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

Test Report

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

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Contents

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

Sponsored Investigation No. FSP 2116

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap cast-in and retrofit fire collars protecting a concrete slab penetrated by unplasticised Polyvinyl Chloride (PVC-U) pipes and high density polyethylene (HDPE) pipes.

1.2 Sponsor

IG6 Pty Ltd as trustee for the IG6 IP Trust
3 Skirmish Court
Victoria Point QLD 4165

1.3 Manufacturer

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

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 4992/4536

1.7 Test date

The fire-resistance test was conducted on 15 June 2020.

2 Description of specimen

2.1 General

The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by unplasticised polyvinyl chloride (PVC-U) and high density polyethylene (HDPE) pipes protected by cast-in and retrofit Snap Fire Systems fire collars.

For the purpose of the test, the specimens were referenced as Specimens 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 penetrated slab for Specimens 1, 2 and 3 comprised a 120-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures.

The penetrated slab for Specimens 4 and 5 comprised a 150-mm thick concrete slab 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 pipes used in the test are stated to be manufactured in accordance with:

- AS/NZS 4401 Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings - Polyethylene (PE) and
- AS/NZS 1477:2017: PVC pipes and fittings for pressure applications.

Specimen 1 – SNAP H100S-RR Cast-in collar protecting a nominal 100-mm PN12 PVC-U stack pipe.

The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 213-mm 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 numbered H100S-RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 114.5-mm outside diameter Iplex 100 PVC-U PN12pipe with a wall thickness of 6.37-mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm 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 open at the unexposed end and closed with a ceramic fibre plug on the exposed end.

On the unexposed face the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled "Specimen #1, 100 PN12 Pressure PVC Stack & H100S-RR", dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Specimen 2 – SNAP H100S-RR Cast-in collar protecting a nominal 80-mm PN12 PVC-U stack pipe.

The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 213-mm 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 numbered H100S-RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised an 88.83-mm outside diameter Vinidex 80 PN12 PVC-U pipe with a wall thickness of 5.26-mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm 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 open at the unexposed end and closed with a ceramic fibre plug on the exposed end.

On the unexposed face the 18-mm annular gap between the pipe and the collar sleeve was protected with a 10-mm deep bead of Fullers Firesound sealant as shown in drawing titled "Specimen #2, 80mm PN12 Pressure PVC Stack & H100S-RR", dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Specimen 3 – SNAP H50S-RR Cast-in collar protecting a nominal 50-mm PVC-U stack pipe.

The SNAP Cast-in H50S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 150-mm 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 numbered H50S-RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 59.95-mm outside diameter Vinidex 50 PN12 PVC pipe with a wall thickness of 3.21-mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm 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 open at the unexposed end and closed ceramic fibre plug on the exposed end.

On the unexposed face the 3-mm annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled "Specimen #3, 50mm PN12 Pressure PVC Stack & H50S-RR", dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Specimen 4 – SNAP H100S-RR Cast-in collar protecting a Geberit HDPE SuperTube BottomTurn bend.

The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 213-mm 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 numbered H100S-RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6-mm fitted through the collar's sleeve. The annular gap between the BottomTurn bend and the inside collar casing was protected with a 10-mm deep bead of Fullers Firesound mastic. On the unexposed face the BottomTurn bend was fitted with a HDPE (PE100) stack pipe as shown in drawing titled "Specimen #4, 110 HDPE SuperTube Stack & H100S-RR", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

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

Specimen 5 – SNAP 110R Retrofit fire collar protecting a Geberit 110 HDPE SuperTube BottomTurn bend.

The SNAP Retrofit 110R fire collar comprised a 0.75-mm steel casing with a 122 mm inner diameter and a 206-mm diameter base flange. The 62-mm high collar casing incorporated a closing mechanism that was comprised of three soft Intumesh intumescent wraps and wire meshes lined within the internal circumference of the collar. Intumescent A was 2.5-mm thick x 58-mm wide x 424-mm long, Intumescent B was 2.5-mm thick x 58-mm wide x 407-mm long and Intumescent C was 2.5-mm thick x 58-mm wide x 389-mm long. Between intumescent strips A and B was a layer of 316 stainless steel mesh 415-mm long x 58-mm wide and between intumescent strips B and C was a layer of 316 stainless steel mesh 398-mm long x 58-mm wide both had wire mesh diameters of 0.15-mm, as shown in drawing titled "SNAP 110 Retro", dated 16 January 2019, by Snap Fire Systems Pty Ltd. The Snap collar was surface mounted around the pipe on the exposed face of the slab and fixed through 3 mounting brackets using 5-mm x 30 mm Concrete Screws.

The annular gap between the pipe and concrete slab on the unexposed face was protected with a bead of Fullers Firesound sealant.

The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6 mm fitted through the collar's sleeve. A 111-mm diameter opening was cut into the slab and the collar fixed centrally over the hole. On the unexposed face the BottomTurn bend was fitted with a HDPE (PE100) stack pipe as shown in drawing titled "Specimen #5, 110 HDPE SuperTube Stack & 110R", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

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

2.2 Dimensions

The specimen comprised a stepped 120-mm / 150-mm thick x 1150-mm x 1150-mm 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.

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-20-E Layout”, dated 13 May 2020 provided by Snap Fire Systems Pty Ltd.

Drawing titled “Specimen #1, 100 PN12 Pressure PVC Stack & H100S-RR”, dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Drawing titled “Specimen #2, 80mm PN12 Pressure PVC Stack & H100S-RR”, dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Drawing titled “Specimen #3, 50mm PN12 Pressure PVC Stack & H50S-RR”, dated 13 May 2020, provided by Snap Fire Systems Pty Ltd.

Drawing titled “Specimen #4 110 HDPE SuperTube Stack & H100S-RR”, dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

Drawing titled “Specimen #5, 110 HDPE SuperTube Stack & 110R”, dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

Drawing number H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

Drawing number H50S-RR-T, dated 29 September 2017, by Snap Fire Systems Pty Ltd.

Drawing titled “SNAP 110 Retro”, dated 16 January 2019, by Snap Fire Systems Pty Ltd.

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 17°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
2 minutes -	Smoke has begun fluing from the end of the pipe of Specimen 3.
3 minutes -	Smoke has begun fluing from the end of the pipes of Specimens 1 and 4.
4 minutes -	Smoke has ceased fluing from Specimen 3.
5 minutes -	Smoke has ceased fluing from the end of the pipe of Specimen 4.
6 minutes -	Smoke has begun fluing from the end of the pipe of Specimen 3.
7 minutes -	Smoke has ceased fluing from Specimens 1, 2 and 5.
8 minutes -	The stack pipe of Specimen 1 has deflected over and is resting on Specimen 3 stack pipe.
10 minutes -	Smoke has resumed fluing from the end of the pipe of Specimen 4.
13 minutes -	The level of smoke fluing from the end of the pipe of Specimen 4 has decreased.
17 minutes -	Smoke has ceased fluing from the end of the pipe of Specimen 4.
27 minutes -	Water has begun pooling on the concrete slab at the base of Specimen 1.
47 minutes -	A small quantity of smoke is fluing from the end of the pipe of Specimen 5.
90 minutes -	Sealant around the base of the pipe of Specimen 2 has begun to swell.
105 minutes -	A small quantity of smoke is fluing from the end of the pipe of Specimen 5.

127 minutes -	Sealant around the base of the pipe of Specimen 4 has begun to swell.
150 minutes -	A small quantity of white liquid has been emitted from the base of Specimen 5. All moisture on the top of concrete slab has evaporated.
186 minutes -	Insulation failure of Specimen 2 - maximum temperature rise of 180K is exceeded on the concrete slab 25-mm from the mastic of Specimen 2.
228 minutes -	The fire collar casting at the base of Specimen 1 and 2 has begun to melt with white liquid being expelled from the base of Specimen 2.
231 minutes -	Insulation failure of Specimen 1 - maximum temperature rise of 180K is exceeded on the concrete slab 25-mm from the pipe of Specimen 1.
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 – SNAP H100S-RR Cast-in collar protecting a nominal 100-mm PN12 PVC-U stack pipe

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	231 minutes

Specimen 2 – SNAP H100S-RR Cast-in collar protecting a nominal 80-mm PN12 PVC-U stack pipe

Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	186 minutes

Specimen 3 – SNAP H50S-RR Cast-in collar protecting a nominal 50-mm PN12 PVC-U stack pipe

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

Specimen 4 – SNAP H100S-RR Cast-in collar protecting a Geberit HDPE SuperTube BottomTurn bend

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

Specimen 5 – SNAP 110R Retrofit fire collar protecting a Geberit HDPE SuperTube BottomTurn bend

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, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

9 Fire-resistance level (FRL)

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

Specimen 1: -/240/120

Specimen 2: -/240/120

Specimen 3: -/240/120

Specimen 4: -/240/180

Specimen 5: -/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. 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 - Iplex PVC-U114.5-mm OD x 6.37-mm wall thickness stack pipe protected with a H110S-RR Cast-in fire collar. The 10-mm annular gap around the pipe on the exposed side was left open. Pipe was plugged on the exposed end with Superwool. The pipe extended 2000 mm above the slab and 500-mm below	On top of the slab 25-mm from collar West	S1
	On top of the slab 25-mm from collar East	S2
	On pipe 25-mm above collar North/ east	S3
	On pipe 25-mm above collar S/W	S4
Specimen 2 - Vinidex PVC-U 88.83-mm OD x 5.26-mm wall thickness stack pipe protected with a H110S-RR Cast-in fire collar. The annular gap around the pipe on the exposed side was protected with a 10-mm deep bead of Fullers Firesound. The pipe was plugged on the exposed end with Superwool.	On top of the slab 25-mm from collar N	S5
	On top of the slab 25-mm from collar S	S6
	On sealant S/W	S7
	On sealant S/E	S8
	On pipe 25-mm above collar WEST	S9
	On pipe 25-mm above collar S/E	S10
Specimen 3 – Vinidex PVC-U 59.95-mm OD x 3.21-mm wall thickness stack pipe protected with a H50S-RR Cast-in fire collar. The annular gap around the pipe on the exposed side was left open. The pipe was plugged on the exposed end with Superwool.	On top of the slab 25-mm from collar West	S11
	On top of the slab 25-mm from collar East	S12
	On pipe 25-mm above sealant West	S13
	On pipe 25-mm above sealant South	S14
Specimen 4 – Geberit Super Tube HDPE PE100 110-mm OD x 4.84-mm wall thickness and stack pipe protected with a H110S-RR Cast-in fire collar. The 10-mm annular gap around the pipe on the exposed was protected with a 10-mm deep bead of Fullers Firesound. Pipe was plugged on the exposed end with Superwool.	On top of the slab 25-mm from collar N	S15
	On top of the slab 25-mm from collar S	S16
	On sealant West	S17
	On pipe 25-mm above sealant East	S18
	On pipe 25-mm above sealant South	S19
Specimen 5 - Geberit Super Tube HDPE PE100 110-mm OD x 4.84-mm wall thickness and stack pipe protected with a 110R Retro-fit fire collar. The pipe penetrated the slab through a 111-mm opening in the slab. The annular gap around the pipe on the exposed was protected with a 10-mm deep bead of Fullers Firesound. Pipe was plugged on the exposed end with Superwool.	On top of the slab 25-mm from collar North	S20
	On top of the slab 25-mm from collar S/W	S21
	On sealant South	S22
	On pipe 25-mm above sealant S/W	S23
	On pipe 25-mm above sealant N/E	S24
Rover		S25
Ambient		S26

Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS 2 AND 3 PRIOR TO TESTING

PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

PHOTOGRAPH 3 – SPECIMENS AFTER 8 MINUTES OF TESTING

PHOTOGRAPH 4 – SPECIMENS AFTER 30 MINUTES OF TESTING

PHOTOGRAPH 5 – SPECIMENS AFTER 60 MINUTES OF TESTING

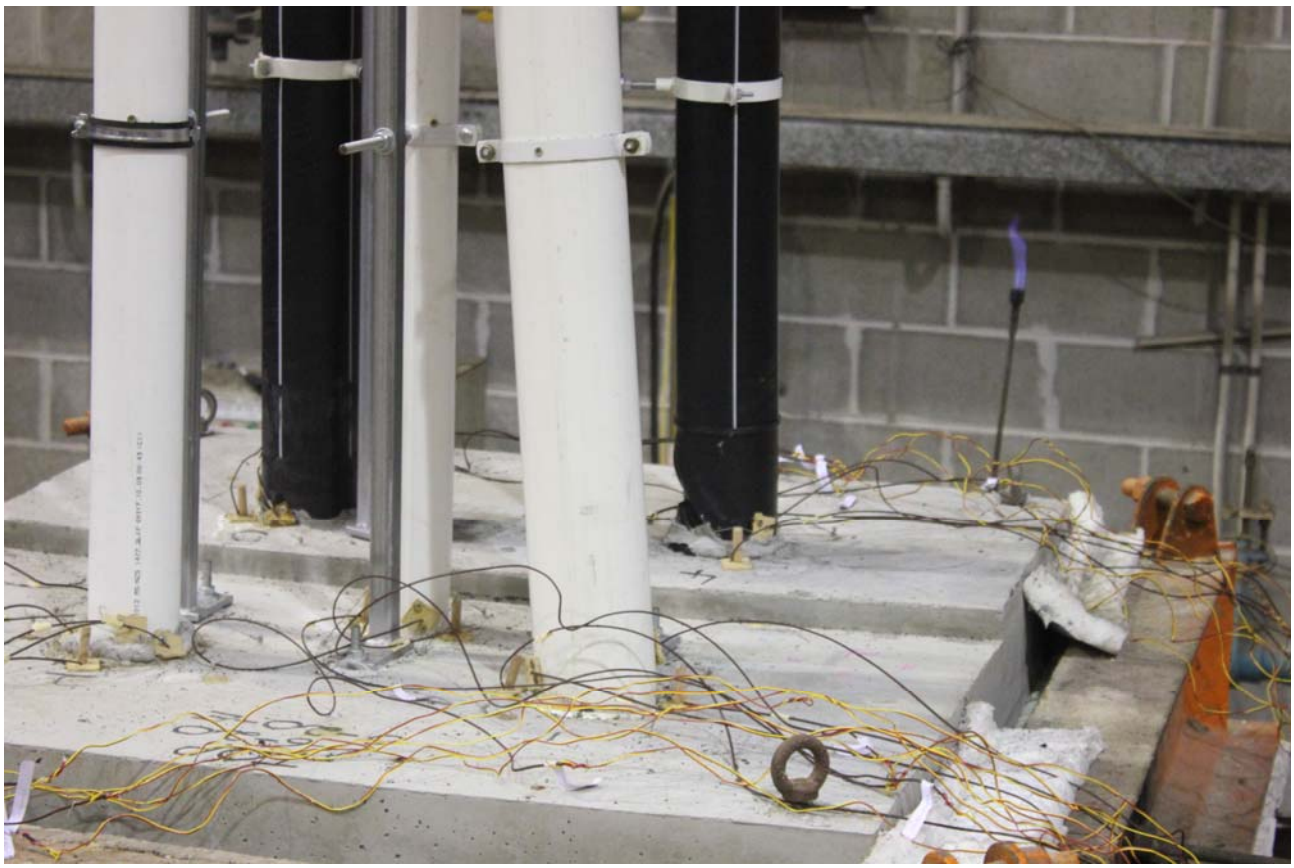
PHOTOGRAPH 6 – SPECIMENS AFTER 90 MINUTES OF TESTING

PHOTOGRAPH 7 – SPECIMENS AFTER 120 MINUTES OF TESTING

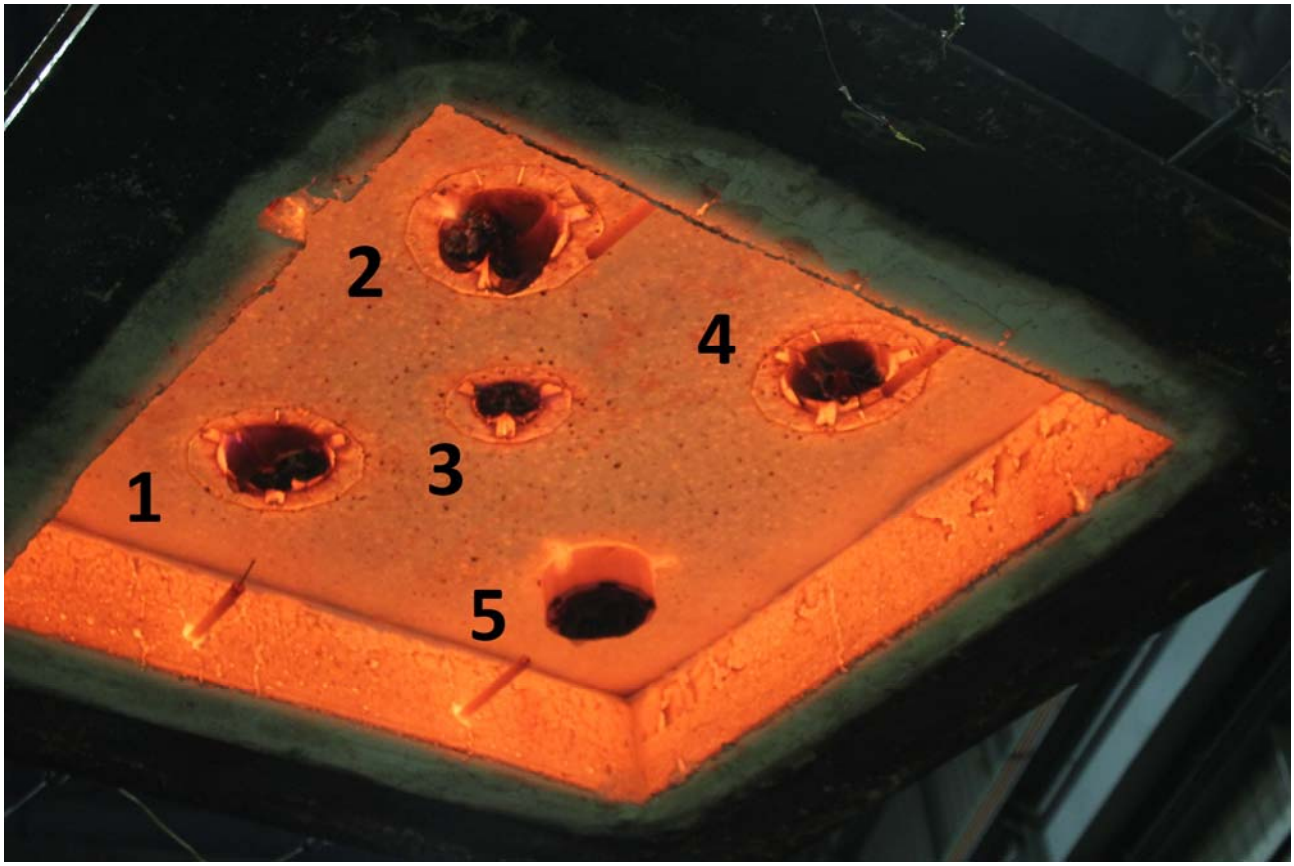
PHOTOGRAPH 8 – SPECIMENS AFTER 180 MINUTES OF TESTING

PHOTOGRAPH 9 – SPECIMENS 1 AND 2 AFTER 228 MINUTES OF TESTING

PHOTOGRAPH 10 – SPECIMENS AFTER 240 MINUTES OF TESTING



PHOTOGRAPH 11 – SPECIMENS AT THE CONCLUSION OF TESTING



PHOTOGRAPH 12 – EXPOSED FACE OF SPECIMENS AT THE CONCLUSION OF TESTING

Appendix C – Test Data charts

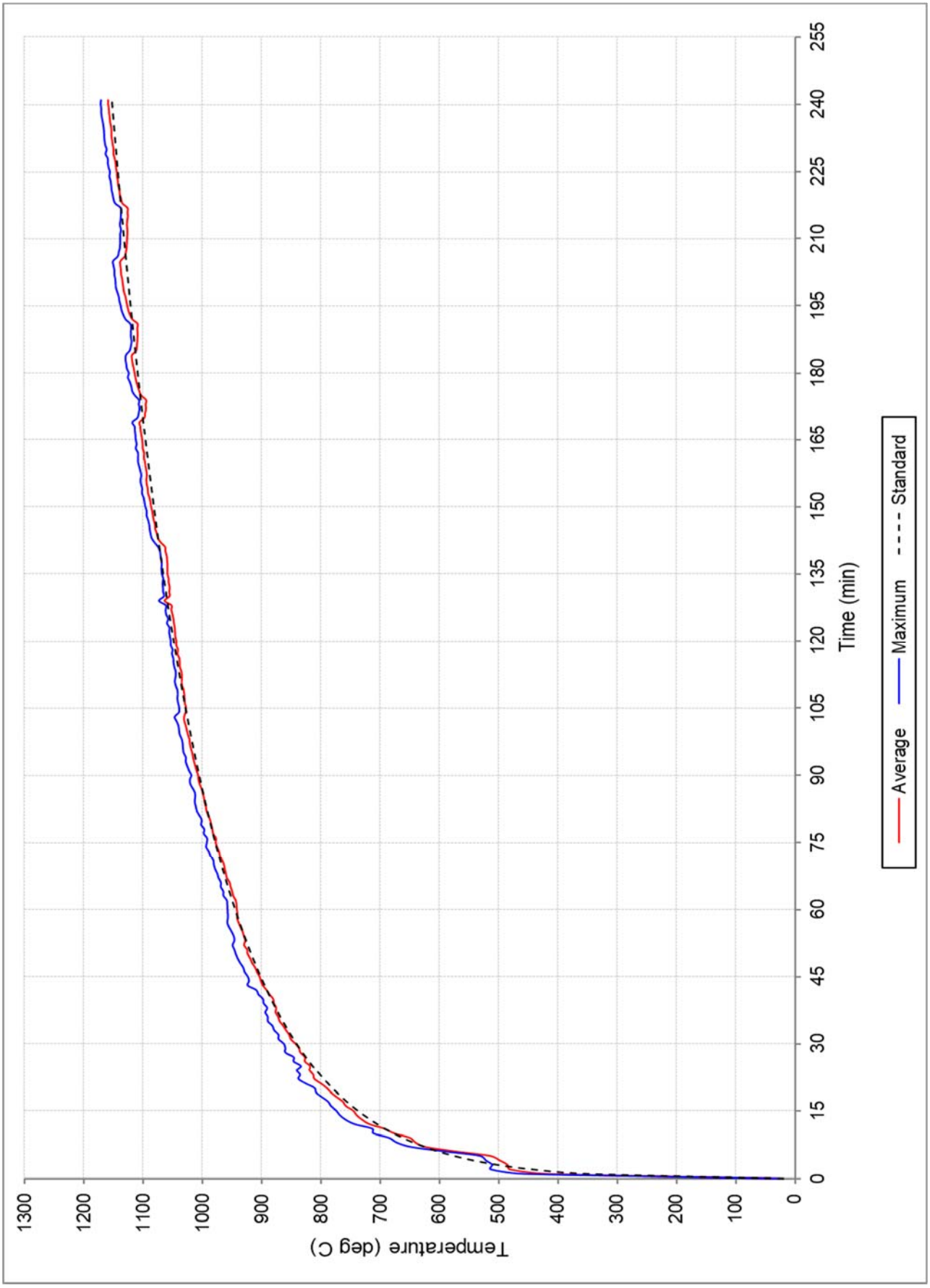


FIGURE 1 – FURNACE TEMPERATURE

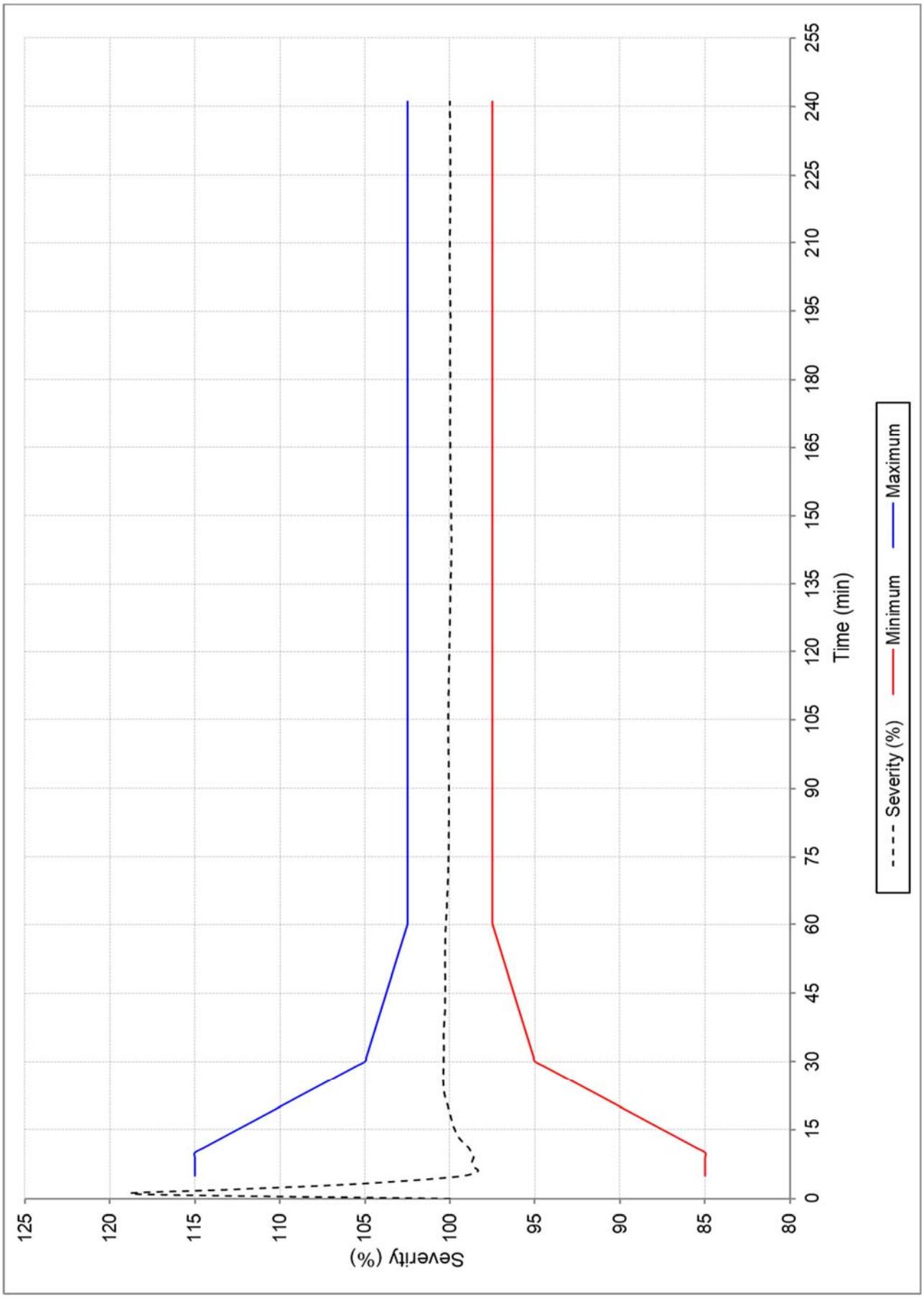


FIGURE 2 – FURNACE SEVERITY

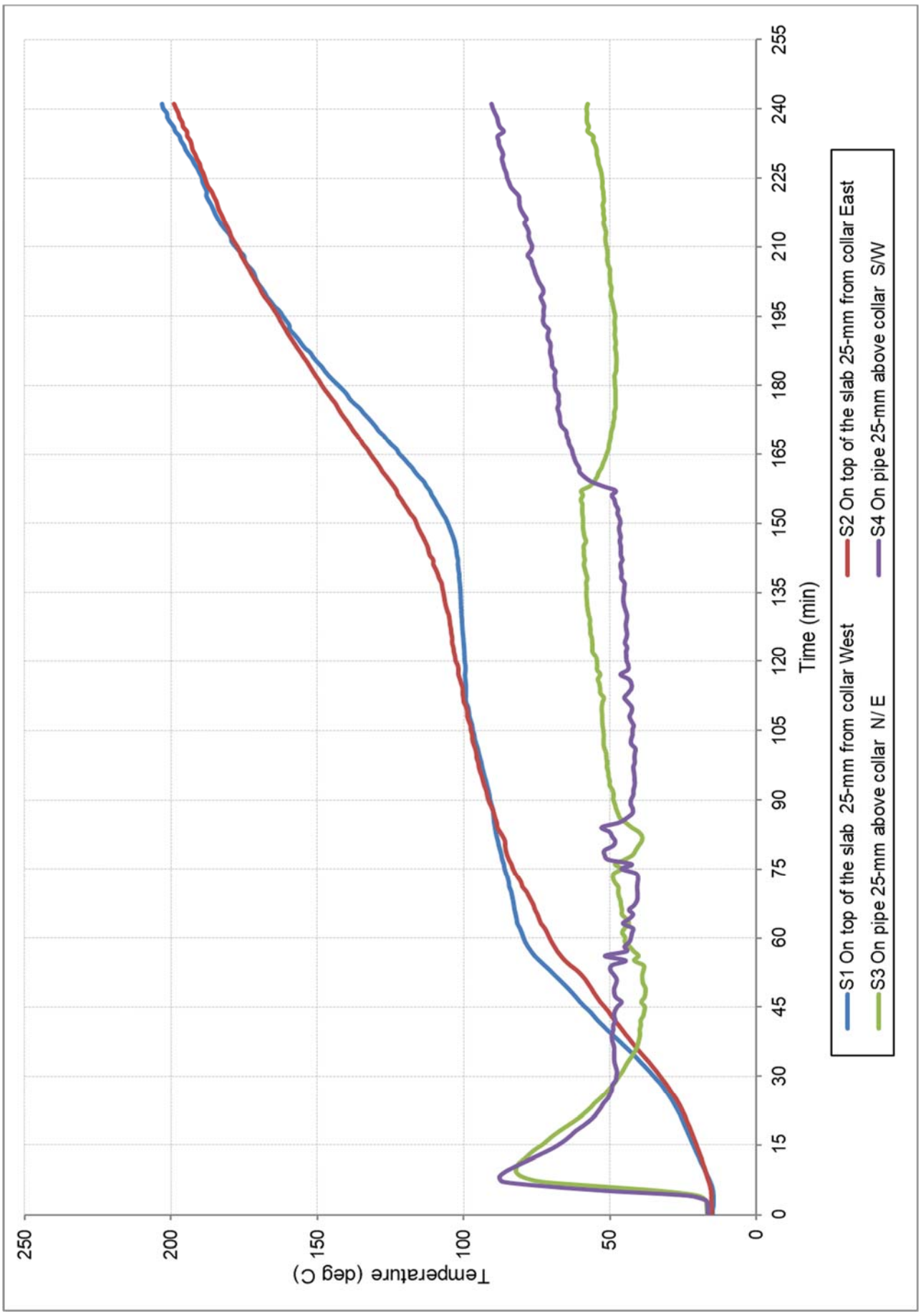


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

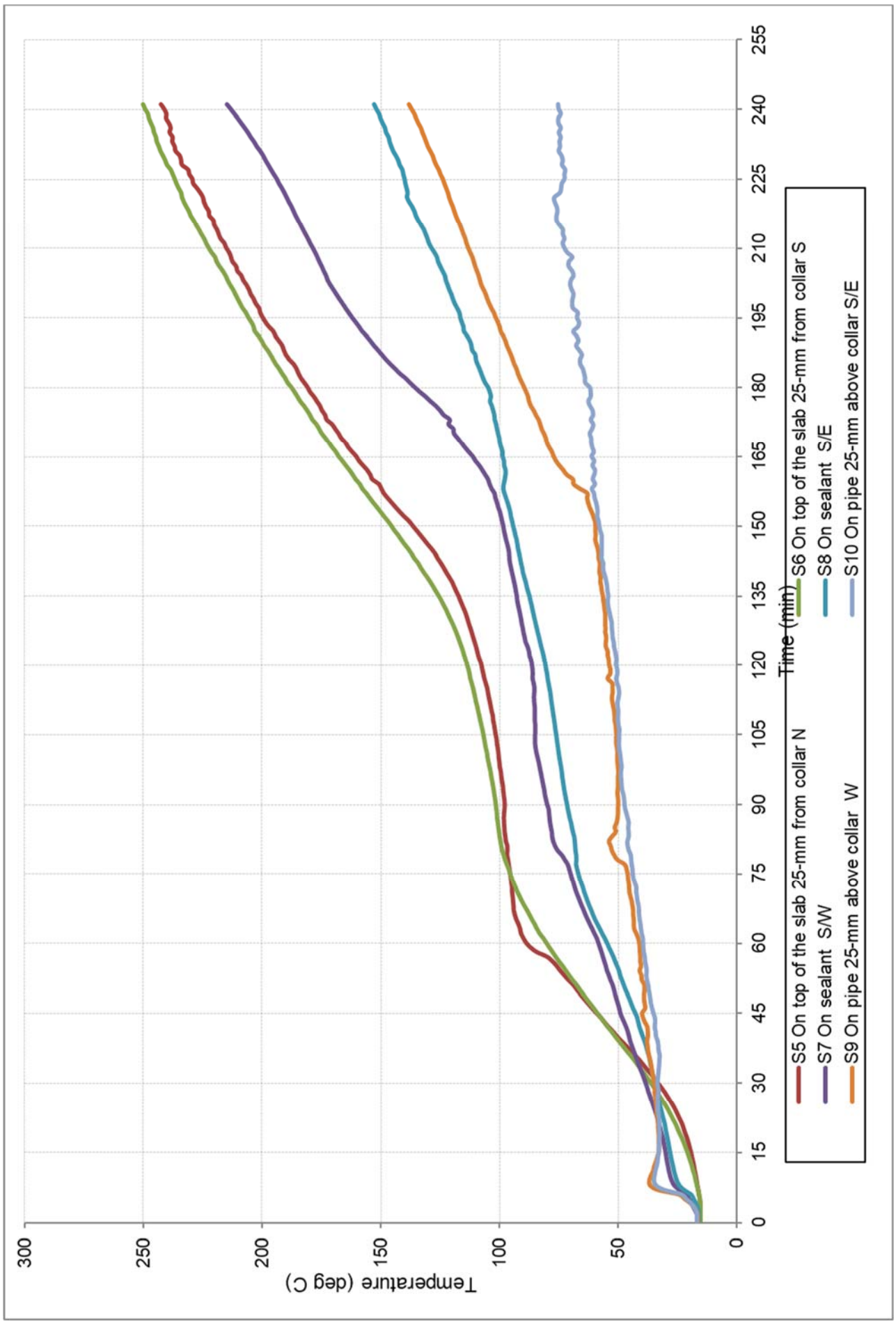


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 2

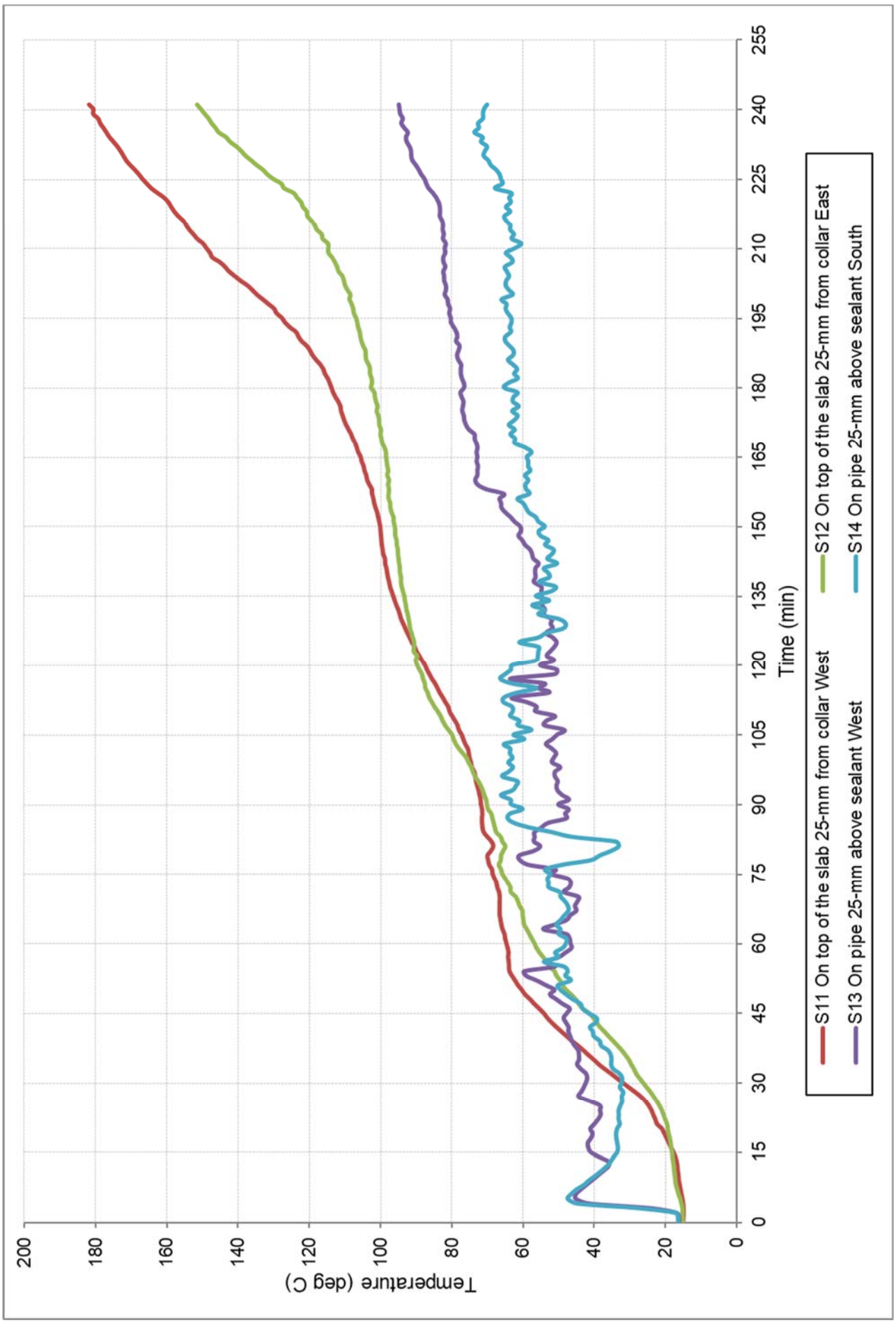


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 3

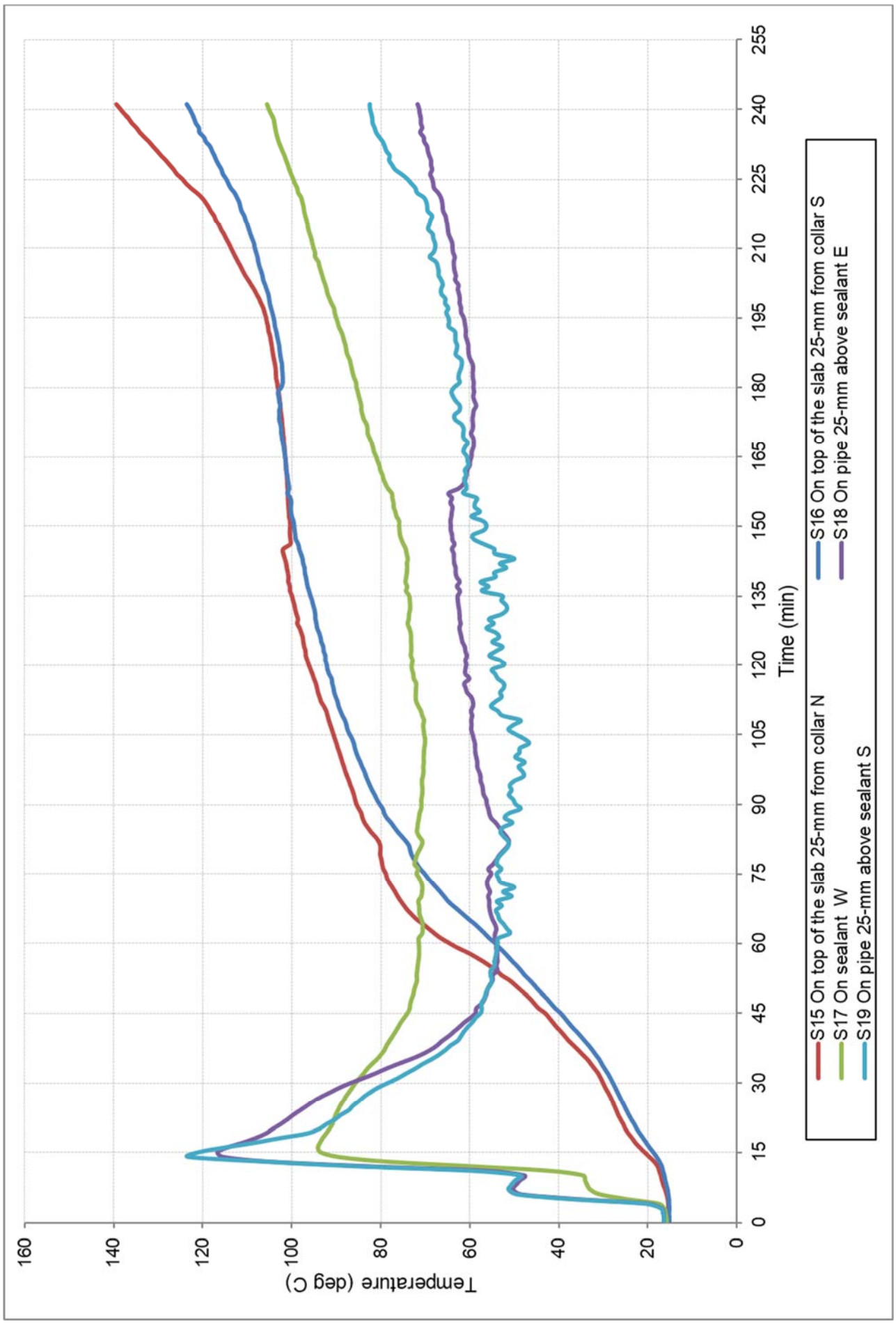


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 4

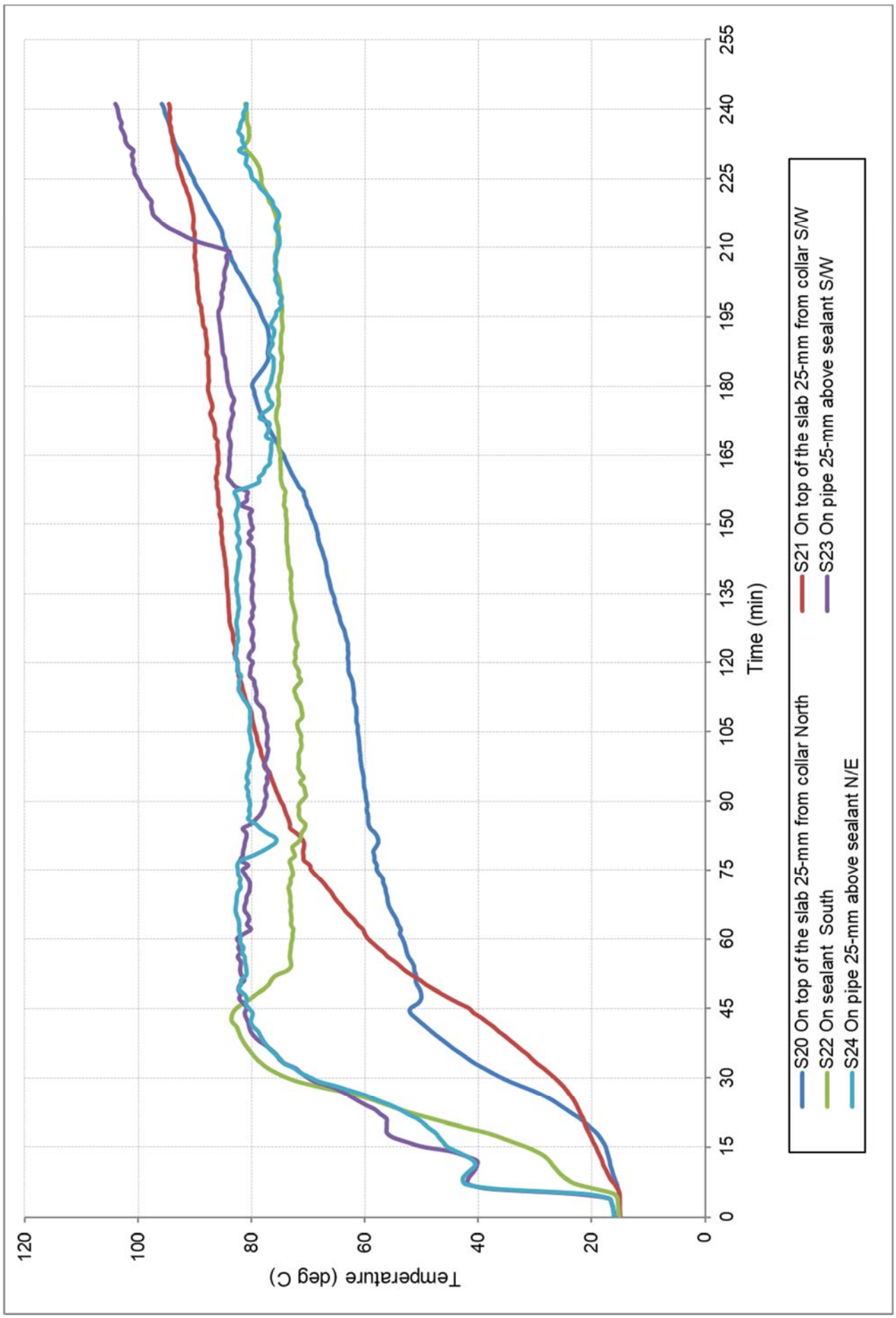
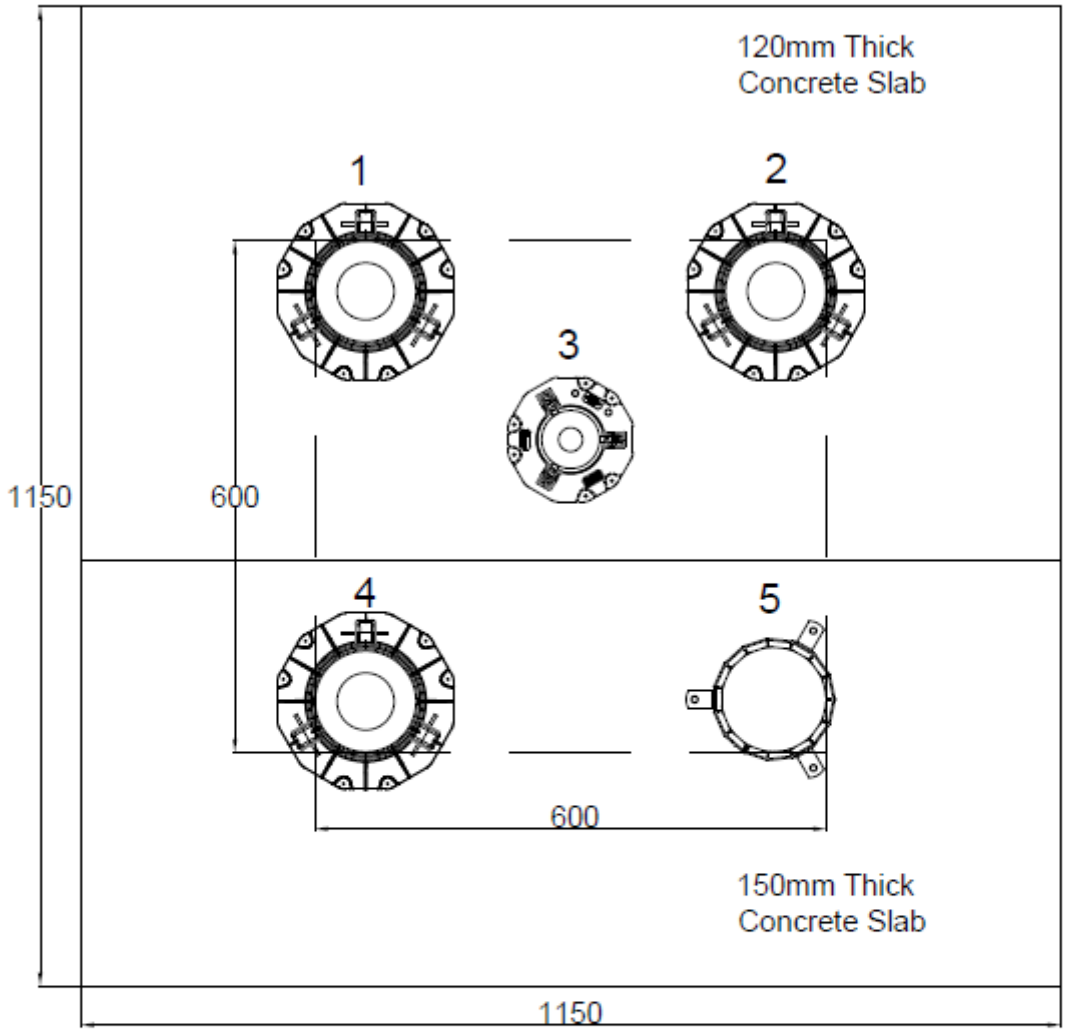


FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 5

Appendix D – Installation drawings

Snap Fire Systems Pty Ltd
Test Slab S-20-E Layout
Date: 13 MAY 2020



Penetration	Collar Code	Pipe Type	Pipe Diameter (mm)	Fitting
1	H100S-RR	P-PVC	100	N/A
2	H100S-RR	P-PVC	80	N/A
3	H50S-RR	P-PVC	50	N/A
4	H100S-RR	HDPE	110	SuperTube
5	110R	HDPE	110	SuperTube

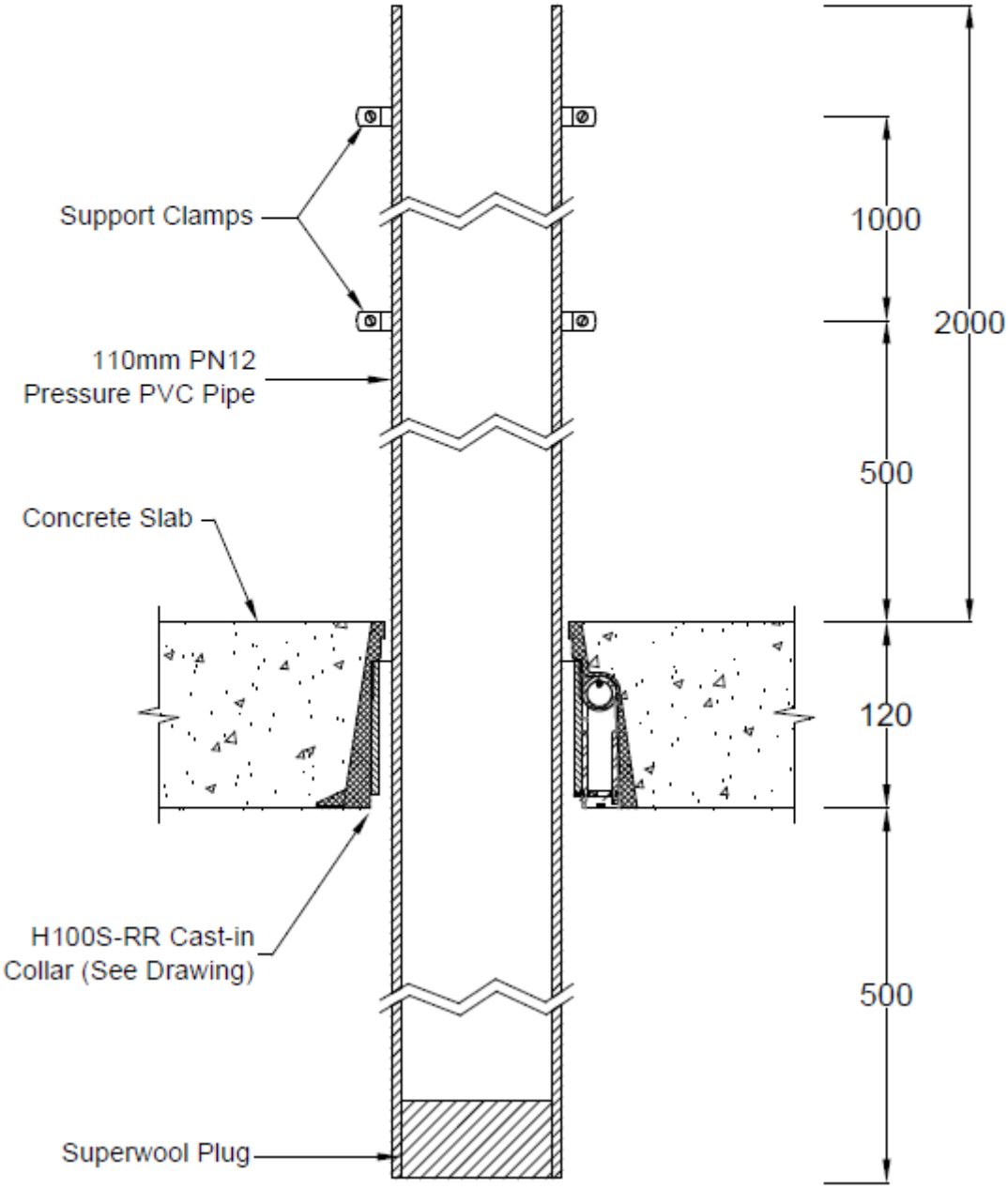
DRAWING TITLED "TEST SLAB S-20-E LAYOUT", DATED 13 MAY 2020, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #1

100 PN12 Pressure PVC Stack & H100S-RR

Date: 13 MAY 2020



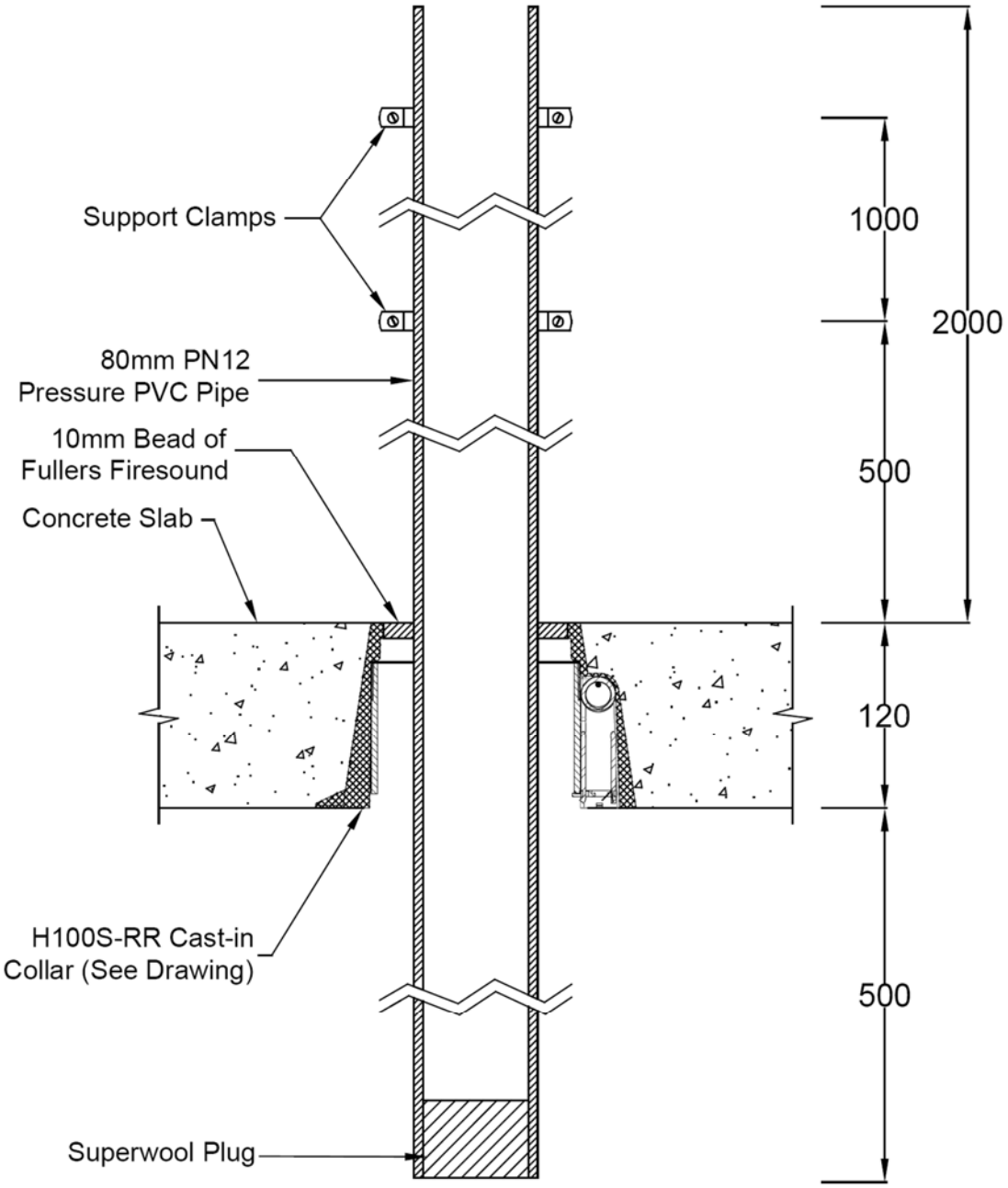
DRAWING TITLED "SPECIMEN #1 100 PN12 PRESSURE PVC STACK & H100S-RR", DATED 13 MAY 2020, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #2

80mm PN12 Pressure PVC Stack & H100S-RR

Date: 13 MAY 2020



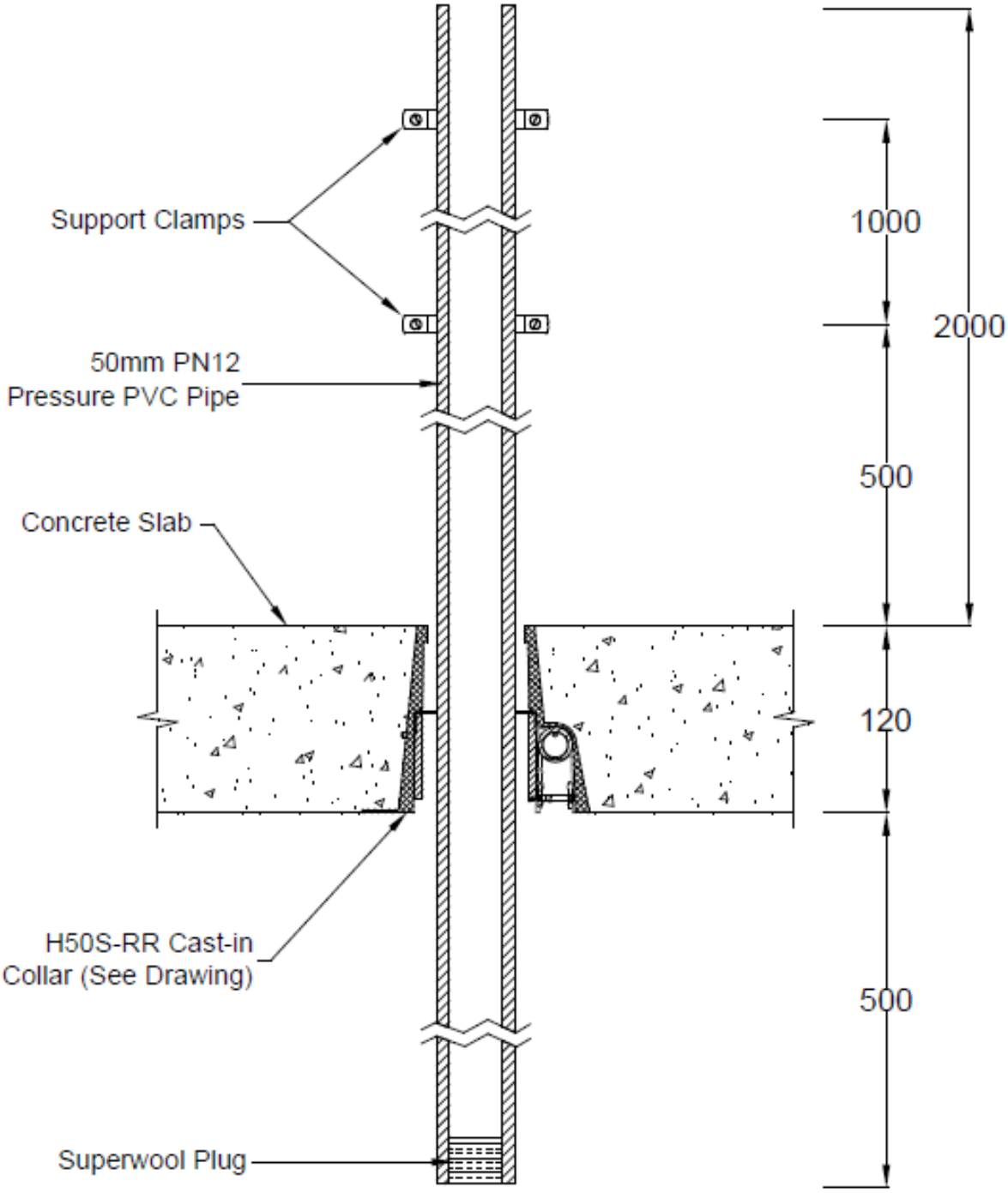
DRAWING TITLED "SPECIMEN #2 80MM PN12 PRESSURE PVC STACK & H100S-RR", DATED 13 MAY 2020, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #3

50mm PN12 Pressure PVC Stack & H50S-RR

Date: 13 MAY 2020



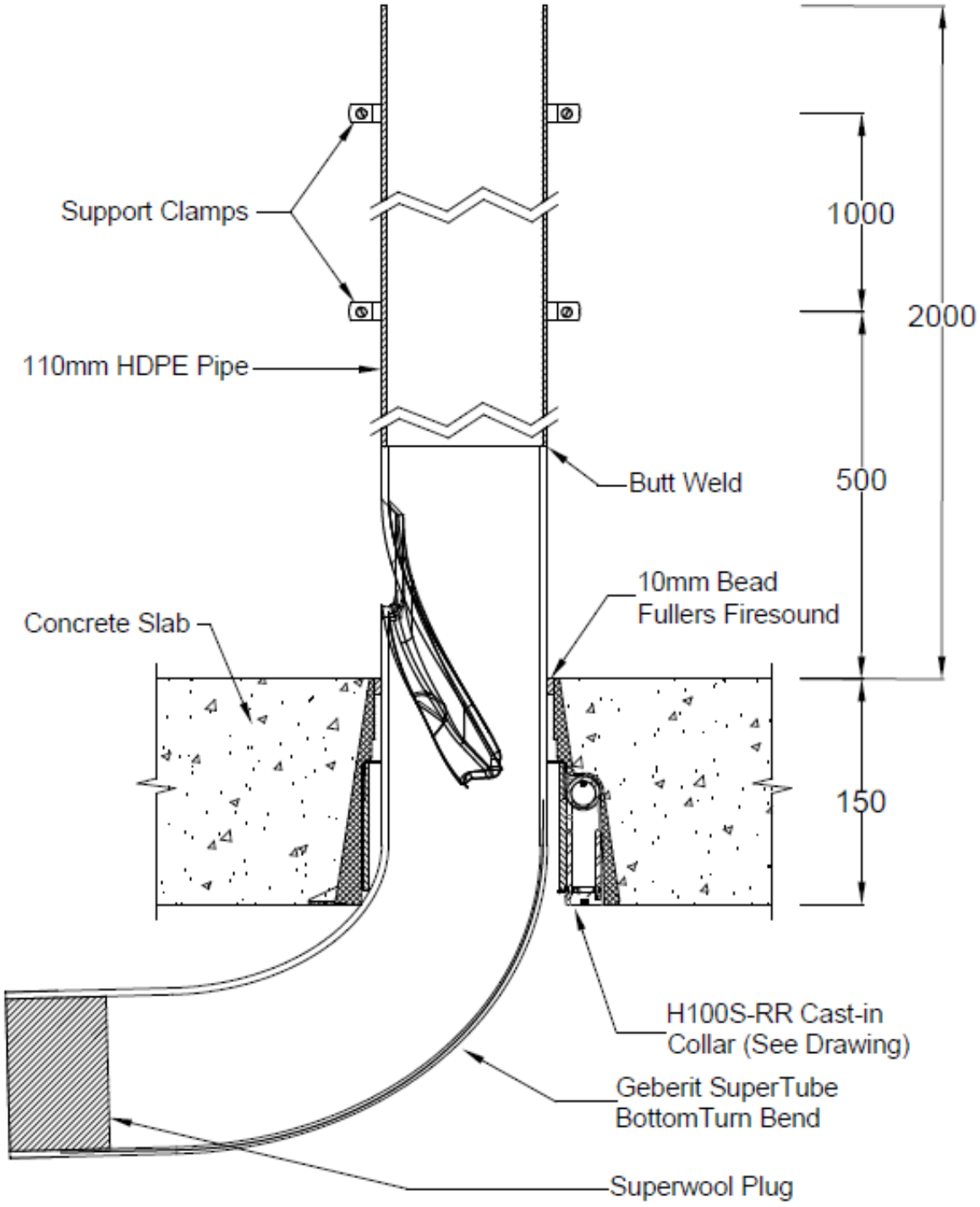
DRAWING TITLED "SPECIMEN #3 50MM PN12 PRESSURE PVC STACK & H50S-RR", DATED 13 MAY 2020, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #4

110 HDPE SuperTube Stack & H100S-RR

Date: 22 MAY 2020



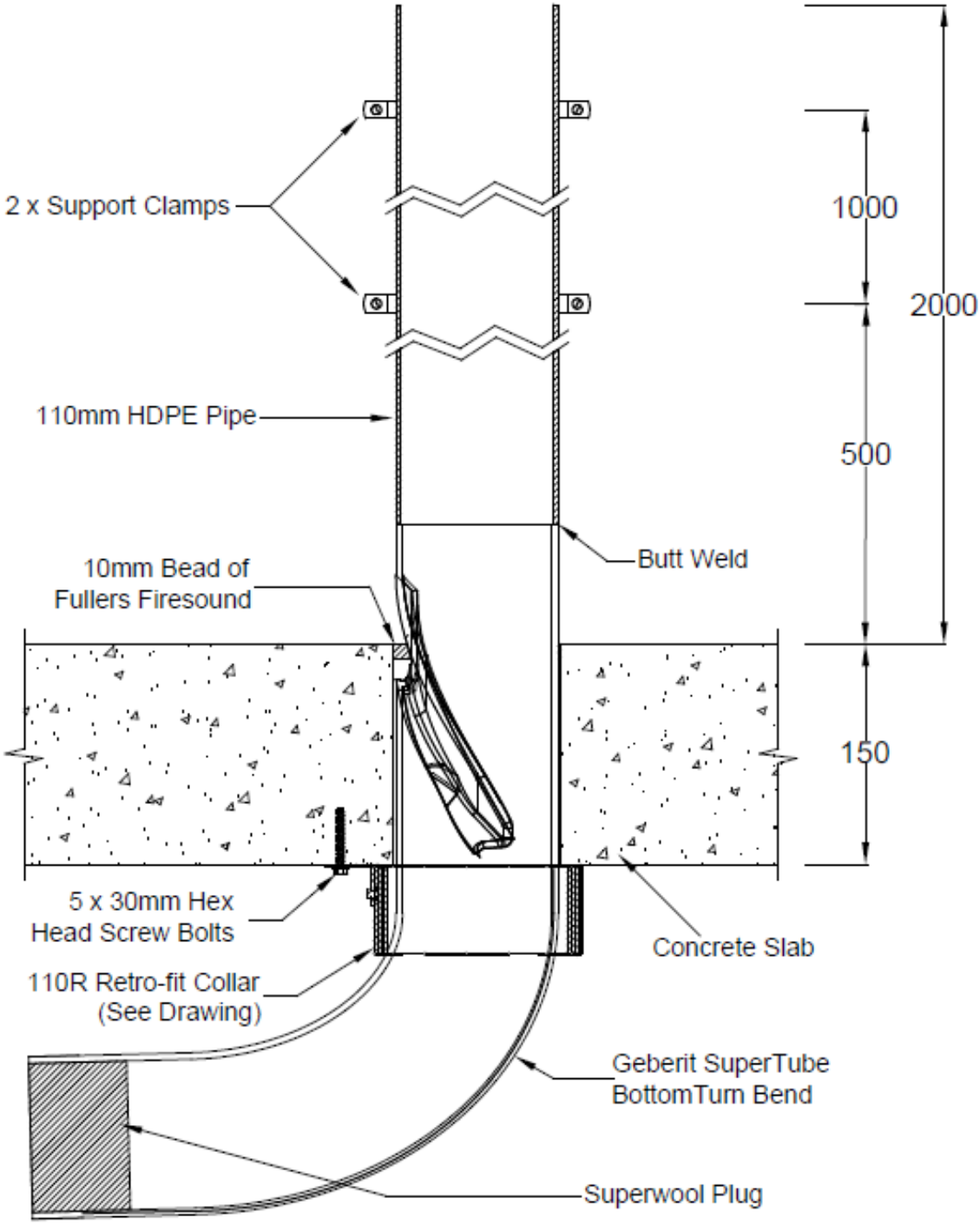
DRAWING TITLED "SPECIMEN #4 110 HDPE SUPERTUBE STACK & H100S-RR", DATED 22 MAY 2020, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

Specimen #5

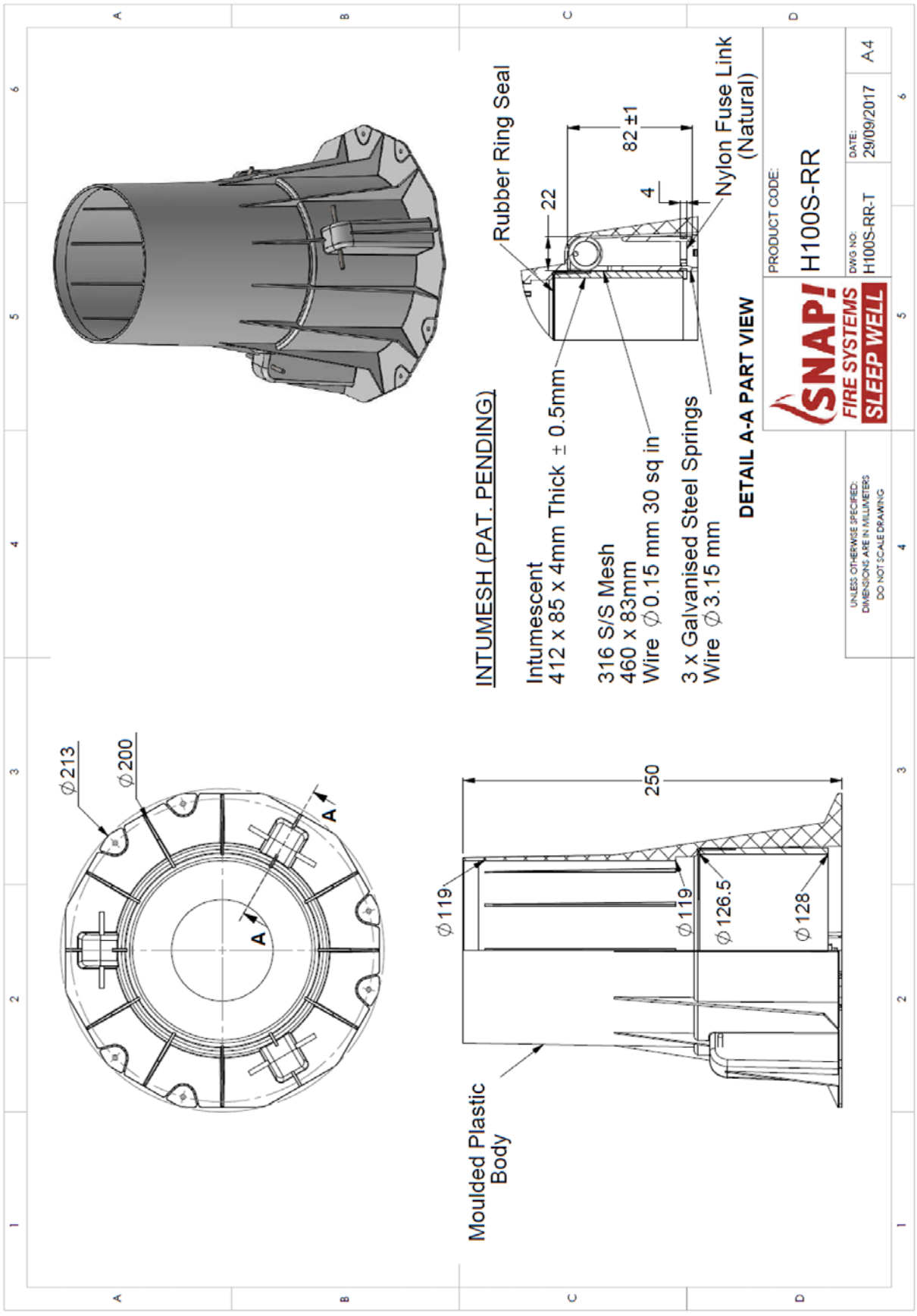
110 HDPE SuperTube Stack & 110R

Date: 22 MAY 2020

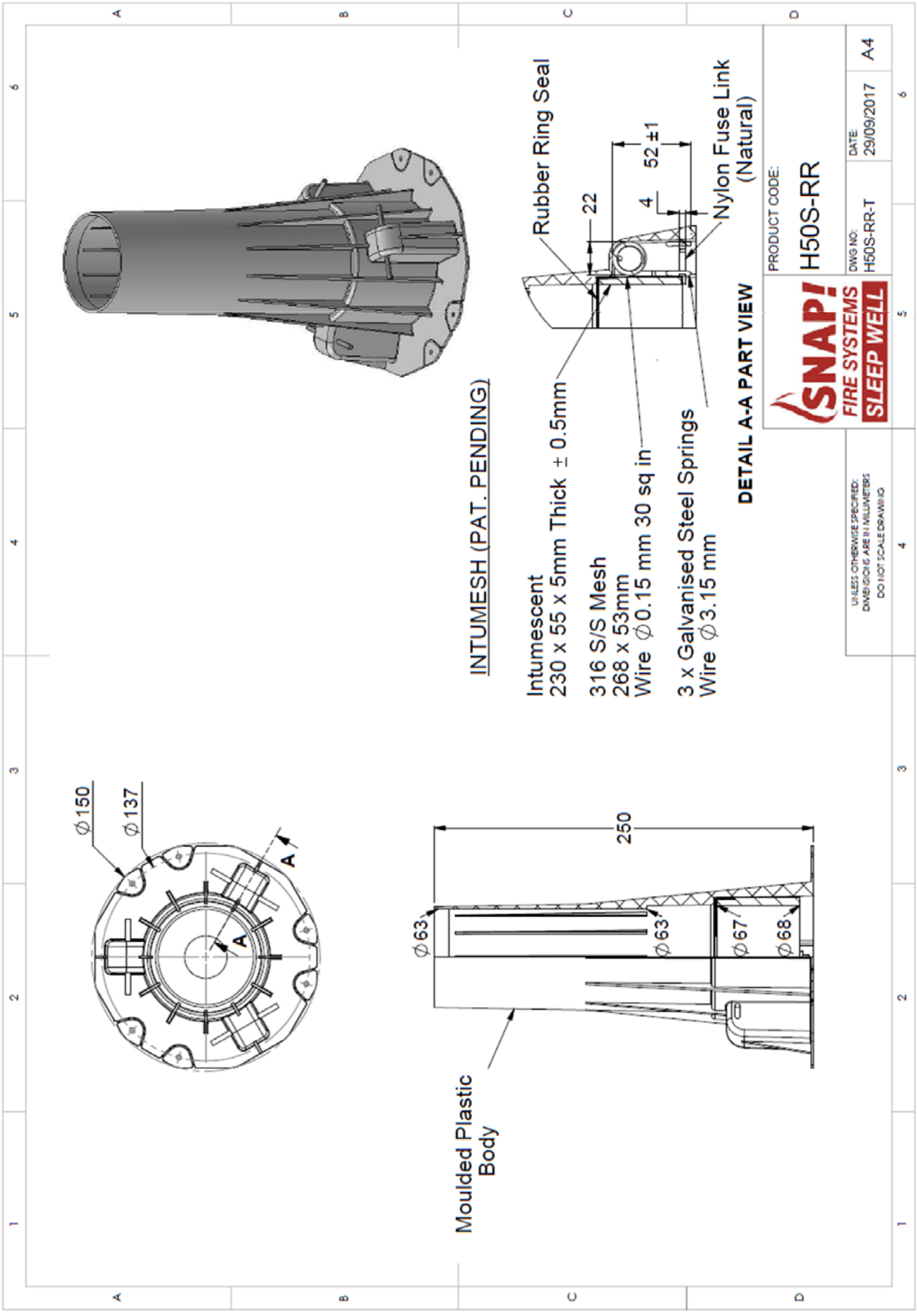


DRAWING TITLED "SPECIMEN #5 110 HDPE SUPERTUBE STACK & 110R", DATED 22 MAY 2020, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

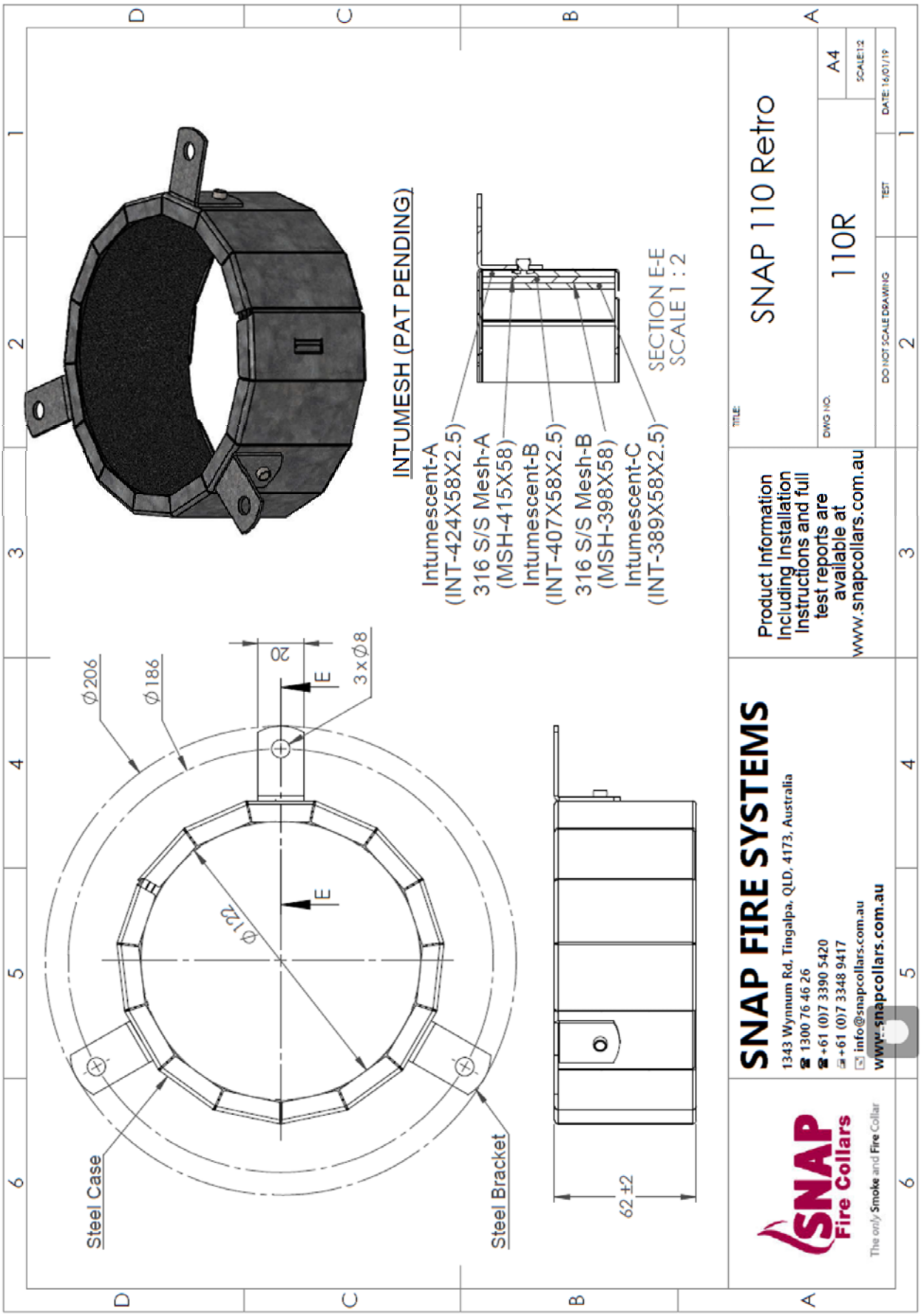
Appendix E – Specimen Drawings



DRAWING NUMBER H100S-RR-T, DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING NUMBER H50S-RR-T, DATED 29 SEPTEMBER 2017, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING TITLED "SNAP 110 RETRO", DATED 16 JANUARY 2019, BY SNAP FIRE SYSTEMS PTY LTD

Appendix F – Certificate(s) of Test

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PO Box 52, North Ryde NSW 1670, Australia
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Certificate of Test

No. 3461

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
3 Skirmish Court
Victoria Point Qld 4165

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2116.

Product Name: SNAP H100S-RR Cast-in collar protecting a nominal 100-mm PN12 PVC-U stack pipe (Specimen 1)

Description: The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by an unplasticised polyvinyl chloride (PVC-U) pipe protected by a cast-in Snap Fire Systems fire collar. The penetrated slab comprised a 120-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5 mm inner diameter and a 213-mm 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 numbered H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 114.5-mm outside diameter Ipex 100 PVC-U PN12pipe with a wall thickness of 6.37 mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm 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 open at the unexposed end and closed with a ceramic fibre plug on the exposed end. On the unexposed face the annular gap between the pipe and the collar sleeve was left unprotected as shown in drawing titled "Specimen #1, 100 PN12 Pressure PVC Stack & H100S-RR", dated 13 May 2020, provided 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	-	231 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/240/120.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. 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: 15 June 2020

Issued on the 20th day of August 2020 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. 3461

INFRASTRUCTURE TECHNOLOGIES
www.csiro.au

14 Julius Avenue, North Ryde NSW 2113
PO Box 52, North Ryde NSW 1670, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3462

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
3 Skirmish Court
Victoria Point Qld 4165

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2116.

Product Name: SNAP H100S-RR Cast-in collar protecting a nominal 80-mm PN12 PVC-U stack pipe (Specimen 2)

Description: The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by an unplasticised polyvinyl chloride (PVC-U) pipe protected by a cast-in Snap Fire Systems fire collar. The penetrated slab comprised a 120-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5 mm inner diameter and a 213-mm 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 numbered H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd. The penetrating service comprised an 88.83-mm outside diameter Vinidex 80 PN12 PVC-U pipe with a wall thickness of 5.26 mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm 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 open at the unexposed end and closed with a ceramic fibre plug on the exposed end. On the unexposed face the 18-mm annular gap between the pipe and the collar sleeve was protected with a 10-mm deep bead of Fullers Firesound sealant as shown in drawing titled "Specimen #2, 80mm PN12 Pressure PVC Stack & H100S-RR", dated 13 May 2020, provided 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	-	186 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/240/120.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. 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: 15 June 2020

Issued on the 20th day of August 2020 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

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Accreditation No. 165 – Corporate Site No. 3625
Accredited for compliance with ISO/IEC 17025 - Testing

COPY OF CERTIFICATE OF TEST – NO. 3462

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14 Julius Avenue, North Ryde NSW 2113
PO Box 52, North Ryde NSW 1670, Australia
T (02) 9490 5444 • **ABN** 41 687 119 230

Certificate of Test

No. 3463

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
3 Skirmish Court
Victoria Point Qld 4165

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2116.

Product Name: SNAP H50S-RR Cast-in collar protecting a nominal 50-mm PN12 PVC-U stack pipe (Specimen 3)

Description: The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by an unplasticised polyvinyl chloride (PVC-U) pipe protected by a cast-in Snap Fire Systems fire collar. The penetrated slab comprised a 120-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP Cast-in H50S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 67 mm inner diameter and a 150-mm 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 numbered H50S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 59.95-mm outside diameter Vinidex 50 PN12 PVC pipe with a wall thickness of 3.21 mm through the collar's sleeve. The pipe projected vertically, 2000-mm above from unexposed face of the concrete slab and 500-mm into furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from unexposed face of the slab. The pipe was open at the unexposed end and closed ceramic fibre plug on exposed end. On unexposed face the 3-mm annular gap between the pipe and collar sleeve was left unprotected as in drawing titled "Specimen #3, 50mm PN12 Pressure PVC Stack & H50S-RR", dated 13 May 2020, provided 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 -/240/120.

The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. 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: 15 June 2020

Issued on the 20th day of August 2020 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3464

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
3 Skirmish Court
Victoria Point Qld 4165

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2116.

Product Name: SNAP H100S-RR Cast-in collar protecting a Geberit HDPE SuperTube BottomTurn bend. (Specimen 4)

Description: The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by a high density polyethylene (HDPE) pipe protected by a cast-in Snap Fire Systems fire collar. The penetrated slab comprised a 150-mm thick concrete slab 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 Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5 mm inner diameter and a 213-mm 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 numbered H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6 mm fitted through the collar's sleeve. The annular gap between the BottomTurn bend and the inside collar casing was protected with a 10-mm deep bead of Fullers Firesound mastic. On the unexposed face the BottomTurn bend was fitted with a HDPE (PE100) stack pipe as shown in drawing titled "Specimen #4, 110 HDPE SuperTube Stack & H100S-RR", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd. The stack pipe projected vertically 2000-mm above from the unexposed face of the concrete slab and the BottomTurn bend projected 500-mm into the furnace chamber. The pipe was supported at nominally 500 mm and 1500-mm from the unexposed face of the slab. The stack pipe was left open at the unexposed end and the BottomTurn bend was closed with a ceramic fibre (Superwool) plug 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. 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: 15 June 2020

Issued on the 20th day of August 2020 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3465

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
3 Skirmish Court
Victoria Point Qld 4165

A full description of the test specimen and the complete test results are detailed in the Division's report FSP 2116.

Product Name: SNAP 110R Retrofit fire collar protecting a Geberit 110 HDPE SuperTube BottomTurn bend (Specimen 5)

Description: The specimen comprised a 1150-mm x 1150-mm reinforced concrete slab penetrated by a high density polyethylene (HDPE) pipe protected by a retro-fit Snap Fire Systems fire collar. The penetrated slab comprised a 150-mm thick concrete slab 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 Retrofit 110R fire collar comprised a 0.75-mm steel casing with a 122 mm inner diameter and a 206-mm diameter base flange. The 62-mm high collar casing incorporated a closing mechanism that was comprised of three soft Intumesh intumescent wraps and wire meshes lined within the internal circumference of collar as shown in drawing titled "SNAP 110 Retro", dated 16 January 2019, by Snap Fire Systems Pty Ltd. The Snap collar was surface mounted around the pipe on the exposed face of the slab and fixed through 3 mounting brackets using 5-mm x 30 mm Concrete Screws. The annular gap between the pipe and concrete slab on the unexposed face was protected with a bead of Fullers Firesound sealant. The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6 mm fitted through the collar's sleeve. A 111-mm diameter opening was cut into the slab and the collar fixed centrally over the hole. On the unexposed face the BottomTurn bend was fitted with a HDPE (PE100) stack pipe as shown in drawing titled "Specimen #5, 110 HDPE SuperTube Stack & 110R", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd. The stack pipe projected vertically, approximately 2000-mm above from the unexposed face of the concrete slab and the BottomTurn bend approximately 500-mm into the furnace chamber. The stack pipe was supported at nominally 500 mm and 1500-mm from the unexposed face of the slab. The stack pipe was left open at the unexposed end and the BottomTurn bend was closed with a ceramic fibre (Superwool) plug 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. 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: 15 June 2020

Issued on the 20th day of August 2020 without alterations or additions.

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 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 ***

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FOR FURTHER INFORMATION

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