

FIRE TEST REPORT

FR10430-001 ISSUE 2

THE FIRE RESISTANCE OF A NON-LOADBEARING DELTACOOL-MW PANEL WALL IN ACCORDANCE WITH AS 1530.4:2014

CLIENT
Delta Panels Pty Ltd
2828 Ipswich Road
Darra
Brisbane, 4076
Australia

All tests and procedures reported herein, unless indicated, have been performed in accordance with the laboratory's scope of accreditation

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TEST SUMMARY

Objective

To determine the fire resistance of a nominally 100 mm thick DeltaCool-MW insulated panel wall assembly when tested in accordance with AS 1530.4:2014 *"Methods for fire tests on building materials, components and structures, Part 4: Fire–resistance test for elements of construction."*

Test Sponsor

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Description of Test Specimen

The test specimen consisted of a wall nominally 3,000 mm high x 3,000 mm wide, formed from three, 100 mm thick DeltaCool-MW panels. Two of the panels were full size, 3,000 mm tall by 1,200 mm wide, the width of the third panel was cut to 590 mm. The panels were installed within a concrete lined specimen holder and orientated such that the panel joints were vertical. The panels were fixed to the specimen holder on both horizontal edges and one vertical edge on both faces of the wall with 50 mm x 50 mm x 1.2 mm thick steel angle.

Date of Test

12 September 2018

Test Results

The test results in accordance with AS 1530.4:2014, "Methods for fire tests on building materials, components and structures – Part 4: Fire – resistance test for elements of construction" was as follows:

Integrity	122 minutes No Failure
Insulation	72 minutes

The tested specimen is deemed to have achieved an FRL of -/120/60

The test standard requires the following statements to be included:

"The results of these fire tests 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."

"This report details methods of construction, the test conditions and results obtained when the specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variations with respect to size, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, is not covered by this report."

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"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."

LIMITATIONS

The results reported here relate only to the item/s tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

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(i) recognises within its scope of recognition of this Arrangement the accreditation of an organisation by other signatories as being equivalent to an accreditation by its own organisation,

(ii) accepts, for its own purposes, endorsed* certificates or reports issued by organisations accredited by other signatories on the same basis as it accepts endorsed* certificates or reports issued by its own accredited organisations,

(iii) recommends and promotes the acceptance by users in its economy of endorsed* certificates and reports,

* *The word "endorsed" means a certificate or report bearing an Arrangement signatory's accreditation symbol (or mark) preferably combined with the ILAC-MRA Mark.*

Signed:

Jennifer Evans
NATA CEO

Date: 24 March 2014

Dr Llewellyn Richards
IANZ CEO

Date: 24th March 2014

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DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	DESCRIPTION
01	30 October 2018	Initial Issue
02	1 June 2023	Amendment to steel skin thickness

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1. TEST PROCEDURE

The test was conducted in accordance with AS 1530.4:2014 “Methods for fire tests on building materials, components and structures, Part 4: Fire-resistance tests for elements of construction, Section 4”, for which the fire resistance of the specimen is the time, expressed in minutes, to failure under one or more of the following criteria.

1.1 Integrity Failure Criteria

Failure shall be deemed to occur upon collapse, the development of cracks or fissures, or other openings develop through which flames or hot gases can pass. Failure is defined when any of the following occurs:

(a) A cotton pad in its frame applied against the surface of the test specimen over any crack, fissure or flaming under examination, until ignition of the cotton pad (defined as glowing or flaming) or for a maximum of 30 seconds.

(b) Gap gauges employed, in turn, without undue force to determine when -

a. a 6 mm gap gauge can be passed through the specimen so that the gap gauge projects into the furnace and can be moved a distance of 150 mm along the gap, or,

b. a 25 mm gap gauge can be passed through the specimen so that the gap gauge projects into the furnace.

(c) Sustained flaming on the surface of the unexposed face for 10 seconds or longer constitutes integrity failure.

1.2 Insulation Failure Criteria

Failure in relation to insulation shall be deemed to have occurred if:

(a) the mean temperature of the relevant thermocouples attached to the unexposed face of the specimen rises by more than 140 K above the initial temperature; or,

(b) the maximum temperature anywhere on the unexposed surface rises more than 180 K above the initial temperature.

2. DESCRIPTION OF TEST SPECIMEN

2.1 General

The test specimen consisted of a wall nominally 3,000 mm high x 3,000 mm wide, formed from three, 100 mm thick DeltaCool-MW panels. Two of the panels were full size, 3,000 mm tall by 1,200 mm wide, the width of the third panel was cut to 590 mm. The panels were installed within a concrete lined specimen holder and orientated such that the panel joints were vertical. The panels were fixed to the specimen holder on both horizontal edges and one vertical edge on both faces of the wall with 50 mm x 50 mm x 1.2 mm thick steel angle.

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2.1.1 Conditioning

The construction of the wall occurred on 10 September 2018. The wall was left under ambient laboratory conditions until testing on 12 September 2018.

2.1.2 Specimen Selection

BRANZ was not responsible for sampling or selection of materials or the construction of the wall.

2.2 Plans and Specification

A copy of the client supplied specification is given in this report as Figure 1. Further details of the tested specimen are held on file by BRANZ. All dimensions are nominal unless otherwise stated. Where discrepancies between the dimensions in the report text and those shown in the attached drawing exist, the report takes precedence.

2.3 Panel Construction

The DeltaCool-MW panels consisted of a ConRock L10 mineral fibre core with a stated density of 100 kg/m³, faced with nominally 0.6 mm thick pre-painted mild steel skins. The steel skins were bonded to the mineral fibre core using a two component polyurethane adhesive. Along the vertical edges of the panels the steel skins had an interlocking male/female joint arrangement.

The measured properties of the 100 mm thick DeltaCool-MW panel including the steel facings were as follows:

Moisture content	0.96 %
Density kg/m³	209.4 kg/m³

2.4 Installation

The panels were joined together along their vertical edges with 3.2 mm diameter x 9.6 mm long stainless steel blind rivets at 300 mm centres on both faces. BOSS Firesilicone-EMA sealant was applied into the female joint detail prior to installation of the adjacent panel.

Mild steel angles, 50 mm x 50 mm x 1.2 mm thick, were placed on the top, bottom and left hand vertical edge (when viewed from the unexposed face) of the wall on both faces. The angles were secured to the panels with 3.2 mm diameter x 9.6 mm long stainless steel blind rivets at 200 mm centres and to the concrete specimen holder with M6 x 60 mm Dynabolts at nominally 400 mm centres, 100 mm from each end. BOSS Firesilicone-EMA sealant was applied to the inside faces of the angles which contacted the panels. The right hand vertical edge was not secured to the specimen holder and ceramic fibre was placed between the panel edge and the specimen holder.

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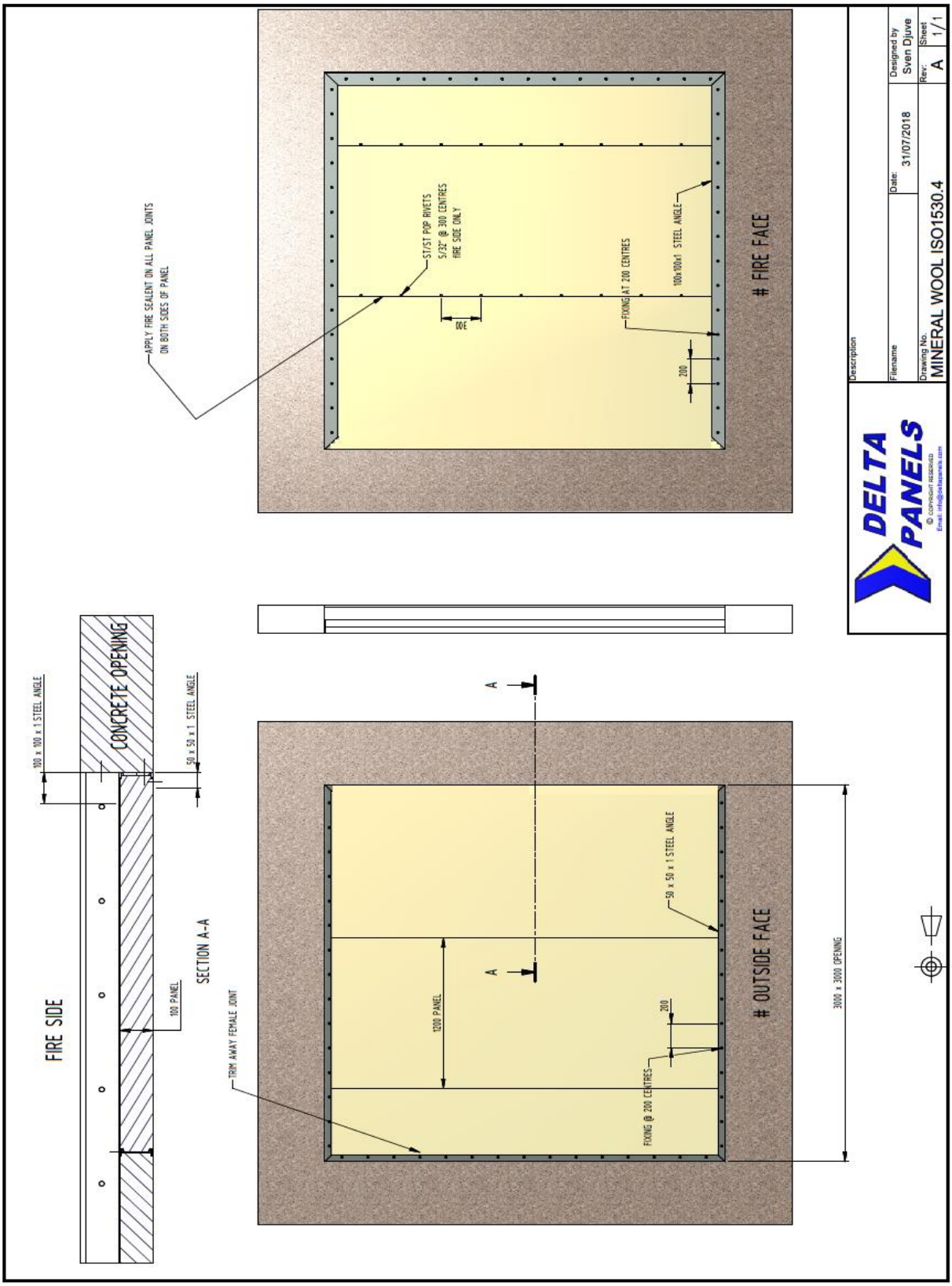
Figure 1: Client Supplied Drawing of Wall



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3. TEST CONDITIONS AND RESULTS

3.1 General

The specimen was tested on 12 September 2018, at the BRANZ laboratories at Judgeford, New Zealand in the presence of the client.

The ambient temperature at the beginning of the test was 8°C.

The specimen was placed against the vertical furnace and the temperature and pressure conditions were controlled to the limits defined in AS 1530.4:2014.

The test was terminated after the specimen had been exposed to the standard fire resistance conditions for 122 minutes.

3.2 Furnace Conditions

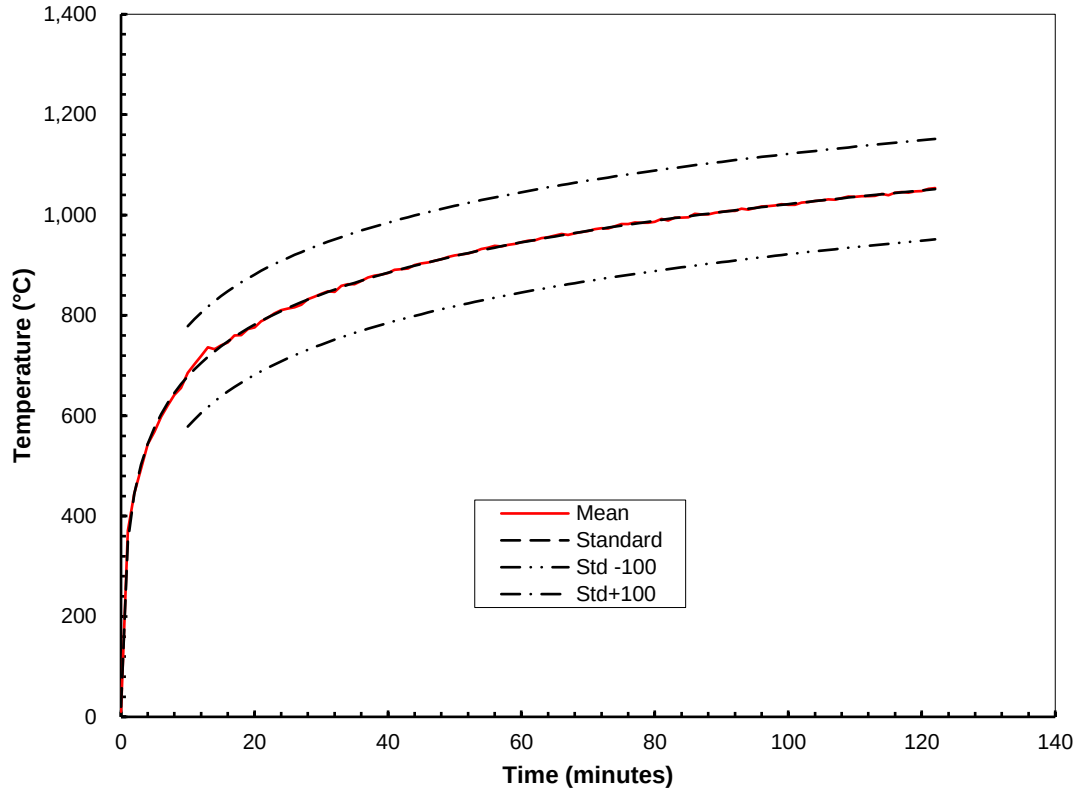
3.2.1 Furnace Temperature Measurement

Temperature measurement within the furnace was made using twelve mineral insulated metal sheathed (MIMS) chromel-alumel thermocouples uniformly distributed in a vertical plane approximately 100 mm from the exposed face of the specimen.

The furnace thermocouples were connected to a computer controlled data logging system which recorded the temperatures at 15 second intervals.

Figure 2 shows the furnace temperature curve and the permitted upper and lower limits in accordance with AS 1530.4-2014.

Figure 2: Furnace Temperature



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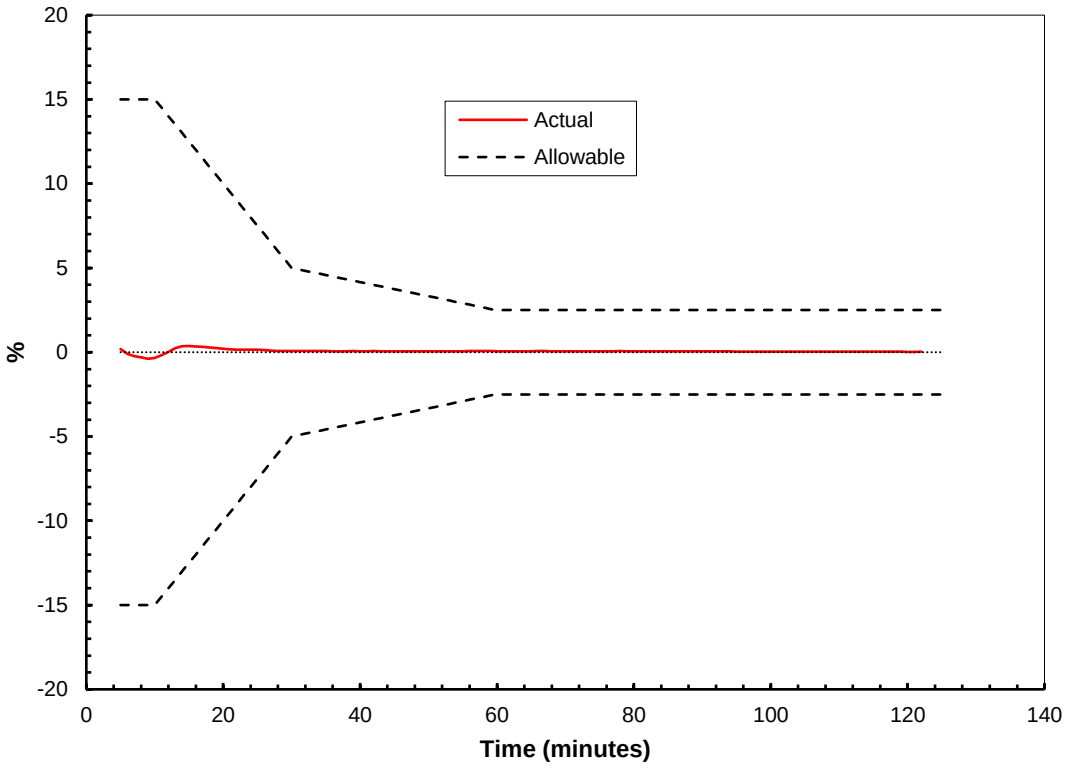
3.2.2 Furnace Control

The percentage deviation of the area of the furnace mean temperature from the standard temperature/time curve was within the standard requirements.

Figure 3 shows the percentage deviation of the mean furnace temperature from the Standard curve.

Figure 3: Percentage Deviation from Standard Curve



3.2.3 Pressure Measurements

The differential pressure of the furnace above the laboratory atmosphere was controlled to be 0 Pa at 500 mm above the notional floor which corresponds to 3.2 Pa at the pressure probe in the furnace. The differential pressure was monitored using a micromanometer connected to a computer controlled data logging system which recorded the pressure at 15 second intervals.

Figure 4 shows the furnace pressure variation with time.

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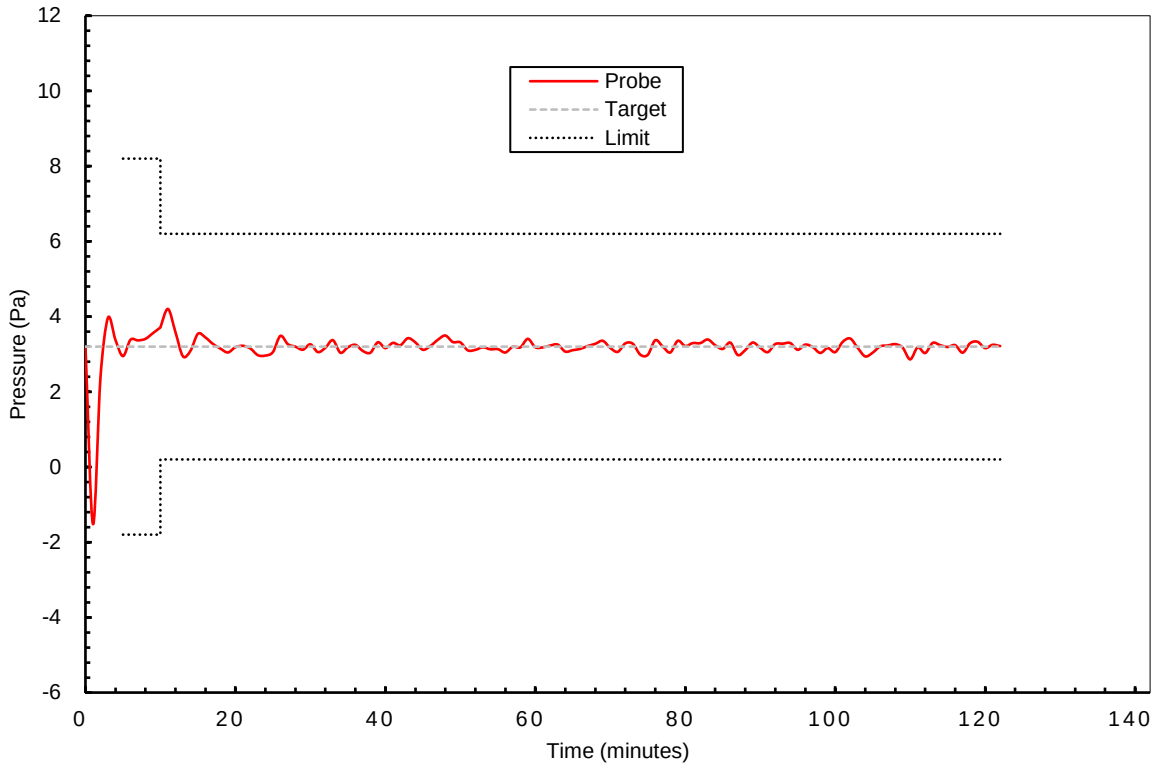
Figure 4: Furnace Pressure



In summary, the furnace conditions complied with the test standard.

3.3 Specimen Temperature Measurement

The temperature on the unexposed face of the test specimen was measured using chromel-alumel thermocouples mounted on copper discs and covered with insulating pads, in accordance with clause 2.2.3 of the test standard.

The thermocouples were placed on the wall as shown in Figure 5.

All the thermocouples described above were connected to a computer controlled data logging system which recorded the temperatures at 15 second intervals.

A roving thermocouple was available for measuring temperatures elsewhere on the specimen.

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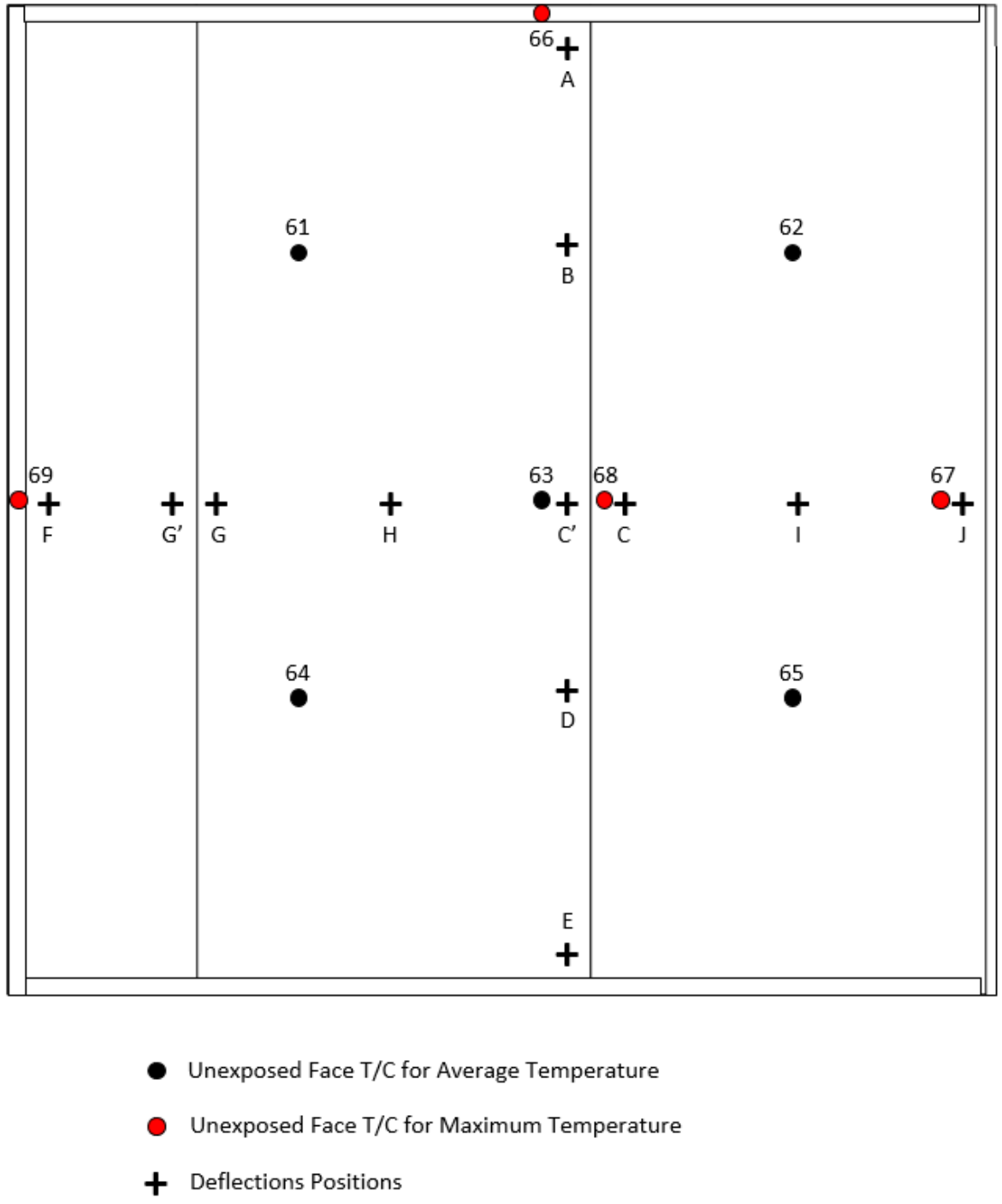
Figure 5: Thermocouple Locations and Deflection Points



3.4 Insulation

The maximum temperature rise measured on the unexposed face of the wall exceeded the maximum Insulation failure criteria of 180 K after 72 minutes into test. The failure was measured using the roving thermocouple adjacent to a panel joint.

Graphs of the mean and maximum temperature rise of the unexposed face of the wall are shown in Figure 6 and Figure 7.

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Figure 6: Unexposed Average and Maximum Temperature Rise – Key Thermocouples

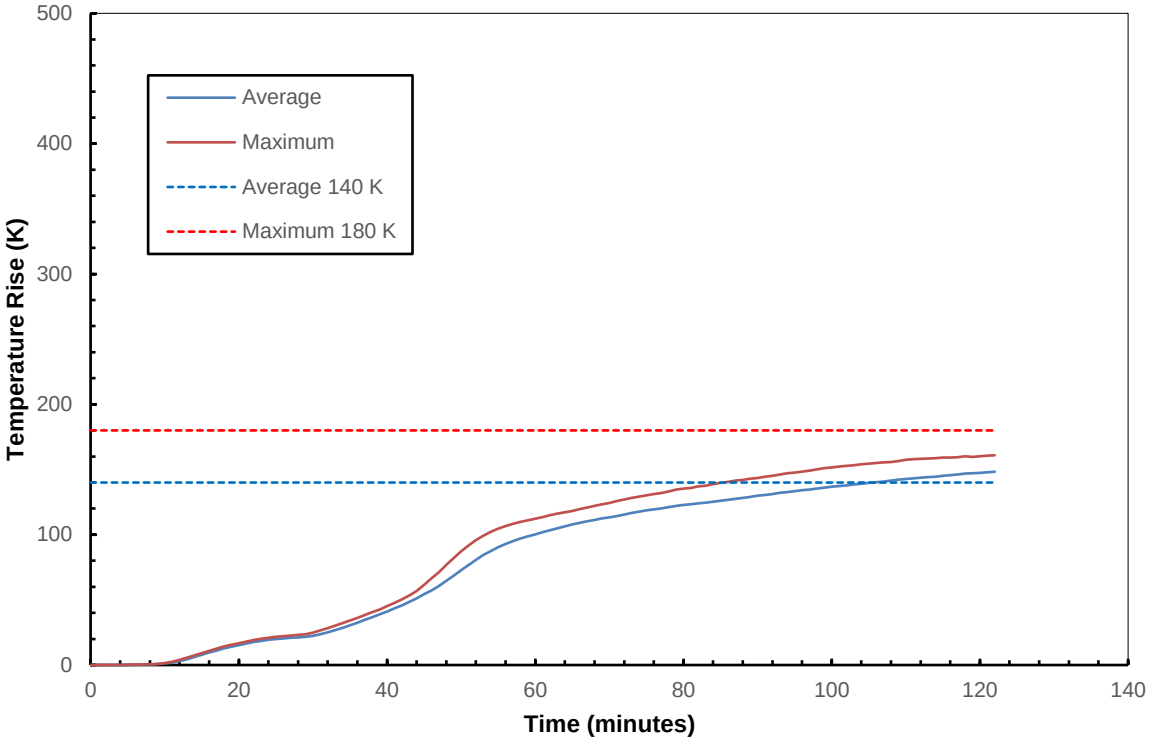
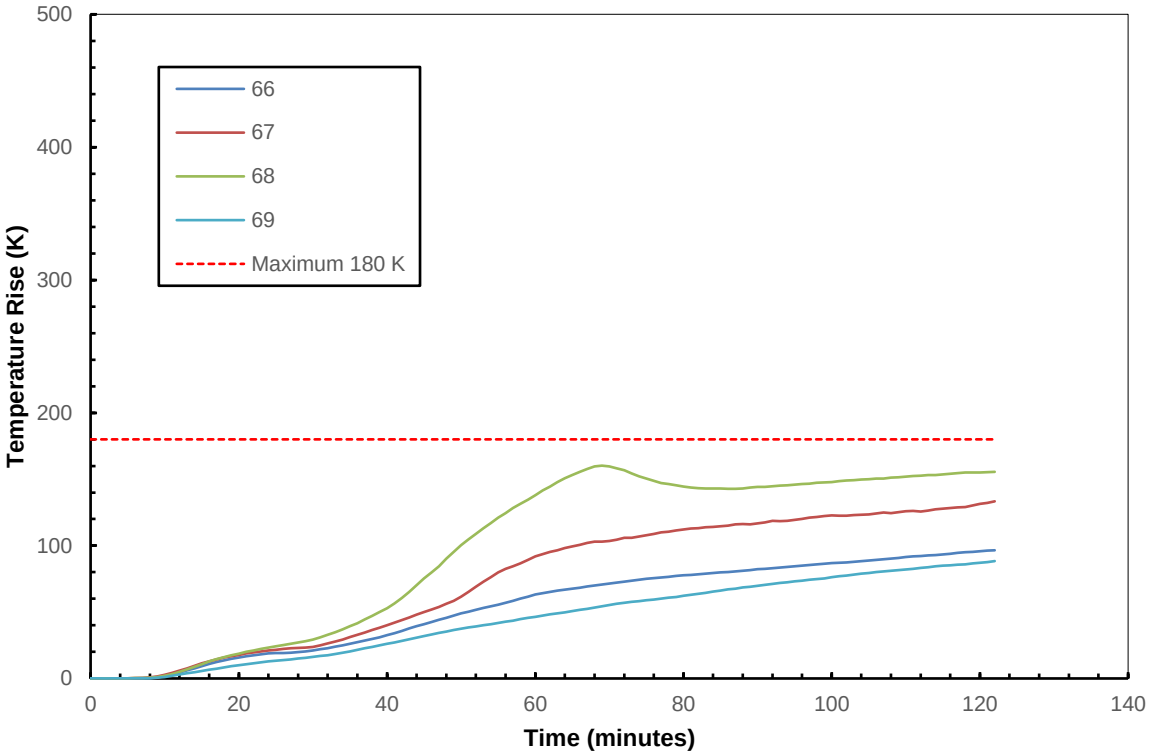


Figure 7: Unexposed Maximum Temperature Rise – Additional Thermocouples



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3.5 Integrity

The wall satisfied the integrity criteria for the 122 minute test duration.

3.6 Deflection Measurements

The lateral deflections on the unexposed face at the positions shown in Figure 5 were measured using a theodolite and rule. The maximum measured deflection was 65 mm away from the furnace at three quarter height and mid width of the wall (deflection point B). The results are summarised in Table 1.

Table 1: Lateral Deflection Measurements of the Wall

Deflection Location	Time (minutes) Deflection (mm)						
	15	30	45	60	75	90	105
A	-3	-6	-6	-9	-10	-11	-12
B	-21	-25	-37	-50	-55	-60	-65
C'	-25	-29	-38	-55	-49	-50	-52
C	-25	-30	-38	-55	-48	-49	-51
D	-15	-20	-27	-47	-48	-50	-54
E	1	0	1	1	1	0	0
F	-1	-1	-37	-1	-1	-1	-2
G'	-15	-23	-39	-43	-37	-40	-47
G	-16	-24	-41	-43	-37	-40	-48
H	-20	-21	-29	-46	-51	-55	-60
I	-20	-20	-23	-33	-39	-45	-54
J	-19	-17	-19	-19	-20	-20	-22

The negative numbers are lateral deflection towards the furnace and positive numbers are lateral deflection away from the furnace.

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3.7 Test Observations

Observations related to the performance of the specimen were at the times stated in minutes and seconds.

U = Observations from the unexposed face.
E = Observations from the exposed face.

Table 2: Test Observations

Time (Min:Sec)	Test Face	Observations
00:00	-	Test commences.
10:00	U	Smoke issue commences from the head of the specimen.
30:00	E	The panel joints remain tight on the exposed face. No significant visible change on the unexposed face.
40:00	U	A slight rippling of the steel sheet at the top left corner on the unexposed face is visible.
50:00	E	The panel joints remain tight on the exposed face.
60:00	-	The specimen continues to satisfy all of the test criteria.
64:00	U	Discolouration of the steel sheet adjacent to the left hand side panel joint adjacent to thermocouple 64 is occurring,
72:10	U	Roving thermocouple applied to area of discolouration visible at the panel joint adjacent to thermocouple 64, 200ºC recorded. **Maximum rise Insulation failure is deemed to have occurred.**
73:00	U	The left hand panel joint where the Insulation failure occurred is beginning to open up slightly.
90:00	-	The specimen continues to satisfy the Integrity criteria of the test.
95:00	U	Roving thermocouple applied to area of discolouration visible at the panel joint adjacent to thermocouple 64, 285ºC recorded, cotton pad applied but did not ignite.
110:00	U	The left hand panel joint has opened up to approximately 4 mm wide.
120:00	-	The specimen continues to satisfy the Integrity criteria of the test.
122:00	-	Test discontinued at the request of the client.

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4. SUMMARY

The test results in accordance with AS 1530.4:2014, “Methods for fire tests on building materials, components and structures – Part 4: Fire – resistance test for elements of construction” was as follows:

Integrity	122 minutes No Failure
Insulation	72 minutes

The tested specimen is deemed to have achieved an FRL of -/120/60

The test standard requires the following statements to be included:

"The results of these fire tests 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."

"This report details methods of construction, the test conditions and results obtained when the specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variations with respect to size, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, is not covered by this report."

“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.”

5. PERMISSIBLE VARIATIONS

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority, 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 if the specimen was tested with one vertical edge unrestrained.
(b) Increase in thickness of the wall.

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PHOTOS

Photo 1: The Unexposed Face of the Specimen Prior to Testing

Photo 2: The Unexposed Face of the Specimen After a Duration of 20 Minutes

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Photo 3: The Unexposed Face of the Specimen After a Duration of 40 Minutes

Photo 4: The Unexposed Face of the Specimen After a Duration of 60 Minutes

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Photo 5: The Unexposed Face of the Specimen After a Duration of 120 Minutes

Photo 6: The Exposed Face of the Specimen Immediately After Testing

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