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

Test Report

Author: Shaw Tran
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Client: IG6 Pty Ltd

Commercial-in-confidence

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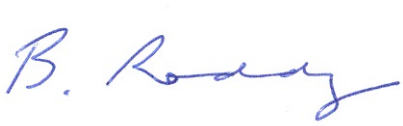
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Fire-resistance test on retrofit fire collars protecting a concrete wall penetrated by services

Sponsored Investigation No. FSP 2246

1 Introduction

1.1 Identification of specimen

The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services.

1.2 Sponsor

IG6 Pty Ltd
1343 Wynnum Road
Tingalpa QLD 4173
Australia

1.3 Manufacturer

Snap Fire Systems Pty Ltd
1343 Wynnum Road
Tingalpa QLD 4173
Australia

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 5135/4711

1.7 Test date

The fire-resistance test was conducted on 1 November 2021.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 180-mm thick concrete wall panel penetrated by multiple services, protected by retrofit fire collars.

The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 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 1260 PVC-U pipes and fittings for drain, waste and vent application;
- AS/NZ 2492:2007/Amdt 1:2018: Cross-linked polyethylene (PE-X) pipes for pressure applications and
- AS/NZS 7671:2010 Plastic piping system for soil and waste discharge (low and high temperature) inside buildings – Polypropylene (PP).

For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5.

Specimen 1 - SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Iplex PVC-SC pipe penetrating a 120-mm diameter opening

The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh, as shown in drawing numbered 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd.

The fire collars were centrally located over a 120-mm diameter opening on both faces of the concrete wall and fixed through the 4 mounting backets using 6 x 35-mm steel wedge masonry anchors.

The penetrating service comprised of a 110-mm outer diameter Iplex PVC-U (PVC SC) pipe with a nominal wall thickness of 3.3-mm fitted through the opening and the fire collar sleeve, as shown in drawing titled 'Specimen #1 100PVC(SC) Pipe & LP100R-D', dated 3 November 2021 by Snap Fire Systems Pty Ltd.

The pipe projected horizontally approximately 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end.

Specimen 2 - SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 120-mm diameter opening

The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh, as shown in drawing numbered 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd.

The fire collars were centrally located over a 120-mm diameter opening on both faces of the concrete wall and fixed through the 4 mounting brackets using 5 x 35-mm mushroom head spikes.

The penetrating service comprised of a 110-mm outer diameter Mueller Pipeline HDPE pipe with a nominal wall thickness of 5-mm fitted through the opening and the fire collar sleeve, as shown in drawing titled 'Specimen #2 110 HDPE Pipe & LP100R-D', dated 3 November 2021 by Snap Fire Systems Pty Ltd.

The pipe projected horizontally approximately 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and plugged with 40-mm thick ceramic fibre on the exposed end.

Specimen 3 - SNAP LP65R retrofit fire collars protecting a nominal 69-mm outer diameter Iplex PVC-U pipe penetrating a 75-mm diameter opening

The SNAP LP65R retrofit fire collar comprised of a 0.7-mm thick, 85-mm inner diameter stainless-steel casing. The 61-mm high collar casing incorporated a closing mechanism which comprised a 4-mm thick 54-mm wide x 300-mm long Intumesh intumescent wrap lined around the internal circumference of the collar casing. The closing mechanism comprised three 3.15-mm stainless steel springs with nylon fuse links and a 300-mm x 55-mm stainless steel mesh as, shown in drawing numbered 'LP 65 R', dated 13 June 2014, by Snap Fire Systems Pty Ltd.

The fire collars were centrally located over a 75-mm diameter opening on both faces of the concrete wall and fixed through the 3 mounting brackets using 6 x 35-mm steel wedge masonry anchors.

The penetrating service comprised of a 69-mm outer diameter Iplex PVC pipe with a nominal wall thickness of 2.9-mm fitted through the opening and the fire collar sleeve as shown in the drawing titled 'Specimen 3 65 PVC Pipe & LP65R', dated 11 November 2021 by Snap Fire Systems Pty Ltd.

The pipe projected 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end.

Specimen 4 - SNAP LP100R-D retrofit fire collars protecting a nominal 82-mm outer diameter Iplex PVC-U pipe penetrating a 90-mm diameter opening

The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh, as shown in drawing numbered 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd.

The fire collars were centrally located over a 90-mm diameter opening on both faces of the concrete wall and fixed through the four mounting brackets using 5 x 30-mm concrete screw bolts.

The penetrating service comprised of an 82-mm diameter Iplex PVC(SC) pipe with a nominal wall thickness of 3.3-mm fitted through the opening and the collars sleeve, as shown in the drawing titled 'Specimen #4 80 PVC Pipe & LP100R-D', dated 3 November 2021 by Snap Fire Systems Pty Ltd. The pipe projected horizontally 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end.

Specimen 5 - SNAP LP50R retrofitted fire collars protecting a nominal 56-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 65-mm diameter opening.

The SNAP LP50R retrofit fire collar comprised of a 0.75-mm thick steel casing with a 69-mm inner diameter. The 61.5-mm high collar casing incorporated a closing mechanism which comprised a 4-mm thick x 58-mm wide x 252-mm long Intumesh intumescent wrap lined around the internal circumference of the collar casing. The closing mechanism is comprised of three 3.15-mm diameter stainless steel springs with nylon fuse links and a 260-mm x 58-mm stainless steel mesh, as shown in drawing titled 'SNAP 50 Low Profile Retro' dated 25 March 2019 by Snap Fire systems Pty Ltd.

The fire collars were centrally located over a 65-mm diameter opening on both faces of the concrete wall and fixed through the 3 mounting backets using 6 x 35-mm steel wedge anchors.

The penetrating service comprised of a 55-mm outer diameter Mueller Pipelines HDPE pipe with a nominal wall thickness of 3.5-mm fitted through the opening and collar sleeve, as shown in drawing titled 'Specimen #5 56 HDPE Pipe & LP50R' dated 11 November 2021 by Snap Fire Systems Pty Ltd.

The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and plugged with 40-mm thick ceramic fibre on the exposed end.

2.2 Dimensions

The concrete wall was nominally 1150-mm wide x 1150-mm high x 180-mm thick.

2.3 Orientation

The concrete wall was placed vertically against the furnace chamber and subjected to fire exposure from one side only.

2.4 Conditioning

The concrete wall was cast on the 20 August 2021. 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 wall 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 Wall W-21-C1 Layout', dated 29 July February 2021, by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #1 100PVC(SC) Pipe & LP100R-D', dated 3 November, by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #2 110 HDPE Pipe & LP100R-D', dated 3 November 2021, by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #3 65 PVC Pipe & LP65R', dated 11 November 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #4 80 PVC Pipe & LP100R-D', dated 3 November 2021, by Snap Fire Systems Pty Ltd.

Drawing titled 'Specimen #5 56 HDPE Pipe & LP50R' dated 11 November 2021 by Snap Fire Systems Pty Ltd.

Drawing titled 'SNAP 50 Low Profile Retro' dated 25 March 2019, by Snap Fire Systems Pty Ltd.

Drawing numbered 'LP100R-D-T', dated 10 February 2017, by Snap Fire Systems Pty Ltd.

Drawing numbered 'LP 65 R-T', dated 13 June 2014, 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 Measurement system

The primary measurement system comprised a multiple-channel data logger, scanning at one-minute intervals during the test.

4.4 Pressure

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

The pressure probe was located approximately 500-mm above the sill of the furnace.

5 Ambient temperature

The temperature of the test area was 21°C at the commencement of the test.

6 Departure from standard

The furnace pressure was in excess of the tolerances of the requirements of AS 1530.4-2014 for the periods of time as shown in Figures 3. The test laboratory confirms that this departure 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 from between the fire collars and pipes of all specimens.
2 minutes -	Smoke is beginning to flue from the ends of specimens 2, 3, 4 and 5.
6 minutes -	Smoke is beginning to flue from the end of specimen 1.
7 minutes -	Smoke has ceased from specimens 2, 3, 4 and 5.
8 minutes -	Discolouration of the concrete wall is visible around the base of specimen 2.
10 minutes -	Smoke has resumed flueing from the ends of specimen 1 and 2.
15 minutes -	Smoke has resumed flueing from the end of specimen 3.
22 minutes -	Smoke has ceased flueing from the end of specimen 2.
24 minutes -	Moisture is visible on the concrete wall around the collar on specimen 3.
25 minutes -	Smoke has resumed to flue from the collar of specimen 1.
30 minutes -	Moisture is visible on the concrete wall around the collar on specimens 2, 4 and 5.
37 minutes -	Smoke is being emitted from between the pipe and the collar of specimen 3.
38 minutes -	Smoke is being emitted from between the pipe and the collar of specimen 4.
60 minutes -	Smoke is being emitted from between the pipe and the collar of specimen 2.
75 minutes -	Discolouration is visible on the concrete wall above the collar of specimen 1.
95 minutes -	The pipe within the collar of Specimen 1 has partially collapsed (Photograph 6).
132 minutes -	Cotton pad test applied to specimen 1 on the top of the pipe near the collar – No ignition of cotton was noted.
138 minutes -	Smoke is beginning to flue from the unexposed end of specimen 4.
162 minutes -	Cotton pad test applied to specimen 2 to the top of the pipe near the collar. – No ignition of cotton was noted.
169 minutes -	A red glow is visible on specimen 2 within the collar (Photograph 8).
186 minutes -	Smoke fluing from specimen 1 between the wall and the collar.
220 minutes -	The pipe within the collar of Specimen 4 has partially collapsed (Photograph 10).
238 minutes -	Cotton pad test applied to Specimen 2 to the top of the pipe near the collar. – No ignition of cotton was noted.
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 furnace pressure versus time 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.

Figure 8 shows the curve of temperature versus time associated with Specimen 5.

8.6 Performance

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

Specimen 1 - SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Iplex PVC-U(PVC-SC) pipe penetrating a 120-mm diameter opening

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

Specimen 2 - SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 120-mm diameter opening

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

Specimen 3 - SNAP LP65R retrofit fire collars protecting a nominal 69-mm outer diameter Iplex PVC-U pipe penetrating a 75-mm diameter opening

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

Specimen 4 - SNAP LP100R-D retrofit fire collars protecting a nominal 82-mm outer diameter Iplex PVC-U pipe penetrating a 90-mm diameter opening

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

Specimen 5 - SNAP LP50R retrofit fire collar protecting a nominal 56-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 65-mm diameter opening

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	-/240/240
Specimen 2	-/240/240
Specimen 3	-/240/240
Specimen 4	-/240/240
Specimen 5	-/240/240

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

The results of these fire tests may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions.

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

Testing Officer
Glenn Williams

Appendices

Appendix A – Measurement location

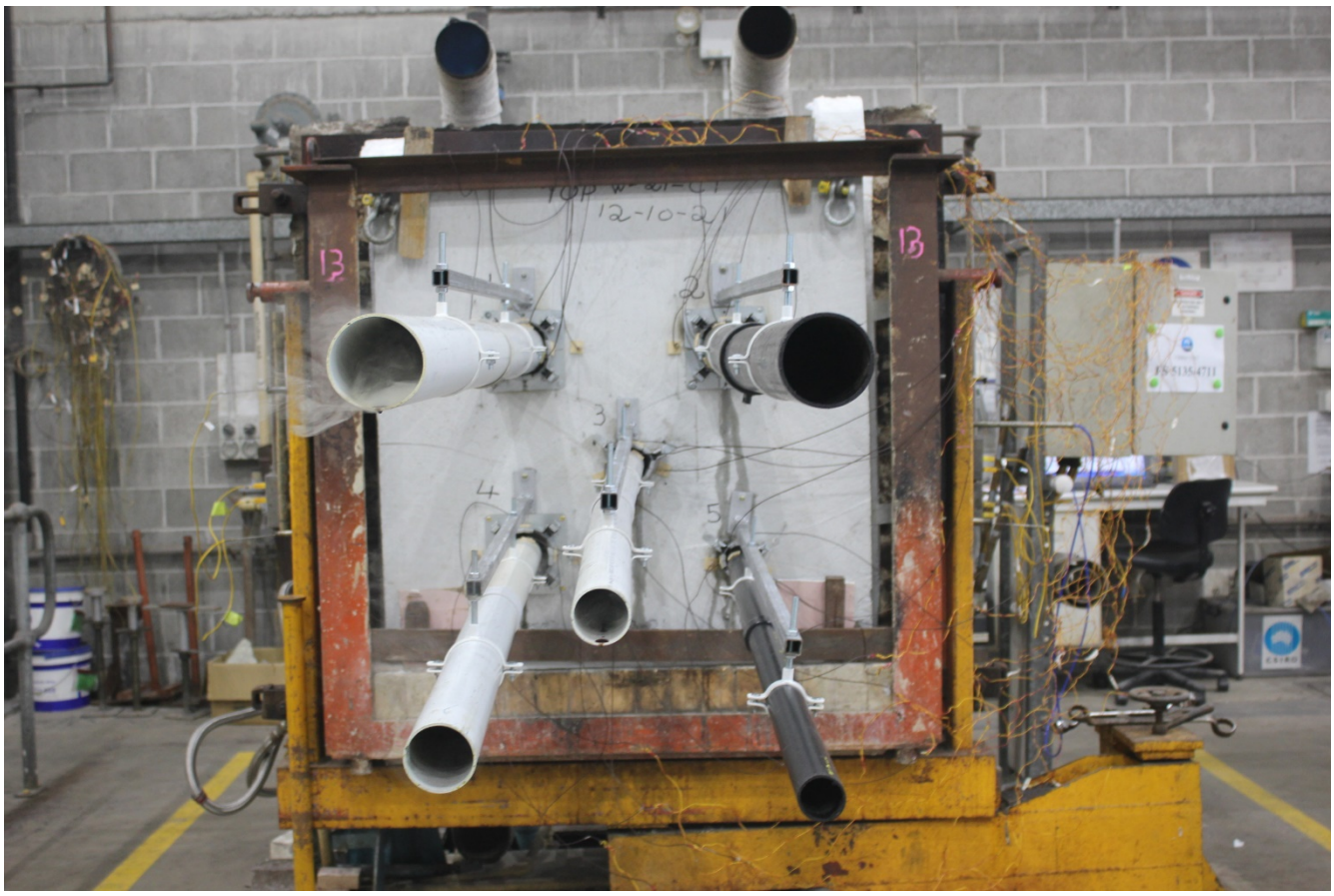
SPECIMEN	THERMCOUPLE POSITION	DESIGNATION
Specimen 1 – SNAP LP100R-D retrofit fire collar protecting a 3.3-mm thick, 110-mm Outer Diameter Iplex PVC-SC pipe penetrating a 125-mm diameter opening.	On the wall, 25-mm LEFT of the collar	S1
	On the wall, 25-mm RIGHT of the collar	S2
	On the TOP of the collar, 25-mm away from the wall	S3
	On the RIGHT of the collar, 25-mm away from the wall	S4
	On the TOP of the pipe, 25-mm away from the collar	S5
	On the RIGHT of the pipe, 25-mm away from the collar	S6
Specimen 2 – A SNAP LP100R-D retrofit fire collar protecting a 5-mm thick, 110-mm outer diameter Mueller Pipelines PE100 pipe penetrating a 125-mm diameter opening.	On the wall, 25-mm LEFT of the collar	S7
	On the wall, 25-mm RIGHT of the collar	S8
	On the TOP of the collar, 25-mm away from the wall	S9
	On the LEFT of the collar, 25-mm away from the wall	S10
	On the TOP of the pipe, 25-mm away from the collar	S11
	On the LEFT of the pipe, 25-mm away from the collar	S12
Specimen 3 – A SNAP LP65R retrofit fire collar protecting a 2.9-mm thick, 69-mm Ø Iplex PVC pipe penetrating a 75-mm diameter opening.	On the wall, 25-mm LEFT of the collar	S13
	On the wall, 25-mm RIGHT of the collar	S14
	On the TOP of the collar, 25-mm away from the wall	S15
	On the LEFT of the collar, 25-mm away from the wall	S16
	On the TOP of the pipe, 25-mm away from the collar	S17
	On the LEFT of the pipe, 25-mm away from the collar	S18

Specimen 4 – A snap LP100R-D retrofit fire collar protecting a 3.3-mm thick, 82-mm outer diameter Iplex PVC pipe penetrating a 90-mm diameter opening.	On the wall, 25-mm LEFT of the collar	S19
	On the wall, 25-mm RIGHT of the collar	S20
	On the TOP of the collar, 25-mm away from the wall	S21
	On the RIGHT of the collar, 25-mm away from the wall	S22
	On the TOP of the pipe, 25-mm away from the collar	S23
	On the RIGHT of the pipe, 25-mm away from the collar	S24
Specimen 5 – A Snap LP50R retrofit fire collar protecting a 3.48-mm thick, 56-mm outer diameter Muller Pipeline PE100 pipe penetrating a 65-mm opening.	On the wall, 25-mm RIGHT of the collar	S25
	On the wall, 25-mm LEFT of the collar	S26
	On the TOP of the collar, 25-mm away from the wall	S27
	On the RIGHT of the collar, 25-mm away from the wall	S28
	On the TOP of the pipe, 25-mm away from the collar	S29
	On the LEFT of the pipe, 25-mm away from the collar	S30
Rover		S31
Ambient		S32

Appendix B – Photographs

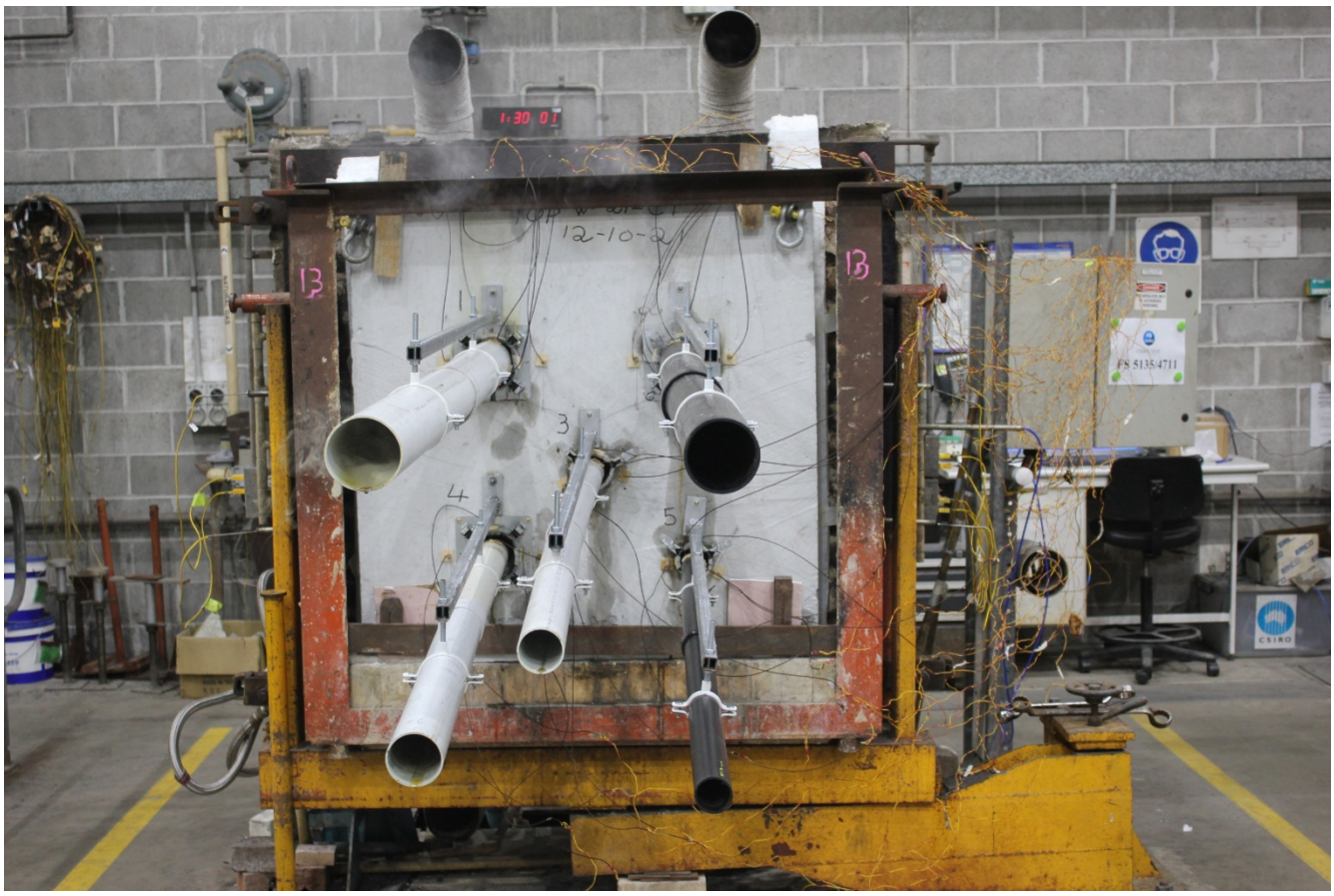
PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING

PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 3 – SPECIMENS AFTER 30 MINUTES OF TESTING

PHOTOGRAPH 4 – SPECIMENS AFTER 60 MINUTES OF TESTING

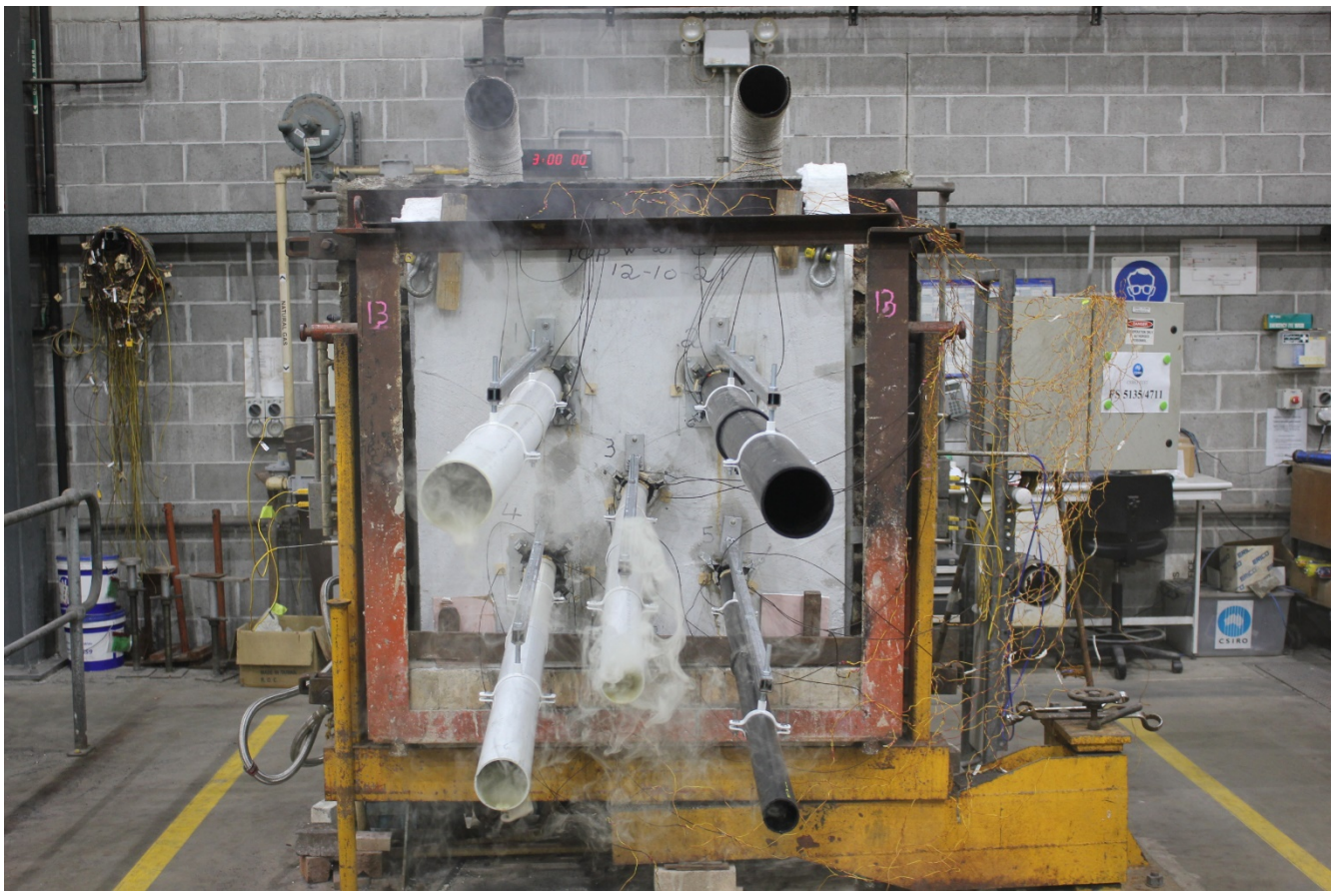


PHOTOGRAPH 5 – SPECIMENS AFTER 90 MINUTES OF TESTING

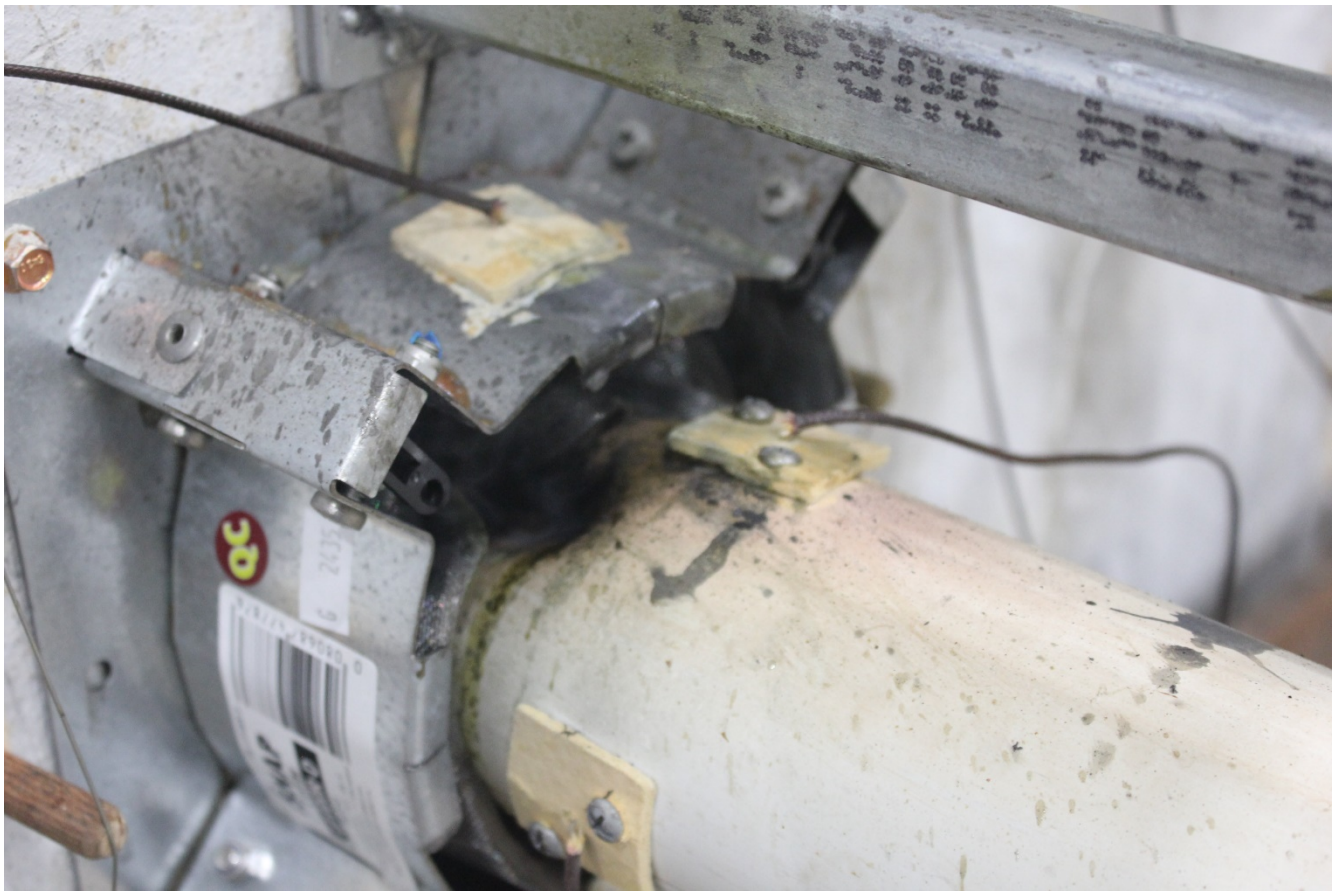
PHOTOGRAPH 6 – SPECIMEN 1 AFTER 95 MINUTES OF TESTING

PHOTOGRAPH 7 – SPECIMENS AFTER 120 MINUTES OF TESTING

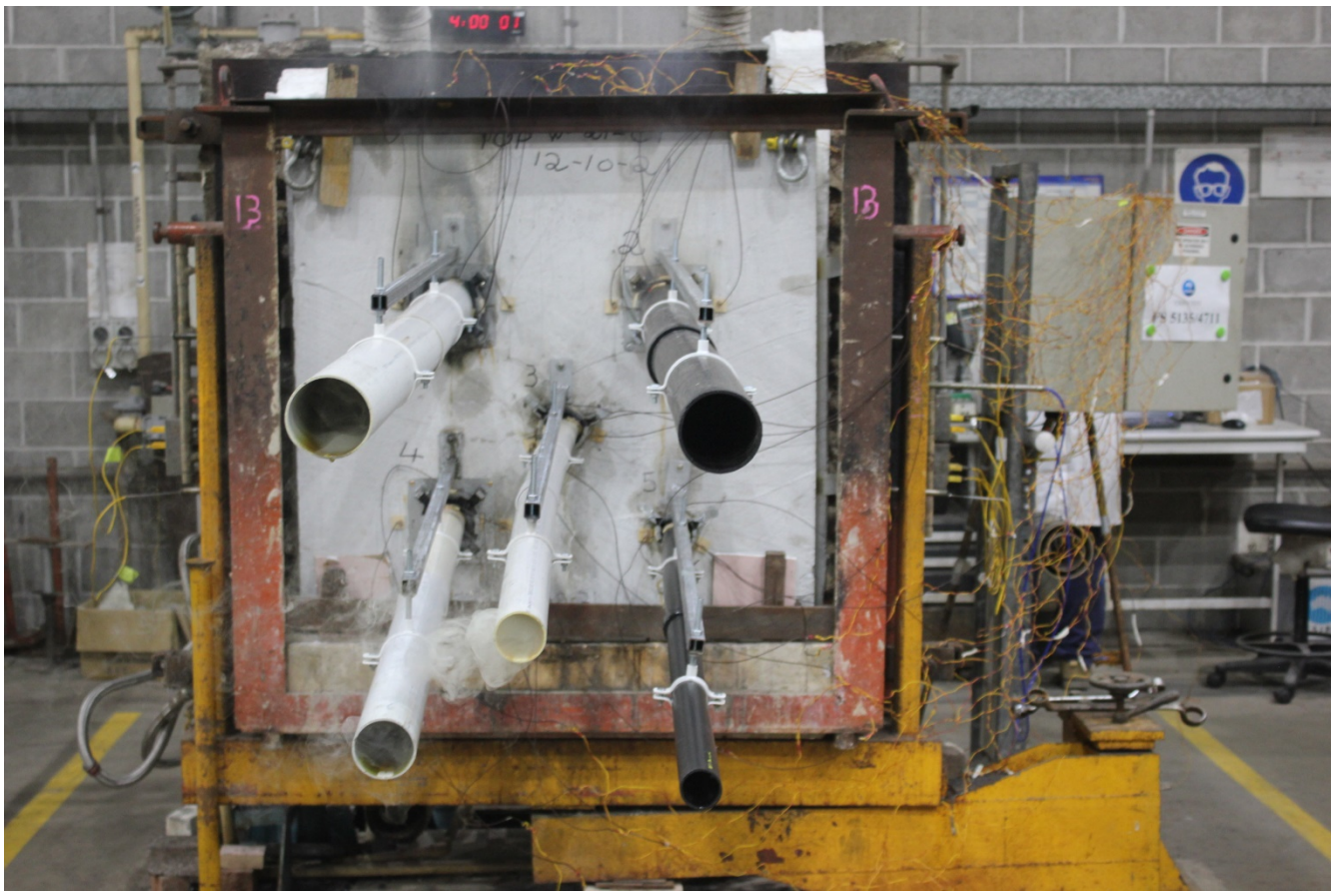
PHOTOGRAPH 8 – SPECIMEN 2 AFTER 169 MINUTES OF TESTING



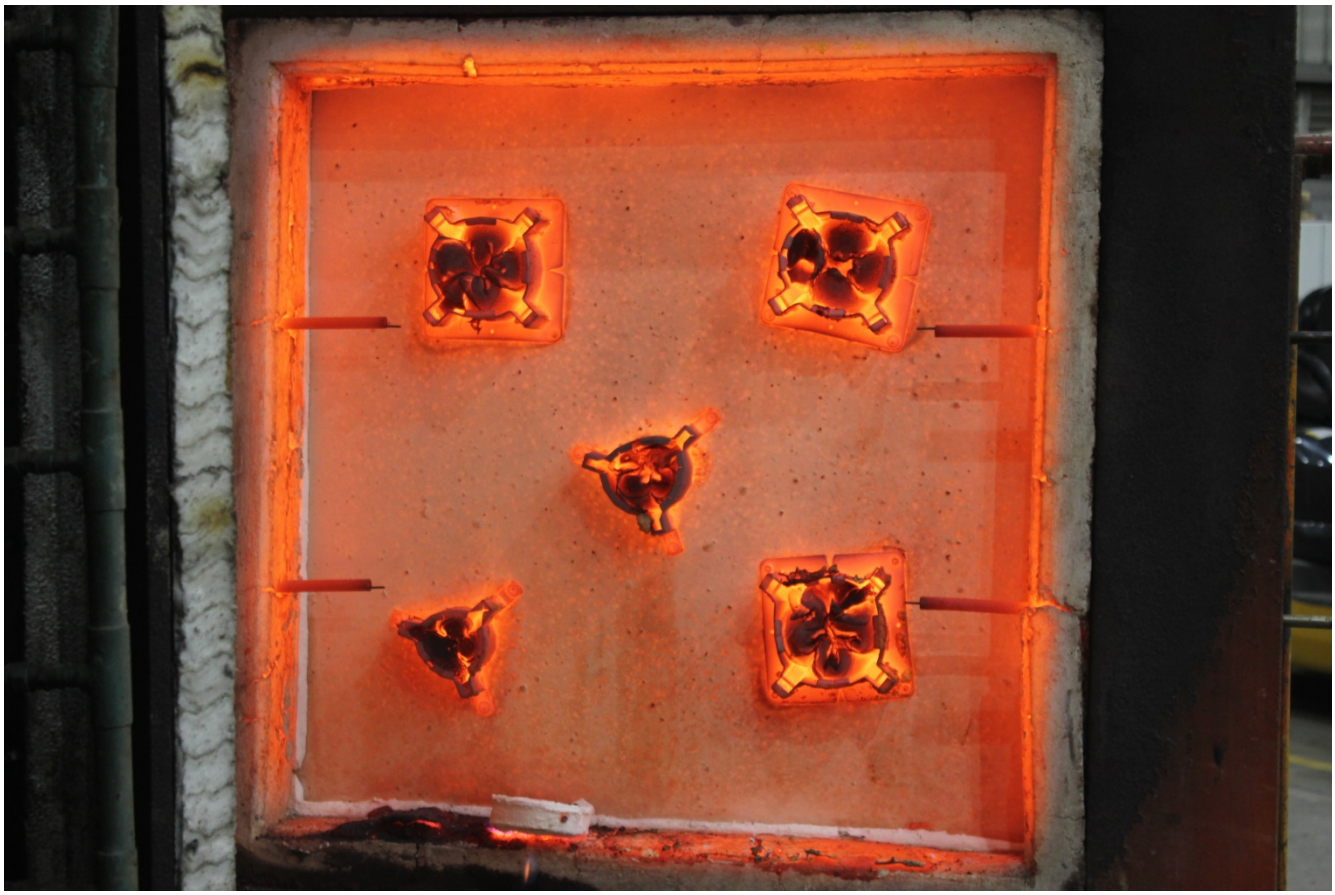
PHOTOGRAPH 9 – SPECIMENS AFTER 180 MINUTES OF TESTING



PHOTOGRAPH 10 – SPECIMEN 4 AFTER 220 MINUTES OF TESTING



PHOTOGRAPH 11 –UNEXPOSED FACE OF SPECIMENS AT THE CONCLUSION OF TESTING



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

Appendix C – Test data charts

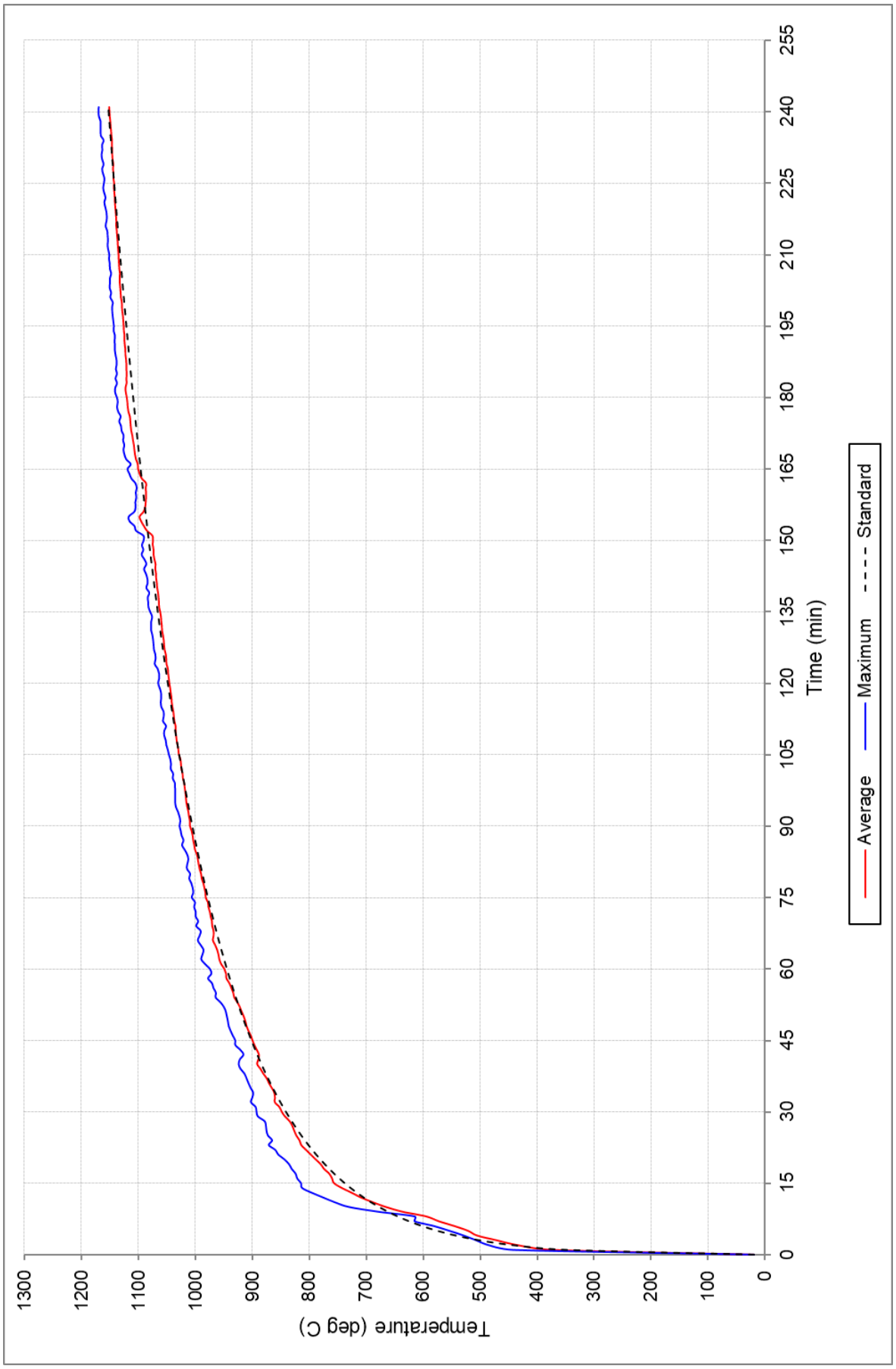


FIGURE 1 – FURNACE TEMPERATURE

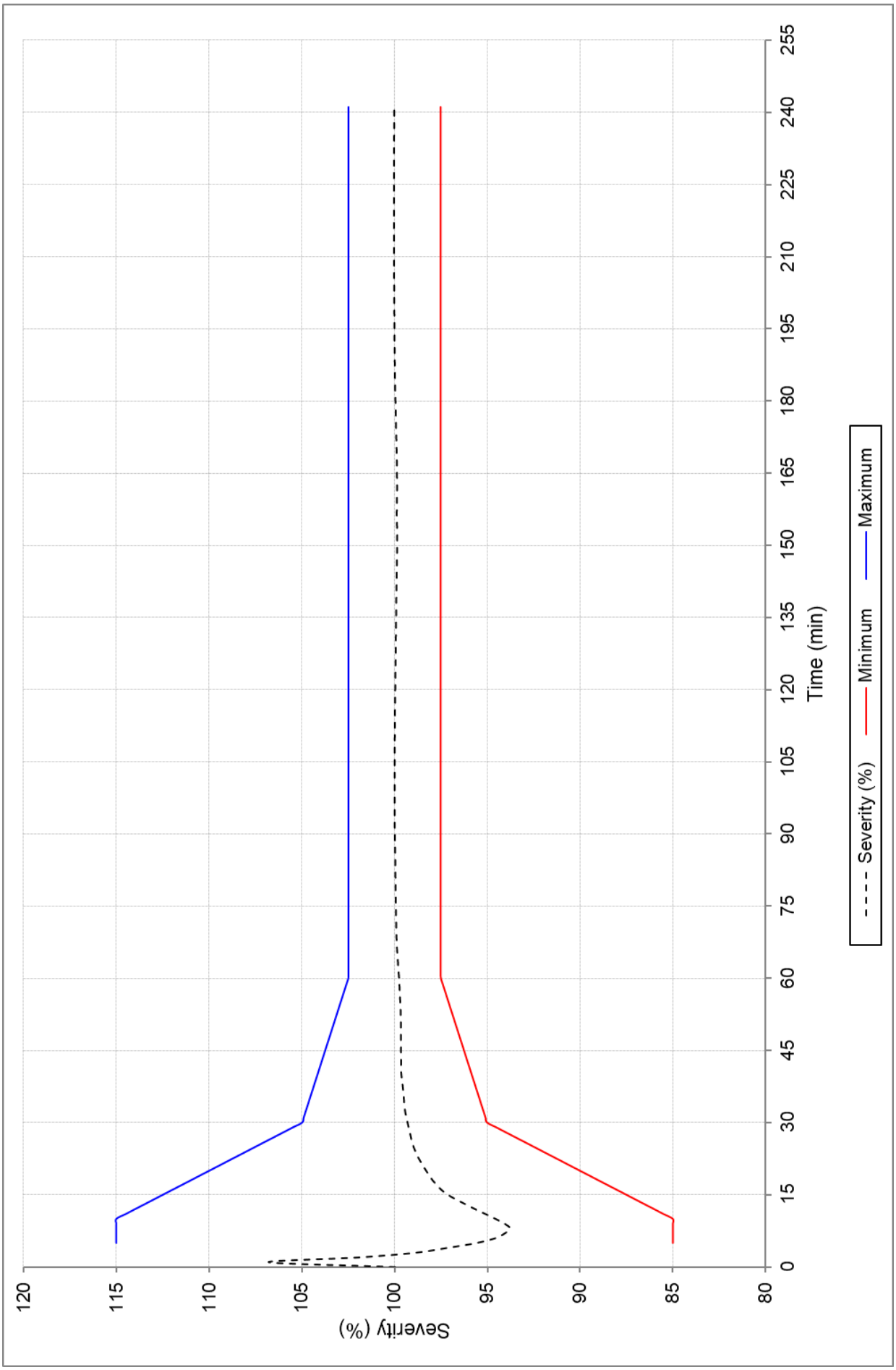


FIGURE 2 – FURNACE SEVERITY

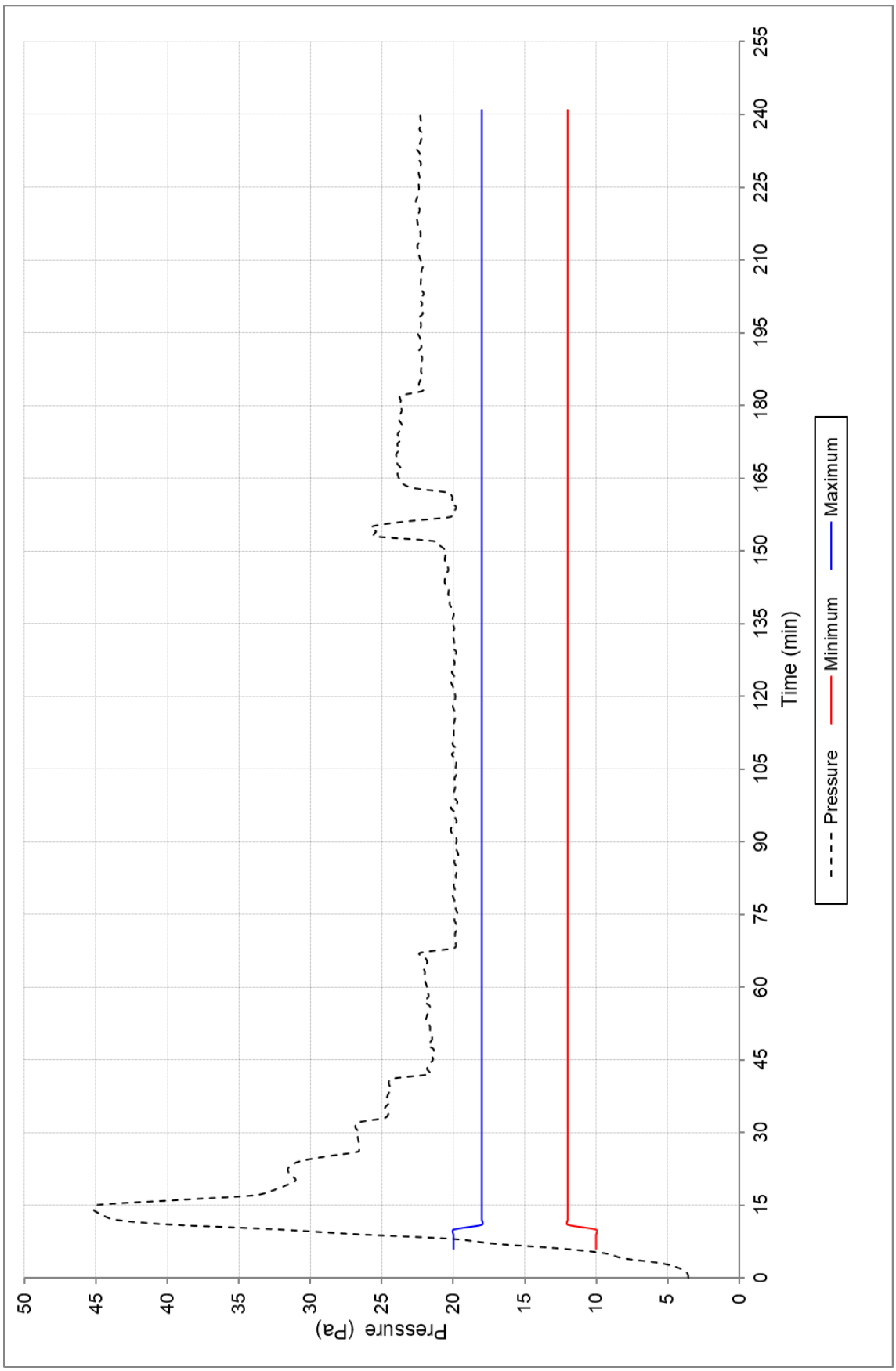


FIGURE 3 – FURNACE PRESSURE

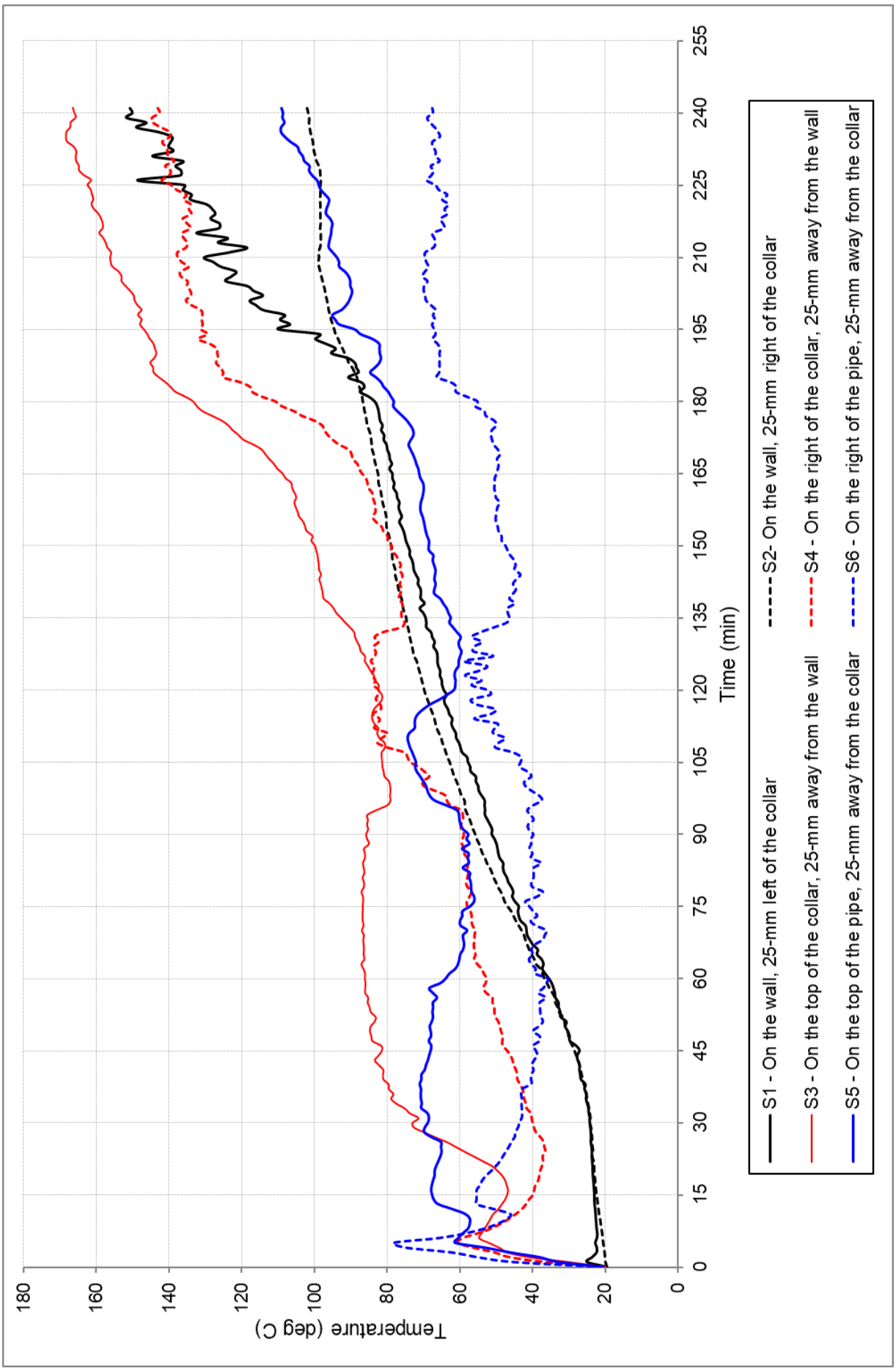


FIGURE 4 - TEMPERATURE VERSUS TIME ASSOCIATED WITH SPECIMEN #1

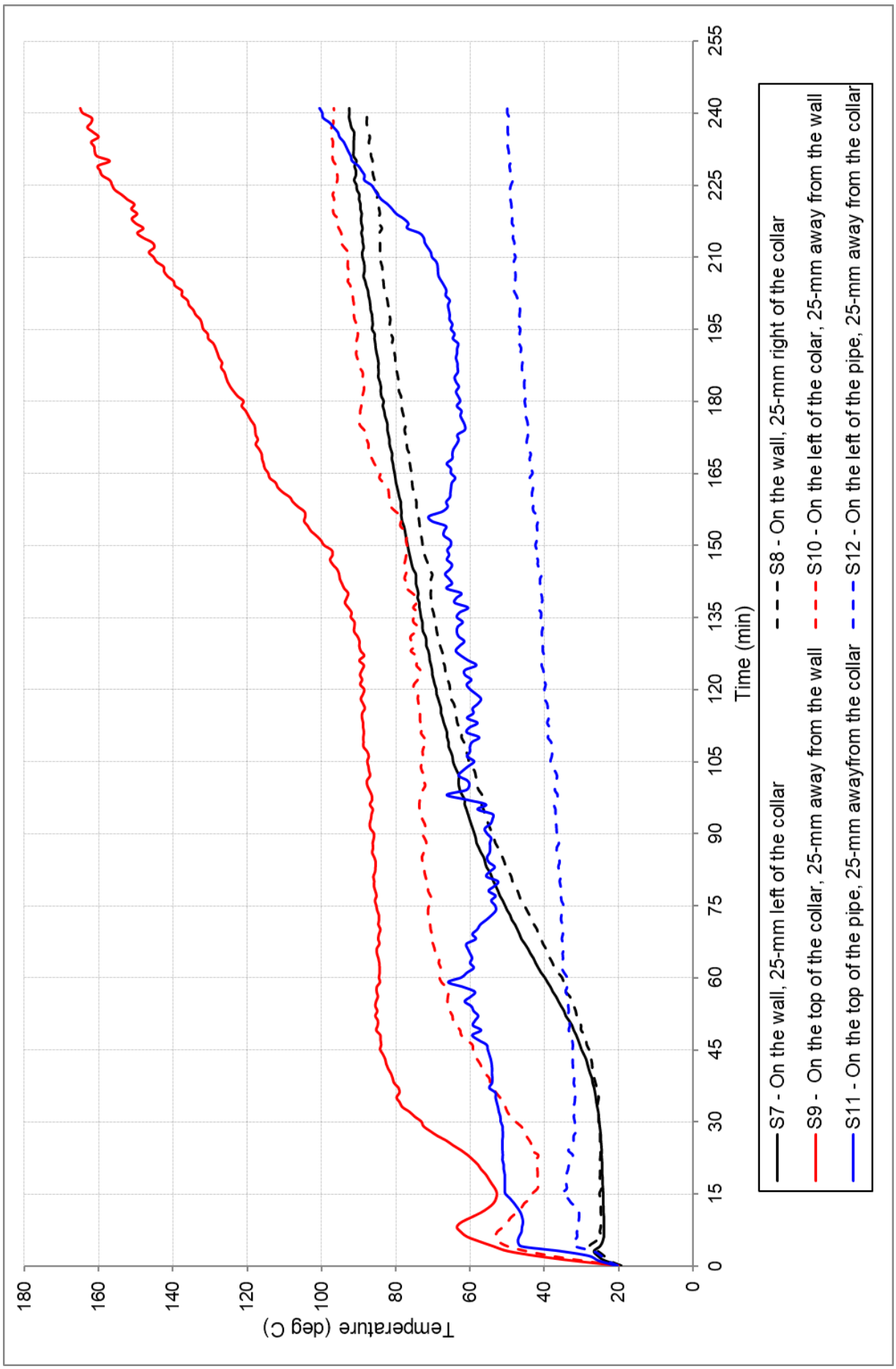


FIGURE 5 - TEMPERATURE VERSUS TIME ASSOCIATED WITH SPECIMEN #2

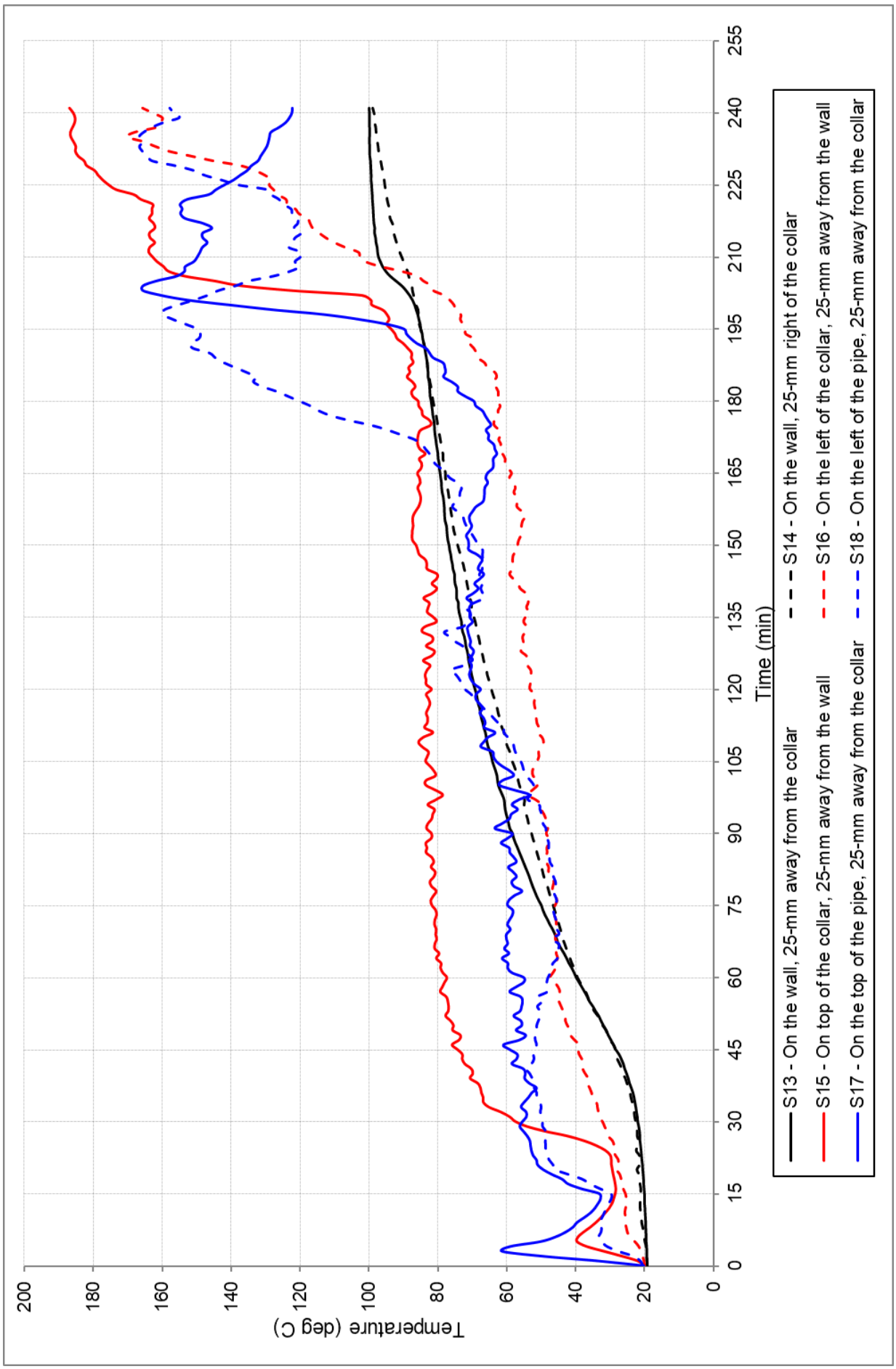


FIGURE 6 - TEMPERATURE VERSUS TIME ASSOCIATED WITH SPECIMEN #3

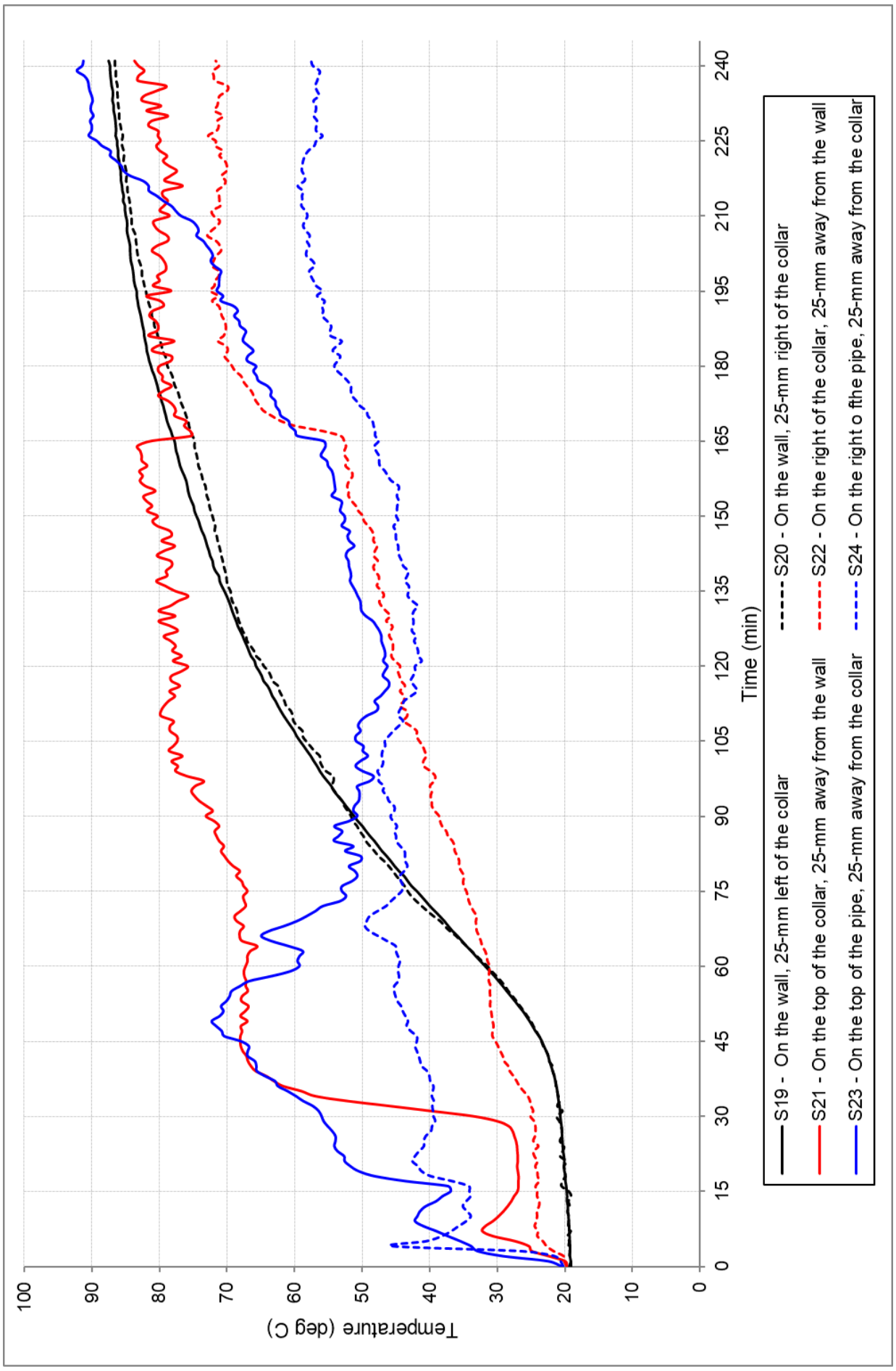


FIGURE 7 - TEMPERATURE VERSUS TIME ASSOCIATED WITH SPECIMEN #4

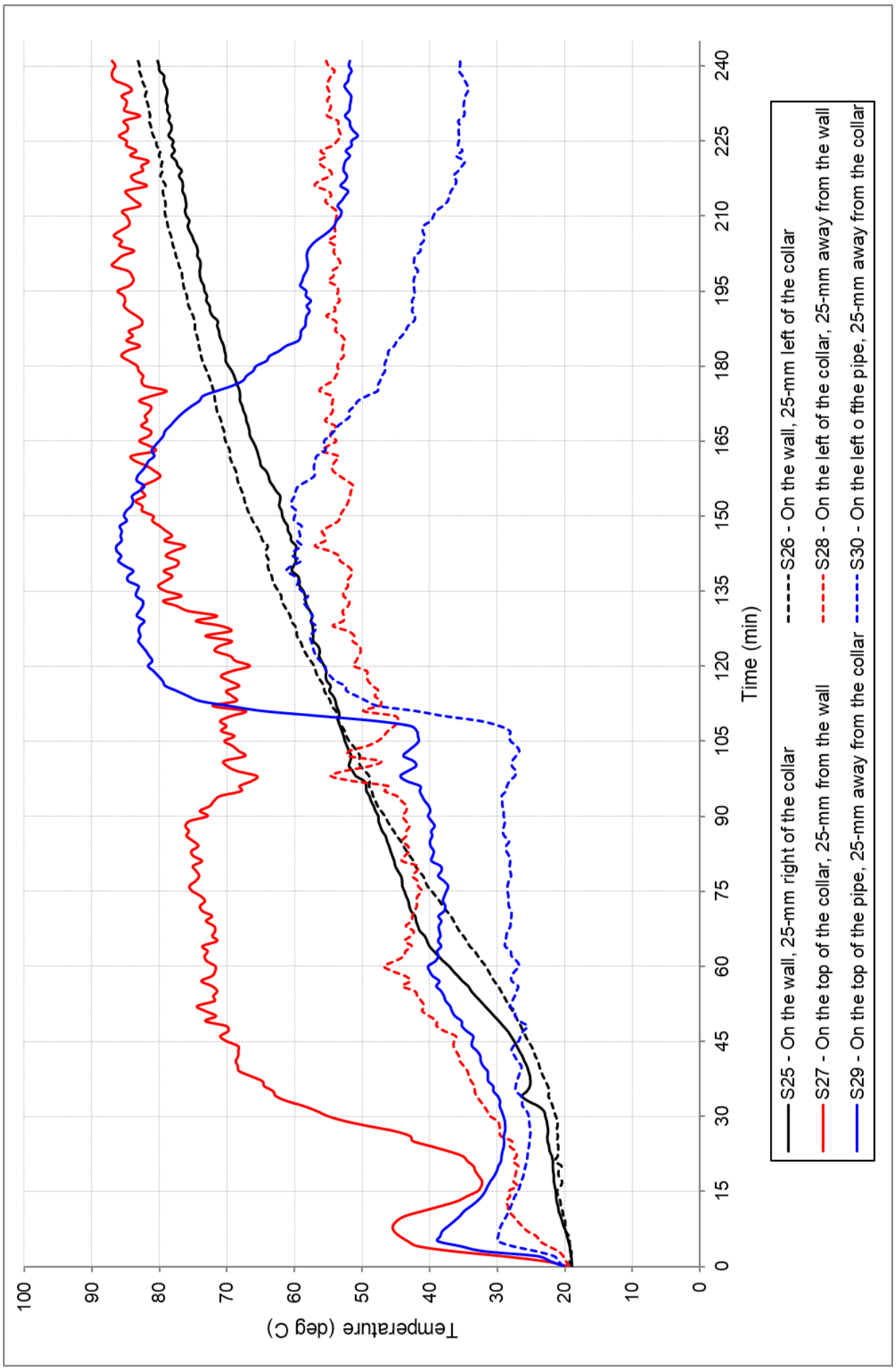


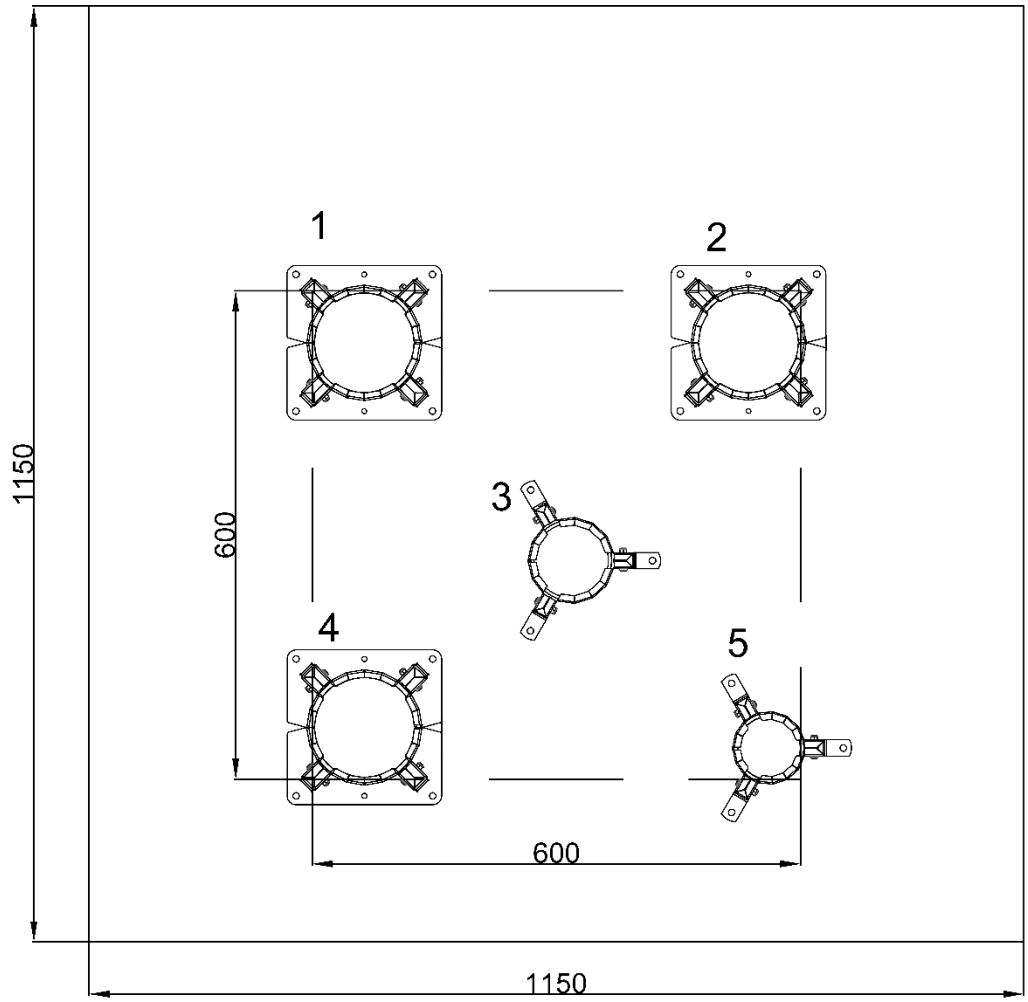
FIGURE 8 - TEMPERATURE VERSUS TIME ASSOCIATED WITH SPECIMEN #5

Appendix D – Layout and installation drawings

Snap Fire Systems Pty Ltd

Test Wall W-21-C1 Layout

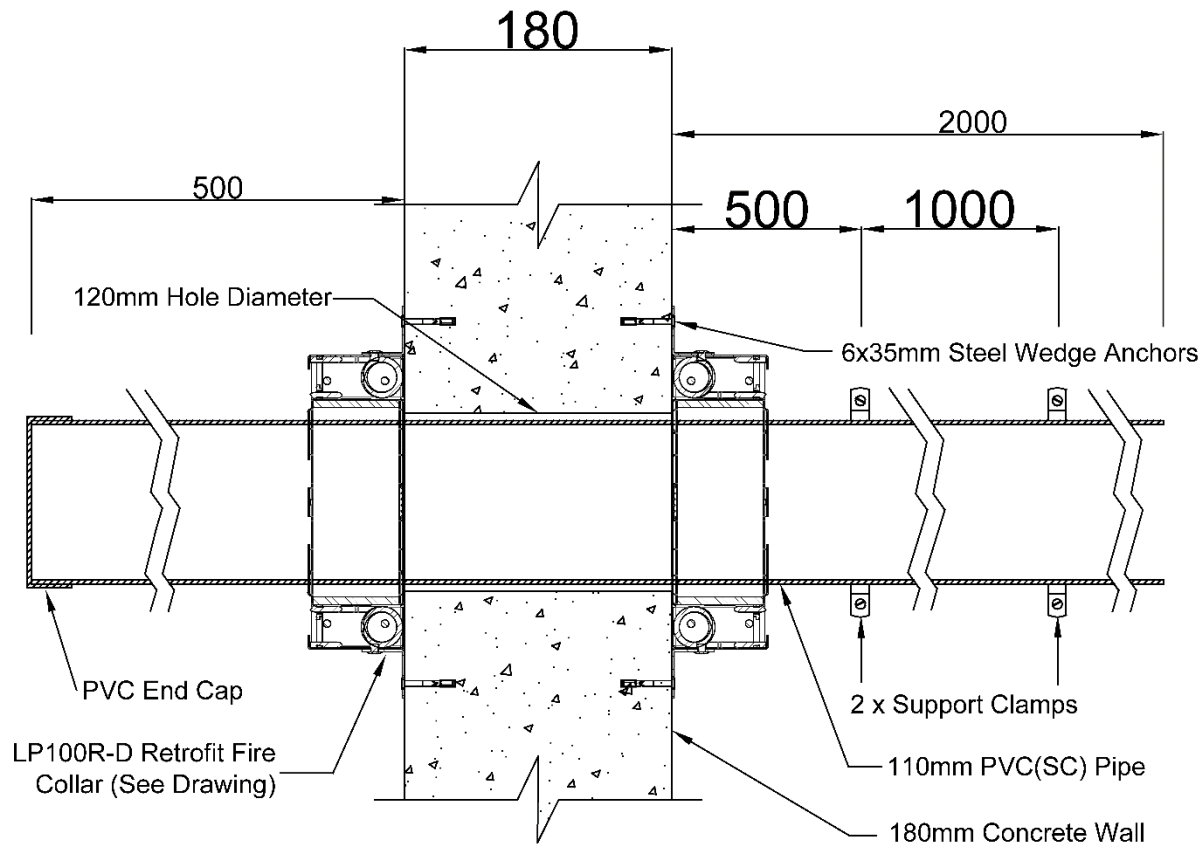
Date:29 JUL 2021



Penetration	Collar Code	Pipe Type	Pipe Diameter
1	LP100R-D	PVC(SC)	100
2	LP100R-D	HDPE	110
3	LP65R	PVC	65
4	LP100R-D	PVC	80
5	LP50R	HDPE	56

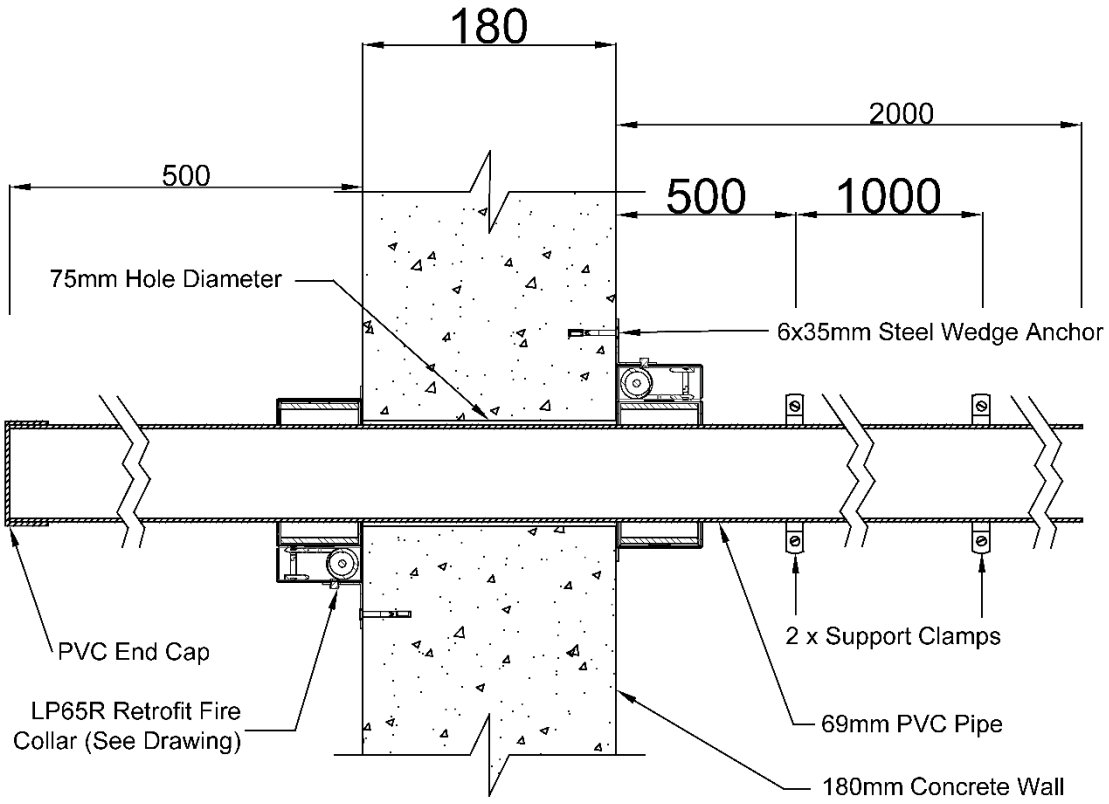
DRAWING TITLED 'TEST WALL W-21-C1 LAYOUT', DATED 29 JULY FEBRUARY 2021, BY SNAP FIRE SYSTEMS PTY LTD.

Snap Fire Systems Pty Ltd
Specimen #1
100 PVC(SC) Pipe & LP100R-D
Date: 03 NOV 2021



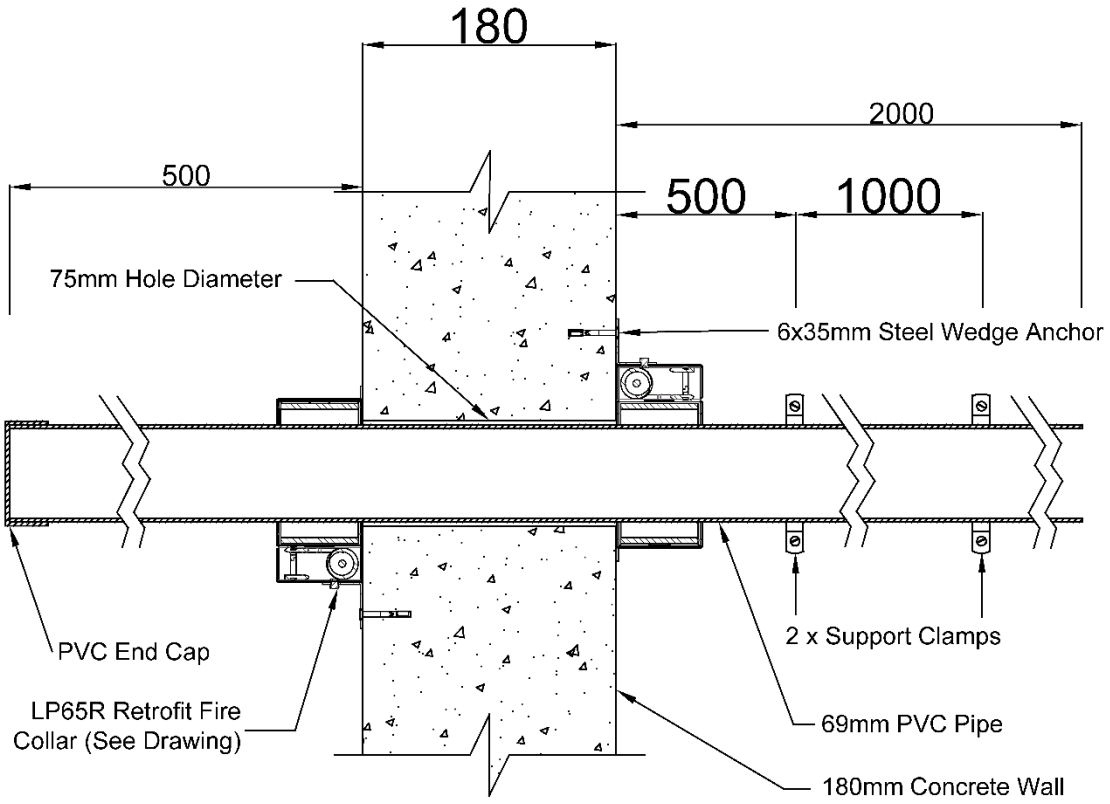
DRAWING TITLED 'SPECIMEN #1 100PVC(SC) PIPE & LP100R-D', DATED 3 NOVEMBER, BY SNAP FIRE SYSTEMS PTY LTD.

Snap Fire Systems Pty Ltd
Specimen #3
65 PVC Pipe & LP65R
Date: 11 NOV 2021



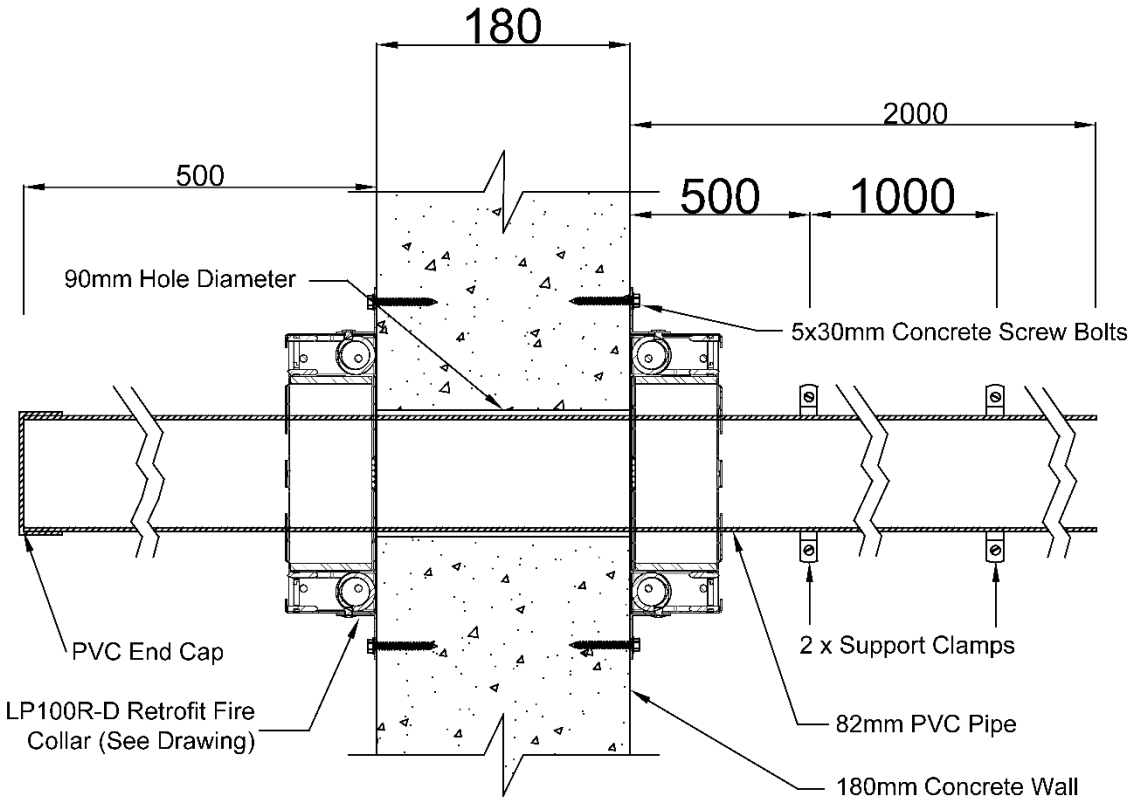
DRAWING TITLED 'SPECIMEN #2 110 PN16 PE100 PIPE & LP100R-D', DATED 14 SEPTEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd
Specimen #3
65 PVC Pipe & LP65R
Date: 11 NOV 2021



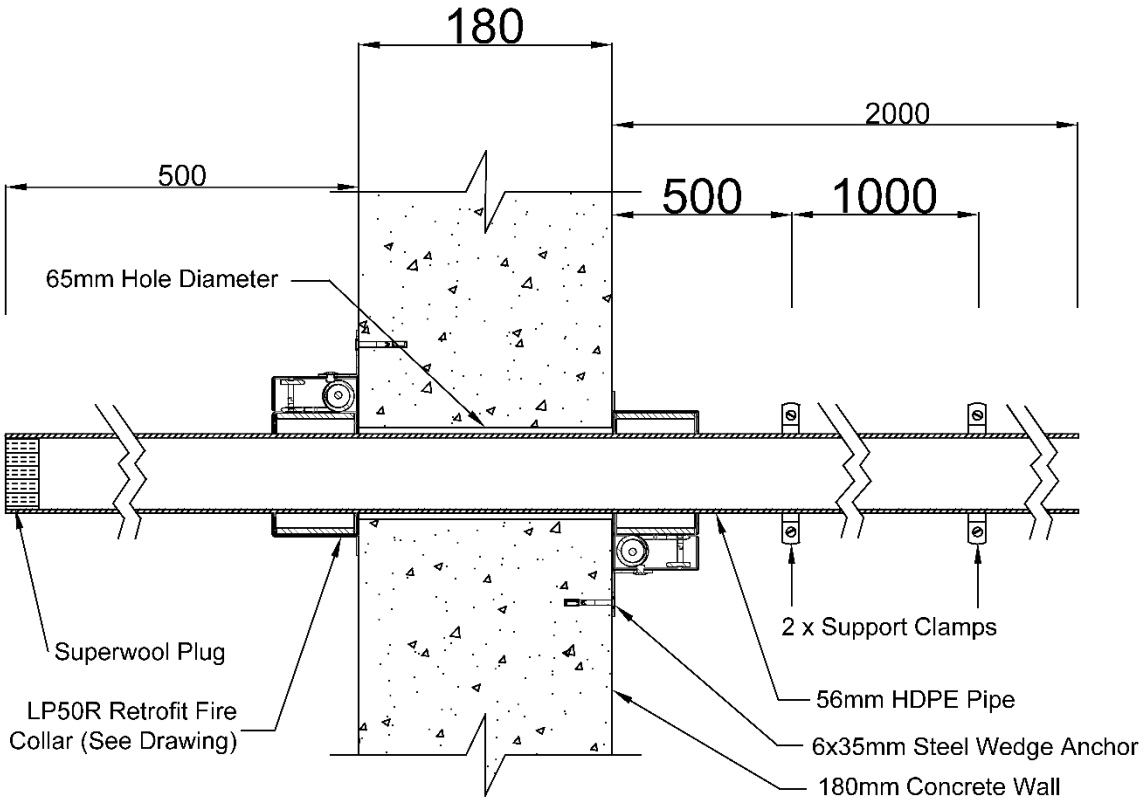
DRAWING TITLED 'SPECIMEN #3, 65 PVC PIPE & LP65R', DATED 11 NOVEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd
Specimen #4
80 PVC Pipe & LP100R-D
Date: 11 NOV 2021



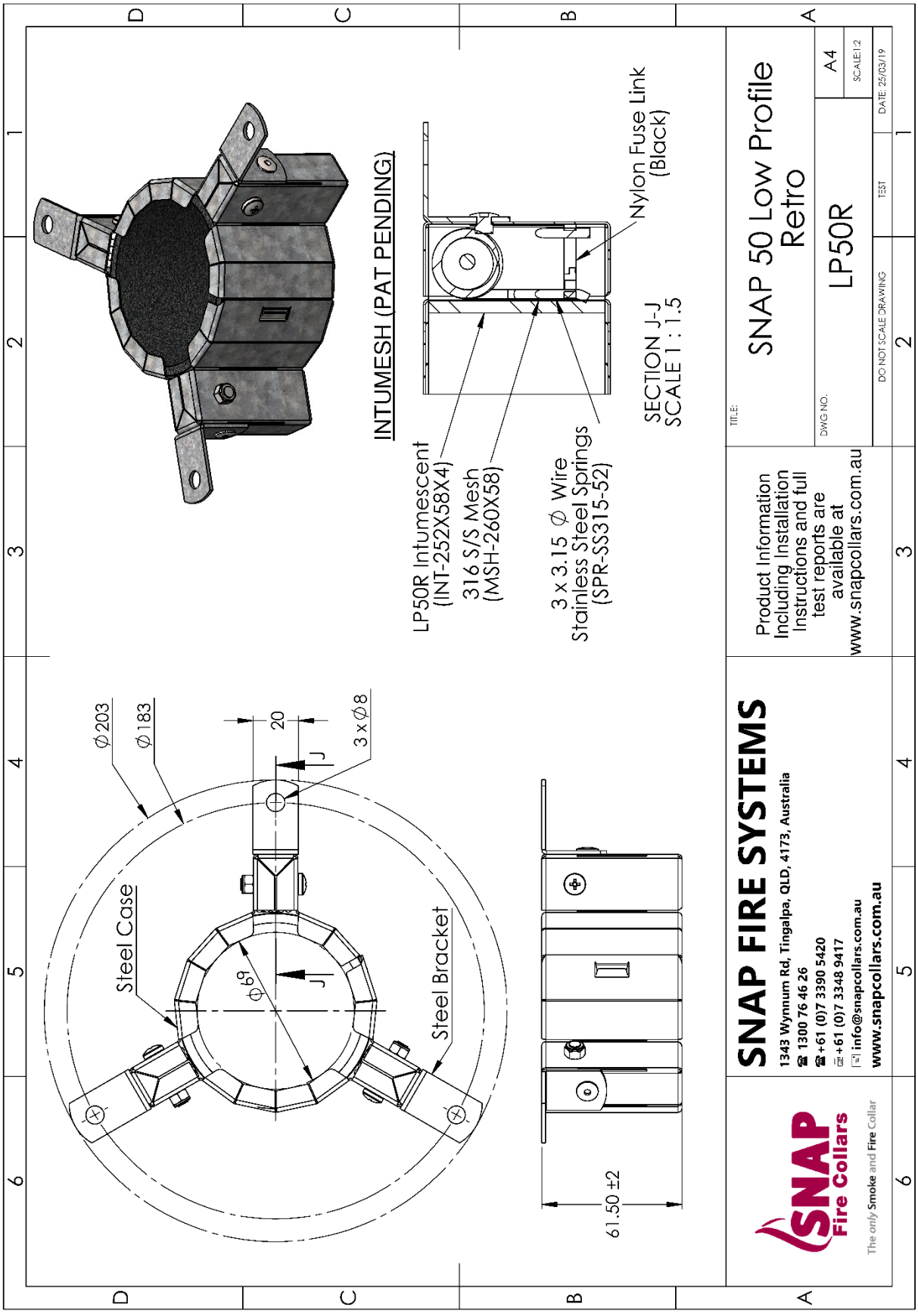
DRAWING TITLED 'SPECIMEN #4, 80 PVC PIPE & LP100R-D', DATED 11 NOVEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd
Specimen #5
56 HDPE Pipe & LP50R
Date: 11 NOV 2021

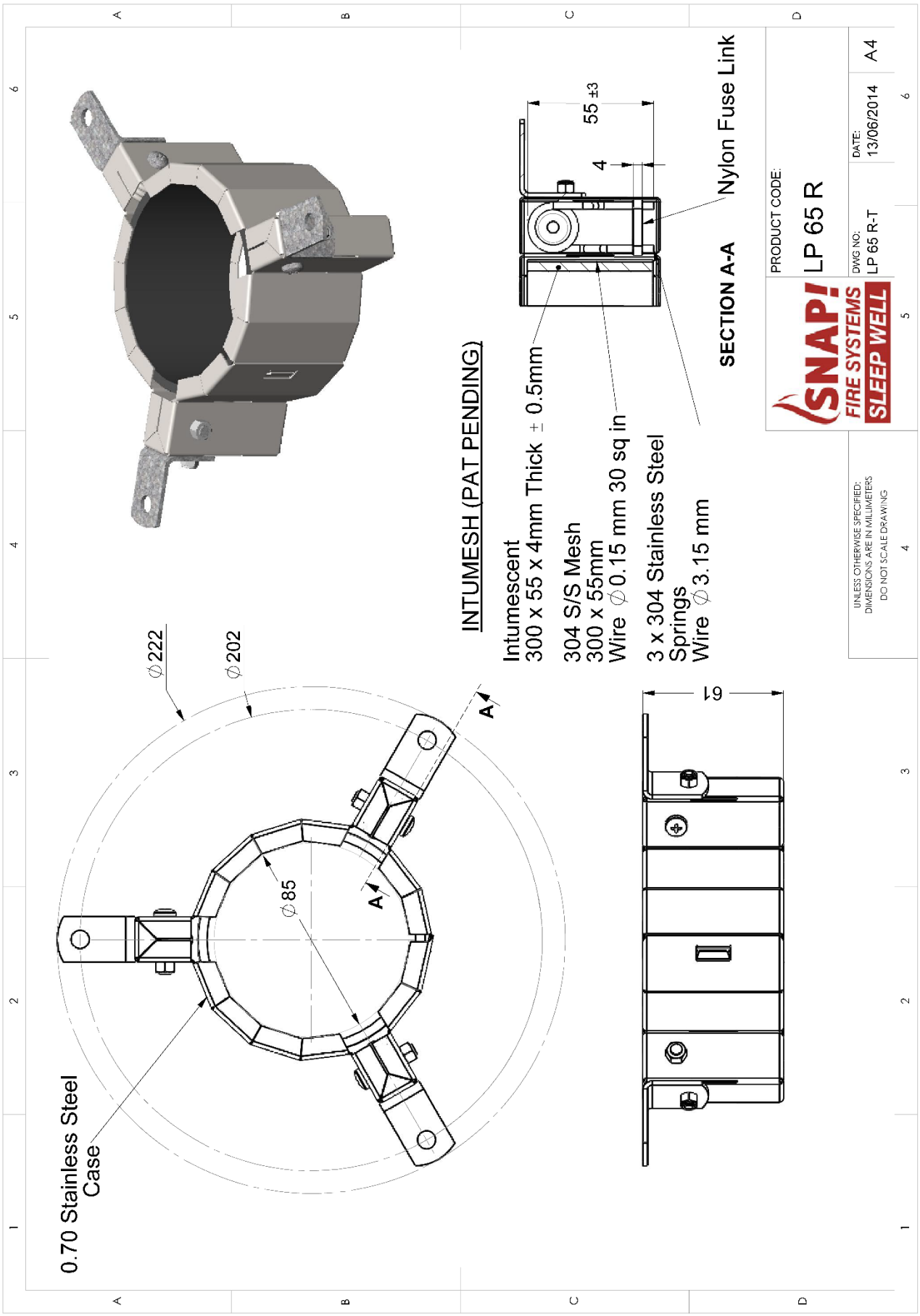


DRAWING TITLED 'SPECIMEN #5, 56 HDPE PIPE & LP50R', DATED 11 NOVEMBER 2021, BY SNAP FIRE SYSTEMS PTY LTD

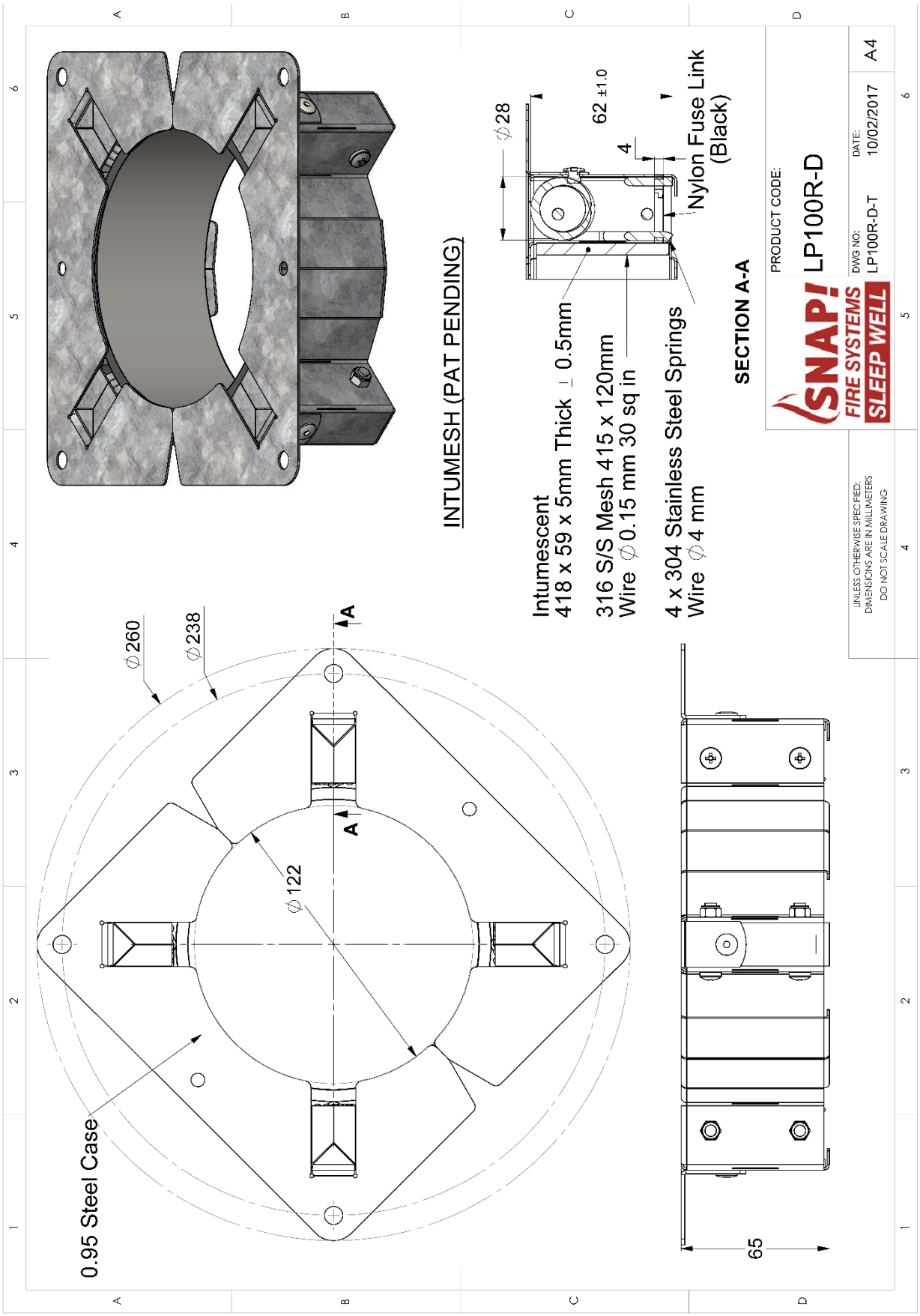
Appendix E – Specimen Drawings



DRAWING TITLED 'SNAP 50 LOW PROFILE RETRO', DATED 25 MARCH 2019, BY SNAP FIRE SYSTEMS PTY LTD.



DRAWING NUMBERED 'LP 65 R-T', DATED 13 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING NUMBERED 'LP 100R-D-T', DATED 10 FEBRUARY 2017, BY SNAP FIRE SYSTEMS PTY LTD

Appendix F – Certificate(s) of Test

INFRASTRUCTURE TECHNOLOGIES
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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. 3666

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
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 numbered FSP 2246.

Product Name: SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Iplex PVC-SC pipe penetrating a 120-mm diameter opening (Specimen 1)

Description: The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services. The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 – Concrete structures. For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5. Specimen 1 is the subject of this Certificate. The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh. The fire collars were centrally located over a 120-mm diameter opening on both faces of the concrete wall and fixed through the 4 mounting backets using 6 x 35-mm steel wedge masonry anchors. The penetrating service comprised of a 110-mm outer diameter Iplex PVC-U (PVC SC) pipe with a nominal wall thickness of 3.3-mm fitted through the opening and the fire collar sleeve. The pipe projected horizontally approximately 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end. The Sponsor provided drawings titled 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd and 'Specimen #1 100PVC(SC) Pipe & LP100R-D', dated 3 November 2021 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 -/240/240.

The fire-resistance level 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 wall system 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: Glenn Williams Date of Test: 1 November 2021

Issued on the 23rd day of December 2021 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

COPY OF CERTIFICATE OF TEST – NO. 3666

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. 3667

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
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 numbered FSP 2246.

Product Name: SNAP LP100R-D retrofit fire collars protecting a nominal 110-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 120-mm diameter opening (Specimen 2)

Description: The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services. The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 – Concrete structures. For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5. Specimen 2 is the subject of this Certificate. The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh. The fire collars were centrally located over a 120-mm diameter opening on both faces of the concrete wall and fixed through the 4 mounting brackets using 5 x 35-mm mushroom head spikes. The penetrating service comprised of a 110-mm outer diameter Mueller Pipeline HDPE pipe with a nominal wall thickness of 5-mm fitted through the opening and the fire collar sleeve. The pipe projected horizontally approximately 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and plugged with 40-mm thick ceramic fibre on the exposed end. The Sponsor provided drawings numbered 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd and 'Specimen #2 110 HDPE Pipe & LP100R-D', dated 3 November 2021 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 -/240/240.

The fire-resistance level 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 wall system 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: Glenn Williams Date of Test: 1 November 2021

Issued on the 23rd day of December 2021 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. 3667

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. 3668

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
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 numbered FSP 2246.

Product Name: SNAP LP65R retrofit fire collars protecting a nominal 69-mm outer diameter Iplex PVC-U pipe penetrating a 75-mm diameter opening (Specimen 3)

Description: The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services. The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 – Concrete structures. For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5. Specimen 3 is the subject of this Certificate. The SNAP LP65R retrofit fire collar comprised of a 0.7-mm thick, 85-mm inner diameter stainless-steel casing. The 61-mm high collar casing incorporated a closing mechanism which comprised a 4-mm thick 54-mm wide x 300-mm long Intumesh intumescent wrap lined around the internal circumference of the collar casing. The closing mechanism comprised three 3.15-mm stainless steel springs with nylon fuse links and a 300-mm x 55-mm stainless steel mesh. The fire collars were centrally located over a 75-mm diameter opening on both faces of the concrete wall and fixed through the 3 mounting brackets using 6 x 35-mm steel wedge masonry anchors. The penetrating service comprised of a 69-mm outer diameter Iplex PVC pipe with a nominal wall thickness of 2.9-mm fitted through the opening and the fire collar sleeve. The pipe projected 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end. The Sponsor provided drawing numbered 'LP 65 R', dated 13 June 2014, by Snap Fire Systems Pty Ltd and drawing titled 'Specimen 3 65 PVC Pipe & LP65R', dated 11 November 2021 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 -/240/240.

The fire-resistance level 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 wall system 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: Glenn Williams Date of Test: 1 November 2021

Issued on the 23rd day of December 2021 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

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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. 3669

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
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 numbered FSP 2246.

Product Name: SNAP LP100R-D retrofit fire collars protecting a nominal 82-mm outer diameter Iplex PVC-U pipe penetrating a 90-mm diameter opening (Specimen 4)

Description: The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services. The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 – Concrete structures. For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5. Specimen 4 is the subject of this Certificate. The SNAP LP100R-D retrofit fire collar comprised a 0.95-mm thick steel casing with a 122-mm inner diameter and a nominal 184-mm square 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 nylon fuse links and a 415-mm x 120-mm stainless steel mesh. The fire collars were centrally located over a 90-mm diameter opening on both faces of the concrete wall and fixed through the four mounting brackets using 5 x 30-mm concrete screw bolts. The penetrating service comprised of an 82-mm diameter Iplex PVC(SC) pipe with a nominal wall thickness of 3.3-mm fitted through the opening and the collars sleeve. The pipe projected horizontally 2000-mm away from the unexposed face of the concrete wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominal 500 mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and closed off with a PVC cap on the exposed end. The Sponsor provided drawing numbered 'LP100R-D-T' dated 10 February 2017, by Snap Fire Systems Pty Ltd and drawing titled 'Specimen #4 80 PVC Pipe & LP100R-D', dated 3 November 2021 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 -/240/240.

The fire-resistance level 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 wall system 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: Glenn Williams Date of Test: 1 November 2021

Issued on the 23rd day of December 2021 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

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

No. 3670

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
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 numbered FSP 2246.

Product Name: SNAP LP50R retrofitted fire collars protecting a nominal 56-mm outer diameter Mueller Pipeline HDPE pipe penetrating a 65-mm diameter opening (Specimen 5)

Description: The sponsor described the specimen as five (5) retrofit fire collars protecting a 180-mm thick concrete wall penetrated by five (5) services. The 180-mm thick concrete wall was reinforced with a single layer of steel reinforcement providing a Fire Resistance period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 – Concrete structures. For the purpose of testing, the penetrations were referenced as Specimens 1, 2, 3, 4 and 5. Specimen 5 is the subject of this Certificate. The SNAP LP50R retrofit fire collar comprised of a 0.75-mm thick steel casing with a 69-mm inner diameter. The 61.5-mm high collar casing incorporated a closing mechanism which comprised a 4 mm thick x 58-mm wide x 252-mm long Intumesh intumescent wrap lined around the internal circumference of the collar casing. The closing mechanism is comprised of three 3.15-mm diameter stainless steel springs with nylon fuse links and a 260-mm x 58-mm stainless steel mesh. The fire collars were centrally located over a 65-mm diameter opening on both faces of the concrete wall and fixed through the 3 mounting backets using 6 x 35-mm steel wedge anchors. The penetrating service comprised of a 55-mm outer diameter Mueller Pipelines HDPE pipe with a nominal wall thickness of 3.5-mm fitted through the opening and collar sleeve. The pipe was supported at nominal 500-mm and 1500-mm from the unexposed face of the concrete wall. The pipe was left open on the unexposed end and plugged with 40-mm thick ceramic fibre on the exposed end. The Sponsor provided drawing titled 'SNAP 50 Low Profile Retro' dated 25 March 2019 by Snap Fire systems Pty Ltd and drawing titled 'Specimen #5 56 HDPE Pipe & LP50R' dated 11 November 2021 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 -/240/240.

The fire-resistance level 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 wall system 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: Glenn Williams Date of Test: 1 November 2021

Issued on the 23rd day of December 2021 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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References

The following informative documents are referred to in this Report:

AS 1530.4-2014	Methods for fire tests on building materials, components and structures Part 4: Fire-resistance tests 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.

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FOR FURTHER INFORMATION

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w https://www.csiro.au/en/Do-business/Services/Materials-infrastructure/Fire-safety