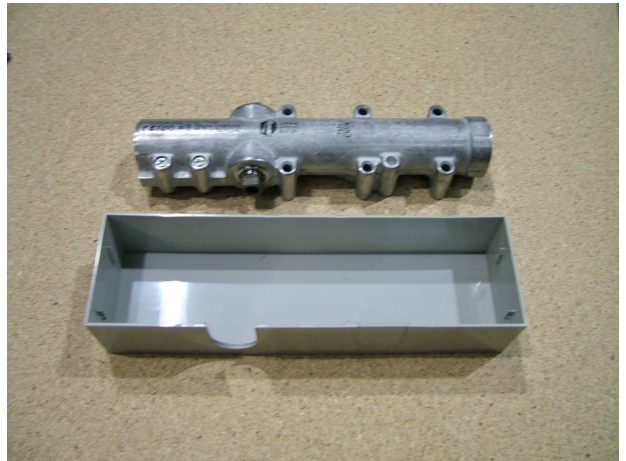


Photo 2.1.11



Photo 2.1.12



Photo 2.1.13



Photo 2.1.14



Photo 2.1.15

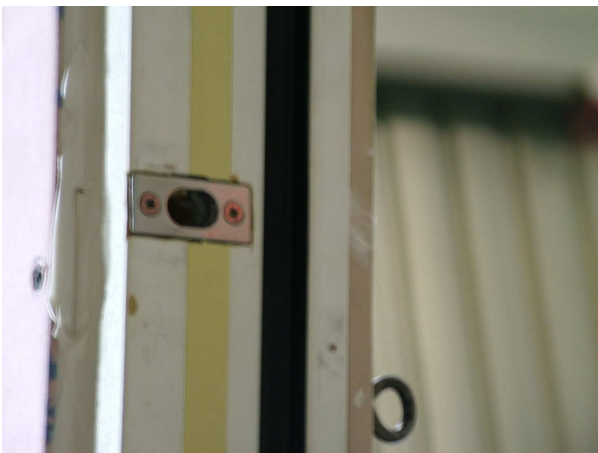


Photo 2.1.16



Photo 2.1.17



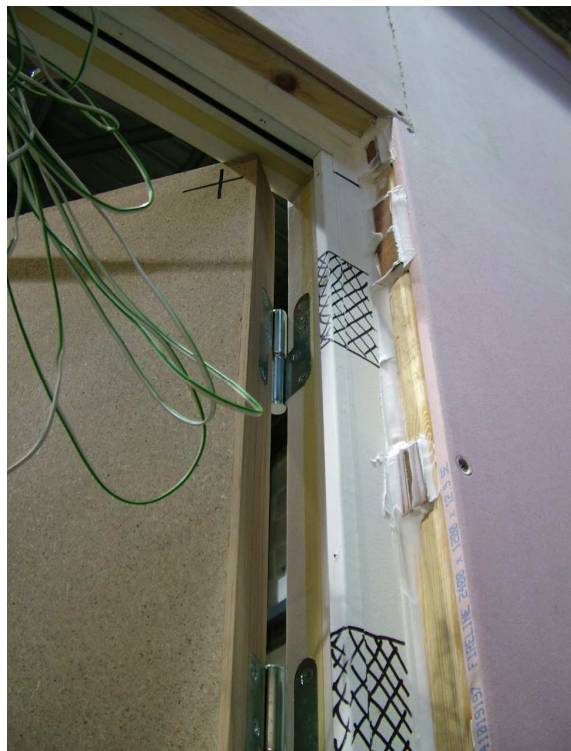
Photo 2.1.18



Photo 2.1.19



Photo 2.1.20



Appendix 2.2 During test photos

Photo 2.2.1



Photo 2.2.2

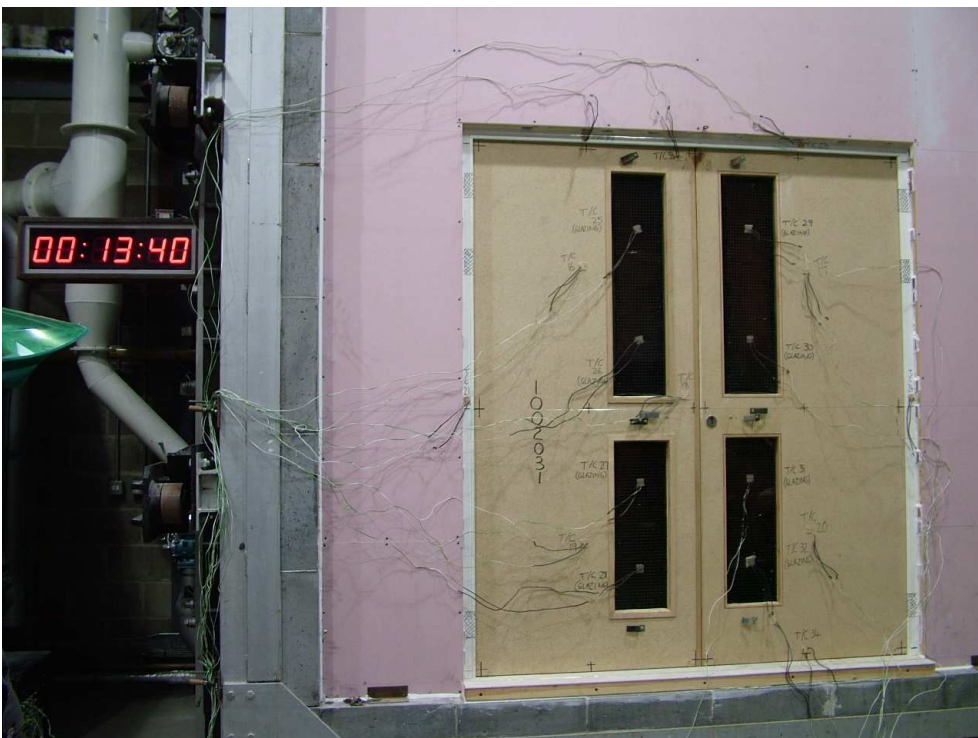


Photo 2.2.3

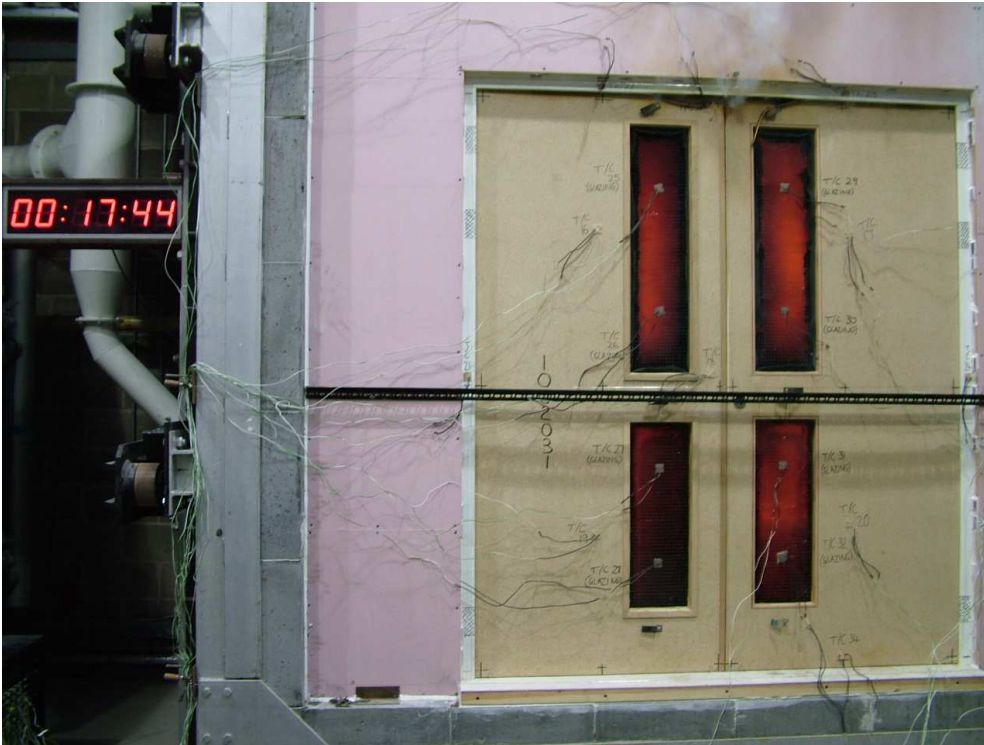


Photo 2.2.4 – After 17 minutes.



Photo 2.2.5

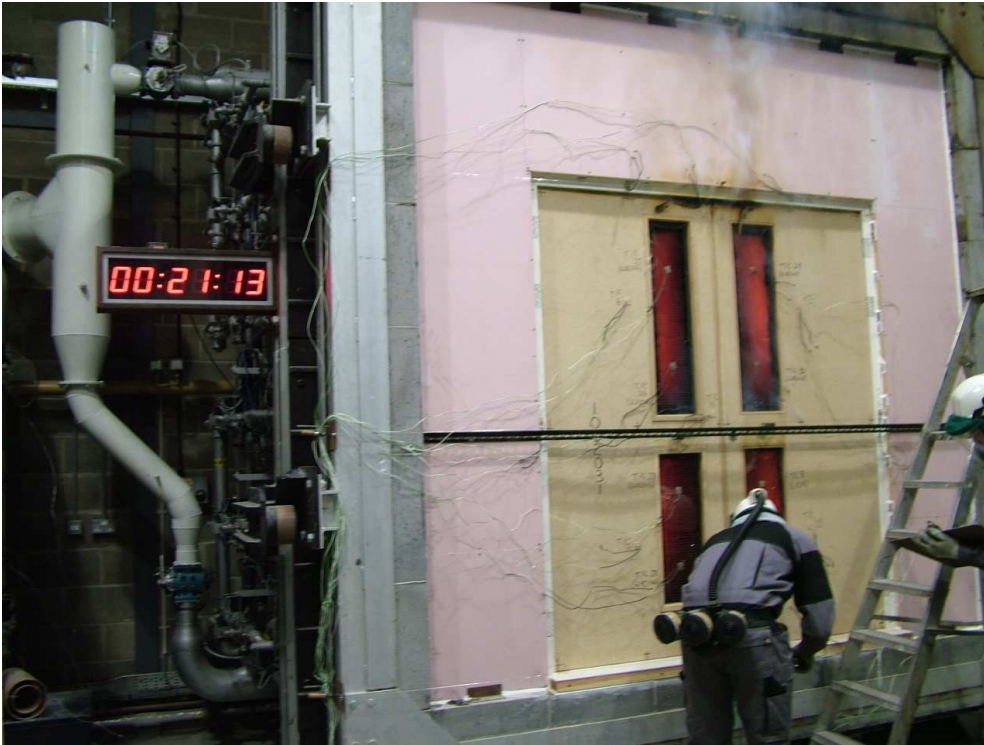


Photo 2.2.6 – After 21 minutes.



Photo 2.2.7 – After 21 minutes.



Photo 2.2.8 – After 21 minutes.



Appendix 2.3 Post-test photos

Photo 2.3.1



Photo 2.3.2



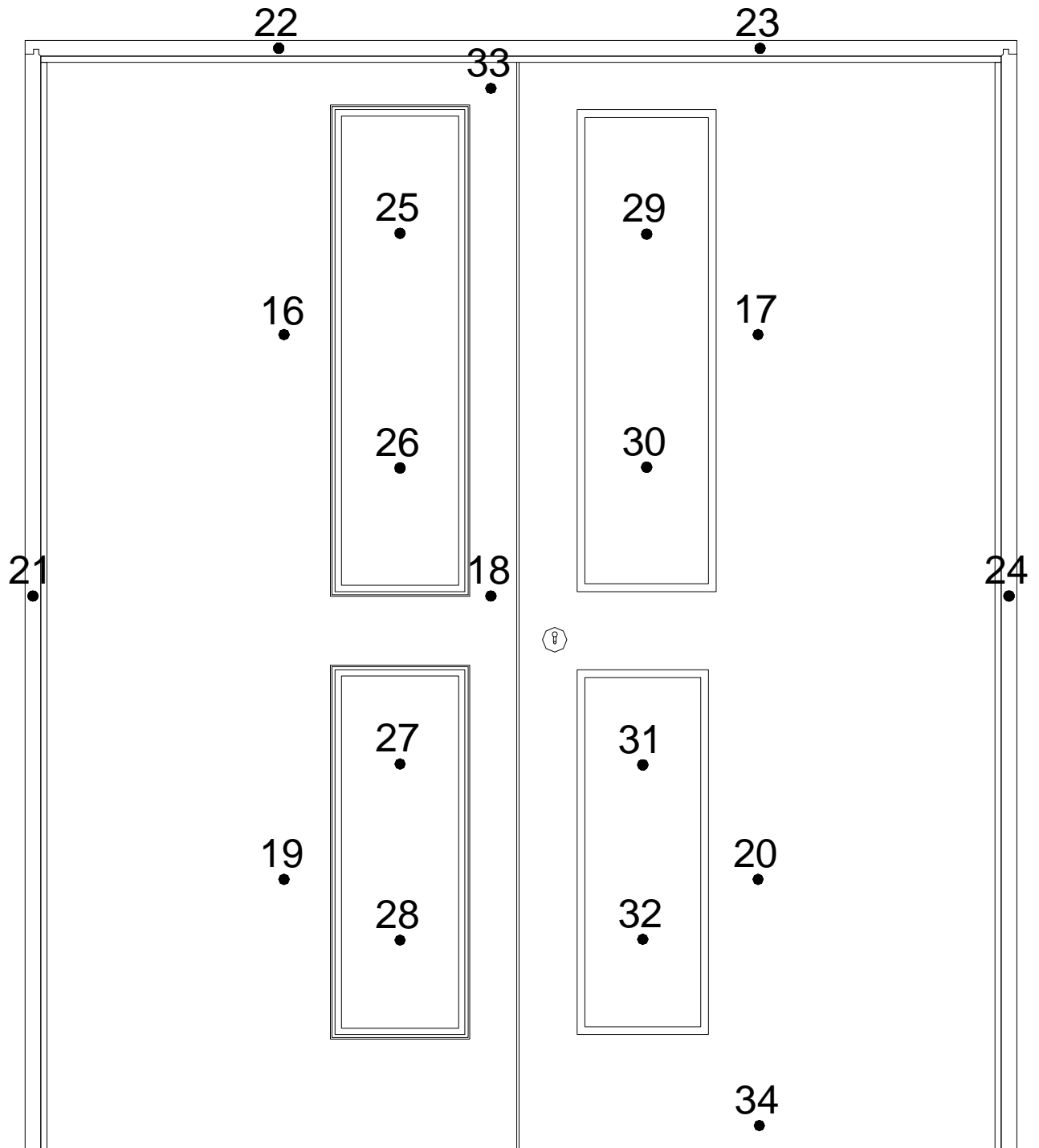
Photo 2.3.3

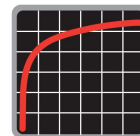


Photo 2.3.4



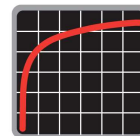
APPENDIX 3 POSITIONING OF INSTRUMENTATION





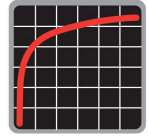
APPENDIX 4 RECORDED THERMOCOUPLE DATA

Time	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22
min	°C	°C	°C	°C	°C	°C	°C	°C
0	5	7	7	7	7	6	6	7
1	5	7	7	6	6	6	6	7
2	4	6	7	7	6	6	6	6
3	4	7	7	7	6	6	6	7
4	5	7	7	7	7	6	6	7
5	4	6	7	7	6	6	6	7
6	4	7	7	8	6	6	6	8
7	4	6	8	8	6	6	6	9
8	5	7	9	9	6	6	6	10
9	4	7	9	9	6	6	6	11
10	4	8	9	12	7	7	7	11
11	4	8	10	13	8	8	7	12
12	4	8	11	14	8	9	7	13
13	5	9	11	14	8	8	7	15
14	4	9	11	14	8	9	8	17
15	4	9	11	14	8	8	8	20
16	4	9	12	14	9	9	9	22
17	4	10	13	16	11	10	9	25
18	4	11	14	17	11	11	10	26
19	5	12	16	17	12	12	11	29
20	4	13	16	20	14	14	11	30
21	4	15	20	21	15	14	13	32
22	4	17	21	21	15	15	14	34
23	4	18	22	20	16	15	14	37
24	5	20	24	21	17	15	15	40
25	4	24	27	25	21	17	16	42
26	4	26	31	25	22	19	17	44
27	4	29	35	26	24	21	18	52
28	4	33	42	30	28	24	20	54
29	4	39	50	34	33	28	21	61
30	4	47	58	38	35	31	22	92
31	5	59	63	45	36	34	24	69
32	5	65	68	46	42	38	25	68

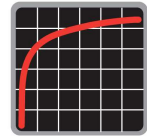


Time min	Chan 23 °C	Chan 24 °C	Chan 25 °C	Chan 26 °C	Chan 27 °C	Chan 28 °C	Chan 29 °C	Chan 30 °C
0	7	7	8	7	7	7	8	7
1	7	6	31	31	26	22	31	30
2	7	6	63	63	51	41	63	60
3	7	6	98	99	88	69	98	95
4	8	6	150	155	143	115	149	152
5	9	6	218	225	210	174	220	226
6	11	6	272	280	260	218	279	287
7	12	6	321	329	308	260	332	337
8	14	6	369	380	358	308	381	388
9	17	6	422	434	414	364	432	444
10	18	6	471	479	466	421	476	473
11	20	7	493	500	487	463	500	496
12	21	7	507	512	499	478	515	509
13	23	8	517	522	510	491	527	518
14	25	8	524	529	517	498	535	526
15	27	9	531	536	525	505	543	533
16	28	10	541	548	537	517	553	543
17	29	11	553	560	550	529	564	552
18	31	13	564	572	562	540	575	561
19	34	14	576	583	573	551	588	573
20	37	15	587	595	584	560	599	583
21	38	17	595	605	594	569	608	591
22	40	18	605	614	602	578	616	599
23	42	20	616	624	614	590	625	608
24	45	21	627	633	625	601	634	616
25	48	22	635	642	635	611	642	624
26	50	23	643	650	641	620	648	631
27	56	24	649	657	650	628	655	637
28	57	26	649	663	656	635	661	643
29	61	27	660	672	665	647	667	648
30	64	28	716	736	676	657	672	654
31	68	30	768	-	683	665	676	660
32	70	31	805	852	698	677	669	667

- Thermocouple malfunction



Time min	Chan 33 °C	Chan 34 °C	Chan 35 °C	Chan 36 °C	Chan 37 °C	Chan 38 °C	Chan 39 °C	Chan 40 °C	Chan 42 °C
0	20	20	20	20	20	19	19	19	20
1	33	34	24	21	22	22	20	19	29
2	28	28	23	21	22	21	20	19	26
3	25	25	22	20	21	20	19	19	24
4	24	23	21	20	21	20	19	19	23
5	23	23	21	20	20	20	19	19	22
6	23	22	22	20	20	20	19	19	22
7	23	22	22	20	20	20	19	19	22
8	22	22	22	20	20	20	19	19	22
9	22	22	22	20	20	20	19	19	22
10	22	22	21	21	21	19	19	19	22
11	23	22	22	23	22	20	19	20	23
12	22	22	21	23	22	20	19	20	23
13	23	22	22	25	23	20	19	20	24
14	23	23	23	26	24	21	19	20	25
15	23	23	23	26	25	21	19	21	26
16	24	24	24	27	26	22	19	21	27
17	24	25	24	28	26	23	19	21	27
18	25	25	26	29	27	24	19	22	29
19	26	26	27	30	28	24	19	22	30
20	27	27	28	30	29	26	19	23	30
21	28	28	29	31	30	26	19	23	31
22	29	29	31	32	31	27	20	23	32
23	30	31	32	33	33	28	19	24	34
24	32	32	34	34	34	29	20	24	35
25	33	33	36	36	35	30	20	25	36
26	35	35	37	37	37	31	20	26	38
27	37	37	39	39	39	32	20	26	40
28	38	39	41	40	40	34	21	27	41
29	40	40	43	42	42	35	21	27	43
30	42	42	45	44	44	36	22	28	45
31	44	44	47	46	46	37	23	29	47
32	46	46	50	48	48	39	25	30	49
33	48	48	52	50	50	40	27	32	51
34	50	50	54	53	52	42	29	33	53
35	52	66	57	55	55	43	30	35	55
36	54	67	59	57	58	45	32	36	57
37	57	63	62	60	60	47	33	36	59
38	59	65	64	62	63	49	35	38	61
39	61	65	67	64	66	51	36	39	64
40	63	70	69	66	69	53	36	42	66
41	66	78	73	67	72	55	37	48	67
42	68	81	76	69	75	57	37	57	70
43	70	84	80	71	79	59	38	65	73
44	73	87	82	72	83	61	38	71	75
45	75	87	88	75	89	63	39	76	78
46	78	90	95	77	96	66	39	78	82
47	83	96	100	80	104	69	39	79	88
48	91	96	103	85	104	72	39	82	94
49	98	98	105	91	109	77	40	88	98
50	99	99	110	95	110	82	40	94	99



Time min	Chan 31 °C	Chan 32 °C	Chan 33 °C	Chan 34 °C
0	7	7	7	6
1	27	22	7	6
2	53	42	7	6
3	89	69	7	6
4	145	114	7	6
5	207	171	8	6
6	260	218	9	6
7	308	264	10	6
8	358	315	11	6
9	412	370	12	6
10	463	428	14	6
11	480	470	15	8
12	496	490	16	7
13	506	502	16	8
14	515	510	17	7
15	522	516	18	7
16	533	526	21	8
17	544	536	26	8
18	555	546	28	9
19	567	556	30	9
20	576	564	33	10
21	584	570	35	11
22	592	579	37	11
23	603	592	40	11
24	614	605	44	12
25	625	617	48	13
26	354	629	50	14
27	643	639	54	14
28	652	647	50	16
29	660	656	51	17
30	667	664	91	18
31	676	673	66	20
32	353	678	60	20