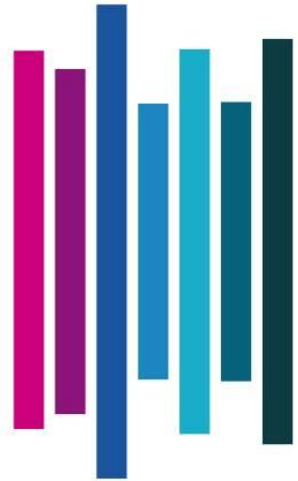


EXOVA
Warringtonfire



TEST REPORT

Bushfire resistance test of an external wall system to BAL-A40 in accordance with AS1530.8.1-2007

EWFA Report No:

38031900.1

Report Sponsor:

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Test Date:

19 December 2016

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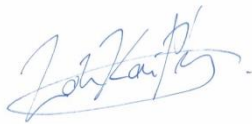
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1 CONSTRUCTION DETAILS

TEST ASSEMBLY

The test assembly comprised a nominal 3000mm wide x 3000mm long x 340mm thick wall system.

TEST SPECIMENS

The wall system consisted of two 70 x 30 timber stud frames; the central frame offset 250mm back incorporating an 800mm x 800mm aluminium framed window and eaves detail. The unexposed side was faced with 10mm Gyprock plasterboard while the exposed side had Ullrich Aluminium - Ulltraclad® Shadoline Weatherboard panels.

Further details are provided in Figures A1.1 to A1.4 and the Schedule of Components.

ASSEMBLY AND INSTALLATION METHODS

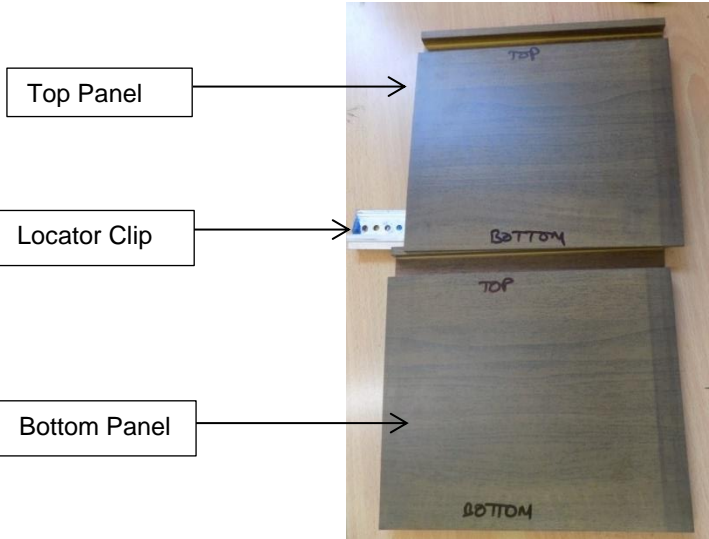
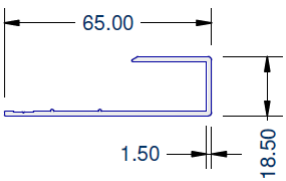
Sponsor constructed timber frame and aluminium panel assembly offsite and delivered to Exova on the 2 December 2016. Exova representatives mounted the specimen assembly onto test frame on 15 December 2016 and unexposed plasterboard was installed on 16 December 2016. The unexposed cladding, framing materials and window were sourced by EWFA.

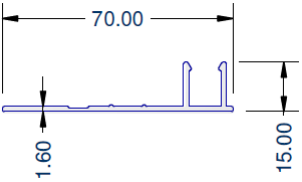
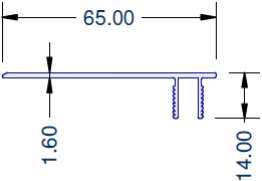
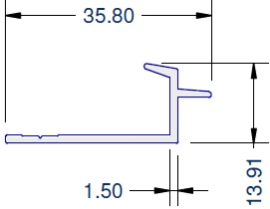
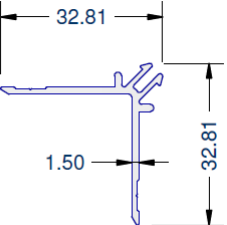
ORIENTATION

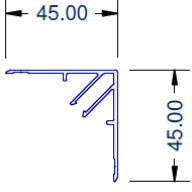
The specimen was asymmetrical with the exposed side of the wall compromised of Ullrich Aluminium - Ulltraclad® Shadoline Weatherboard cladding and plasterboard on the unexposed side.

It was confirmed that the system was exposed from the side that would normally face the outside of the building.

2 SCHEDULE OF COMPONENTS

No.	Item	Description
Substrate		
1	Product	Ullrich Aluminium - Ulltraclad® Shadoline Weatherboard
	Material	Aluminium
	Size	1500mm wide × 205mm high × 15.0mm deep with 1.5mm thick aluminium
	Linear Mass Density	1.3 kg/m (measured)
	Location/ Fixing	<p>The panels were installed horizontally from the bottom up on the exposed side of the timber frame (item 13) with a layer of sarking (item 8) in between. A starting channel (item 2) was used at the bottom perimeter while a locator clip (item 5) was installed in between the panels.</p> <div style="text-align: center;">  </div> <p>A top channel (item 4) was installed at the top edge of the panels along the perimeter. The panels were screwed to the studs of the timber frame (item 13) with Square Head Square Drive 8g × 50mm long Coarse Thread screws. See Figure A1.4 for illustration.</p>
Support System		
2	Item Name	Window Flashing
	Product	<p>Aluminium extrusion</p> 
	Size	65mm × 18.5mm × 1.5mm thick
	Installation	The window flashing was used as bottom and vertical edge channel and was riveted to the panels (item 1).
3	Item Name	Soffit Clip Base

No.	Item	Description
	Product	Aluminium extrusion 
	Size	70.0mm x 15.0mm x 1.6mm thick
	Installation	The channel was installed at the sill on top of panels and riveted to the panel.
4	Item Name	Soffit Clip Top
	Product	Aluminium extrusion 
	Size	65mm x 14.0mm x 1.6mm thick
	Installation	The channel was installed at the sill and on top of the wall and riveted to the panel.
5	Item Name	Ulrich Aluminium Locator Clip
	Product	Aluminium extrusion 
	Size	35.8mm x 13.91mm x 1.5mm thick
	Installation	Installed at each panel level and screw fixed to studs with Bugle Head Square Drive 8g x 30 Coarse Thread screws.
6	Item Name	Male Flat Corner
	Product	Aluminium extrusion 
	Size	32.81mm x 32.81mm x 1.5mm thick
	Installation	<ul style="list-style-type: none"> Installed at the framing side of wall at the outer corner and mated with the outer female flat corner with panels between them. Installed at the exposed side of panels at the inner corner and mated with the inner female flat corner with panels between them.

No.	Item	Description
7	Item Name	Female Flat Corner
	Product	Aluminium extrusion 
	Size	45.0mm x 14.0mm x 1.5mm thick
	Installation	<ul style="list-style-type: none"> Installed at the framing side of wall at the inner corner and mated with the outer male flat corner with panels between them. Installed at the exposed side of panels at the outer corner and mated with the inner male flat corner with panels between them.
Wraps and Sealants		
8	Product	Ametalin SILVERWRAP™ MD-M3
	Size	1350mm tall sheet, full width of wall
	Location	Between the timber frame and exposed cladding (item 1).
Insulation		
9	Item Name	Cavity Insulation
	Product	Bradford R1.5 Wall and Floor Batts
	Size	1160mm high x 580mm wide x 75mm thick
	Density	8.8kg/m ³ (measured)
	Location	Installed in the cavity of the wall system.
Unexposed Cladding		
10	Product	10mm Gyprock RE Plasterboard
	Size	1200mm wide x 3000mm long x 10mm thick sheets cut to suit.
	Density	660 kg/m ³ (measured)
	Location	Clad horizontally on the unexposed side of the timber framing.
	Fixings	32mm x 6g Bugle Head Drill Point Fine Thread ZY Plasterboard Screws at nominal 300mm centres.
Window		
11	Frame	Extruded Aluminium
	Glazing	6TF Grade A Safety Glass – 6mm thick toughened glass
	Size	OD: Nominal 800mm wide x 800mm high x 52mm deep. ID: 720mm wide x 720mm high (to glazing).
12	Product	Screen Mesh
	Size	Overall size of nominally 790mm wide x 790mm high x 0.85mm thick powder coated stainless steel with 2.25mm square holes.
	Location	Screen installed on the exposed side of the glazed window and screw fixed to glazing frame with 8g x 25mm long square drive, stainless steel screws at nominal 165mm centres.
Framing		

No.	Item	Description
13	Product	Boral F27
	Density	70mm x 35mm
	Density	928kg/m ³ (measured)
	Location	Refer to figures A1.1 and A1.2 for frame details.
Lining		
14	Eaves and sill lining	6.0mm Hardieflex™ sheet

3 TEST PROCEDURE

STATEMENT OF COMPLIANCE

The test was performed in accordance with the requirements of AS 1530.8.1: 2007 Section 15 as appropriate for walls.

VARIATIONS TO TEST METHOD

None

PRE-TEST CONDITIONING

The wall construction was delivered to EWFA on the 2nd of December 2016. During this period the test specimen was subjected to normal laboratory temperatures and conditions.

SAMPLING / SPECIMEN SELECTION

The laboratory was not involved in the sampling or selection of the test specimen for the fire resistance test.

AMBIENT TEMPERATURE

The ambient temperature at the start of the test was 32°C and varied between 31°C and 36°C during the test.

TEST DURATION

The test was terminated after 60 minutes in accordance with the procedures of AS1530.8.1-2007.

INSTRUMENTATION AND EQUIPMENT

The instrumentation was provided in accordance with AS1530.8.1: 2007 and as detailed below:

A 3 mm gap gauge was available during the test to assess the performance of the test specimen under the criteria of integrity.

Radiant heat flux measurements to determine the irradiance transmitted from the exposed face of the specimen were made using Medtherm Heat Flux Gauges.

During calibration, a Heat Flux Gauge was centrally located with respect to the specimen at a distance equal to the leading surface of the specimen. A second Heat Flux Gauge was located close to the vertical centre of the specimen, at the leading edge, in the South wall section at a height of 2265mm from the floor.

During the test, the Heat Flux Gauge 2265mm from the floor remained in place, using values found during an ancillary pre-test calibration to determine the heat flux at the leading edge of the glazing.

During the test, a second Heat Flux Gauge was located centrally with respect to the glazed element on the wall to determine the radiant heat flux 250mm from the exposed side of the specimen in the period 20 to 60 minutes.

The Heat Flux Gauge positions are shown in Figure A4.1 in Appendix 4.

4 TEST MEASUREMENTS

INCIDENT HEAT FLUX MEASUREMENTS

Heat flux measurements are provided in Figure A5.1 in Appendix 5.

SPECIMEN TEMPERATURES

Specimen temperature data is provided in A 5.3 and Table A5.1 in Appendix 5.

OBSERVATIONS

A table that includes observations of the significant behaviour of the specimen and details of the occurrence of the various performance criteria specified in AS 1530.8.1-2007 is provided in Appendix 2. Photographs of the specimen are included in Appendix 6.

5 TEST RESULTS

The test specimen achieved the following performance when tested in accordance with AS 1530.8.1- 2007 Clause 14 and 15 as appropriate for walls.

Table 1: Results for Radiant Exposure and Class A Crib

Performance Criteria	Time to Failure (min)	Position of Failure
Formation of through-gaps greater than 3 mm during 60 minutes test period	No failure	-
Sustained flaming for 10 s on the non-fire side	No failure	-
Flaming on the fire-exposed side at the end of the 60 minute test period.	No failure	-
Radiant heat flux 365mm from the non-fire side exceeding 15 kW m ⁻²	Not applicable	NA
Mean and maximum temperature rises greater than 140K and 180K on non-fire side during the 60 minutes test period.	No failure	-
Radiant heat flux 250 mm from the specimen, greater than 3 kW m ⁻² between 20 min and 60 min	No failure	-
Mean and maximum temperature of internal faces exceeding 250 °C and 300°C respectively between 20 min and 60 min after commencement of test	No failure	-
Crib class	A	Peak heat flux
		40 kW/m²
Test Result		BAL-A40

6 APPLICATION OF TEST RESULTS

TEST LIMITATIONS

The results of this fire test may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions. The results only relate to the behaviour of the specimen of the element of the construction under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they necessarily reflect the actual behaviour in fires.

VARIATIONS FROM THE TESTED SPECIMENS

This report details the methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the general procedure outlined in AS1530.8.1. Any significant variation 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 addressed by this report. It is recommended that any proposed variation to the tested configuration other than as permitted under the field of direct application specified in Appendix 3 should be referred to the test sponsor in the first instance to obtain appropriate documentary evidence of compliance from Exova Warringtonfire Aus Pty Ltd or another Registered Testing Authority.

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 1 DRAWINGS OF TEST ASSEMBLY

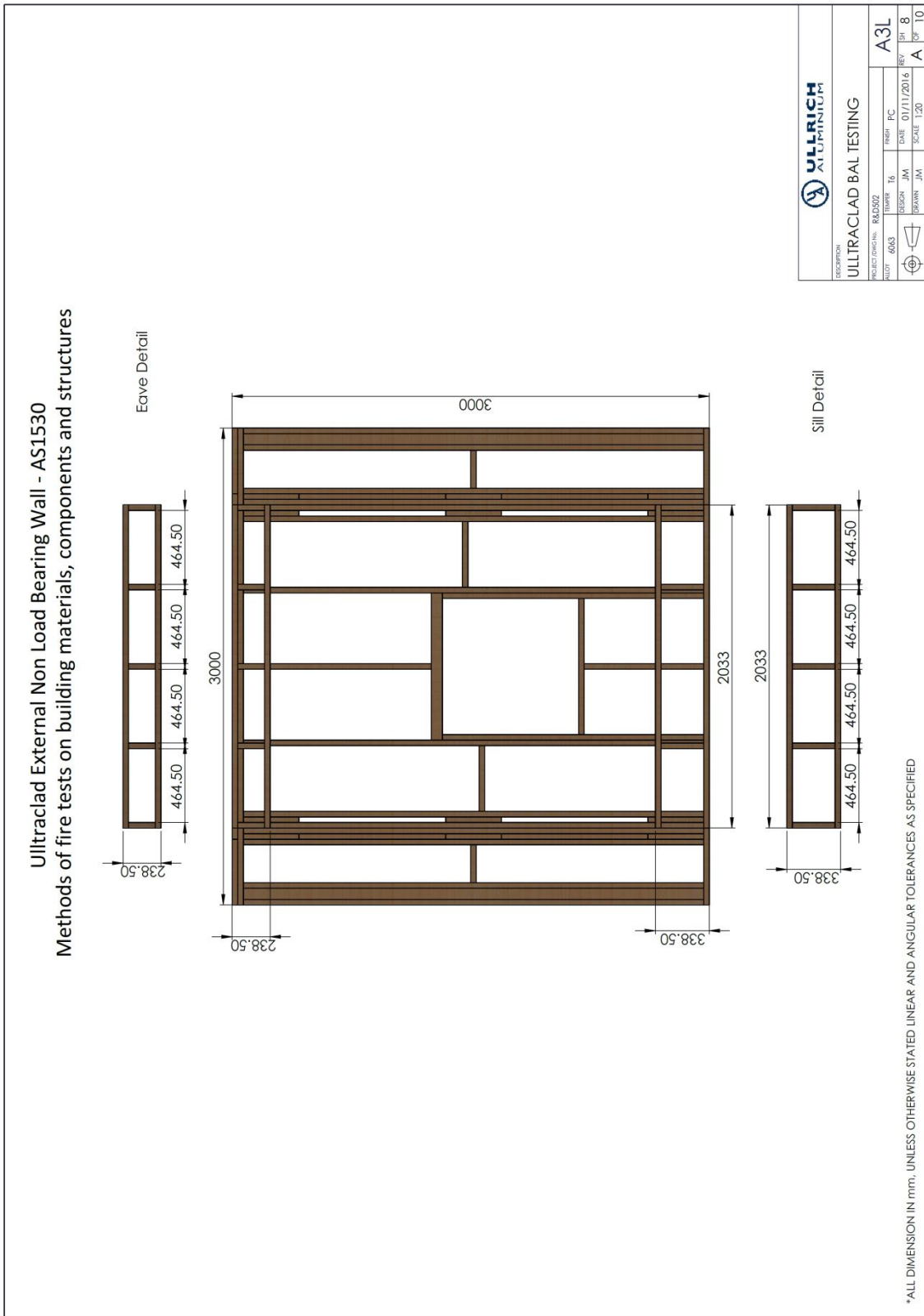


Figure A1.1: Front frame elevation and Isometric view
Drawings provided by client and verified by Exova

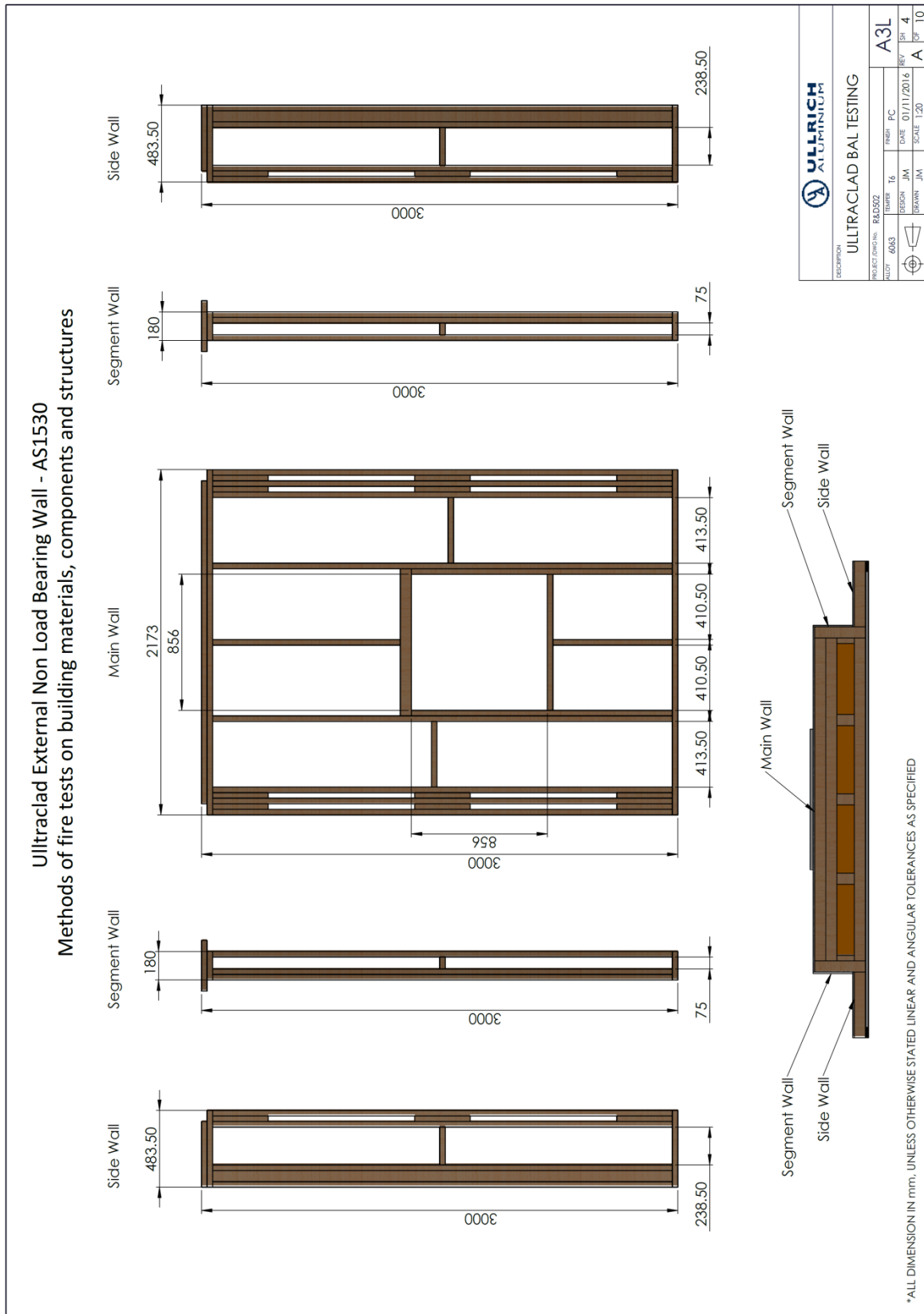


Figure A1.2: Rear frame elevation and Isometric view
 Drawings provided by client and verified by Exova

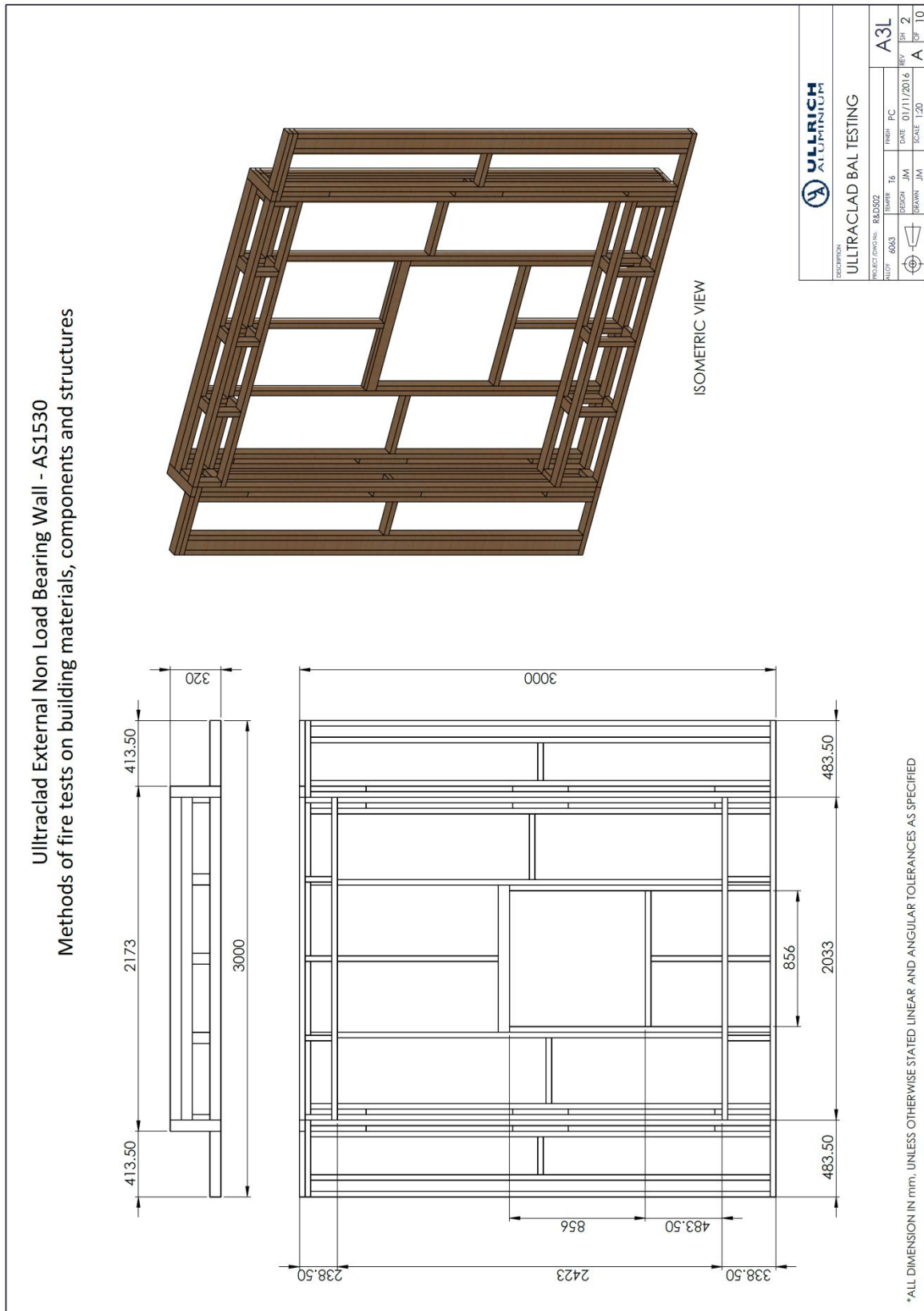


Figure A1.3: Finished timber framing
Drawings provided by client and verified by Exova

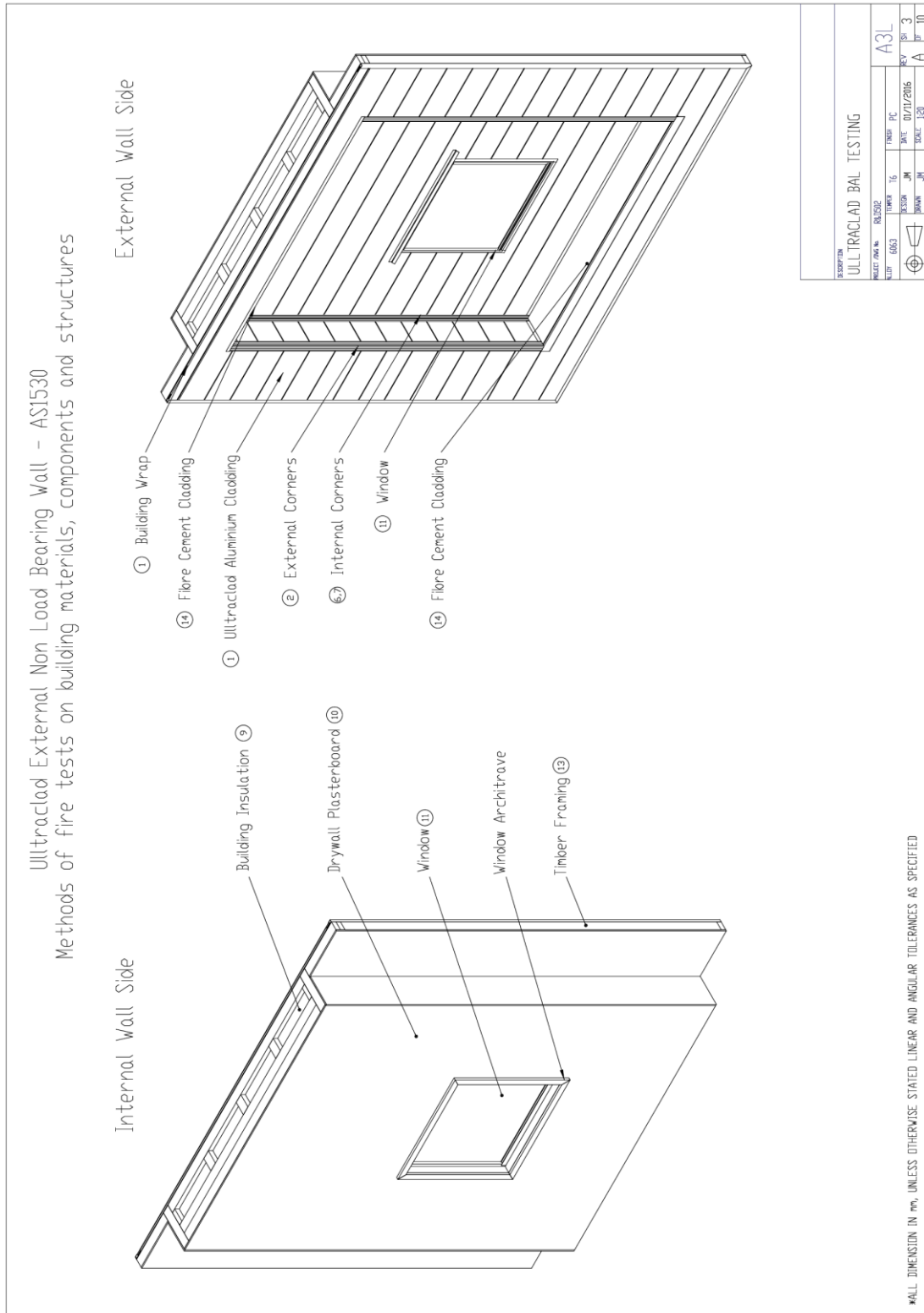


Figure A1.4: Finished assembly (Item numbers correspond to 'Schedule of Components' in Section 2 Drawings provided by client and verified by Exova)

APPENDIX 2 TEST OBSERVATIONS

The following observations include observations of the significant behaviour of the specimen.
All observations are from the unexposed side unless otherwise stated.

Time		Observation
min	sec	
0	00	Bushfire test was commenced and the burning crib was placed against the specimen The ambient temperature was 32°C
0	05	The screen was removed and the specimen was exposed to the radiant heat profile for BAL 40 as specified in AS1530.8.1-2007.
1	00	Crackling sound heard from the specimen
1	30	Smoke emitting from the specimen
2	10	Darkening of the panels close to the crib
2	30	Flaming of the panel surface above the crib and close to the bottom right hand corner of the window
10	00	Screen positioned in front of the furnace and exposure to the radiant heat profile for BAL 40 ceased. Monitoring of the specimen to the criteria specified in AS1530.8.1-2007 continued.
60	00	No further changes to the specimen observed. The bushfire test was stopped in accordance with the procedures of AS1530.8.1-2007.

APPENDIX 3 DIRECT FIELD OF APPLICATION

A 3.1 GENERAL

AS 1530.8.1-2007 Section 15.7 states:

The results of a fire test contained in the test report are directly applicable, without reference to the testing authority for a technical opinion, to similar constructions where one or more of the following changes have been made, provided no individual component is removed or reduced:

- a) Increase in the length of a wall of identical construction to the specimen.
- b) Increase in thickness of the wall.
- c) For framed walls-
 - (i) increase in timber density;
 - (ii) increase in cross-sectional dimensions of the framing element(s);
 - (iii) decrease in sheet or panel sizes;
 - (iv) decrease in stud spacing; or
 - (v) decrease in fixing centres of wall sheet materials.

APPENDIX 4 INSTRUMENTATION POSITIONS

The instrumentation was positioned in accordance with the requirements of AS1530.8.1-2007, Clause 16.3 as summarised below.



LEGEND:

- = Incipient fire spread thermocouple positions—Mean temperature rise
- = Incipient fire spread thermocouple positions—Maximum temperature rise
- = Incipient fire spread thermocouple positions—Eaves mean and maximum
- = Non fire side thermocouple positions—Mean temperature rise
- = Non fire side thermocouple positions—Maximum temperature rise

Figure A4.1: Thermocouple locations on wall system

Note: The crib was located in the south internal corner of the recess to the exposed side

Table A4.1: Thermocouple Locations

Position	T/C	Location		Description
		x	y	
Internal Quarter Points	011	750	2250	Internal cavity surfaces - Mean temperature rise
	012	2250	2250	
	013	250	1500	
	014	2750	1500	
	015	1500	600	
External Quarter Points	024	750	2250	Unexposed face - Mean temperature rise
	025	2250	2250	
	026	250	1620	
	027	2750	1500	
	028	1500	600	
Eave	016	550	2755	Internal surface of eaves - Max and mean temperature rise
	017	1500	2755	
	018	1900	2755	
Crib	019	325	385	Internal cavity surfaces - Max temperature rise adjacent to south crib
	020	555	385	Internal cavity surface - Max temperature rise above south crib
	021	555	535	Unexposed face - Max temperature rise adjacent to south crib
	022	325	385	
	023	555	385	
Heat Flux Gauge Positions	HFG1	250	1500	Embedded in surface of exposed face.
	HFG2	1500	1500	250mm from exposed side from 20 min to 60 min of test.

APPENDIX 5 TEST DATA

A 5.1 HEAT FLUX MEASUREMENTS

Before the test heat flux emitted by the radiant panel was measured at the centre and quarter points and the results are indicated below at a distance of 3m.

0.213	0.197
0.267	
0.205	0.175

The average of the irradiance received at each of the quarter points was 74% of that at the central point and therefore met the requirements of AS1530.8.1-2007, Clause 13.3.

A 5.2 MEASURE HEAT FLUX RECEIVED

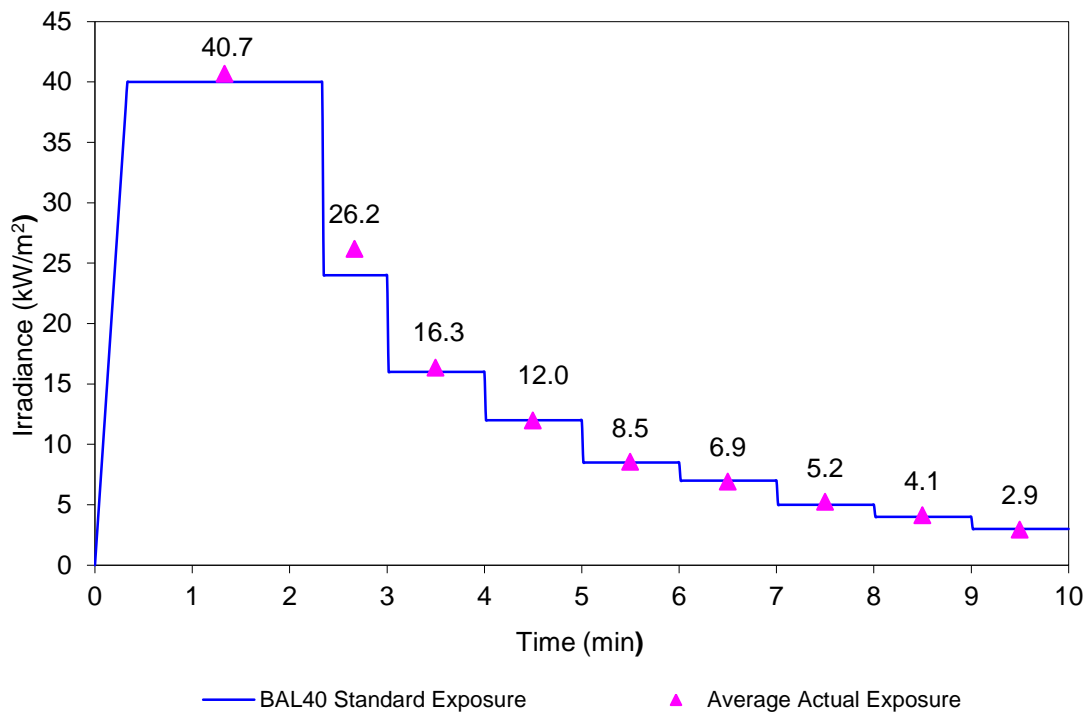


Figure A5.1: Averaged irradiance levels during the test to the external facade

Less than 0.4 kW/m² heat flux radiation was received by the heat flux gauge positioned centrally to the front of the specimen, 250mm from the wall during the time period 20 to 60 minutes.

A 5.3 SPECIMEN TEMPERATURES

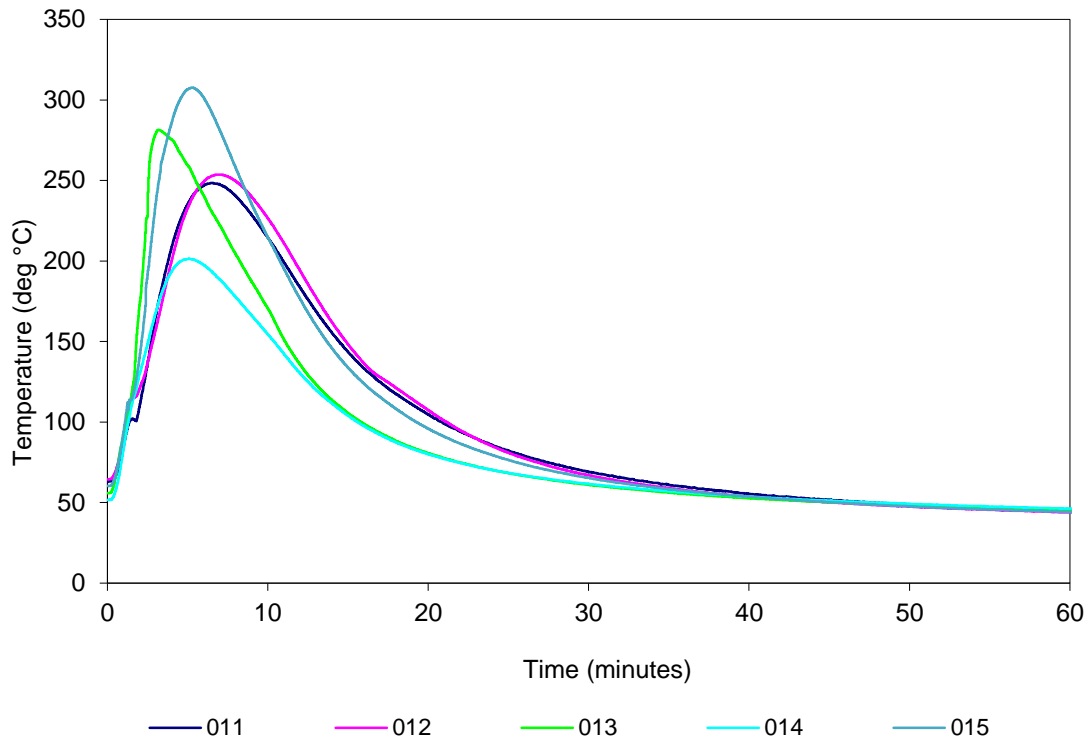


Figure A5.2: Specimen temperatures. Temperatures vs. time, Internal quarter points

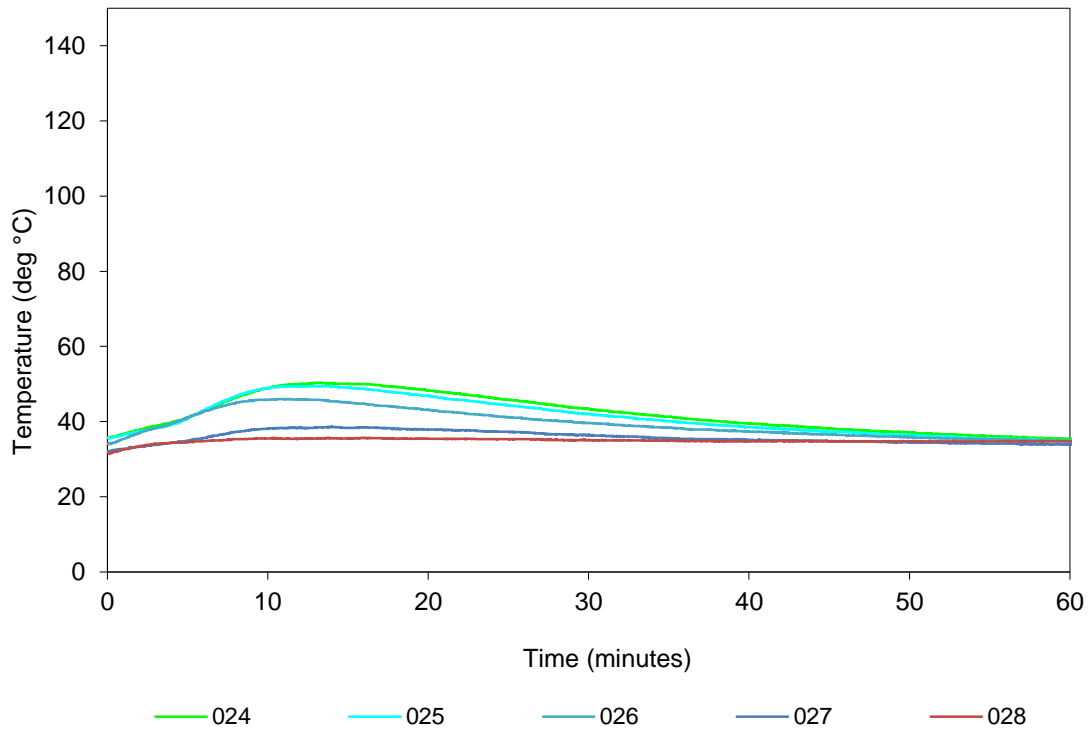


Figure A5.3: Specimen temperatures. Temperatures vs. time, Unexposed quarter points

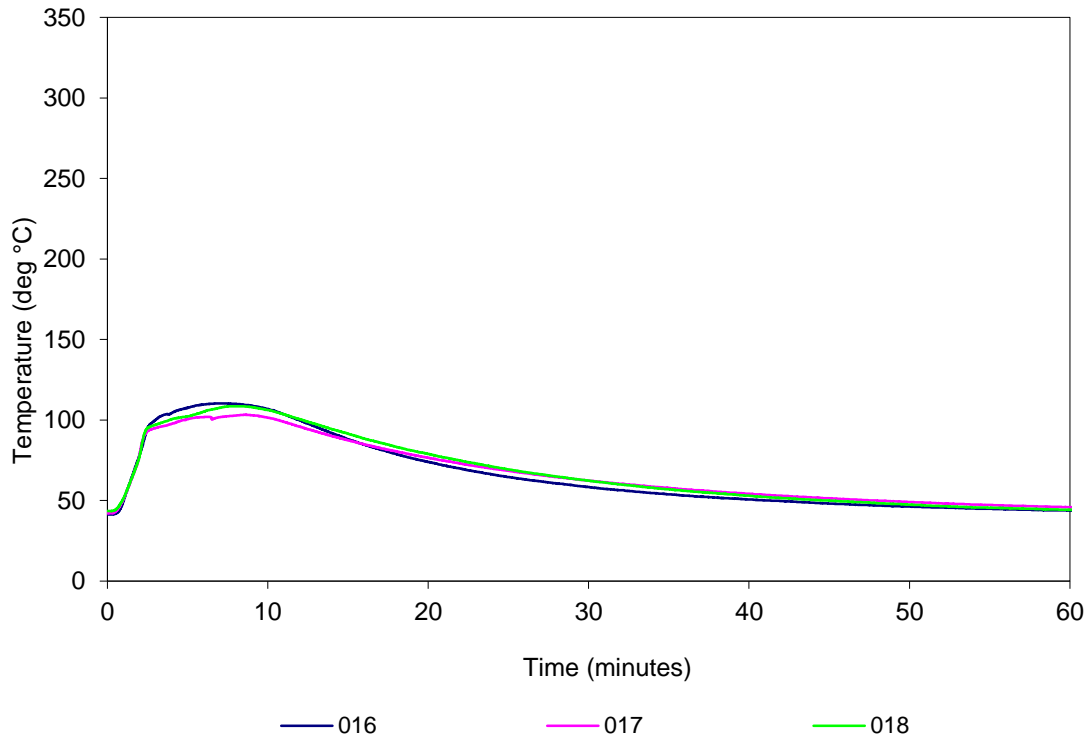


Figure A5.4: Specimen temperatures. Temperatures vs. time, Eave mean and maximum

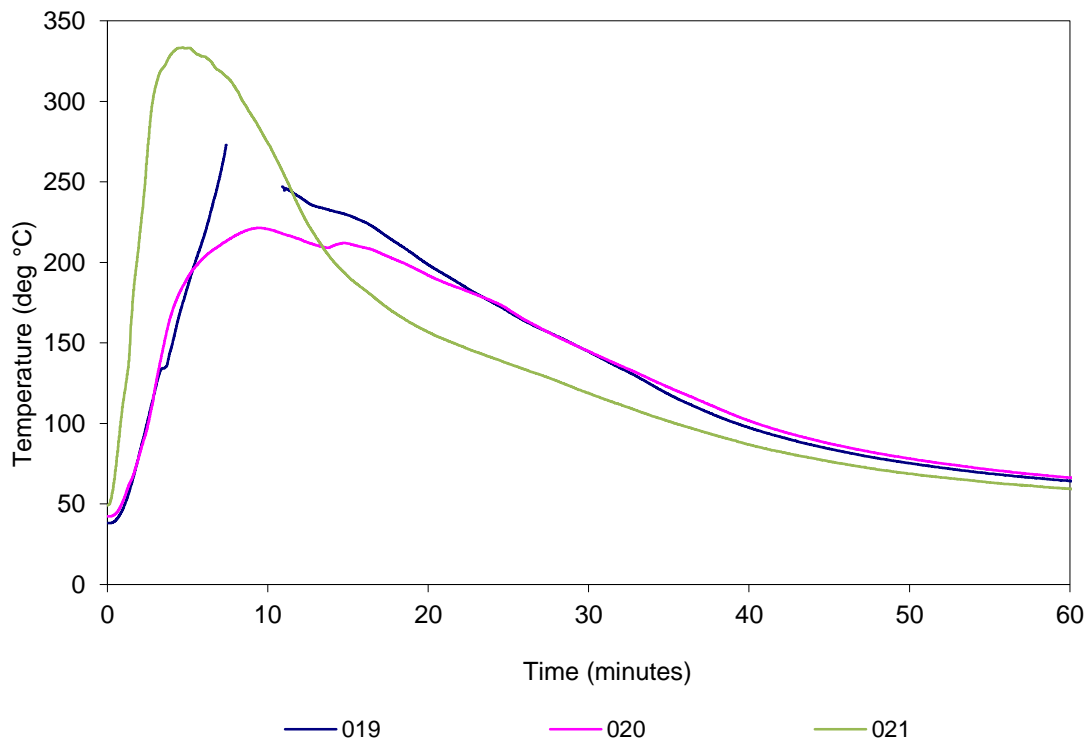


Figure A5.5: Specimen temperatures. Temperatures vs. time, Internal around crib
TC 019 had disconnected between 7-11 minutes hence data has been omitted for that duration.

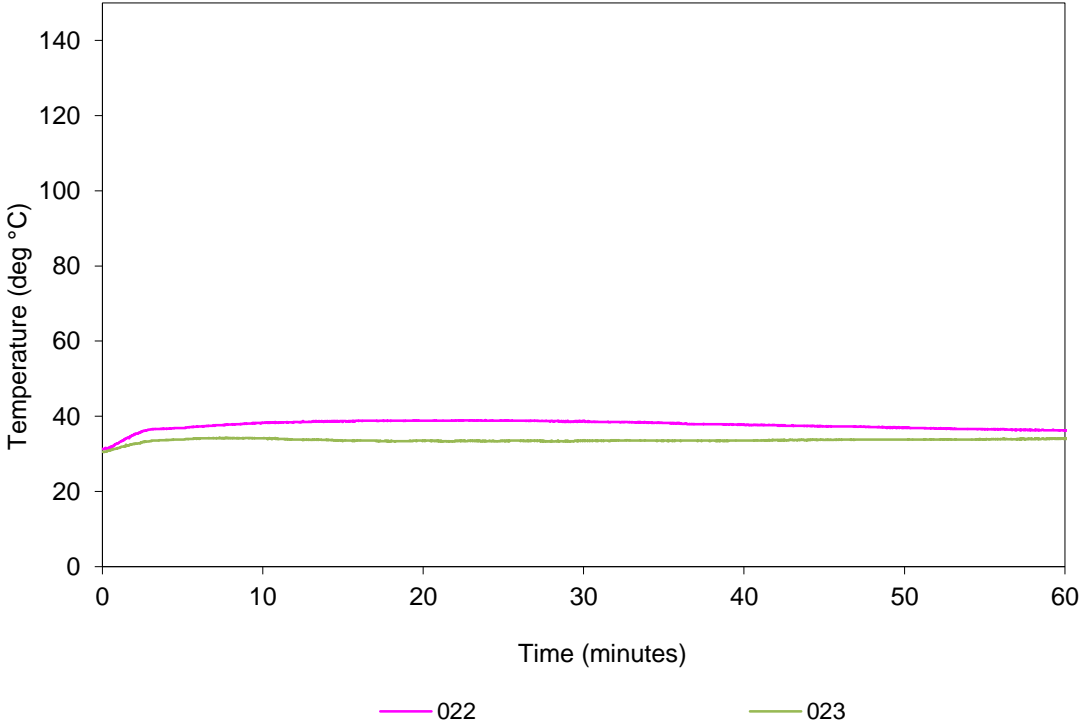


Figure A5.6: Specimen temperatures. Temperatures vs. time, Unexposed around crib

Table A5.1: Test Specimen Temperatures

T/C	Description ³	Temp (°C) at t (min)					Limit ^{1,2} Mins
		0	15	30	45	60	
011	Upper south internal quarter point	63	139	68	51	45	-
012	Upper north internal quarter point	64	143	66	50	44	-
013	South internal quarter point	56	102	60	50	45	-
014	North internal quarter point	52	101	61	51	46	-
015	Bottom internal quarter point	60	129	64	50	44	-
Average of internal quarter points		59	123	64	50	45	-
024	Upper south surface quarter point	36	50	43	38	35	-
025	Upper north surface quarter point	36	49	42	37	35	-
026	South surface quarter point	34	45	40	37	35	-
027	North surface quarter point	32	38	36	35	34	-
028	North surface quarter point	32	36	35	35	35	-
Average of surface quarter points		34	44	39	36	35	-
016	Eave above crib	41	87	58	48	44	-
017	Eave at middle of specimen	42	86	62	51	46	-
018	Eave above north window reveal	43	90	62	50	44	-
019	Centre of crib on inside of return wall	26	228	142	83	64	-
020	Centre of crib on inside of back wall	42	211	142	86	66	-
021	Above mid-width of crib inside of back wall	49	188	117	75	59	-
022	Centre of crib on unexposed side of return wall	31	39	39	37	36	-
023	Centre of crib on unexposed side of back wall	31	34	34	34	34	-

- Note
- ¹ Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by any surface thermocouple does not rise by more than 180°C above the initial temperature.
Limit time for the average of surface quarter points is the time to the nearest whole minute, rounded down to the nearest minute, at which the average measured temperature does not rise by more than 140°C above the initial temperature.
 - ² Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by any internal thermocouple does not reach 300°C.
Limit time for the average of internal quarter points is the time to the nearest whole minute, rounded down to the nearest minute, at which the average measured temperature does not reach 250°C.
 - ³ Refer to Appendix 4 for locations of thermocouples as only a generic description is included in the table.
- # Thermocouple failure.
- '-' Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred.

APPENDIX 6 PHOTOGRAPHS



Figure A6.1: Unexposed face of specimen before commencement of the fire-resistance test



Figure A6.2: Exposed face of specimen before commencement of the fire-resistance test



Figure A6.3: Unexposed face of specimen at the end of the test



Figure A6.4: Exposed face of specimen at the end of the test