

# Fire-resistance test on a load-bearing vertical separating element

## Test Report

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**Report number:** FSV 2075 (Revision B)  
**Date:** 24 March 2021

**Client:** Ritek Systems Pty Ltd

Commercial-in-confidence

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**Report Status and Revision History:**

VERSION	STATUS	DATE	DISTRIBUTION	ISSUE NUMBER
Revision A	Final for issue	06/02/2020	CSIRO/CLIENT	FSV 2075
Revision B	Amend for re-issue	24/03/2021	CSIRO/CLIENT	FSV 2075

This report supersedes FSV 2075 issued 6 February 2020 due to a change in ownership of the Intellectual Property associated with manufacturer and trade name of the product/system described in the report. The sponsor has confirmed there has been no change to the design and material specifications of the product/system referenced in this report.

**Report Authorization:**

AUTHOR	REVIEWED BY	AUTHORISED BY
Chris Wojcik	Brett Roddy	Brett Roddy
		
24 March 2021	24 March 2021	24 March 2021

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# Fire-resistance test on a load-bearing vertical separating element

## Sponsored Investigation No. FSV 2075

### Revision B

## 1 Introduction

### 1.1 Identification of specimen

The sponsor identified the specimen as a load-bearing, concrete core filled Ritek 150X-Plus wall system.

### 1.2 Sponsor

Ritek Systems Pty Ltd  
19 Lowermill Road  
COOROY QLD

### 1.3 Manufacturer

James Hardie Australia Pty Ltd  
10 Colquhoun Street  
Rosehill NSW

### 1.4 Test standards

Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2014, Fire-resistance tests of elements of construction.

Section 3: Walls – Vertical Separating Elements.

### 1.5 Test number

CSIRO Reference test number FS 4949/4473

### 1.6 Test date

The fire-resistance test was conducted on 20 January 2020.

## 2 Description of specimen

### 2.1 General

The specimen comprised a reinforced concrete filled wall system measuring 2980-mm high x 2980-mm wide x 150-mm thick. The specimen wall comprised three Ritek 150X-Plus pre-fabricated permanent formwork panels, screw fixed together and filled with concrete after panel assembly.

The 1200-mm wide Ritek 150X-Plus pre-fabricated permanent formwork panels comprised two 6-mm thick fibre cement sheets bonded using industrial strength adhesive to anodised aluminium extrusions separated with aluminium joiners at nominally 350-mm vertical centres, to form a stud assembly. The studs were equally spaced over the width of the panel at nominally 164-mm centres. The aluminium joiners incorporated galvanised steel inserts (rebar chairs) for provision of horizontal reinforcing bars, as shown in drawing numbered 19005.P01.D02, Sheet 1, dated 26 October 2020, by Ritek Systems Pty Ltd.

The pre-fabricated wall panels were installed vertically and fastened together using 8g x 25-mm long CSK screws at nominally 600-mm vertical centres. The screws were fixed into a 1.2-m thick x 40-mm wide aluminium strip located on the inside of the panel fibre cement sheeting. A maximum vertical joint width of 2-mm was maintained between wall panel facings.

The wall assembly was reinforced using N12 reinforcing bars at 350-mm centres, both horizontally and vertically prior to being filled with 32 MPa concrete. The concrete was pumped in through the top openings in 1500-mm high layers and trowelled off level when completely filled. The concrete mix comprised 10-mm coarse aggregate with a 180-mm slump measured at the time of core filling.

### 2.2 Orientation

The wall specimen was of symmetrical construction.

### 2.3 Dimensions

The wall specimen was nominally 3000-mm wide x 3000-mm high x 150-mm thick. All dimensions are nominal.

### 2.4 Restraints

The specimen was unrestrained along the vertical sides. The resulting gaps along the unrestrained edges were sealed with compressed ceramic fibre.

### 2.5 Load

A total load of 800 kN was applied to the specimen for the duration of the test. The load determined by the client, was applied uniformly by a steel platen acting along the top of the wall.

### 2.6 Conditioning

The specimen wall was constructed and core filled on 11 October 2019 and left to cure under external atmospheric conditions until the test date.

## 2.7 Selection, construction and installation of the specimen and the supporting construction

The construction was organised by the sponsor. CSIRO was not involved in the selection of the materials.

## 3 Documentation

The following documents were supplied or referenced by the sponsor as a complete description of the specimen and should be read in conjunction with this report:

- Drawings numbered 19005.P01.D.01, Sheets 1-3, dated 26 October 2020, by Ritek Systems Pty Ltd.
- Drawings numbered 19005.P01.D.02, Sheets 1-4, dated 26 October 2020, by Ritek Systems Pty Ltd.

## 4 Equipment

### 4.1 Furnace

The furnace had a nominal opening of 3000-mm x 3000-mm for attachment of vertical specimens.

The furnace was lined with refractory bricks and materials with the thermal properties as specified in AS 1530.4-2014 and was heated by combustion of a mixture of natural gas and air.

### 4.2 Temperature

The temperature in the furnace chamber was measured by eight type K, 3-mm diameter, and 310 stainless steel Mineral Insulated Metal Sheathed (MIMS) thermocouples. Each thermocouple was housed in high-nickel steel tubes opened at the exposed end.

The temperatures of the specimen were measured by glass-fibre insulated and sheathed K-type thermocouples with a wire diameter of 0.5-mm.

Locations of the thermocouples on the unexposed face of the specimen are described in Appendix A.

### 4.3 Pressure

The furnace pressure was measured by a differential low-pressure transducer with a range of  $\pm 50$  Pa.

The pressure probe was located approximately 1000-mm above the sill of the furnace, where the pressure was controlled at 4 Pa.



## 4.4 Measurement system

The primary measurement system comprised multiple-channel data loggers, scanning at one-minute intervals during the test.

## 5 Ambient temperature

The temperature of the test area was 24°C at the commencement of the test.

## 6 Departure from standard

There were no departures from the requirements of AS 1530.4-2014.

## 7 Termination of the test

The test was terminated at 241 minutes by the agreement with the sponsor.

## 8 Test results

### 8.1 Critical observations

The following observations were made during the fire-resistance test:

- 22 minutes - Moisture is forming on the unexposed face of the wall (photograph 4).
- 60 minutes - The amount of moisture on the unexposed face is increasing.
- 90 minutes - Steam is being emitted from along the right panel joint.
- 120 minutes - More moisture patches are appearing on the unexposed face of the wall.
- 170 minutes - Moisture on the unexposed face of the wall is starting to dry up.
- 241 minutes - No apparent change to the specimen.  
Test terminated.

## 8.2 Furnace temperature

Figure 1 shows the standard curves of temperature versus time for heating the furnace chamber and the actual curves of average and maximum temperature versus time recorded during the heating period.

## 8.3 Furnace severity

Figure 2 shows the curve of furnace severity versus time during the heating period.

## 8.4 Furnace pressure

Figure 3 shows the curve of average pressure versus time inside the furnace chamber recorded during the heating period.

## 8.5 Specimen temperature

Figure 4 shows curves of average and maximum temperature versus time recorded on the unexposed face of the specimen.

Figure 5 shows the curve of maximum temperature versus time recorded around the perimeter.

Figure 6 shows the curves of temperature versus time recorded 15-mm from the edge of the panel joints.

## 8.6 Specimen deflection

Figure 7 shows the curves of maximum lateral and axial deflection versus time recorded at the centre and the edge of the wall.

## 8.7 Performance

Performance observed in respect of AS 1530.4-2014 criteria was as follows:

Structural adequacy	-	no failure at 241 minutes
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

This report details methods of construction, the test conditions and the results obtained when specific element of construction described herein was tested following the procedure outlined in this standard. 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 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.

## 9 Fire-Resistance Level (FRL)

For the purpose of building regulations in Australia, the FRL of the test specimen was 240/240/240.

The fire-resistance level of the wall system is applicable when the system is exposed to fire from either direction.

For the purposes of AS 1530.4-2014 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions.

## 10 Field of direct application of test results

The results of the fire test contained in this test report are directly applicable, without reference to the testing authority, to similar constructions where one or more changes listed in Clause 3.9 of AS 1530.4-2014, have been made provided no individual component is removed or reduced.

## 11 Tested by



Chris Wojcik  
Testing Officer

# Appendices

## Appendix A – Measurement location

Measurement Location		
Group location	T/C Position	T/C designation
Specimen		
Unexposed Face	Top left quarter point	S1
	Top right quarter point	S2
	Bottom left quarter point	S3
	Bottom right quarter point	S4
	centre	S5
Perimeter	Left edge – 100-mm from the edge mid-height	S6
	Head - centre	S7
	Head – panel joint near centre	S8
	Right edge – 100-mm from the edge mid-height	S9
Panel joints	Left joint – $\frac{3}{4}$ height	S10
	Left joint – $\frac{1}{2}$ height	S11
	Right joint – $\frac{3}{4}$ height	S12
	Right joint – $\frac{1}{2}$ height	S13
Rover		
Ambient		

Appendix B – Test photographs



**PHOTOGRAPH 1 – TOP SECTION OF SPECIMEN PRIOR TO TESTING**



**PHOTOGRAPH 2 – EXPOSED FACE OF THE SPECIMEN PRIOR TO TESTING**



**PHOTOGRAPH 3 – UNEXPOSED FACE OF THE SPECIMEN PRIOR TO TESTING**



**PHOTOGRAPH 4 – SPECIMEN AT 23 MINUTES INTO THE TEST**



**PHOTOGRAPH 5 – SPECIMEN AT 30 MINUTES INTO THE TEST**



**PHOTOGRAPH 6 – SPECIMEN AT 60 MINUTES INTO THE TEST**



**PHOTOGRAPH 7 – SPECIMEN AT 120 MINUTES INTO THE TEST**



**PHOTOGRAPH 8 – SPECIMEN AT 180 MINUTES INTO THE TEST**



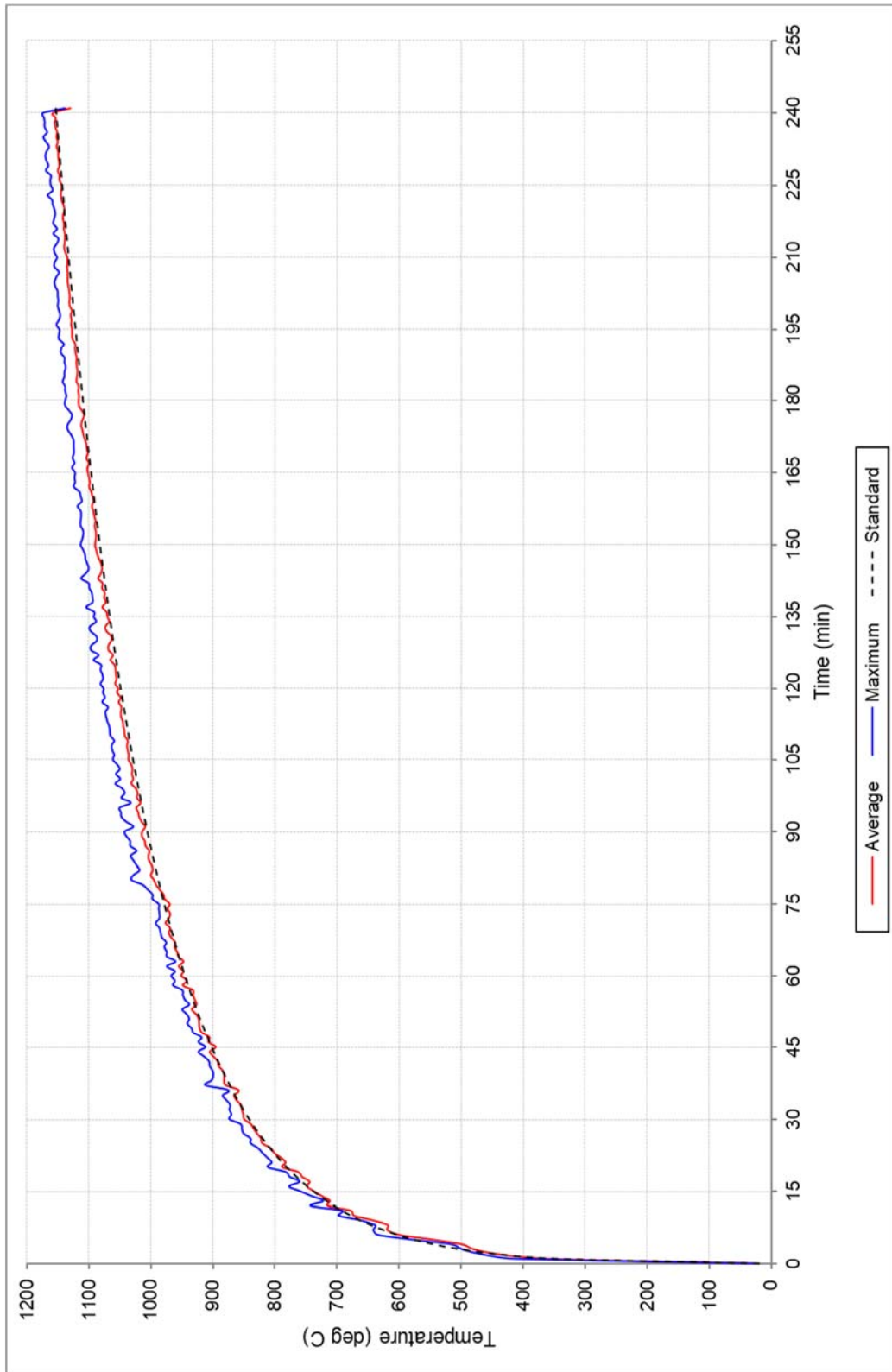


**PHOTOGRAPH 9 – SPECIMEN AT THE CONCLUSION OF TESTING**



**PHOTOGRAPH 10 – EXPOSED FACE OF THE SPECIMEN AFTER THE CONCLUSION OF TESTING**

## Appendix C – Test data charts



**FIGURE 1 – FURNACE TEMPERATURE**

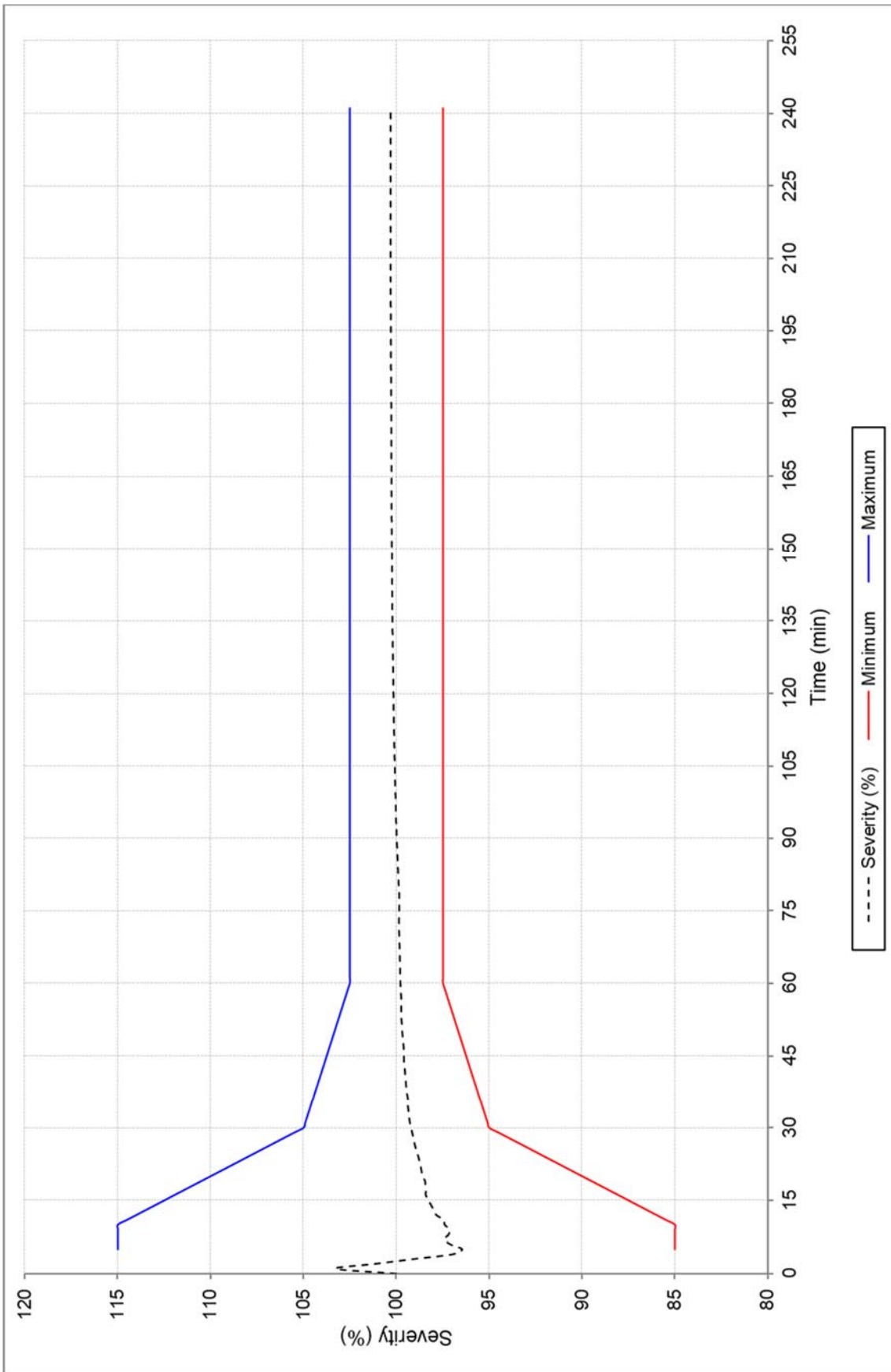
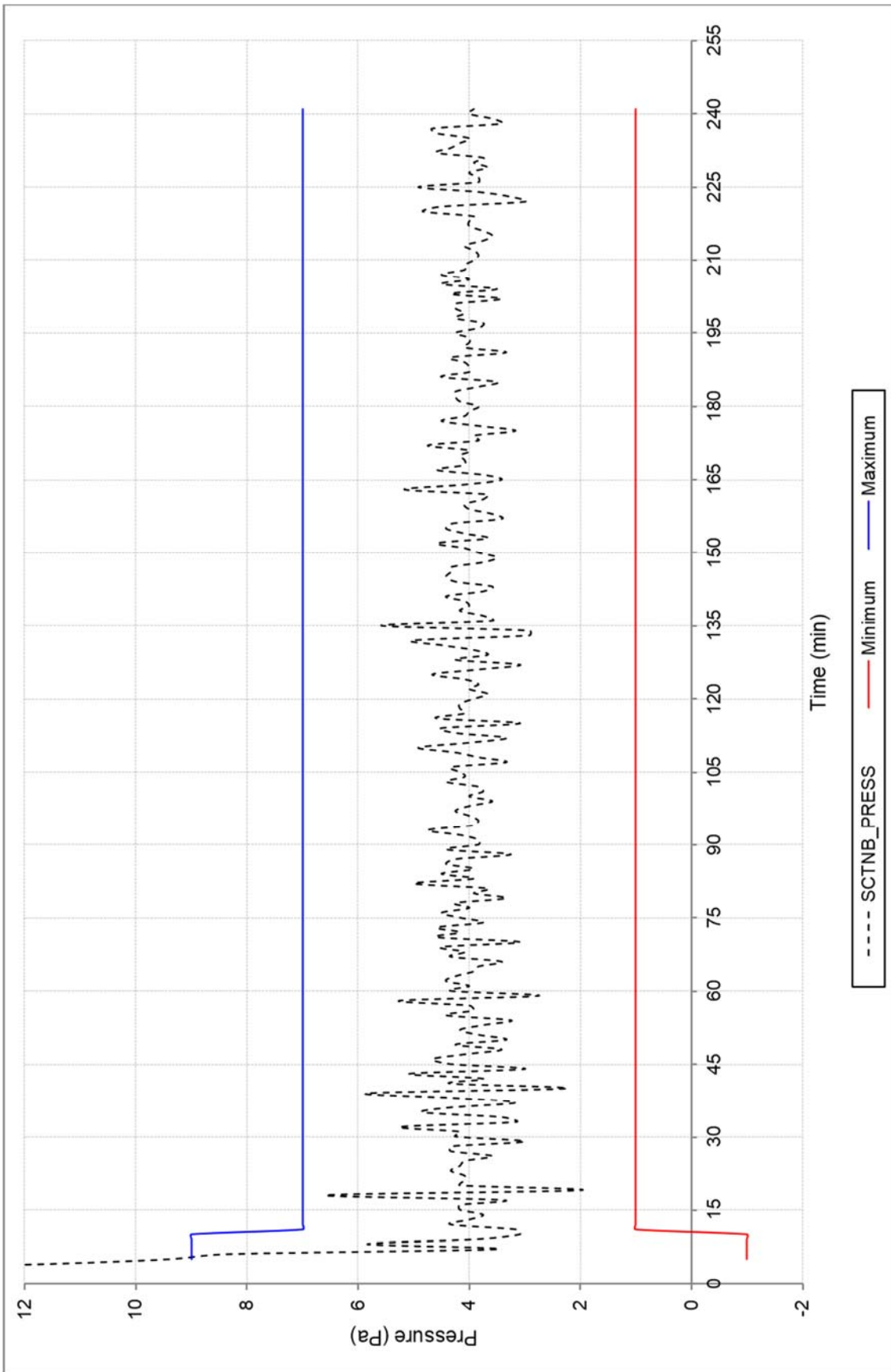
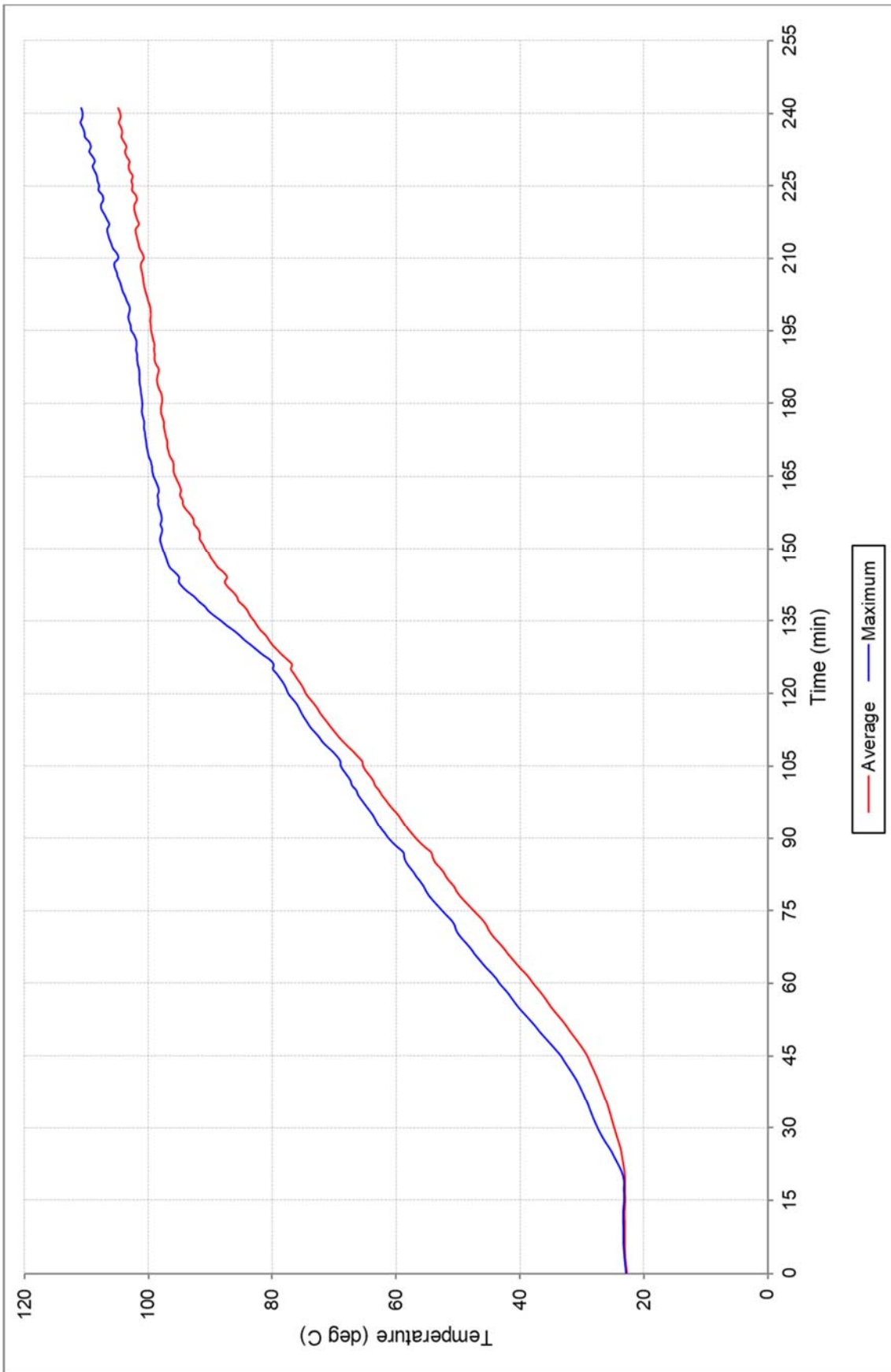


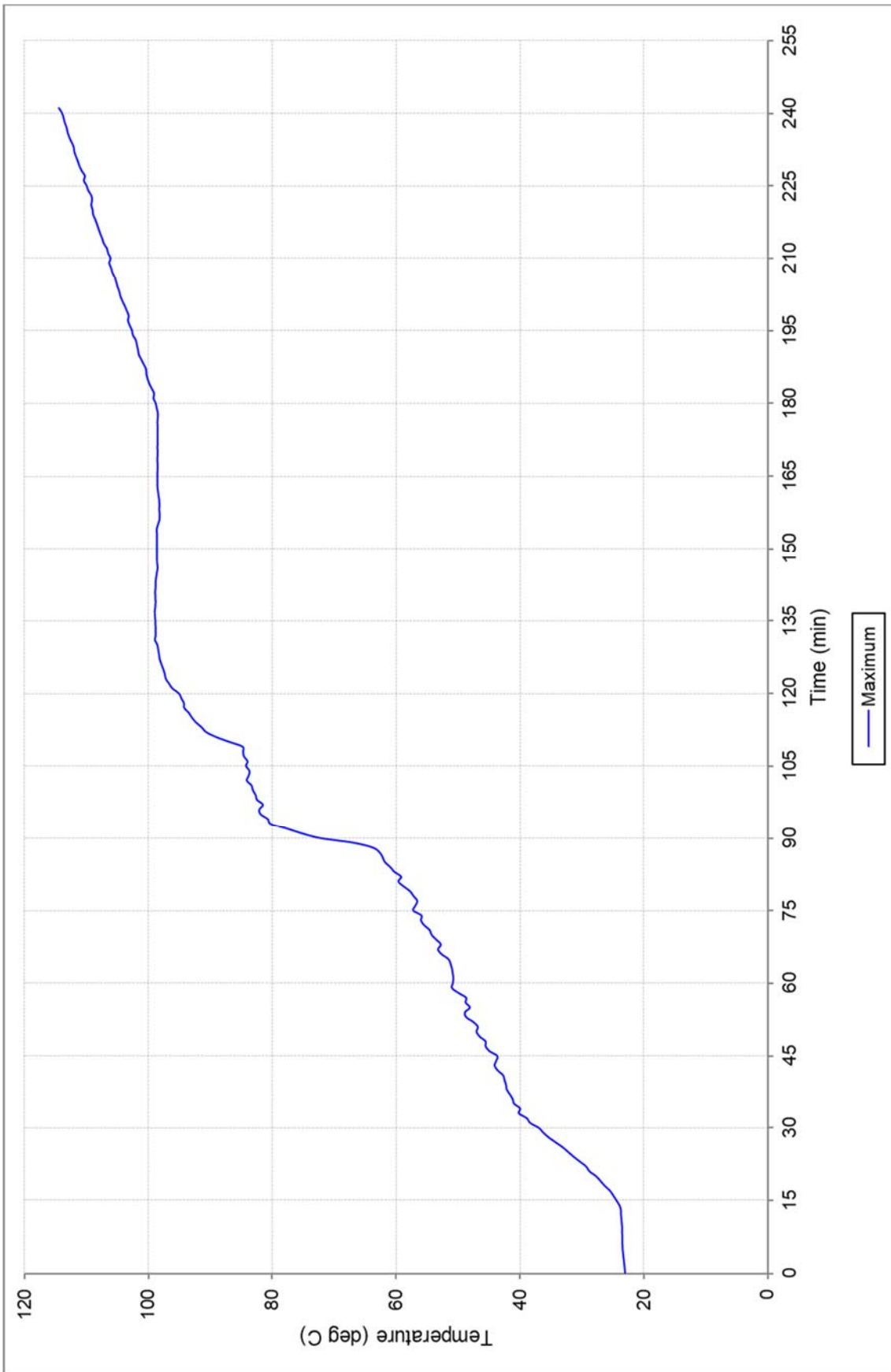
FIGURE 2 – FURNACE SEVERITY



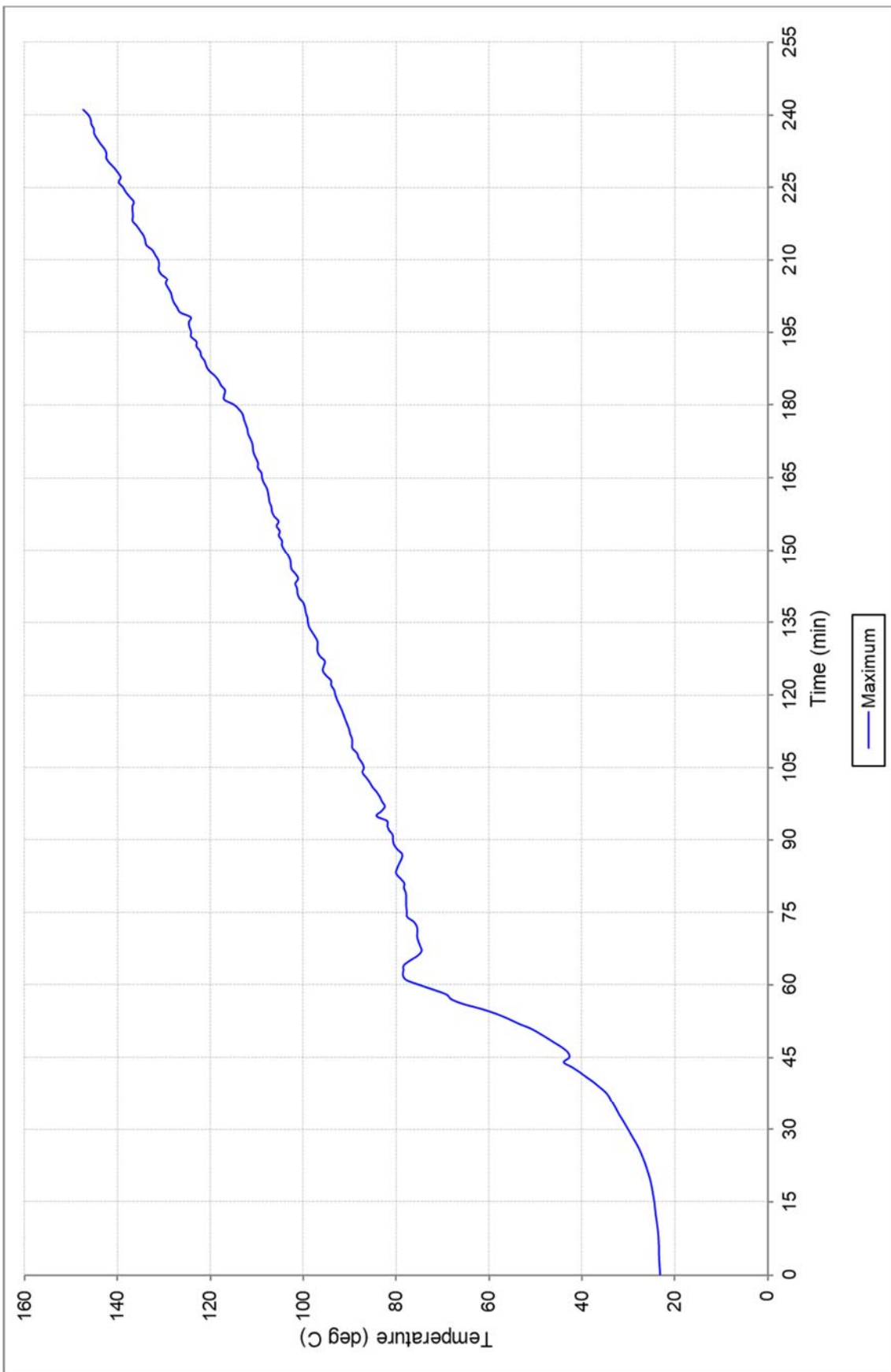
**FIGURE 3 – FURNACE PRESSURE**



**FIGURE 4 – SPECIMEN TEMPERATURE – UNEXPOSED FACE OF THE SPECIMEN**



**FIGURE 5 – SPECIMEN TEMPERATURE – UNEXPOSED FACE - PERIMETER**



**FIGURE 6 – SPECIMEN TEMPERATURE – UNEXPOSED FACE – ASSOCIATED WITH PANEL JOINTS**

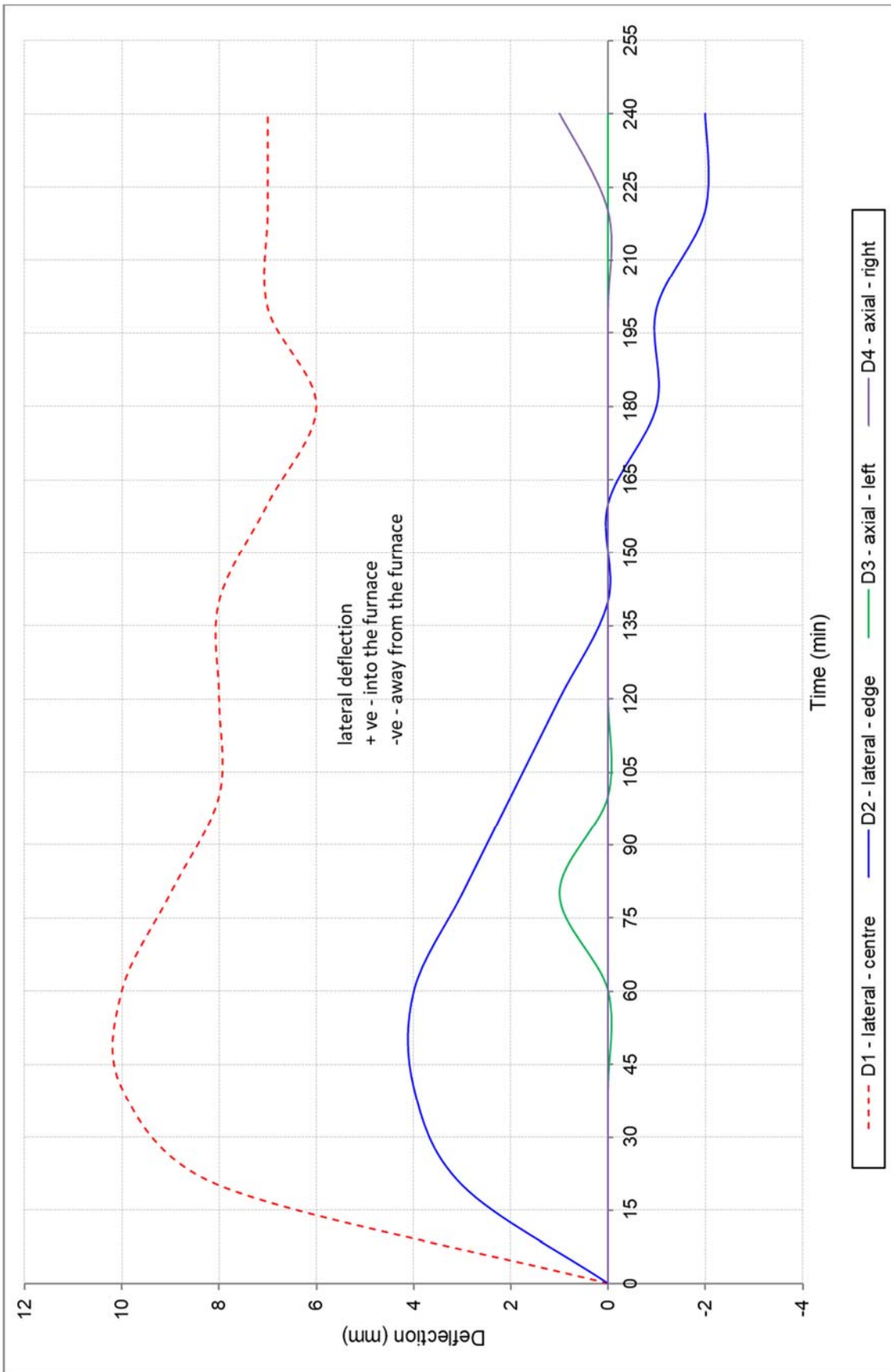
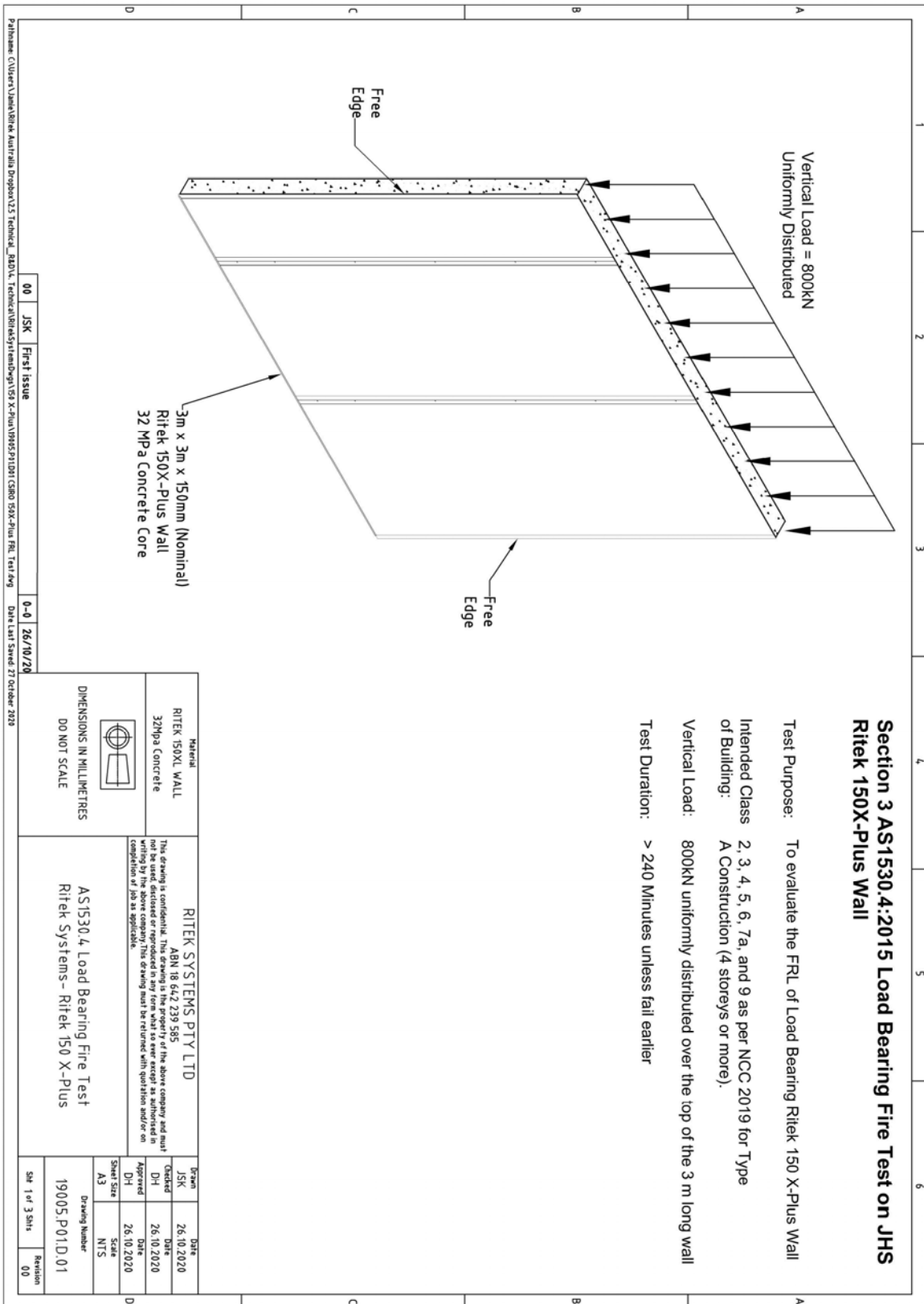


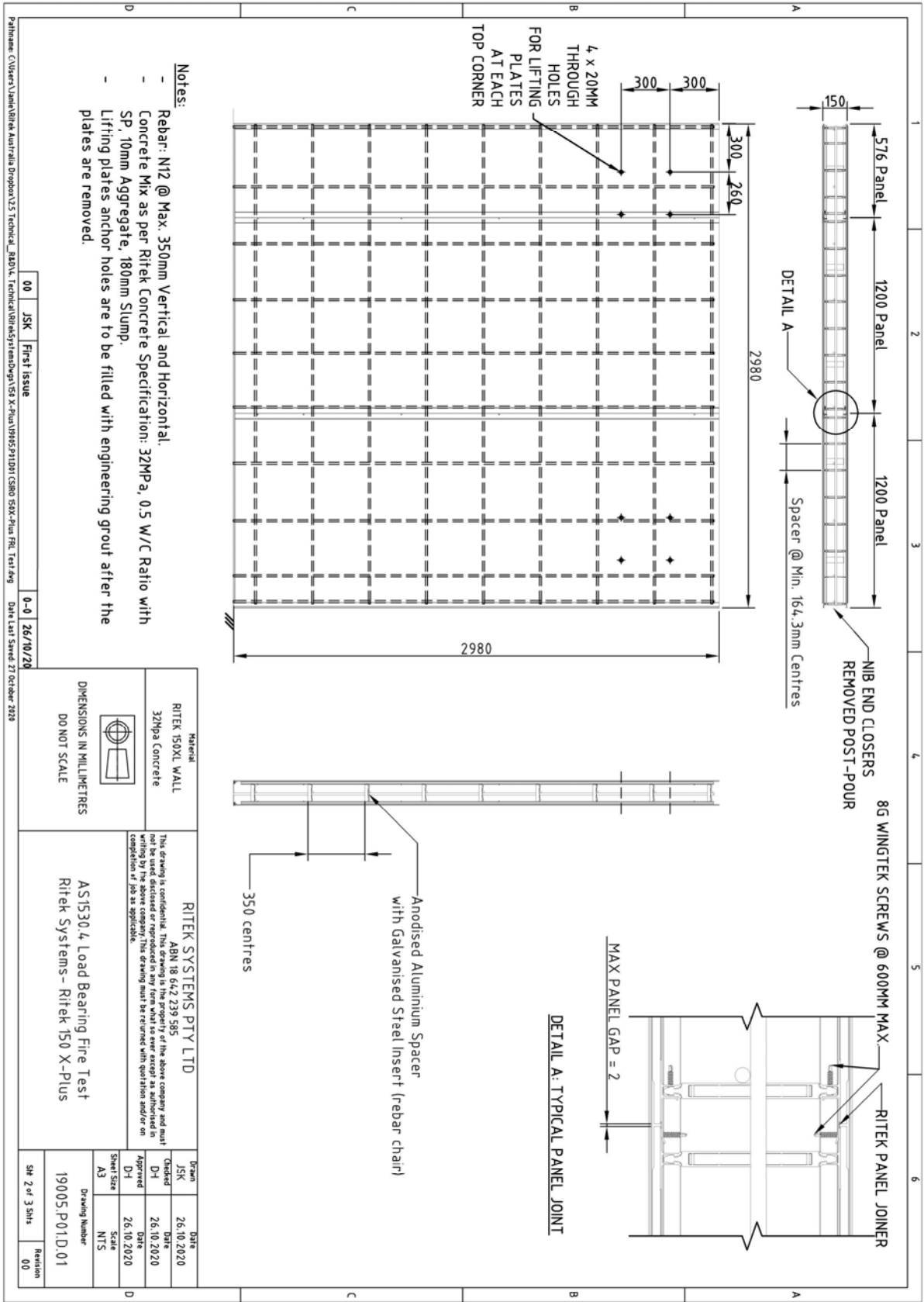
FIGURE 7 – SPECIMEN DEFLECTION



# Appendix D – Specimen drawings



**DRAWING NUMBERED 19005.P01.D.01, SHEET 1, DATED 26 OCTOBER 2020, BY RITEK SYSTEMS PTY LTD**

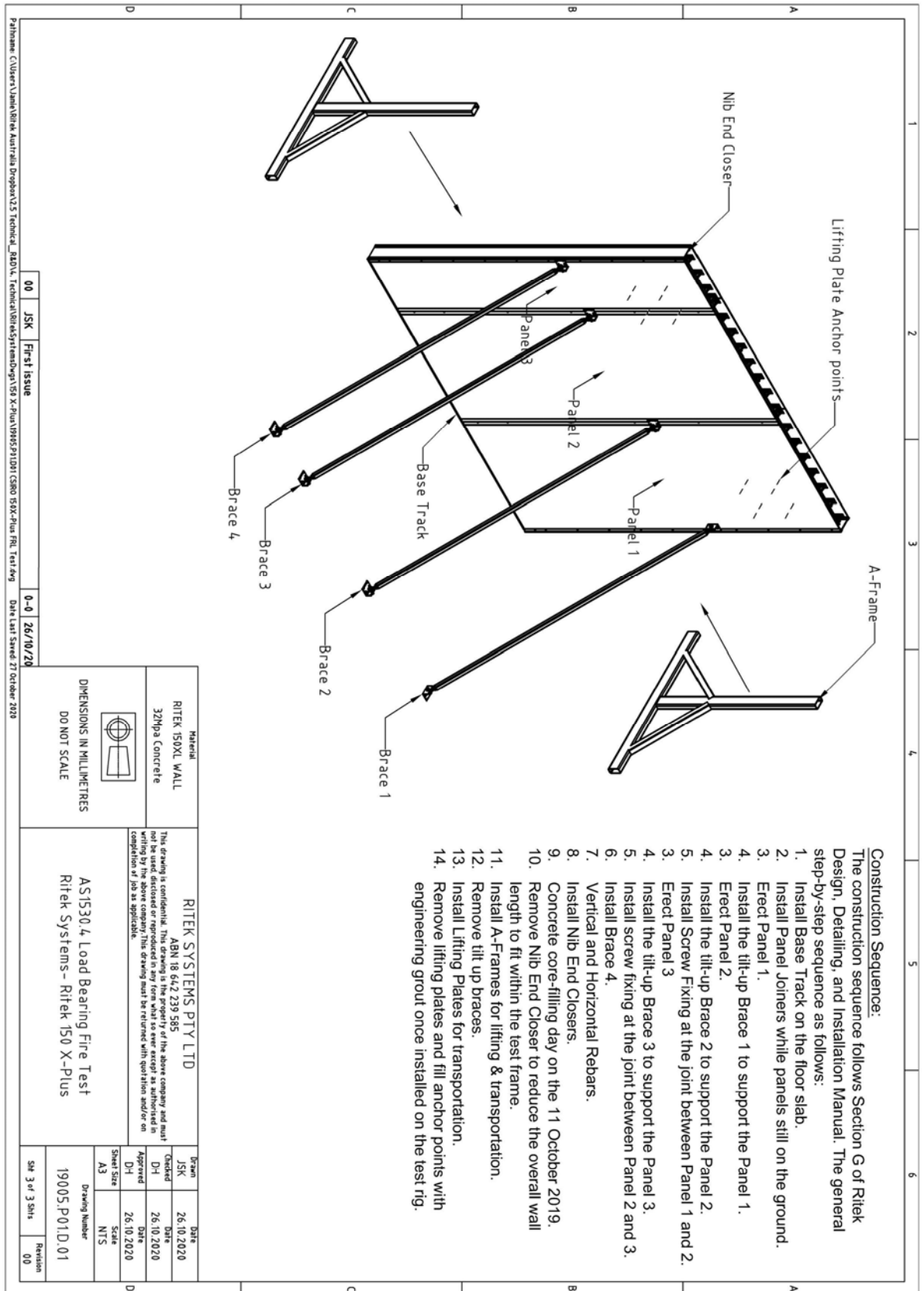


- Notes:**
- Rebar: N12 @ Max. 350mm Vertical and Horizontal.
  - Concrete Mix as per Ritek Concrete Specification: 32MPa, 0.5 W/C Ratio with SP, 10mm Aggregate, 180mm Slump.
  - Lifting plates anchor holes are to be filled with engineering grout after the plates are removed.

00	JSK	First Issue	0-0	26/10/20
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Material <b>RITEK 150XL WALL</b> 32mpa Concrete	RITEK SYSTEMS PTY LTD ABN 18 642 239 585 <small>This drawing is confidential. This drawing is the property of the above company and must not be used, disclosed or reproduced in any form without the prior written consent of Ritek Systems Pty Ltd. This drawing must be returned with your files and/or on completion of job as applicable.</small>	AS1530.4 Load Bearing Fire Test Ritek Systems - Ritek 150 X-Plus	Form	Date
			Checked	26.10.2020
DIMENSIONS IN MILLIMETRES DO NOT SCALE		Drawing Number <b>19005.P01D.01</b>	Approved	Date
Sheet Size A3			Scale	NTS
		Revision	00	

**DRAWING NUMBERED 19005.P01.D.01, SHEET 2, DATED 26 OCTOBER 2020, BY RITEK SYSTEMS PTY LTD**



00	JSK	First Issue	0-0	26/10/20
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Material	RITEK ISOXL WALL 32Mpa Concrete
DIMENSIONS IN MILLIMETRES DO NOT SCALE	

RITEK SYSTEMS PTY LTD  
ABN 18 642 239 585

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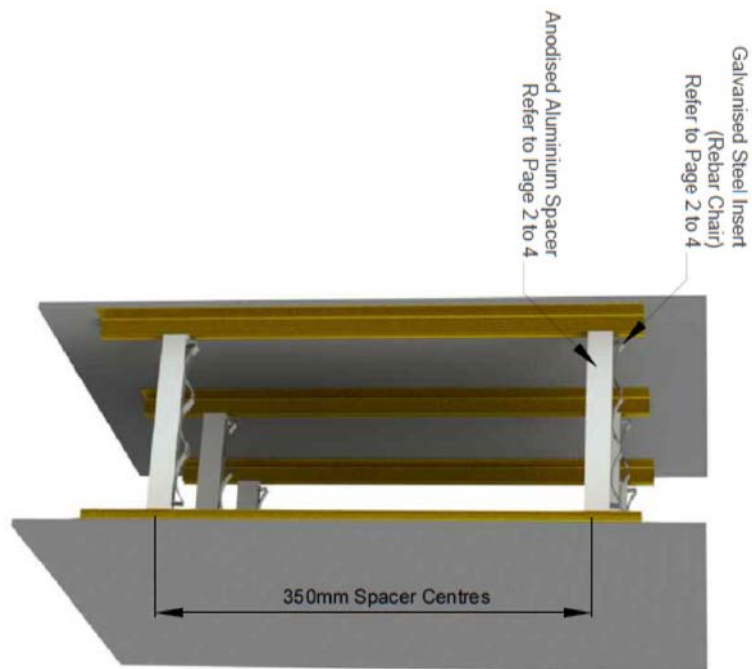
AS1530.4, Load Bearing Fire Test  
Ritek Systems - Ritek 150 X-Plus


Drawn	JSK	Date	26.10.2020
Checked	DH	Date	26.10.2020
Approved	DH	Date	26.10.2020
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SM 3 of 3 Shts	Revision	00	

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# RITEK X-Plus



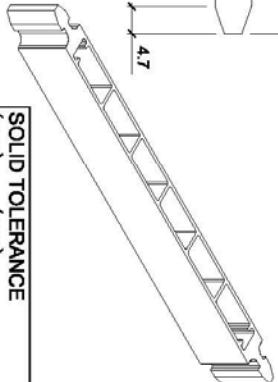
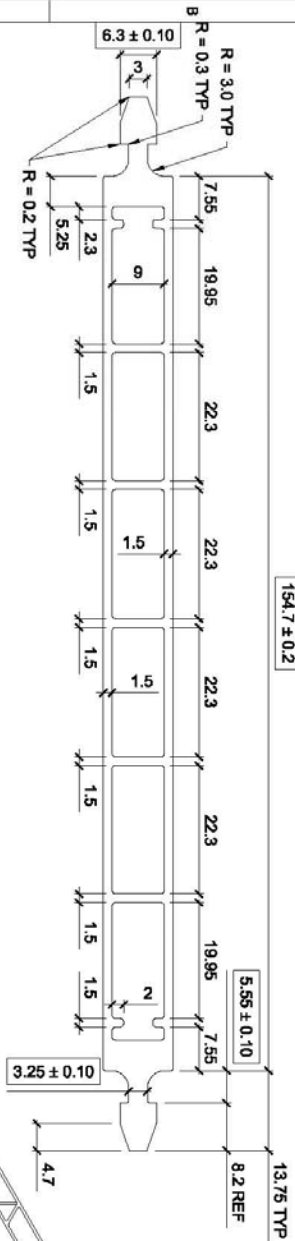
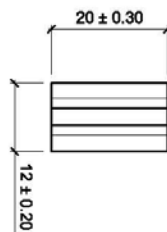
Ritek XL vs. Ritek X-Plus		 Ritek Systems Ritek Systems Pty Ltd - ABN 18 642 239 585	Date 26 - 10 - 2020	Drawing 19005.P01.D02
Material :	XL and X-Plus Panels		Drawn By JSK	Scale NTS
		This drawing is confidential. This drawing is the property of the above company and must not be used, disclosed or reproduced in any form what so ever except as authorised in writing by the above company. This drawing must be returned with quotation and/or on completion of job as applicable.	Approved By DH	Sheet No 1 of 4

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182.2 REF

**PROPERTIES**  
 VOLUME: 15.42 cm<sup>3</sup>  
 WEIGHT: 41.6 grams



**NOTE**

**BOXED DIMENSIONS CRITICAL - IMPORTANT TOLERANCES**  
 EXTRUSION TO BE FLAT WITHIN ± 1.0mm IN 1m.  
 MATERIAL: ALUMINIUM 6063-T5  
 ANODIZED COATING GRADE : AA25  
 (MIN. AVG. THICKNESS 25 MICRON, MIN. LOCAL THICKNESS 20 MICRON)

RADI KEY (mm)	
REF	1.0
RA	2.0
RB	2.0
UNSPECIFIED	0.5
F	FULL RADIUS

SOLID TOLERANCE		
(mm)	(mm)	±
OVER	UP TO	TOL
3	6	0.15
6	12	0.18
12	19	0.20
19	25	0.23
25	38	0.25
38	50	0.30
50	100	0.36
100	150	0.61
150	200	0.86
200	250	1.12
250		1.37

200mm Spacer



Ritek Systems Pty Ltd - ABN 18 642 239 585

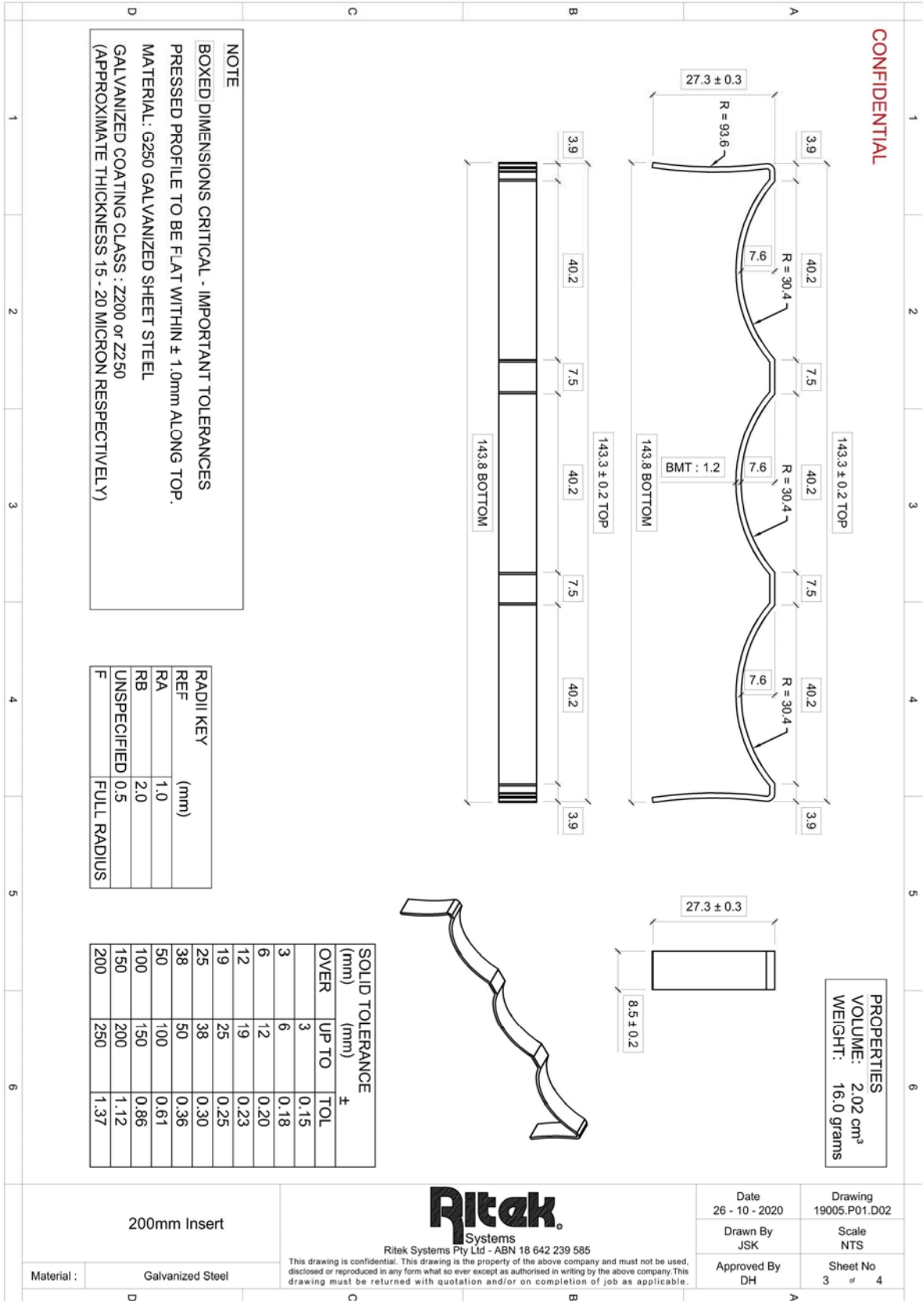
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Material : Aluminium Extrusion

Date 26 - 10 - 2020	Drawing 19005.P01.D02
Drawn By JSK	Scale NTS
Approved By DH	Sheet No 2 of 4

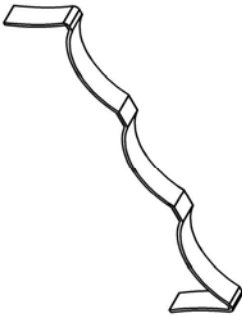
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**PROPERTIES**  
 VOLUME: 2.02 cm<sup>3</sup>  
 WEIGHT: 16.0 grams

**PROPERTIES**  
 VOLUME: 2.02 cm<sup>3</sup>  
 WEIGHT: 16.0 grams



Ritek Systems Pty Ltd - ABN 18 642 239 585

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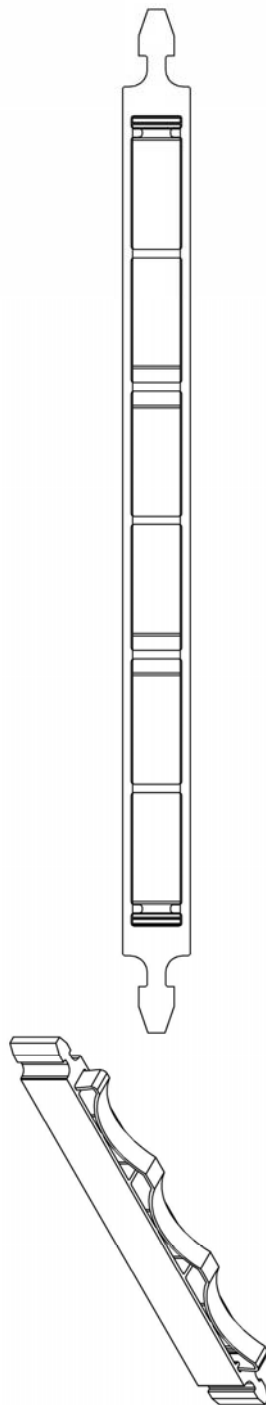
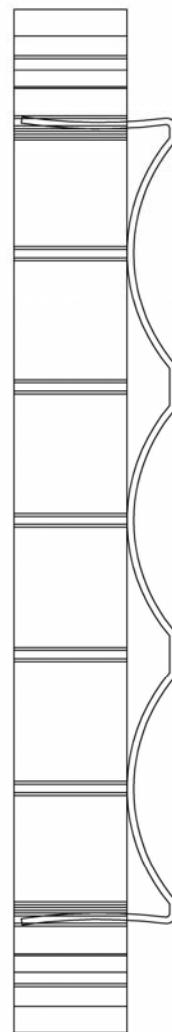
Date 26 - 10 - 2020	Drawing 19005.P01.D02
Drawn By JSK	Scale NTS
Approved By DH	Sheet No 3 of 4

200mm Insert

Material : Galvanized Steel

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NOTE:  
ONCE INSERTED, THE STEEL INSERT SHALL NOT SEPARATE FROM THE SPACER WITHOUT REQUIRING ANY FORCE (INTERFERENCE FIT).

ASSEMBLED WEIGHT:  
57.7 grams

Assembled 200mm Spacer  
with Insert

Material : Aluminium Extrusion

**Ritek**  
Systems

Ritek Systems Pty Ltd - ABN 18 642 239 585

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Date  
23 - 10 - 2020

Drawing  
19005.P01.D02

Drawn By  
JSK

Scale  
NTS

Approved By  
DH

Sheet No  
4 of 4

DRAWING NUMBERED 19005.P01.D.02, SHEET 4, DATED 26 OCTOBER 2020, BY RITEK SYSTEMS PTY LTD

# Appendix E – Certificate(s) of Test

<b>INFRASTRUCTURE TECHNOLOGIES</b> <a href="http://www.csiro.au">www.csiro.au</a>		
14 Julius Avenue, North Ryde NSW 2113 PO Box 52, North Ryde NSW 1670, Australia T (02) 9490 5444 • ABN 41 687 119 230		
<h2>Certificate of Test</h2>		No. 3360 Revision B
This is to certify that the element of construction described below was tested by CSIRO Infrastructure Technologies in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4 Fire-resistance tests of elements of construction, 2014 (Section 3: Walls – Vertical Separating Elements), on behalf of:		
Ritek Systems Pty Ltd 19 Lowermill Road COOROY QLD		
A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSV 2075 Revision B.		
Product Name:	Load-bearing, concrete core filled Ritek 150X-Plus wall system	
Description:	The specimen comprised a reinforced concrete filled wall system measuring 2980-mm high x 2980 mm wide x 150 mm thick. The specimen wall comprised three Ritek 150X-Plus pre-fabricated permanent formwork panels, screw fixed together and filled with concrete after panel assembly. The 1200-mm wide Ritek 150X-Plus pre-fabricated permanent formwork panels comprised two 6 mm thick fibre cement sheets bonded using industrial strength adhesive to anodised aluminium extrusions separated with aluminium joiners at nominally 350-mm vertical centres, to form a stud assembly. The studs were equally spaced over the width of the panel at nominally 164-mm centres. The aluminium joiners incorporated galvanised steel inserts (rebar chairs) for provision of horizontal reinforcing bars, as shown in drawing numbered 19005.P01.D02, Sheet 1, dated 26 October 2020, by Ritek Systems Pty Ltd. The pre-fabricated wall panels were installed vertically and fastened together using 8g x 25-mm long CSK screws at nominally 600-mm vertical centres. The screws were fixed into a 1.2-m thick x 40-mm wide aluminium strip located on the inside of the panel fibre cement sheeting. A maximum vertical joint width of 2-mm was maintained between wall panel facings. The wall assembly was reinforced using N12 reinforcing bars at 350-mm centres, both horizontally and vertically prior to being filled with 32 MPa concrete. The concrete was pumped in through the top openings in 1500-mm high layers and trowelled off level when completely filled. The concrete mix comprised 10-mm coarse aggregate with a 180-mm slump measured at the time of core filling. The wall specimen was of symmetrical construction. A total load of 800 kN was applied to the specimen for the duration of the test. The load determined by the client, was applied uniformly by a steel platen acting along the top of the wall.	
Performance observed in respect of the following AS 1530.4-2014 criteria:		
Structural Adequacy	-	no failure at 241 minutes
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes
and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of 240/240/240.		
The fire-resistance level of the wall system is applicable when the system is exposed to fire from either direction. For the purposes of AS 1530.4-2014 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions. This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance.		
Testing Officer:	Chris Wojcik	Date of Test: 20 January 2020
Issued on the 24 <sup>th</sup> day of March 2021. This Certificate supersedes Certificate 3360 issued 7 February 2020 due to a change in ownership of the Intellectual Property associated with manufacturer and trade name of the product/system described in the Certificate. The sponsor has confirmed there has been no change to the design and material specifications of the product/system referenced in this Certificate.		
 Brett Roddy Manager, Fire Testing and Assessments		
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	This document is issued in accordance with NATA's accreditation requirements. Accreditation No. 165 – Corporate Site No. 3625 Accredited for compliance with ISO/IEC 17025 - Testing	

**COPY OF CERTIFICATE OF TEST NUMBERED 3360 REVISION B**



## References

The following informative documents are referred to in this Report:

- AS 1530.4-2014 Methods for fire tests on building materials, components and structures - Part 4:  
Fire-resistance tests of elements of building construction.

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