Warrington FIRE research
CONSULTANCY • TESTING

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Issue Number	2172500.1AS
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Test Report

TEST DESCRIPTION

FIRE RESISTANCE TEST OF A 50mm THICK QT® EcoSeries EXTERIOR WALL PANEL SYSTEM TESTED IN ACCORDANCE WITH AS 1530.4-2005.

TEST APPLICANT

QT Systems.
PO Box 6249
Acacia Ridge,
QLD, 4110.

TEST DATE

1st May 2007

Unit 2, 409 - 411 Hammond Road, Dandenong, Victoria 3175, P.O. Box 4282, Dandenong South, Victoria 3164, Australia.
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On behalf of Warrington Fire Research (Aust) Pty Ltd

GENERAL CONDITIONS OF USE

CONTENTS

1 CONSTRUCTION DETAILS

TEST ASSEMBLY

The test assembly comprised a nominal 3000mm wide × 3000mm high QT® EcoSeries Exterior Wall Panel system.

TEST SPECIMENS

The wall was constructed from 50mm thick QT® EcoSeries Exterior Wall Panels installed in the horizontal orientation that were rendered to the exposed side and fixed to the exposed side of a timber framed wall that was faced with 10mm thick plasterboard to the unexposed side. Further details are provided in Figures A1.1 to A1.2 and the Schedule of Components.

ASSEMBLY AND INSTALLATION METHODS

The QT® EcoSeries Exterior Wall Panel system was built into a steel restraint frame by the test applicant at WFRA Melbourne on the 19th & 20th of April 2007 under the supervision of a WFRA representative.

ORIENTATION

The specimen was exposed from the QT® EcoSeries Exterior Wall Panel side of the wall system.

2 SCHEDULE OF COMPONENTS

ITEM	DESCRIPTION
Panel	
Product Name	QT® EcoSeries Exterior Wall Panel.
Material	Conpolcrete™. Conpolcrete™ is a formulation that is made from cement, 100% recycled polystyrene and binders.
Density	Approximately 345 kg/m^3 (measured).
Size	Each panel was 2230mm long × 900mm wide × 50mm thick.
Fixings	
Screws	100mm × 3.2g long bugle head galvanised screws used to fix the QT® EcoSeries Exterior Wall Panels to the frame at nominal 300mm vertical centres, and nominal 460mm horizontal centres into the framing.
Buttons	29mm diameter QT® buttons made from Nylon 6, used as a "washer" with the screws to fix the QT® EcoSeries Exterior Wall Panels to the framing.
Sealant	
Product name	HB Fuller FireSound sealant. This was applied around the perimeter of the panels at the top bottom and fixed edge of the system, between the panel edge face and the concrete block surround.
Foam Sealant	
Product name	HANDIFOAM® Fireblock – polyurethane foam sealant, applied to the face of the battens and to bond all panel joints.
Render	
Product Name	Dulux 193-85835 Renderwall 2001.
Material	Cementious masonry render (composition retained in file) was used on the exposed face of the QT® EcoSeries Exterior Wall Panels.
Thickness	Nominal 6-8mm thick.
Additive	
Product name	Dulux 194-51619 Acratex Acrabond, used as an additive in the render mix.
Mesh	
Product Name	QT® WallMesh.
Material	Raw Net 100% Fibreglass, Alkali-Resistant, Woven Yarn, was placed on the entire face of the 1st rendered layer, and was then rendered over the top of.
Weight	0.1 kg/m^2.
Battens	
Material	Pine timber battens.
Size	35mm wide × 25mm deep.

ITEM	**DESCRIPTION**
Fixing	Battens fixed to the timber stud framing with 100mm long × 3.06mm thick framing nails.
Sarking	
Product name	Sisalation 499 – light duty breather foil. This was fixed to the entire face of the timber stud wall, between the the battens and the timber stud wall.
Material	Two outer layers of aluminium foil bonded to both sides of a high density kraft paper.
Framing	
Material	Timber – Pine.
Size	70mm wide × 35mm thick.
Fixing	The timber framing was secured into the perimeter surrounding blocks on the top bottom and fixed edge using 75mm long × 10mm diameter masonry anchors.
Cladding	
Product	10mm thick standard plasterboard, used to clad the unexposed face of the timber stud wall.
Finishing	
Product Name	CSR Gyprock Base Coat 45.
Tape	Nominal 50mm wide paper tape.
Specimen Perimeter Surround and Edge Sealing	
	390mm long × 190mm deep × 90mm thick solid concrete blocks on sides, top and bottom, appropriately fixed to the steel restraint frame and 25mm thick ceramic fibre sealing the free edge (east edge) of the specimen.

3 TEST PROCEDURE

STATEMENT OF COMPLIANCE

The test was performed in accordance with the requirements of AS 1530.4-2005 section 2 and 3 as appropriate for non-load bearing walls.

VARIATION TO TEST METHOD

None

PRE-TEST CONDITIONING

The specimen was allowed to cure in the test laboratory after construction for a period of 11 days prior to testing. During this period the average temperature and relative humidity of the laboratory was 19℃ and 53% respectively.

SAMPLING / SPECIMEN SELECTION

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

AMBIENT TEMPERATURE

The ambient temperature at the start of the test was 23℃ and varied between 23℃ and 25℃ during the test.

TEST DURATION

The test was terminated after 137 minutes 40 seconds after agreement between the test laboratory and applicant.

INSTRUMENTATION AND EQUIPMENT

The instrumentation was provided in accordance with AS 1530.4-2005 and as detailed below:

The furnace temperature was measured by 6-off mineral insulated metal sheathed Type K thermocouples with wire diameters not greater than 1mm and overall diameter of 3mm with the measuring junction insulated from the sheath. The thermocouples protruded a minimum of 25mm from steel supporting tubes.
The non fire side specimen temperatures were measured by Type K thermocouples with wire diameters less than 0.5mm diameter soldered to 12mm diameter × 0.2mm thick copper discs covered by 30mm × 30mm × 2.0 mm inorganic insulating pads. The thermocouples positions are described in Table A4.1, and are shown on Figure A4.1 in Appendix 4.
A roving thermocouple was available to measure temperatures at positions that appeared hotter than the positions monitored by the fixed thermocouples.
The furnace pressure was measured at a position 500mm above the bottom of the wall.
Cotton pads and gap gauges were available during the test to assess the performance under the criteria for integrity.

4 TEST MEASUREMENTS

FURNACE TEMPERATURE AND PRESSURE MEASUREMENTS

Furnace temperature and pressure data are provided in A5.1 and A5.2 in Appendix 5.

SPECIMEN TEMPERATURES

Specimen temperature data is provided in A5.3 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 1530.4-2005 is provided in Appendix 2. Photographs of the specimen are included in Appendix 5.

5 TEST RESULTS

The specimen achieved the following performance when tested in accordance with AS 1530.4-2005.

Criteria	Result
Loadbearing capacity	Not applicable
Integrity	No failure at 137 minutes
Insulation	118 minutes
FRL	**-/120/90**

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 procedure outlined in AS 1530.4-2005. 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 should be referred to the test sponsor in the first instance to obtain appropriate documentary evidence of compliance from Warrington Fire Research or another Registered Testing Authority.

UNCERTAINTITY 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

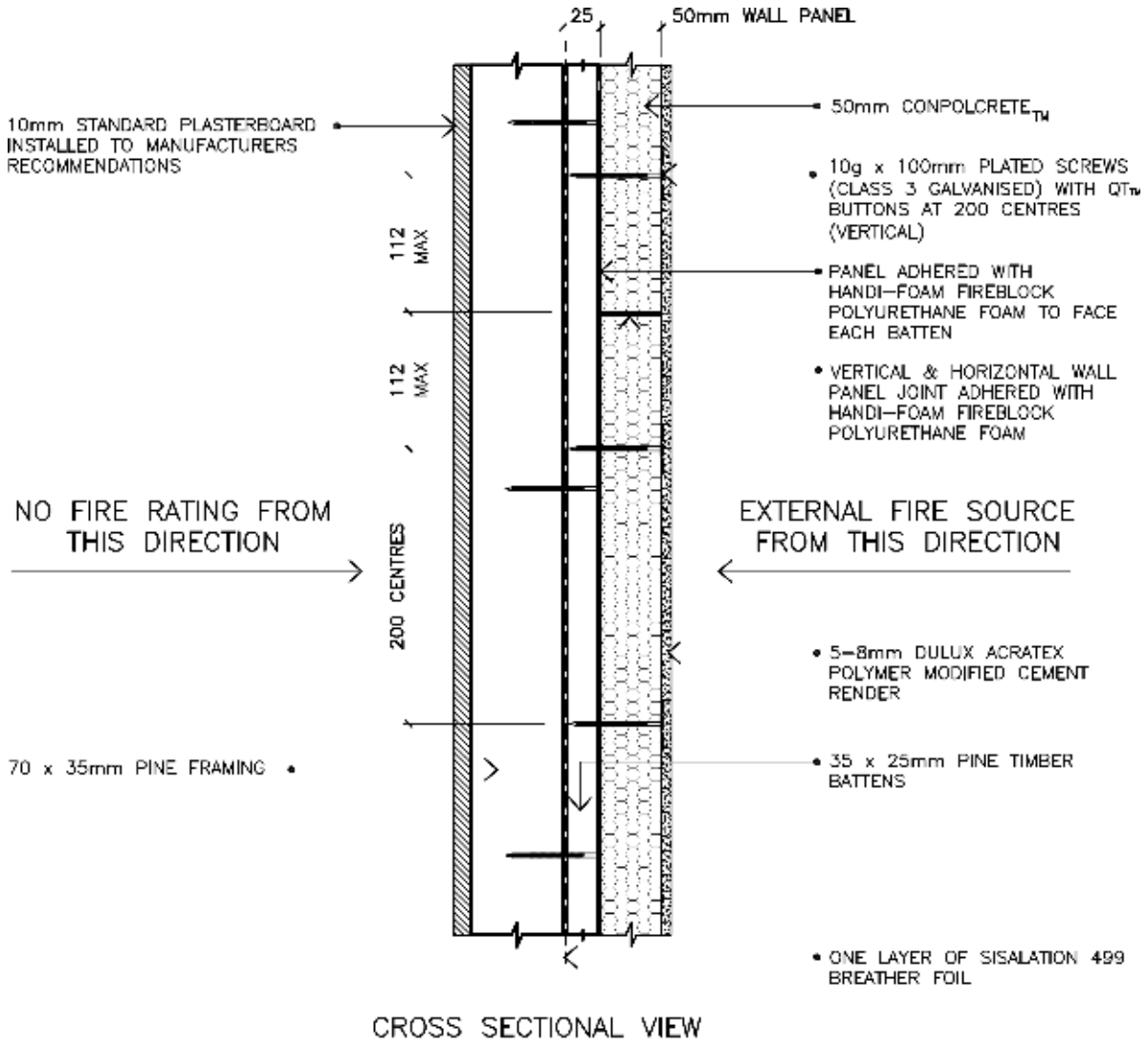
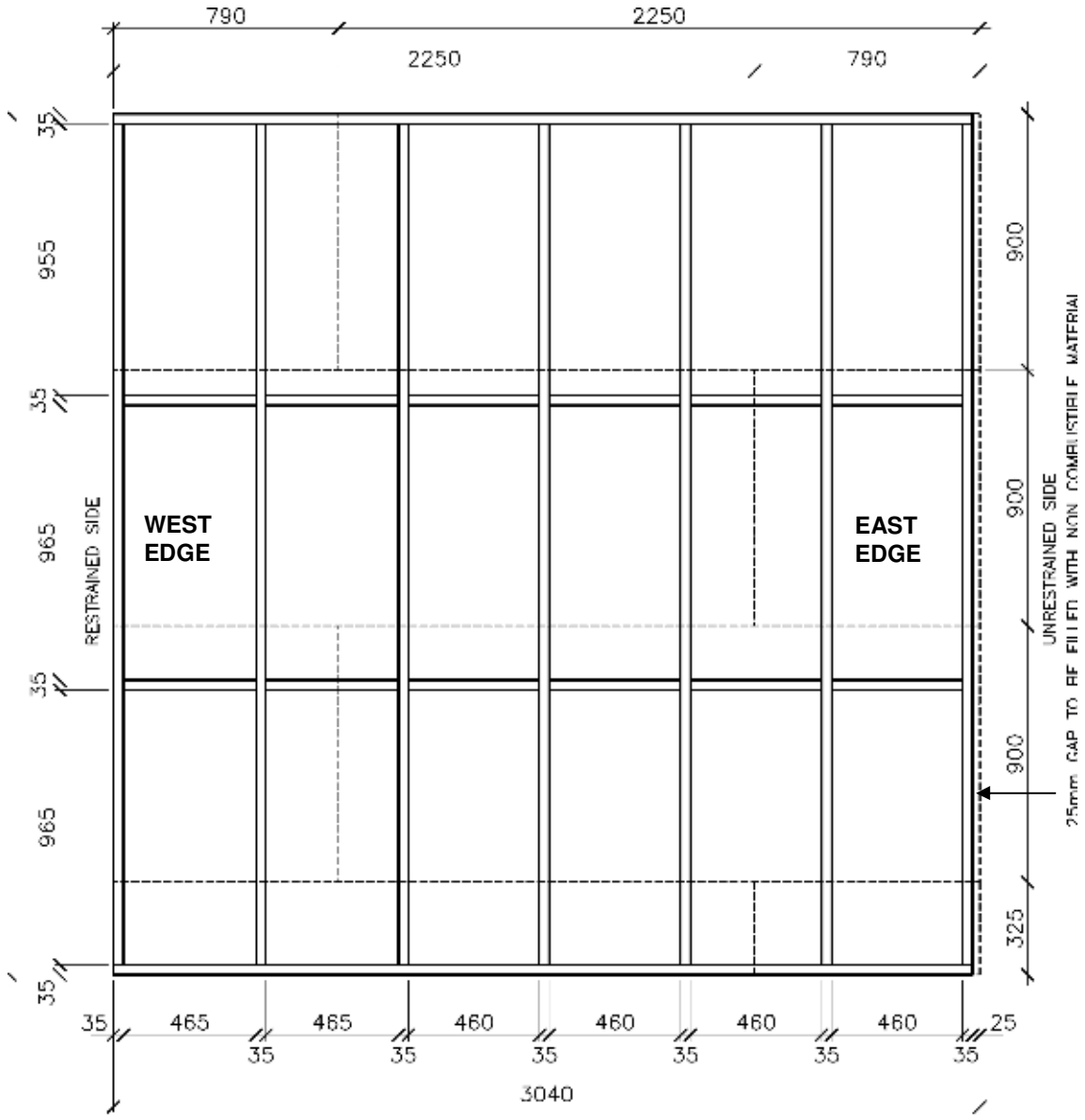


Figure A1.1: Test Specimen – (Drawing provided by test sponsor)



STUD FRAME AND PANEL LAYOUT

Figure A1.2: Test Specimen viewed from the unexposed face
(Drawing provided by test sponsor)
Note: - Panel layout is defined by dotted lines.
- The top, bottom and west edges were fixed to the concrete block surround

APPENDIX 2 TEST OBSERVATIONS

The following observations are observations of the significant behaviour of the specimen during the test.

Time		Observation
Min	**Sec**	
0	00	Fire Resistance Test was commenced and ambient air temperature was approximately 23°C.
6	44	Smoke had begun to be emitted through the top of the steel restraint frame.
10	00	Smoke had begun to be emitted through the block joins.
12	50	Smoke had begun to be emitted through the base of the wall in the centre.
19	00	It had become evident that moisture had begun to run down from the top of the wall approximately 1000mm west of the free edge.
28	50	It had become evident that wisps of smoke had begun to be emitted approximately 1000mm from the bottom of the wall.
60	00	The wall continues to maintain integrity in accordance with AS 1530.4-2005.
61	00	A roving thermocouple was applied adjacent to thermocouple B4 for 90 seconds, resulting in a temperature of 49°C.
75	00	No hot spots had become evident on the face of the specimen.
86	00	An increase in smoke had become evident, with a change in colour from a yellowy/brown smoke to a whiter smoke.
90	00	The wall continues to maintain integrity in accordance with AS 1530.4-2005. No hot spots had become evident on the face of the specimen.
115	00	A hot spot had begun to become evident at the top of the wall, approximately 700mm from the west fixed edge.
118	00	A roving thermocouple was applied over the hot spot at the top of the wall, approximately 700mm from the west fixed edge for 90 seconds, resulting in a temperature of 215°C.
120	00	The wall continues to maintain integrity in accordance with AS 1530.4-2005.
123	00	It had become evident that the wall had begun to darken around thermocouple B4 – approximately 750mm from the west fixed edge, 750mm from the bottom of the wall.
130	00	Cracking had become evident in the shape of a cross at the hot spot at the top of the wall, approximately 700mm from the west fixed edge.
137	40	The wall continues to maintain integrity in accordance with AS 1530.4-2005. The fire resistance test was stopped at the request of the sponsor.

APPENDIX 3 DIRECT FIELD OF APPLICATION

A 3.1 GENERAL

AS 1530.4-2005 states that the results of a fire resistance test on a wall are directly applicable without reference to the testing authority, to similar constructions where one or more of the following changes are made provided no individual component is removed or reduced:

A 3.2 SEPARATING ELEMENTS

a) An increase in the length of a wall of identical construction is permitted.

b) An increase in thickness of the wall is permitted.

c) For framed walls-
   i) increase in timber density
   ii) increase in cross-sectional dimension of the framing elements
   iii) Increase in steel thickness up to a maximum of 2mm
   iv) decrease in sheet or panel size
   v) decrease in stud spacing
   vi) decrease in fixing centres of wall sheet materials.

APPENDIX 4 INSTRUMENTATION

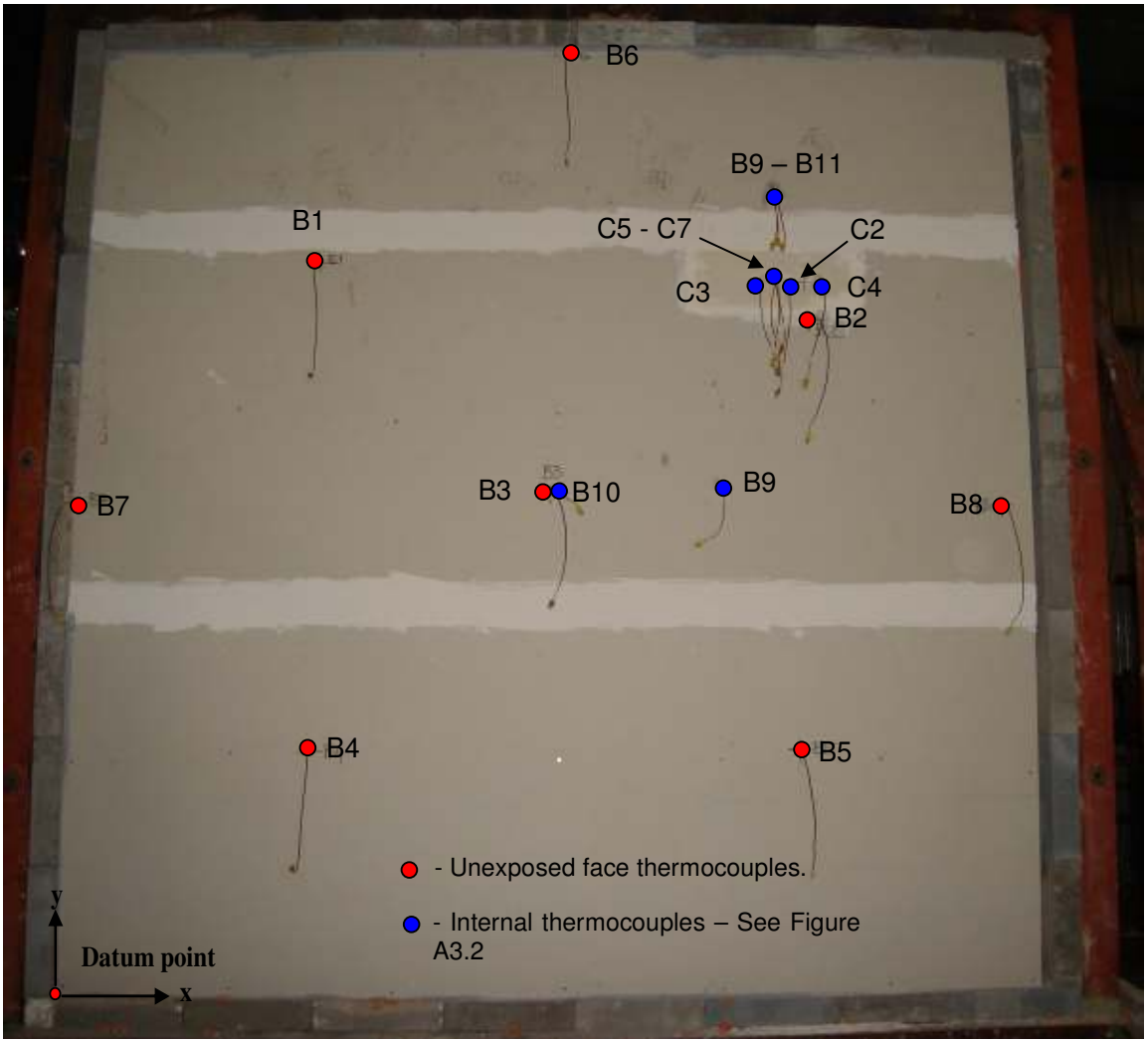


Figure A4.1: Thermocouple Locations.

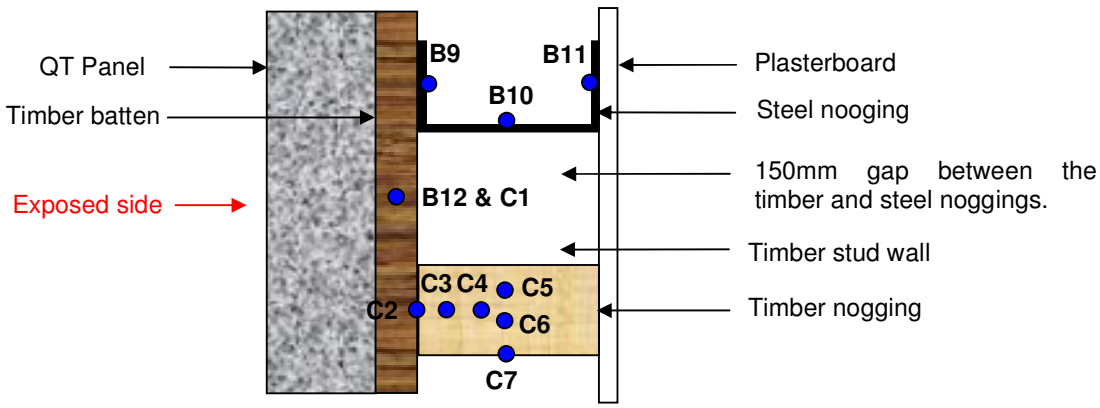


Figure A4.2: Thermocouple Locations – See Table A3.1 for specific thermocouple locations.

Table A4.1: Thermocouple locations

T/C	LOCATION		DESCRIPTION
	x	y	
B 1	750	2250	Upper west quarter point.
B 2	2250	2100	Upper east quarter point.
B 3	1490	1500	Centre of wall.
B 4	750	750	Lower west quarter point.
B 5	2250	750	Lower east quarter point.
B6	1550	3010	15mm from the top of the wall in the centre.
B7	15	1500	15mm from the fixed edge of the wall at mid-height.
B8	2900	1500	100mm from the free edge at mid-height.
Internal thermocouples			
T/C	**x**	**y**	**z**	**DESCRIPTION –** Z direction measurements taken from unexposed face of wall system
B9	2300	2525	80	Exposed face of a steel nogging.
B10	2300	2510	48	Middle of the web of steel nogging.
B11	2300	2525	10	Unexposed face of a steel nogging.
B12	1500	1500	90	Batten cavity.
C1	1950	1500	90	Batten cavity.
C2	2300	2200	80	Exposed face of timber nogging.
C3	2200	2200	70	10mm from the exposed face of timber nogging.
C4	2400	2200	60	20mm from the exposed face of timber nogging.
C5	2275	2202	45	20mm from the bottom horizontal face of timber nogging.
C6	2225	2192	45	10mm from the bottom horizontal face of timber nogging.
C7	2250	2182	45	Bottom horizontal face of timber nogging.

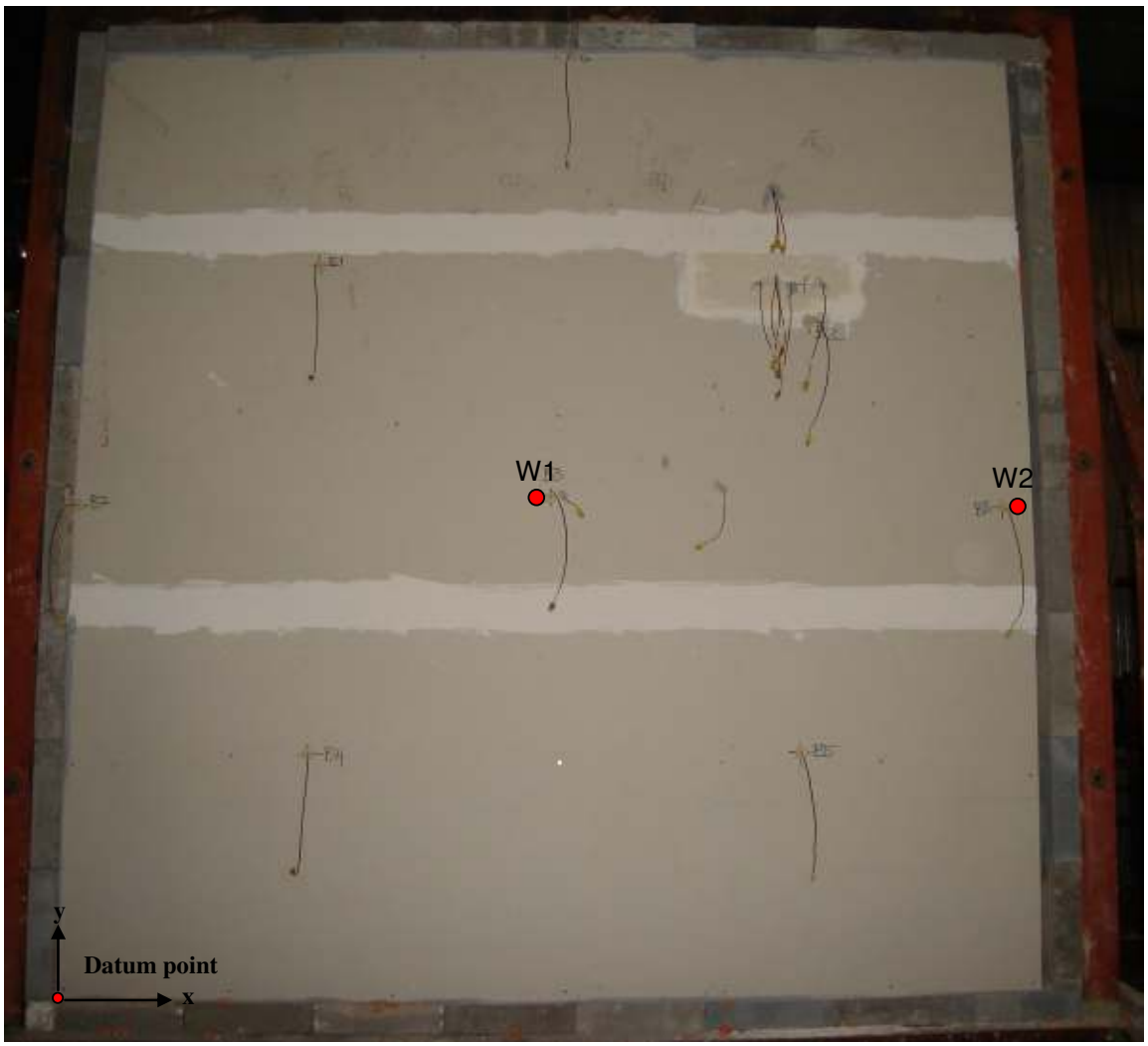


Figure A4.3: Deflection Measurement Locations

Table A 4.2 Deflection Point Locations

Ref.	x	y	Description
W 1	1480	1500	Centre of the wall.
W 2	2950	1500	50mm from free edge of the wall.

APPENDIX 5 TEST DATA

A 5.1 FURNACE TEMPERATURE

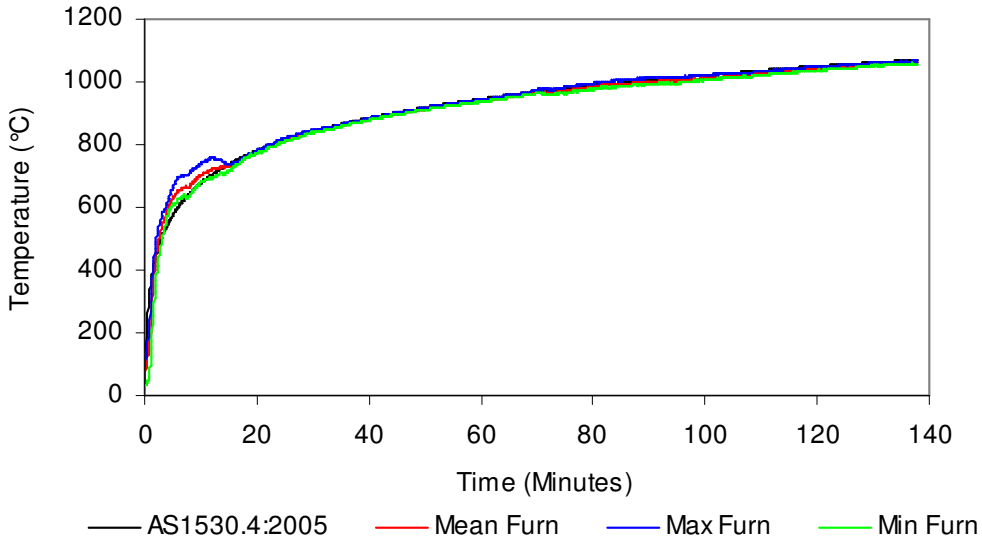


Figure A5.1: Furnace Temperatures vs. Time.

A 5.2 FURNACE PRESSURE

Time (minutes)	Pressure (Pa)	Time (minutes)	Pressure (Pa)
	Avg		Avg
5-10	**-1**	75-80	**-1**
10-15	**2**	80-85	**0**
15-20	**2**	85-90	**1**
20-25	**2**	90-95	**1**
25-30	**2**	95-100	**1**
30-35	**1**	100-105	**2**
35-40	**2**	105-110	**2**
40-45	**2**	110-115	**2**
45-50	**2**	115-120	**2**
50-55	**2**	120-125	**2**
55-60	**1**	125-130	**2**
60-65	**0**	130-135	**1**
65-70	**-2**	135-140	**1**
70-75	**-1**		

A 5.3 SPECIMEN TEMPERATURES

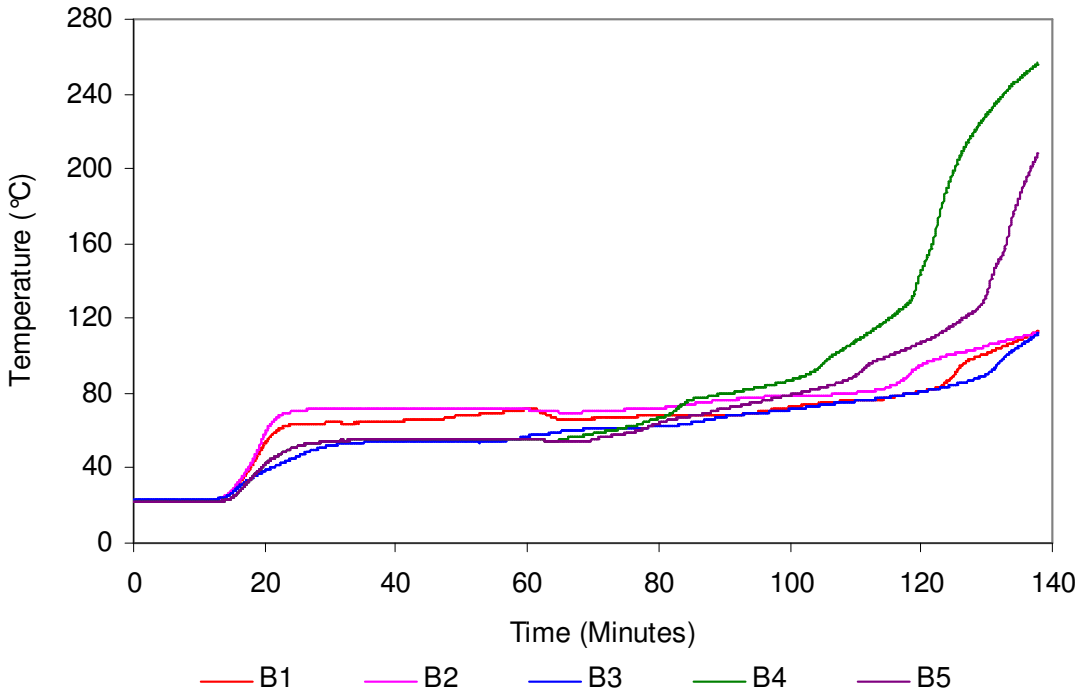


Figure A5.2: Quarter points. Temperatures vs. Time

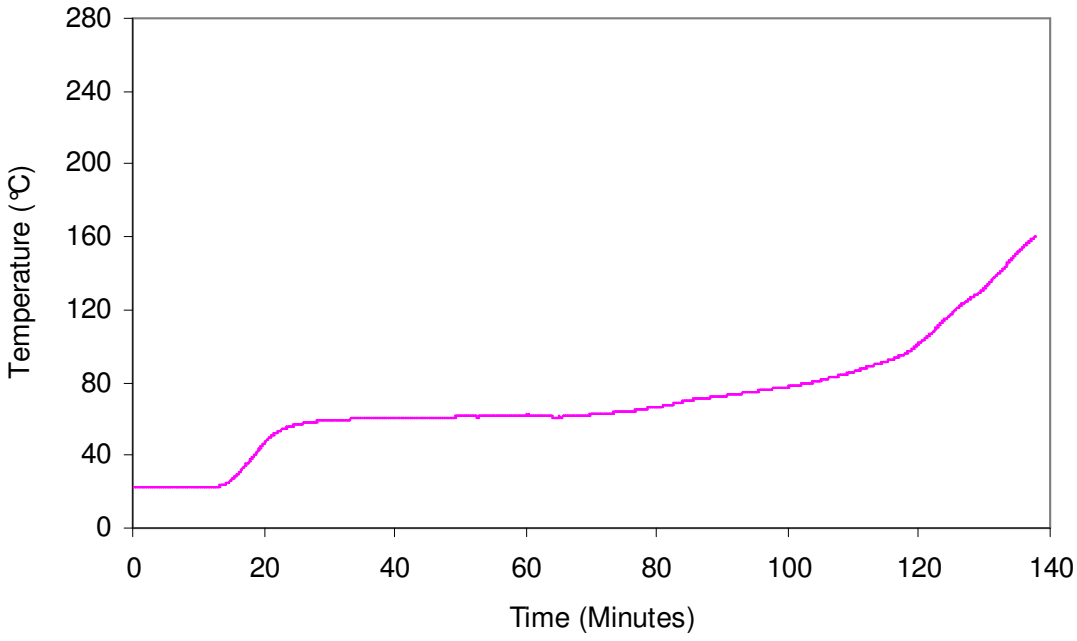


Figure A5.3: Average of quarter points. Temperatures vs. Time

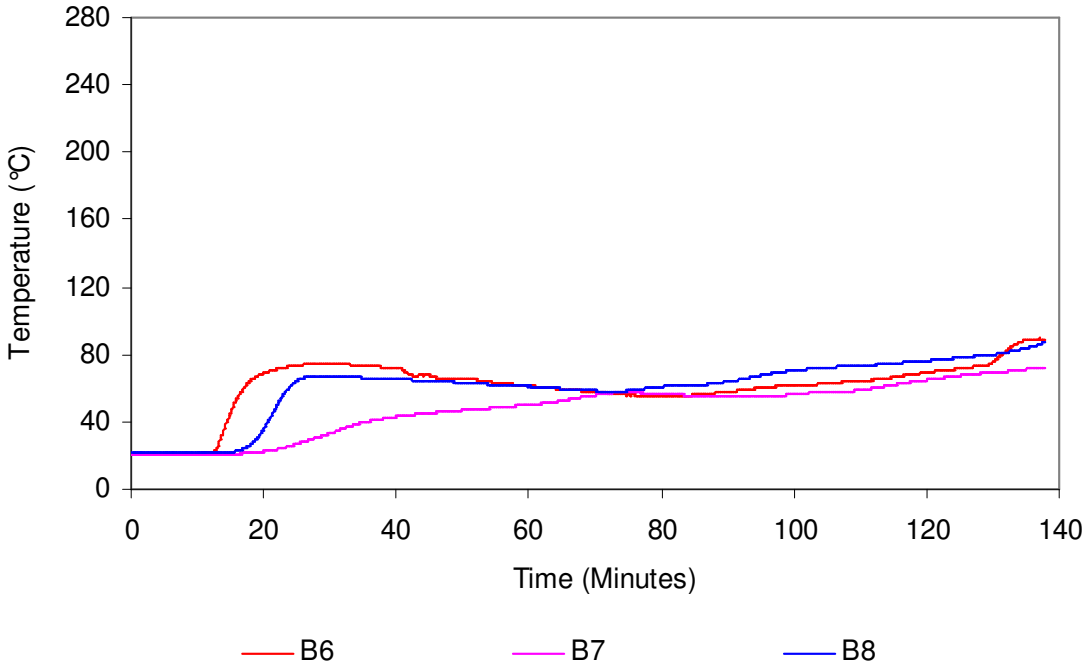


Figure A5.4: Other surface. Temperatures vs. Time

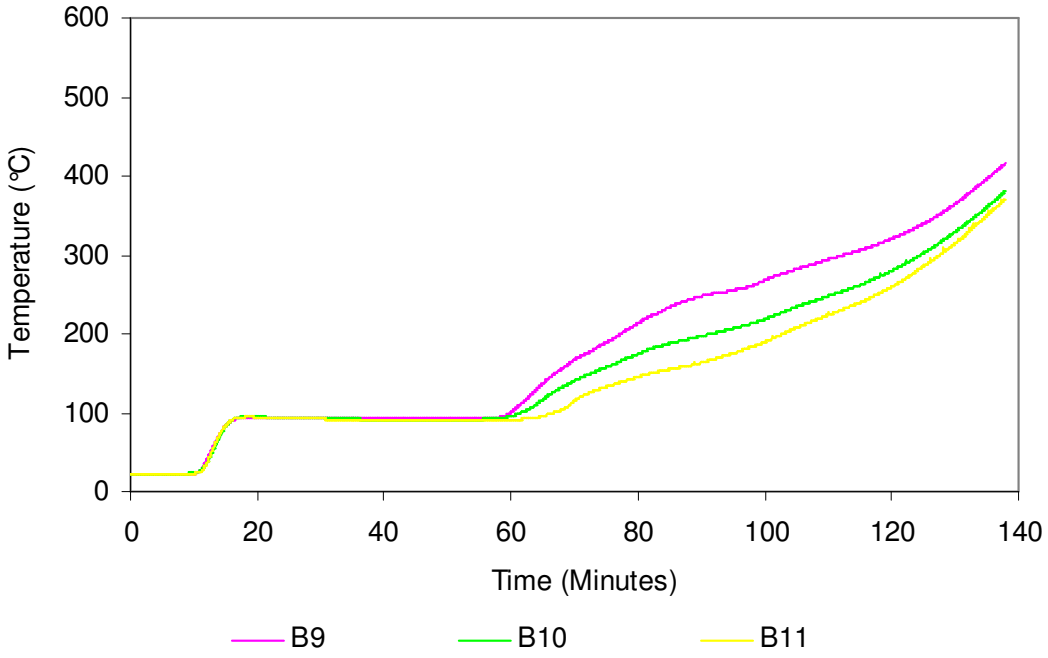


Figure A5.5: Internal Steel Temperatures vs. Time

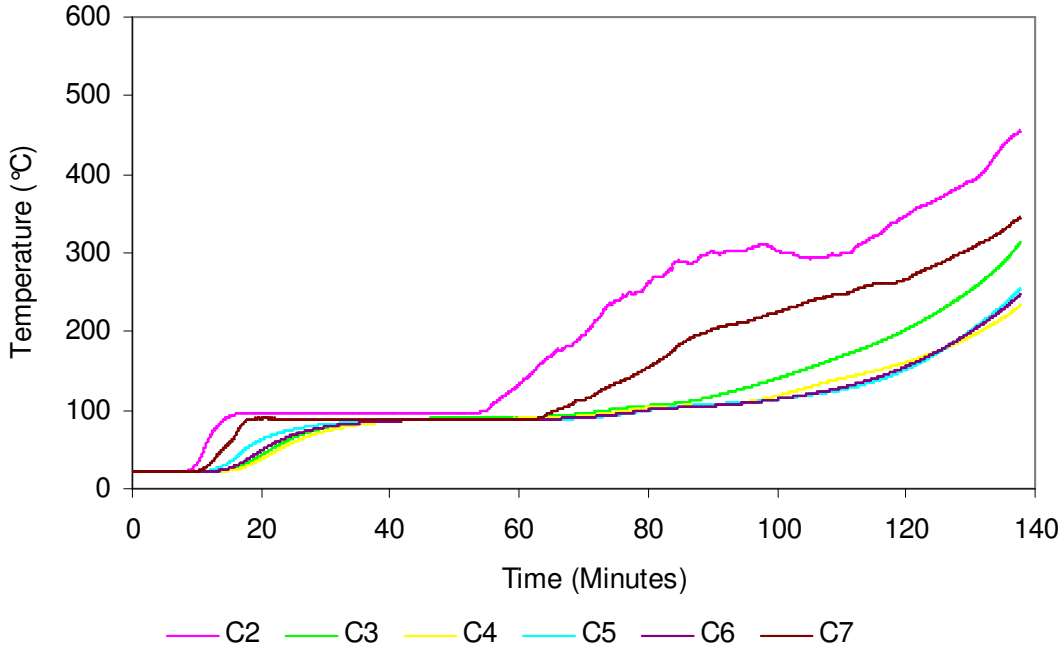


Figure A5.6: Internal Timber Temperatures vs. Time

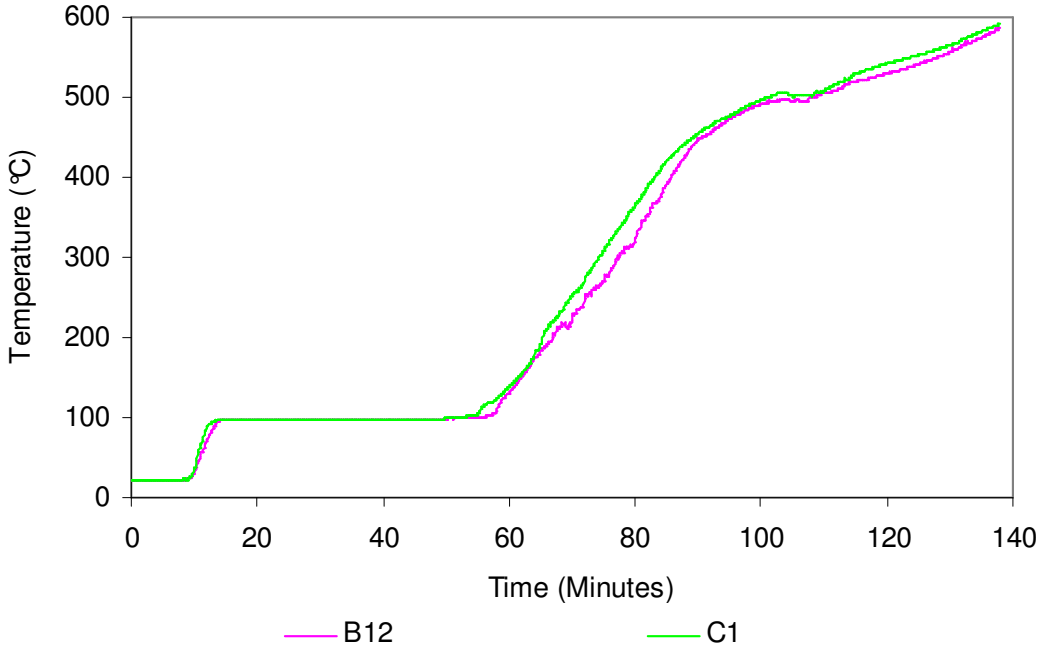


Figure A5.7: Internal Cavity Temperatures vs. Time

Table A5.1: Test Specimen Temperatures

T/C	Description[2]	Temp (°C) at t (minutes)						Limit[1] Mins
		0	30	60	90	120	137	
B1	Upper west quarter point.	23	65	72	69	82	113	-
B2	Upper east quarter point.	22	73	72	77	96	112	-
B3	Centre of wall.	22	52	57	67	81	110	-
B4	Lower west quarter point.	22	30	29	79	146	254	125
B5	Lower east quarter point.	22	55	56	72	108	203	136
B6	15mm from the top of the wall in the centre.	21	75	62	58	70	90	-
B7	15mm from the fixed edge of the wall at mid-height.	21	34	51	56	66	73	-
B8	100mm from the free edge at mid-height.	22	67	62	65	77	87	-
Internal thermocouples[3]								
B9	Exposed face of a steel nogging	21	94	102	248	322	411	N/A
B10	Middle of the web of steel nogging	21	92	95	195	280	374	N/A
B11	Unexposed face of a steel nogging	22	91	90	162	260	364	N/A
B12	Batten cavity	20	97	130	446	529	582	N/A
C1	Batten cavity	20	96	138	454	542	588	N/A
C2	Exposed face of timber nogging	21	95	133	301	347	451	N/A
C3	10mm from the exposed face of timber nogging.	21	77	90	116	202	305	N/A
C4	20mm from the exposed face of timber nogging.	21	73	88	106	160	228	N/A
C5	20mm from the bottom horizontal face of timber nogging.	21	82	87	107	151	248	N/A
C6	10mm from the bottom horizontal face of timber nogging.	21	79	88	106	156	243	N/A
C7	Bottom horizontal face of timber nogging.	21	88	87	203	267	341	N/A

Notes

[1] Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.

[2] Refer to Appendix 4 for locations of thermocouples as only a generic description is included in the table.

[3] Internal thermocouple, therefore no limit on insulation.

'-' 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.

# Indicates thermocouple fault.

A 5.4 DEFLECTION MEASUREMENTS

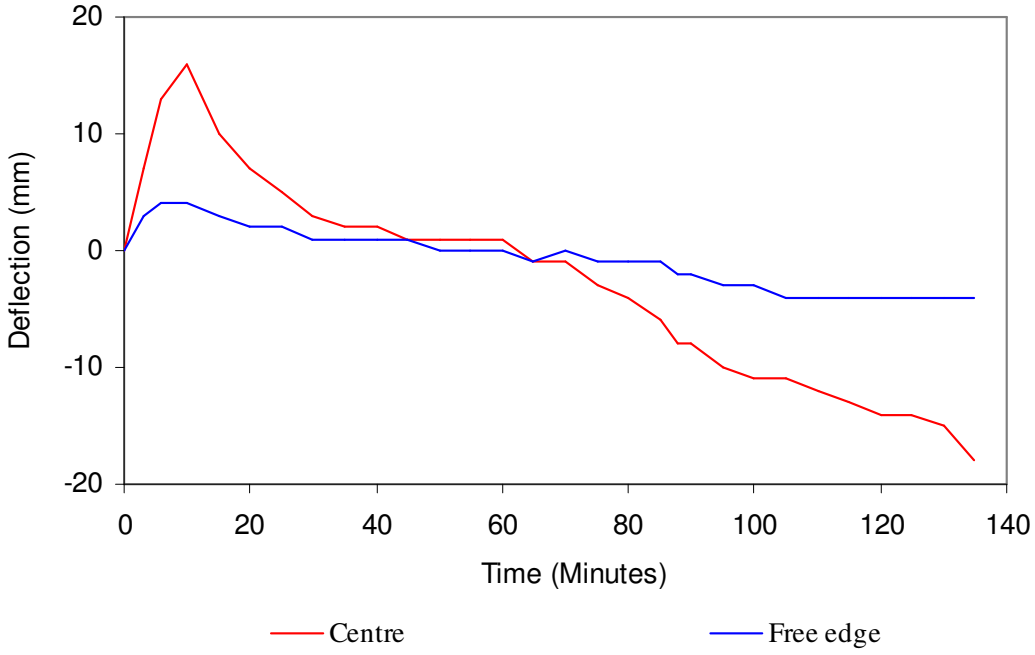


Figure A5.8: Out-of-Plane Deflection of the wall vs. Time.
Positive measurements show movement of wall towards furnace and negative measurements show movement of wall away from furnace.

APPENDIX 6 PHOTOGRAPHS

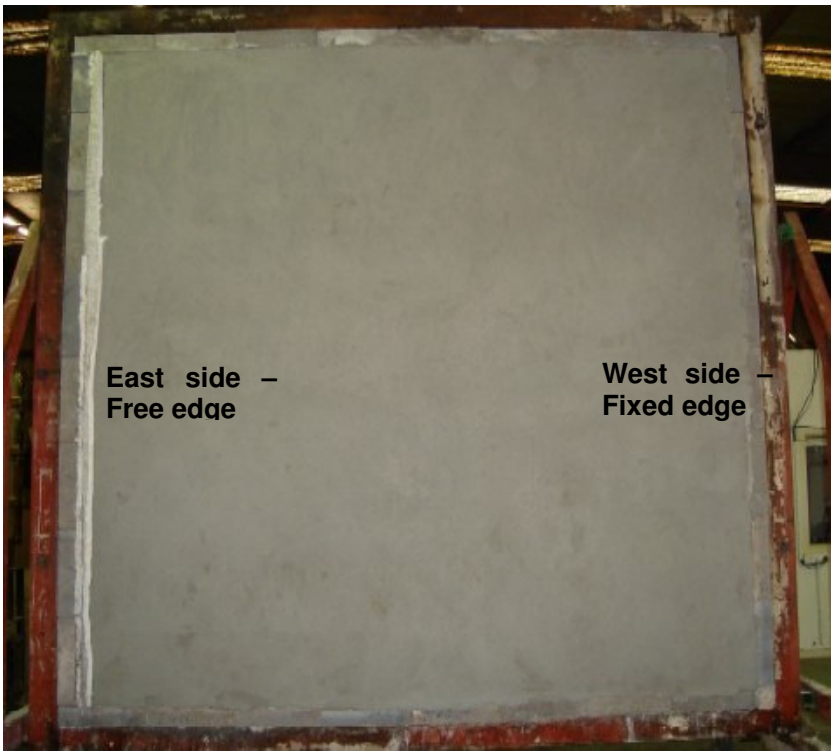


Figure A6.1. Exposed face of test specimen prior to commencement of test.

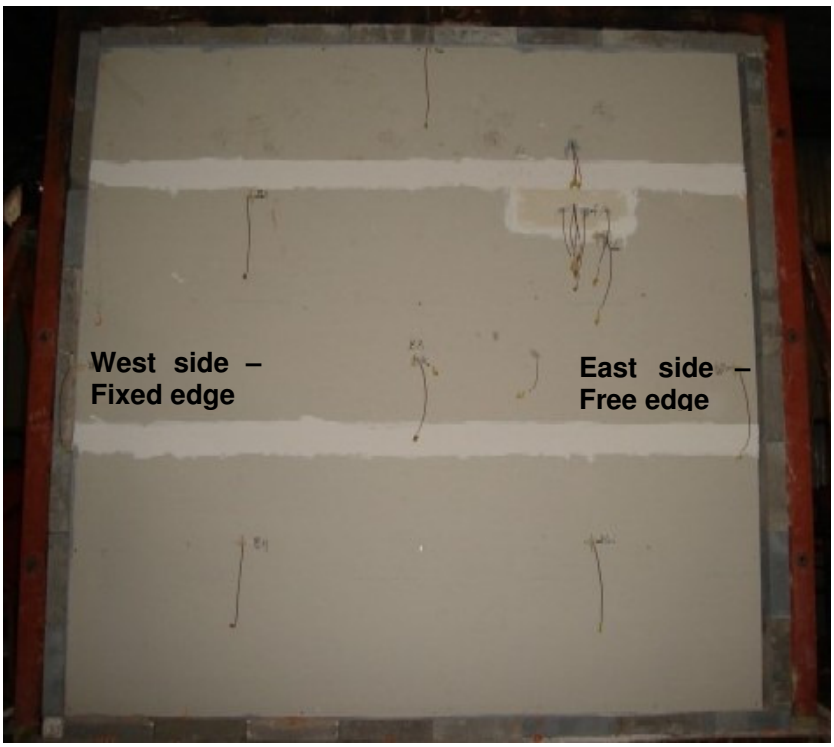


Figure A6.2: Unexposed face of test specimen prior to commencement test.

Figure A6.3 Exposed face of test specimen after the completion of the test.

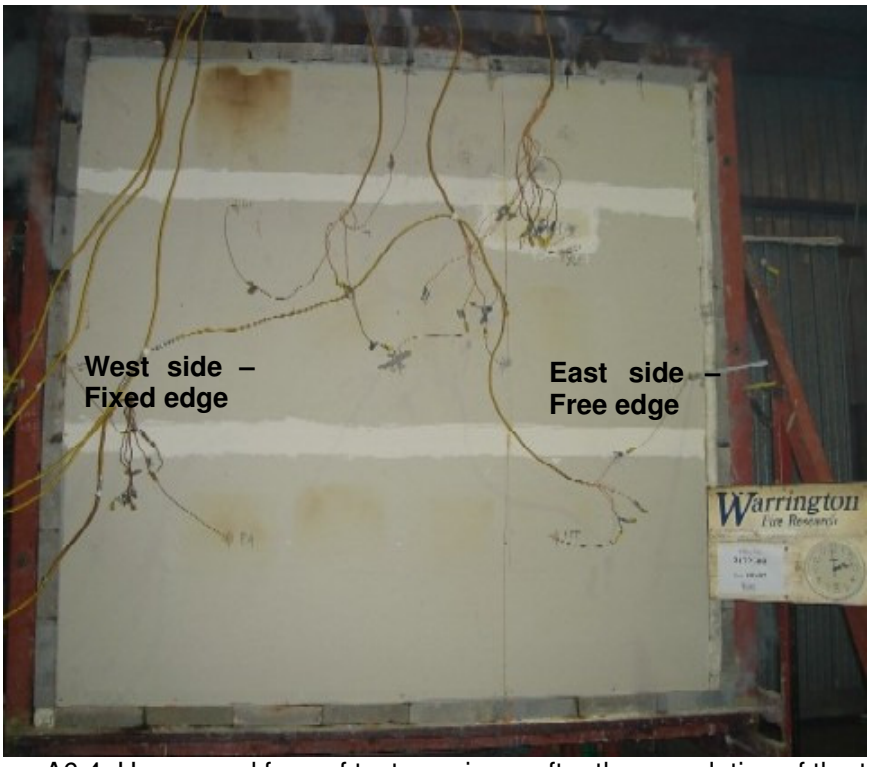


Figure A6.4: Unexposed face of test specimen after the completion of the test.