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

Test Report

Author: Peter Gordon
Report number: FSP 1978
Date: 20 February 2019

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

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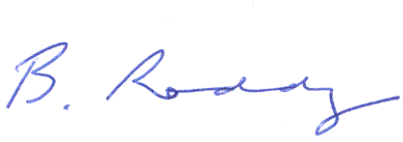
AUTHOR	REVIEWED BY	AUTHORISED BY
Peter Gordon	Glenn Williams	Brett Roddy
		
20 February 2019	20 February 2019	20 February 2019

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Contents

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

Sponsored Investigation No. FSP 1978

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as two (2) retrofit fire collars protecting a steel framed plasterboard wall system.

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 of 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 4836/4336

1.7 Test date

The fire-resistance test was conducted on 17 January 2019.

2 Description of specimen

2.1 General

The wall system is described as a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120.

The wall was penetrated by two services.

The pipe used in the test was stated to be manufactured in accordance with:

- AS/NZS 1260 'PVC-U pipes and fittings for drain, waste and vent application'; and
- ASTM F442/F442M-13e1 Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

Specimen 1 - SNAP 50R Retrofit fire collar protecting a nominal 2 inch (60.35-mm) CPVC pipe

The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and a 147-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism which comprised two soft Intumesh intumescent wraps lined within the internal circumference of the collar. Intumescent A was 4-mm thick x 43-mm wide x 220-mm long, and Intumescent B was 4-mm thick x 43-mm wide x 200-mm long. Between the strips was a layer of 316 grade stainless steel mesh 210-mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T dated 31 March 2017, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 3 mounting brackets using 38-mm (10g) course thread laminating screws.

The penetrating service comprised a 60.35-mm diameter CPVC pipe, with a wall thickness of 4.95-mm which penetrated the wall through a 63-mm diameter cut-out hole as shown in drawing titled "Specimen # 1, 2 Inch CPVC Pipe & 50R, dated 22 November 2018", provided by Snap Fire Systems Pty Ltd. The pipe projected horizontally, 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm, and 1500-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with a Superwool plug on the exposed end.

Specimen 2 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) pipe

The SNAP retrofit HP250R-B collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 453-mm diameter base flange. The 184-mm high collar casing incorporated two strips of Intumesh intumescent material, 910-mm x 179-mm x 12-mm thick and 958-mm x 179-mm x 2.5-mm thick. The closing mechanism comprised five stainless steel springs, with a nylon fuse link, and a 949-mm x 174-mm 316 stainless steel mesh located in between the intumescent strips as shown in drawing numbered HP 250R-B-T dated 15 August 2017, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 5 mounting brackets using 8-mm threaded rod and 12 x M8 nuts.

The penetrating service comprised a 250-mm PVC pipe, with a wall thickness of 6.66-mm fitted through the collar's sleeve. The pipe penetrated the wall through a 265-mm diameter opening and projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber. The pipe was supported at nominally 500-mm, and 1500-mm from the unexposed face of the plasterboard wall, as shown in drawing titled "Specimen #2, 225 PVC Pipe & HP250R-B" dated 22 November 2018, provided by Snap Fire Systems Pty Ltd. The pipe was open on the unexposed end and capped on the exposed end with a PVC end cap.

2.2 Dimensions

The wall specimen was nominally 1150-mm wide x 1150-mm high x 116-mm thick. All dimensions are nominal.

2.3 Orientation

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

2.4 Conditioning

The specimen wall was delivered on 14th January 2019 and stored under laboratory atmospheric conditions until the test date.

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-18-F Layout", dated 21 November 2018, by Snap Fire Systems Pty Ltd
- Drawing titled "Specimen #1, 2 Inch C-PVC Pipe & 50R, dated 22 November 2018", provided by Snap Fire Systems Pty Ltd.
- Drawing titled "Specimen #2, 225 PVC Pipe & HP250R-B" dated 22 November 2018, provided by Snap Fire Systems Pty Ltd.
- Drawing numbered 50R-T dated 31 March 2017, by Snap Fire Systems Pty Ltd.
- Drawing numbered HP 250R-B-T dated 15 August 2017, 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 32°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 181 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 inside the collar of Specimen 2 and furnace flues.
2 minutes -	Smoke being emitted from the collar of Specimen 2 has increased.
3:30 minutes -	Smoke is being emitted from the furnace flues in large quantities. Smoke is fluing from Specimen 2.
4:30 minutes -	Smoke is fluing from Specimen 1.
5:30 minutes -	Smoke fluing from Specimen 1 has ceased.
11 minutes -	Discolouration around the plasterboard wall around the collar of Specimen 2.
17 minutes -	Smoke fluing from Specimen 2 has reduced, however fluing of smoke between the collar and pipe continues, adjacent to Thermocouple #11.
21 minutes -	Smoke fluing from Specimen 2 has further reduced, however fluing of smoke between the collar and pipe continues.
60 minutes -	Fluing of smoke between the collar and pipe of Specimen 2 continues. Smoke is fluing from Specimen 1 again.
136 minutes -	Liquid has started dripping from the ends of the pipes of Specimens 1 and 2.
157 minutes -	Insulation Failure of Specimen 1 – maximum temperature rise of 180K is exceeded from the plasterboard above the collar on the unexposed face. Discolouration of the plasterboard wall is visible around the collar of Specimen 1 on the top right side.
173 minutes -	Insulation Failure of Specimen 2 – maximum temperature rise of 180K is exceeded from the plasterboard above the collar on the unexposed face.
181 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.

8.5 Performance

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

Specimen 1 - SNAP 50R Retrofit fire collar protecting a nominal 2 inch (60.35-mm OD) CPVC pipe.

Structural adequacy	-	not applicable
Integrity	-	no failure at 181 minutes
Insulation	-	157 minutes

Specimen 2 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) pipe.

Structural adequacy	-	not applicable
Integrity	-	no failure at 181 minutes
Insulation	-	173 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 this standard. Any significant variation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

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

9 Fire-resistance level (FRL)

For the purpose of building regulations in Australia, the FRL of the test specimen was:-

Specimen 1 - -/120/120

Specimen 2 - -/120/120

The fire-resistance level is applicable when the system is exposed to fire from either direction.

The fire-resistance level (FRL) is limited to that of the separating element.

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 10.11 of AS 1530.4-2014, have been made provided no individual component is removed or reduced.

11 Tested by

Peter Gordon
Testing Officer

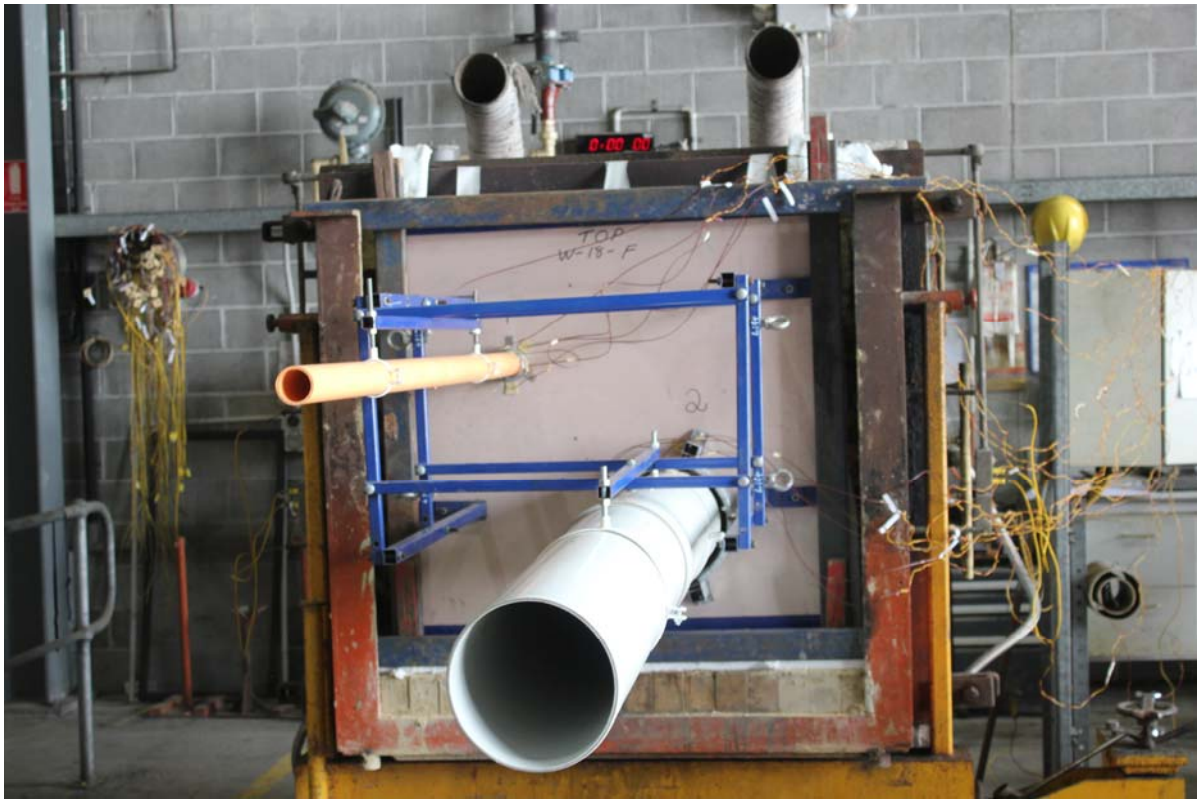
Appendices

Appendix A – Measurement location

Specimen	T/C Position	T/C designation
Specimen 1	On p/b, 25-mm above collar	S1
	On p/b, 25-mm right of collar	S3
	On top of collar 25-mm from P/B	S3
	Right side of collar 25-mm from P/B	S4
	On pipe 25-mm from collar left top	S5
	On pipe 25-mm from collar right top	S6
Specimen 2	On p/b, 25-mm above collar	S7
	On p/b, 25-mm left of collar	S8
	On top of collar 25-mm from P/B	S9
	Left side of collar 25-mm from P/B	S10
	On pipe 25-mm from collar top	S11
	On pipe 25-mm from collar left	S12
Rover	Rover	S13
Ambient	Ambient	S14

Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

PHOTOGRAPH 3 – SPECIMEN 2 AFTER 2 MINUTES OF TESTING

PHOTOGRAPH 4 – SPECIMENS AFTER 17 MINUTES OF TESTING

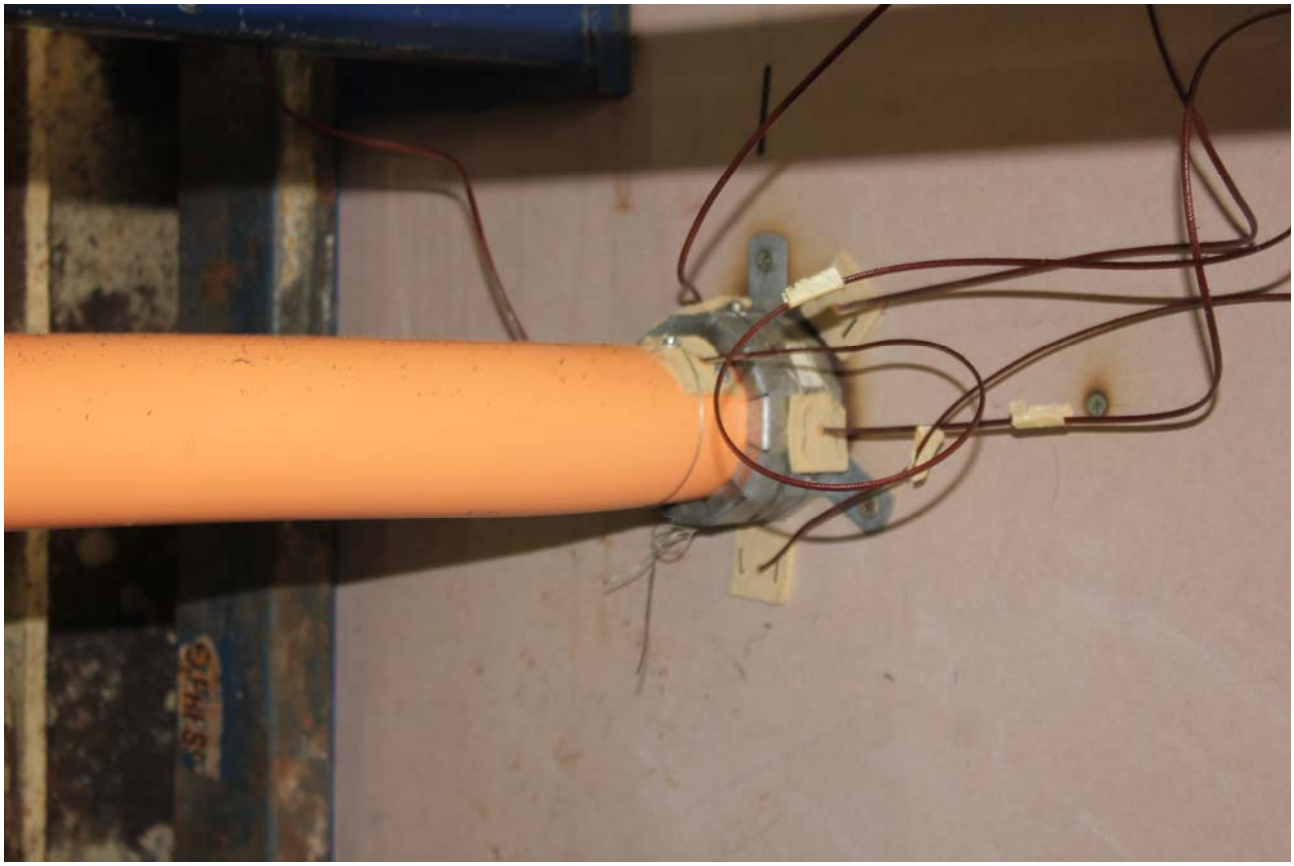
PHOTOGRAPH 5 – SPECIMENS AFTER 30 MINUTES OF TESTING

PHOTOGRAPH 6 – SPECIMENS AFTER 60 MINUTES OF TESTING

PHOTOGRAPH 7 – SPECIMENS AFTER 90 MINUTES OF TESTING

PHOTOGRAPH 8 – SPECIMENS AFTER 120 MINUTES OF TESTING

PHOTOGRAPH 9 – SPECIMENS AFTER 136 MINUTES OF TESTING

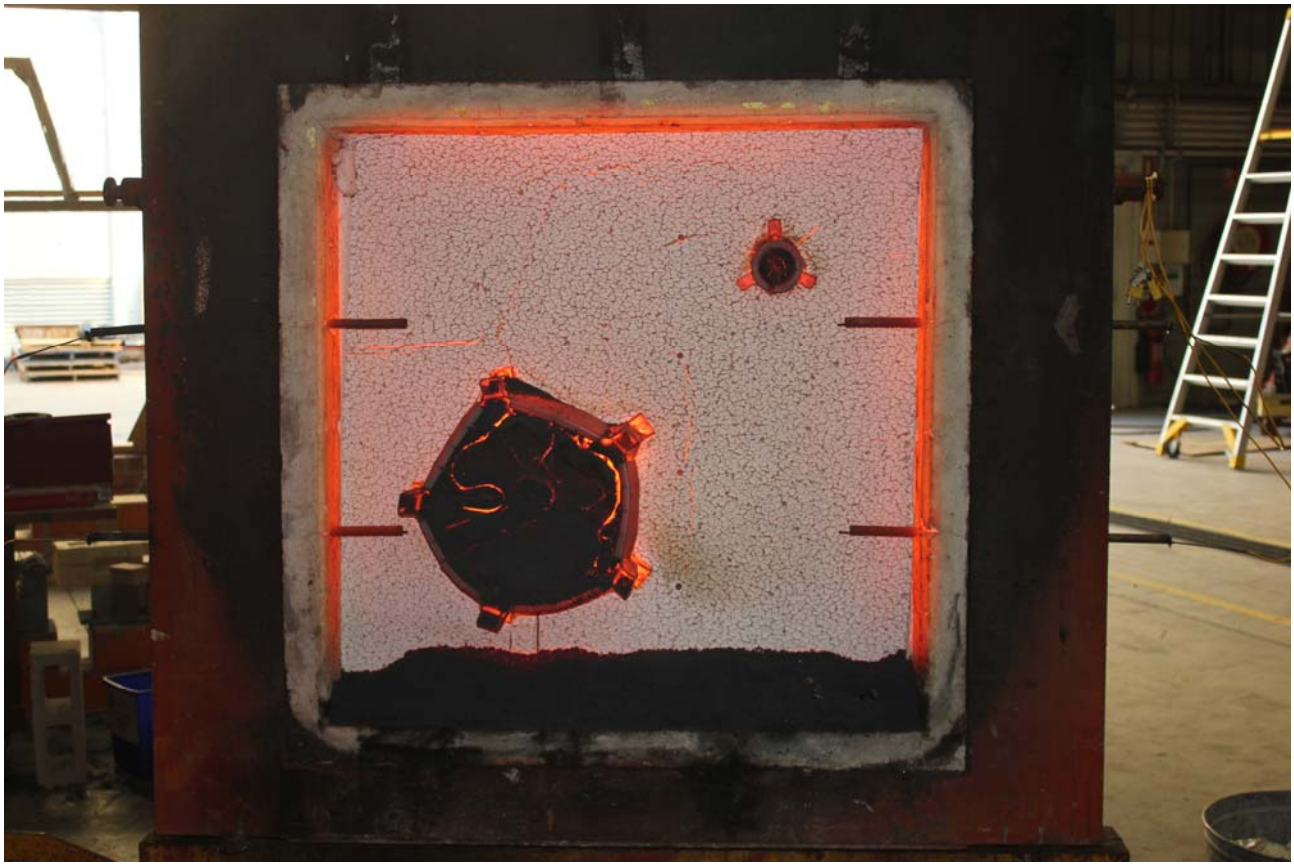


PHOTOGRAPH 10 – SPECIMEN 1 AFTER 157 MINUTES OF TESTING

PHOTOGRAPH 11 – SPECIMEN 2 AFTER 170 MINUTES OF TESTING

PHOTOGRAPH 12 – SPECIMENS AFTER 180 MINUTES OF TESTING

PHOTOGRAPH 13 – UNEXPOSED FACE OF SPECIMENS AT THE CONCLUSION OF TESTING



PHOTOGRAPH 14 – EXPOSED FACE OF SPECIMENS AT CONCLUSION OF TESTING

Appendix C – Furnace Temperature

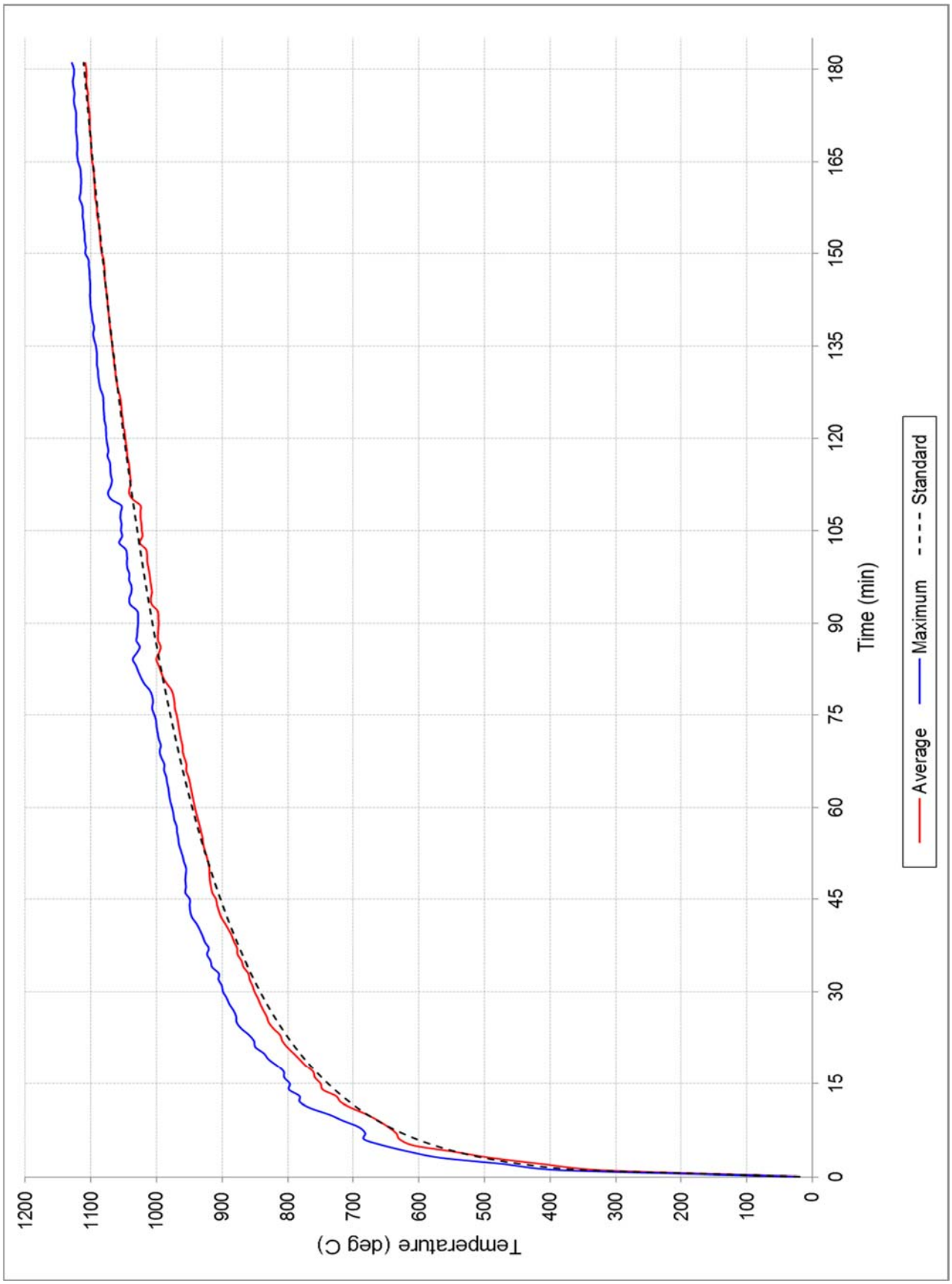


FIGURE 1 – FURNACE TEMPERATURE

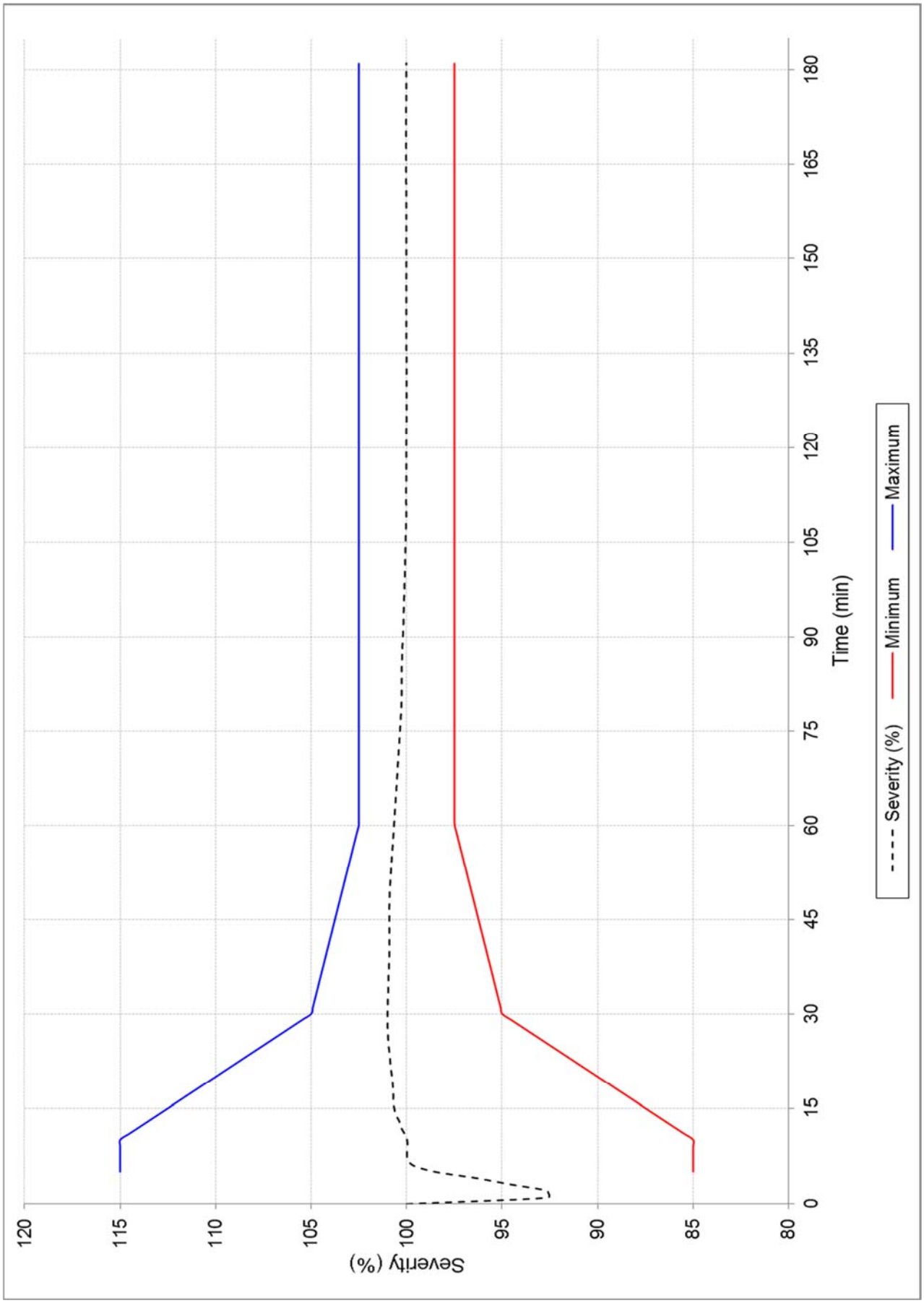


FIGURE 2 – FURNACE SEVERITY

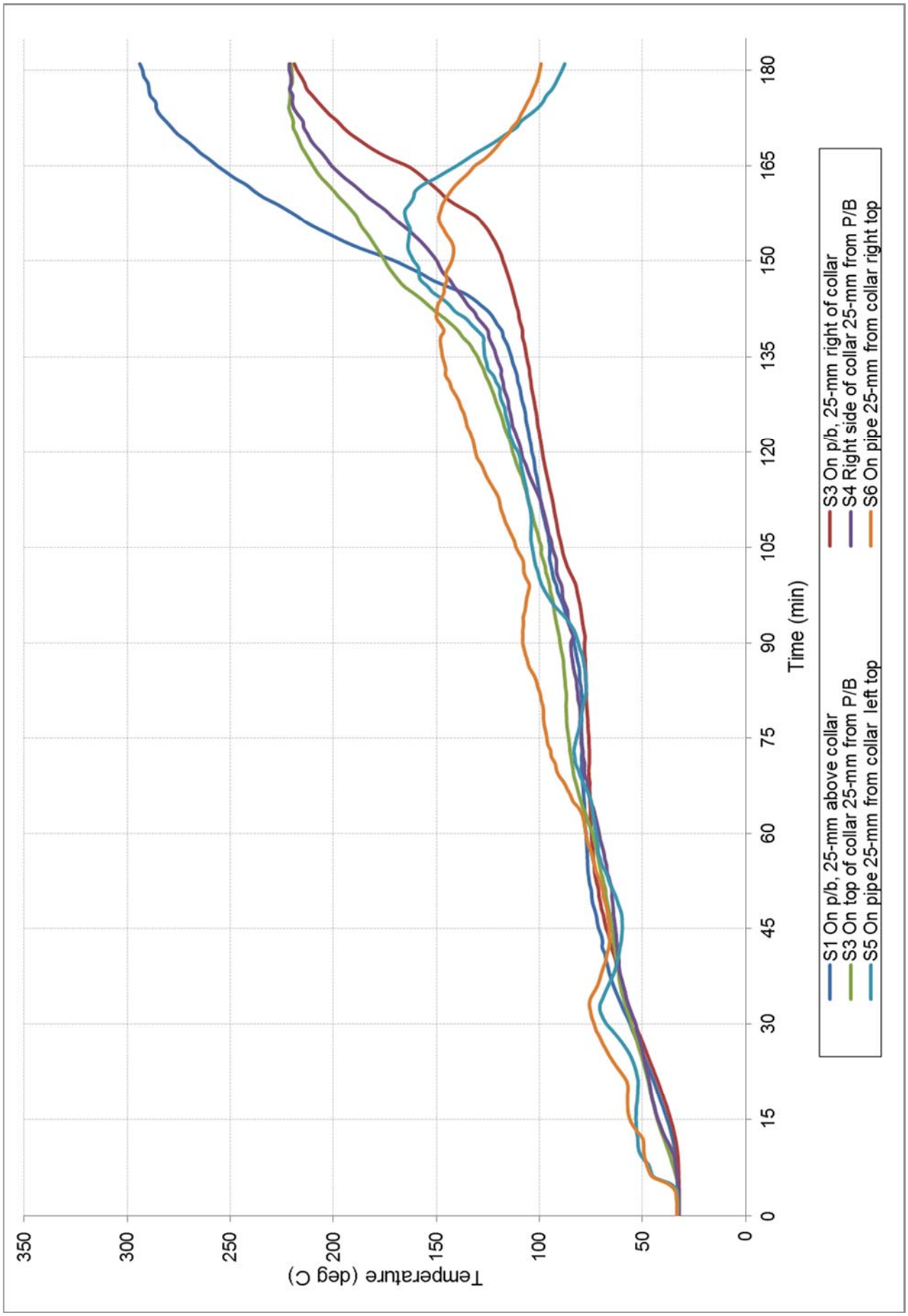


FIGURE 3 - SPECIMEN 1 TEMPERATURE

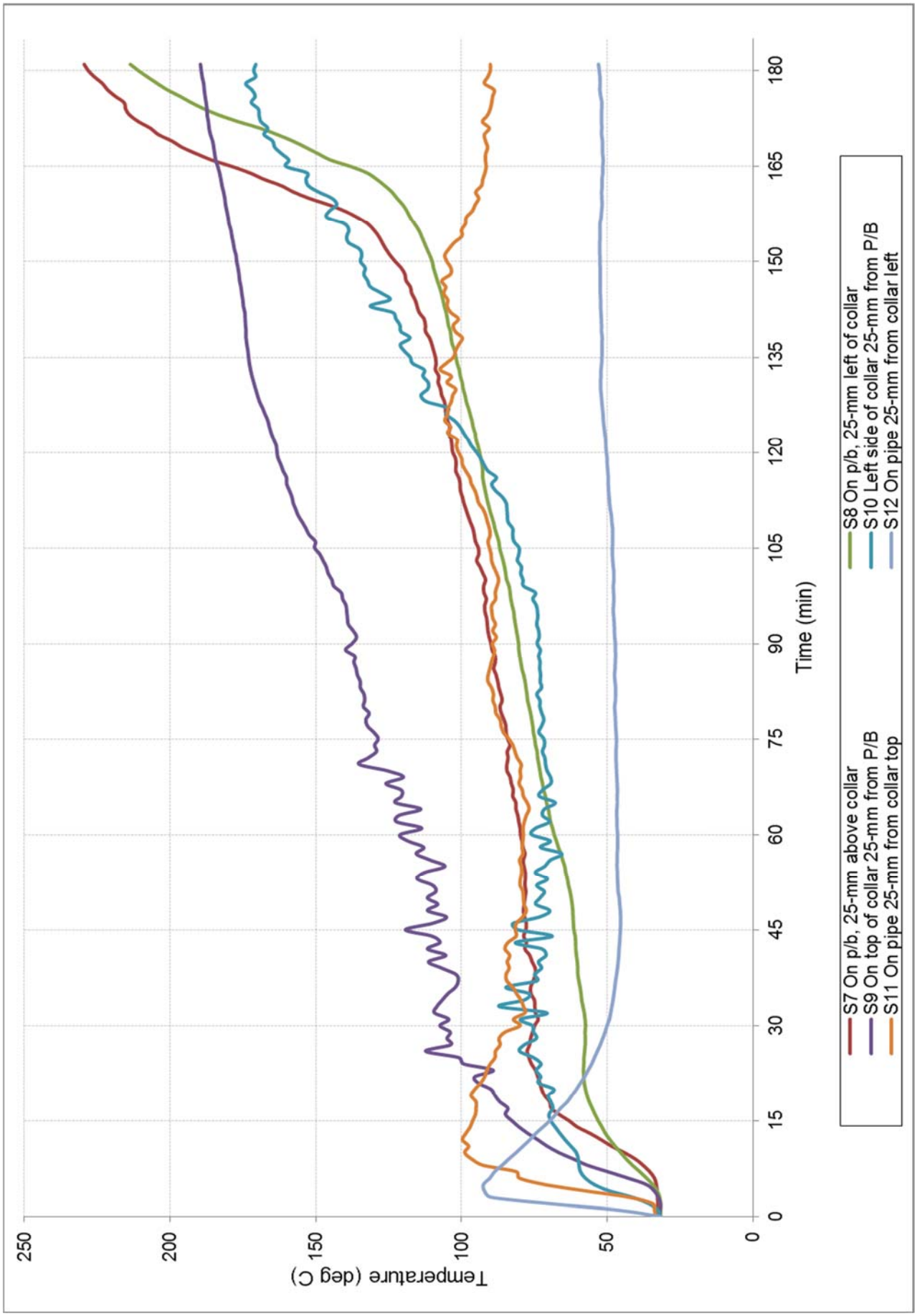
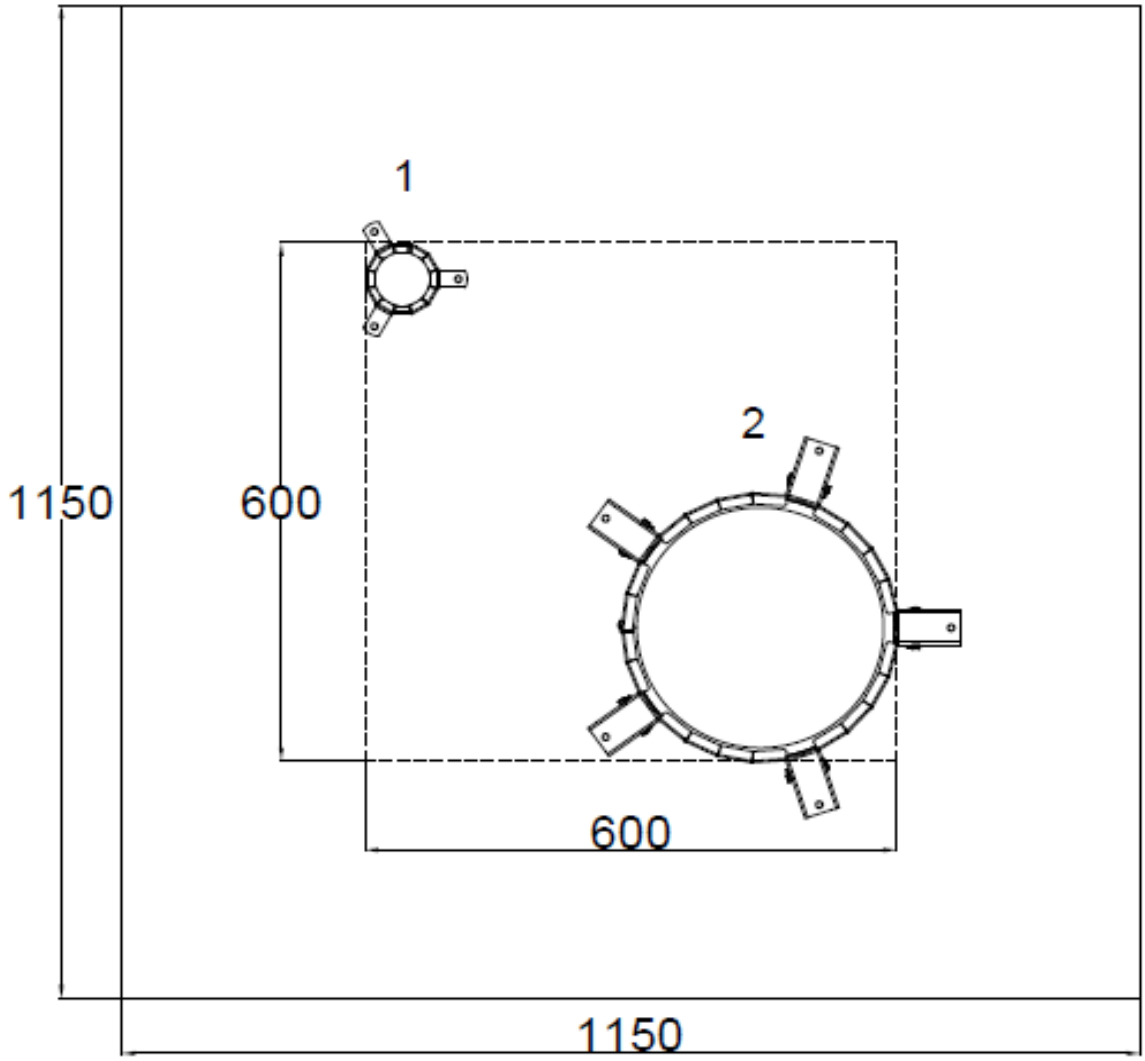


FIGURE 4 - SPECIMEN 2 TEMPERATURE

Appendix D – Specimen layout and installation drawings

Snap Fire Systems Pty Ltd
Test Wall W-18-F Layout
Date: 21 NOV 2018

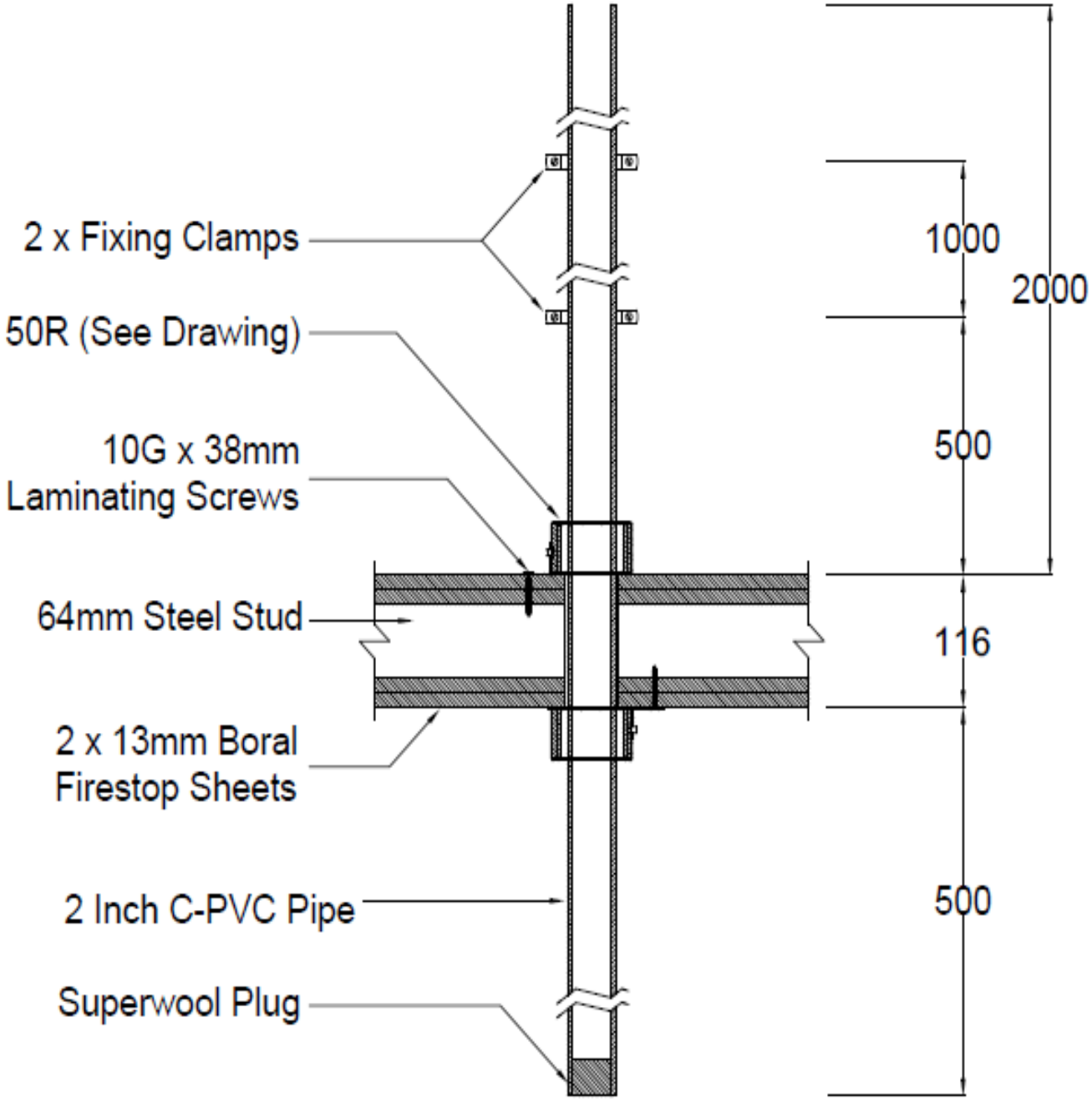


Penetration	Collar Code	Pipe Type	Pipe Diameter (mm)	Sealant
1	50R	C-PVC	50	N/A
2	HP250R-B	PVC	250	N/A

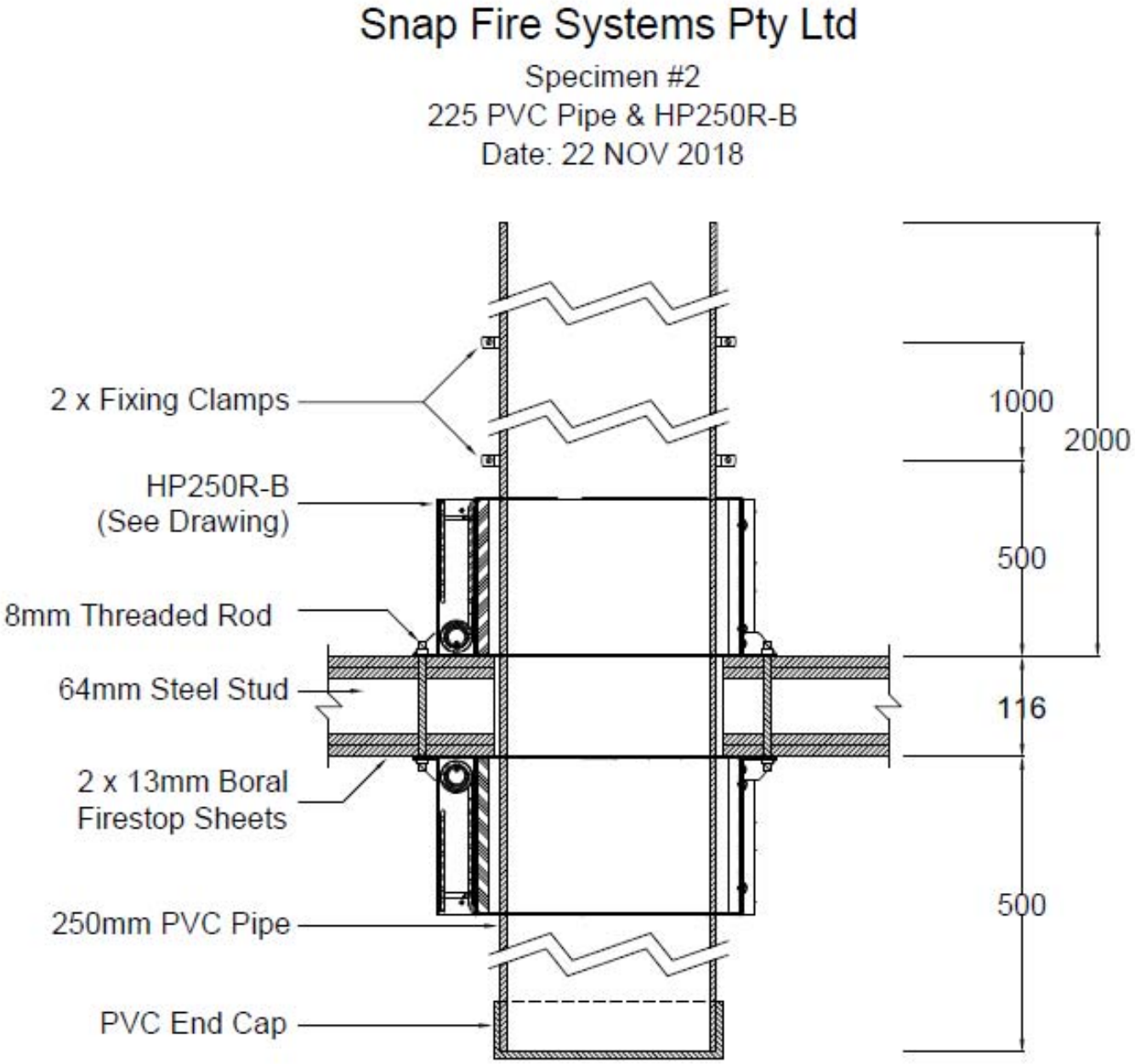
DRAWING TITLED "TEST WALL W-18-F LAYOUT" DATED 21 NOVEMBER 2018, BY SNAP FIRE SYSTEMS PTY LTD.

Snap Fire Systems Pty Ltd

Specimen #1
2 Inch C-PVC Pipe & 50R
Date: 22 NOV 2018

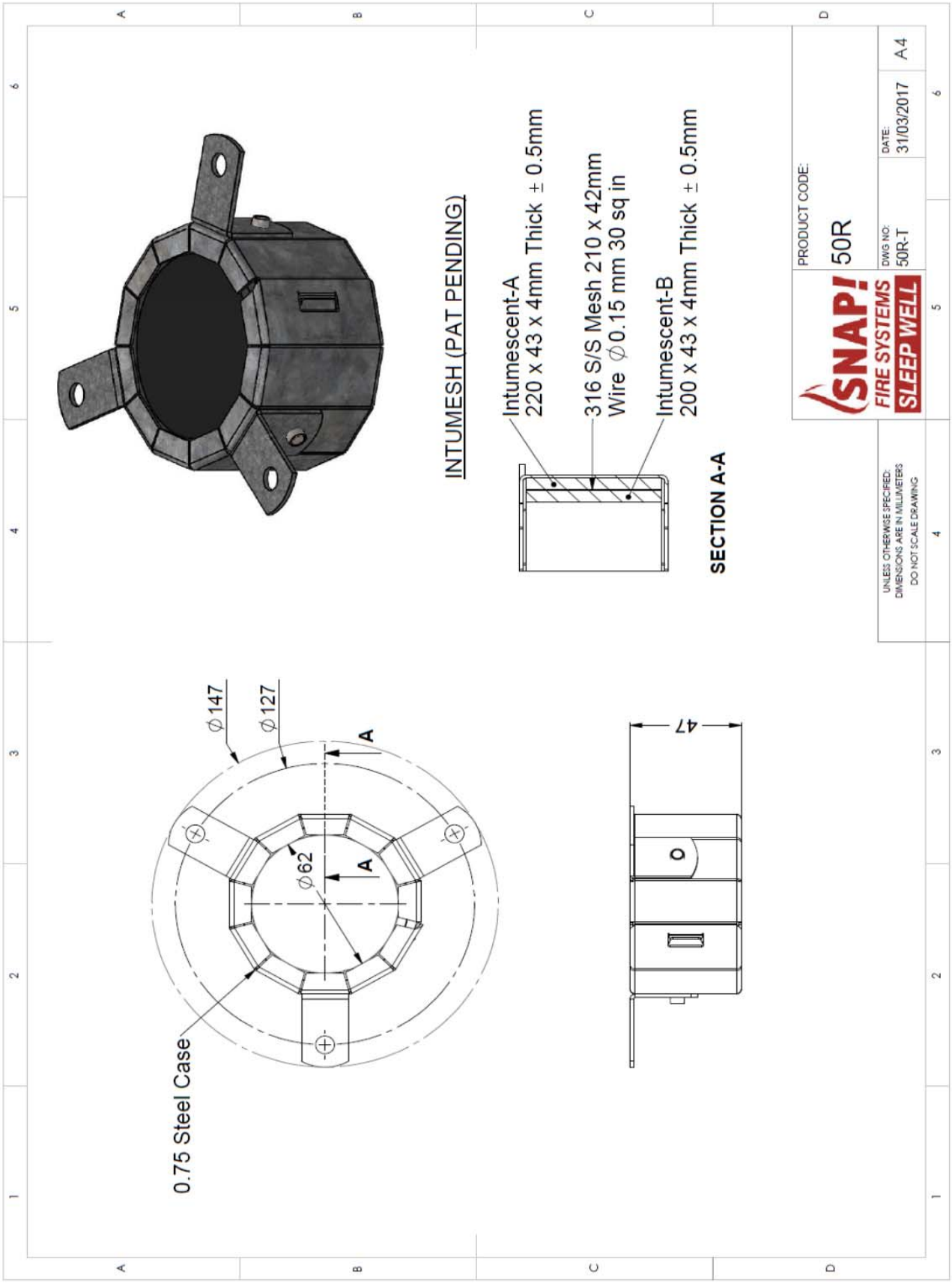


DRAWING TITLED "SPECIMEN #1 2 INCH C-PVC PIPE & 50R" DATED 22 NOVEMBER 2018, BY SNAP FIRE SYSTEMS PTY LTD.

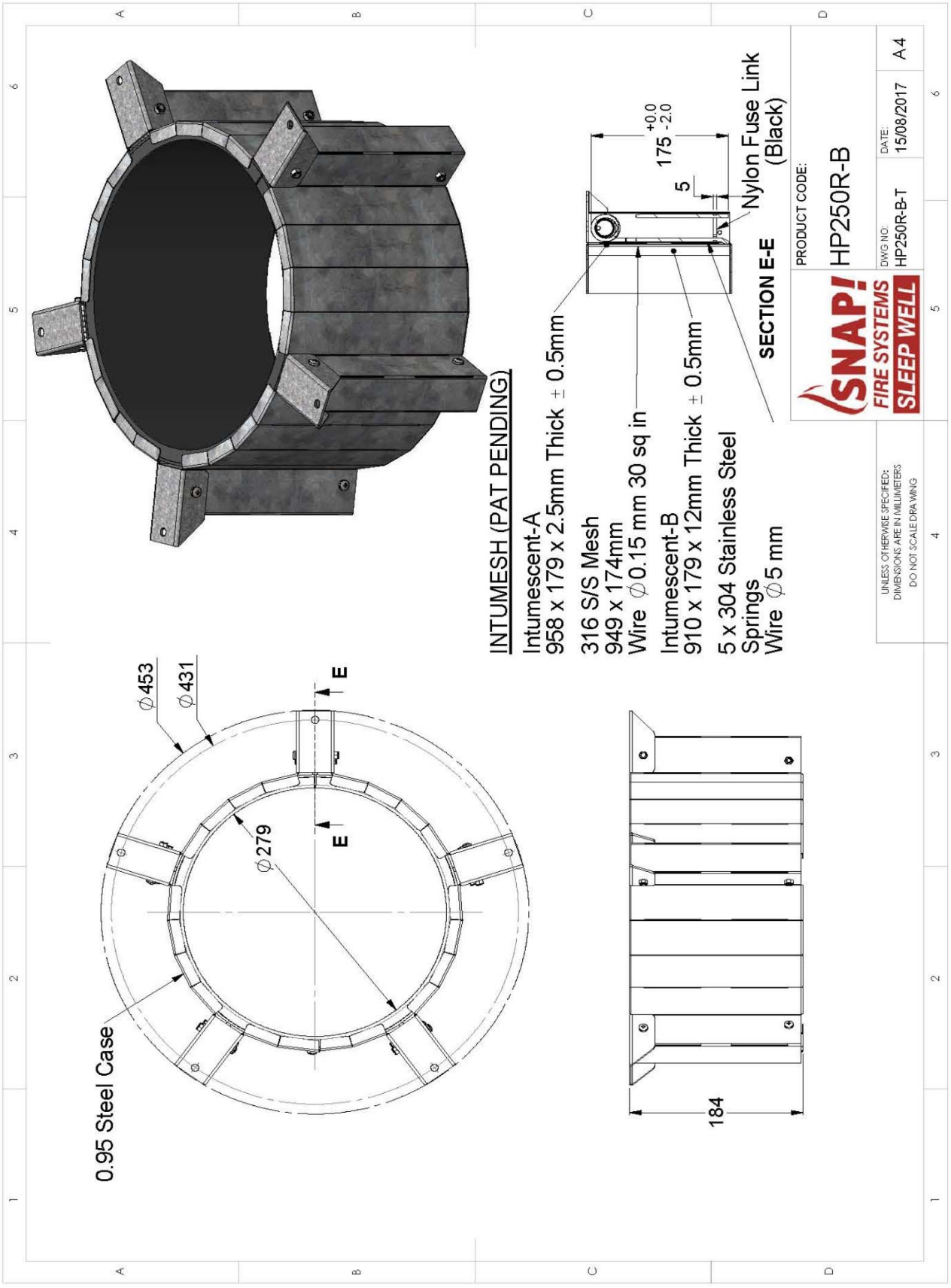


DRAWING TITLED "SPECIMEN #2 225 PVC PIPE & HP250R-B" DATED 22 NOVEMBER 2018, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD.

Appendix E – Specimen Drawings



DRAWING NUMBERED 50 R-T DATED 31 MARCH 2017, BY SNAP FIRE SYSTEMS PTY LTD.



DRAWING NUMBERED HP250R-B-T DATED 15 AUGUST 2017, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix F – Copy of Certificate(s) of Test

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. 3215

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 numbered FSP 1978.

Product Name: SNAP 50R Retrofit fire collar protecting a nominal 2 inch (60.35-mm) CPVC pipe

Description: The sponsor identified the specimen as a retrofit fire collar protecting a steel framed plasterboard wall system, penetrated by a nominal 2 inch (60.35-mm) CPVC pipe. The wall system is described as a 116-mm thick plasterboard lined steel framed, comprising two layers of 13-mm thick Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and a 147-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism which comprised two soft Intumesh intumescent wraps lined within the internal circumference of the collar. Intumescent A was 4-mm thick x 43-mm wide x 220-mm long, and Intumescent B was 4-mm thick x 43-mm wide x 200-mm long. Between the strips was a layer of 316 grade stainless steel mesh 210-mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T dated 31 March 2017, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 3 mounting brackets using 38-mm (10g) course thread laminating screws. The penetrating service comprised a 60.35-mm diameter CPVC pipe, with a wall thickness of 4.95-mm which penetrated the wall through a 63-mm diameter cut-out hole. The pipe projected horizontally, 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm, and 1500-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with a 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 181 minutes
Insulation	157 minutes

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

The fire-resistance level of the specimens is applicable when the system is exposed to fire from either direction. 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 recognized 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: 17 January 2019

Issued on the 7th day of February 2019 without alterations or additions.

B. Roddy

Brett Roddy
Manager, Fire Testing and Assessments

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Certificate of Test

No. 3216b

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 numbered FSP 1978.

Product Name: HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) pipe

Description: The sponsor identified the specimen as a retrofit fire collar protecting a steel framed plasterboard wall system, penetrated by a nominal 2 inch (60.35-mm) CPVC pipe. The wall system is described as a 116-mm thick plasterboard lined steel framed, comprising two layers of 13-mm thick Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. The SNAP retrofit HP250R-B collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 453-mm diameter base flange. The 184-mm high collar casing incorporated two strips of Intumesh intumescent material, 910-mm x 179-mm x 12-mm thick and 958-mm x 179-mm x 2.5-mm thick. The closing mechanism comprised five stainless steel springs, with a nylon fuse link, and a 949-mm x 174-mm 316 stainless steel mesh located in between the intumescent strips as shown in drawing numbered HP 250R-B-T dated 15 August 2017, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 5 mounting brackets using 8-mm threaded rod and 12 x M8 nuts. The penetrating service comprised a 250-mm PVC pipe, with a wall thickness of 6.66-mm fitted through the collar's sleeve. The pipe penetrated the wall through a 265-mm diameter opening and projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber. The pipe was supported at nominally 500-mm, and 1500-mm from the unexposed face of the plasterboard wall. The pipe was open on the unexposed end and capped on the exposed end with a PVC end cap.

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

Structural Adequacy	not applicable
Integrity	no failure at 181 minutes
Insulation	173 minutes

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

The fire-resistance level of the specimens is applicable when the system is exposed to fire from either direction. 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 recognized 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: 17 January 2019

Issued on the 20th day of February 2019 without alterations or additions.

B. Roddy

Brett Roddy
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References

The following informative documents are referred to in this Report:

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

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