

Fire-resistance test on a load-bearing horizontal separating element

Test Report

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Report number: FSH 1920

Date: 13 September 2018

Client: Tech Coatings NZ Limited

Commercial-in-confidence

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13 September 2018	13 September 2018	13 September 2018

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Fire-resistance test on a load-bearing horizontal separating element

Sponsored Investigation No. FSH 1920

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as a 4690-mm long x 3000-mm wide x 273-mm thick timber framed floor/ceiling system with 19-mm thick structural timber plywood flooring, lined with a single layer of 13-mm thick standard GIB plasterboard. The exposed face of the plasterboard ceiling was protected with 1040 μ of FBL-100 Intumescent paint.

1.2 Sponsor

Tech Coatings NZ Limited
12 Tokomaru Street
Welbourn 4312
New Zealand

1.3 Manufacturer

International Coatings Group
757 SE 17th St #846
Fort Lauderdale, Florida 33316
USA

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 4: Floors, roofs and ceilings Horizontal Separating Elements.

1.5 Test number

CSIRO Reference test number FS4787/4271.

1.6 Test date

The fire-resistance test was conducted on 31 July 2018.

2 Description of specimen

2.1 General

The timber framed floor/ceiling system measured 4690-mm long x 3000-mm wide x 273-mm thick and comprised 240-mm deep x 45-mm thick MSG H3 treated Radiata pine joists and blockings. The floor was lined with 19-mm CCA thick structural plywood and the underside of the floor/ceiling clad with a single layer of 13-mm thick standard GIB plasterboard protected with 1040 μ of FBL-100 Intumescent paint.

Refer to CSIRO Test Specification, CSIRO Full – Scale Mid floor 13-mm Plasterboard TC-0011, dated 13/06/2018, by Tech Coatings.

Floor Structure

The floor structure comprised 240-mm x 45-mm x 4600-mm long MSG H3 treated timber joists, spaced at nominally 400-mm centres. Timber blockings 240-mm x 45-mm MSG H3 treated were fixed at nominally 1200-mm centres. Trimmer joists 3000-mm long 240-mm x 45-mm MSG H3 treated timber were fixed at both ends of the specimen with 75-mm X 3.06-mm D Head framing nails, three 100-mm x 14g Bugle Screws were used per joist.

The outside face of the boundary joists were protected with a single layer of 253-mm wide x 13-mm thick Fyreline GIB Plasterboard. The Fyreline protruded 13-mm past the bottom of the joists to protect the edge of the standard GIB plasterboard ceiling.

The timber floor joists were clad on the unexposed face using 19-mm CCA thick structural plywood sheets nominally 1200-mm wide x 2400-mm wide. The plywood sheets were fixed to the timber floor joists using 50-mm x 8g 304 S/S countersunk screws, perimeter fixings were located at 150-mm centres and mid sheet fixing located at 400-mm centres.

Ceiling Lining

The specimen was lined on the exposed face of the floor joists with one layer of 13-mm thick standard GIB Plasterboard, nominally measuring 2400-mm long x 1200-mm wide and 13-mm thick. The plasterboard sheets were directly fixed to the underside of the timber joists using 32-mm x 6g GIB Grabber screws and GibFix All-Bond adhesive. Perimeter fixings comprised 32-mm 6g GIB Grabber screws located at 200-mm centres. Mid sheet fixing comprised daubes of Gibfix All-Bond located at 200-mm centres and 32-mm x 6g GIB grabber screws located at 600-mm centres. Additional Mid Sheet fixings at 50-mm x 7g plasterboard screws were located at 200-mm centres. All plasterboard joints were set with GIB paper tape and two coats of GIB MaxSet as detailed in CSIRO Test Specification, CSIRO Full – Scale Mid floor 13-mm Plasterboard TC-0011, dated 13/06/2018, by Tech Coatings

Intumescent Coating

The exposed face of the plaster ceiling was painted with 2 coats x 800 μ WFT of FBL-100 Intumescent paint using an airless spray gun. The final paint thickness of 1040 μ DFT was measured after the final application of paint was applied, using a Defelsko Positector 200c Ultrasonic probe.

2.2 Orientation

The floor / ceiling specimen was exposed to the furnace chamber from the underside.

2.3 Dimensions

The floor / ceiling specimen was 4690-mm long x 3000-mm wide x 273-mm thick. All dimensions are nominal.

2.4 Restraints

The specimen was unrestrained along the long axis sides. The resulting gaps along the unrestrained edges were sealed with compressed ceramic fibre and mastic.

2.5 Load

A total load of 2510 kg comprising of a steel frame carrying a total of 4 concrete slabs was applied to the specimen for the duration of the test. The load determined by the client, was applied through two beams separated by 2300-mm acting across the top of the floor.

2.6 Conditioning

The specimen installation was completed on 3 July 2018, and left to cure under standard laboratory 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:

CSIRO Test Specification, CSIRO Full – Scale Mid floor 13-mm Plasterboard TC-0011, dated 13/06/2018, by Tech Coatings.

Drawing Number TC 0011 UPPER FLOOR 3000x4300mm JOIST SPAN 4300mm dated 13/06/18, by Tech Coatings.

Drawing Number TC 0011.1 UPPER FLOOR 3M x 4.3m RCP AND LONG SECTION, dated 13/06/18, by Tech Coatings

Confidential information about the test specimen has been submitted and is retained at CSIRO Infrastructure Technologies.

4 Equipment

4.1 Furnace

The furnace had a nominal opening of 4300-mm x 3000-mm for attachment of horizontal 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 ten 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 unexposed face 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 are described in Appendix A.

4.3 Pressure

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

The pressure probe was located approximately 100-mm below the underside of the specimen, where the pressure was controlled at 20 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 18°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 62 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

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

- 5 minutes - Light smoke is emitted from the perimeter of floor specimen.
- 10 minutes - Smoke is coming from the plasterboard perimeter end on the western side.
- 13 minutes - Smoke around the perimeter of specimen has reduced.
- 18 minutes - Small amount of smoke / steam emitted from the plywood floor joint approximately 200-mm in from the eastern side.
- 20 minutes - There are a number of 20-mm to 30-mm flakes of paint falling off the exposed face of specimen observed from the furnace view port.
- 23 minutes - Small amount of smoke / steam emitted from the plywood floor joint approximately 150-mm in from the eastern side.
- 27 minutes - Smoke increasing from the ends of specimen.
- 30 minutes - Incipient Spread of Fire Failure – maximum temperature of 250°C was exceeded on the unexposed face of the plasterboard ceiling membrane within the ceiling cavity at the north west quarter point TC#26.
Light smoke emitted from north east side of plasterboard boundary.
- 35 minutes - Smoke level increasing from the south east corner of specimen.
- 39 minutes - Smoke emitted from the centre joints of the unexposed plywood floor.
- 40 minutes - Flakes of paint continue to falling off the exposed face of specimen.
- 58 minutes - Smoke level emitted from the specimen has increased
- 60 minutes - No visible change to the specimen.
- 61 minutes - Integrity Failure – Flaming for a duration of greater than 10 seconds observed on the unexposed face of the plywood floor approximately 200-mm in from the middle of the western side boundary edge.
- 62 minutes - 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 curves of maximum temperature versus time recorded on the unexposed face of plasterboard within the specimen cavities.

Figure 6 shows the curves of temperature versus time recorded at plasterboard / paint interface.

Figure 7 shows the curves of temperature versus time associated with the timber joists.

Figure 8 shows the curves of air temperature versus time recorded in the floor cavity.

8.6 Specimen deflection

Figure 9 shows the curves of maximum deflection versus time recorded at the centre of the floor.

8.7 Performance

Performance observed in respect of the following AS 1530.4-2014 criteria:

Structural adequacy	-	no failure at 62 minutes
Integrity	-	61 minutes
Insulation	-	no failure at 62 minutes
Incipient spread of fire	-	30 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 60/60/60.

The fire-resistance level of the floor system is applicable when the system is exposed to fire from the same side as tested.

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 4.12 of AS 1530.4-2014, have been made provided no individual component is removed or reduced.

11 Tested by

Peter Gordon
Testing Officer

Appendices

Appendix A – Measurement location

Measurement Location		
Specimen	T/C Position	T/C designation
INTERNAL - SE – joint of plasterboard	Interface of joist and plasterboard	S1
	10-mm cover in the joist	S2
	20-mm cover in the joist	S3
	10-mm cover in the joist – mid-height of the joist	S4
	on the joist – mid-height of the joist	S5
INTERNAL - SE – centre of plasterboard	Interface of joist and plasterboard	S6
	10-mm cover in the joist	S7
	20-mm cover in the joist	S8
	10-mm cover in the joist – mid-height of the joist	S9
	on the joist – mid-height of the joist	S10
INTERNAL - NW – centre of plasterboard	Interface of joist and plasterboard	S11
	10-mm cover in the joist	S12
	20-mm cover in the joist	S13
	10-mm cover in the joist – mid-height of the joist	S14
	on the joist – mid-height of the joist	S15
INTERNAL - NW – joint of plasterboard	Interface of plasterboard (Not over joint) refer TC37 on joint	S16
	10-mm cover in the joist	S17
	20-mm cover in the joist	S18
	10-mm cover in the joist – mid-height of the joist	S19
	on the joist – mid-height of the joist	S20
INTERNAL – NE	ceiling cavity	S21
INTERNAL – SW	ceiling cavity	S22
INCIPIENT SPREAD OF FIRE – unexposed face of the plasterboard ceiling	Quarter point - SE	S23
	Quarter point - NE	S24
	Quarter point - SW	S25
	Quarter point - NW	S26
	Centre of Ceiling	S31
Interface of plasterboard and paint	Quarter point - SE	S27
	Quarter point - NE	S28
	Quarter point - SW	S29
	Quarter point - NW	S30
UNEXPOSED FACE	Quarter point - NW	S32
	Quarter point - NE	S33
	Quarter point - SW	S34
	Quarter point - SE	S35
	Centre of Ceiling	S36

INTERNAL - NW – joint of plasterboard	Interface of Joist plasterboard	S37
JOINTS ON UNEXPOSED FACE	South of centre	S38
	East of centre	S39
	West of centre	S40
Rover		S41
Ambient		S42

Appendix B – Test photographs



PHOTOGRAPH 1 – EXPOSED FACE OF THE SPECIMEN PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF THE SPECIMEN PRIOR TO LOADING



PHOTOGRAPH 3 – UNEXPOSED FACE OF THE SPECIMEN PRIOR TO TESTING



PHOTOGRAPH 4 – SPECIMEN AT 30 MINUTES INTO THE TEST



PHOTOGRAPH 5 – SPECIMEN AT 35 MINUTES INTO THE TEST



PHOTOGRAPH 6 – SPECIMEN AT 58 MINUTES INTO THE TEST



PHOTOGRAPH 7 – SPECIMEN AT 59 MINUTES INTO THE TEST



PHOTOGRAPH 8 – SPECIMEN AT 60 MINUTES INTO THE TEST



PHOTOGRAPH 9 – SPECIMEN AT 61 MINUTES INTO THE TEST



PHOTOGRAPH 10 – SPECIMEN AT 61 MINUTES INTO THE TEST



PHOTOGRAPH 11 – SPECIMEN AFTER THE CONCLUSION OF TESTING

Appendix C – Test data charts

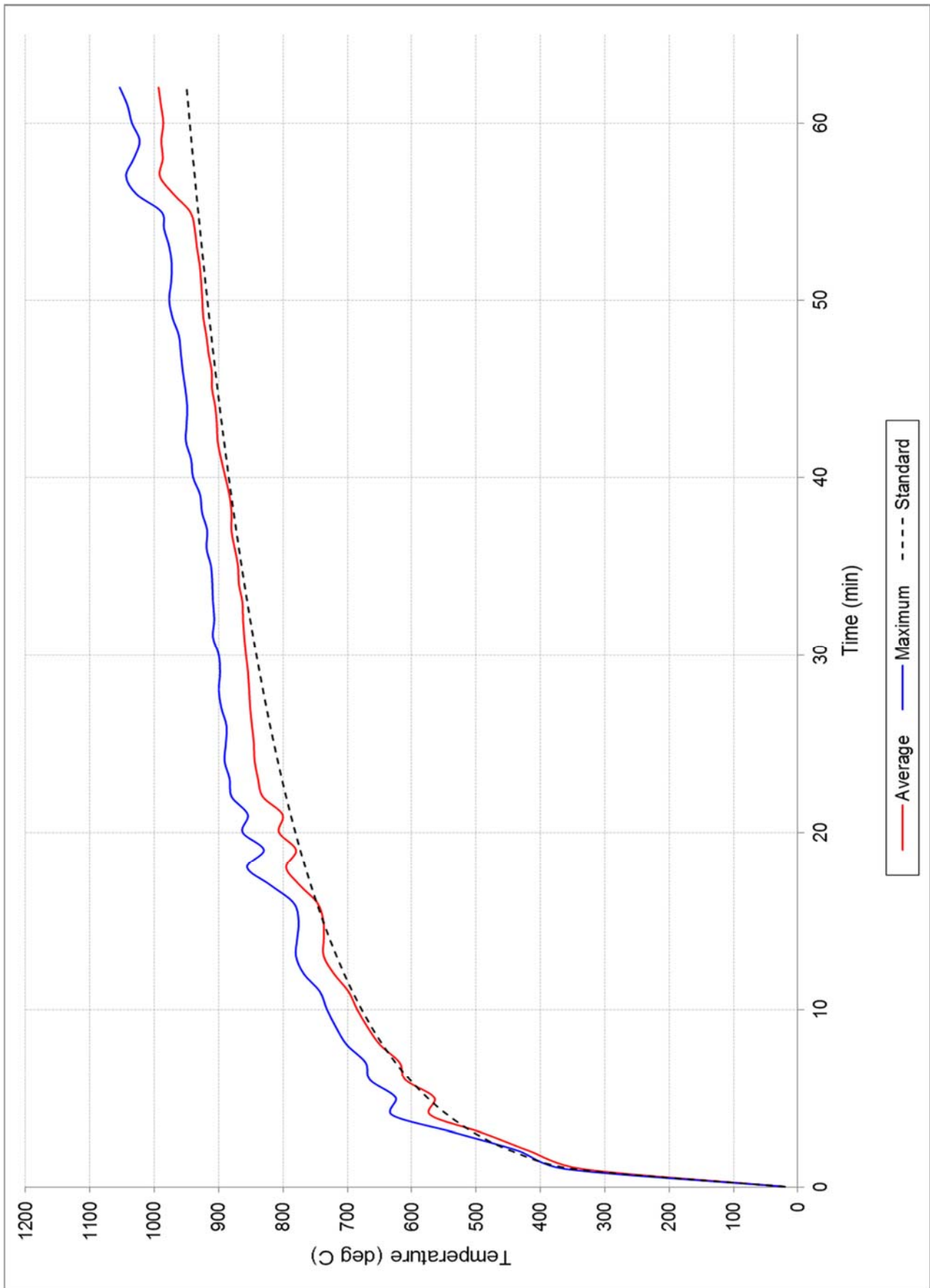


FIGURE 1 – FURNACE TEMPERATURE

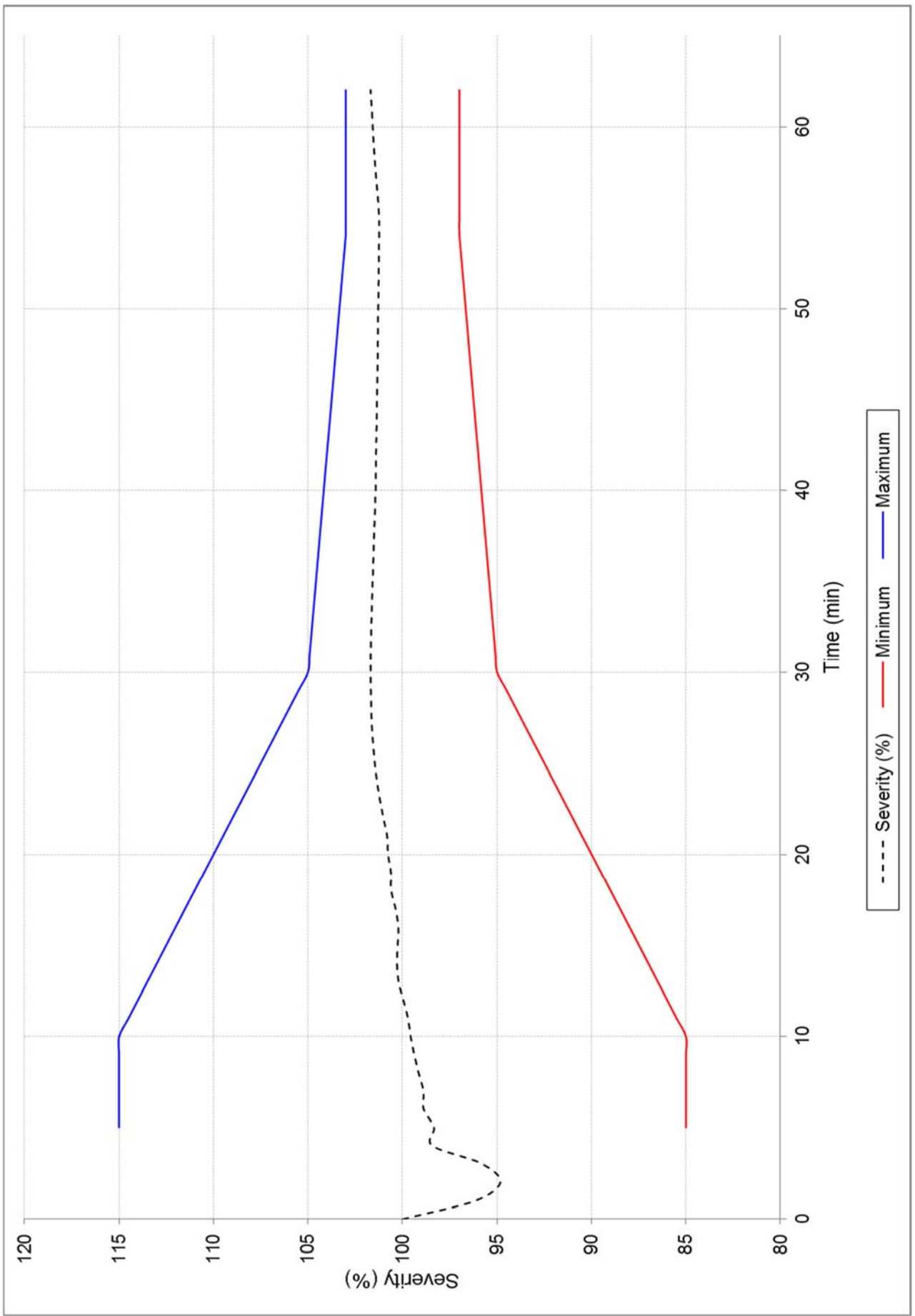


FIGURE 2 – FURNACE SEVERITY

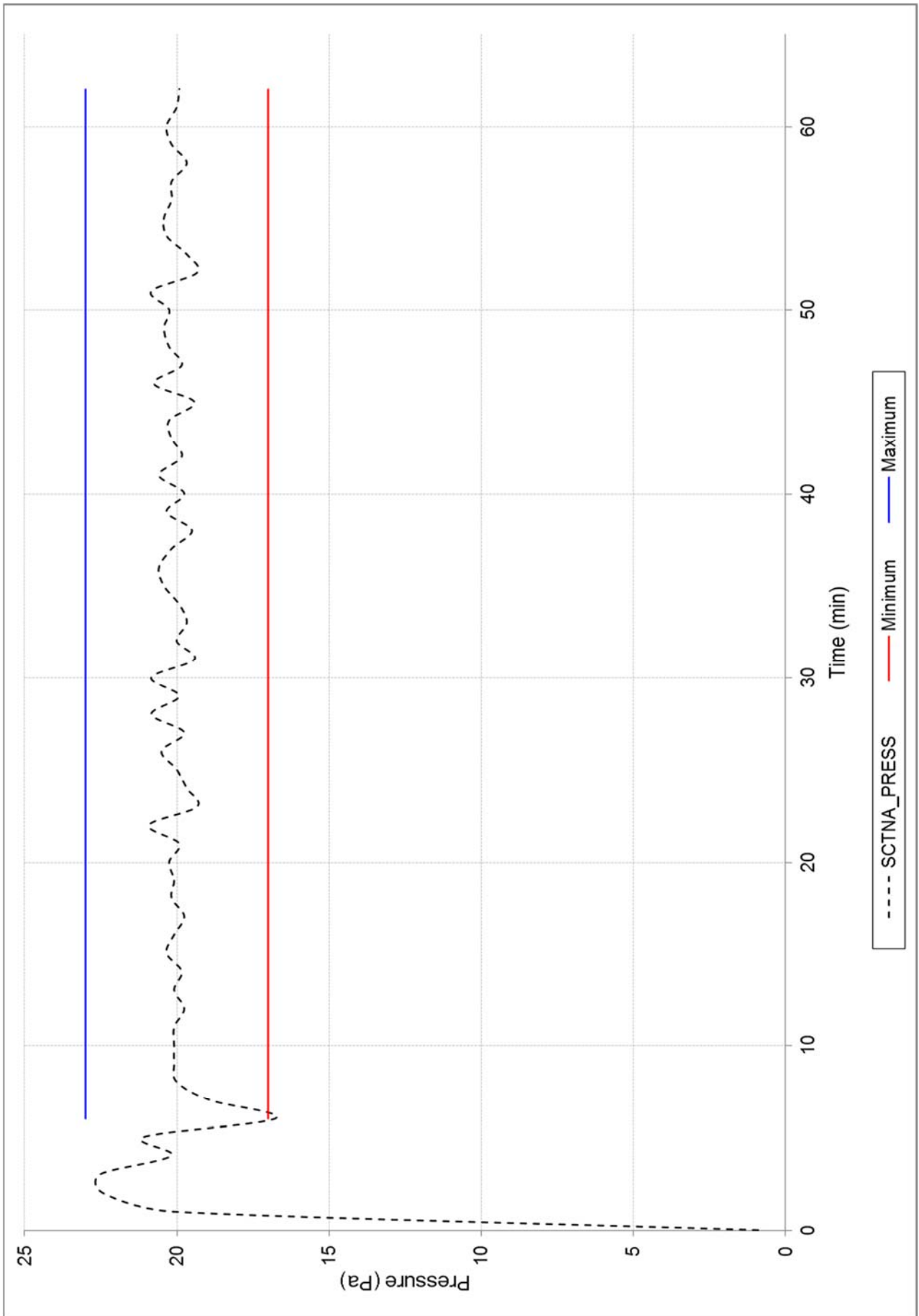


FIGURE 3 – FURNACE PRESSURE

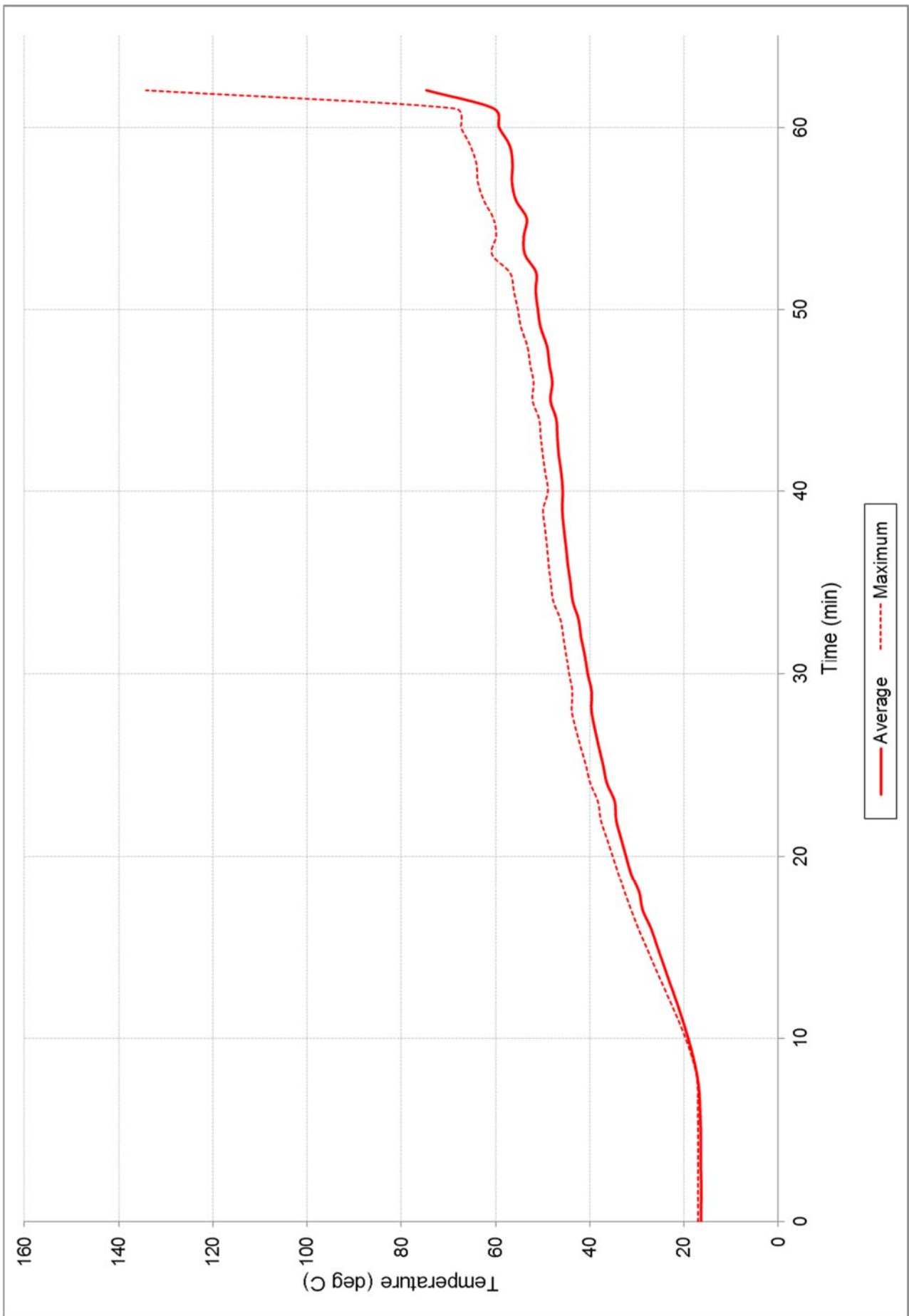


FIGURE 4 – SPECIMEN TEMPERATURE – UNEXPOSED FACE OF THE SPECIMEN

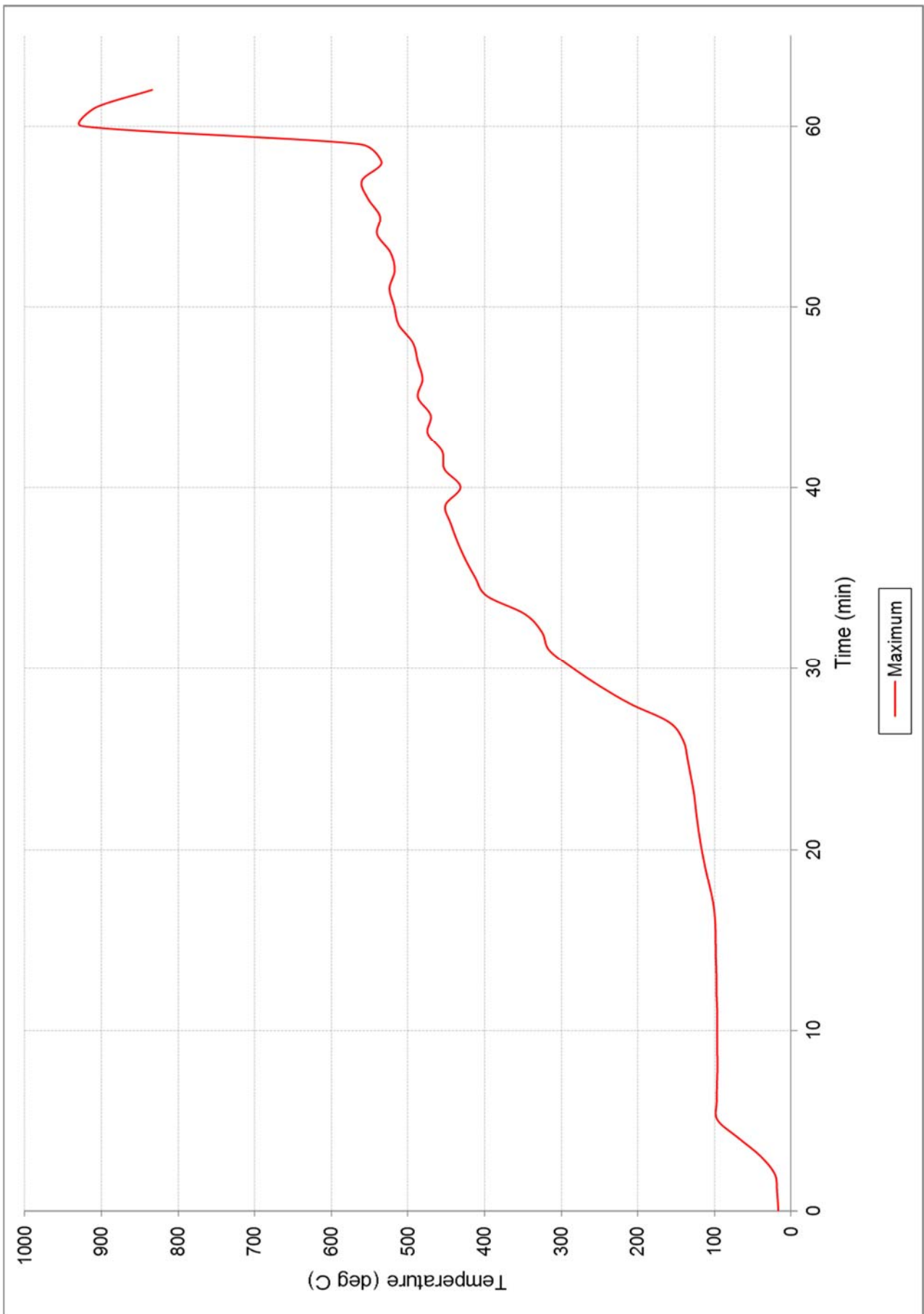


FIGURE 5 – SPECIMEN TEMPERATURE – ON UNEXPOSED FACE OF THE PLASTERBOARD WITHIN THE FLOOR CAVITY

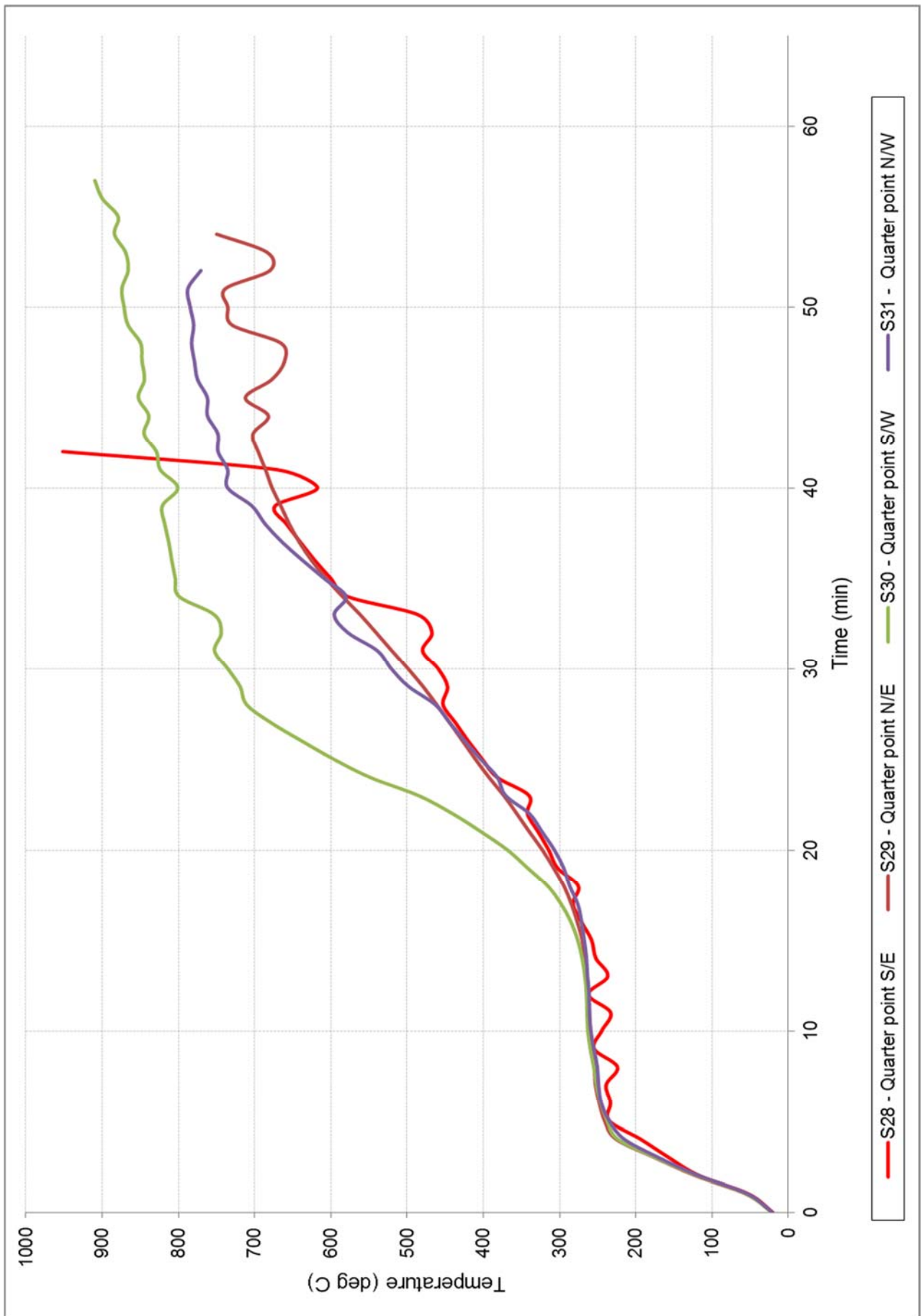


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PLASTERBOARD / PAINT INTERFACE

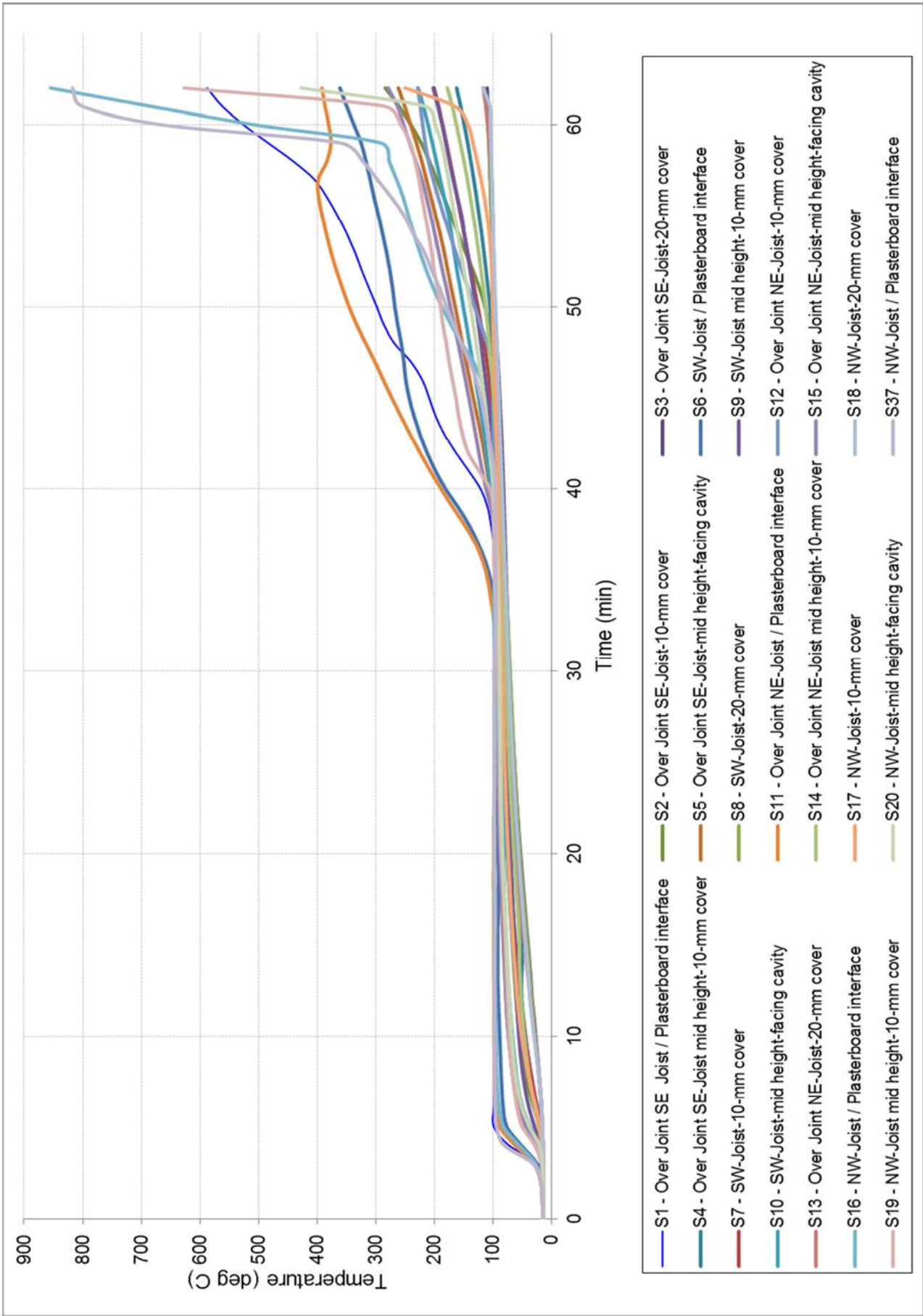


FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH THE TIMBER JOISTS

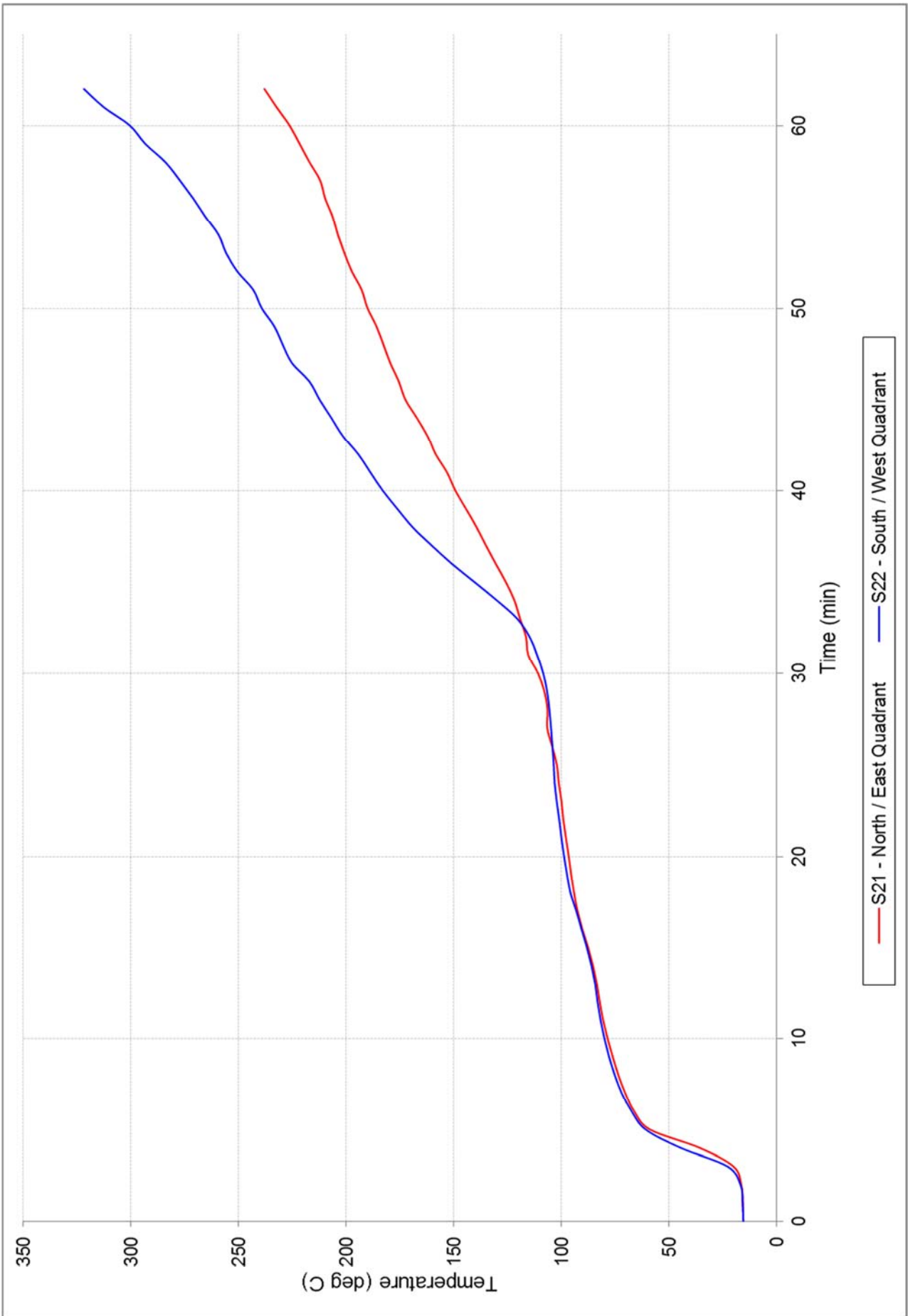


FIGURE 8 – SPECIMEN AIR TEMPERATURE WITHIN THE CAVITY

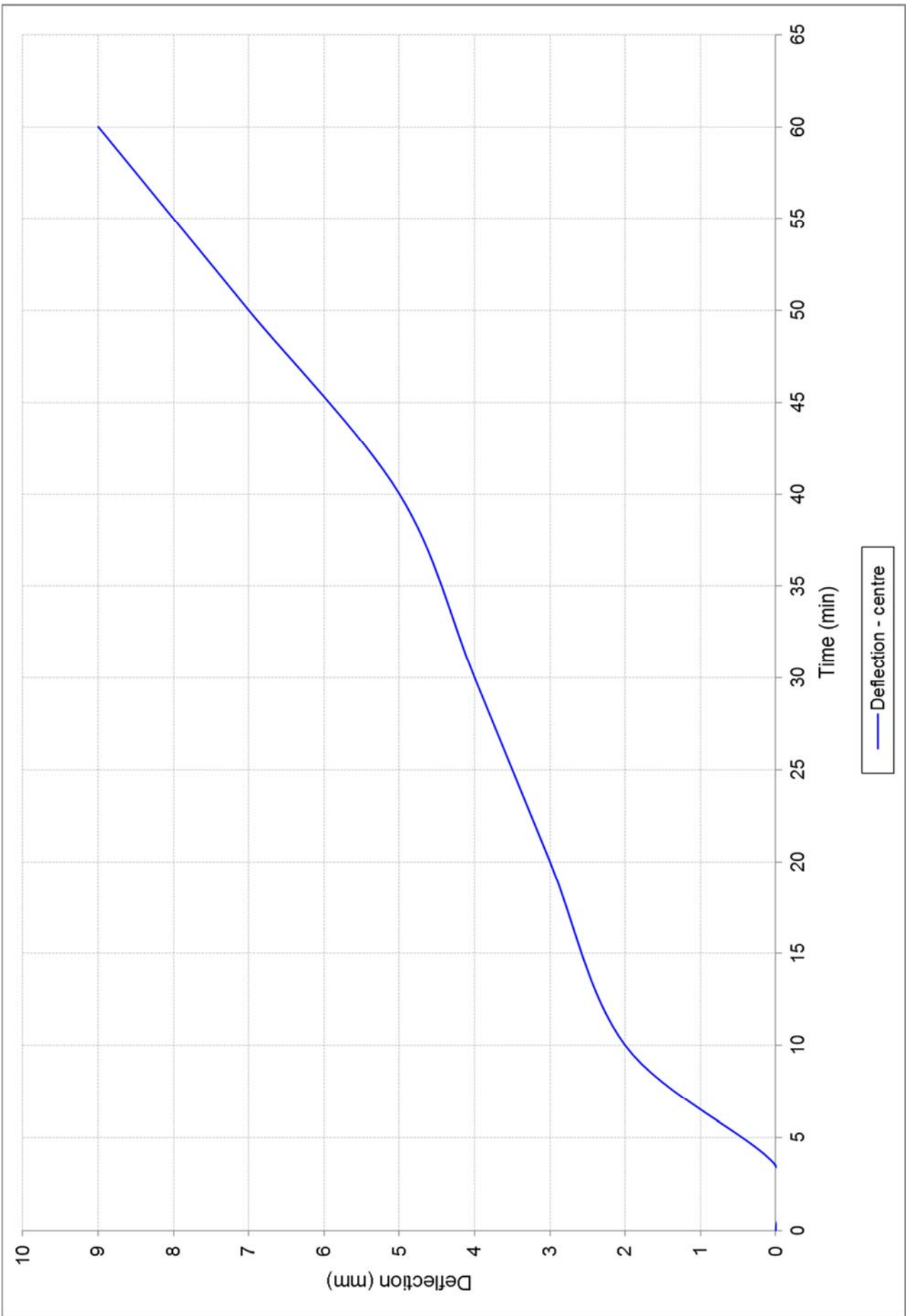


FIGURE 9 – SPECIMEN DEFLECTION



13/06/2017

CSIRO Test Specification

Test number: TC_0011

Shane Wyatt
TECH COATINGS NZ Limited

CSIRO Full- Scale Mid floor 13mm Plasterboard TC- 0011

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Tech Coatings test specification



Scope of Work

- The test specimen is 4690mm long x 3000mm wide x 273mm thick, timber framed mid-floor/ceiling system drawn & constructed as per NZS 3603:1993, refer to [TC_0011_SH4271_13mm_GIB_Ceiling_Drawing.pdf](#)
- The floor system is comprised of 240mm x 45mm MSG H3 treated joists at 400mm centres, **Boundary Joists** are 240mm x 45mm MSG H3 treated timber joists, the floor lining is 19mm CCA structural plywood and the underside of the mid-floor/ceiling is lined with a single layer of 13mm standard GIB plasterboard, protected with a 1000 μ (DFT) coat of *FBL-100* Intumescent paint.

Schedule of Materials

- 19mm CCA Structural Plywood
- 50mm x 8g 304 Stainless steel countersunk screws
- 190mm x 45mm MSG, H3 Treated Timber Joist
- 100mm x 14g Bugle Screws
- 75mm x 3.06mm D Head framing nails
- 13mm GIB Standard Plasterboard
- 13mm GIB Fyreline Plasterboard
- 32mm x 6g Gib grabber screws
- 50mm x 7g Plasterboard screws
- Gibfix All bond, Stud Adhesive
- GIB MaxSet, Jointing Compound
- GIB Paper Joint Tape
- *FBL-100*, Intumescent Paint

Construction

The floor/ceiling will be constructed with the following elements working from the floor down to the ceiling:

- **Flooring** – Will be 19mm CCA Structural Plywood to be fixed using 50mm x 8g 304 S/S countersunk screws. Perimeter fixing @150mm centres max. Mid sheet fixing @ 400mm centres max.
- **Flooring Joists** – 240mm x 45mm MSG, H3 Treated Timber Joists spaced at 400mm centres max. The **Trimmer joists** on either side will be protected with a layer of 253mm wide x 13mm thick Fyreline GIB Plasterboard. The Fyreline is to go 13mm past the bottom of the joist to protect the edge of the standard GIB plasterboard
- **Boundary Joists** – These will be 240x45mm MSG, H3 Treated timber joist fixed with 75mm X 3.06mm D Head framing nails. Three 100mm x 14g Bugle Screws are to be used per joist.
- **Ceiling** – The ceiling will be lined with 13mm Standard Gib plasterboard, fixed according to the standard screwing pattern with 32mm x 6g GIB grabber screws & GibFix all bond adhesive. Perimeter fixing 32mm 6g GIB Grabber screws @ 200mm centres. Mid Sheet Fixing, **daubs** of Gibfix All bond @ 200mm centres, 32mm x 6g GIB grabber screws @ 600mm centres. Extra 50mm x 7g plasterboard screws @ 200mm centres.
- **Fyreline** (refer to detail A, [TC_0011.1](#)), 1500mm long x 240mm wide x 13mm thick Fyreline plasterboard to be fixed to the underside of mid-floor/ceiling. It is to not to protrude more than 25mm into the furnace opening. Perimeter fixing along joint with 13mm standard GIB plasterboard with 32mm 6g Grabber screws @ 200mm centres. The outside face of the perimeter joists are to protected on the outside face by 13mm Fyreline GIB Plasterboard.

Stopping

First (Taping) Coat

Using a 150mm broad-knife, fill the recess formed by the edges of the sheets with GIB MaxSet. Centre the GIB tape along the joint and using a 150mm broad knife press the tape down into the compound. Immediately apply a thin coat of compound over the surface of the tape.

Allow compound to dry, then scrape back

Second Coat

Apply a second coat of jointing compound with a trowel. Ensure that this coat extends at least 25mm beyond the edge of the first coat.

Allow compound to dry the scrape back

Finishing Coat

Apply a finishing coat of compound with a 280mm trowel. Joint edges should be feathered at least 25mm beyond the edges of the previous coat.

Allow compound to dry the scrape back

Paint Specification

Intumescent Coat

The ceiling will be coated with ICG FBL 100 Intumescent paint. Please refer to the Product Data Sheet.

The surface must be prepared as per AS/NZS 2311:2017, section 3

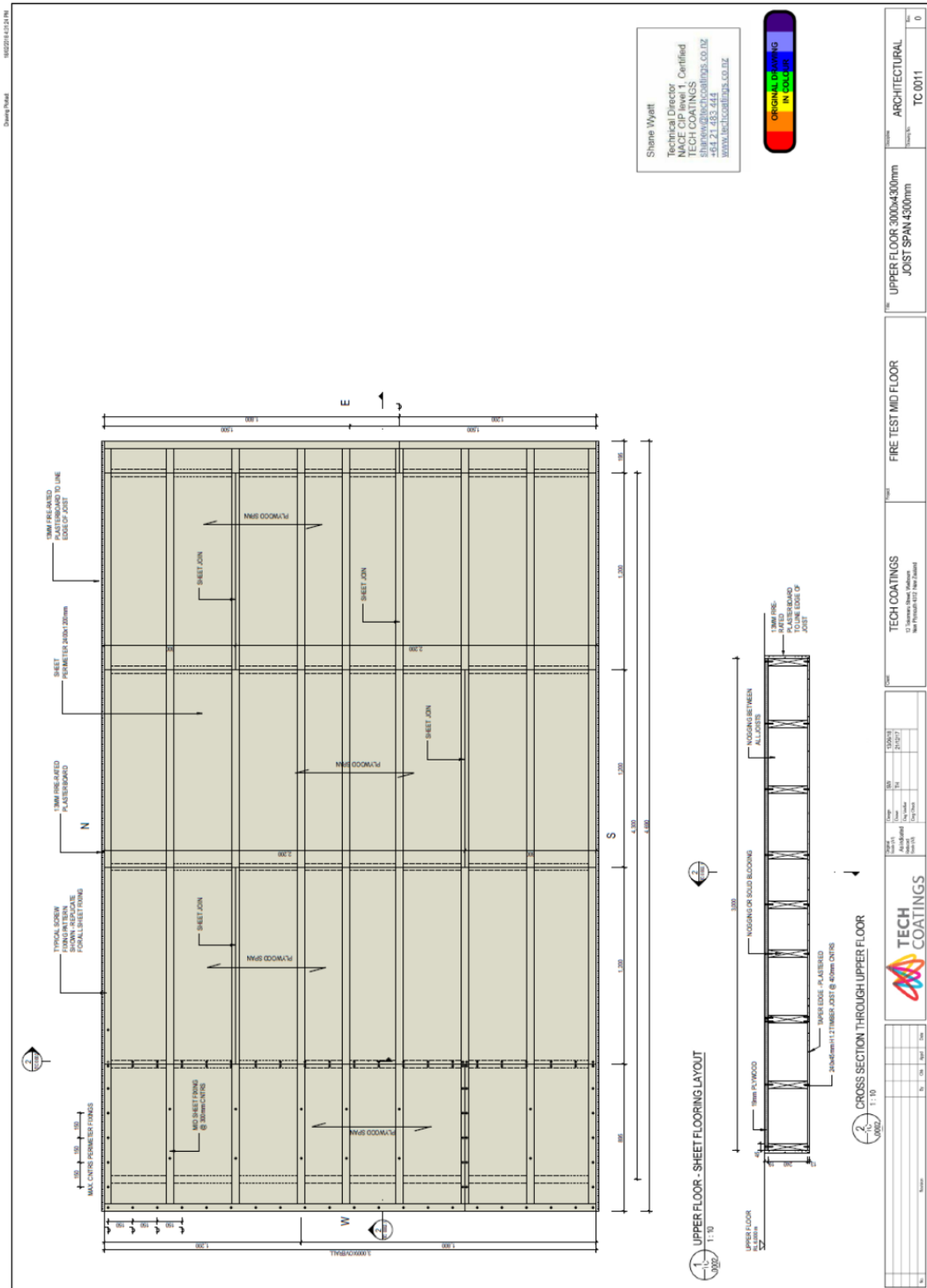
The DFT required is 1000 μ . This will be achieved by the application of 2 x 800 μ WFT coats. A WFT gauge is to be used to check the consistency of application. DFT readings are to be taken between coats. Final DFT will be determined by using a Defelsko Positector 200c Ultrasonic probe.

If you have any questions please contact

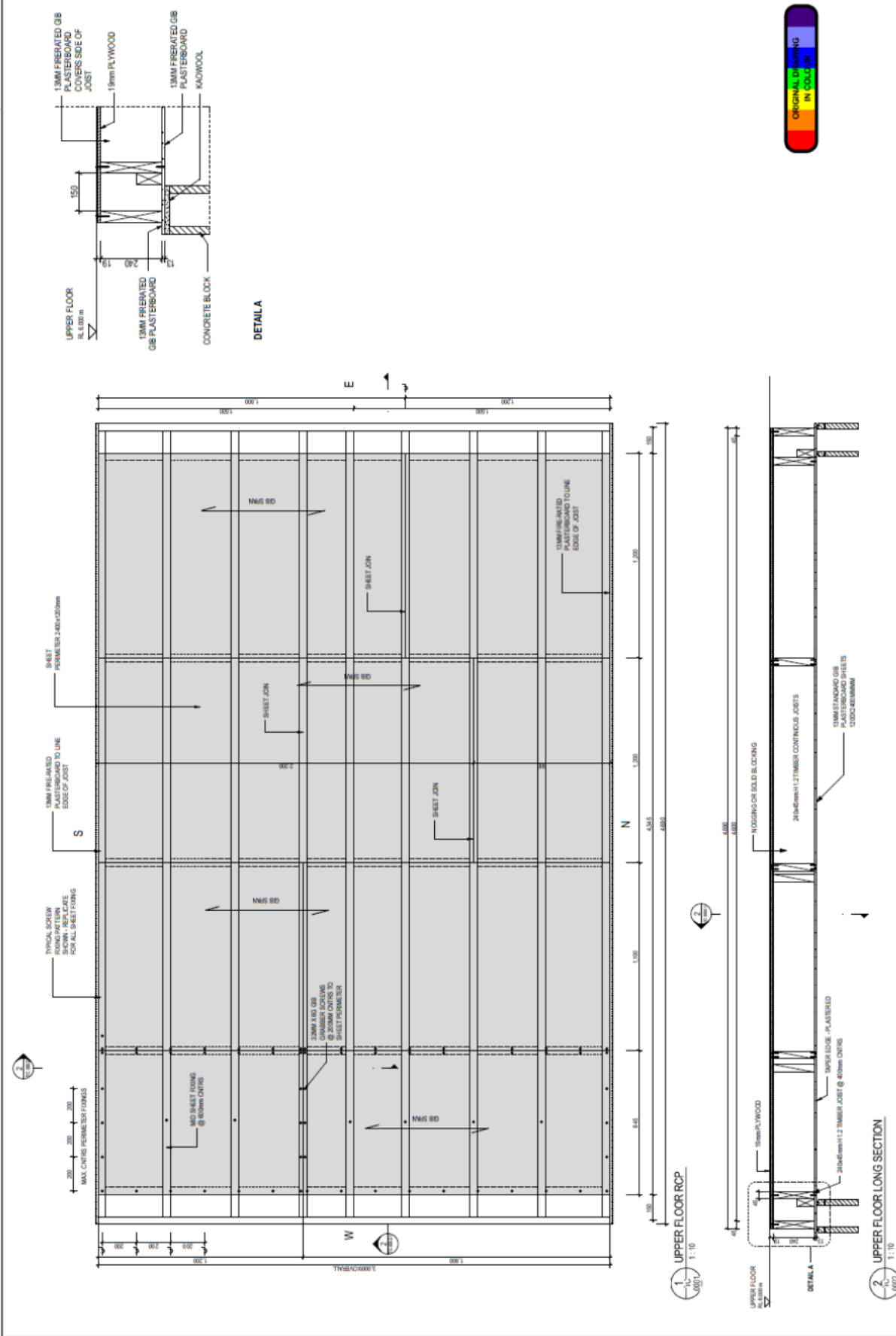
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Appendix D – Specimen drawings



DRAWING TC0011, UPPER FLOOR 3000 X 4300MM JOIST SPAN 4300MM, DATED 13/06/18, BY TECH COATINGS



		PROJECT: UPPER FLOOR 3M X 4.3m RCP AND LONG SECTION DRAWING NO: TC-0011.1
DATE: 13/06/18 DRAWN BY: [Name] CHECKED BY: [Name]	TECH COATINGS 15 University Ave, Northcote VIC 3070 Australia Tel: 03 9450 1000 Email: info@techcoatings.com.au	FIRE TEST MID FLOOR ARCHITECTURAL TC-0011.1

DRAWING TC0011, UPPER FLOOR 3M X 4.3M RCP AND LONG SECTION, DATED 13/06/18, BY TECH COATINGS

Appendix F – Certificate(s) of Test

INFRASTRUCTURE TECHNOLOGIES www.csiro.au		
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. 3147
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 4: Floors, roofs and ceilings Horizontal Separating Elements), on behalf of:		
Tech Coatings NZ Limited 12 Tokomaru Street Welbourn 4312 New Zealand		
A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSH 1920.		
Product Name:	Timber framed floor/ceiling system with 19-mm thick structural timber plywood flooring, lined with a single layer of 13-mm thick standard GIB plasterboard, protected with 1040µ of FBL-100 Intumescent paint	
Description:	The floor/ceiling system measured 4690-mm long x 3000-mm wide x 273-mm thick and comprised 240-mm deep x 45-mm thick MSG H3 treated Radiata pine joists and blockings. The floor was lined with 19-mm CCA thick structural plywood and the underside of the floor/ceiling clad with a single layer of 13-mm thick standard GIB plasterboard protected with 1040µ of FBL-100 Intumescent paint. The floor structure comprised 240-mm x 45-mm x 4600-mm long MSG H3 treated timber joists, spaced at nominally 400-mm centres. The outside face of the boundary joists were protected with a single layer of 253-mm wide x 13-mm thick Fyrelite GIB Plasterboard. The timber floor joists were clad on the unexposed face using 19-mm CCA thick structural plywood sheets nominally 1200-mm wide x 2400-mm wide. The specimen was lined on the exposed face of the floor joists with one layer of 13-mm thick standard GIB Plasterboard, nominally measuring 2400-mm long x 1200-mm wide and 13-mm thick. The exposed face of the plaster ceiling was painted with FBL-100 Intumescent paint - thickness of 1040µ DFT was measured after the final paint application. The floor/ceiling specimen was exposed to the furnace chamber from the underside. A total load of 2510 kg was applied to the specimen for the duration of the test.	
Performance observed in respect of the following AS 1530.4-2014 criteria:		
Structural Adequacy	Integrity	Insulation
Incipient spread of fire	no failure at 62 minutes 61 minutes	no failure at 62 minutes 30 minutes
and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of 60/60/60. The fire-resistance level of the floor system is applicable when the system is exposed to fire from the same side as tested.		
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 recognized 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: 31 July 2018
Issued on the 13 th day of September 2018 without alterations or additions.		
 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 3147

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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FOR FURTHER INFORMATION

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