Fire-resistance test on fire collars protecting a concrete slab penetrated by services and a blank penetration seal

Test Report

Author: Peter Gordon
Report number: FSP 2271
Date: 13 October 2022

Client: IG6 Pty Ltd

Inquiries should be addressed to:

Fire Testing and Assessments	Author	The Client
NATA Registered Laboratory 14 Julius Avenue North Ryde, NSW 2113 Telephone +61 2 9490 5444	Infrastructure Technologies 14 Julius Avenue North Ryde, NSW 2113 Telephone +61 2 9490 5500	IG6 Pty Ltd 1343 Wynnum Road Tingalpa QLD Telephone + 61 7 3390 5420

Report Status and Revision History:

VERSION	STATUS	DATE	DISTRIBUTION	ISSUE NUMBER
Revision A	Draft for review	24/03/2022	CSIRO and The Client	FSP 2271
Revision B	Final for issue	28/06/2022	CSIRO and The Client	FSP 2271
Revision C	Amend to drawing 'Specimen #3 160 Triplus Stack & HP150R' and 'Specimen #4, 160 Raupiano Stack & HP150R'.	13/10/2022	CSIRO and The Client	FSP 2271

Report Authorisation:

AUTHOR	REVIEWED BY	AUTHORISED BY
Peter Gordon	Glenn Williams	Brett Roddy
		
13 October 2022	13 October 2022	13 October 2022

Use of this Report

Use of Reports – Testing

This report is subject to binding obligations under which it was prepared. In particular, the Report must not be used:

- *as a means of endorsement; or*
- *in a company prospectus or notification to a Stock Exchange document for capital raising, without the prior written consent of CSIRO.*

The Report may be published verbatim and in full, provided that a statement is included on the publication that it is a copy of the Report issued by CSIRO.

Excerpts of the Report may not be published.

Use of Reports – Consultancy

This report is subject to binding obligations under which it was prepared. In particular, the Report may only be used for the following purposes:

- *the information in the Report may be used by the party that commissioned the Report for its internal business operations (but not licensing to third parties);*
- *the report may be copied for distribution within the organisation that commissioned the Report;*
- *copies of the Report (or extracts of the Report) may be distributed to contractors and agents of the organisation that commissioned the Report who have a need for the Report for its internal business operations. Any extracts of the Report distributed for this purpose must clearly note that the extract is part of a larger Report held by the organisation that commissioned the Report and which has been prepared by CSIRO.*

The name, trade mark or logo of the CSIRO must not be used without the prior written consent of CSIRO.

The Report must not be used as a means of endorsement without the prior written consent of CSIRO.

Copyright and disclaimer

Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Contents

Fire-resistance test on fire collars protecting a concrete slab penetrated by services and a blank penetration seal

Sponsored Investigation No. FSP 2271

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimens as SNAP fire collars protecting a 150-mm thick concrete slab penetrated by three services and a blank penetration seal comprising: two unplasticized polyvinyl chloride (uPVC) pipes, a Valsir Triplus (polypropylene) pipe and a Rehau Raupiano (polypropylene) pipe.

1.2 Sponsor

IG6 Pty Ltd
1343 Wynnum Road
Tingalpa QLD

1.3 Manufacturer

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 5161/4704

1.7 Test date

The fire-resistance test was conducted on 8 March 2022.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 150-mm thick concrete slab which was penetrated by multiple services protected by three retrofit fire collars and one cast-in fire collar.

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 and 4. 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 1260 PVC-U pipes and fittings for drain, waste and vent application;
- AS/NZS 7671:2010 Plastic piping system for soil and waste discharge (low and high temperature) inside buildings – Polypropylene (PP).

Specimen 1 – A SNAP LP100R-D Low Profile Retrofit fire collar and SNAP FWS Repair Plate protecting a DN100 uPVC pipe incorporating a floor waste and a 4-way riser

The SNAP LP100R-D Low Profile Retrofit fire collar comprised a 0.95-mm steel casing with a 122-mm inner diameter and a 260-mm diameter base flange. The 65-mm high collar casing incorporated a closing mechanism which comprised a 5-mm thick x 59-mm wide x 418-mm long Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised four 4-mm diameter 304 stainless steel springs with black nylon fuse links and a 415-mm long x 120-mm wide mesh with a wire diameter of 0.15-mm as shown in drawing numbered LP100R-D-T dated 10 February 2017, by Snap Fire Systems Pty Ltd.

The SNAP FWS Repair plate was fabricated using 3-mm thick galvanised steel and comprised two semi-annular shaped pieces with an outer diameter of 168-mm and an inner diameter of 111-mm. Each piece had two fixing holes as shown in drawing titled 'SNAP 100 FWS Repair Plate, dated 24 November 2021, by Snap Fire Systems Pty Ltd.

A cast in fire collar (with a green plastic housing) was used to provide the opening in the concrete slab. The cast in fire collar comprised a green plastic casing with a 110-mm inner diameter, a 210-mm external diameter base flange and 0.75-mm thick steel base plate. The 80-mm high collar casing incorporated a layer of 425-mmx 50-mm x 15-mm thick intumescent material.

The SNAP 100 FWS repair plate and SNAP LP100R-D fire collar were superimposed centrally located over the cast-in collar on the exposed face of the concrete slab and fixed in place through four mounting brackets using 5-mm x 30-mm long steel concrete steel bolts.

The penetrating service comprised a uPVC pipe with a floor waste system incorporating a 4-way riser. The penetrating Iplex DWV uPVC (sandwich construction) pipe had a 110-mm outside diameter with a wall thickness of 3.4 mm and was fitted through both collar sleeves. The top of the pipe incorporated a floor waste comprising a chrome plated brass grate and a plastic puddle flange. A 15-mm thick grout screed was laid on top of the concrete slab and finished flush with the floor grate.

On the exposed side of the slab a uPVC 4-way riser with a wall thickness of 3.3-mm was coupled to the penetrating pipe inside the SNAP LP100R-D fire collar. Two 200-mm long sections of DN50 uPVC pipe (side arms) were glued to the 4- way riser. The 4-way riser was then supported from the two side arms using nut clips and M10 threaded rods fixed to the concrete slab with steel drop-in anchors.

The 4-way riser was charged with water to the level shown in drawing titled 'Specimen #1 100 PVC Floor Waste & 100 Green under LP100R-D', dated 24 February 2022, by Snap Fire Systems Pty Ltd.

Specimen 2 – A SNAP H150S-RR High-Top Stack cast-in fire collar protecting a blank penetration seal

The SNAP H150S-RR High-Top Stack cast-in fire collar comprised a 2-mm thick polypropylene casing with a 180 mm inner diameter and a 292-mm diameter base flange. The 250-mm high collar casing incorporated a 600-mm wide x 110-mm wide x 6-mm thick intumescent material and a rubber ring seal. The closing mechanism comprised four (4) x 4-mm diameter galvanised steel springs, a nylon fuse link, and a 640 mm x 109-mm 316 stainless steel mesh as shown in drawing tilted 'SNAP 150 High-Top Stack' dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The SNAP H150S-RR collar cap comprised a 2-mm thick polypropylene casing with an outside diameter of 190.7-mm and an inner diameter of 181-mm as shown in drawing titled '150 Cap', dated 14 October 2020, by Snap Fire Systems Pty Ltd.

The H150S-RR fire collar was cast into a 150-mm thick concrete slab with the collar casing cut down to 150-mm high to finish flush with the unexposed face of the concrete slab.

The opening inside the sleeve of the SNAP H150S-RR Cast-in fire collar was protected with a blank penetration seal. The blank penetration seal comprised a SNAP H150S-RR collar cap incorporating a small section of uPVC pipe located inside the collar's sleeve. The Iplex DWV uPVC (sandwich construction) pipe was approximately 140-mm long, had a 160-mm outside diameter and a nominal wall thickness of 4.68-mm and incorporated PVC endcaps glued to both ends using PVC adhesive. The top PVC end cap was centrally fixed to the underside of the H150S-RR collar cap and with a M6 x 25-mm cup head bolt, nut and a 17-mm washer. The blank penetration seal was friction fitted into the sleeve of the SNAP H150S-RR fire collar from the unexposed face and fixed in place using two 25-mm wide x 230-mm long metal straps that were attached through the central bolt and screw fixed to the concrete slab with four M5 x 30-mm concrete screws as shown in drawing titled "Specimen #2, 150 PVC(SC) Plug and H150S-RR", dated 24 February 2022, by Snap Fire Systems Pty Ltd.

Specimen 3 – A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Triplus stack pipe penetrating a 175-mm diameter core hole

The SNAP HP150R High Profile Retrofit fire collar comprised a 0.95-mm thick steel casing with a 175-mm inner diameter and a 326-mm base flange. The 117-mm high fire collar casing incorporated a strip of 570-mm long x 112-mm wide x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four SPR-SS400-102 stainless steel springs bound with nylon fuse links, and a 590-mm x 109 mm 316 stainless steel mesh as shown in drawing titled "SNAP 150 High Profile Retro" dated 5 October 2017, by Snap Fire Systems Pty Ltd.

The HP150R fire collar was centrally located over the 160-mm aperture on the exposed face of the slab and fixed through the four (4) mounting brackets using 6.5-mm x 40-mm long steel sleeve masonry anchors.

The penetrating service comprised a Valsir Triplus polypropylene pipe with a 160-mm outside diameter and a nominal wall thickness of 5.67-mm fitted through the fire collars sleeve and penetrated the concrete slab through a 175-mm diameter core hole as shown in drawing titled 'Specimen #3, 160 Triplus Stack & HP150R', dated 24 February 2022, by Snap Fire Systems Pty Ltd.

The pipe projected vertically, 2000-mm above the unexposed face of the concrete slab and 500-mm into the furnace chamber and was supported at 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and capped with a ceramic fibre (Superwool) plug on the exposed end.

Specimen 4 – A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Raupiano Plus stack pipe penetrating a 175-mm diameter core hole

The SNAP HP150R High Profile Retrofit fire collar comprised a 0.95-mm thick steel casing with a 175-mm inner diameter and a 326-mm base flange. The 117-mm high fire collar casing incorporated a strip of 570 mm long x 112-mm wide x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four (4) SPR-SS400-102 stainless steel springs bound with nylon fuse links, with a 590-mm x 109 mm 316 stainless steel mesh as shown in drawing titled 'SNAP 150 High Profile Retro' dated 5 October 2017, by Snap Fire Systems Pty Ltd.

The HP150R fire collar was centrally located over the 160-mm aperture on the exposed face of the slab and fixed through the four (4) mounting brackets using 6-mm-mm x 40-mm long steel sleeve masonry anchors.

The penetrating service comprised an a Rehau Raupiano Plus polypropylene pipe with a 160-mm outside diameter pipe and a wall thickness of 4.25-mm fitted through fire collar sleeve and penetrated the concrete slab through a 175-mm diameter core hole as shown in drawing titled 'Specimen #4, 160 Raupiano Stack & HP150R', dated 24 February 2022, by Snap Fire Systems Pty Ltd.

The pipe projected vertically, 2000-mm above the unexposed face of the concrete slab and 500-mm into the furnace chamber and was supported at 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and capped with a ceramic fibre (Superwool) plug on the exposed end.

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 20 October 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-A3 Layout', dated 06 September 2021, by Snap Fire Systems Pty Ltd.
- Drawing titled '100 PVC Floor waste & 100 Green under LP100R-D', dated 24 Feb 2022, by Snap Fire Systems Pty Ltd.
- Drawing titled 'Specimen #1 100 PVC Floor Waste & 100 Green under LP100R-D', dated 24 February 2022, by Snap Fire Systems Pty Ltd.
- Drawing titled 'Specimen #2 150 PVC(SC)PLUG & HP150S-RR', dated 24 February 2022, by Snap Fire Systems Pty Ltd.
- Drawing titled 'Specimen #3 160 Triplus Stack & HP150R', dated 24 February 2022, by Snap Fire Systems Pty Ltd.
- Drawing titled 'Specimen #4, 160 Raupiano Stack & HP150R', dated 24 February 2022, by Snap Fire Systems Pty Ltd.
- Drawing titled 'SNAP 100FWS Repair Plate', dated 24 November 2021, by Snap Fire Systems Pty Ltd.
- Drawing numbered LP100R-D-T dated 10 February 2017, by Snap Fire Systems Pty Ltd.
- Drawing tilted 'SNAP 150 High Top Stack' dated 29 September 2017, by Snap Fire Systems Pty Ltd.
- Drawing titled '150 Cap', dated 14 October 2020, by Snap Fire Systems Pty Ltd.
- Drawing titled 'SNAP 150 High Profile Retro' dated 5 October 2017, by Snap Fire Systems Pty Ltd.

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 Pressure

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

The pressure probe was located approximately 350-mm below the concrete slab supporting construction.

4.4 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 22°C at the commencement of the test.

6 Departure from standard

The furnace pressure was outside of the tolerances of the requirements of AS 1530.4-2014 for periods of time as shown in Figure 3. The test laboratory confirms that this departure in furnace pressure would not have significantly affected the results of this test.

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 is being emitted between the concrete slab and the pipes of Specimens 3 and 4.
3 minutes -	Smoke is fluing from the end of the pipes of Specimens 3 and 4.
4 minutes -	Smoke has begun fluing from the floor waste grate of Specimen 1.
6 minutes -	Smoke fluing from end of the pipes of Specimens 3 and 4 has reduced.
9 minutes -	Smoke has ceased fluing from the end of the pipe of Specimen 4.
14 minutes -	Light discolouration (smoke staining) is visible on the base of the pipes of Specimens 3 and 4.

15 minutes -	The level of smoke being emitted at the base of Specimens 1 and 4 (between the slab and pipes) has reduced.
19 minutes -	Smoke has ceased fluing from the pipe of Specimen 3.
25 minutes -	The collar cap of Specimen 2 has lifted slightly.
39 minutes -	Further lifting of the collar cap of Specimen 2 (Photograph 6).
105 minutes -	Light smoke has resumed fluing from the end of the pipes of Specimens 3 and 4.
133 minutes -	Light smoke is venting from the floor waste grate of specimen 1 and the collar cap of Specimen 2 (Photograph 11).
155 minutes -	Light smoke is being emitted from the base of all specimens.
191 minutes -	Light smoke has ceased being emitted from the collar cap of Specimen 2. Light fluing continues from the end of the pipes of Specimens 3 and 4.
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 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 curve of temperature versus time associated with Specimen 1.

Figure 5 shows the curve of temperature versus time associated with Specimen 2.

Figure 6 shows the curve of temperature versus time associated with Specimen 3.

Figure 7 shows the curve of temperature versus time associated with Specimen 4.

8.6 Performance

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

Specimen 1 – A SNAP LP100R-D Low Profile Retrofit fire collar and SNAP FWS Repair Plate protecting a DN100 uPVC pipe incorporating a floor waste and a 4-way riser

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

Specimen 2 - A SNAP 150 High-Top Stack cast-in fire collar protecting a blank penetration seal

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

Specimen 3 - A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Triplus stack pipe penetrating a 175-mm diameter core hole

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

Specimen 4 - A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Raupiano stack pipe penetrating a 175-mm diameter core hole

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

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

*The 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

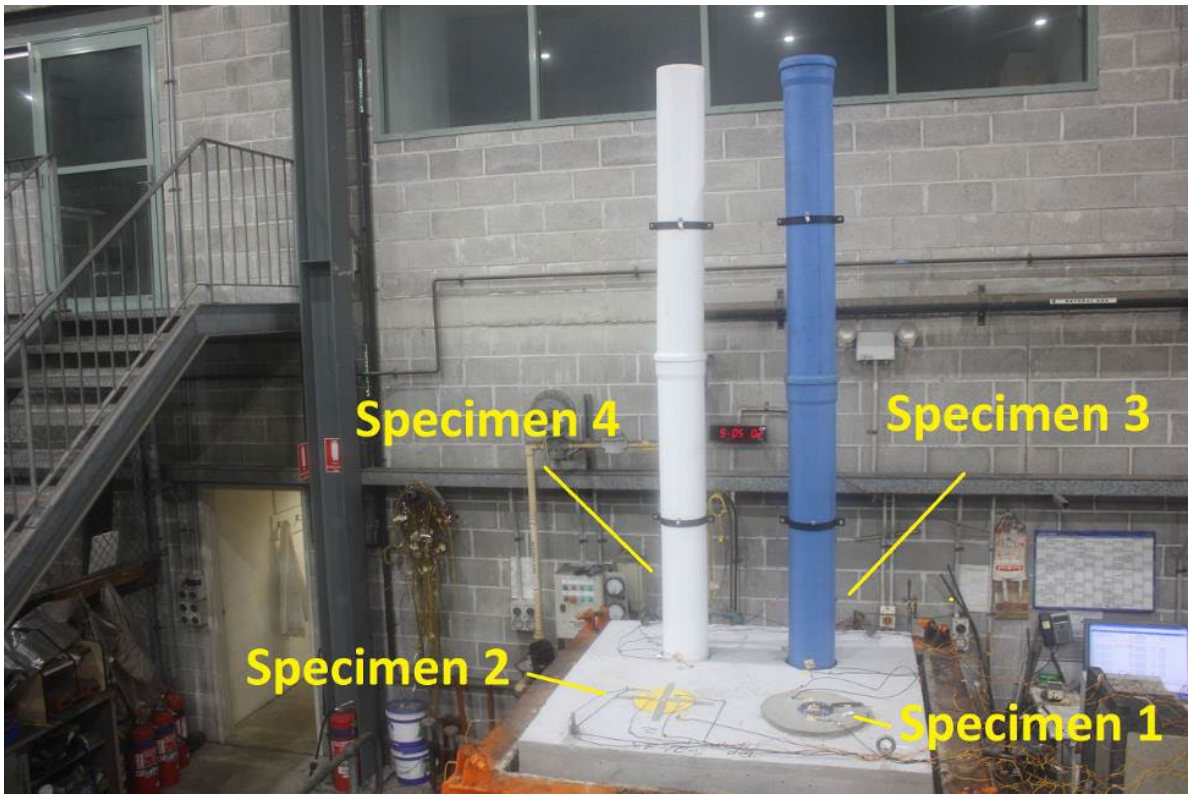
Appendices

Appendix A – Measurement location

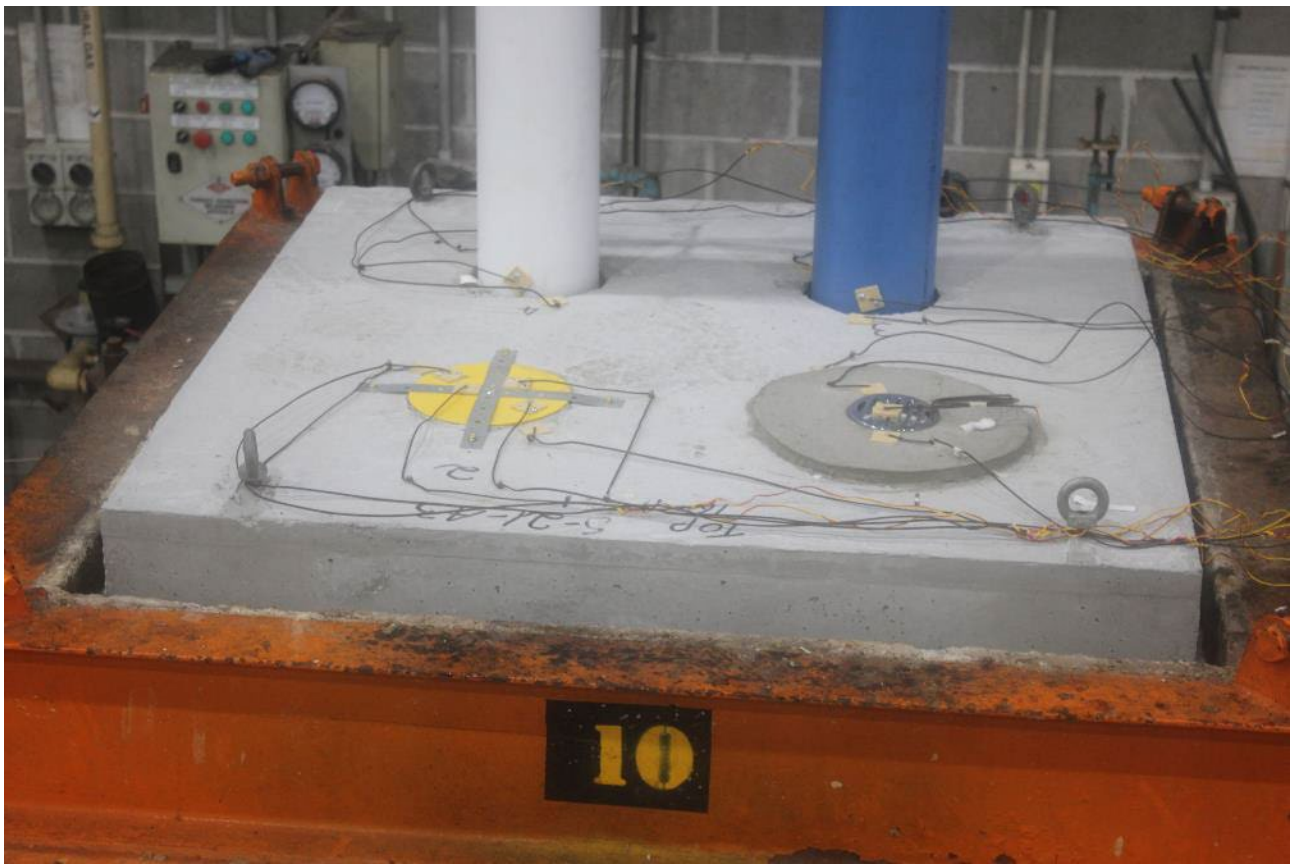
Specimen	T/C Position	T/C designation
Specimen 1 - A SNAP LP100R-D Low Profile Retrofit fire collar and SNAP FWS Repair Plate protecting a DN100 uPVC pipe incorporating a floor waste and a 4-way riser	On the centre of the grate	S1
	On the screed, 25-mm from the grate (North)	S2
	On the screed, 25-mm from the grate (South)	S3
	On the slab, 25-mm from the screed (NW)	S4
Specimen 2 - A SNAP H150S-RR High-Top Stack cast-in fire collar protecting a blank penetration seal	On the slab, 25-mm from the collar cap (NW)	S5
	On the slab, 25-mm from the collar cap (SE)	S6
	On the collar cap 25-mm from the slab (NW)	S7
	On the collar cap 25-mm from the slab (SE)	S8
	On the collar cap, off-centre (NE)	S9
	On the metal strapping, off-centre (West)	S10
Specimen 3 - A SNAP HP150R High Profile Retrofit fire collar protecting a nominal 160-mm Triplus stack pipe penetrating a 175-mm diameter core hole.	On the slab, 25-mm from the core hole (NW)	S11
	On the slab, 25-mm from core the hole (South)	S12
	On the pipe, 25-mm above the slab (NW)	S13
	On the pipe, 25-mm above the slab (South)	S14
Specimen 4 - A SNAP HP150R High Profile Retrofit fire collar protecting a nominal 160-mm Raupiano Plus stack pipe penetrating a 175-mm diameter core hole	On the slab, 25-mm from the core hole (NW)	S15
	On the slab, 25-mm from core the hole (South)	S16
	On the pipe, 25-mm above the slab (NW)	S17
	On the pipe, 25-mm above the slab (South)	S18
Rover		S19
Ambient		S20

Appendix B – Photographs

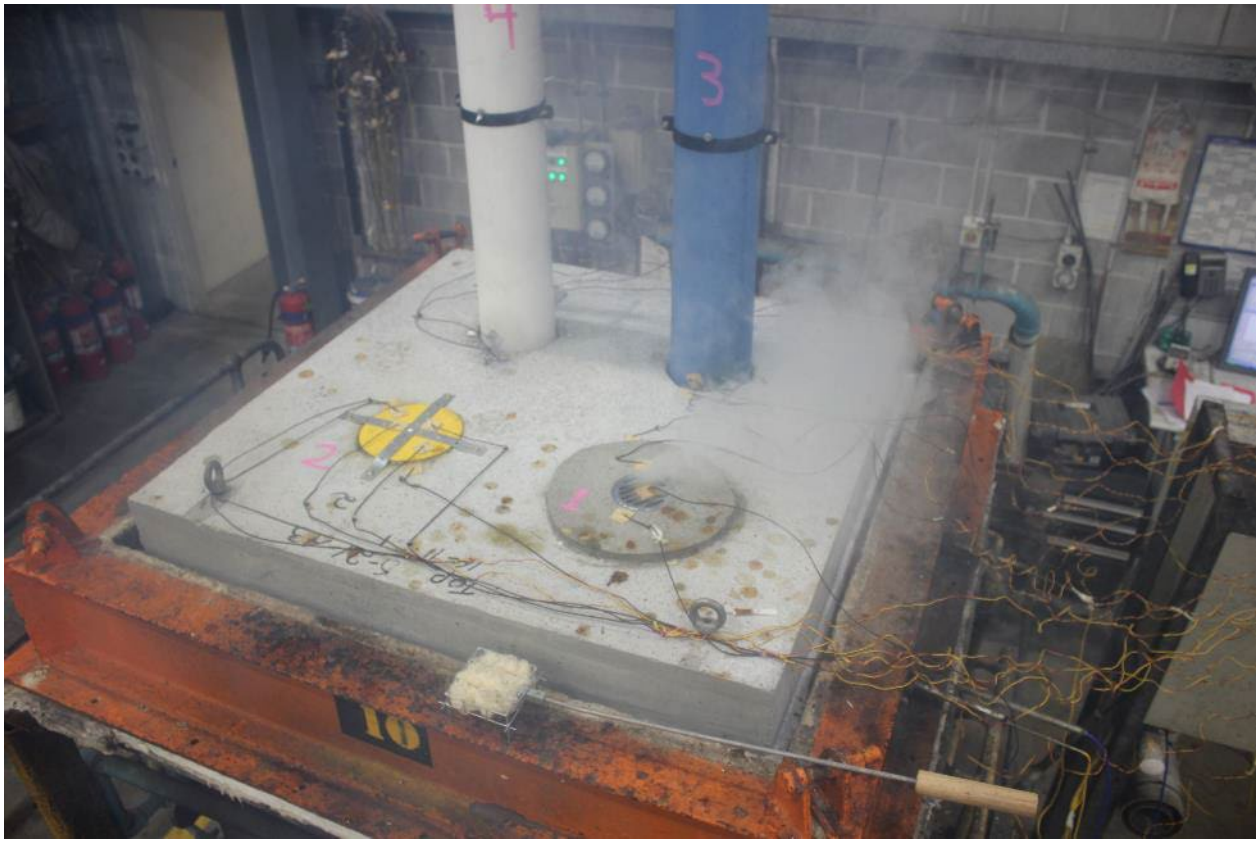
PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



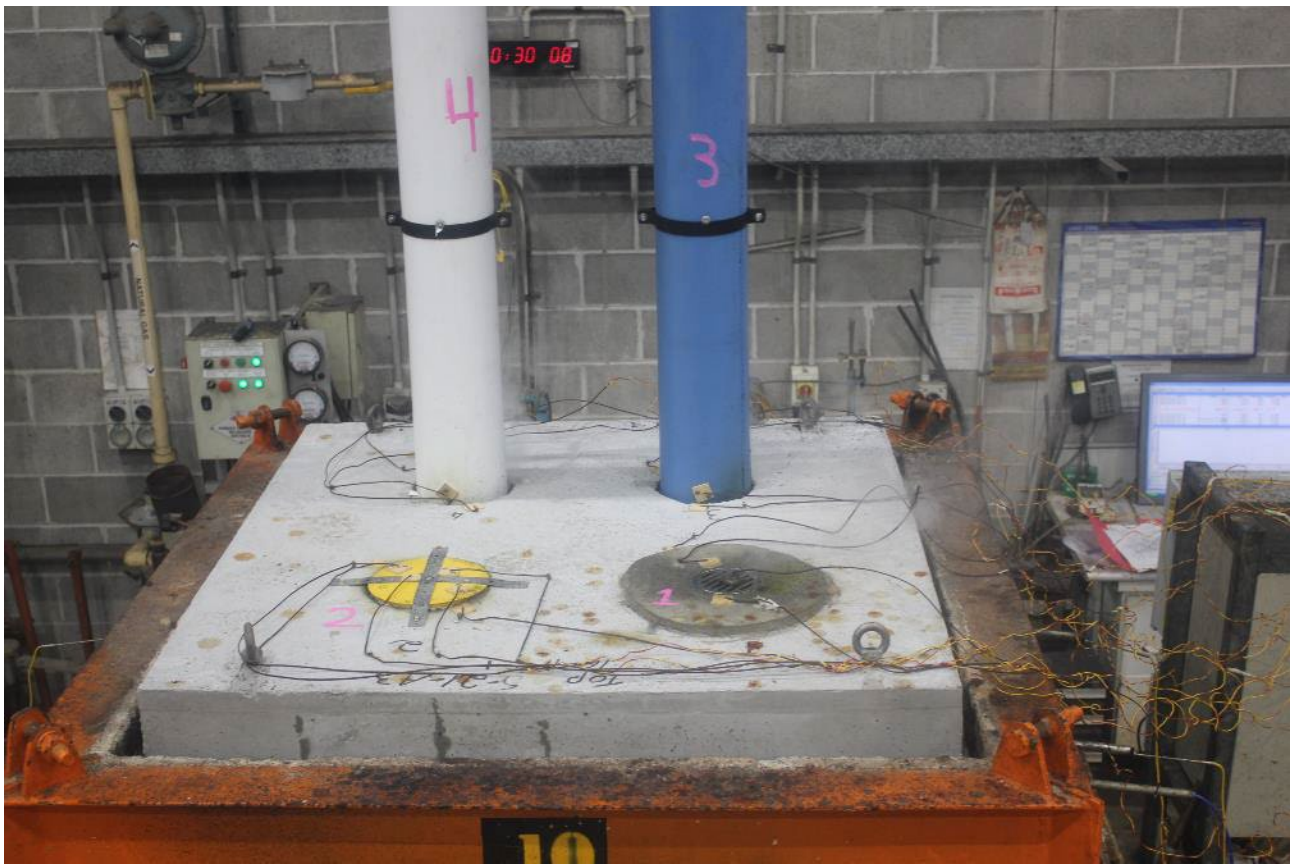
PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 3 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 4 – SPECIMENS AT 8 MINUTES INTO THE TEST

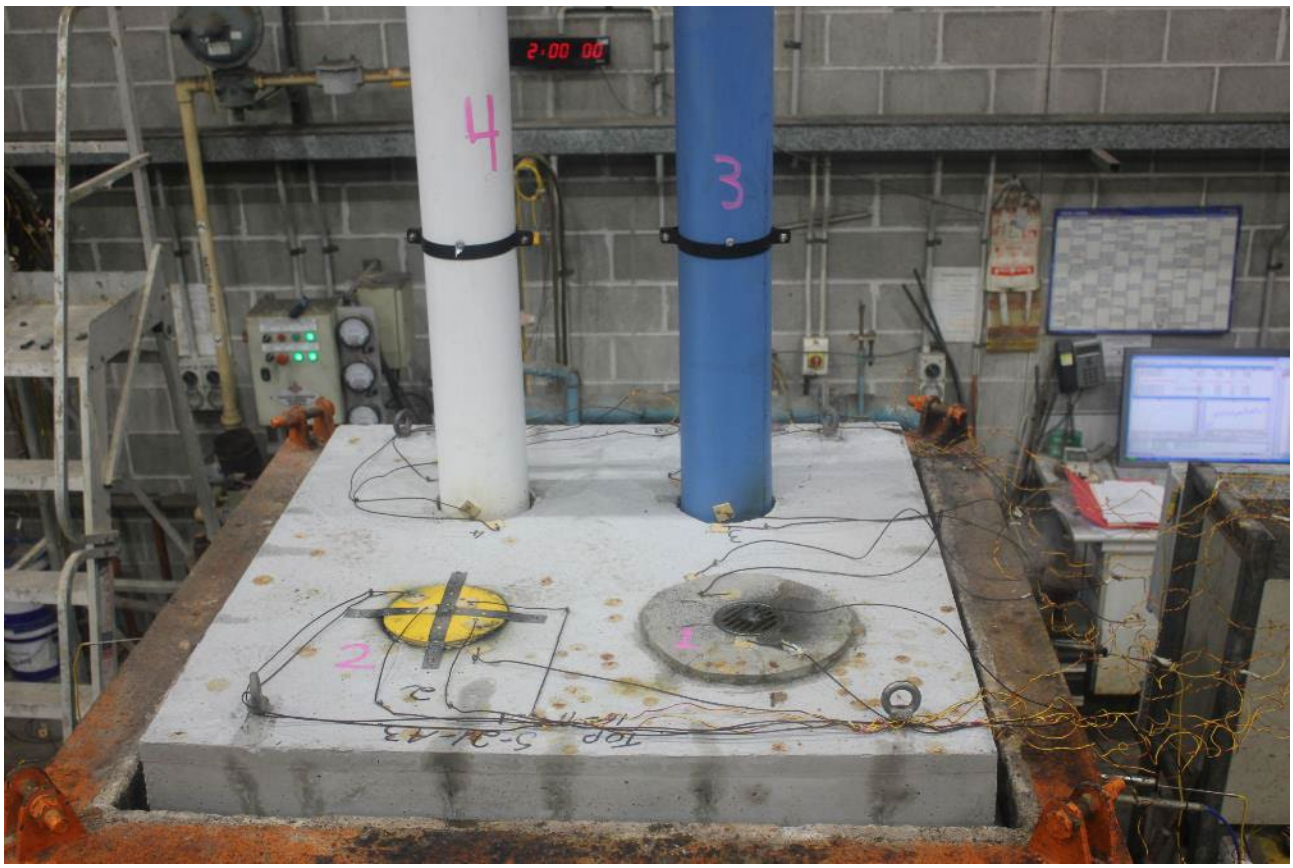


PHOTOGRAPH 5 – SPECIMENS AT 30 MINUTES INTO THE TEST

PHOTOGRAPH 6 –SPECIMEN 2 AT 39 MINUTES INTO THE TEST

PHOTOGRAPH 7 – SPECIMENS 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 3 AND 4 AT 133 MINUTES INTO THE TEST

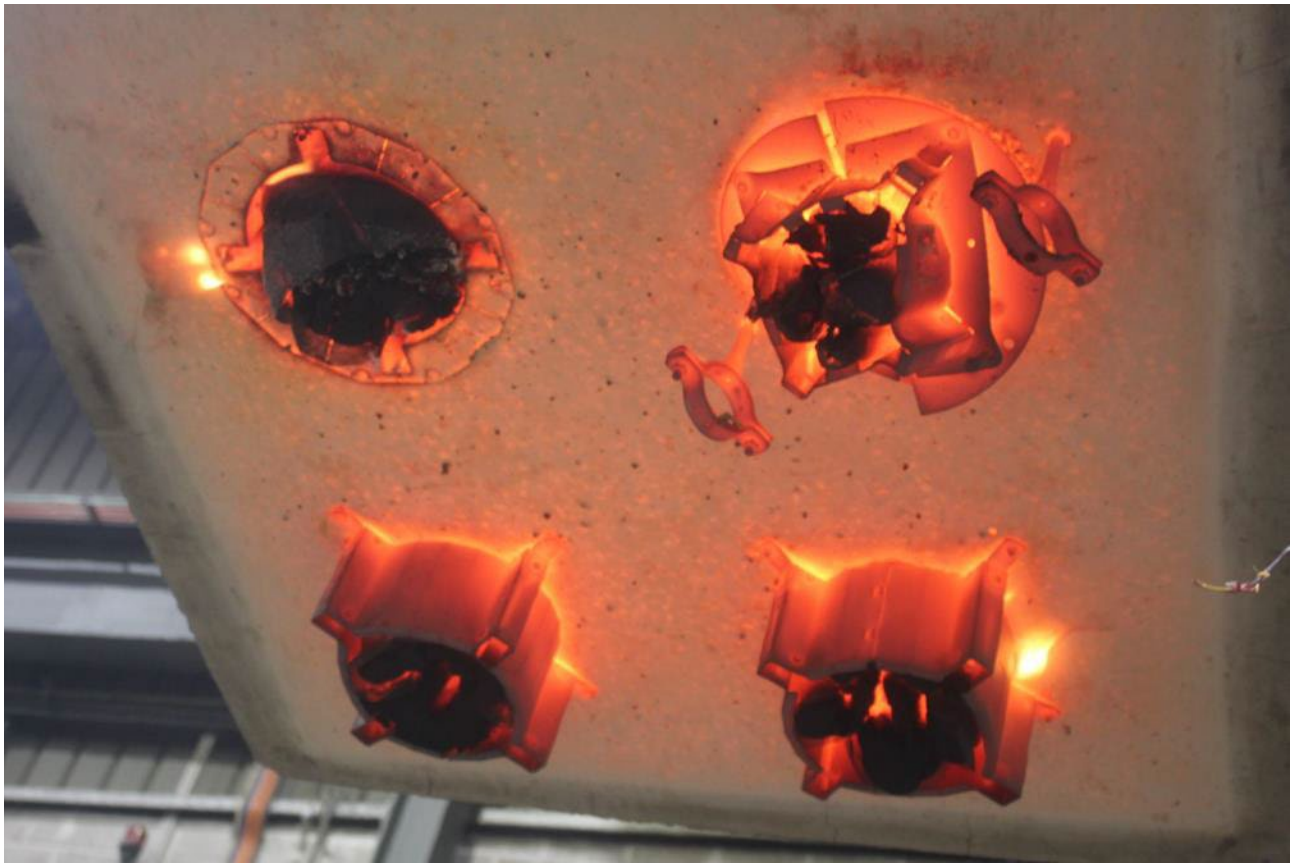
PHOTOGRAPH 11 – SPECIMENS 1 AND 2 AT 133 MINUTES INTO THE TEST

PHOTOGRAPH 12 – SPECIMENS AT 180 MINUTES INTO THE TEST

PHOTOGRAPH 13 – SPECIMENS AT 240 MINUTES INTO THE TEST.

PHOTOGRAPH 14 – SPECIMENS AT THE CONCLUSION OF TESTING

PHOTOGRAPH 15 – SPECIMENS AT THE CONCLUSION OF TESTING



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

Appendix C – Test Data charts

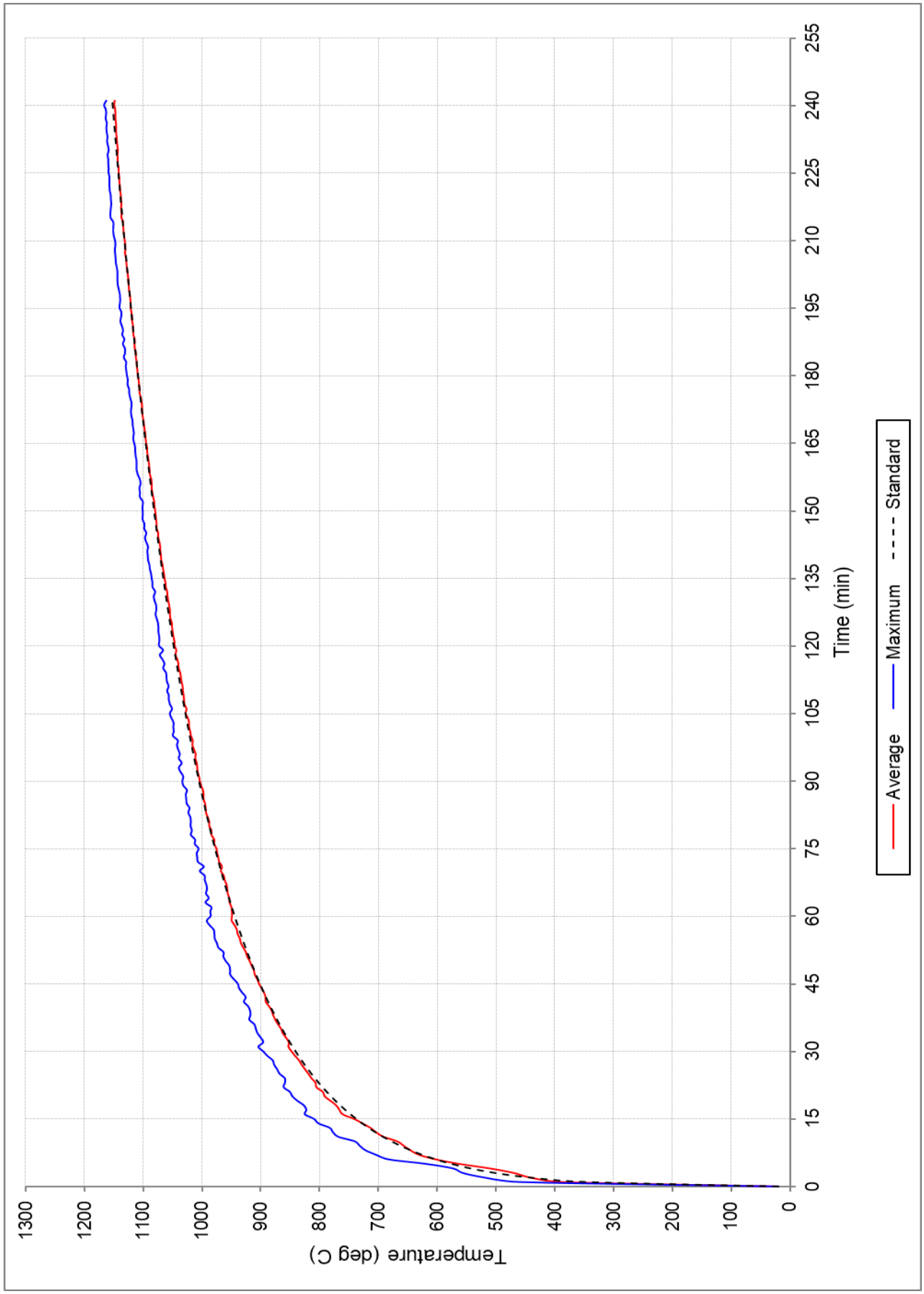


FIGURE 1 – FURNACE TEMPERATURE

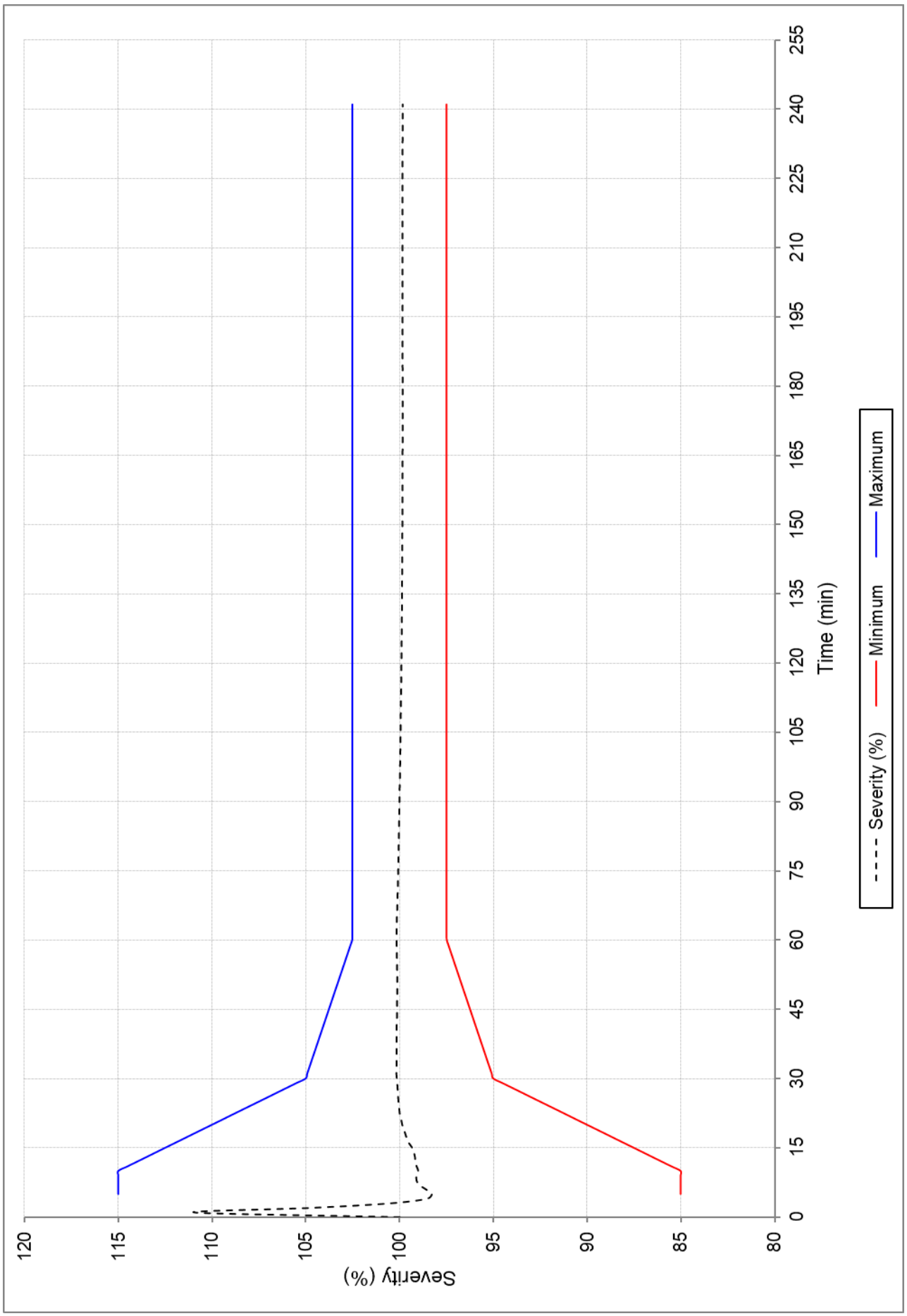


FIGURE 2 – FURNACE SEVERITY

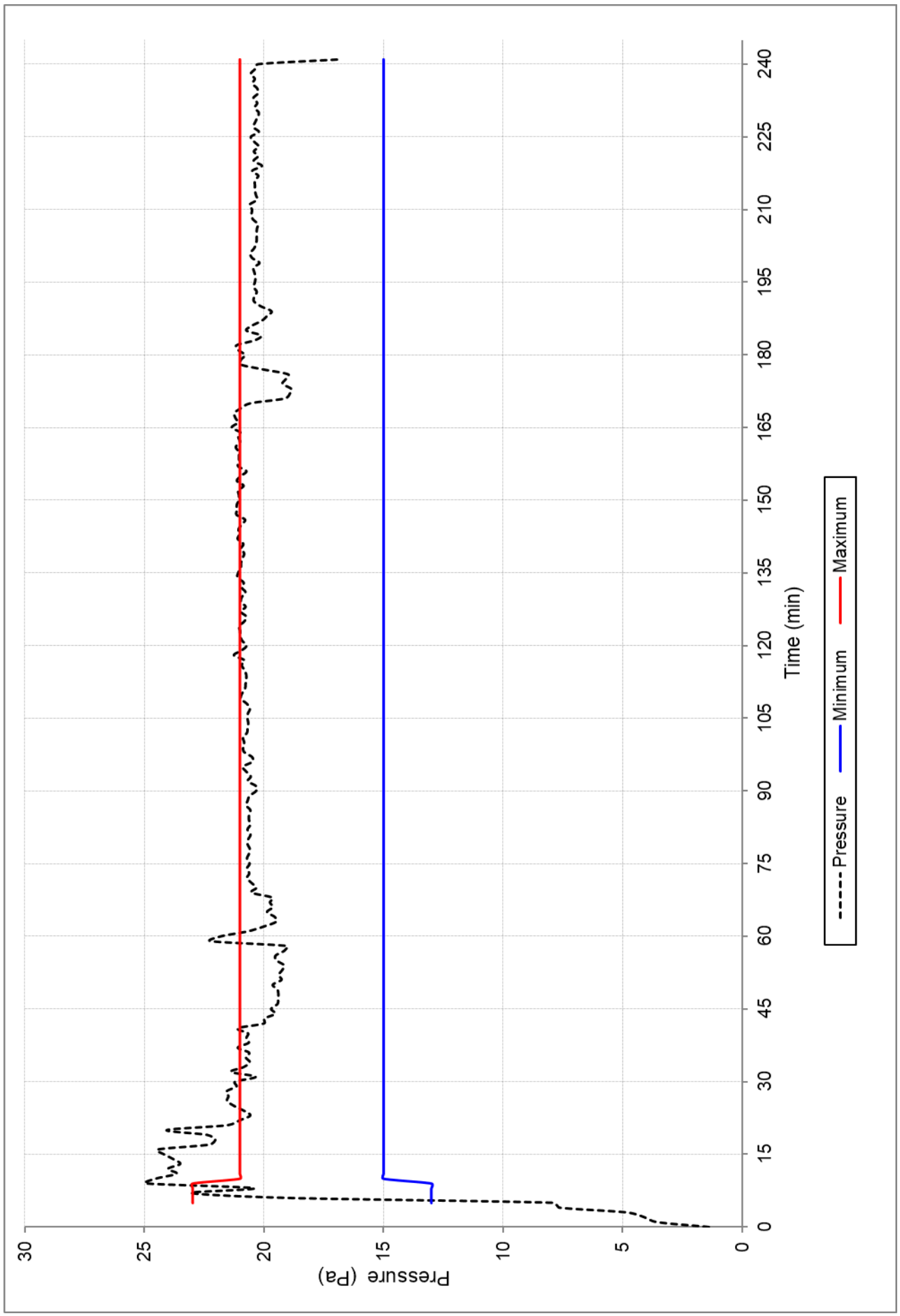


FIGURE 3 – FURNACE PRESSURE

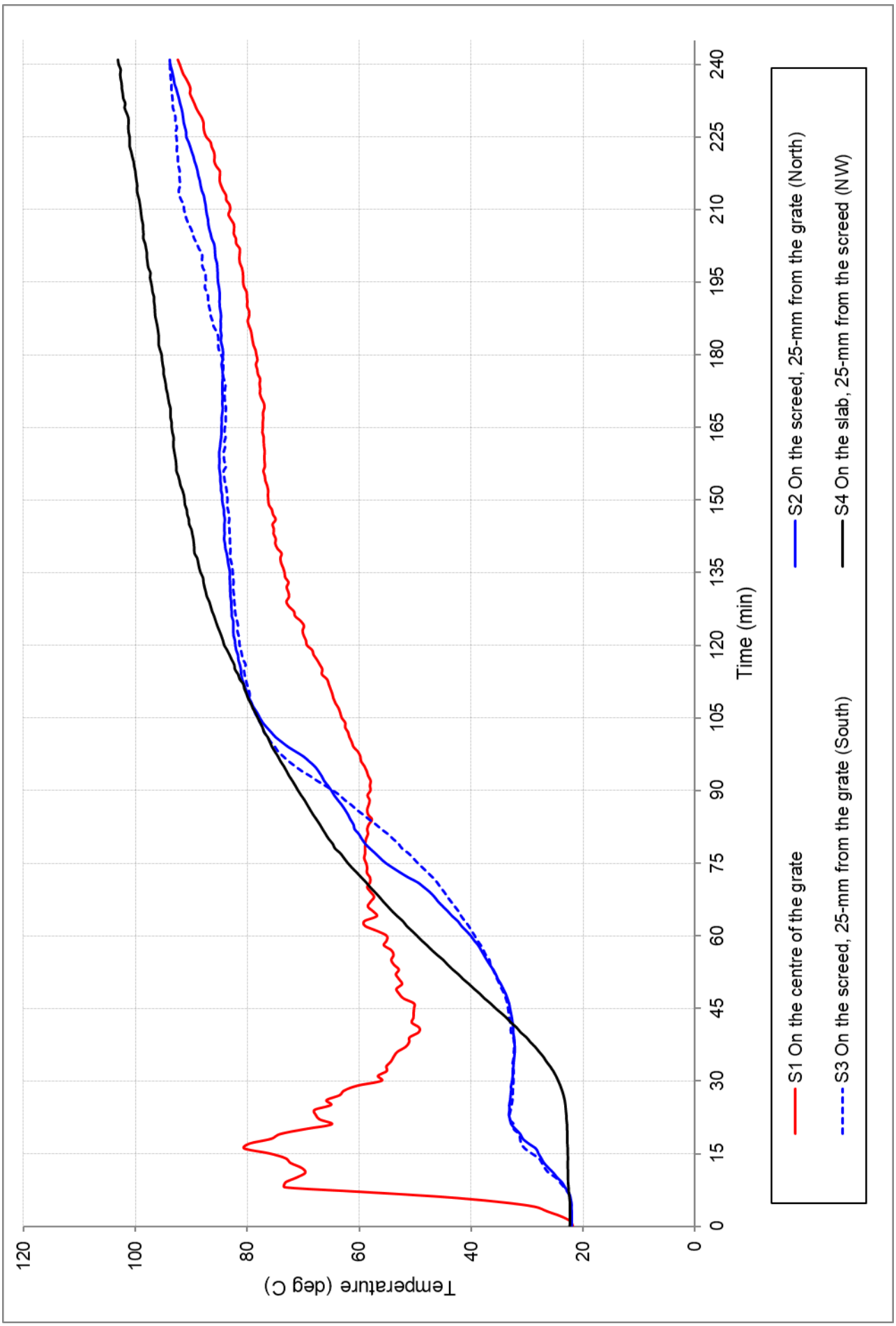


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

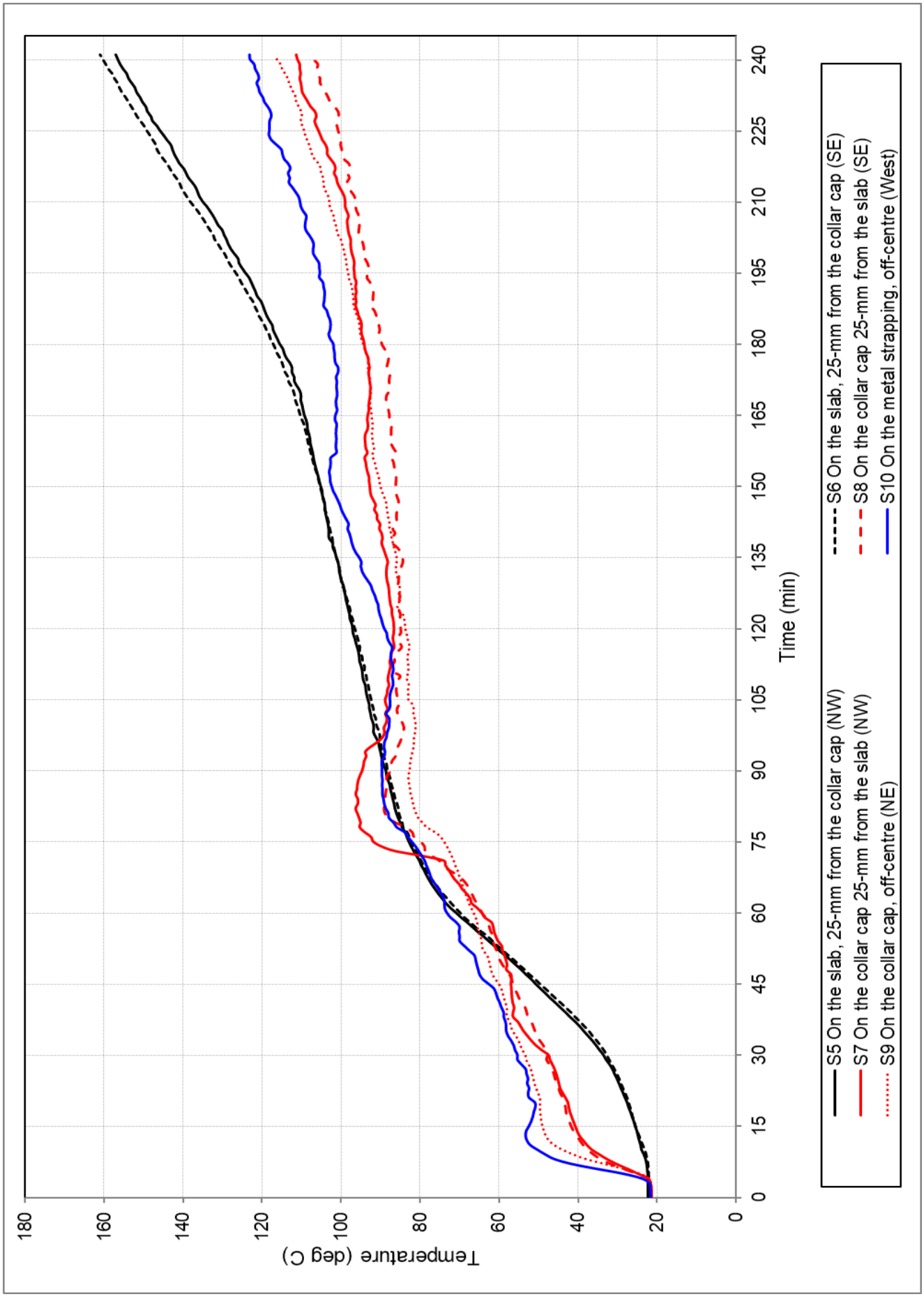


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 2

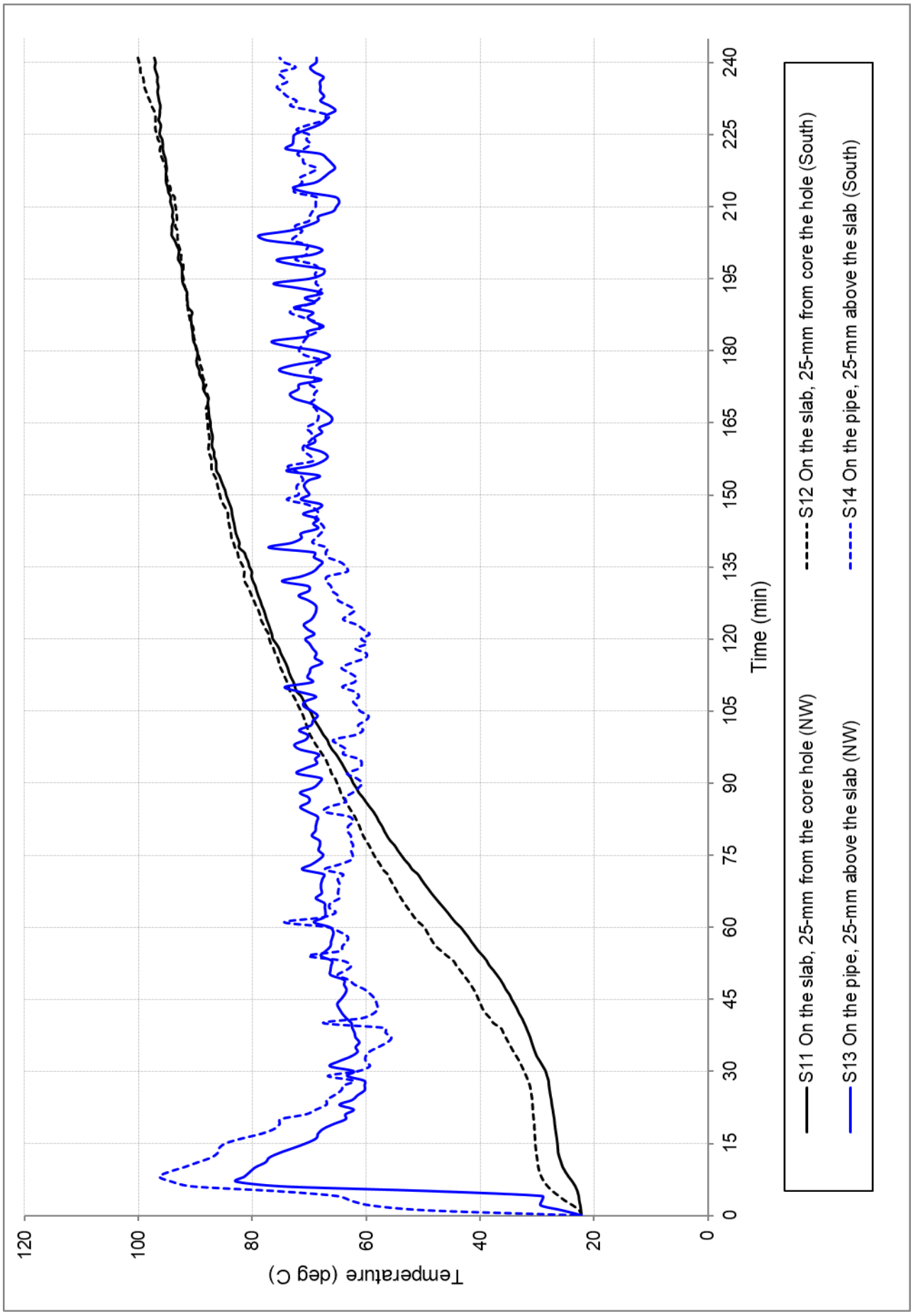


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 3

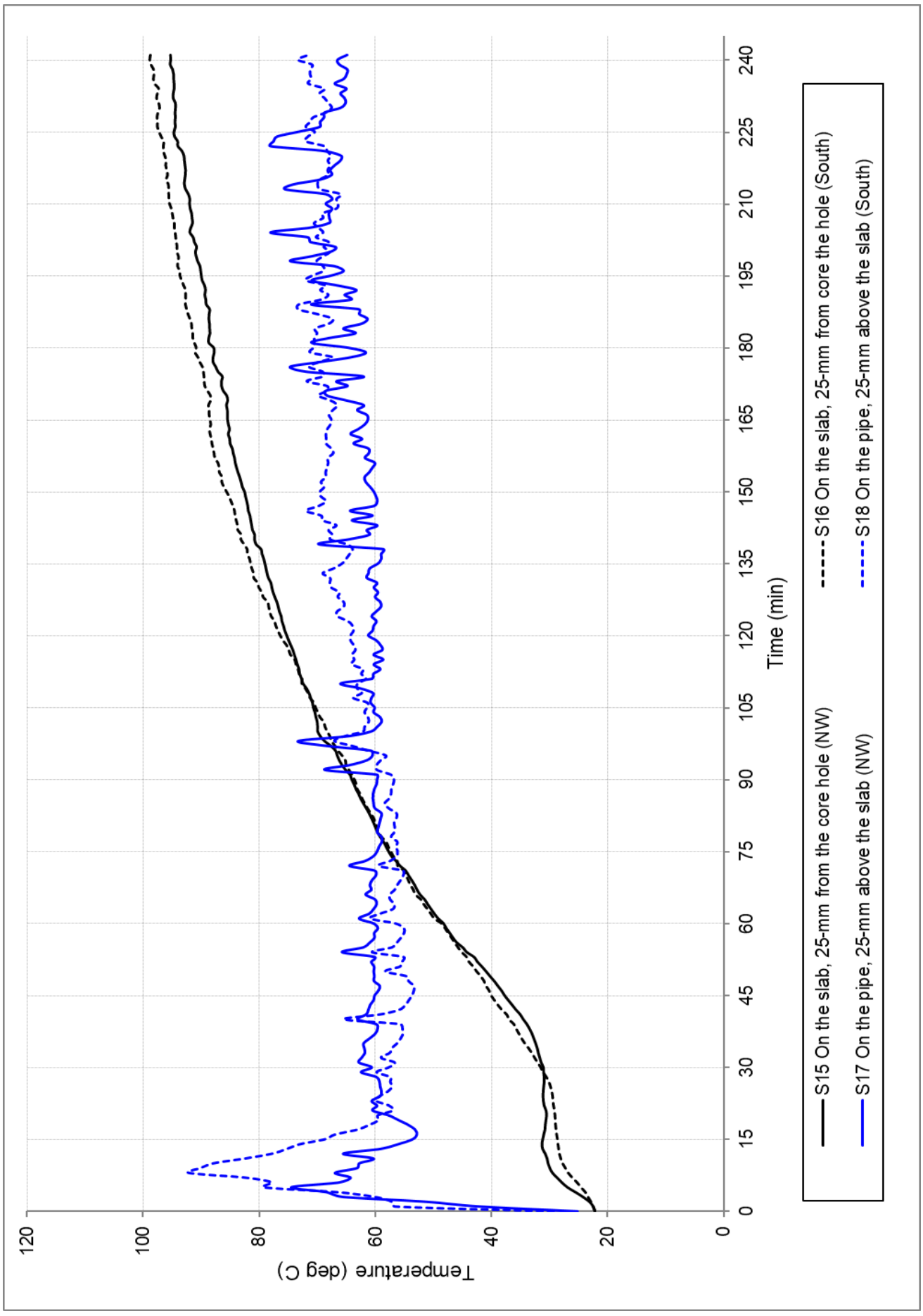


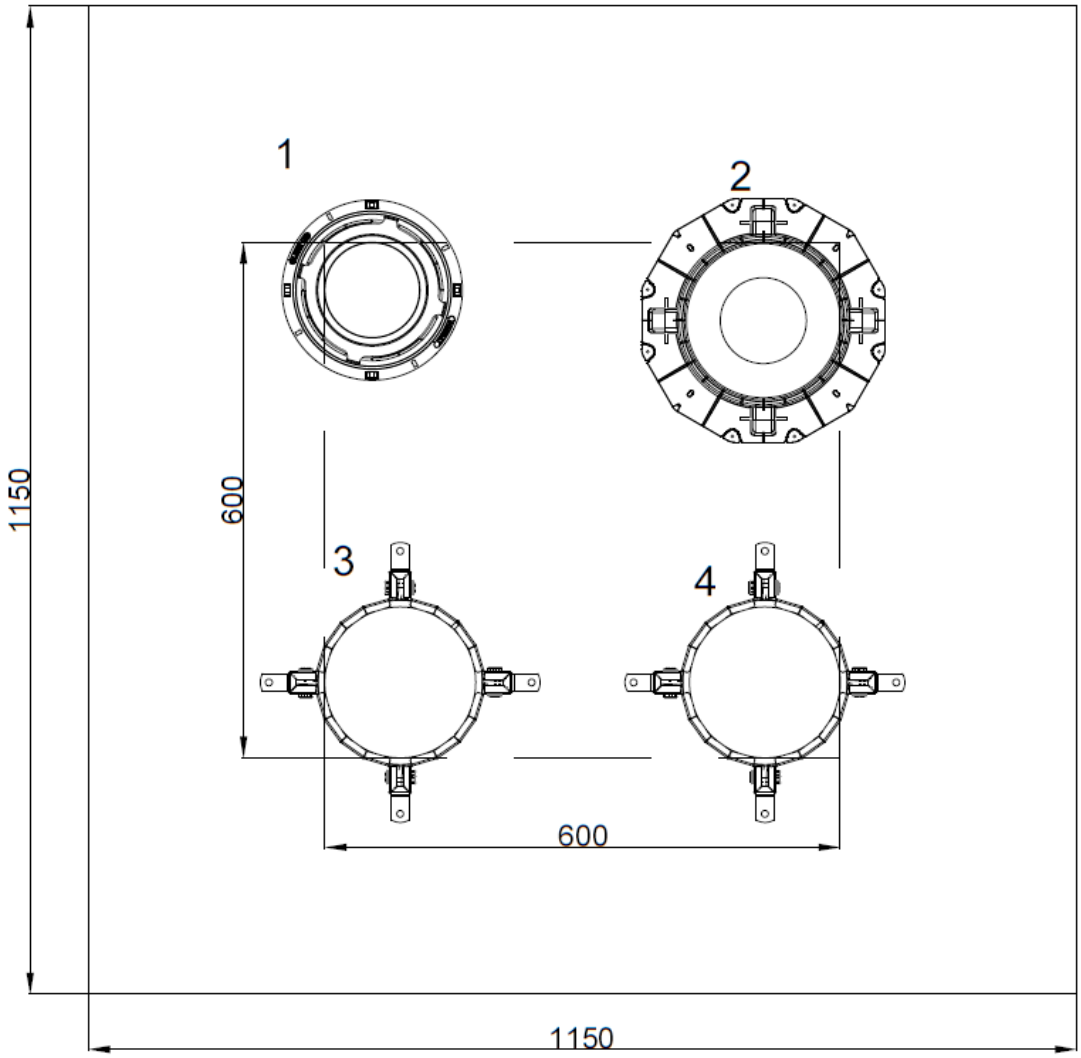
FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 4

Appendix D – Installation drawings

Snap Fire Systems Pty Ltd

Test Slab S-21-A3 Layout

Date:06 SEPT 2021



Penetration	Collar Code	Pipe Type	Pipe Diameter
1	LP100R-D / 100 Green	PVC(SC)	100
2	H150S-RR	PVC Blank	150
3	HP150R	Triplus	160
4	HP150R	Raupiano	160

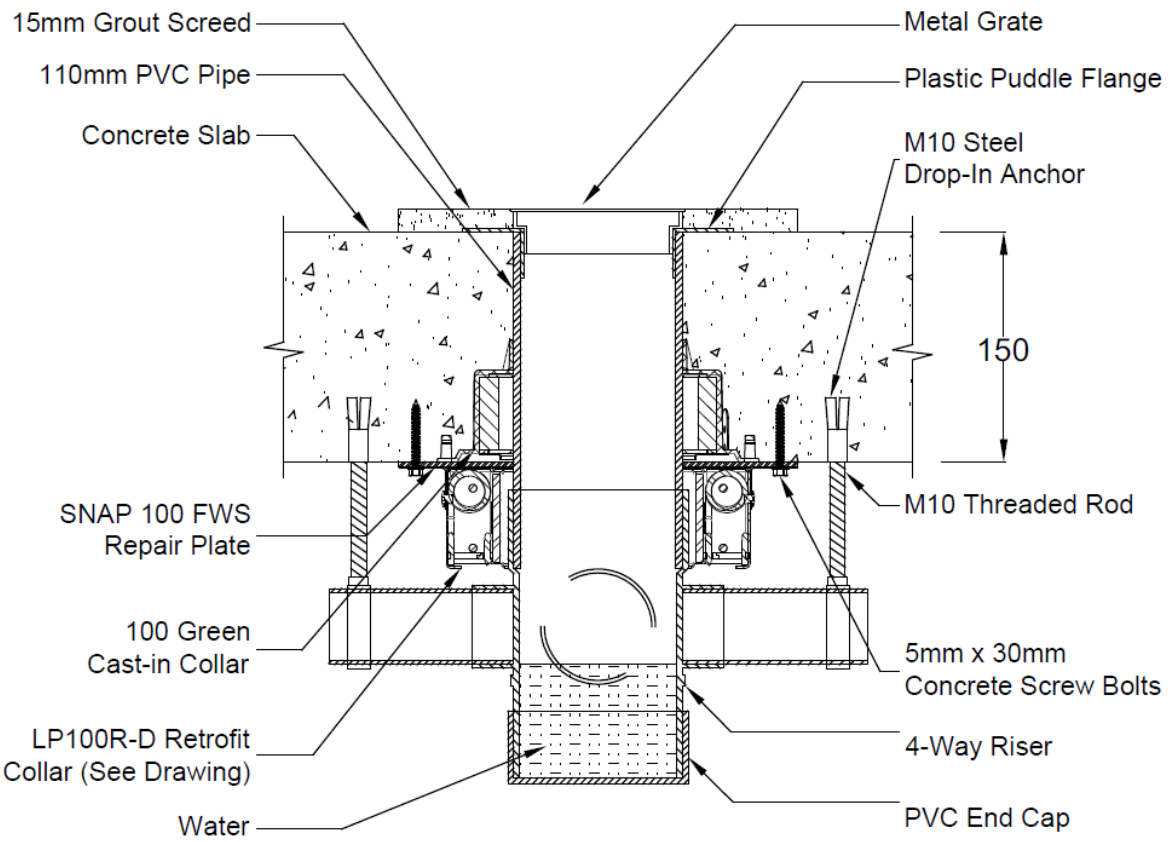
DRAWING TITLED "TEST SLAB S-21-A3 LAYOUT", DATED 6 SEPTEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #1

100 PVC Floorwaste & 100 Green under LP100R-D

Date: 24 FEB 2022



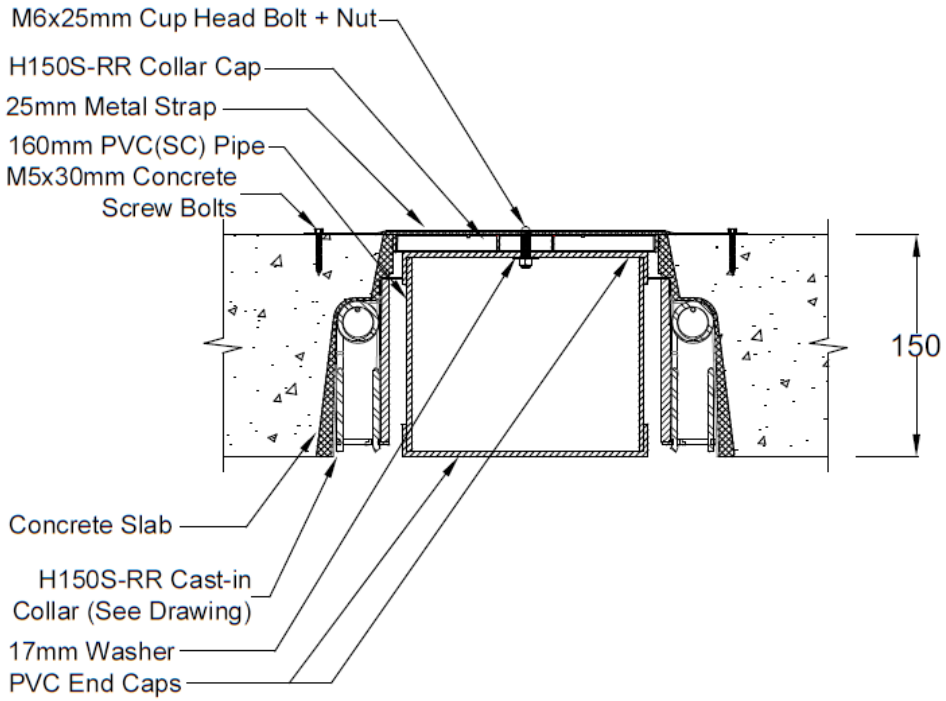
DRAWING TITLED 'SPECIMEN #1 '100 PVC FLOORWASTE &100 GREEN UNDER LP100R-D', DATED 24 FEB 2022, BY SNAP FIRE SYSTEMS PTY LTD

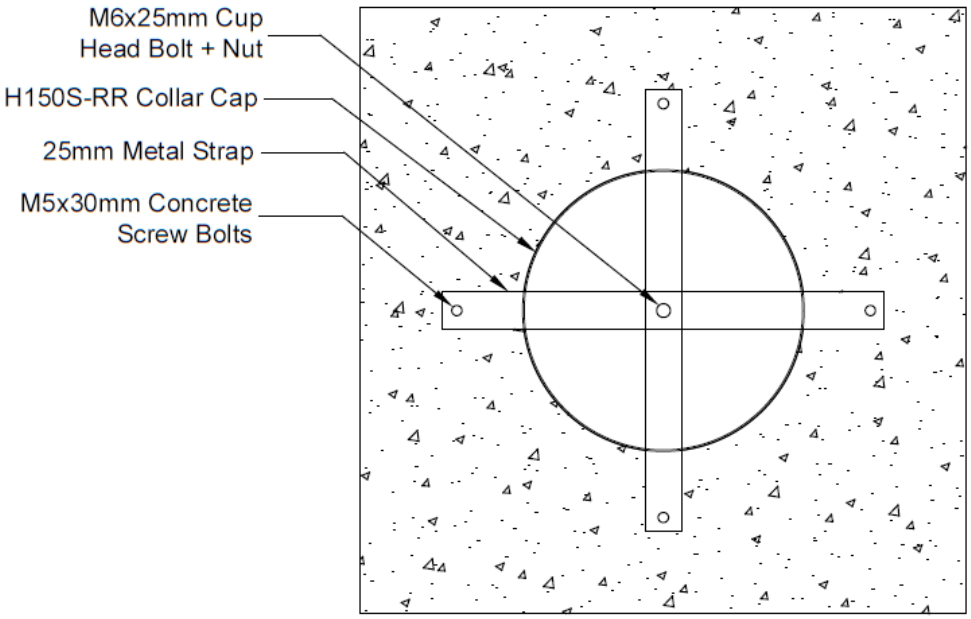
Snap Fire Systems Pty Ltd

Specimen #2

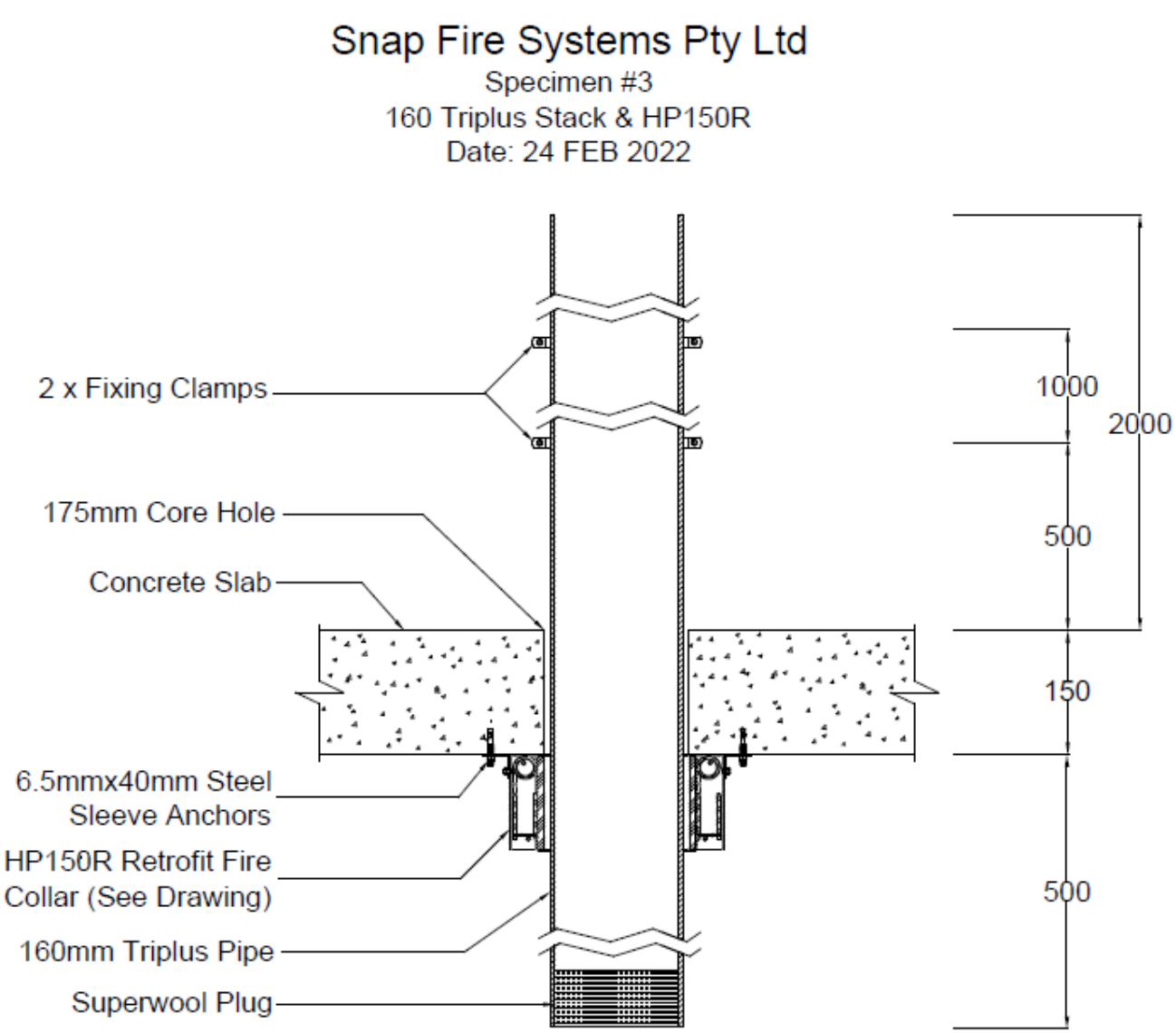
150 PVC(SC) Plug & H150S-RR

Date: 24 FEB 2022





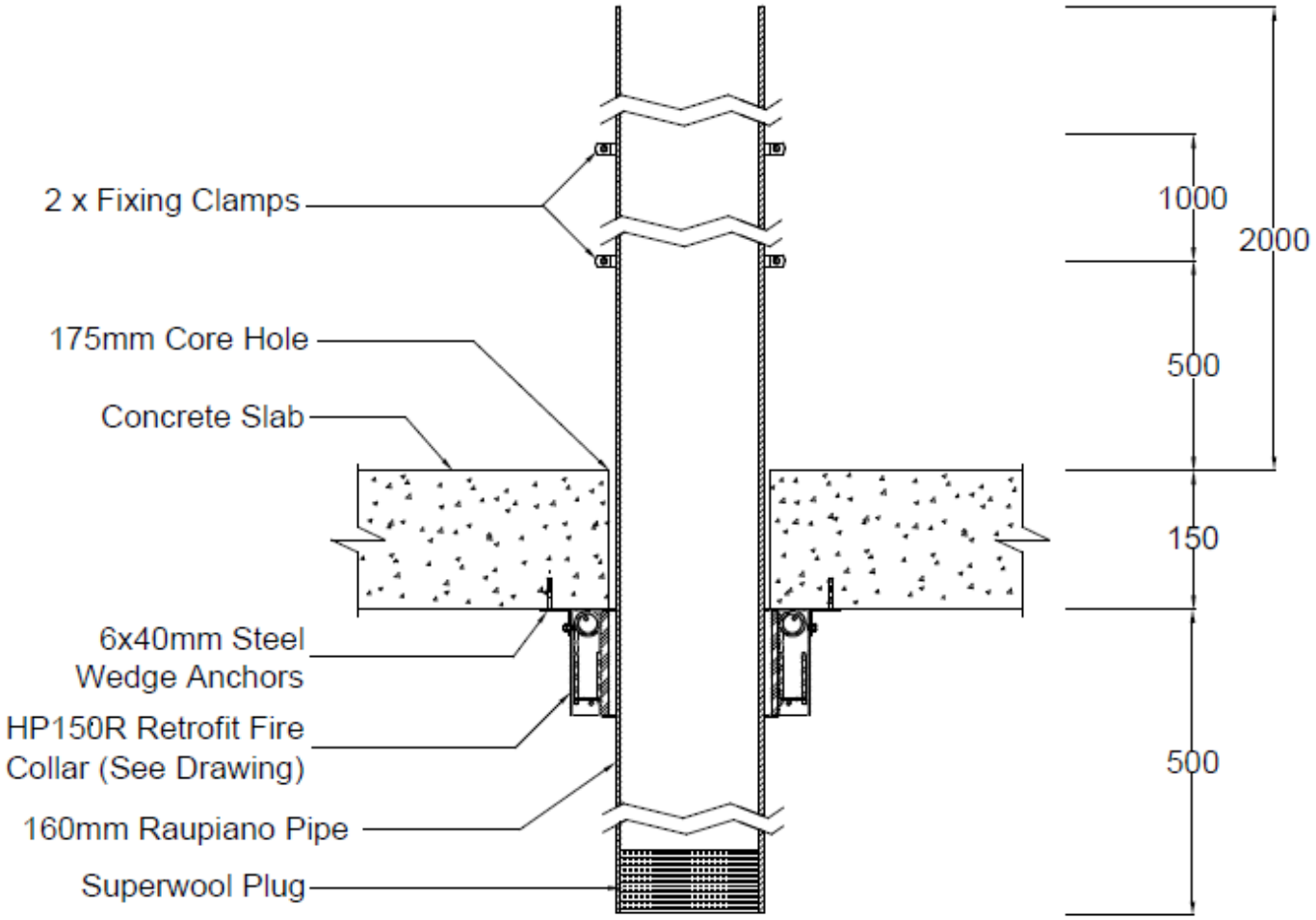
DRAWING TITLED 'SPECIMEN #2 50 TRIPLUS FLOOR WASTE & H50FWS-RR', DATED 15 FEBRUARY 2022 BY SNAP FIRE SYSTEMS PTY LTD



DRAWING TITLED 'SPECIMEN #3 160 TRIPLUS STACK & HP150R', DATED 24 FEBRUARY 2022 BY SNAP FIRE SYSTEMS PTY LTD

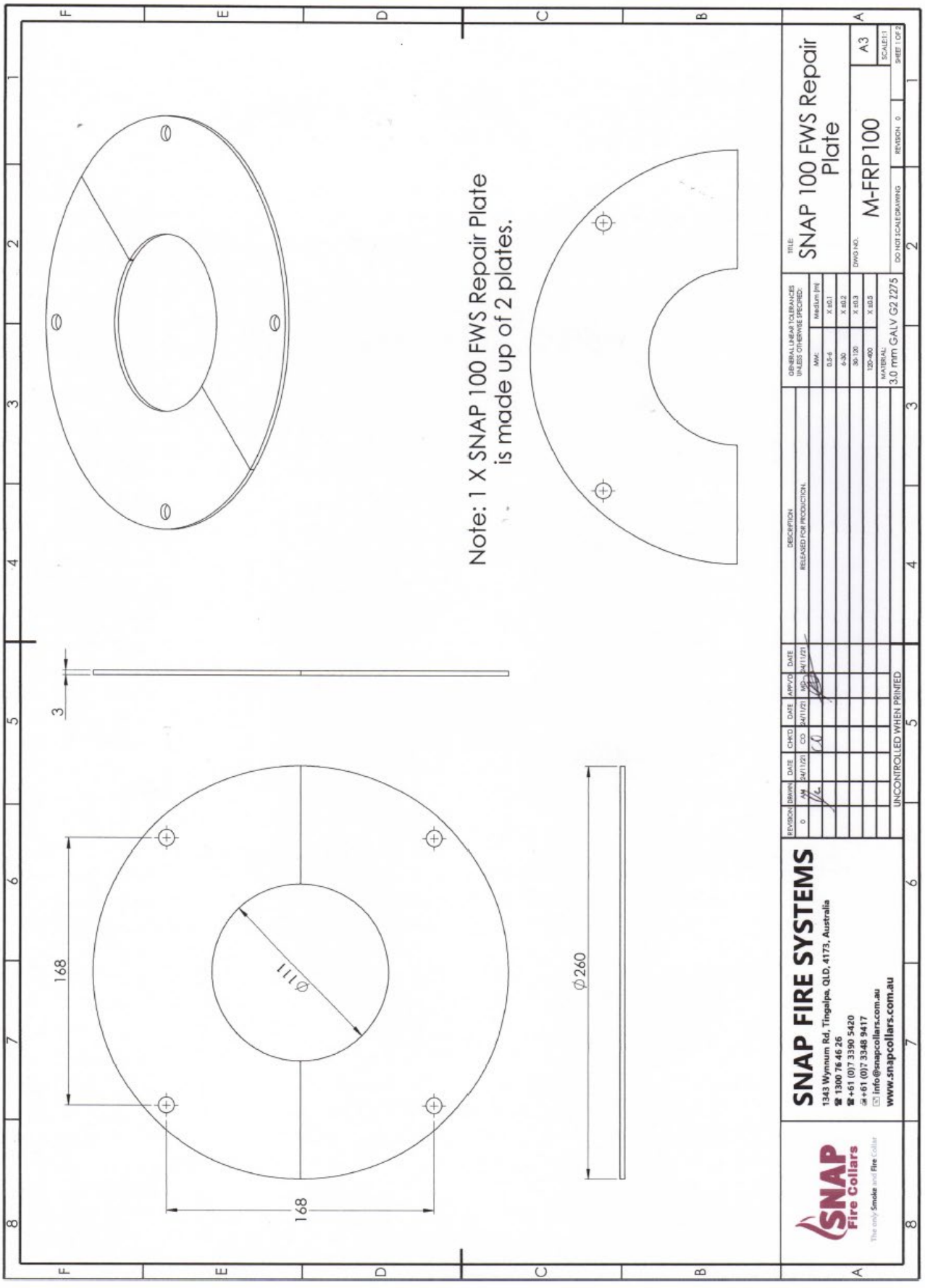
Snap Fire Systems Pty Ltd

Specimen #4
160 Raupiano Stack & HP150R
Date: 24 FEB 2022

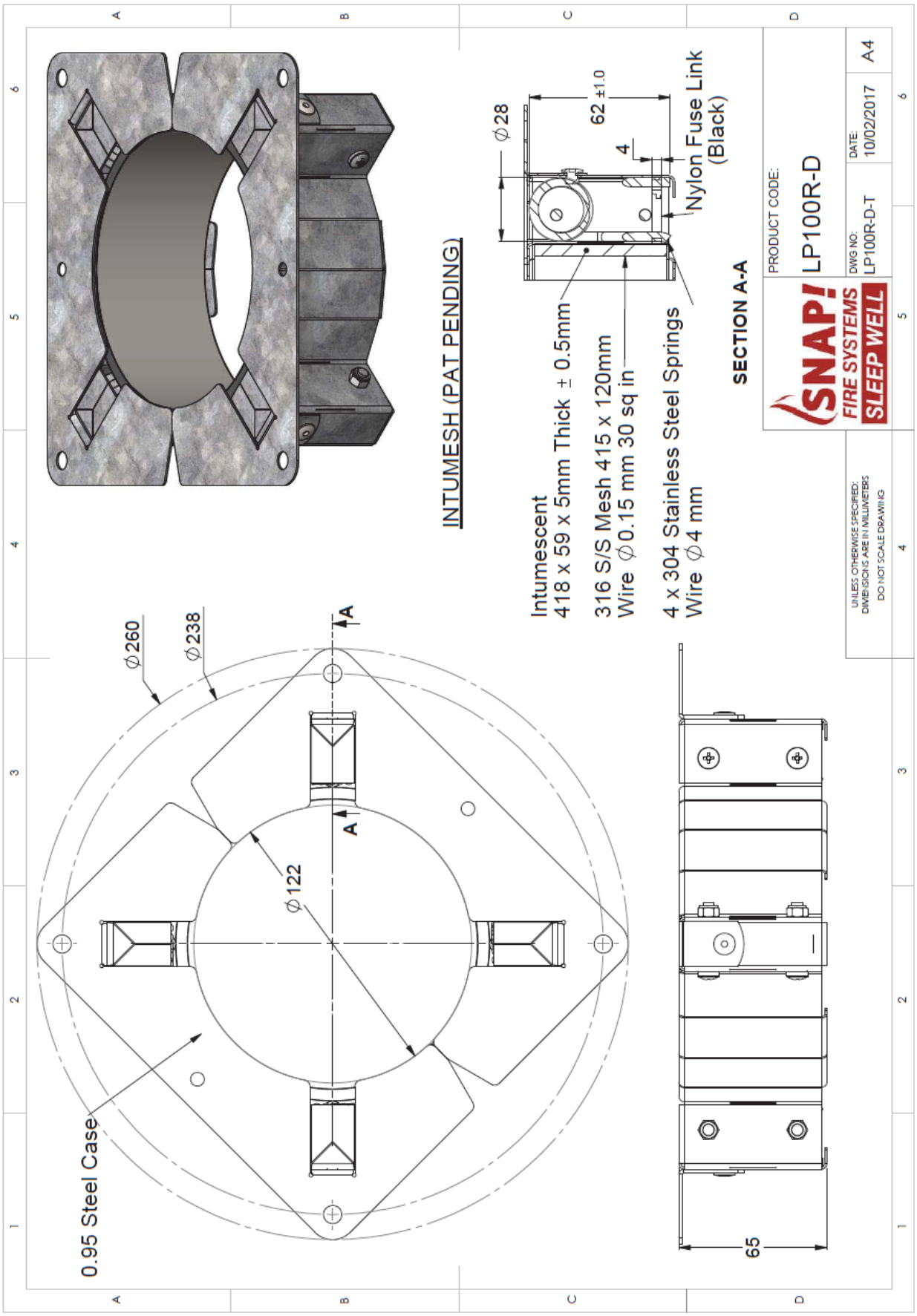


DRAWING TITLED 'SPECIMEN #4 16 RAUPIANO STACK & HP150R', DATED 24 FEB 2022 BY SNAP FIRE SYSTEMS PTY LTD

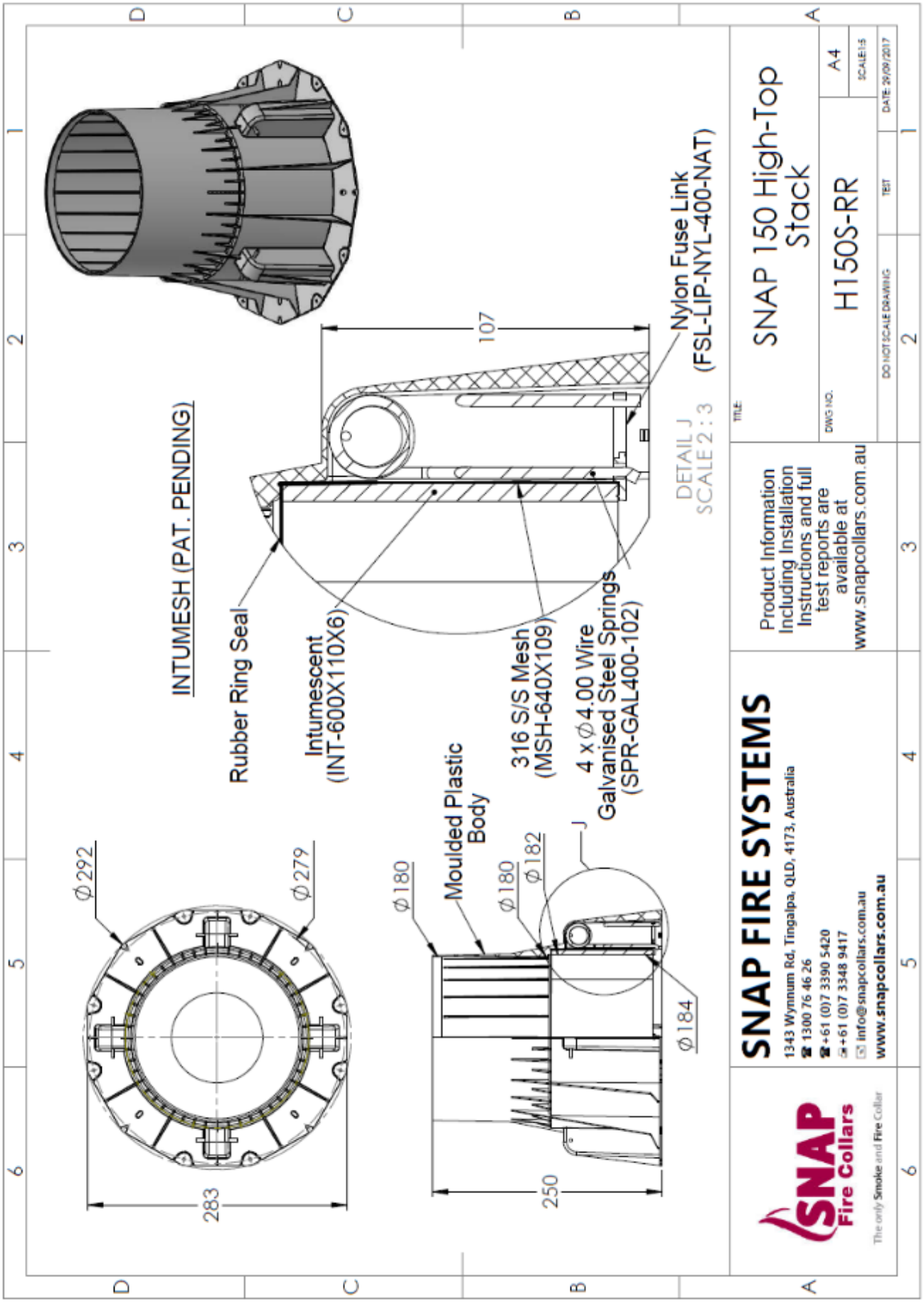
Appendix E – Specimen Drawings



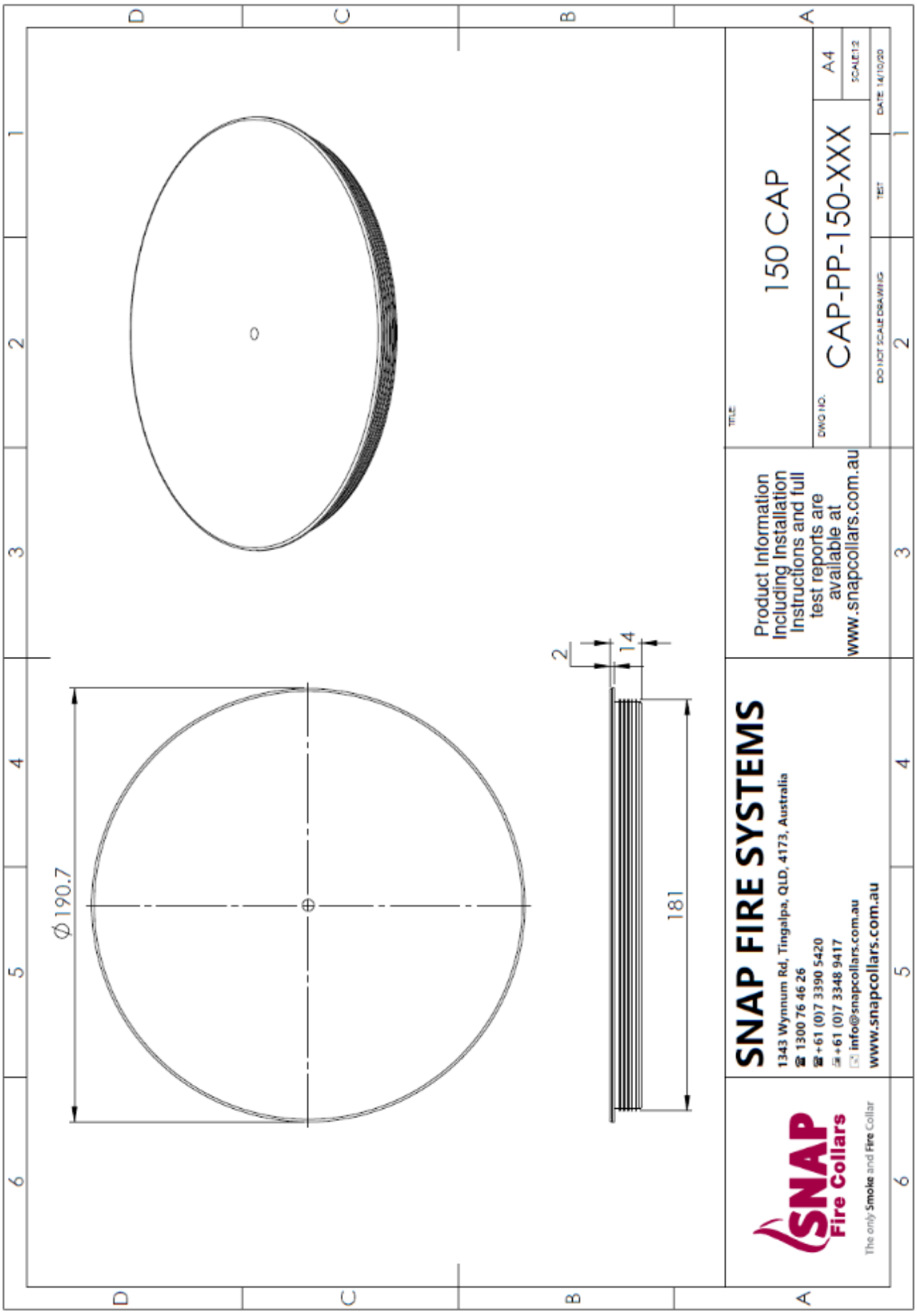
DRAWING TITLED 'SNAP 100 FWS REPAIR PLATE', DATED 24 NOVEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD



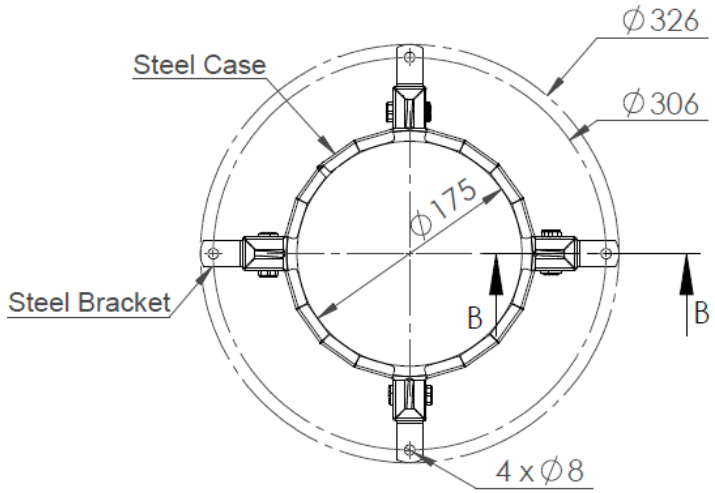
DRAWING NUMBERED LP100R-D-T, DATED 10 FEBRUARY 2017, BY SNAP FIRE SYSTEMS PTY LTD

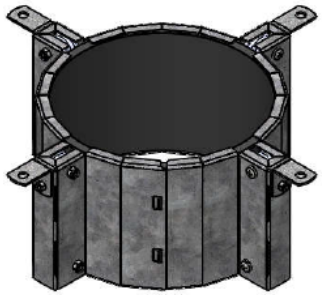


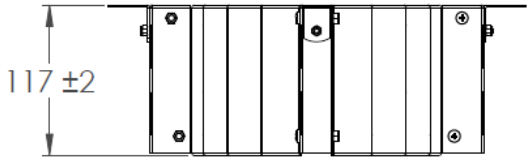
DRAWING TITLED "SNAP 150 HIGH-TOP STACK", DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD



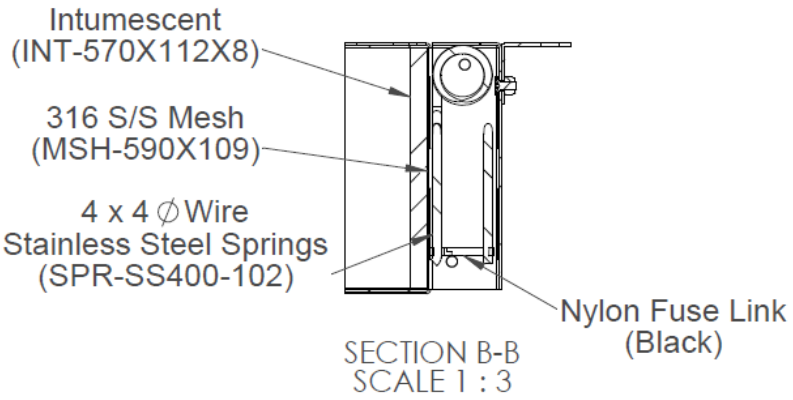
DRAWING TITLED "150 CAP", DATED 14 OCTOBER 2020 BY SNAP FIRE SYSTEMS PTY LTD







INTUMESH (PAT PENDING)



SECTION B-B
SCALE 1 : 3

SNAP FIRE SYSTEMS
1343 Wynnum Rd, Tingalpa, QLD, 4173, Australia
☎ 1300 76 46 26
☎ +61 (0)7 3390 5420
+61 (0)7 3348 9417
info@snapcollars.com.au
www.snapcollars.com.au

Product Information Including Installation Instructions and full test reports are available at www.snapcollars.com.au

TITLE: SNAP 150 High Profile Retro

DWG NO. HP150R

A4

SCALE:1:5

DO NOT SCALE DRAWING | TEST | DATE: 05/10/17

Appendix F – Certificate(s) of Test

INFRASTRUCTURE TECHNOLOGIES
www.csiro.au

14 Julius Avenue,
North Ryde NSW 2113, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3696

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
1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSP 2271.

Product Name: A SNAP LP100R-D Low Profile Retrofit fire collar and SNAP FWS Repair Plate protecting a DN100 uPVC pipe incorporating a floor waste and a 4-way riser (Specimen 1)

Description: The sponsor identified the specimens as SNAP fire collars protecting a 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by multiple services. The 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 and 4. Specimen 1 is the subject of this Certificate. The SNAP LP100R-D Low Profile Retrofit fire collar comprised a 0.95-mm steel casing with a 122 mm inner diameter and a 260-mm diameter base flange. The 65-mm high collar casing incorporated a closing mechanism which comprised a 5-mm thick x 59-mm wide x 418-mm long Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised four 4-mm diameter 304 stainless steel springs with black nylon fuse links and a 415-mm long x 120-mm wide mesh with a wire diameter of 0.15-mm. The SNAP FWS Repair plate was fabricated using 3-mm thick galvanised steel and comprised two semi-annular shaped pieces with an outer diameter of 168-mm and an inner diameter of 111-mm. Each piece had two fixing holes. A cast in fire collar (with a green plastic housing) was used to provide the opening in the concrete slab. The cast in fire collar comprised a green plastic casing with a 110-mm inner diameter, a 210-mm external diameter base flange and 0.75-mm thick steel base plate. The 80-mm high collar casing incorporated a layer of 425-mmx 50-mm x 15-mm thick intumescent material. The SNAP 100 FWS repair plate and SNAP LP100R-D fire collar were superimposed centrally located over the cast-in collar on exposed face of the concrete slab and fixed in place through four mounting brackets using 5-mm x 30-mm long steel concrete steel bolts. The penetrating service comprised a uPVC pipe with a floor waste system incorporating a 4-way riser. The penetrating Iplex DWV uPVC (sandwich construction) pipe had a 110-mm outside diameter with a wall thickness of 3.4 mm and was fitted through both collar sleeves. The top of the pipe incorporated a floor waste comprising a chrome plated brass grate and a plastic puddle flange. A 15-mm thick grout screed was laid on top of concrete slab and finished flush with floor grate. On exposed side of slab a uPVC 4-way riser with a wall thickness of 3.3-mm was coupled to the penetrating pipe inside the SNAP LP100R-D fire collar. Two 200-mm long sections of DN50 uPVC pipe (side arms) were glued to the 4-way riser. The 4-way riser was then supported from the two side arms using nut clips and M10 threaded rods fixed to concrete slab with steel drop-in anchors. The Sponsor provided drawings titled 'Specimen #1 100 PVC Floor Waste & 100 Green under LP100R-D', dated 24/02/2022, 'Test Slab S-21-A3 Layout', dated 06/09/21, and 'SNAP 100FWS Repair Plate', dated 24/11/21, all by Snap Fire Systems Pty Ltd as a complete description of the specimen and should be read in conjunction with this Certificate.

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 FRL of the specimen is applicable when the system is exposed to fire from the same direction as tested. The 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: 8 March 2022

Issued on the 28th day of June 2022 without alterations or additions.

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. 3696

INFRASTRUCTURE TECHNOLOGIES
www.csiro.au

14 Julius Avenue,
North Ryde NSW 2113, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3697

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
1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSP 2271.

Product Name: A SNAP H150S-RR High-Top Stack cast-in fire collar protecting a blank penetration seal (Specimen 2)

Description: The sponsor identified the specimens as SNAP fire collars protecting a 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by multiple services. The 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 and 4. Specimen 2 is the subject of this Certificate. The SNAP H150S-RR High-Top Stack cast-in fire collar comprised a 2-mm thick polypropylene casing with a 180 mm inner diameter and a 292-mm diameter base flange. The 250-mm high collar casing incorporated a 600-mm wide x 110-mm wide x 6-mm thick intumescent material and a rubber ring seal. The closing mechanism comprised four (4) x 4-mm diameter galvanised steel springs, a nylon fuse link, and a 640 mm x 109-mm 316 stainless steel mesh. The SNAP H150S-RR collar cap comprised a 2-mm thick polypropylene casing with an outside diameter of 190.7-mm and an inner diameter of 181-mm. The H150S-RR fire collar was cast into a 150-mm thick concrete slab with the collar casing cut down to 150-mm high to finish flush with the unexposed face of the concrete slab. The opening inside the sleeve of the SNAP H150S-RR Cast-in fire collar was protected with a blank penetration seal. The blank penetration seal comprised a SNAP H150S-RR collar cap incorporating a small section of uPVC pipe located inside the collar's sleeve. The Iplex DWV uPVC (sandwich construction) pipe was approximately 140 mm long, had a 160-mm outside diameter and a nominal wall thickness of 4.68-mm and incorporated PVC endcaps glued to both ends using PVC adhesive. The top PVC end cap was centrally fixed to the underside of the H150S-RR collar cap and with a M6 x 25-mm cup head bolt, nut and a 17-mm washer. The blank penetration seal was friction fitted into the sleeve of the SNAP H150S-RR fire collar from the unexposed face and fixed in place using two 25-mm wide x 230-mm long metal straps that were attached through the central bolt and screw fixed to the concrete slab with four M5 x 30 mm concrete screws. The Sponsor provided drawings titled 'Specimen #2 150 PVC(SC)PLUG & HP150S-RR', dated 24 February 2022, 'Test Slab S-21-A3 Layout', dated 06 September 2021, and '150 Cap', dated 14 October 2020, all by Snap Fire Systems Pty Ltd as a complete description of the specimen and should be read in conjunction with this Certificate.

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 FRL of the specimen is applicable when the system is exposed to fire from the same direction as tested. The 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: 8 March 2022

Issued on the 28th day of June 2022 without alterations or additions.

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. 3697

INFRASTRUCTURE TECHNOLOGIES
www.csiro.au

14 Julius Avenue,
North Ryde NSW 2113, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3698a

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
1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSP 2271 Revision C.

Product Name: A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Triplus stack pipe penetrating a 175-mm diameter core hole (Specimen 3)

Description: The sponsor identified the specimens as SNAP fire collars protecting a 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by multiple services. The 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 and 4. Specimen 3 is the subject of this Certificate. The SNAP HP150R High Profile Retrofit fire collar comprised a 0.95-mm thick steel casing with a 175-mm inner diameter and a 326-mm base flange. The 117-mm high fire collar casing incorporated a strip of 570-mm long x 112-mm wide x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four SPR-SS400-102 stainless steel springs bound with nylon fuse links, and a 590-mm x 109 mm 316 stainless steel mesh. The HP150R fire collar was centrally located over the 160-mm aperture on the exposed face of the slab and fixed through the four (4) mounting brackets using 6.5-mm x 40-mm long steel sleeve masonry anchors. The penetrating service comprised a Valsir Triplus polypropylene pipe with a 160-mm outside diameter and a nominal wall thickness of 5.67-mm fitted through the fire collars sleeve and penetrated the concrete slab through a 175-mm diameter core. The pipe projected vertically, 2000-mm above the unexposed face of the concrete slab and 500 mm into the furnace chamber and was supported at 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and capped with a ceramic fibre (Superwool) plug on the exposed end. The Sponsor provided drawings titled Specimen #3, 160 Triplus Stack & HP150R', dated 24 February 2022, 'Test Slab S-21-A3 Layout', dated 06 September 2021, and "SNAP 150 High Profile Retro" dated 5 October 2017, all by Snap Fire Systems Pty Ltd as a complete description of the specimen and should be read in conjunction with this Certificate.

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 FRL of the specimen is applicable when the system is exposed to fire from the same direction as tested. The 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: 8 March 2022

Issued on the 13th day of October 2022 without alterations or additions. This issue supersedes issue dated 28 June 2022.

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. 3698A

INFRASTRUCTURE TECHNOLOGIES
www.csiro.au

14 Julius Avenue,
North Ryde NSW 2113, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3699

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
1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSP 2271.

Product Name: A SNAP HP150R High Profile Retrofit fire collar protecting a DN160 Raupiano Plus stack pipe penetrating a 175-mm diameter core hole (Specimen 4)

Description: The sponsor identified the specimens as SNAP fire collars protecting a 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by multiple services. The 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 and 4. Specimen 4 is the subject of this Certificate. The SNAP HP150R High Profile Retrofit fire collar comprised a 0.95-mm thick steel casing with a 175-mm inner diameter and a 326-mm base flange. The 117-mm high fire collar casing incorporated a strip of 570 mm long x 112-mm wide x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four (4) SPR-SS400-102 stainless steel springs bound with nylon fuse links, with a 590-mm x 109 mm 316 stainless steel. The HP150R fire collar was centrally located over the 160-mm aperture on the exposed face of the slab and fixed through the four (4) mounting brackets using 6-mm-mm x 40-mm long steel sleeve masonry anchors. The penetrating service comprised an a Rehau Raupiano Plus polypropylene pipe with a 160-mm outside diameter pipe and a wall thickness of 4.25-mm fitted through fire collar sleeve and penetrated the concrete slab through a 175-mm diameter core hole. The pipe projected vertically, 2000-mm above the unexposed face of the concrete slab and 500 mm into the furnace chamber and was supported at 500-mm and 1500-mm from the unexposed face of the slab. The pipe was left open at the unexposed end and capped with a ceramic fibre (Superwool) plug on the exposed end. The Sponsor provided drawings titled Specimen #4, 160 Raupiano Stack & HP150R', dated 24 February 2022, 'Test Slab S-21-A3 Layout', dated 06 September 2021, and SNAP 150 High Profile Retro' dated 5 October 2017, all by Snap Fire Systems Pty Ltd as a complete description of the specimen and should be read in conjunction with this Certificate.

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 FRL of the specimen is applicable when the system is exposed to fire from the same direction as tested. The 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: 8 March 2022

Issued on the 28th day of June 2022 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. 3699

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.
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.

*** end of report ***

CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.

FOR FURTHER INFORMATION

Infrastructure Technologies
Brett Roddy
Group Leader, Fire Testing and Assessments
t +61 2 94905449
e brett.roddy@csiro.au
w www.csiro.au/en/Do-business/Services/Materials-infrastructure/Fire-safety