Fire-resistance test on a load bearing horizontal separating element

Test Report

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Report number: FSH 2576 Revision A

Date: 13 August 2026

Client: FireCrunch Australasia Pty Ltd

Commercial-in-confidence

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Revision A	The Client provided updated drawings titled CSIRO Flooring Test 2 Layers Drawings, 7 sheets, dated 5 July 2026, by FireCrunch Australasia Pty Ltd. Reference to Insulation thickness was corrected in Section 2.3.	13/04/2026	CSIRO/CLIENT	FSH 2576

Report Authorization:

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13 August 2026	13 August 2026	13 August 2026

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Fire-resistance test on a load bearing horizontal separating element Sponsored Investigation No. FSH 2576

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as a loaded steel framed floor/ceiling system protected with FireCrunch board and included Vulcan wool insulation within floor ceiling cavity.

1.2 Sponsor

FireCrunch Australasia Pty Ltd
Suite 19, Level 44 MLC Centre
19-29 Martin Place, NSW 2000

1.3 Manufacturer(s)

FireCrunch Australasia Pty Ltd
Suite 19, Level 44 MLC Centre
19-29 Martin Place, NSW 2000

1.4 Test standard

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

Section 4: Floor, Roofs and Ceiling Horizontal Separating Elements.

1.5 Test number

CSIRO reference test number FS 5477/5127

1.6 Test date

The fire-resistance test was conducted on 9th July 2026.

2 Description of specimen

2.1 General

The sponsor identified the specimen as a loaded steel framed floor/ceiling system with nominal dimensions of 4500-mm long x 2850-mm wide x 293-mm thick. The system comprised of C-Sections of 250-mm x 75-mm x 2.4 BMT steel frame. The floor was lined with a layer of 19-mm TG 4-sided K-Floor board, and the underside of the floor/ceiling clad with two layers of 10-mm thick K-Clad SE board.

2.2 Floor Structure and flooring

The floor structure comprised eight C-Section joists with measured dimensions of 4500-mm x 250-mm x 75-mm x 2.4 BMT, spaced at nominally 450-mm centres and 350-mm from one edge. The joists were fixed to C-Sections bearers at the supported ends. It had a nominal dimension of 2850-mm x 250-mm x 75-mm x 2.4 BMT. AC250 brackets were used to fix the joists to the bearers and bolted with four M12x30 flanged purlin bolts.

The floor bearer and joist structure was clad on the unexposed face using 19-mm TG 4 K-Floor board, featuring a 4-sided tongue and groove profile, with nominal dimensions of 2700-mm x 600-mm. The maximum length of the flooring board installed on the unexposed side was 2400-mm to cover seven joists, then joined to an additional board to complete the total 2850-mm width of the floor. The floor was screw fixed using 10g x 40 Phillips drive screws, Class 3, at 200-mm centres, 15-mm from the edges and 50-mm from the corners. SIKA Sikaflex 400 Fire sealant was applied in the interface between the joist and the board sheet in contact, and between the tongue and groove of the board. Refer to Appendix D Drawings for more detail

2.3 Ceiling Lining and insulation

The floor bearer and joist structure was protected on the exposed face (underside) with two layers of 10-mm thick K-Clad SE board, with nominal dimensions of 3000-mm x 1200-mm.

The two layers of the K-Clad SE board were installed with a 3-mm gap recessed joint for the first layer (underlayer) and a 5-mm gap for the second layer (exposed layer) along the joist and 1200-mm apart. The gaps were filled with SIKA Sikaflex 400 Fire sealant and the underlayer was glued to the metal structure with a bead of SIKA Sikaflex 400 Fire sealant and fixed against the joist using 10g x 40 Phillips drive screws, Class 3, at 200-mm centres, 15-mm from the edges and 50-mm from the corners.

The second layer (exposed face) was installed overlapping the joints of the first layer, as shown in the drawings titled combined FireCrunch, Rev 3, page 3 out of 7, dated 5 July 2026, by FireCrunch Australasia Pty Ltd, located in Appendix D. The exposed layer was fixed against the underlayer using 10g x 40 Phillips drive screws, Class 3, at 200-mm centres, 15-mm from the edges and 50-mm from the corners.

Cavity insulation was installed above the ceiling lings, between the floor bearer and joist structure. The cavity insulation comprised a layer of 80-mm thick DCT VulcanWool insulation (High-density mineral rock fibre- Proctor), with measured density of nominal 90 kg/m^3. The insulation was installed into the cavity of the ceiling-floor system. Refer to Appendix D Drawings for more detail.

2.4 Edge detail and Restraint

Along both unsupported (long) e edges of the floor, a nominal 75-mm gap between the furnace wall and the specimen edge was filled with ceramic fibre blanket. This provided an effective seal to the furnace and no structural support to the specimen.

2.5 Orientation

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

2.6 Dimensions

The floor specimen measured 4500-mm long x 2850-mm wide x 293-mm thick.

2.7 Load

A total load of 11.93 kN was applied as two uniform line loads of 5.96 kN separated by 2500-mm (1000mm from ends) and applied to the top surface of the floor.

2.8 Conditioning

The specimen installation was completed on 24th June 2026 and exposed to indoor laboratory conditions until the test date.

2.9 Selection, construction and installation of the specimen and the supporting construction

The construction was organised by the sponsor. CSIRO was not involved in the sampling or 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:

- Drawing Titled CSIRO Flooring Test 2 Layers Drawings, 7 sheets, dated 5 July 2026, by FireCrunch Australasia Pty Ltd.

No Confidential information about the test specimens has been submitted to CSIRO Infrastructure Technologies.

4 Equipment

4.1 Furnace

The furnace had a nominal opening of 4350-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 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 floor and ceiling 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 500-mm below the underside of the specimen, where the pressure was set at 17 Pa (to provide a pressure of 20 Pa at 100-mm below the board ceiling).

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 ambient laboratory air temperature measured as specified by AS 1530.4-2014 clause 2.11.5 was 25°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 92 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

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

Time	Observation
10 seconds -	Smoke is emitting from the perimeter of the specimen.
23 minutes -	Smoke emission has intensified.
57 minutes -	A slight deformation towards the furnace is noted at the centre of the specimen.
75 minutes -	Incipient Spread of Fire Failure – maximum temperature of 250 ^{o}C was exceeded on the unexposed face of the VulcanWool insulation within the cavity at the North-East quarter point - Thermocouple #6.
76 minutes -	Smoke is emitted from the second joint of the floor, seen from the east end.
80 minutes -	A gap is formed, with around 3-mm wide on the second joint of the floor, seen from the South-East end. Cotton pad applied with no ignition noted.
84 minutes -	A gap is formed, with around 3-mm wide on the second joint of the floor, seen from the North-East end. Cotton pad applied with no ignition noted.
86 minutes -	Integrity failure of the Specimen - Cotton pad was applied on the 3-mm wide gap located on the second joint of the floor, seen from the South-East end. Ignition of the cotton pad was noted.
88 minutes -	Insulation failure of the specimen - Maximum temperature rise of 180K was exceeded on the floor at the South-East quarter point - Thermocouple #12. Substantial deformation toward the furnace is noted at the centre and the south end of the specimen.
92 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 the curves of temperature versus time associated with Group 1 hot flange.

Figure 5 shows the curves of temperature versus time associated with Group 2. RISF-Ceiling membrane.

Figure 6 shows the curve of temperature versus time associated with Group 3. On top of the Floor, quarter points and centre.

Figure 7 shows the curves of temperature versus time on top of the Floor, Average T/C.

Figure 8 shows the curves of temperature versus time associated with Group 4. on top of the floor. critical T/C.

Figure 9 shows the curves of temperature versus time for Group 5. cavity air temperature.

8.6 Specimen deflection

Figure 10 shows the curve of deflection versus time recorded on the unexposed face of the wall system.

8.7 Performance

Performance of the incipient spread of fire (RISF) of the steel framed floor/ceiling system. The maximum temperature of 250°C was exceeded in the space between the VulcanWool insulation and the 19mm TG 4 K-Floor board, at 75 min. The performance between the ceiling and floor at all locations and times to exceed 250°C of other positions are listed below.

Table 1. Resistance to incipient Spread

Location of thermocouple	Time to exceed 250°C
Quarter Point Northeast	75 min
Quarter Point Southeast	77 min
Quarter Point Northwest	85 min
Quarter Point Southwest	84 min
Centre	81 min

Table 2. Time and deflection of the specimen for Structural Adequacy

Criteria of failure	Max Value	Result
Max deflection of the laterally loaded elements (L^2/400*d)	>158-mm	104-mm at 92 min - **No failure**
Rate of deflection (L^2/9000*d) (The rate of deflection limit shall not apply before a deflection of L/30 (143-mm) is exceeded)	<7.0-mm / minute	Max rate of 12-mm/minute at 92 minutes at 104-mm Before maximum deflection of 143-mm - **No failure**

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

Structural adequacy	-	no failure at 92 minutes
Integrity	-	86 minutes
Insulation	-	88 minutes
Incipient Spread of Fire, RISF		75 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 90/60/60 and RISF 75 minutes, when a total load of 11.93 kN was applied as two uniform line loads of 5.96 kN separated by 2500-mm (1000-mm from ends) and applied to the top of the floor.

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 apply to installations exposed to fire from the same side as tested.

11 Tested by

Peter Gordon
Testing Officer

Appendices

Appendix A – Measurement location

Specimen	T/C Position	T/C designation
Group 1-Hot flange, between the FireCrunch board and the Purlin	QP NE	S1
	QPSE	S2
	QP NW	S3
	QP SW	S4
	Centre	S5
Group 2. RISF-Top face of the VulcanWool insulation. Average T/C	QP NE	S6
	QPSE	S7
	QP NW	S8
	QP SW	S9
	Centre	S10
Group 3. On top of the Floor, Average T/C	QP NE	S11
	QPSE	S12
	QP NW	S13
	QP SW	S14
	Centre	S15
Group 4. On top of the floor. Critical T/Cs At the joint, 2150-mm from the East edge At the Junction	100-mm from the South end, Centre	S16
	100-mm from the North end, Centre	S17
	15-mm from the joint (on the west), ¼ span from the South end.	S18
	15-mm from the joint (on the East), 1/2 span from the South end.	S19
	15-mm from the joint (on the west), 3/4 span from the South end.	S20
	960-mm East and 440-mm South	S21
	1205-mm West and 425-mm North	S22
Group 5. Cavity air temperature (MIMs)	1400-mm from the South end and 1500-mm from the west end.	S23
Rover	N/A	S24
Ambient	N/A	S25

Appendix B – Test photographs

PHOTOGRAPH 1 – INSTALLATION OF THE FLOOR ON THE STEEL STRUCTURE

PHOTOGRAPH 2 – EXPOSED FACE OF THE SPECIMEN PRIOR TO TESTING

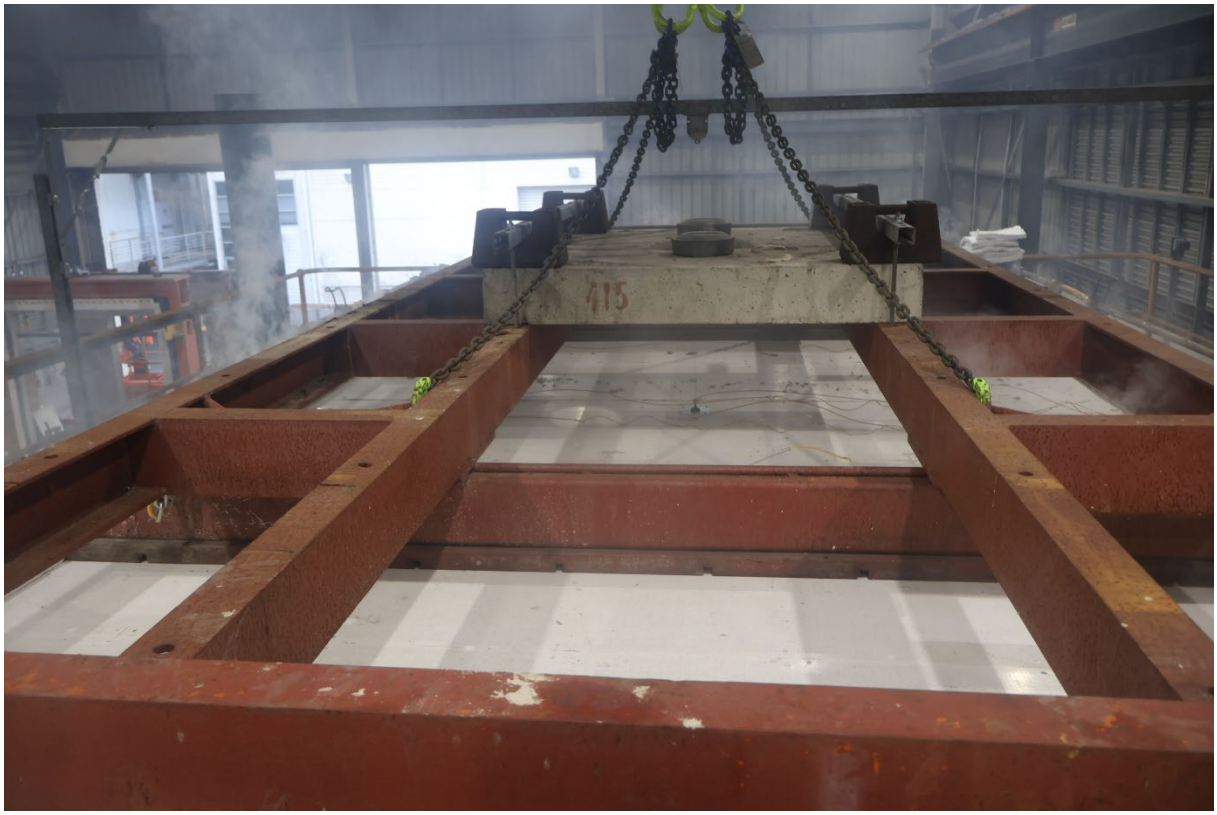
PHOTOGRAPH 3 – UNEXPOSED FACE PRIOR TO TESTING

PHOTOGRAPH 4 – UNEXPOSED FACE OF THE LOADED SPECIMEN PRIOR TO TESTING

PHOTOGRAPH 5 – SPECIMEN AT 30 MINUTES INTO THE TEST, WEST END.

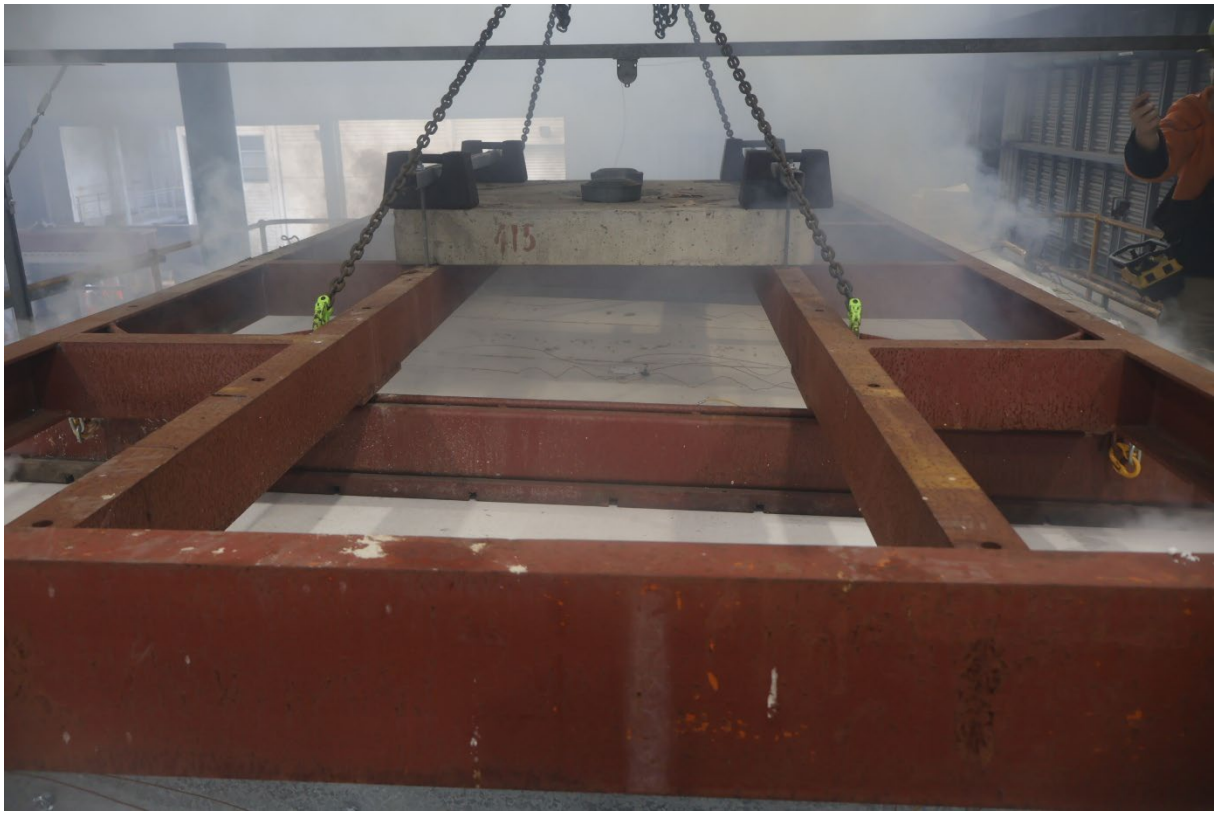
PHOTOGRAPH 6 – SPECIMEN AT 30 MINUTES INTO THE TEST, SOUTH-WEST END.

PHOTOGRAPH 7 – SPECIMEN AT 60 MINUTES INTO THE TEST, WEST END.



PHOTOGRAPH 8 – SPECIMEN AT 60 MINUTES INTO THE TEST, SOUTH-WEST END.

PHOTOGRAPH 9 – SPECIMEN AT 86 MINUTES INTO THE TEST



PHOTOGRAPH 10 – SPECIMEN AT 90 MINUTES INTO THE TEST, WEST END.

PHOTOGRAPH 11 – SPECIMEN AT 90 MINUTES INTO THE TEST, SOUTH-WEST END.

PHOTOGRAPH 12 – UNEXPOSED FACE OF THE SPECIMEN AFTER THE CONCLUSION OF TESTING

Appendix C – Test data charts

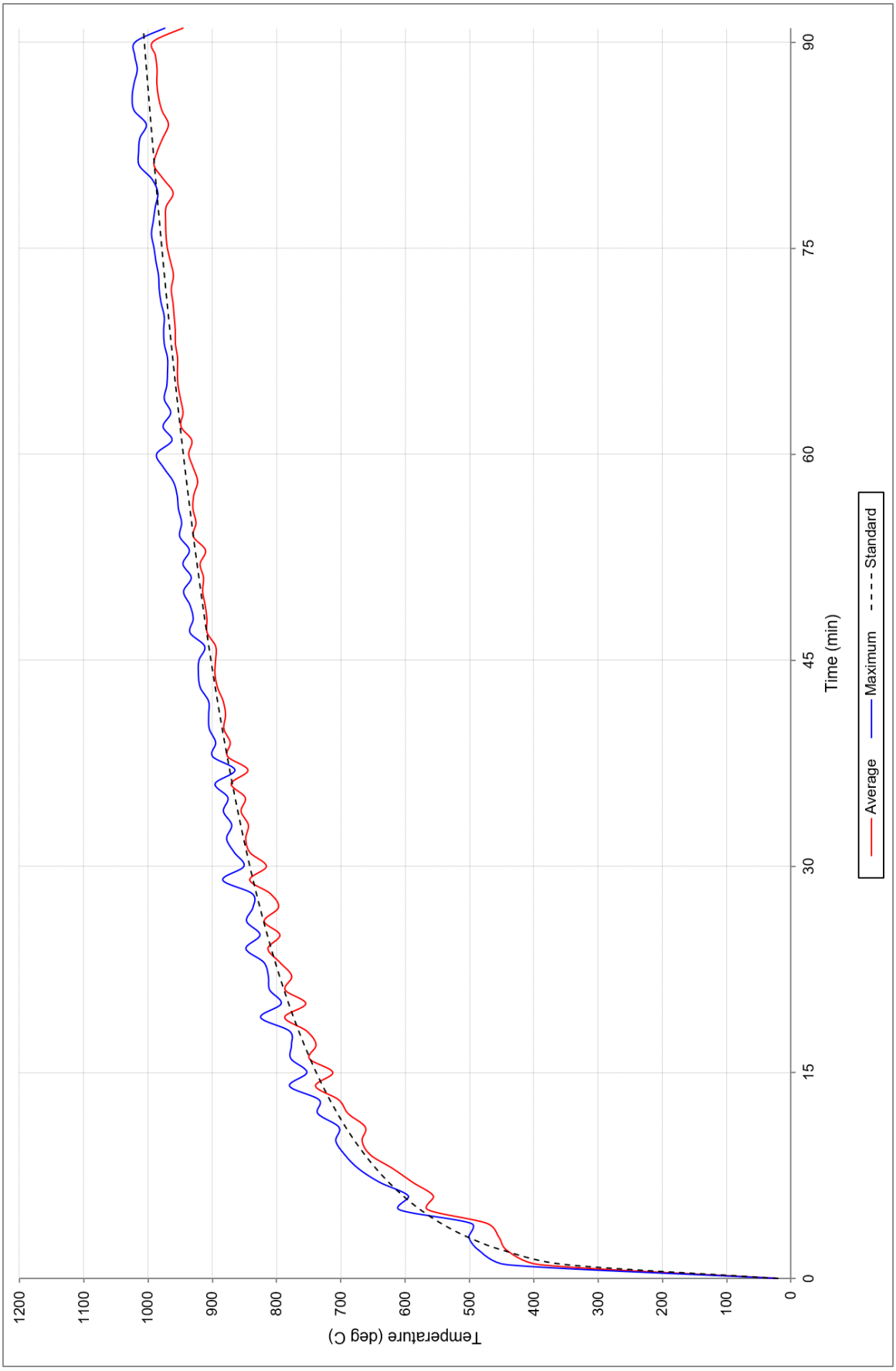


FIGURE 1 – FURNACE TEMPERATURE

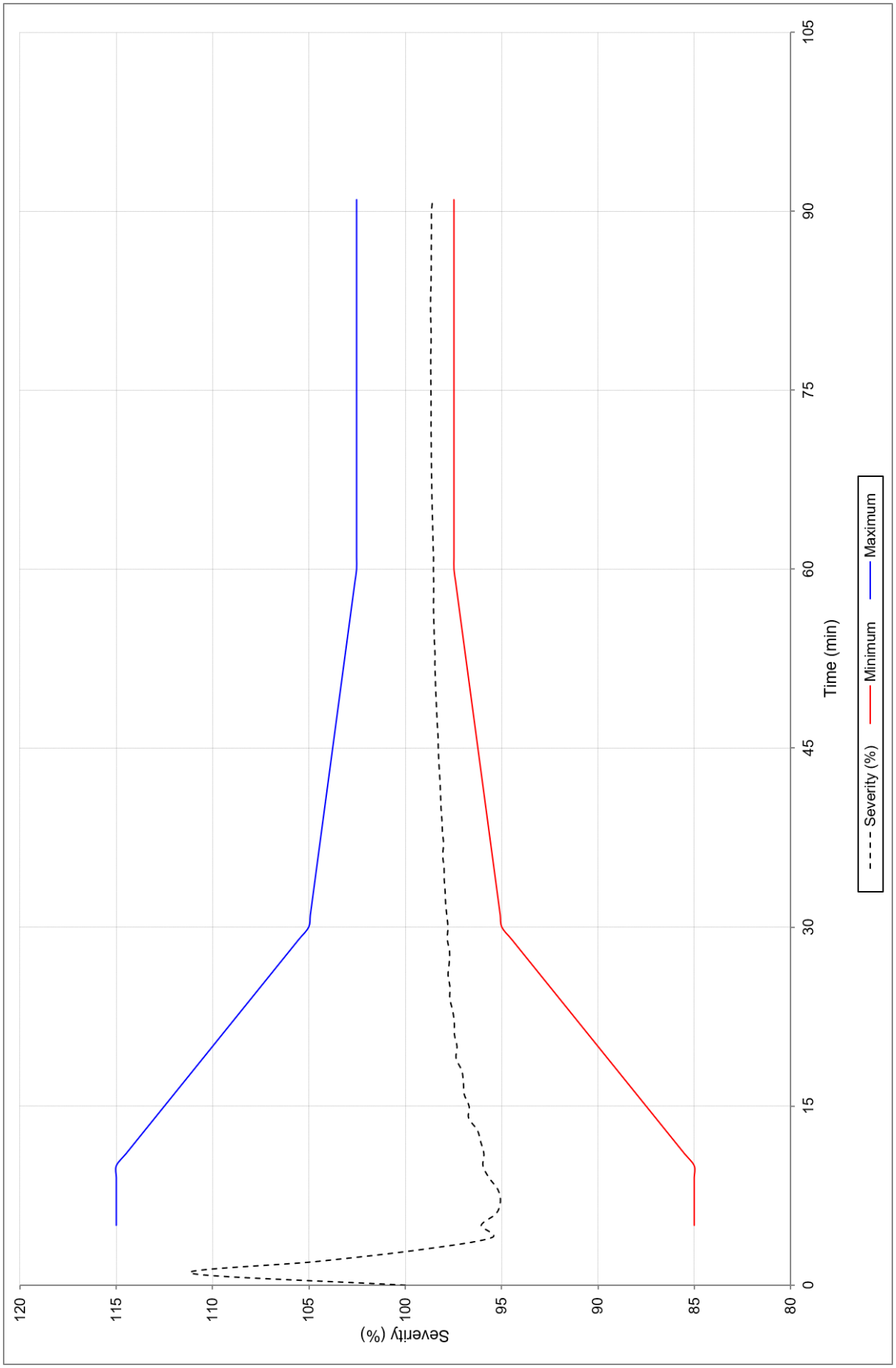


FIGURE 2 – FURNACE SEVERITY

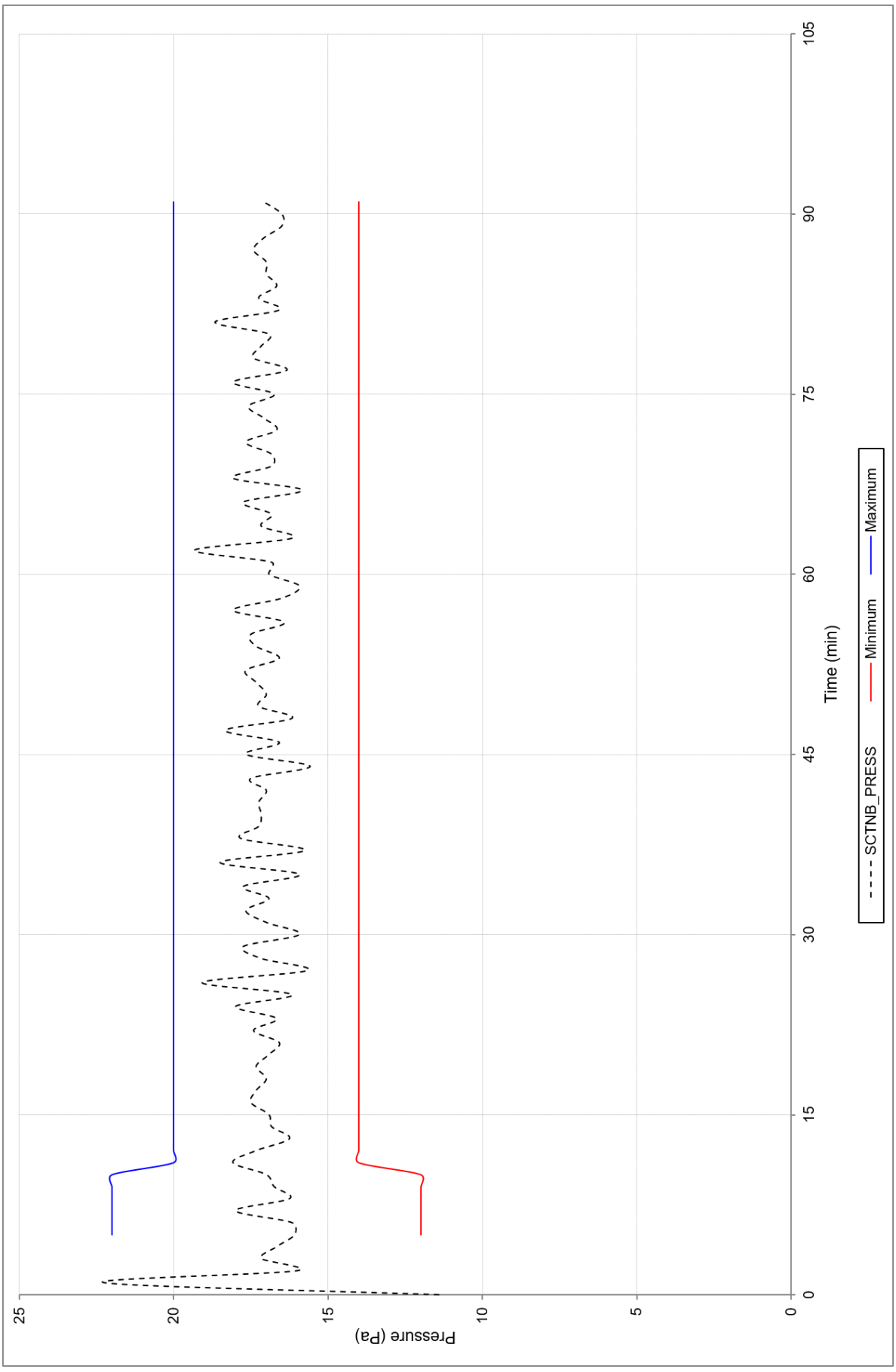


FIGURE 3 – FURNACE PRESSURE

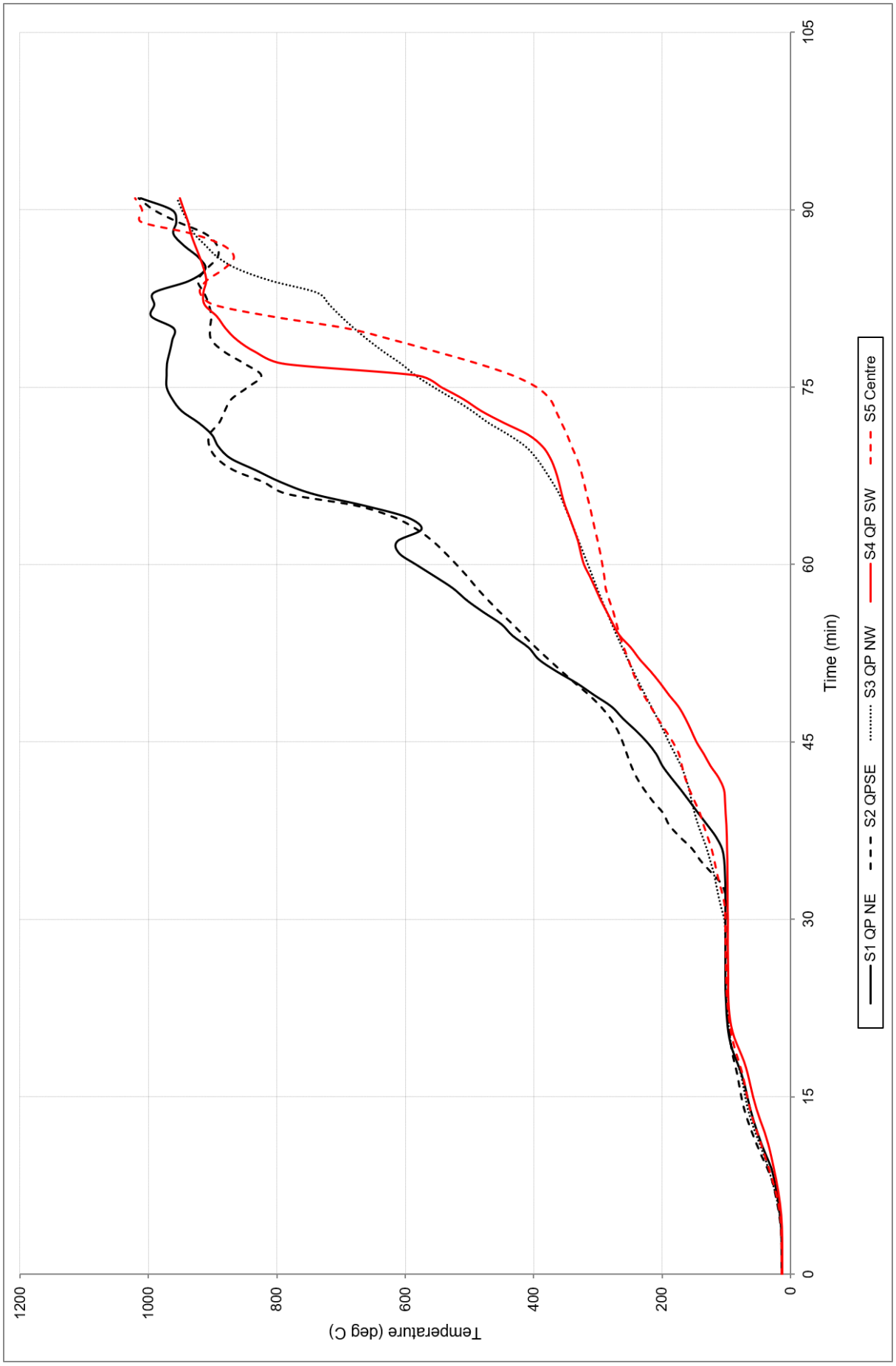


FIGURE 4 – SPECIMEN TEMPERATURE – GROUP 1, HOT FLANGE

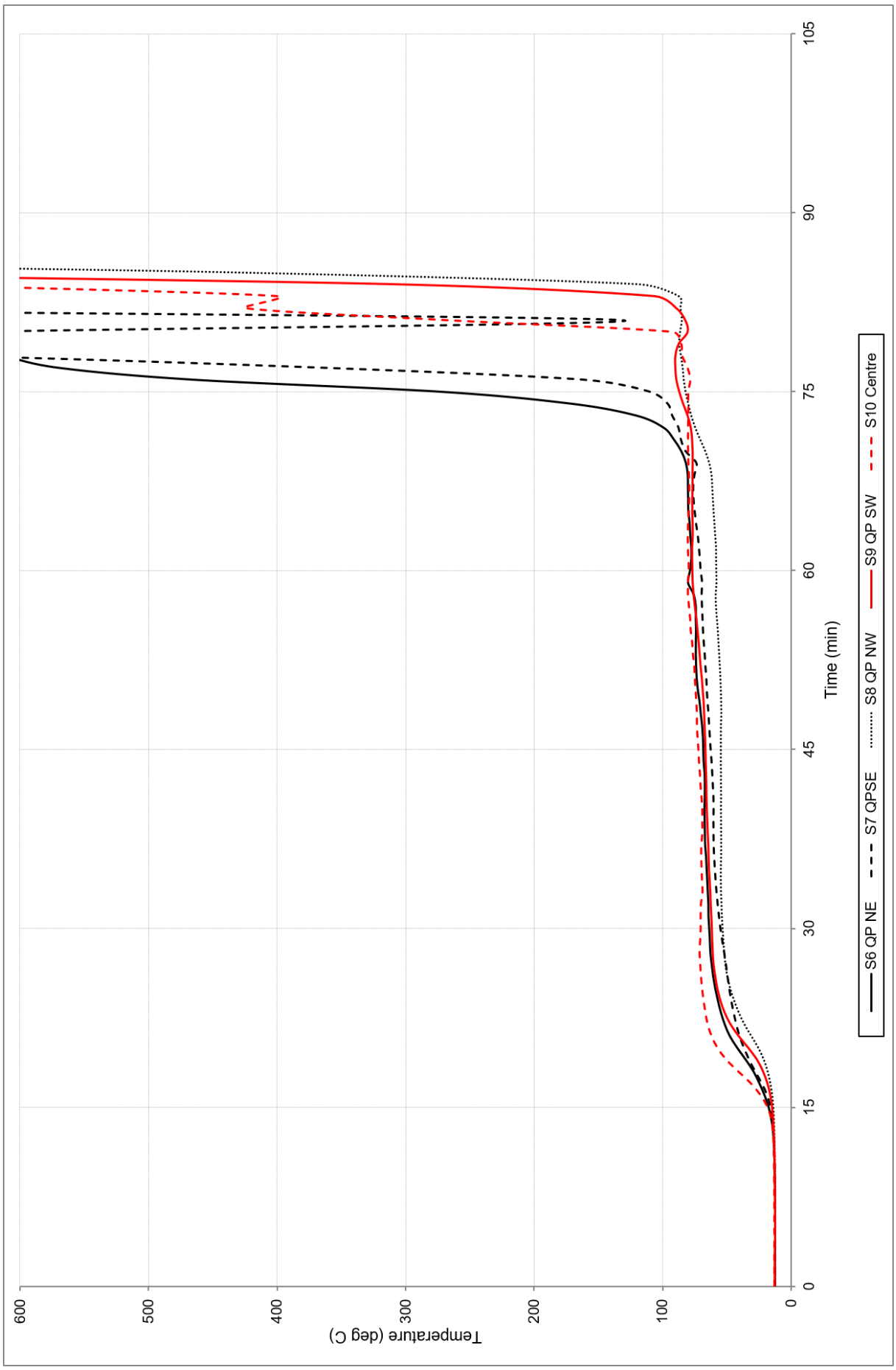


FIGURE 5 – SPECIMEN TEMPERATURE – GROUP 2, CEILING MEMBRANE.

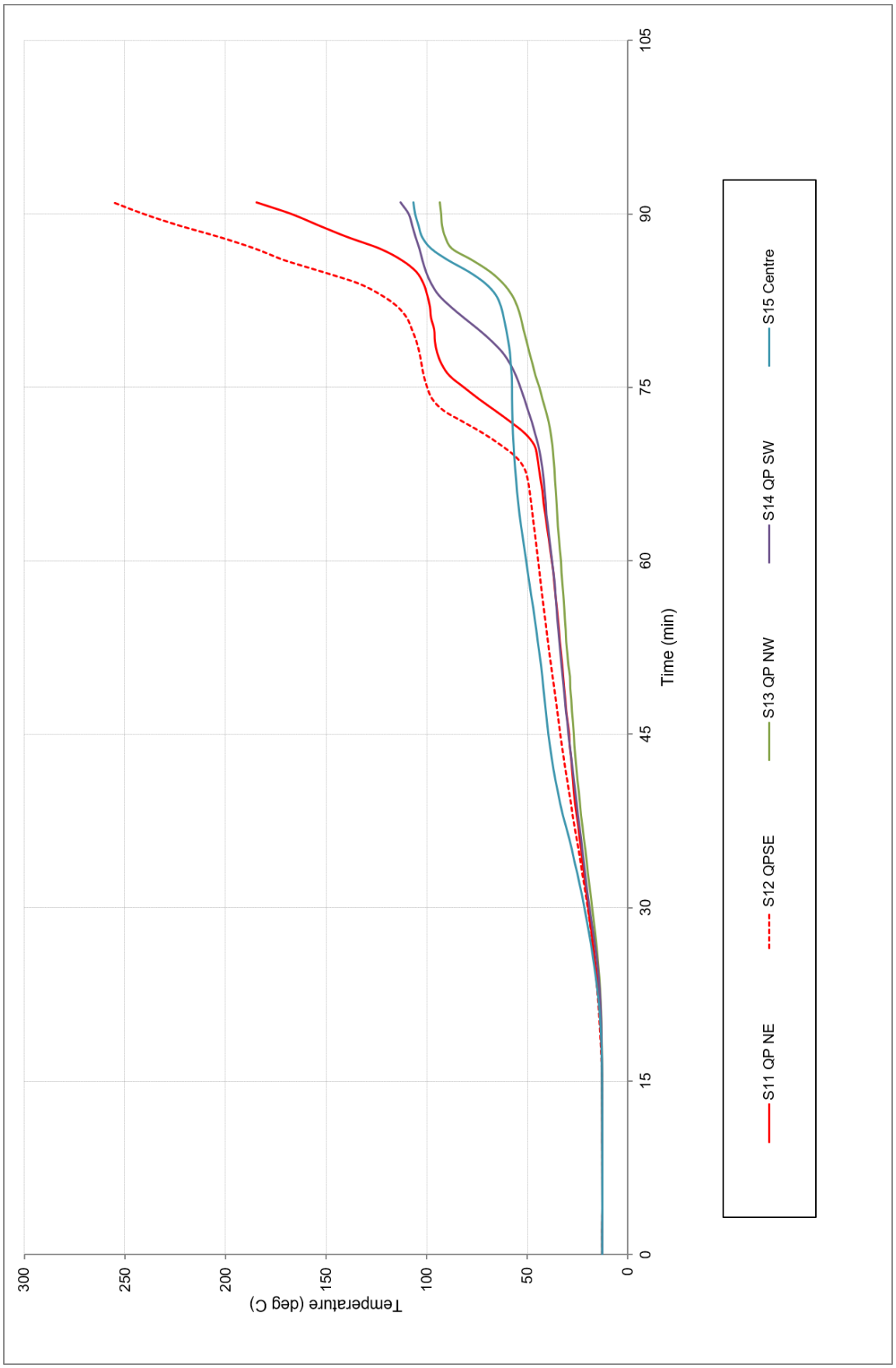


FIGURE 6 – SPECIMEN TEMPERATURE – GROUPS 3 ON TOP OF THE FLOOR, QUARTER POINTS AND CENTRE.

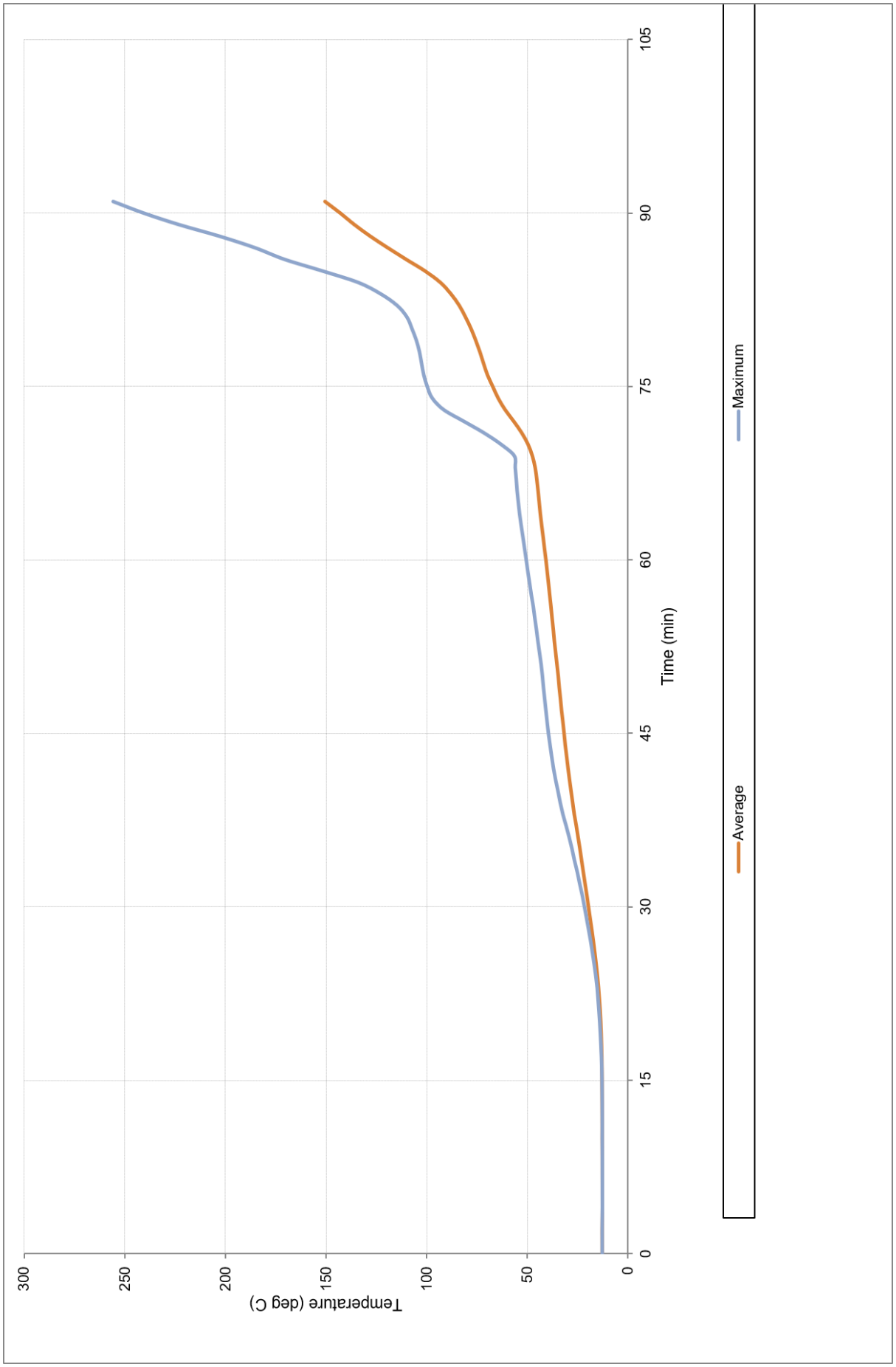


FIGURE 7 – TEMPERATURE VERSUS TIME – ON TOP OF THE FLOOR, AVERAGE T/C

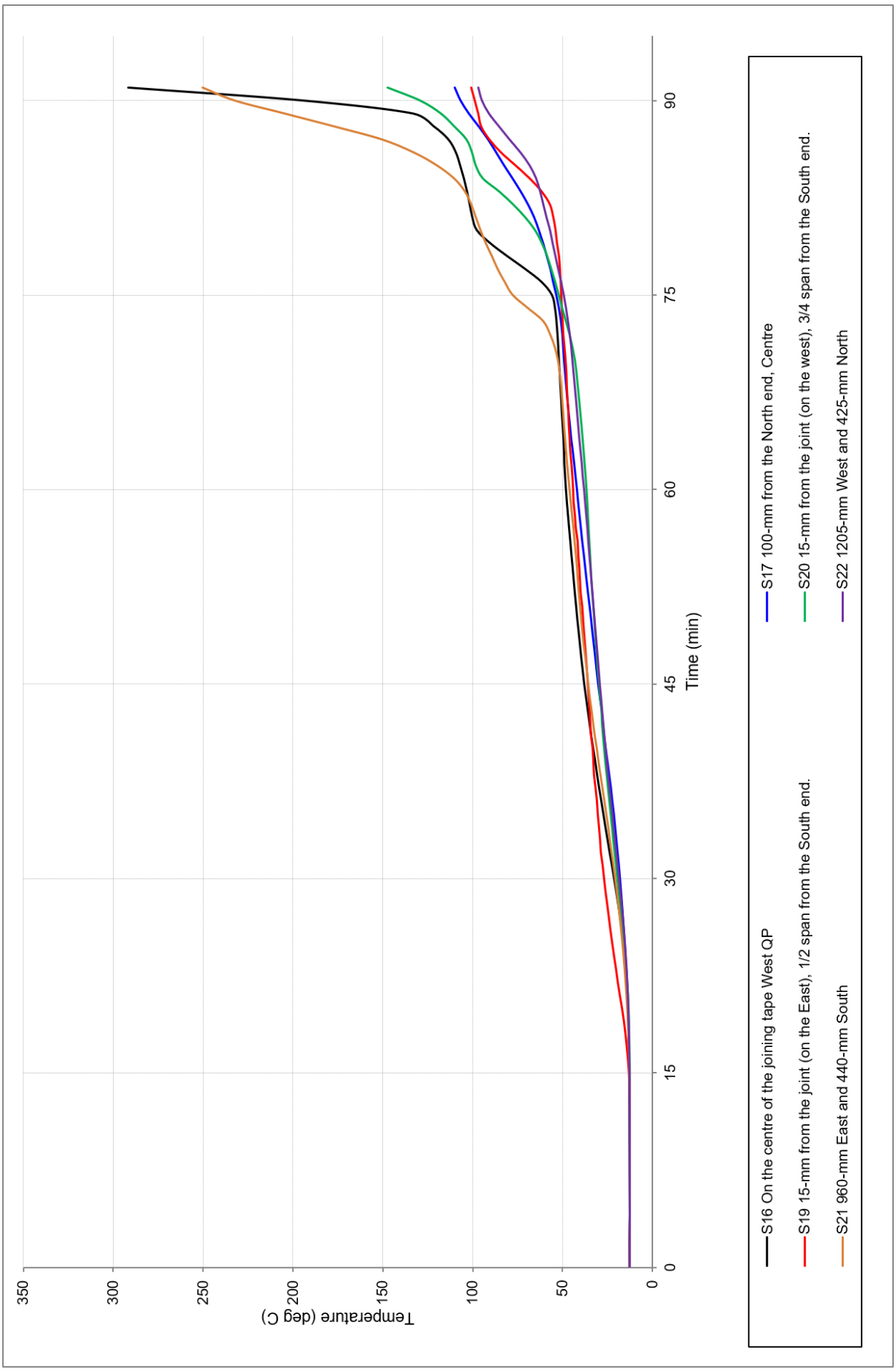


FIGURE 8 – TEMPERATURE VERSUS TIME – GROUP 4, FLOOR JOINTS

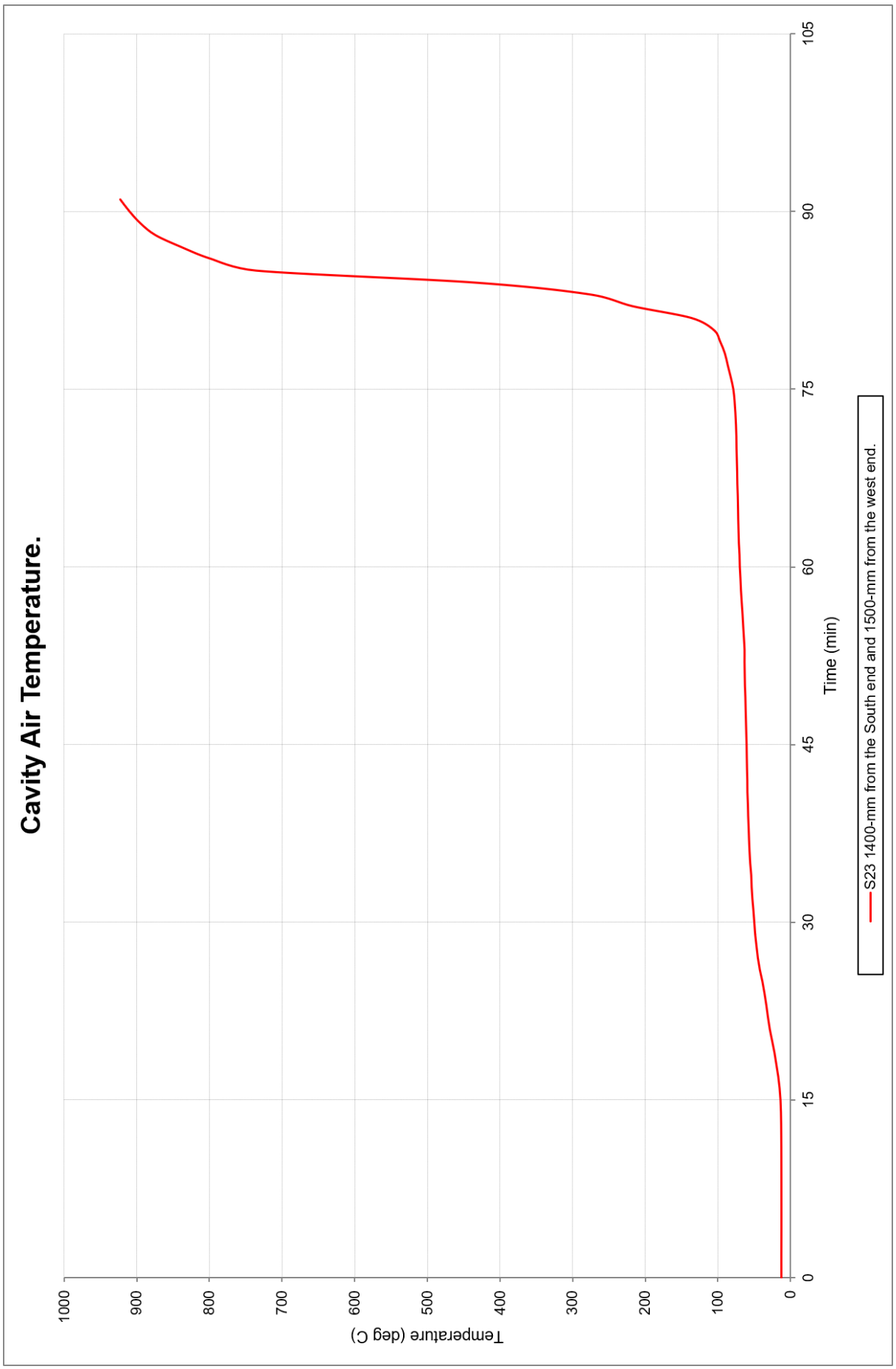


FIGURE 9 – TEMPERATURE VERSUS TIME – GROUP 5. CAVITY AIR TEMPERATURE.

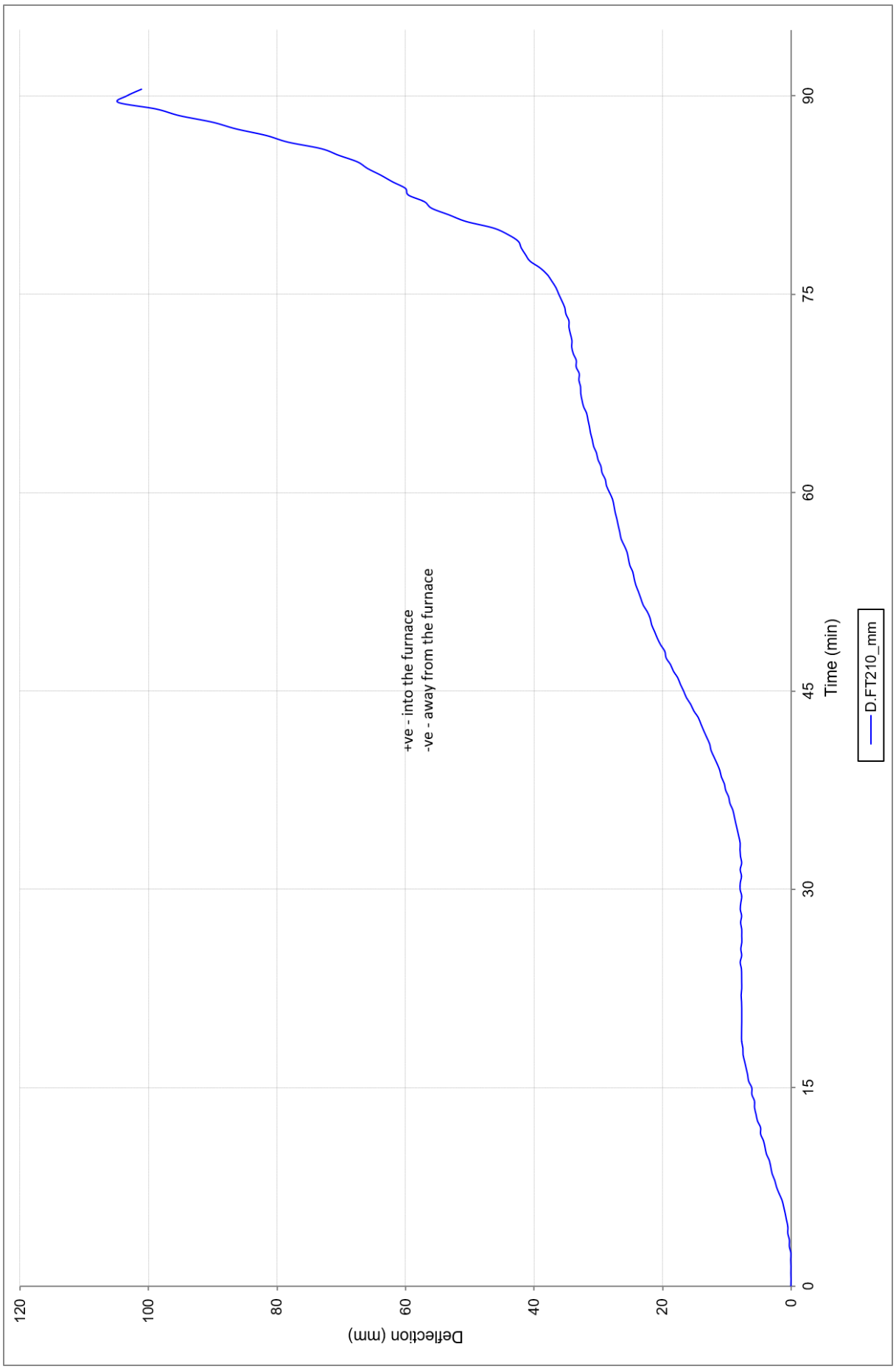
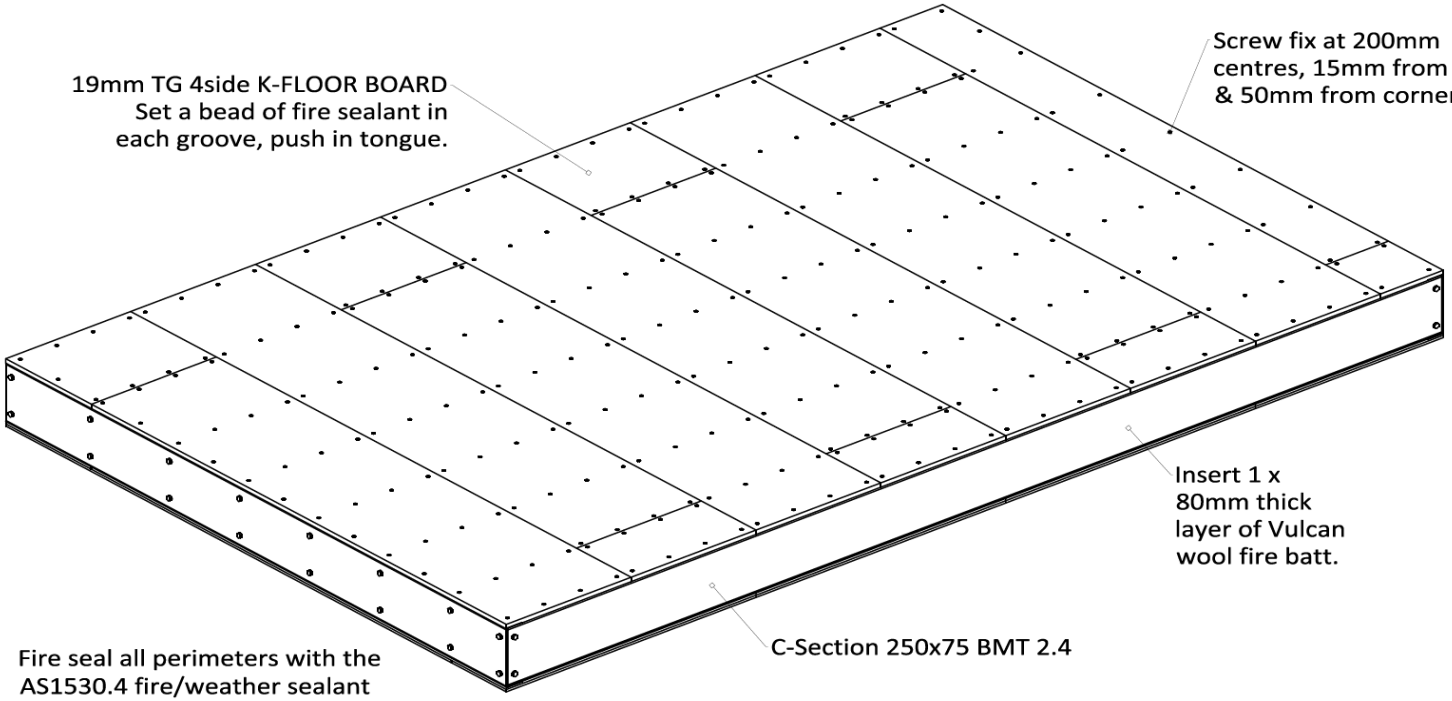


FIGURE 10 – SPECIMEN DEFLECTION – AT THE CENTRE

Appendix D – Specimen drawings

Firecrunch K FLOOR NATA LABS, CSIRO TESTED SYSTEM FRL 90/60/60



3D VIEW - TOP SIDE

FireCrunch Australian Certified Building Solutions

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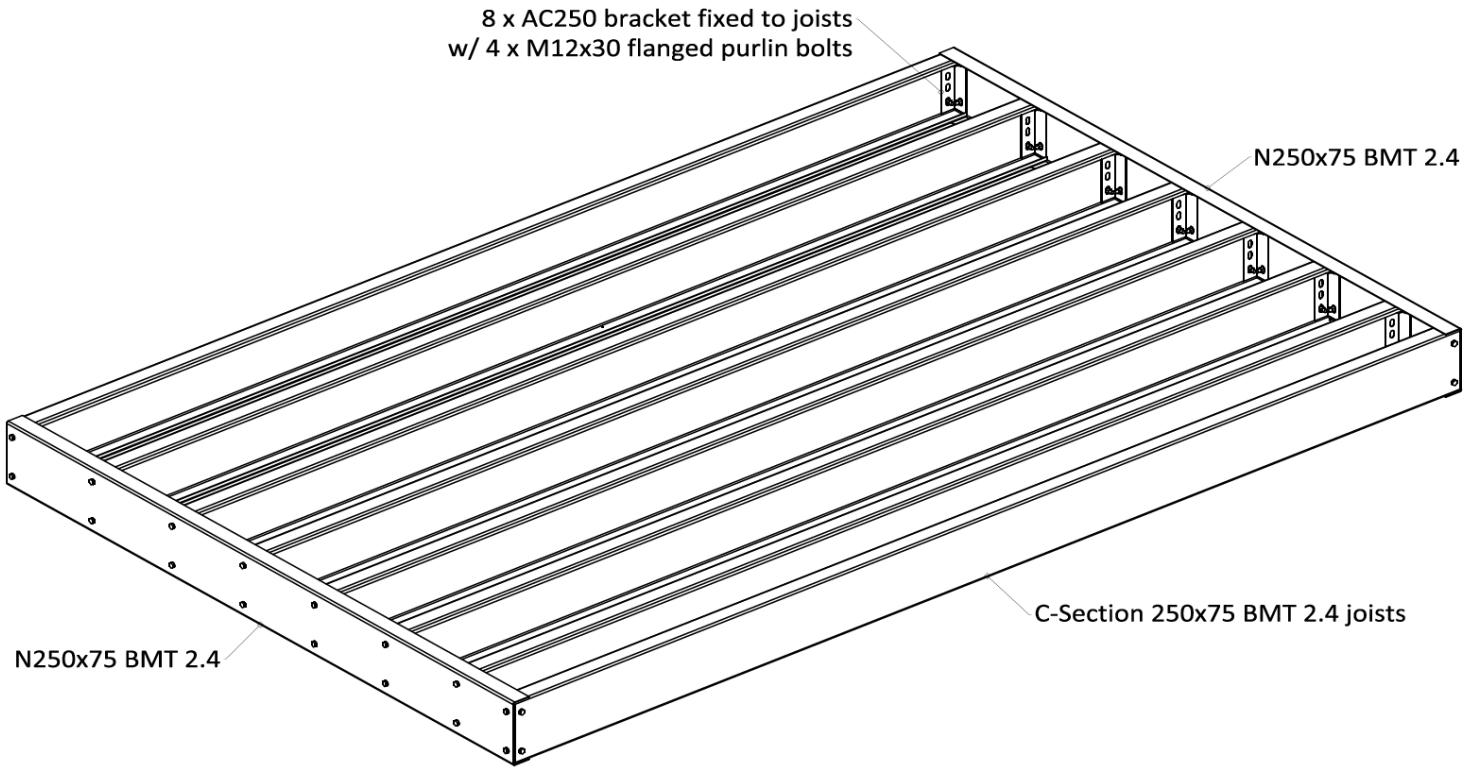
DRAWING TITLED CSIRO FLOORING TEST 2 LAYERS DRAWINGS, PAGE 1 OUT OF 7, DATED 5 JULY 2026, BY FIRECRUNCH AUSTRALASIA PTY LTD.

Firecrunch K FLOOR NATA LABS, CSIRO TESTED SYSTEM FRL 90/60/60



3D VIEW - C-Section 250x75 BMT 2.4 FRAME

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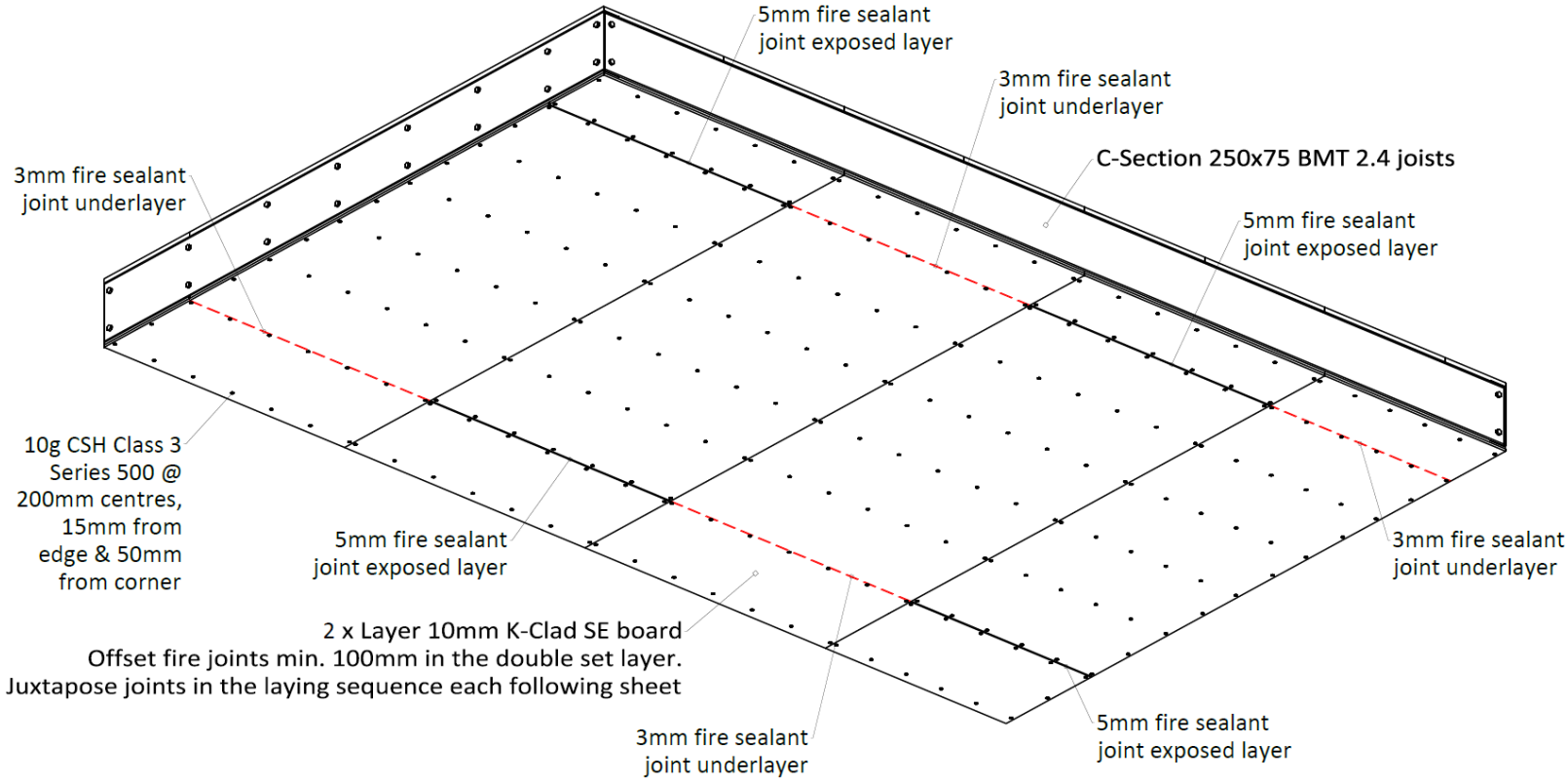

3D VIEW - UNDERSIDE

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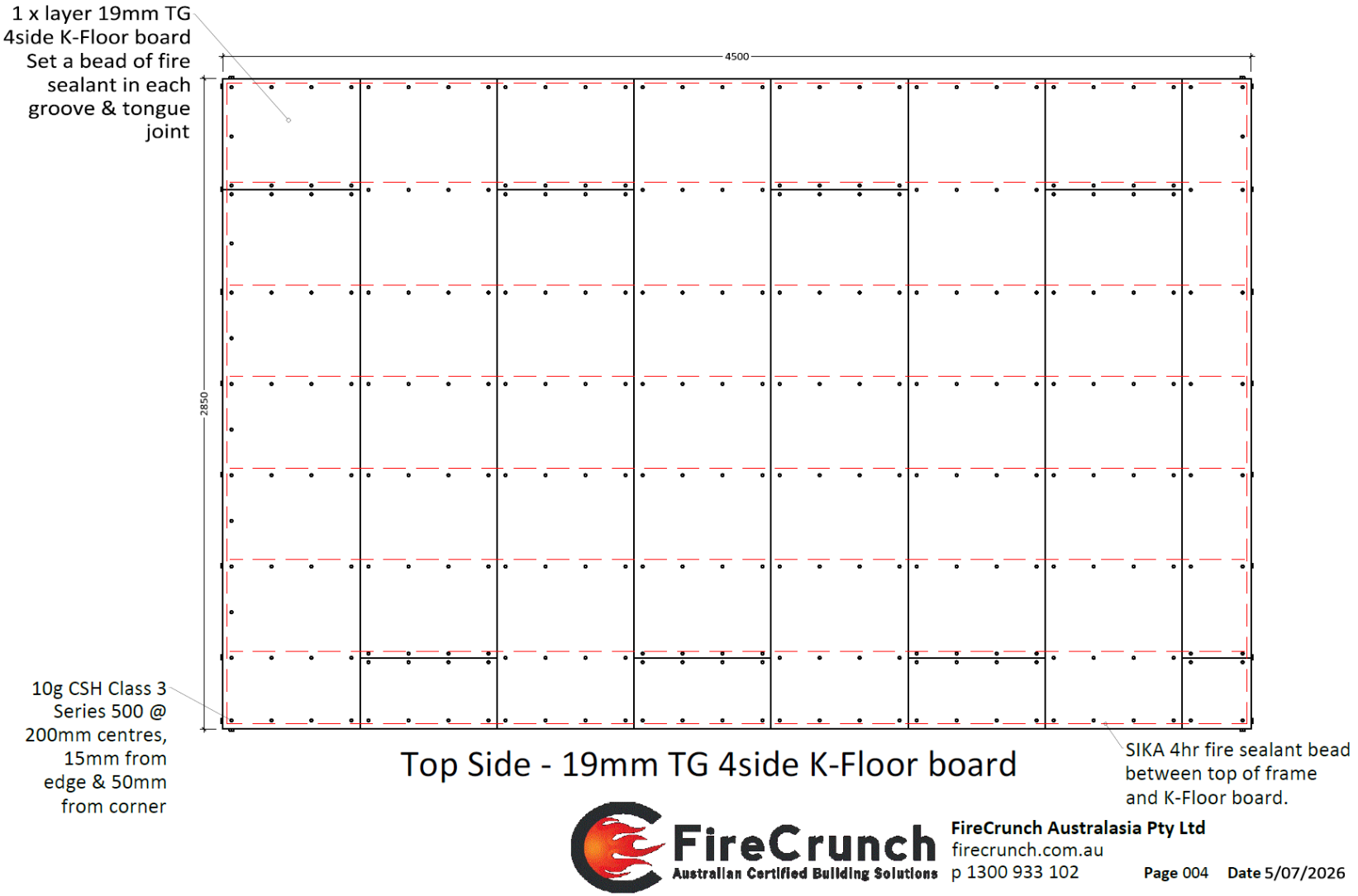
Firecrunch K FLOOR NATA LABS, CSIRO TESTED SYSTEM FRL 90/60/60



Top Side - 19mm TG 4side K-Floor board

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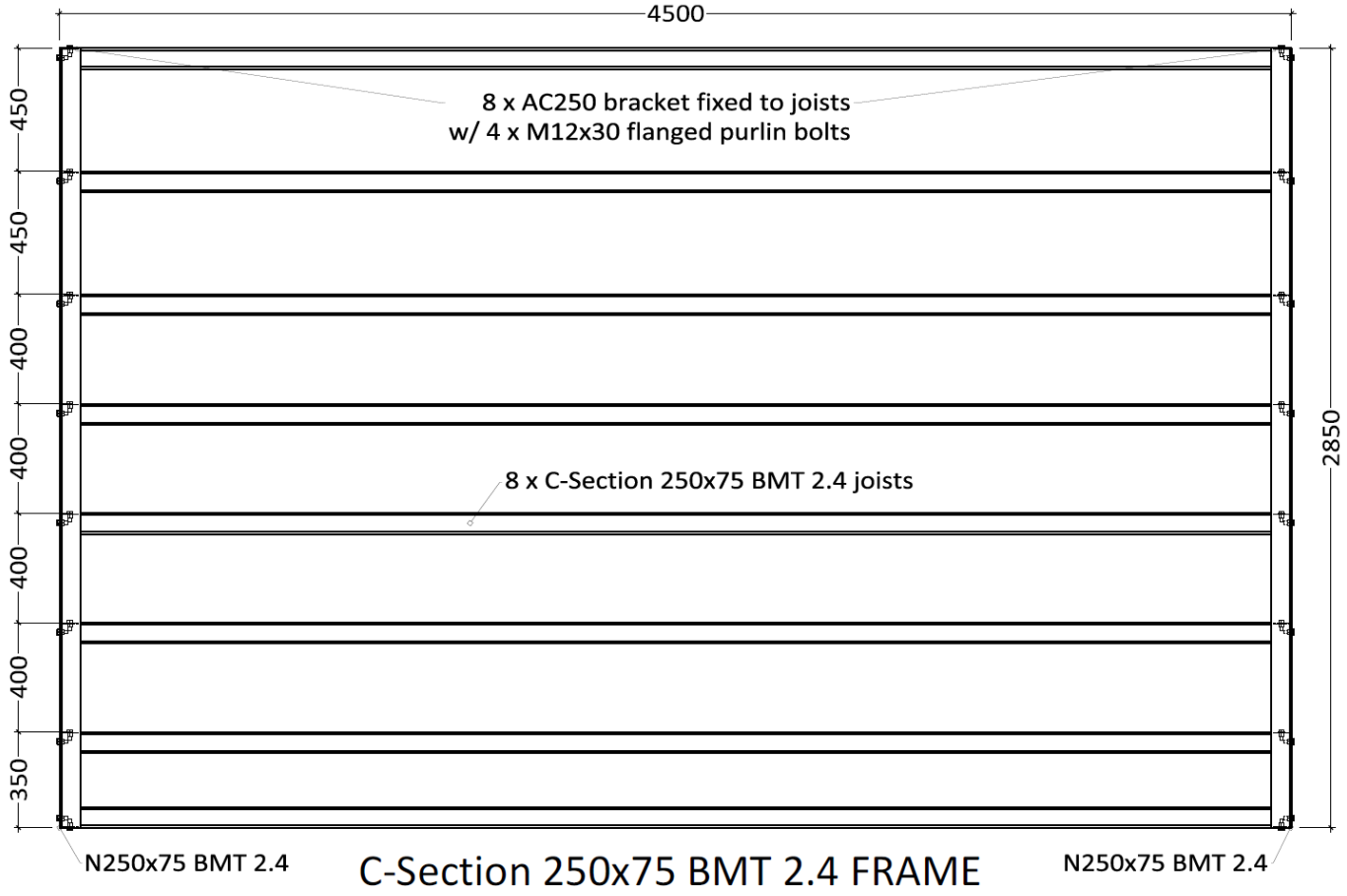
DRAWING TITLED CSIRO FLOORING TEST 2 LAYERS DRAWINGS, PAGE 4 OUT OF 7, DATED 5 JULY 2026, BY FIRECRUNCH AUSTRALASIA PTY LTD.

Firecrunch K FLOOR NATA LABS, CSIRO TESTED SYSTEM FRL 90/60/60



C-Section 250x75 BMT 2.4 FRAME

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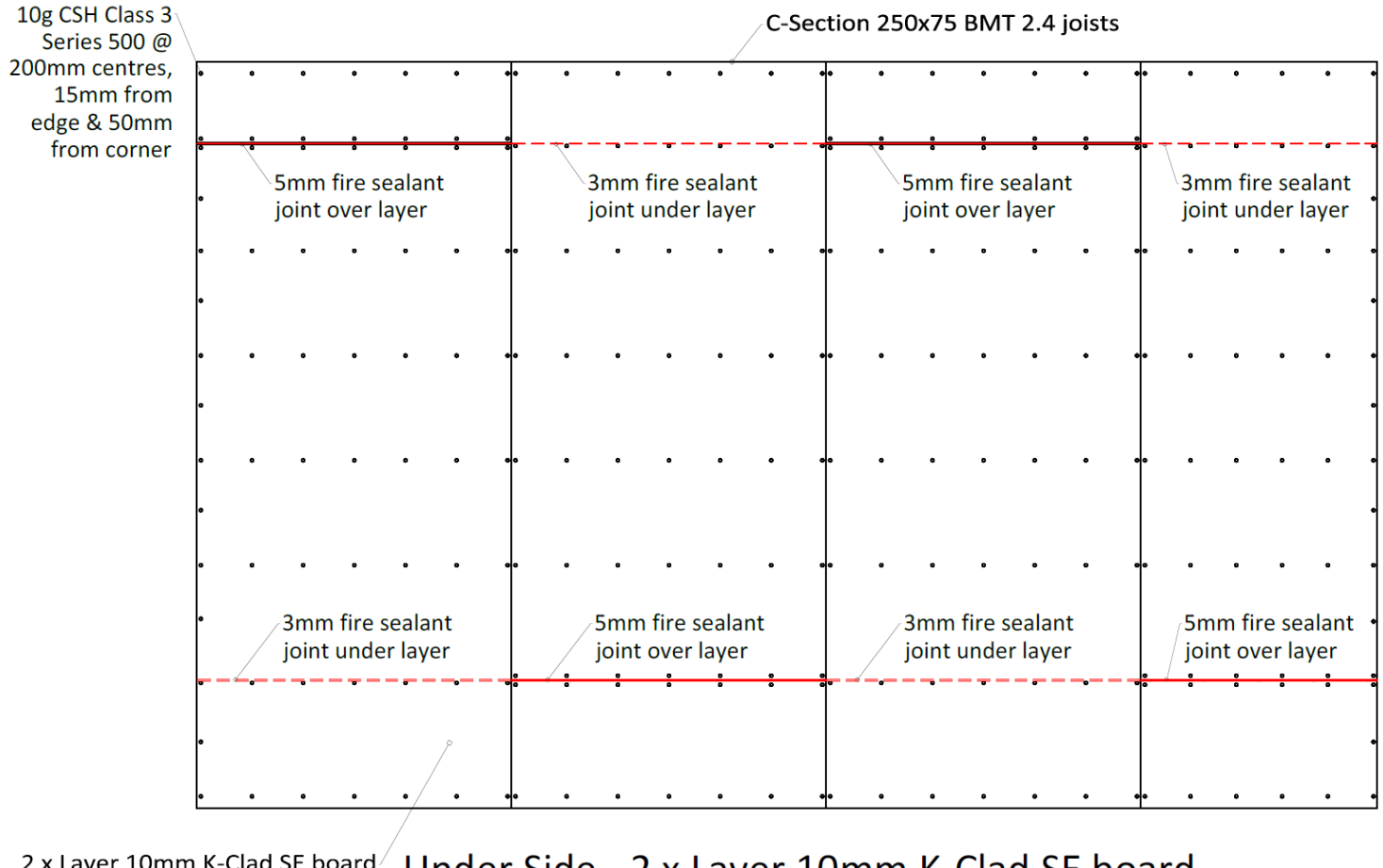
Firecrunch K FLOOR NATA LABS, CSIRO TESTED SYSTEM FRL 90/60/60



Under Side - 2 x Layer 10mm K-Clad SE board

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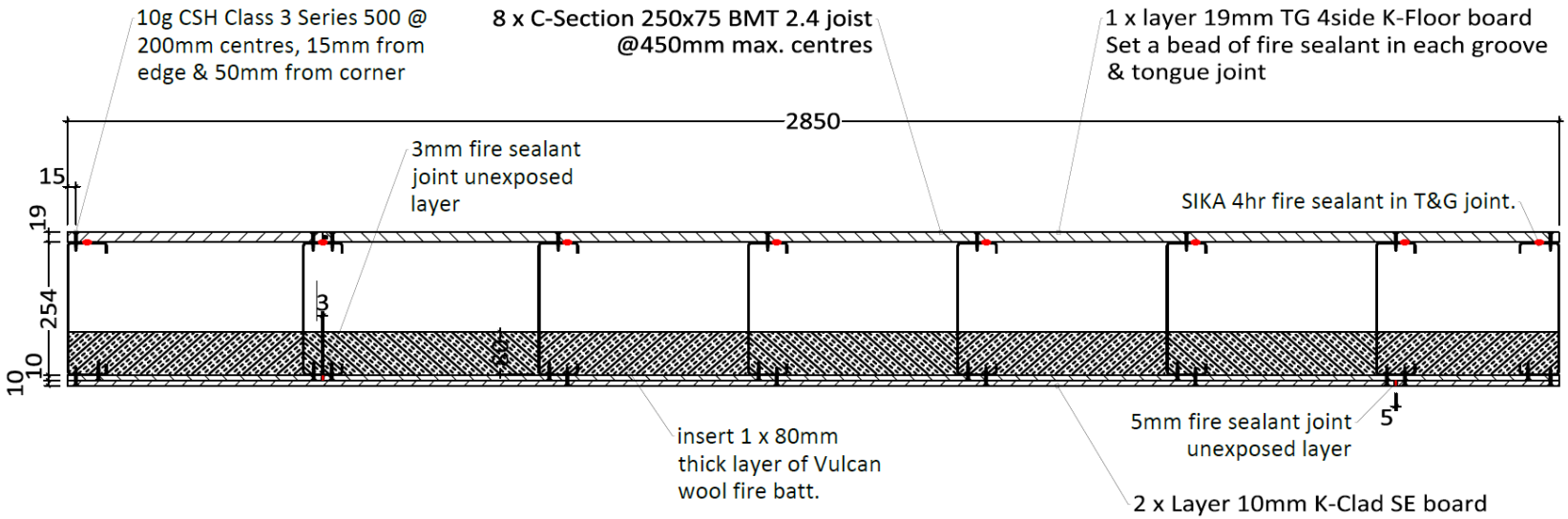

CROSS SECTION

SIKA 4hr fire sealant

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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 for elements of building construction.

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FOR FURTHER INFORMATION

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