Fire-resistance test on fire collars protecting a concrete slab penetrated by services

Test Report

Author: Peter Gordon
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Date: 21 September 2021

Client: IG6 Pty Ltd as trustee for the IG6 IP Trust

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21 September 2021	21 September 2021	21 September 2021

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Contents

Fire-resistance test on fire collars protecting a concrete slab penetrated by services

Sponsored Investigation No. FSP 2224

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as SNAP cast-in fire collars protecting a 150-mm thick concrete floor slab penetrated by five stack pipes.

1.2 Sponsor

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

1.3 Manufacturers

Snap Fire Systems Pty Ltd
1343 Wynnum Road
Tingalpa QLD

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 10: Service penetrations and control joints.

1.5 Reference standard

Australian Standard 4072, Components for the protection of openings in fire-resistant separating elements, Part 1 - 2005, Service penetrations and control joints.

1.6 Test number

CSIRO Reference test number FS 5113/4688

1.7 Test date

The fire-resistance test was conducted on 10 August 2021.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by five stack pipes protected by SNAP Fire Systems cast-in fire collars.

The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures.

For the purpose of the test, the penetrations were referenced as Specimen 1, 2, 3, 4 and 5. Documents containing a complete description of each specimen were supplied by the sponsor and are retained on file.

The pipes used in the test are stated to be manufactured in accordance with:

- AS/NZS 7671:2010 Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings— Polypropylene (PP).
- AS/NZS 4130:2018 'Polyethylene (PE) pipes for pressure applications';

Specimen 1 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 75 Raupiano stack pipe.

The SNAP H65S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 79 mm inner diameter and a 168-mm outer diameter base flange. The 250-mm high collar casing incorporated a 280-mm x 65-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 322-mm x 63-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 65 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The H65S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab.

The penetrating service comprised a 74.15-mm outside diameter Rehau Raupiano Plus pipe with a wall thickness of 2.07-mm fitted through the collar's sleeve. The Raupiano Plus pipe construction comprised three layers consisting of an abrasion resistant polypropylene inner layer, a mineral-filled polypropylene middle layer and a polypropylene outer layer. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end.

On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #1, 75 Raupiano Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

Specimen 2 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 40 Triplus stack pipe incorporating a bell joint inside the collar.

The SNAP H50S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 150-mm outer diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 268-mm x 53-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 50 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The H50S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab.

The penetrating service comprised a 40.06-mm outside diameter Valsir Triplus stack pipe with a wall thickness of 2.23-mm fitted through the collar's sleeve with a 'bell end' pipe joint located inside the fire collar casing. The Triplus pipe construction comprised three layers consisting of a highly chemical resistant polypropylene inner layer, a mineral-filled polypropylene middle layer, and a polypropylene outer layer. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end.

On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #2, 40 Triplus Stack w/ Bell End in Collar & H50S-RR', dated 14 July 2021 by Snap Fire Systems Pty Ltd.

Specimen 3 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 50 PN16 PE100 stack pipe.

The SNAP H50S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 150-mm outer diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 268-mm x 53-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 50 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The H50S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab.

The penetrating service comprised a 50.24-mm outside diameter David Moss SDR11/PN16 PE100 polypropylene stack pipe with a wall thickness of 5.02-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end.

On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #3, 50 PN16 PE100 Stack & H50S-RR', dated 14 July 2021 by Snap Fire Systems Pty Ltd.

Specimen 4 - A SNAP H100S-RR High-Top Stack cast-in fire collar protecting a nominal 90 Triplus stack pipe incorporating a bell joint inside the collar.

The SNAP H100S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 213-mm outer diameter base flange. The 250-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three equally spaced 3.15-mm diameter galvanised steel springs bound with nylon fuse links acting against a 460-mm x 83-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 100 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The H100S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab.

The penetrating service comprised a 90.43-mm outside diameter Valsir Triplus stack pipe with a wall thickness of 3.5-mm fitted through the collar's sleeve with a "bell end" pipe joint located inside the collar. On the unexposed face of the slab, the annular gap between the pipe and the inside of the collar incorporated a PE backing rod which was backfilled to a 10-mm depth using H.B Fullers Firesound sealant which was finished flush with the slab as shown in drawing titled 'Specimen #4, 90 Triplus Stack w/ Bell End in Collar & H100S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

The Triplus pipe construction comprised three layers consisting of a highly chemical resistant polypropylene inner layer, a mineral-filled polypropylene middle layer, and a polypropylene outer layer. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end.

Specimen 5 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 63 PN16 PE100 stack pipe.

The SNAP H65S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 79 mm inner diameter and a 168-mm outer diameter base flange. The 250-mm high collar casing incorporated a 280-mm x 65-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 322-mm x 63-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 65 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The H65S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab.

The penetrating service comprised a 63.25-mm outside diameter David Moss SDR11/PN16 PE100 polypropylene stack pipe with a wall thickness of 6.2-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end.

On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #5, 63 PN16 PE100 Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

2.2 Dimensions

The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab to suit the opening in the specimen containing frame.

2.3 Orientation

The reinforced concrete slab was placed horizontally on top of the furnace chamber and subjected to fire exposure from the underside.

2.4 Conditioning

The concrete slab was left to cure for a period longer than 30 days. The specimen was delivered on 21 July 2021 and stored under standard laboratory atmospheric conditions until the test date.

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

The supporting floor construction and specimen installation 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:

Drawing titled 'Test Slab S-21-F Layout', dated 9 July 2021 by, Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #1, 75 Raupiano Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #2, 40 Triplus Stack w/ Bell End in Collar & H50S-RR', dated 14 July 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #3, 50 PN16 PE100 Stack & H50S-RR', dated 14 July 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #4, 90 Triplus Stack w/ Bell End in Collar & H100S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #5, 63 PN16 PE100 Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'SNAP 50 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

Drawing titled 'SNAP 65 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

Drawing titled 'SNAP 100 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd.

No confidential information about the test specimen has been submitted to CSIRO Infrastructure Technologies.

4 Equipment

4.1 Furnace

The furnace had a nominal opening of 1000-mm x 1000-mm for attachment of vertical or 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 four 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.

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

4.3 Measurement system

The primary measurement system comprised a multiple-channel data logger, 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 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:

Time	Observation
1 minute -	Smoke has begun fluing from the end of the pipe of Specimens 1, 2 & 4.
4 minutes -	Smoke has ceased fluing from the end of the pipe of Specimens 1 and 2. Smoke is being emitted between the collar and the pipe at the base of Specimens 2.
5 minutes -	Smoke has begun fluing from the end of the pipe of Specimens 3 and 5.
7 minutes -	Smoke has ceased fluing from the end of the pipe of Specimens 3, 4 and 5.
8 minutes -	Smoke has ceased fluing from collar at the base of Specimen 2.
9 minutes -	Smoke has resumed fluing from end of the pipe of Specimen 5.
13 minutes -	Smoke has ceased fluing from the end of the pipe of Specimen 5.
15 minutes -	Light smoke is venting from the collar at the base of Specimen 1.
18 minutes -	Smoke has ceased venting from the collar at the base of Specimen 1.
20 minutes -	Moisture has begun forming of the concrete slab at the base of Specimen 3.
23 minutes -	Moisture has begun forming of the concrete slab at the base of Specimens 1, 2, 4 and 5.
38 minutes -	Moisture has pooled on the top of the concrete slab.
62 minutes -	The sealant has begun to swell at the base of Specimen 4. The moisture on the concrete slab at the base of Specimens 1, 2, 4 and 5 has begun to dry. Moisture has pooled around Specimen 3 due to the buckling of the concrete slab.
135 minutes -	Moisture has evaporated on the unexposed face of the slab.
155 minutes -	The base of the pipes inside collar sleeves of Specimen 2, 3 and 5 have begun to melt.
180 minutes -	Little to no visible changes to all specimens.
241 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 Specimen temperature

Figure 3 shows the curve of temperature versus time associated with Specimen 1.

Figure 4 shows the curve of temperature versus time associated with Specimen 2.

Figure 5 shows the curve of temperature versus time associated with Specimen 3.

Figure 6 shows the curve of temperature versus time associated with Specimen 4.

Figure 7 shows the curve of temperature versus time associated with Specimen 5.

8.5 Performance

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

Specimen 1 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 75 Raupiano stack pipe

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

Specimen 2 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 40 Triplus stack pipe incorporating a “bell end” pipe joint inside the collar’s sleeve

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

Specimen 3 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 50 PN16 PE100 stack pipe

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

Specimen 4 - A SNAP H100S-RR High-Top Stack cast-in fire collar protecting a nominal 90 Triplus stack pipe incorporating a “bell end” pipe joint inside the collar’s sleeve

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

Specimen 5 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 63 PN16 PE100 stack pipe

Structural adequacy	-	not applicable
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 the specific element of construction described herein was tested following the procedure outlined in AS 1530.4. Any significant variation with respect to size, construction details, loads, stresses, edge of end conditions, other than that 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 the measurement of fire resistance, it is not possible to provide a stated degree for accuracy of the result.

9 Fire-resistance level (FRL)

For the purpose of building regulations in Australia, the FRL's of the test specimens were as follows:

Specimen 1	-	-/240/180*
Specimen 2	-	-/240/180*
Specimen 3	-	-/240/180*
Specimen 4	-	-/240/180*
Specimen 5	-	-/240/180*

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

* Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed.

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 10.12 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

Specimen	T/C Position	T/C designation
Specimen 1 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 75 Raupiano stack pipe.	On the slab, 25-mm from collar (North)	S1
	On the slab, 25-mm from collar (South)	S2
	On the pipe, 25-mm above collar (North)	S3
	On the pipe, 25-mm above collar (South)	S4
Specimen 2 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 40 Triplus stack pipe incorporating a “bell end” pipe joint inside the collar’s sleeve	On the slab, 25-mm from collar (North)	S5
	On the slab, 25-mm from collar (South)	S6
	On the pipe, 25-mm above collar (North)	S7
	On the pipe, 25-mm above collar (South)	S8
Specimen 3 - A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 50 PN16 PE100 stack pipe.	On the slab, 25-mm from collar (North)	S9
	On the slab, 25-mm from collar (S/W)	S10
	On the pipe, 25-mm above collar (West)	S11
	On the pipe, 25-mm above collar (East)	S12
Specimen 4 - A SNAP H100S-RR High-Top Stack cast-in fire collar protecting a nominal 90 Triplus stack pipe incorporating a “bell end” pipe joint inside the collar’s sleeve.	On the slab, 25-mm from collar (West)	S13
	On the slab, 25-mm from collar (East)	S14
	On the sealant (North)	S15
	On the sealant (South)	S16
	On the pipe, 25-mm above the sealant (North)	S17
	On the pipe, 25-mm above the sealant (South)	S18
Specimen 5 - A SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 63 PN16 PE100 stack pipe.	On the slab, 25-mm from collar (North)	S19
	On the slab, 25-mm from collar (South)	S20
	On the pipe, 25-mm above collar (North)	S21
	On the pipe, 25-mm above collar (South)	S22
Rover		S23
Ambient		S24

Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMEN PRIOR TO TESTING

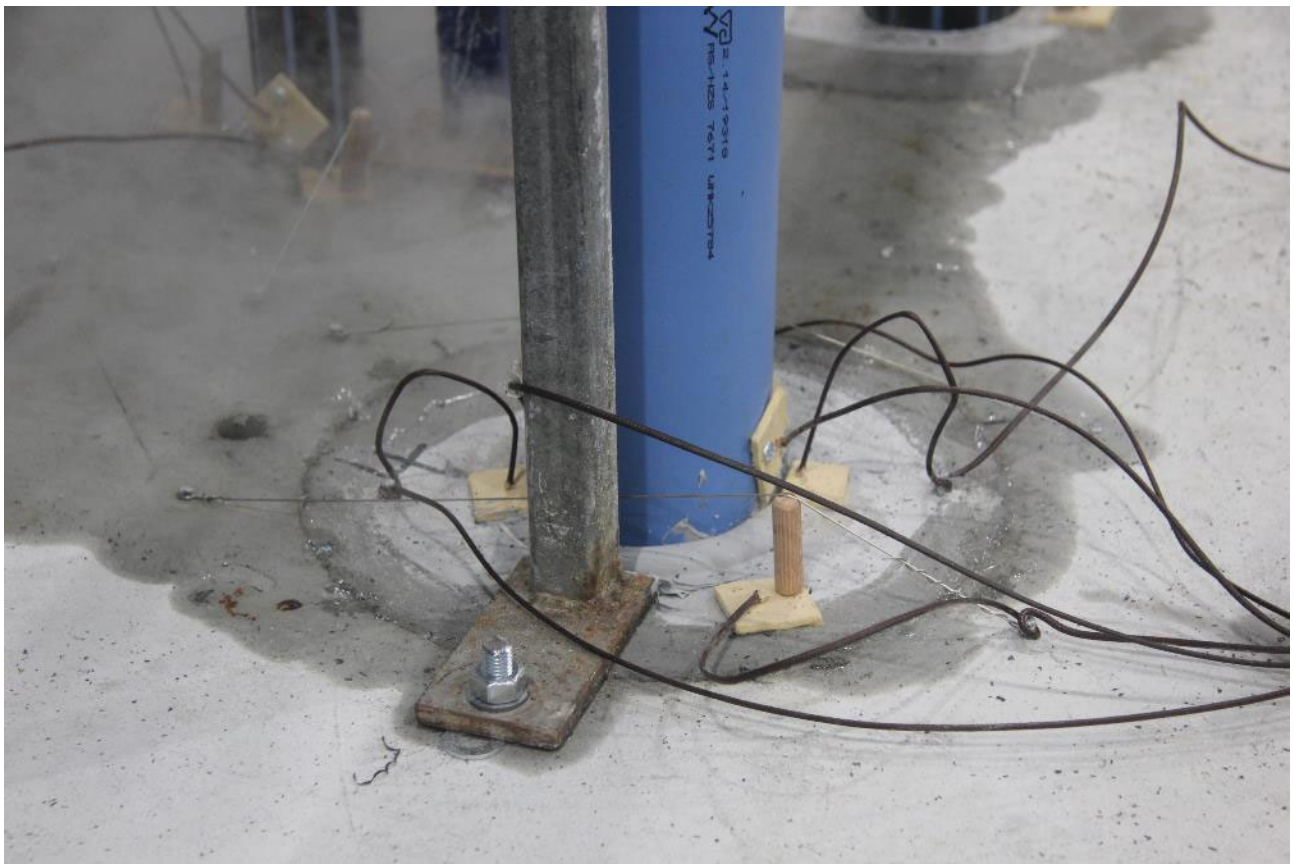
PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMEN PRIOR TO TESTING

PHOTOGRAPH 3 – SPECIMEN 1 AT 15 MINUTES INTO THE TEST

PHOTOGRAPH 4 – SPECIMENS AT 25 MINUTES INTO THE TEST

PHOTOGRAPH 5 – UNEXPOSED FACE OF SPECIMENS AT 30 MINUTES INTO THE TEST

PHOTOGRAPH 6 –SPECIMENS AT 60 MINUTES INTO THE TEST



PHOTOGRAPH 7 – SPECIMEN 4 AT 60 MINUTES INTO THE TEST

PHOTOGRAPH 8 – SPECIMENS AT 90 MINUTES INTO THE TEST

PHOTOGRAPH 9 – SPECIMENS AT 120 MINUTES INTO THE TEST

PHOTOGRAPH 10 – SPECIMENS AT 135 MINUTES INTO THE TEST

PHOTOGRAPH 11 – SPECIMEN 2 AT 155 MINUTES INTO THE TEST

PHOTOGRAPH 12 – SPECIMEN 5 AT 155 MINUTES INTO THE TEST

PHOTOGRAPH 13 – SPECIMENS AT 180 MINUTES INTO THE TEST

PHOTOGRAPH 14 – SPECIMENS AT 240 MINUTES INTO THE TEST

PHOTOGRAPH 15 – SPECIMENS AT THE CONCLUSION OF TESTING

PHOTOGRAPH 16 – EXPOSED FACE OF SPECIMENS AT THE CONCLUSION OF TESTING

Appendix C – Test Data charts

FIGURE 1 – FURNACE TEMPERATURE

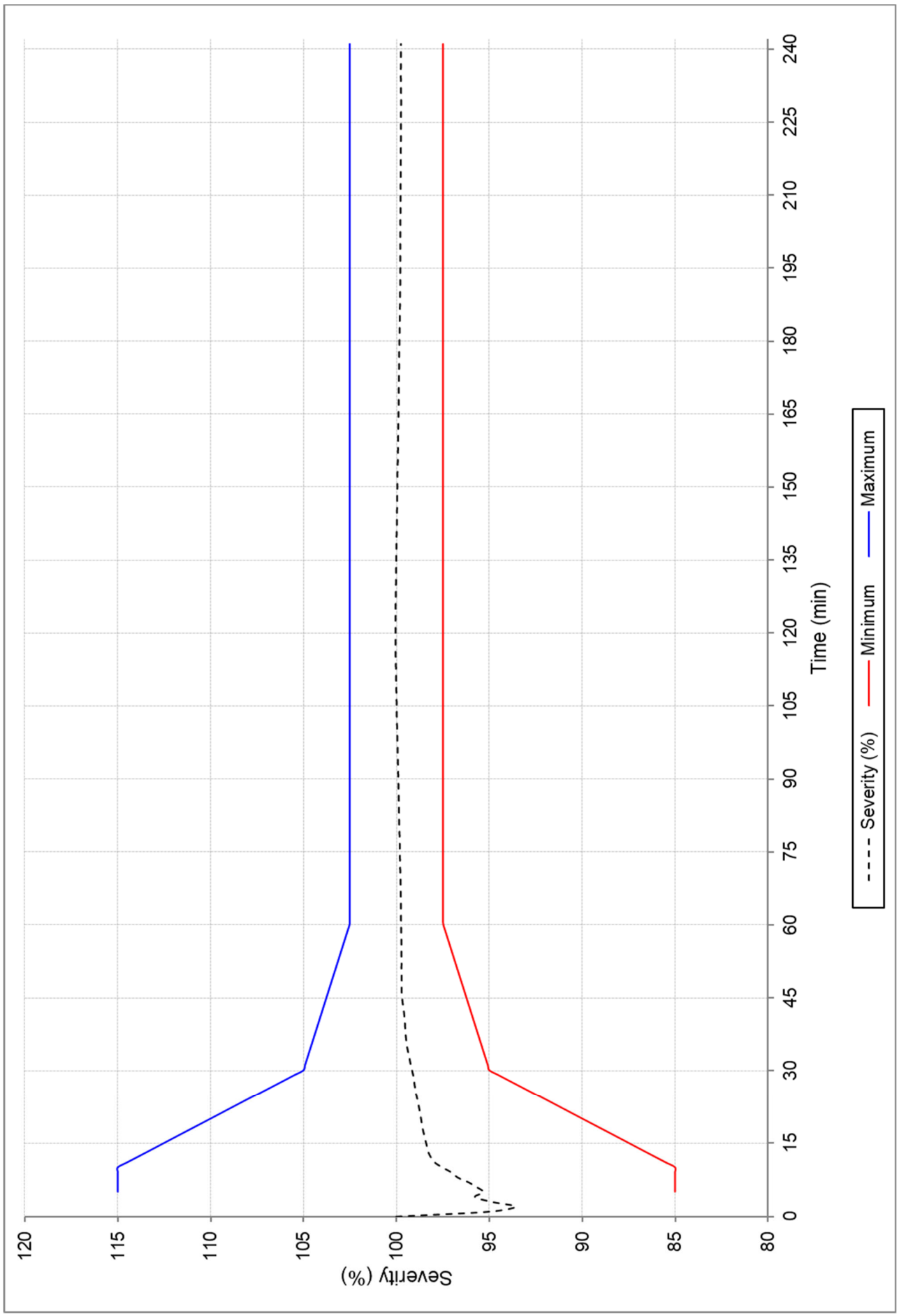


FIGURE 2 – FURNACE SEVERITY

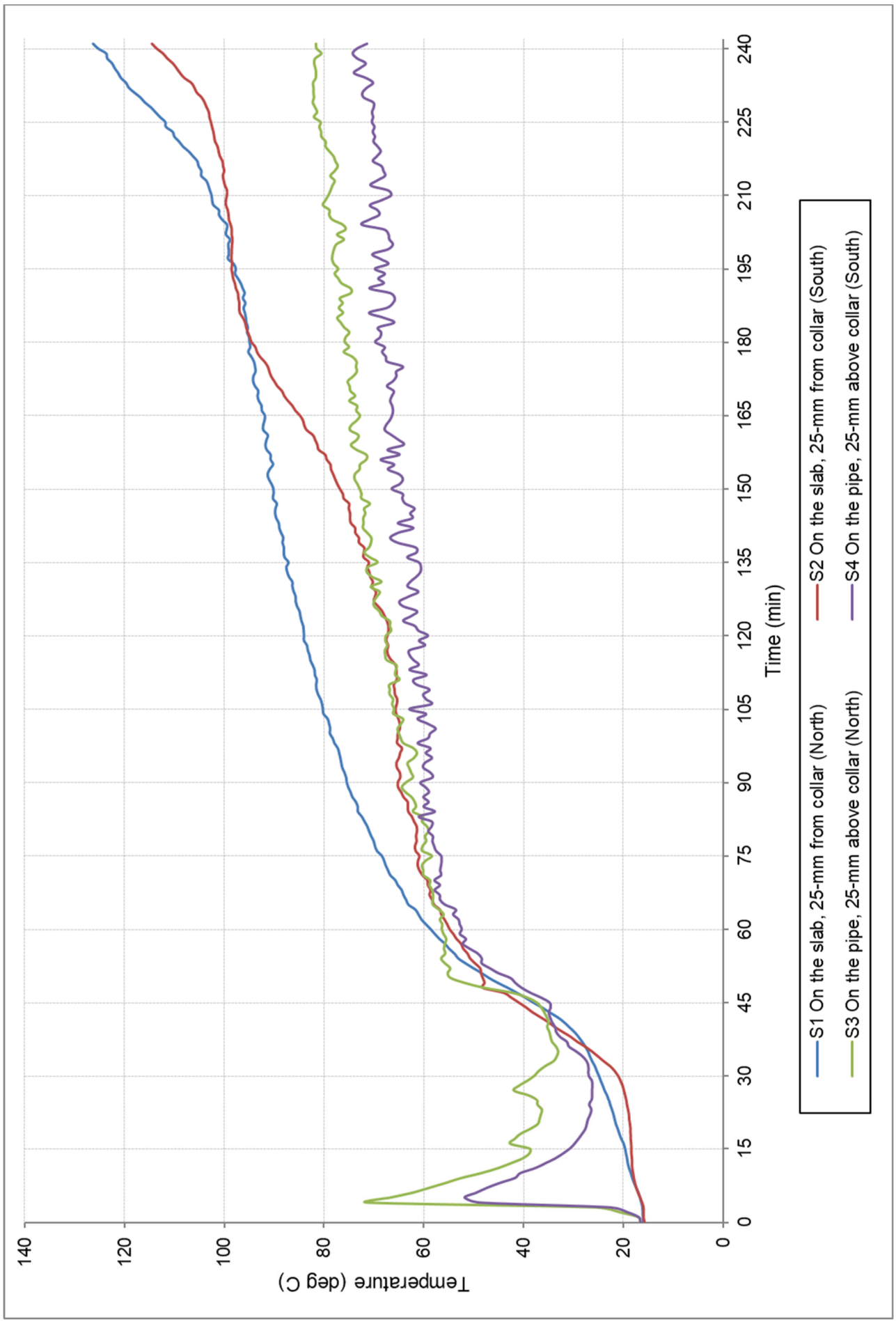


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

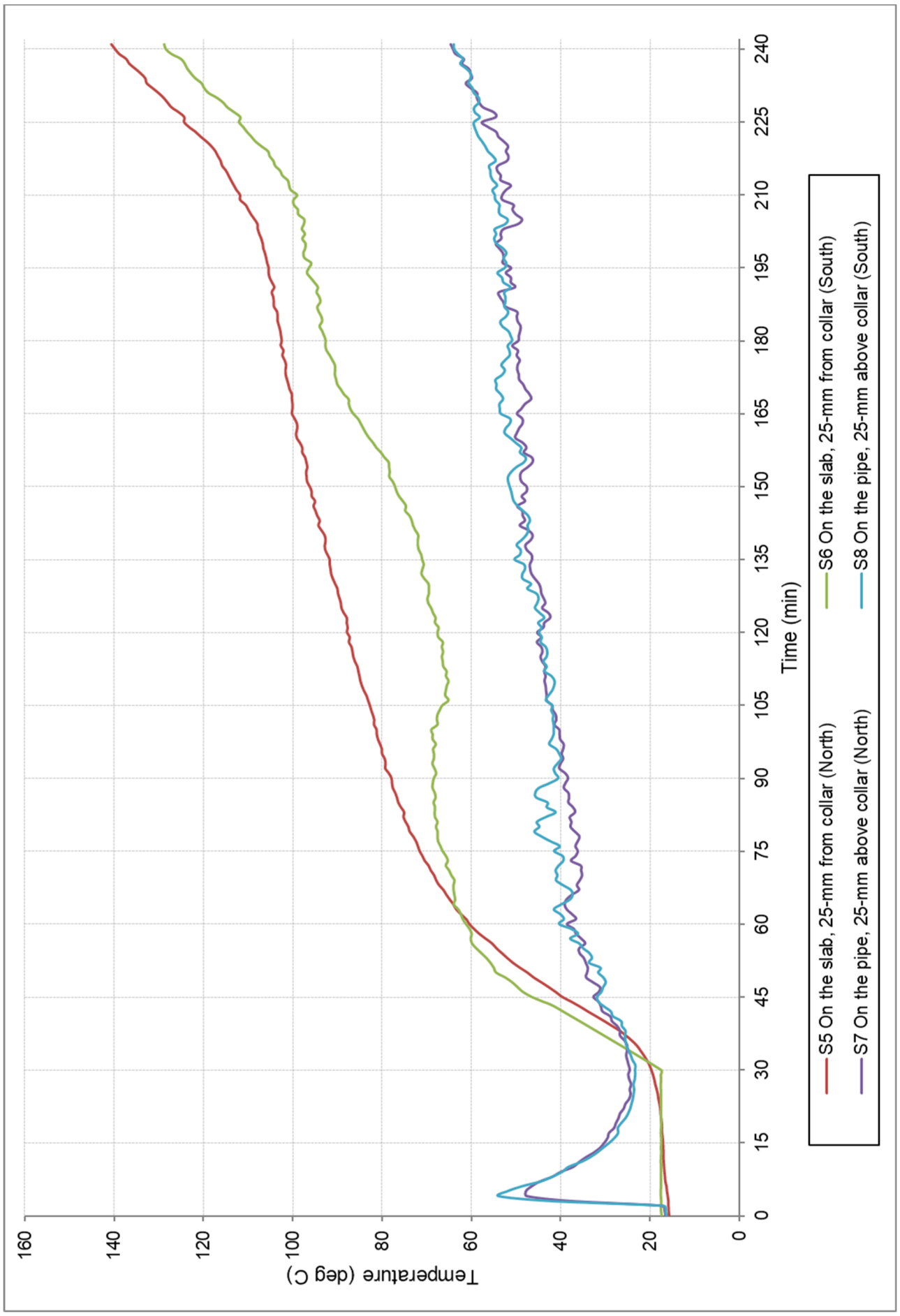


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 2

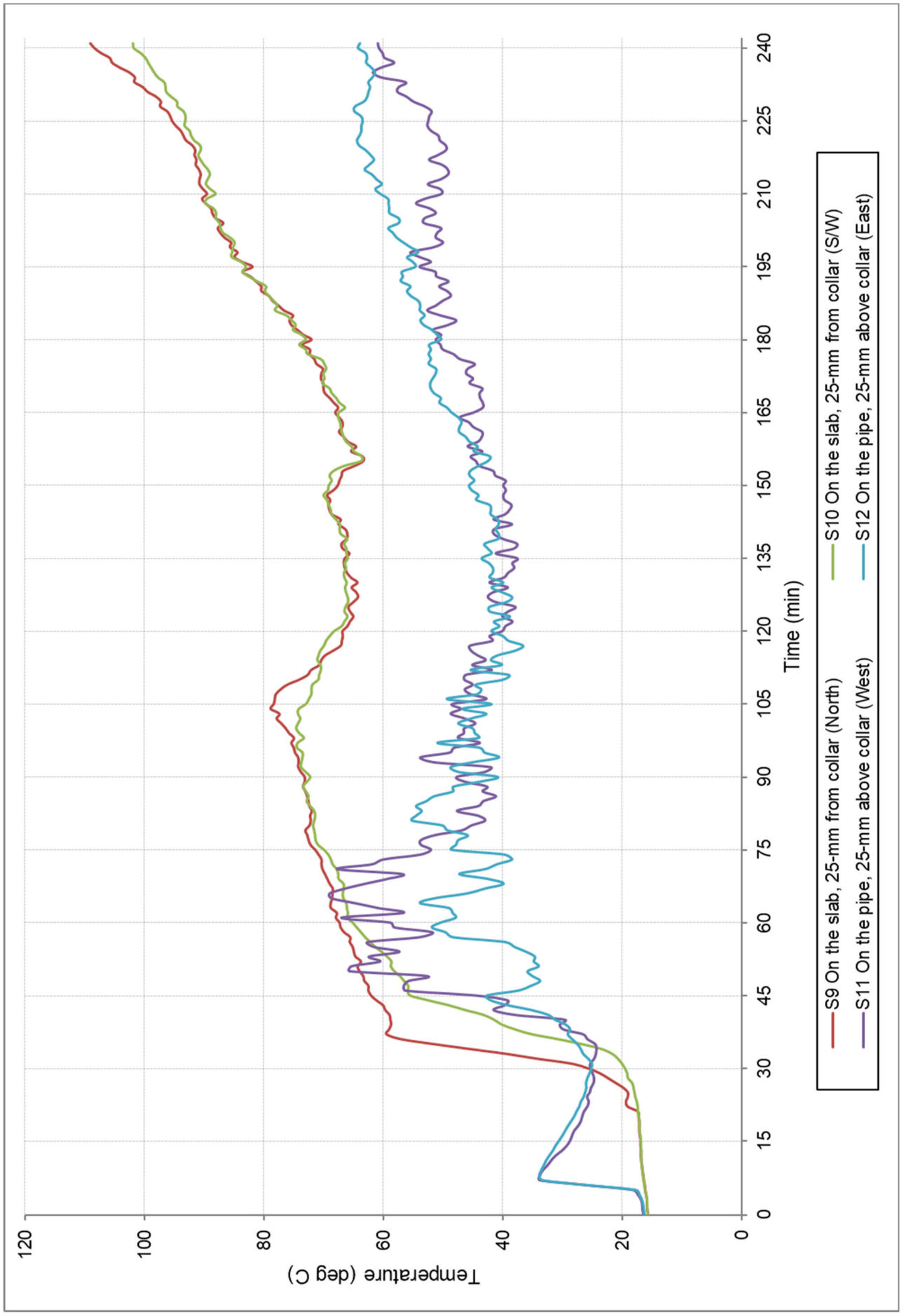


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 3

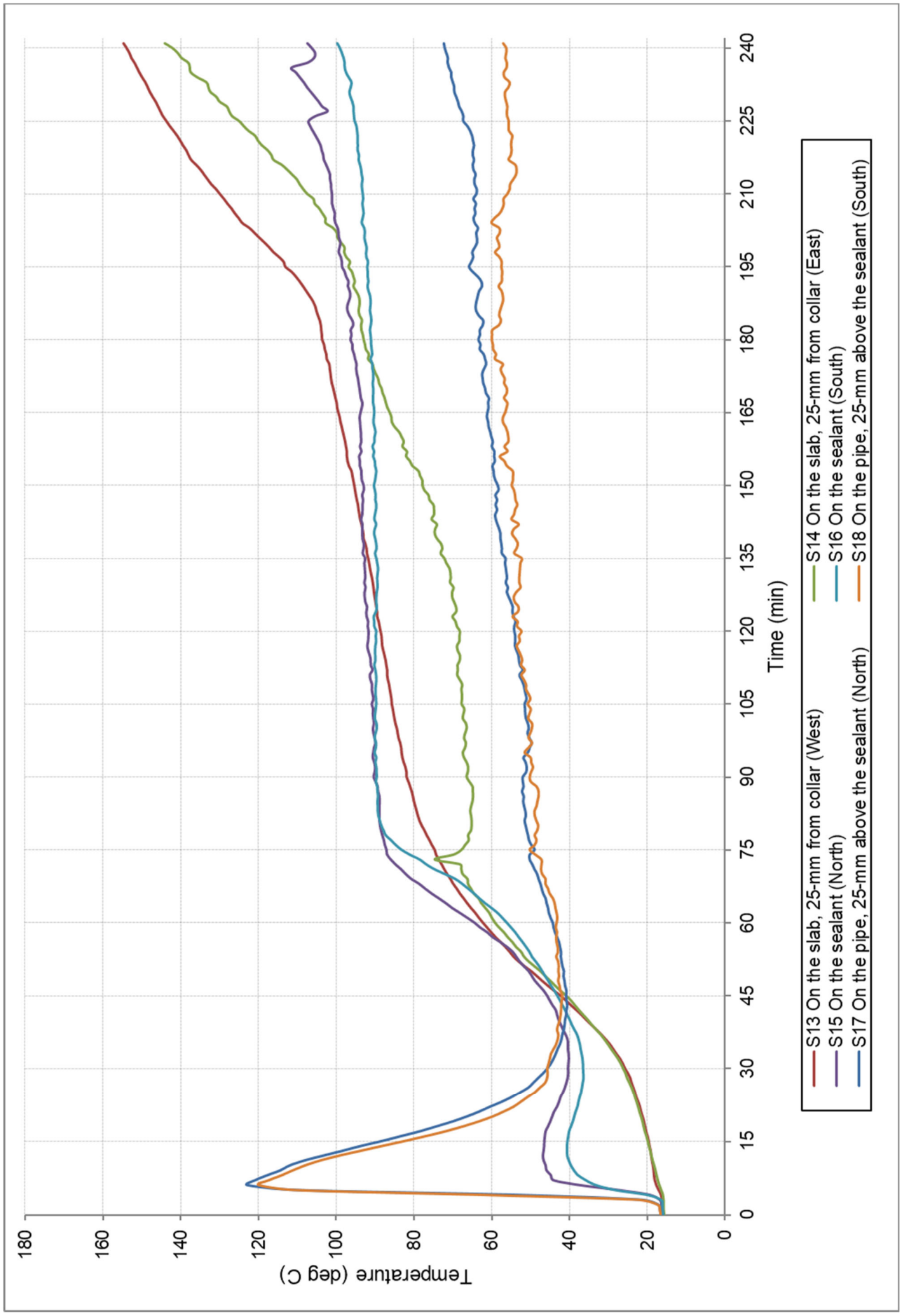


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 4

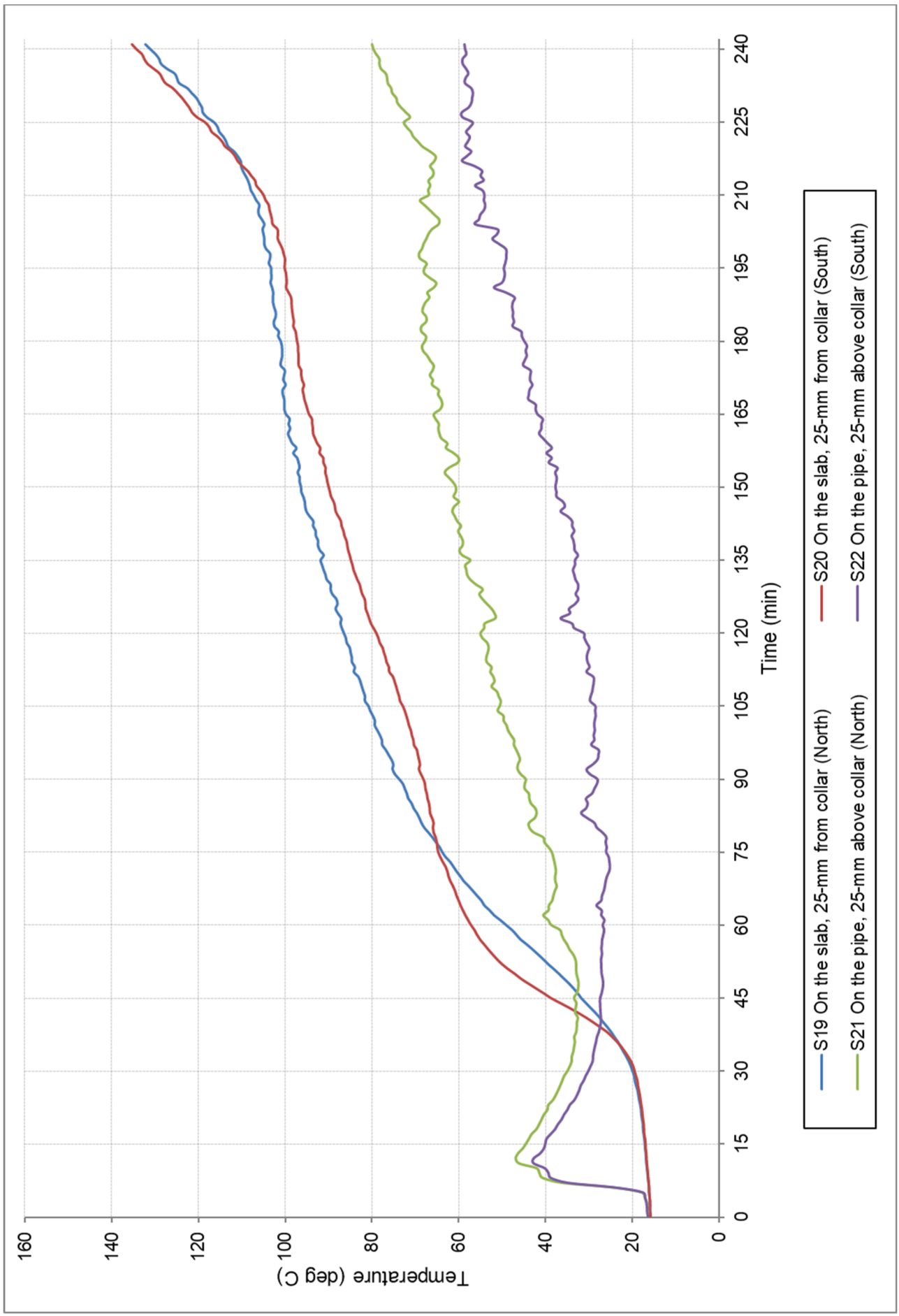


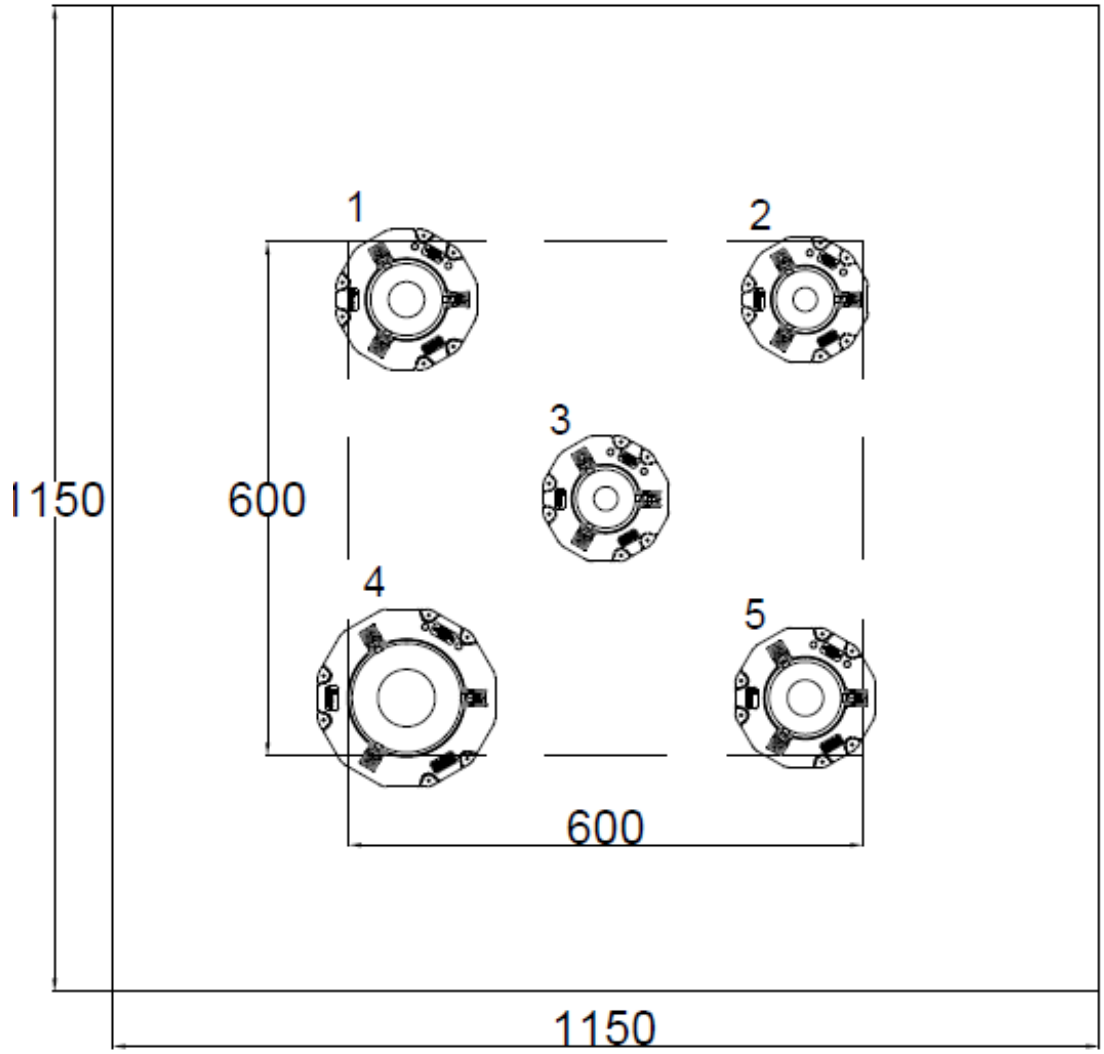
FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 5

Appendix D – Installation drawings

Snap Fire Systems Pty Ltd

Test Slab S-21-F Layout

Date: 09 JUL 2021



Penetration	Collar Code	Pipe Type	Pipe Diameter
1	H65S-RR	Raupiano	75mm
2	H50S-RR	Triplus+Fitting	40mm
3	H50S-RR	PE100 SDR11	50mm
4	H100S-RR	Triplus+Fitting	90mm
5	H65S-RR	PE100 SDR11	63mm

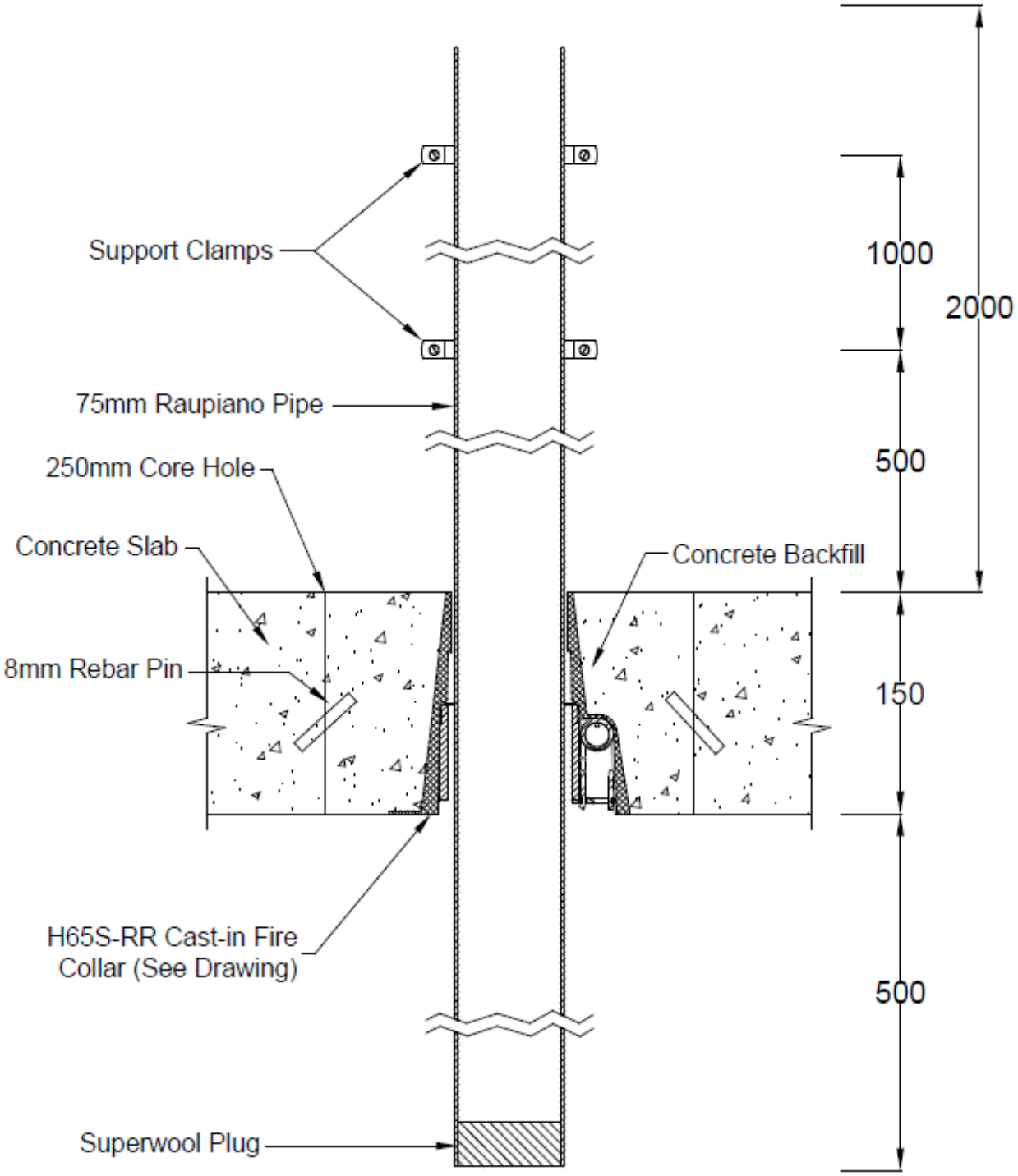
DRAWING TITLED 'TEST SLAB S-20-F LAYOUT', DATED 09 JULY 2021, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #1

75 Raupiano Stack & H65S-RR

Date: 13 JUL 2021



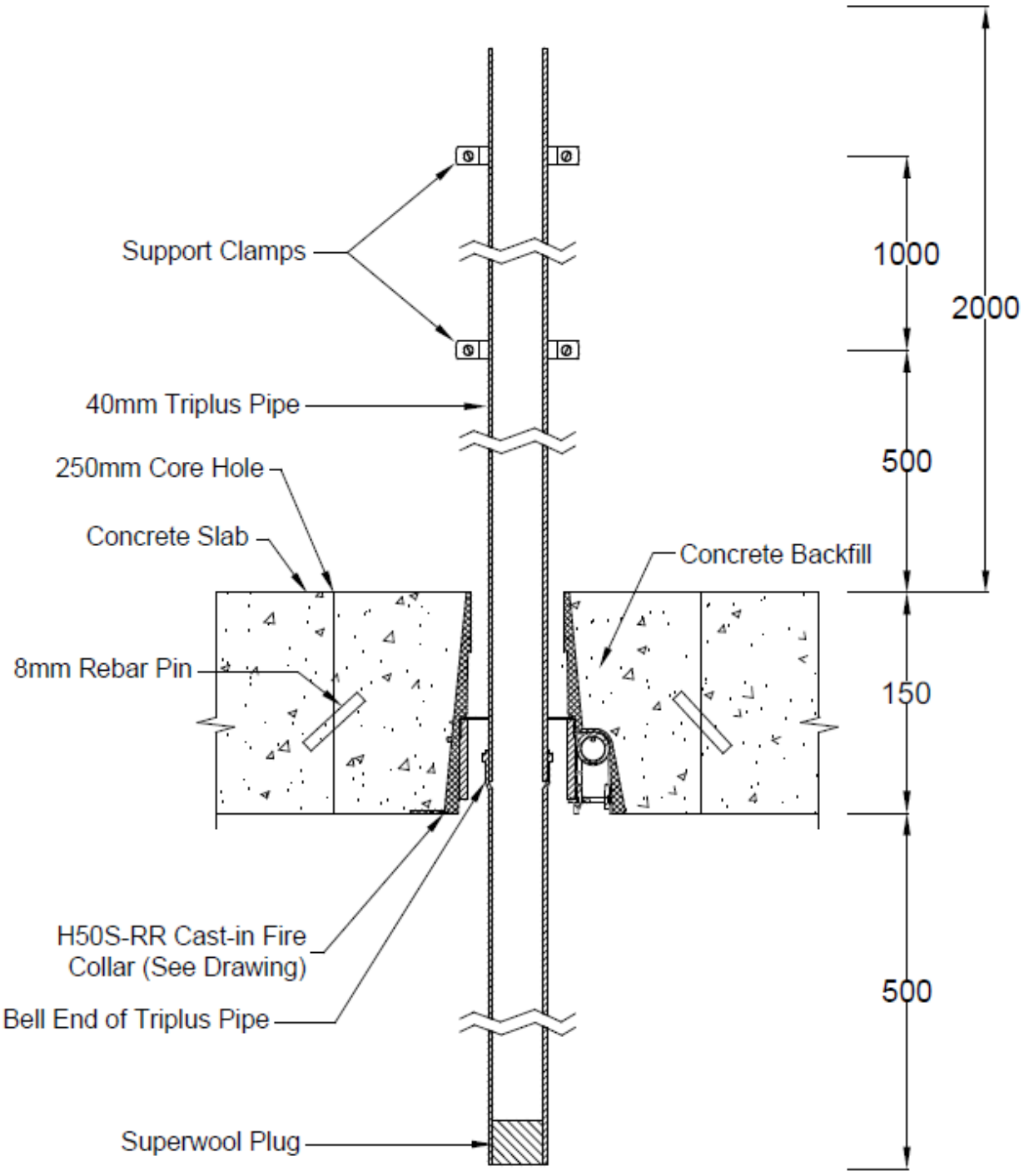
DRAWING TITLED 'SPECIMEN #1, 75 RAUPIANO STACK & H65S-RR', DATED 13 JULY 2020 BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #2

40 Triplus Stack w/ Bell End in Collar & H50S-RR

Date: 14 JUL 2021



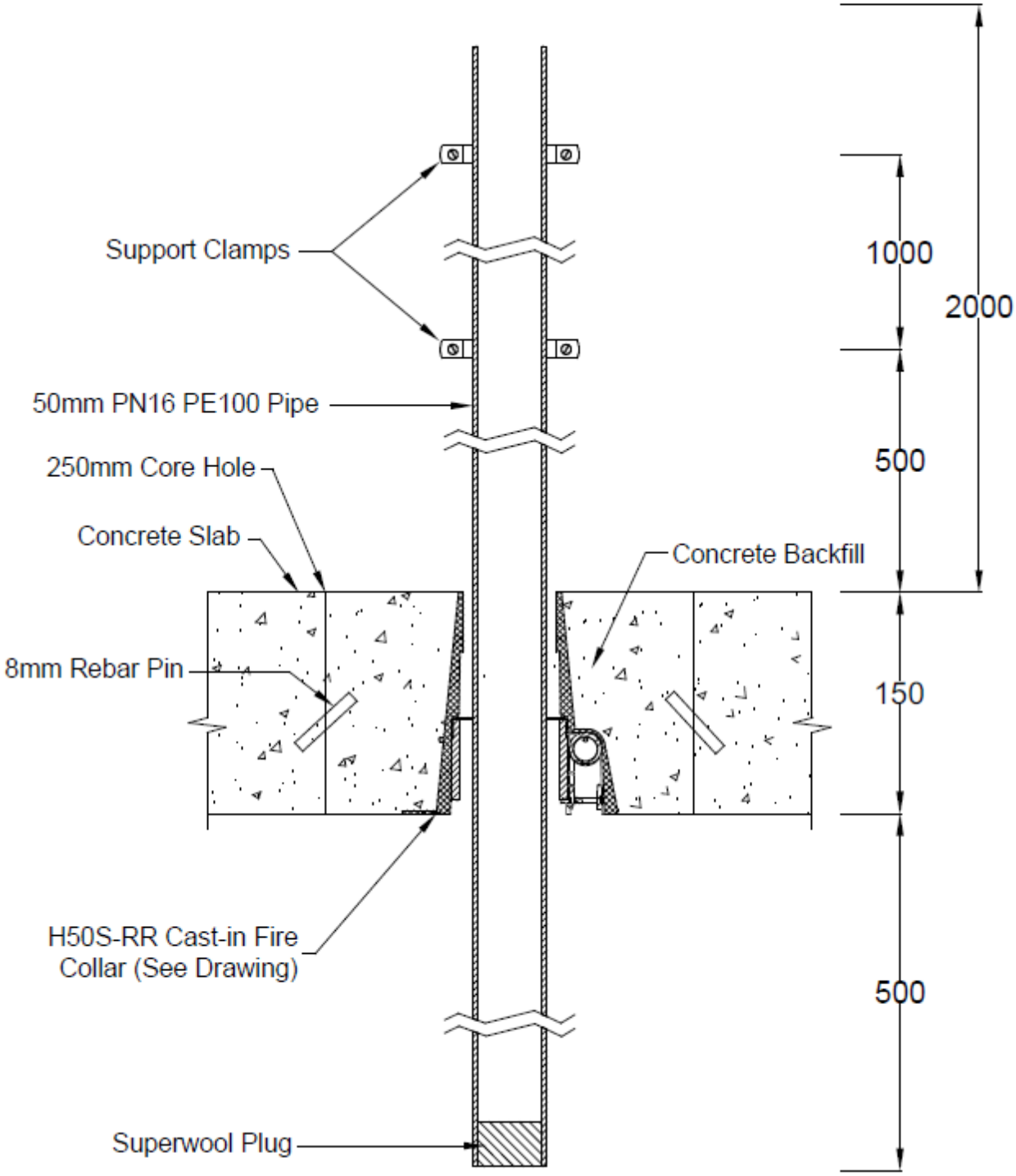
DRAWING TITLED 'SPECIMEN #2, 40 TRIPLUS STACK W/ BELL END IN COLLAR & H50S-RR', DATED 14 JULY 2021 BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #3

50 PN16 PE100 Stack & H50S-RR

Date: 14 JUL 2021



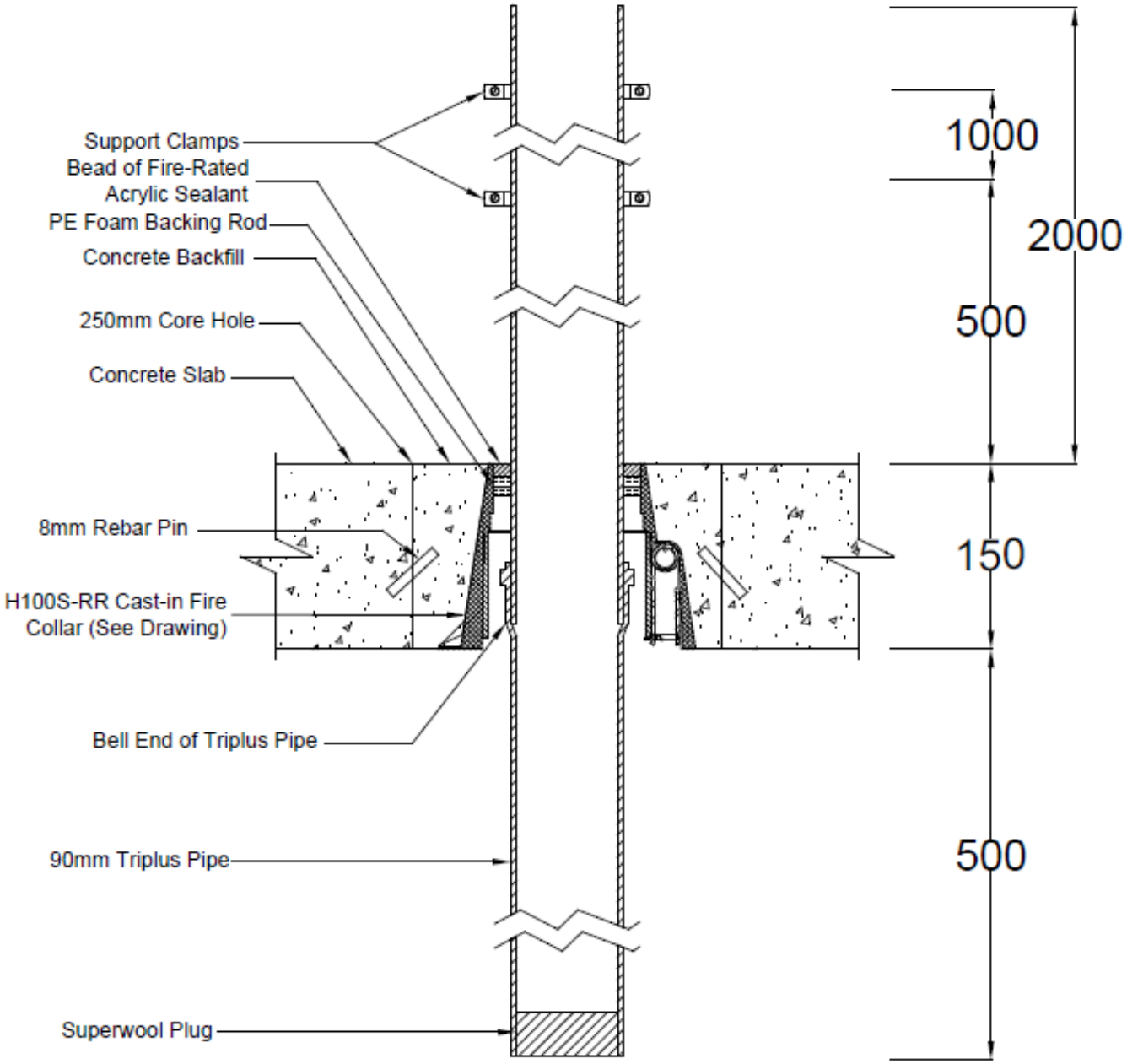
DRAWING TITLED 'SPECIMEN #3, 50 PN16 PE100 STACK & H50S-RR', DATED 14 JULY 2021 BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #4

90 Triplus Stack w/ Bell End in Collar & H100S-RR

Date: 13 JUL 2021



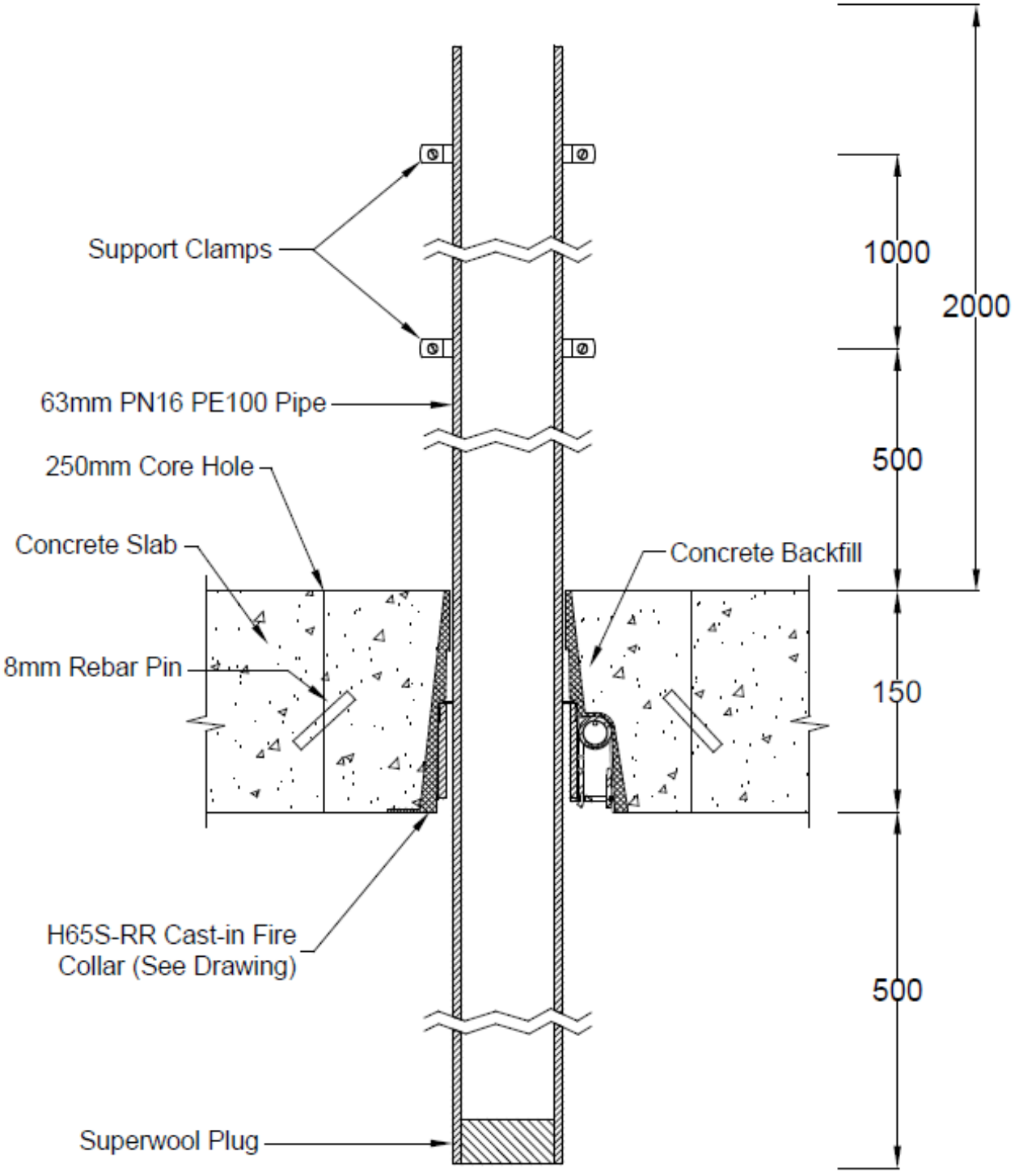
DRAWING TITLED 'SPECIMEN #4, 90 TRIPLUS STACK W/ BELL END IN COLLAR & H100S-RR', DATED 13 JULY 2021 BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #5

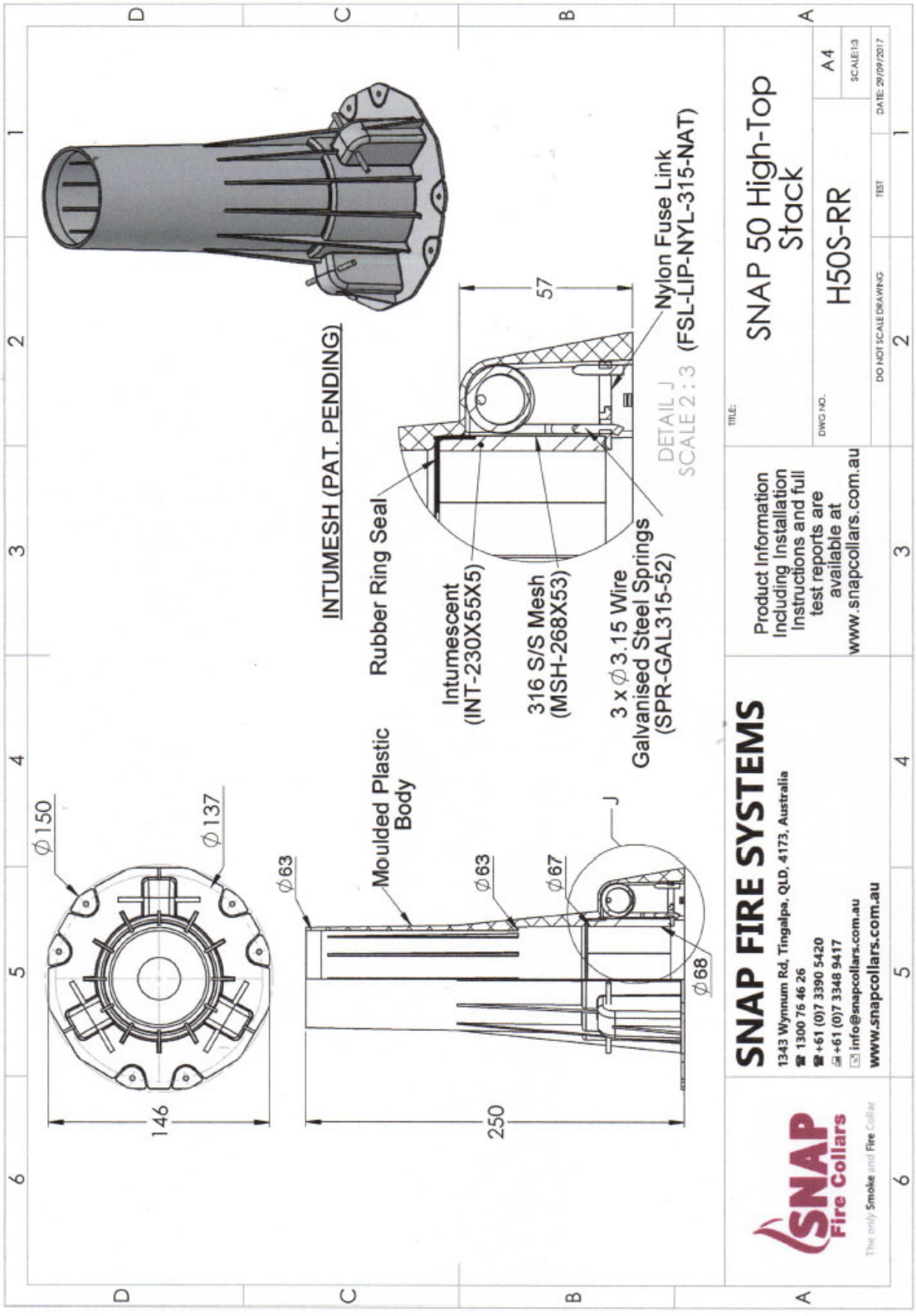
63 PN16 PE100 Stack & H65S-RR

Date: 13 JUL 2021

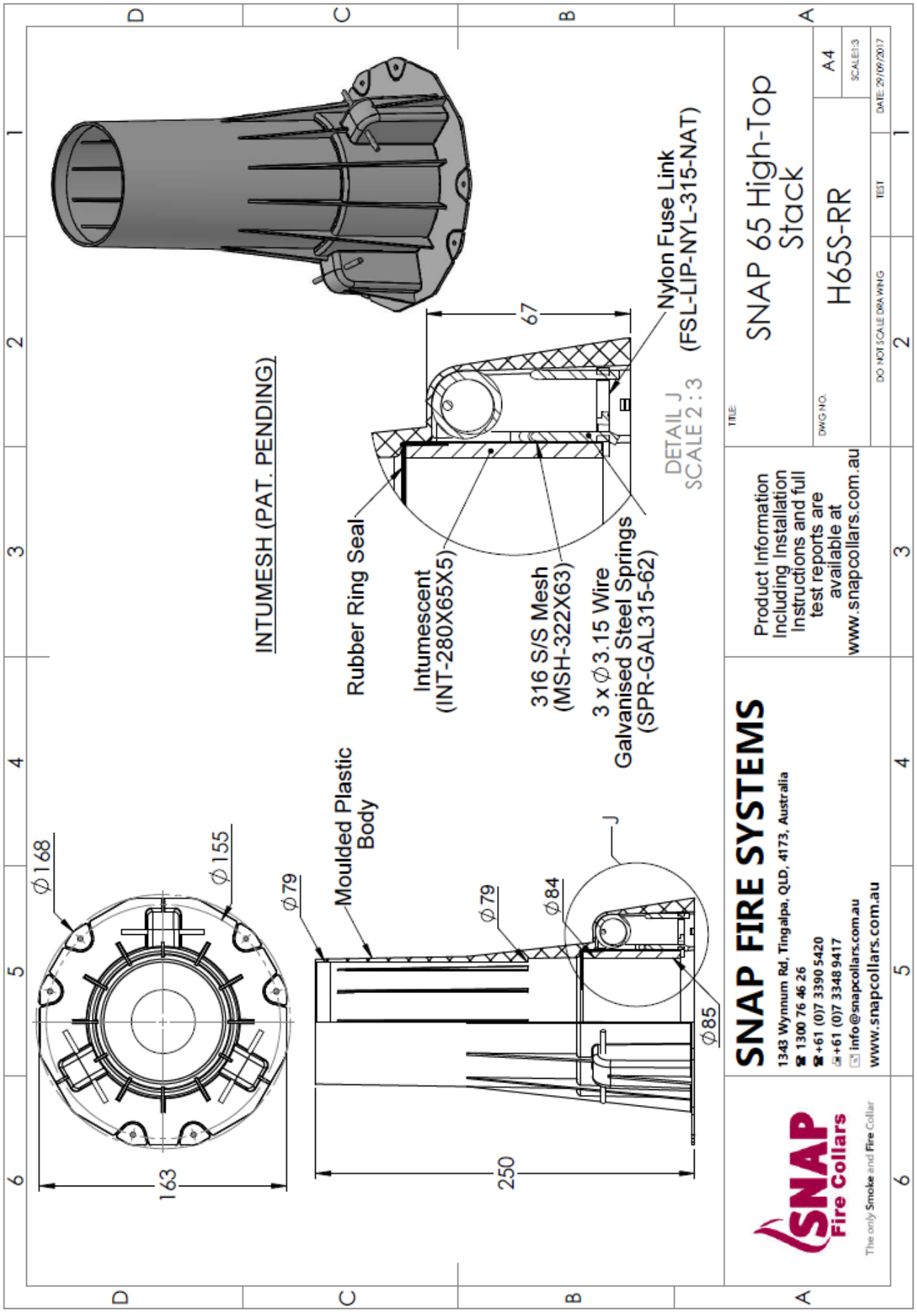


DRAWING TITLED 'SPECIMEN #5, 63 PN16 PE100 STACK & H65S-RR', DATED 13 JULY 2021 BY SNAP FIRE SYSTEMS PTY LTD

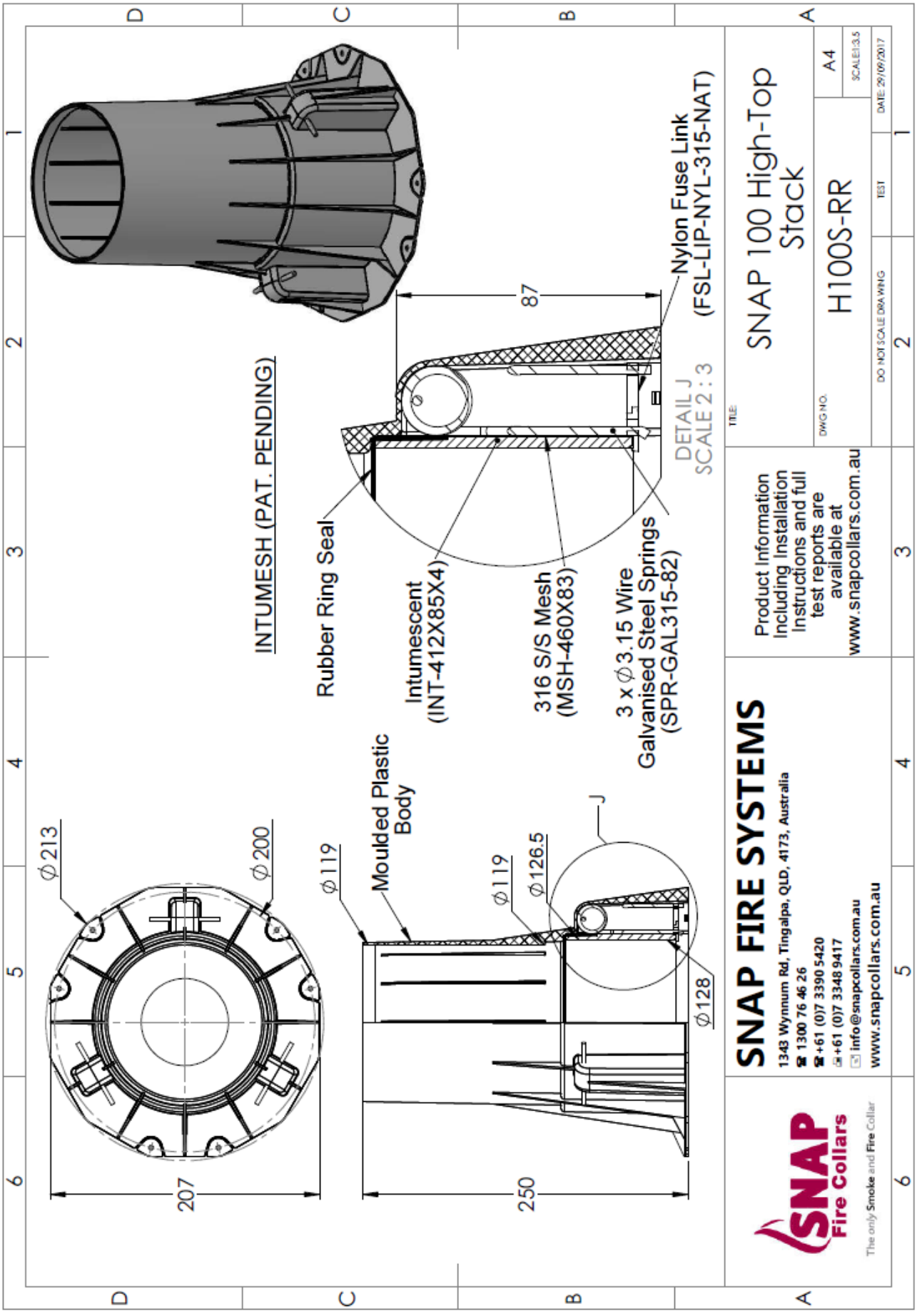
Appendix E – Specimen Drawings



DRAWING TITLED 'SNAP 50 HIGH-TOP STACK', DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING TITLED 'SNAP 65 HIGH-TOP STACK', DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING TITLED 'SNAP 100 HIGH-TOP STACK', DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD

Appendix F – Certificate(s) of Test

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Certificate of Test

No. 3596

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 10: Service penetrations and control joints, on behalf of:

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2224.

Product Name: SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 75 Raupiano stack pipe (Specimen 1)

Description: The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by a stack pipe protected by SNAP Fire Systems cast-in fire collars. The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP H65S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 79 mm inner diameter and a 168-mm outer diameter base flange. The 250-mm high collar casing incorporated a 280-mm x 65-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 322-mm x 63-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 65 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd. The H65S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab. The penetrating service comprised a 74.15-mm outside diameter Rehau Raupiano Plus pipe with a wall thickness of 2.07 mm fitted through the collar's sleeve. The Raupiano Plus pipe construction comprised three layers consisting of an abrasion resistant polypropylene inner layer, a mineral-filled polypropylene middle layer and a polypropylene outer layer. The pipe projected vertically 2000 mm above the unexposed face of the concrete slab and 500 mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end. On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #1, 75 Raupiano Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

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

Structural Adequacy	-	not applicable
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 -/240/180.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed. 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: Peter Gordon Date of Test: 10 August 2021

Issued on the 21st day of September 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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 – NO. 3596

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PO Box 52, North Ryde NSW 1670, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3597

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 10: Service penetrations and control joints, on behalf of:

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2224.

Product Name: SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 40 Triplus stack pipe incorporating a bell joint inside the collar (Specimen 2)

Description: The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by a stack pipe protected by SNAP Fire Systems cast-in fire collars. The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP H50S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 150-mm outer diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 268-mm x 53-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 50 High-Top Stack', dated 29/09/17, by Snap Fire Systems Pty Ltd. The H50S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab. The penetrating service comprised a 40.06-mm outside diameter Valsir Triplus stack pipe with a wall thickness of 2.23 mm fitted through the collar's sleeve with a 'bell end' pipe joint located inside the fire collar casing. The Triplus pipe construction comprised three layers consisting of a highly chemical resistant polypropylene inner layer, a mineral-filled polypropylene middle layer, and a polypropylene outer layer. The pipe projected vertically 2000 mm above the unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of slab. The pipe was left open at unexposed end and plugged with ceramic fibre on the exposed end. On the unexposed face of the slab, the annular gap between pipe and collar sleeve was left unprotected as shown in drawing 'Specimen #2, 40 Triplus Stack w/ Bell End in Collar & H50S-RR', dated 14/07/21 by Snap Fire Systems Pty Ltd.

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

Structural Adequacy	-	not applicable
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 -/240/180.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed. 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: Peter Gordon Date of Test: 10 August 2021

Issued on the 21st day of September 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3598

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 10: Service penetrations and control joints, on behalf of:

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2224.

Product Name: A SNAP H50S-RR High-Top Stack cast-in fire collar protecting a nominal 50 PN16 PE100 stack pipe (Specimen 3)

Description: The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by a stack pipe protected by SNAP Fire Systems cast-in fire collars. The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP H50S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 150-mm outer diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 268-mm x 53-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 50 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd. The H50S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab. The penetrating service comprised a 50.24-mm outside diameter David Moss SDR11/PN16 PE100 polypropylene stack pipe with a wall thickness of 5.02 mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500 mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and plugged with ceramic fibre on the exposed end. On the unexposed face of the slab, the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #3, 50 PN16 PE100 Stack & H50S-RR', dated 14 July 2021 by Snap Fire Systems Pty Ltd.

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

Structural Adequacy	-	not applicable
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 -/240/180.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed. 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: Peter Gordon Date of Test: 10 August 2021

Issued on the 21st day of September 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3599

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 10: Service penetrations and control joints, on behalf of:

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2224.

Product Name: A SNAP H100S-RR High-Top Stack cast-in fire collar protecting a nominal 90 Triplus stack pipe incorporating a bell joint inside the collar (Specimen 4)

Description: The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by a stack pipe protected by SNAP Fire Systems cast-in fire collars. The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP H100S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner dia. and a 213-mm outer diameter base flange. The 250-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three equally spaced 3.15-mm dia. galvanised steel springs bound with nylon fuse links acting against a 460-mm x 83-mm 316 stainless steel mesh as shown in drawing 'SNAP 100 High-Top Stack', dated 29/09/17, by Snap Fire Systems Pty Ltd. The H100S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab. The penetrating service comprised a 90.43-mm outside dia. Valsir Triplus stack pipe with a wall thickness of 3.5 mm fitted through the collar's sleeve with a "bell end" pipe joint located inside the collar. On the unexposed face of the slab, the annular gap between pipe and the inside of collar incorporated a PE backing rod which was backfilled to a 10-mm depth using H.B Fullers Firesound sealant which was finished flush with slab as shown in drawing 'Specimen #4, 90 Triplus Stack w/ Bell End in Collar & H100S-RR', dated 13/07/21 by Snap Fire Systems Pty Ltd. The Triplus pipe construction comprised three layers consisting of a highly chemical resistant polypropylene inner layer, a mineral-filled polypropylene middle layer, and a polypropylene outer layer. The pipe projected vertically 2000 mm above unexposed face of the concrete slab and 500-mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500 mm from unexposed face of the slab. The pipe was left open at unexposed end and plugged with ceramic fibre on the exposed end.

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

Structural Adequacy	-	not applicable
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 -/240/180.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed. 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: Peter Gordon Date of Test: 10 August 2021

Issued on the 21st day of September 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3600

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 10: Service penetrations and control joints, on behalf of:

IG6 Pty Ltd as trustee for the IG6 IP Trust
1343 Wynnum Road
Tingalpa QLD

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2224.

Product Name: SNAP H65S-RR High-Top Stack cast-in fire collar protecting a nominal 63 PN16 PE100 stack pipe (Specimen 5)

Description: The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab. The slab was penetrated by a stack pipe protected by SNAP Fire Systems cast-in fire collars. The 150-mm thick concrete slab was reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP H65S-RR High-Top Stack cast-in fire collar comprised a 1.6-mm thick polypropylene casing with a 79 mm inner diameter and a 168-mm outer diameter base flange. The 250-mm high collar casing incorporated a 280-mm x 65-mm x 5-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 322-mm x 63-mm 316 stainless steel mesh as shown in drawing titled 'SNAP 65 High-Top Stack', dated 29 September 2017, by Snap Fire Systems Pty Ltd. The H65S-RR collar was cast into a 150-mm thick concrete slab with the collar's casing cut down to 150-mm high finishing flush with the unexposed face of the concrete slab. The penetrating service comprised a 63.25-mm outside diameter David Moss SDR11/PN16 PE100 polypropylene stack pipe with a wall thickness of 6.2 mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the unexposed face of the concrete slab and 500 mm below into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from unexposed face of the slab. The pipe was left open at unexposed end and plugged with ceramic fibre on the exposed end. On the unexposed face of the slab, the annular gap between pipe and the collar sleeve was left unprotected as shown in drawing titled 'Specimen #5, 63 PN16 PE100 Stack & H65S-RR', dated 13 July 2021 by Snap Fire Systems Pty Ltd.

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

Structural Adequacy	-	not applicable
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 -/240/180.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. Specimens were tested in a concrete slab with a Fire Resistance Period (FRP) for insulation of 180 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The maximum FRL of any test specimen cannot exceed the FRL achieved by the concrete slab in which it was installed. 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: Peter Gordon Date of Test: 10 August 2021

Issued on the 21st day of September 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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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 of elements for building construction.
AS 4072.1-2005	Components for the protection of openings in fire-resistant separating elements. Part 1: Service penetrations and control joints.
AS 3600-2018	Concrete structures.

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FOR FURTHER INFORMATION

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