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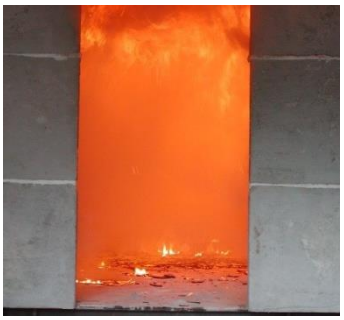

BRANZ Type Test

FR 5740-TT [2016]

FIRE RESISTANCE OF A LOAD BEARING TIMBER FRAMED WALL LINED WITH 50 MM THICK RESENE CONSTRUCTION SYSTEMS INTEGRA PANEL AND 10 MM STANDARD PLASTERBOARD

CLIENT
Resene Construction Systems
10b Abros Place
Burnside
Christchurch
New Zealand

This Laboratory is accredited by International Accreditation New Zealand (IANZ). The tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

TEST SUMMARY

Objective

To determine the fire resistance of a load bearing wall system when tested in accordance with AS 1530.4 – 2005 “Methods for fire tests on building materials, components and structures, Part 4: Fire–resistance test of elements of construction.”

Test sponsor

Resene Construction Systems
10b Abros Place
Burnside
Christchurch
New Zealand

Description of test specimen

The test specimen consisted of a nominally 3,000 mm wide x 2,900 mm high load bearing timber framed wall lined with 50 mm thick horizontal Integra AAC panels to the exposed face and 10 mm thick GIB® Standard plasterboard to the unexposed face. Two of the framing cavities were filled with polyester insulation.

Date of test

16 December 2015

Test results

The test results in accordance with AS 1530.4 – 2005, “Methods for fire tests on building materials, components and structures – Part 4: Fire – resistance test of elements of construction” was as follows:

Stability	167 minutes	No failure
Integrity	167 minutes	No failure
Insulation	159 minutes	

The fire resistance level (FRL) of the tested specimen is as follows: 120/120/120

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."

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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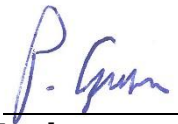


Author

Paul Chapman
Senior Fire Testing Engineer
IANZ Approved Signatory

Reviewer

E. Soja
Senior Fire Safety Engineer

DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	EXPIRY DATE	DESCRIPTION
1	3 March 2016	3 March 2021	Initial Issue

1. TEST SPECIFICATION

The test was conducted in accordance with AS 1530.4-2005 *"Methods for fire tests on building materials, components and structures,* Part 4: *Fire-resistance tests of 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 Structural Adequacy

Failure in relation to structural adequacy shall be deemed to have occurred when collapse occurs, or when the axially loaded element exceeds a contraction of C=*h*/100 mm; or when the rate of axial contraction exceeds 3*h*/1000 mm/min where "*h*" is the initial height.

For the test specimen the maximum allowable contraction was 29 mm and the maximum allowable rate of contraction was 8.7 mm per minute.

1.2 Integrity

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) 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.

1.3 Insulation

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 nominally 3,000 mm wide x 2,900 mm high load bearing timber frame lined with 50 mm thick horizontal Integra AAC panels to the exposed face and 10 mm thick GIB® Standard plasterboard to the unexposed face. Two of the framing cavities were filled with polyester insulation.

2.2 Plans and Specification

Copies of the client supplied specification are given in this report as Figure 1 to Figure 5. Further details of the tested specimens 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 drawings exist, the report takes precedence.

2.3 Construction

2.3.1 Framing

The load bearing framing consisted of nominal 90 mm x 45 mm MSG 8 timber studs at 600 mm centres with nogs at 800 mm centres from the bottom of the wall. There were four load bearing studs with two floating studs cut approximately 50 mm short at the top and bottom positioned on the vertical sides of the specimen frame. These perimeter studs were cut short and were not fixed to the specimen frame so that they carried no load but provided fixing for the lining at the edges of the wall. The gap between the perimeter studs and the concrete lined specimen frame was filled with a ceramic fibre blanket to provide minimum restraint to the wall consistent with an adequate seal to the passage of furnace gases.

The top plate was secured directly to the top of the opening in the test frame with M16 bolts at nominally 500 mm centres. The bottom plate was placed on top of concrete filled blocks nominally 100 mm high and positioned to be flush to the exposed face. The bottom plate was then secured through the blocks into the test frame with M12 threaded rod and washers/nuts at nominally 500 mm centres.

The framing was nailed together with two 90 mm x 3.15 mm diameter nails at each framing junction.

Over the exposed face of the timber frame, finger jointed 45 mm x 20 mm timber battens were nailed to the studs and top plate with 75 mm x 3.15 mm nails at 400 mm centres.

The measured properties of the timber framing was as follows:

Density	490 kg/m^3
Moisture content	9.9%

2.3.2 Wall lining

On the exposed face, the 50 mm thick Integra lightweight concrete panels were installed horizontally with a full 2,200 mm long panel and a 790 mm long panel for each row. The vertical panel butt joints were offset by nominally 1,400 mm centres up the wall. The panels were screw fixed with three 14g x 100 mm long screws to each stud. The screw fixing was no closer than 50 mm to a vertical end and 60 mm from a horizontal edge of each panel.

The first row of panels was positioned 50 mm below the bottom plate so that it over-hung the framing. A uPVC Resene Construction Systems Starter Strip Flashing was secured to the bottom edge of the lower row of panels. The flashing was secured with a bead of Bostik "TUF AS NAILS" builders adhesive and nailed with 2.8 mm diameter x 40 mm long nails at 400 mm centres.

All panel joints were bedded in Rockcote Multistop thin bead adhesive.

On the unexposed face the framing was lined with 10 mm thick GIB® Standard plasterboard. The boards were secured with Gorilla Wallboard adhesive and screw fixed with 6g x 41 mm at 300 mm centres. The joints between the edges of the sheets of plasterboard were stopped with paper tape and GIB® Tradeset™ 45 stopping plaster. All screw heads were also stopped with plaster.

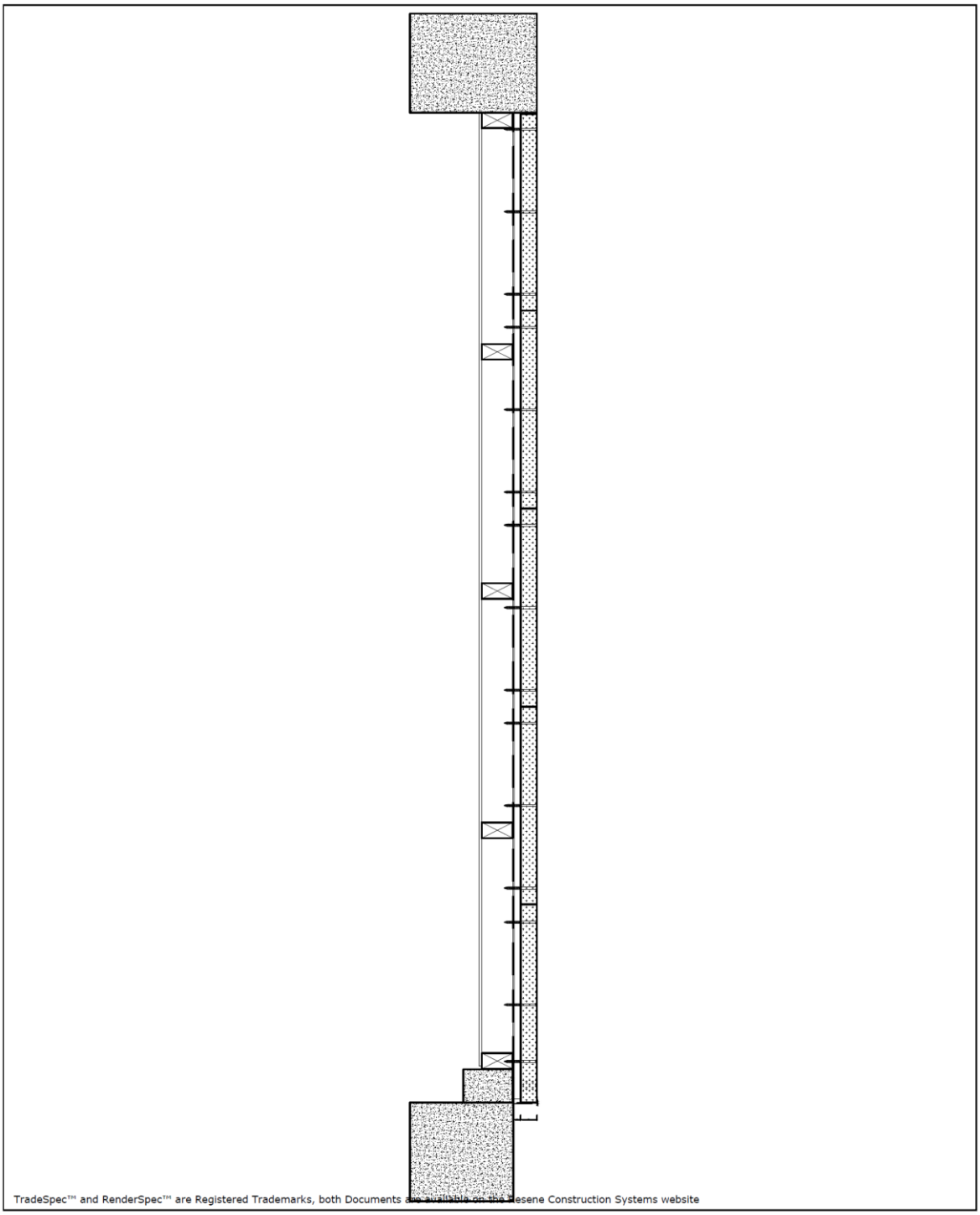
2.3.3 Insulation

As viewed from the unexposed face the two left hand frame cavities were filled with nominally 90 mm thick Autex GreenStuf R2.2 polyester insulation with a stated weight of 510g/m^2.

2.3.4 Building wrap

Thermakraft 215 bituminous building paper was stapled over the timber framing before the timber battens were installed.

Figure 1: Client supplied drawing – section view



Resene Construction Systems

System: Integra Lightweight Concrete Facade System

Scale: NTS @ A4

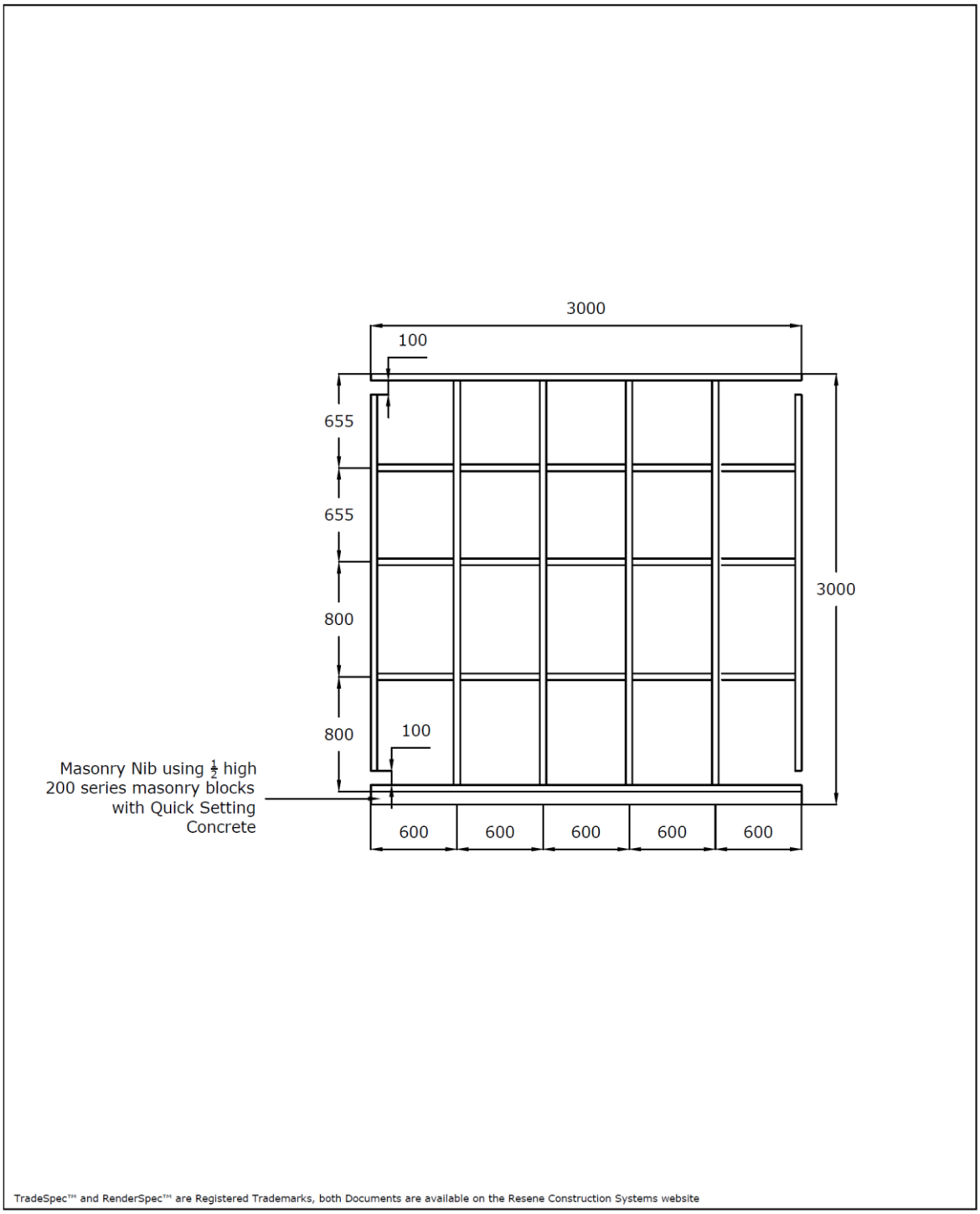
Substrate: Integra Panel 50mm

Date: 25 February 2016

Drawing Name: Section

Sheet: 10.02.00

Figure 2: Client supplied drawing – framing layout



TradeSpec™ and RenderSpec™ are Registered Trademarks, both Documents are available on the Resene Construction Systems website

Resene Construction Systems

System	Scale
Integra System	NTS
Substrate	**Date**
Integra Substrate	7 December 2015
Drawing Name	**Sheet**
Framing Layout	10.02.00

Figure 3: Client supplied drawing – panel layout

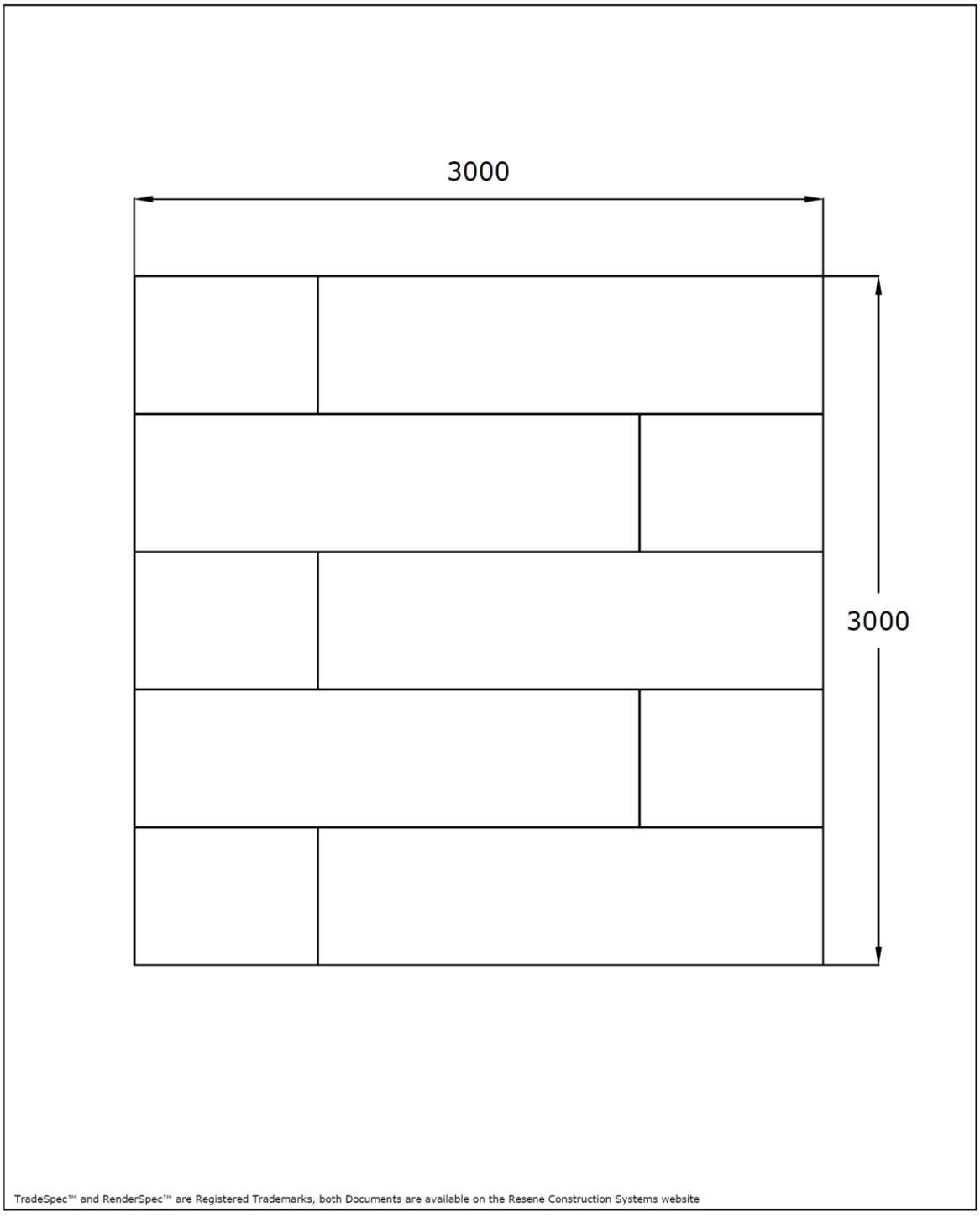
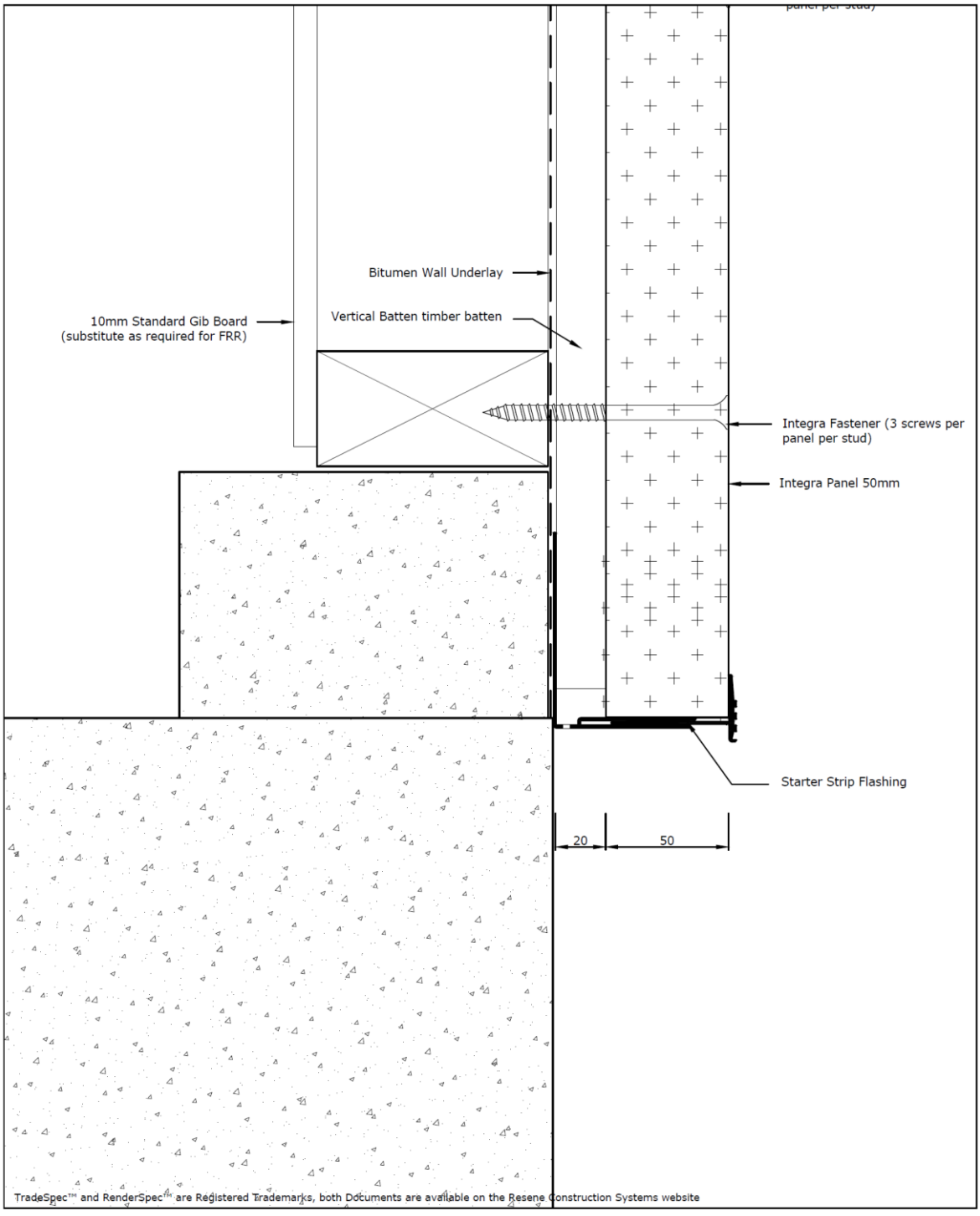


Figure 4: Client supplied drawing - foundation



Resene Construction Systems

System: Integra Lightweight Concrete Facade System

Scale: 1 : 2 @ A4

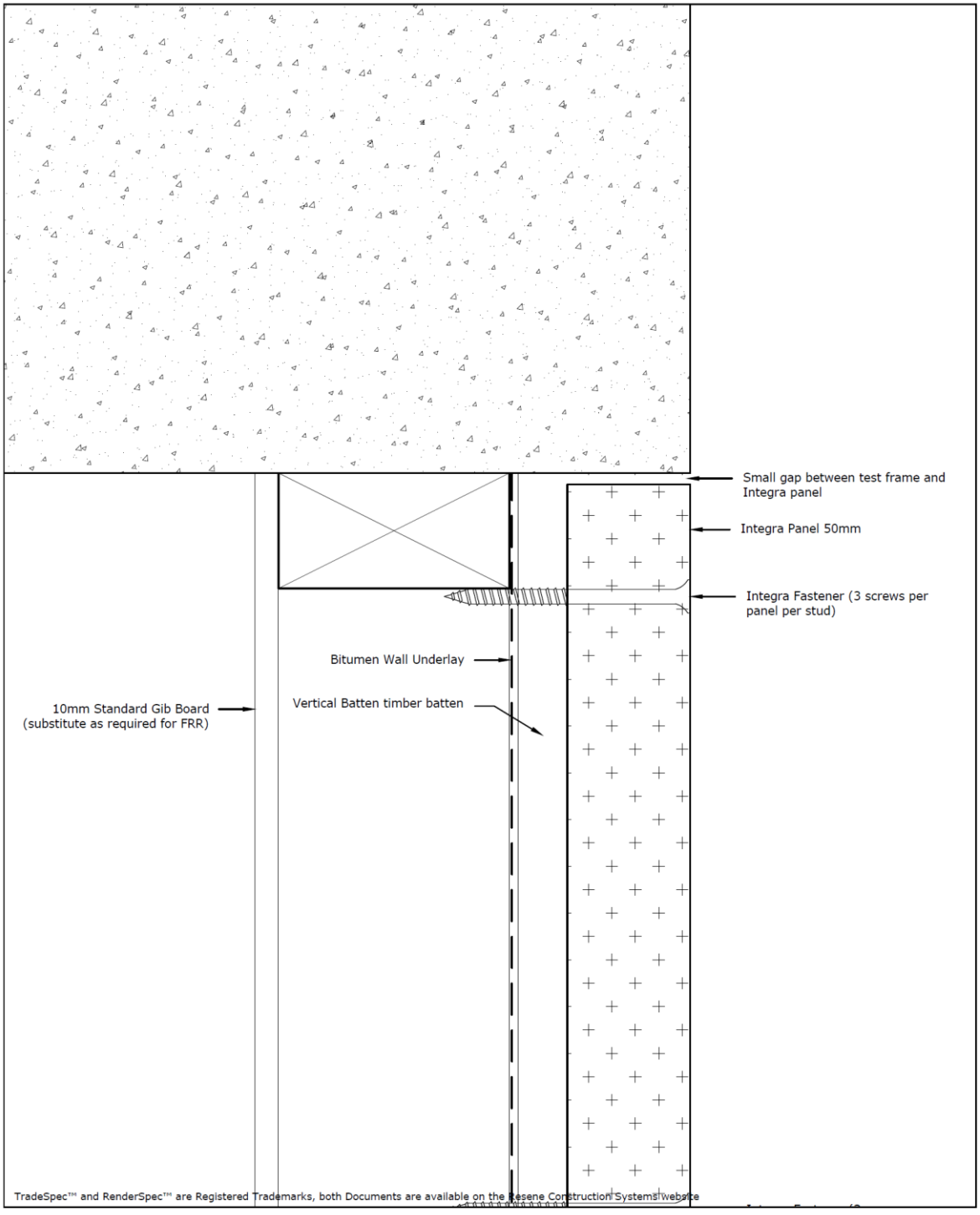
Substrate: Integra Panel 50mm

Date: 25 February 2016

Drawing Name: Foundation

Sheet: 10.02.00

Figure 5: Client supplied drawing – top of wall



Resene Construction Systems

System: Integra Lightweight Concrete Facade System

Scale: 1 : 2 @ A4

Substrate: Integra Panel 50mm

Date: 25 February 2016

Drawing Name: Top of Wall

Sheet: 10.02.00

3. TEST CONDITIONS AND RESULTS

3.1 General

The specimen was tested on 16 December 2015, at the BRANZ laboratories at Judgeford, New Zealand.

The ambient temperature at the beginning of the test was 15°C.

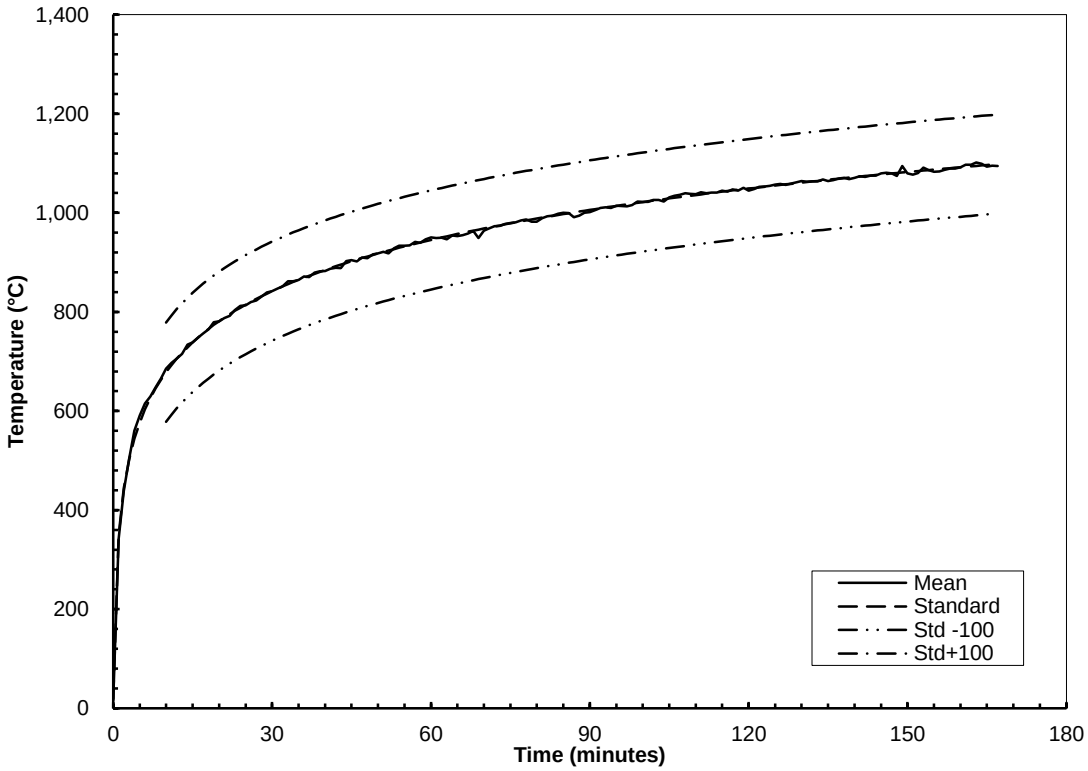
The test was terminated after the specimen had been exposed to the standard fire resistance conditions for 167 minutes.

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

The furnace thermocouples were connected to a computer controlled data logging system which recorded the temperatures at 15 second intervals. Figure 6 shows the furnace temperature curve and the permitted upper and lower limits in accordance with AS 1530.4-2005.

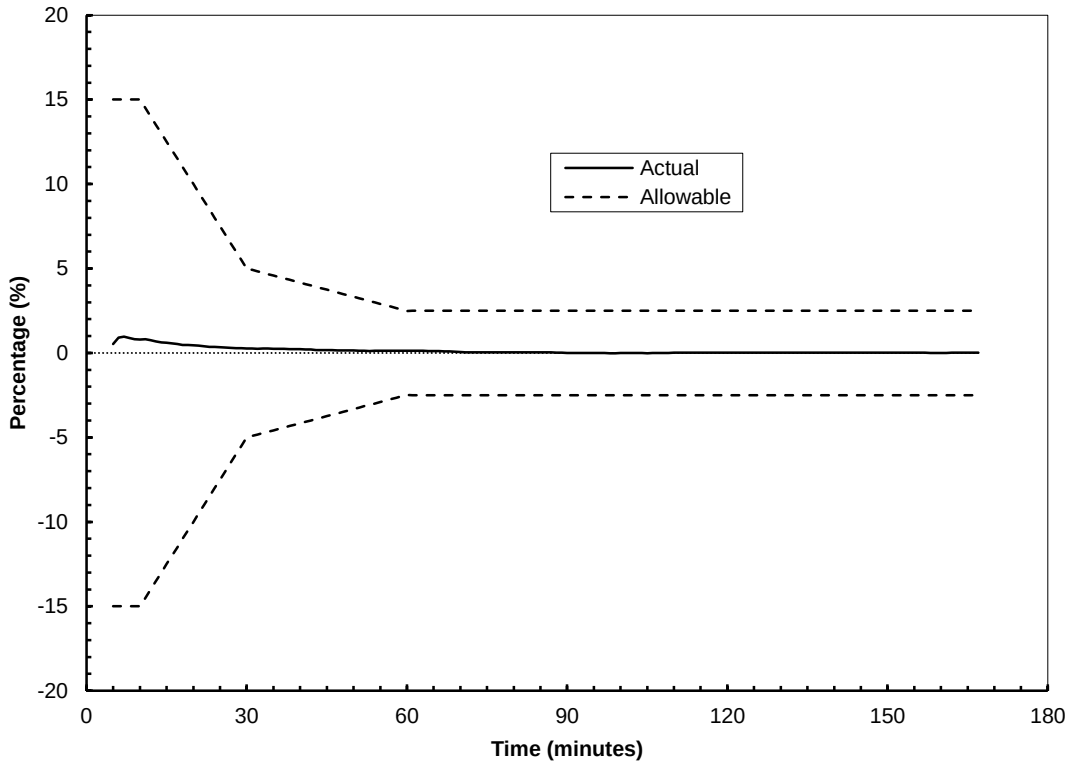
Figure 6: Furnace Temperature



3.3 Furnace Control

The percentage deviation of the furnace mean temperature from the standard time temperature curve is shown in Figure 7.

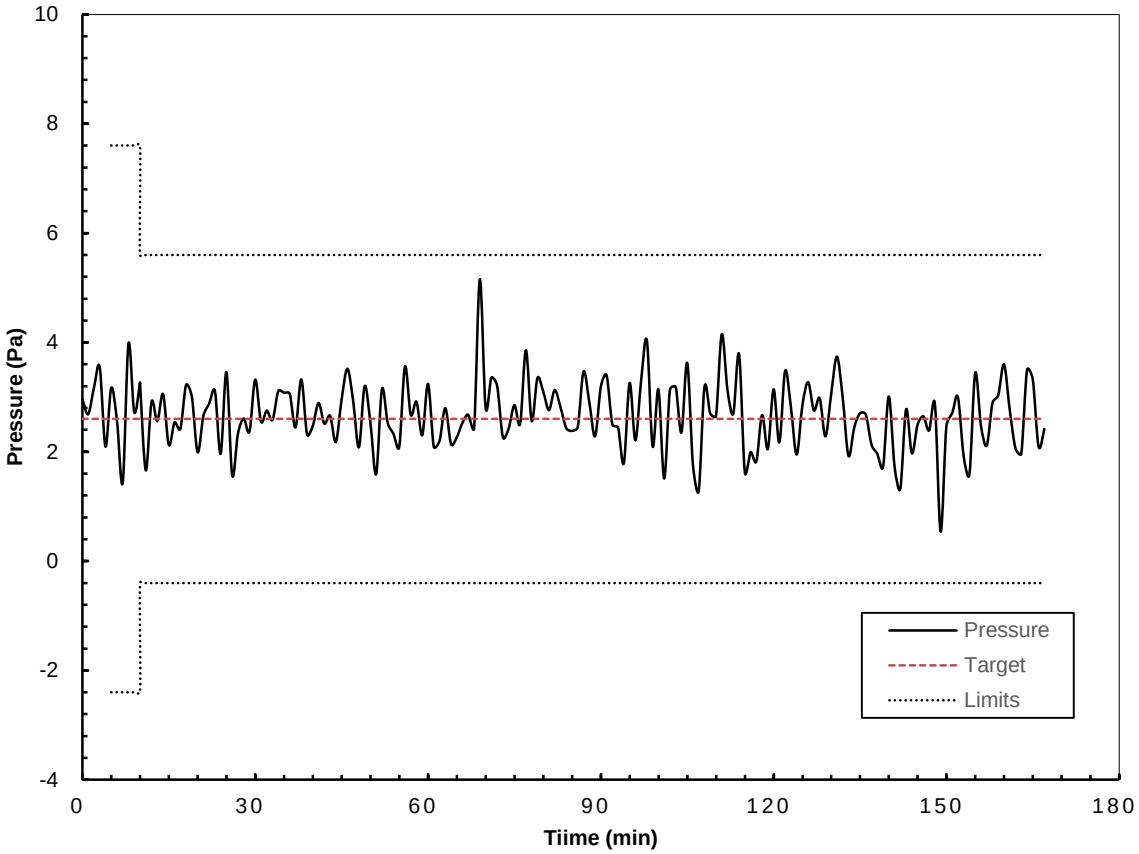
Figure 7: Percentage Deviation from Standard Curve



3.4 Pressure Measurement

The differential pressure of the furnace above the laboratory atmosphere was controlled to be neutral nominally 500 mm above the notional floor which corresponds to 2.6 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 8 shows the furnace pressure variation with time.

Figure 8: Furnace Pressure



The furnace pressure met the requirements of the standard for the duration of the test.

3.5 Specimen Temperature Measurement

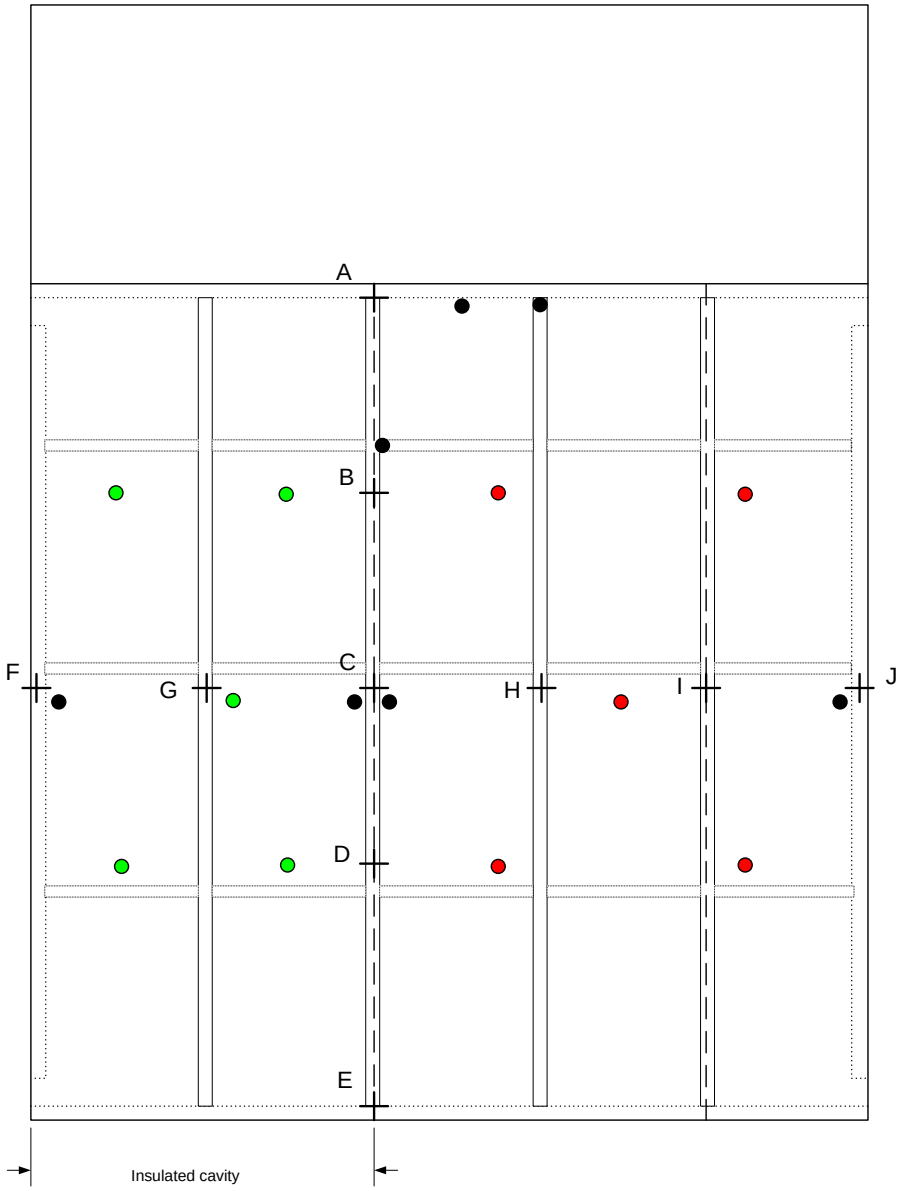
The temperature on the unexposed face of the test specimens was measured using chromel-alumel thermocouples mounted on copper discs and covered with insulating pads, in accordance with clause 2.2.3 of the test standard. The thermocouples were placed on the unexposed face of the wall as shown in Figure 9.

In accordance with the test standard the five thermocouples to measure the average temperature rise of the wall were positioned at the centre and then one at the centre of each quarter section of the wall. For the average temperature measurement the wall was divided into two parts, Insulated where the frame cavity was packed with insulation and Un-insulated. Additional thermocouples were positioned over the wall as required by the test standard subject to the maximum temperature rise criteria.

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.

Figure 9: Thermocouple Locations and Deflection points



3.6 Insulation

3.6.1 Unexposed face – insulated

The insulated part of the wall maintained 140 K average temperature rise criteria for the 167 minute duration of the test. The maximum temperature measured by the thermocouples located at the centre and the centre of the quarter sections exceeded the 180 K maximum temperature raise criteria after 159 minutes.

A graph of the average and maximum temperature rise on the unexposed face of the insulated part of the wall is shown in Figure 10.

3.6.2 Unexposed face – uninsulated

The insulated part of the wall maintained 140 K average temperature rise criteria for the 167 minute duration of the test. The maximum temperature measured by the thermocouples located at the centre and the centre of the quarter sections exceeded the 180 K maximum temperature raise criteria after 162 minutes.

A graph of the average and maximum temperature rise on the unexposed face of the insulated part of the wall is shown in Figure 11.

3.6.3 Unexposed face – other thermocouples

The temperature measured at other locations on the unexposed face of the test specimen maintained the maximum temperature criteria for the 167 minute duration of the test.

A graph of the temperature rise measure on other locations on the test specimen on the unexposed face is shown in Figure 12.

Figure 10: Insulated average and maximum temperature rise

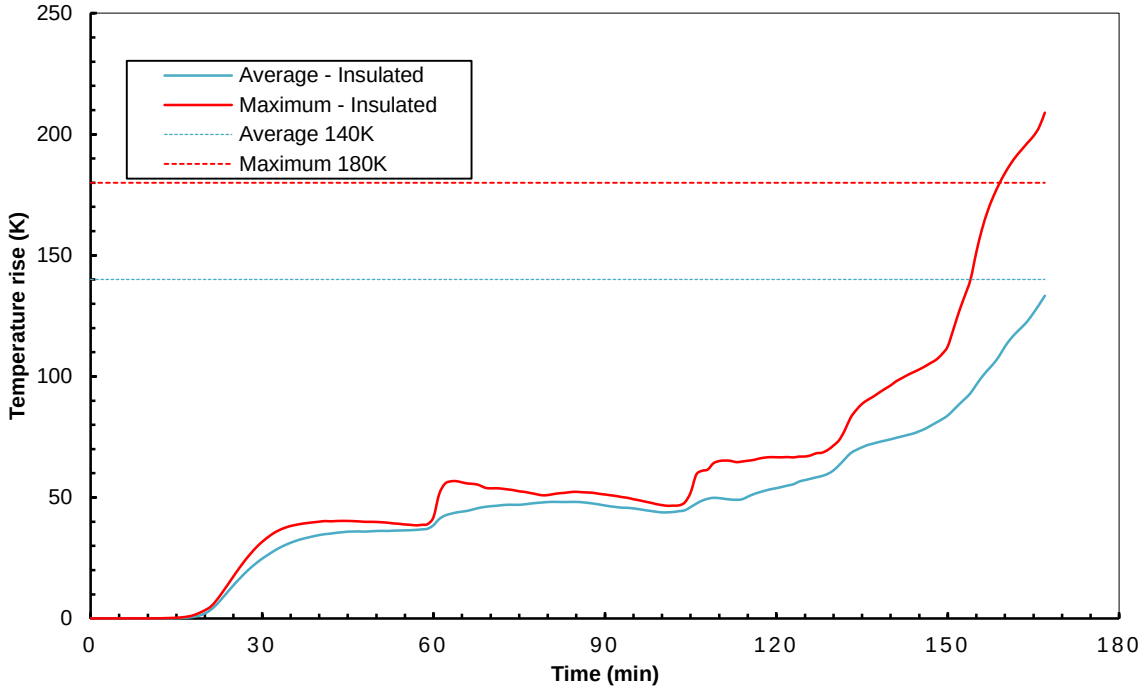


Figure 11: Uninsulated average and maximum temperature rise

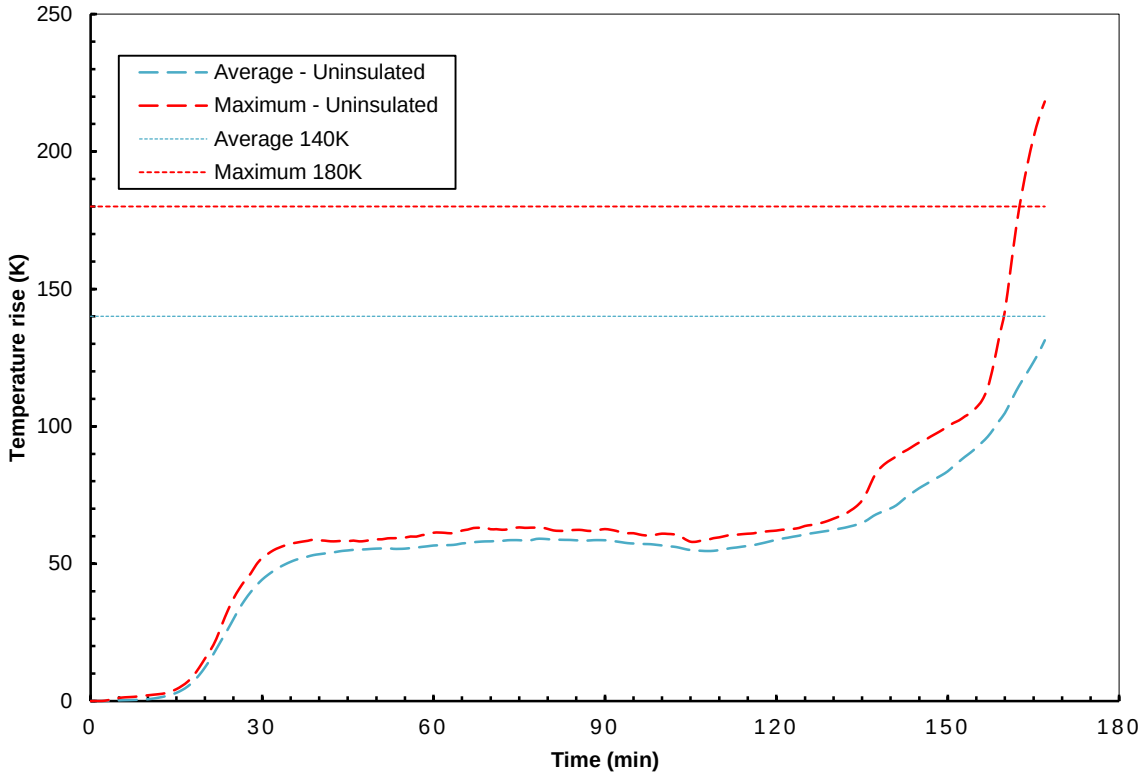
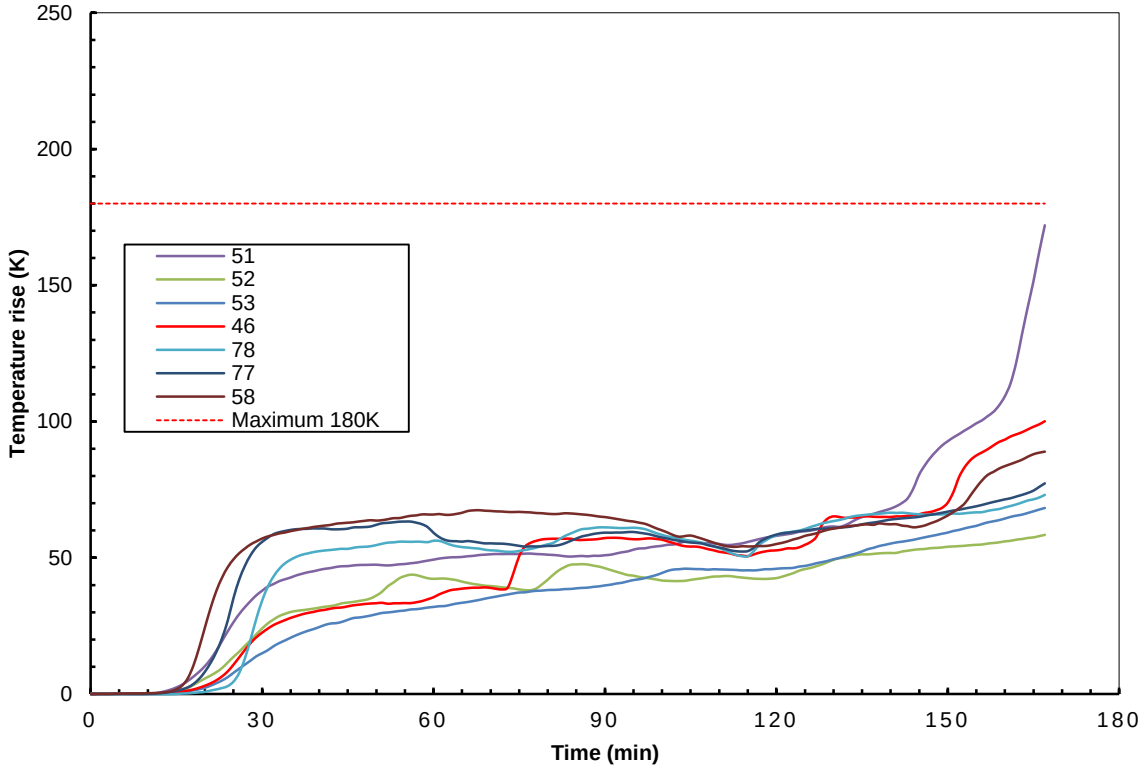


Figure 12: Other thermocouple temperature measurement



3.7 Loading

At the request of the client a load of 5.56 kN/stud was applied to each of the four load bearing studs. The load was applied 30 minutes before the commencement of the test. The load was monitored using a load cell, placed between each of the two jacks and the moveable platen, and connected to a computer controlled data logging system which recorded the load at 15 second intervals.

3.8 Deflection measurements

3.8.1 Axial deflection

The maximum measured deflection of the loading platen during the test was 12.4 mm at 167 minutes. A positive number indicates a reduction in wall height. The maximum measure rate of deflection was 3.4 mm/minute at 167 minutes.

Figure 13 shows the axial deflections of the loading platen during the test. Figure 14 shows the rate of deflection.

Figure 13: Axial deflection of the wall

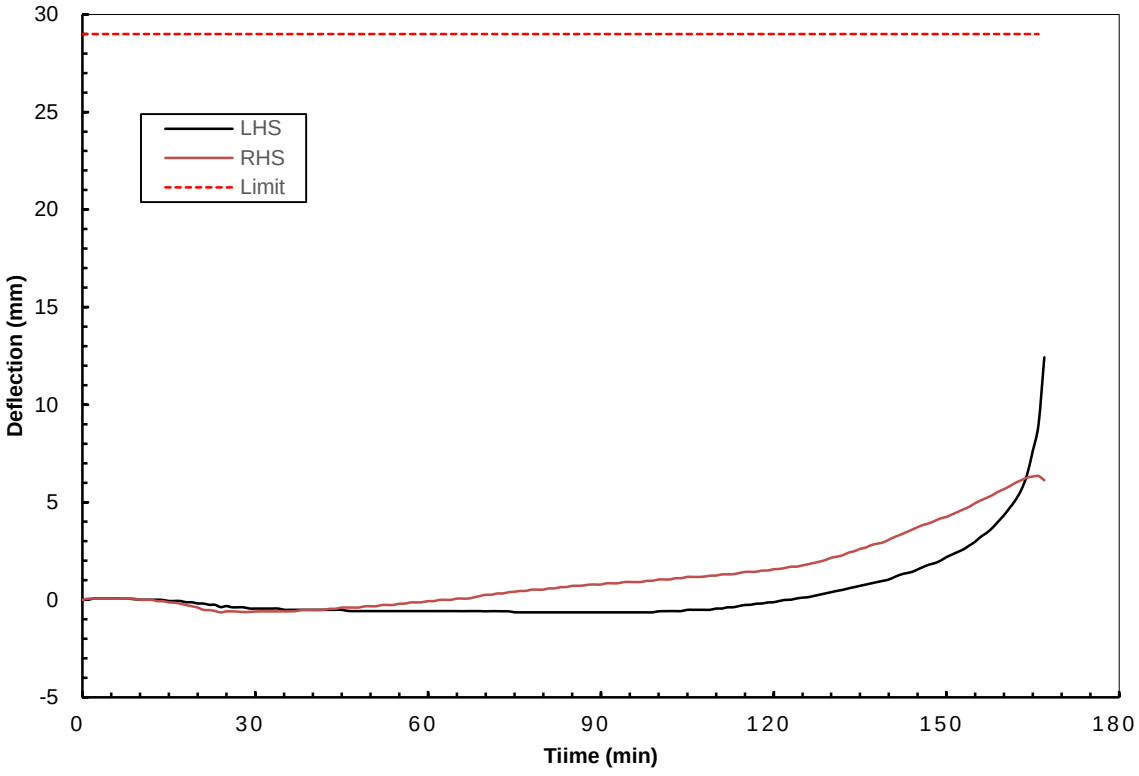
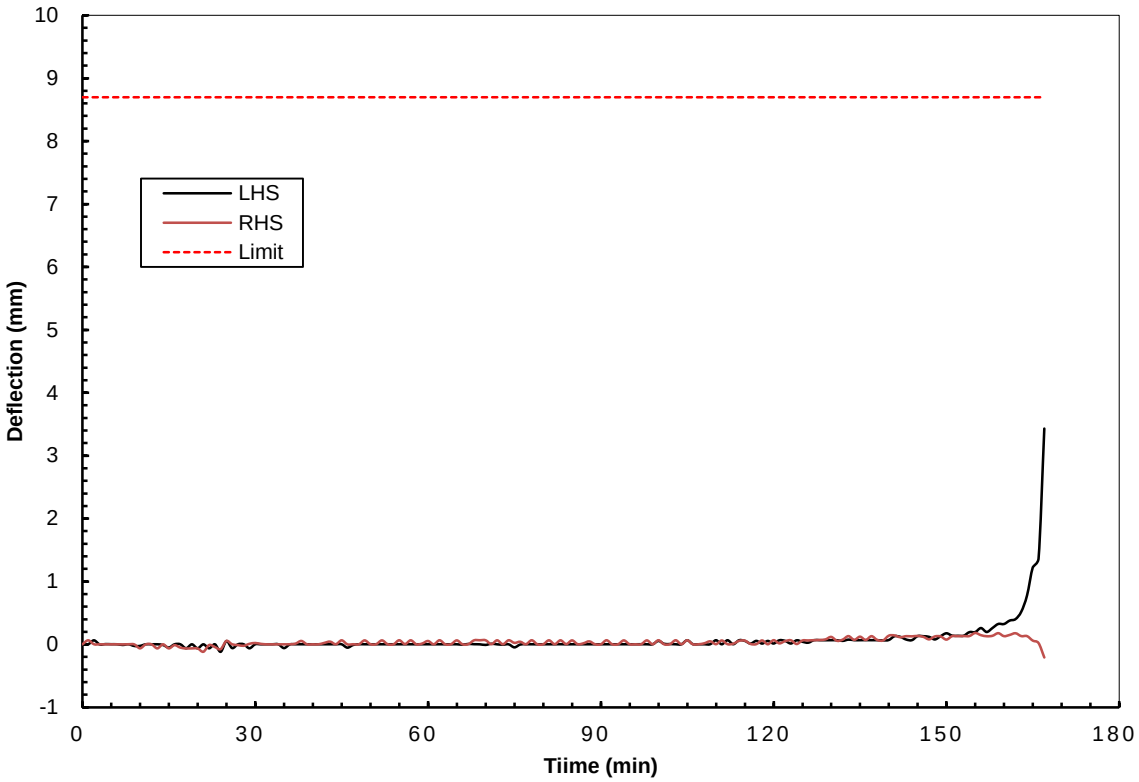


Figure 14: Rate of deflection of wall



3.8.2 Lateral deflection

The lateral deflection of the wall was measured using a theodolite and rule at the deflection location points is shown in Figure 9.

The maximum measured deflection of the wall was 12 mm towards the furnace measured at 90 minutes at mid height of the third load bearing stud (from the left hand side).

Table 1 gives the lateral deflection data measure during the test at the locations indicated in Figure 9.

Table 1: Lateral deflection measured during the test

Negative deflection towards furnace										
Time	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**	**135**	**150**
A	-1	-2	-3	-5	-7	-8	-9	-9	-9	-10
B	-4	-3	-7	-7	-9	-9	-9	-10	-7	-1
C	-6	-4	-5	-10	-10	-11	-9	-7	-1	5
D	-2	-1	-2	-5	-7	-5	-5	-4	0	3
E	0	1	1	1	1	0	2	2	3	2
F	0	1	1	0	1	1	0	2	0	1
G	-4	-3	-4	-8	-8	-10	-10	-6	-1	3
H	-3	-1	-3	-7	-10	-12	-10	-9	-5	-1
I	-2	0	-2	-7	-8	-9	-9	-9	-9	-9
J	1	2	1	2	1	-1	1	1	2	2

3.9 Structural Adequacy

The test specimen maintained the load for the duration of the test and therefore maintained the Structural Adequacy criteria for the 167 minute duration of the test.

3.10 Observations

Observations relating to the performance of the specimen were at the times stated in Table 2 minutes and seconds.

Table 2: Test Observations

Time (Min:Sec)	Observations	
33:30	E	A crack was visible on the left hand side of the upper panel above a joint in the lower panels.
44:30	E	Minor cracking was visible of the lower panels.
55:00	E	Further cracking was occurring on the panels. This appeared to be slightly worse on the panels on the insulated cavities.
72:00	E	Further cracking was occurring over the visible panels. The largest crack was approximately 1-2 mm in width.
96:00	E	The largest crack on the left hand side was 2-3 mm in width. On the right hand side at the bottom there were horizontal cracks which were approximately 2-3 mm in height.
120:00	E	No significant change. It appears the gaps had reduced in size.
136:00	U	There was a small volume of smoke being emitted from the top of the left hand side of the wall between the plasterboard and test frame.
140:00	U	The stud at location point H had deflected away from the furnace slightly more than the other.
158:00	U	A crackling sound was heard from the wall. Minor discoloration of the paper facing was occurring across the bottom of the wall.
161:00	U	The wall was starting to deflection significantly outwards and the plasterboard facing was starting to deflect to the left hand edge between fixing at approximately 500 mm from the bottom of the wall.
163:00	U	Smoke started to be emitted from the left hand side of the wall where the plasterboard had pulled away from the framing. This was approximately 500 mm from the bottom of the wall.
167:00	-	Test stopped.

3.11 Integrity

The test specimen maintained the Integrity criteria for the 167 minute duration of the test.

4. SUMMARY

The test results in accordance with AS 1530.4 – 2005, “Methods for fire tests on building materials, components and structures – Part 4: Fire – resistance test of elements of construction” was as follows:

Stability	167 minutes	No failure
Integrity	167 minutes	No failure
Insulation	159 minutes	

The fire resistance level (FRL) of the tested specimen is as follows 120/120/120

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.
(b) Increase in thickness of the wall.
(c) Framing –
    a. Increase in timber density;
    b. Increase in cross-sectional dimensions of the framing element(s);
    c. Decrease in sheet or panels sizes;
    d. Decrease in stud spacing; or
    e. Decrease in fixing centres of wall sheet materials.

PHOTOS

Photo 1: Test specimen before start of fire test

Photo 2: Test specimen at 60 minutes exposure

Photo 3: Test specimen at 120 minutes exposure

Photo 4: Test specimen after 160 minutes exposure

BRANZ Type Test Summary

This is to certify that the specimen described below has been tested by BRANZ Ltd on behalf of

Resene Construction Systems
10b Abros Place
Burnside
Christchurch
New Zealand

Test standard: AS 1530.4:2005 Part 4: Fire resistance tests for elements of construction.

Specimen name: Resene Construction Systems Integra external wall system

Specimen description: Timber framed wall with studs at 600 mm centres, Building wrap under 20 mm timber battens lined with 50 mm thick Integra panels to one side and 10 mm thick GIB® stand plasterboard to the other side of the framing

A full description of the test specimen and the test results are given in BRANZ Test Report:

Fire Test FR 5740-TT [2016] – Test date 16 December 2015

Regulatory authorities are advised to examine test reports before approving any product.

Orientation of exposure: From the Integra side

The test results were as follows:

Stability	167 minutes	No failure
Integrity	167 minutes	No failure
Insulation	159 minutes	

FRL 120/120/120

Issue Date: **3 March 2016**

Expiry Date: **3 March 2021**

This Laboratory is accredited by International Accreditation New Zealand (IANZ). The tests reported herein have been performed in accordance with the laboratory's scope of accreditation.