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

Test Report

Author: Chris Wojcik
Report number: FSP 1849
Date: 12 September 2017

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

Commercial-in-confidence

Inquiries should be address to:

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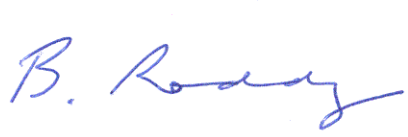
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Fire-resistance test on fire collars protecting a concrete floor slab penetrated by services

Sponsored Investigation No. FSP 1849

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as two (2) retrofit Fire Collars protecting a 150-mm thick concrete floor slab penetrated by one (1) PVC pipe and one (1) cluster of Pex-a 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 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 4693/4128

1.7 Test date

The fire-resistance test was conducted on 31 July 2017.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by one (1) PVC pipe and one (1) cluster of Pex-a pipes protected by retrofitted Snap Fire Systems fire collars.

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'; and
- AS/NZS 2492:2007 'Cross-linked polyethylene (PE-X) pipes for pressure applications'

For the purpose of the test, the specimens were referenced as Penetrations 1 and 2.

Penetration 1 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) Stack Pipe

The SNAP retrofitted HP250R-B collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 453-mm diameter base flange. The 175-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 dated 15 August 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 225-mm PVC Stack Pipe, with a wall thickness of 7-mm fitted through the collar's sleeve. The pipe penetrated the 200-mm thick section of the slab through a 250-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-17-D Penetration 1, 225-mm PVC Stack Pipe & HP250R-B" dated 28 August 2017, provided by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a PVC End Cap.

Penetration 2 – LP50R Retrofit fire collar protecting a nominal cluster of 3 x 20-mm Pex-a Pipes

The SNAP retrofit LP50R fire collar comprised a 0.75-mm steel case with a 69-mm inner diameter and a 203-mm diameter base flange. The 62-mm high collar casing incorporated a 255-mm x 58-mm x 4-mm thick Intumesh intumescent material. The closing mechanism incorporated three stainless steel springs, with nylon fuse links and a 260-mm x 58-mm stainless steel mesh as shown in drawing numbered LP50R-T dated 14 January 2015, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a cluster of 3 x 20-mm Pex-a Pipes, with an individual wall thickness of 3-mm fitted through the collar's sleeve. The pipes penetrated the slab through a 43-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-17-D Penetration 2, 3 x 20-mm Pex-a Pipe & LP50R" dated 28 August 2017, provided by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with Superwool Plugs.

2.2 Dimensions

The overall dimension of the concrete slab was 1150-mm wide x 1150-mm long x 150-mm thick, 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.

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 numbered HP250R-B-T dated 15 August 2017, by Snap Fire Systems Pty Ltd.

Drawing numbered LP50 R-T dated 14 January 2015, by Snap Fire Systems Pty Ltd.

Drawing titled “Test Slab S-17-D Penetration 1, 225-mm PVC Stack Pipe & HP250R-B” dated 28 August 2017, provided by Snap Fire Systems Pty Ltd.

Drawing titled “Test Slab S-17-D Penetration 2, 3 x 20-mm Pex-a Pipe & LP50R” dated 28 August 2017, provided 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 14°C at the commencement of the test.

6 Departure from standard

There were no departures from the requirements of AS 1530.4-2014.

7 Termination of test

The test was terminated at 241 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

The following observations were made during the fire-resistance test:

Time	Observation
1:30 minutes -	Fluing is noted on Penetration 2.
2 minutes -	Fluing continues on Penetration 2.
3 minutes -	Fluing is noted on Penetration 1.
4 minutes -	Flaming is noted on Penetration 1.
7 minutes -	Penetration 1 is starting to deform.
8 minutes -	Penetration 2 has ceased fluing.
12 minutes -	A popping sound (spalling) is audible from the furnace.
25 minutes -	No further spalling sounds are audible from the furnace.
60 minutes -	Light smoke is visible between the pipes in Penetration 2, at the base.
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 maximum temperature versus time associated with Penetration 1.

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

8.5 Performance

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

Penetration 1 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) Stack Pipe

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

Penetration 2 – LP50R Retrofit fire collar protecting a nominal cluster of 3 x 20-mm Pex-a Pipes

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 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's of the test specimens were as follows:

Penetration 1 - -/240/240

Penetration 2 - -/240/240

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

Chris Wojcik
Testing Officer

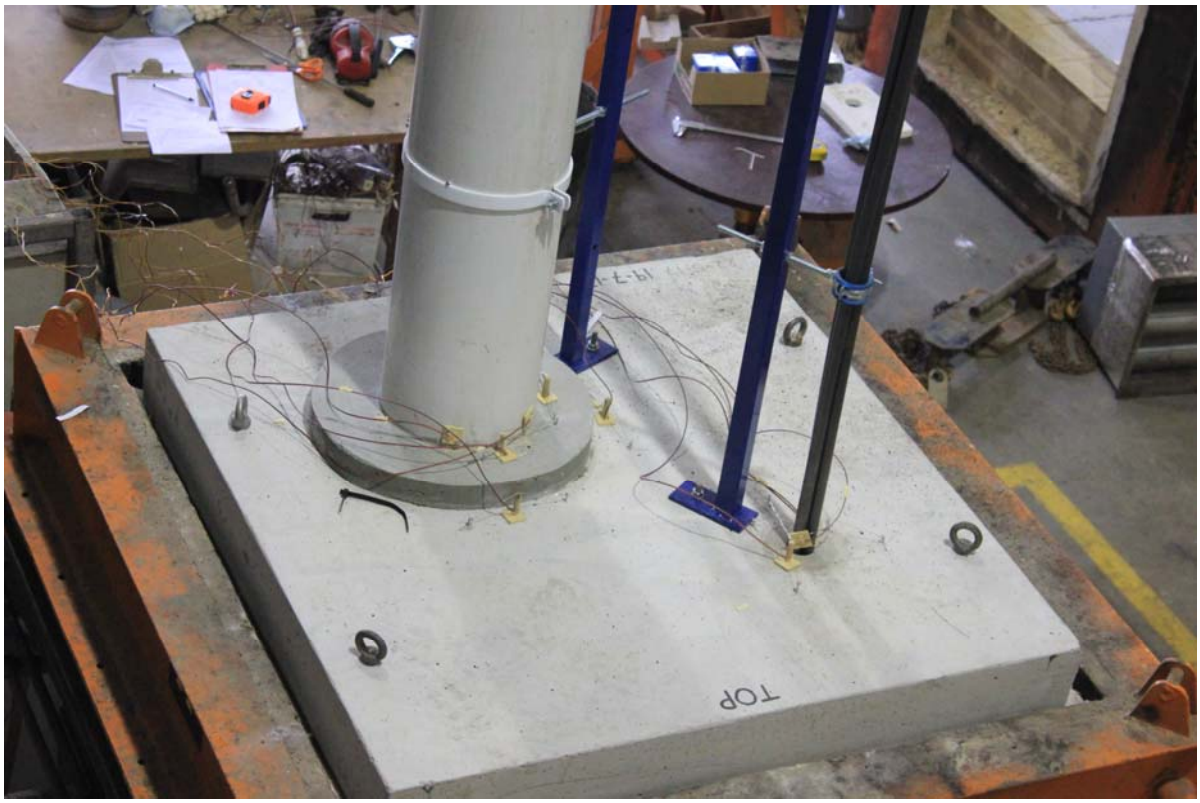
Appendices

Appendix A – Measurement location

Measurement Location		Data Logger Channel Information
Group location **Specimen**	**T/C Position**	**T/C designation**
Penetration 1 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) Stack Pipe	On top of the slab – 25-mm from the hob	S1
	On top of the slab – 25-mm from the hob	S2
	On concrete hob , 25-mm from the pipe	S3
	On concrete hob , 25-mm from the pipe	S4
	On the pipe, 25-mm from the hob	S5
	On the pipe, 25-mm from the hob	S6
	On the pipe, 25-mm from the hob	S7
Penetration 2 – LP50R Retrofit fire collar protecting a nominal cluster of 3 x 20-mm Pex-a Pipes	On top of the slab – 25-mm from the hob	S8
	On top of the slab – 25-mm from the hob	S9
	On the pipes, 25-mm from the concrete	S10
	On the pipes, 25-mm from the concrete	S11
Rover		S12
Ambient		S13

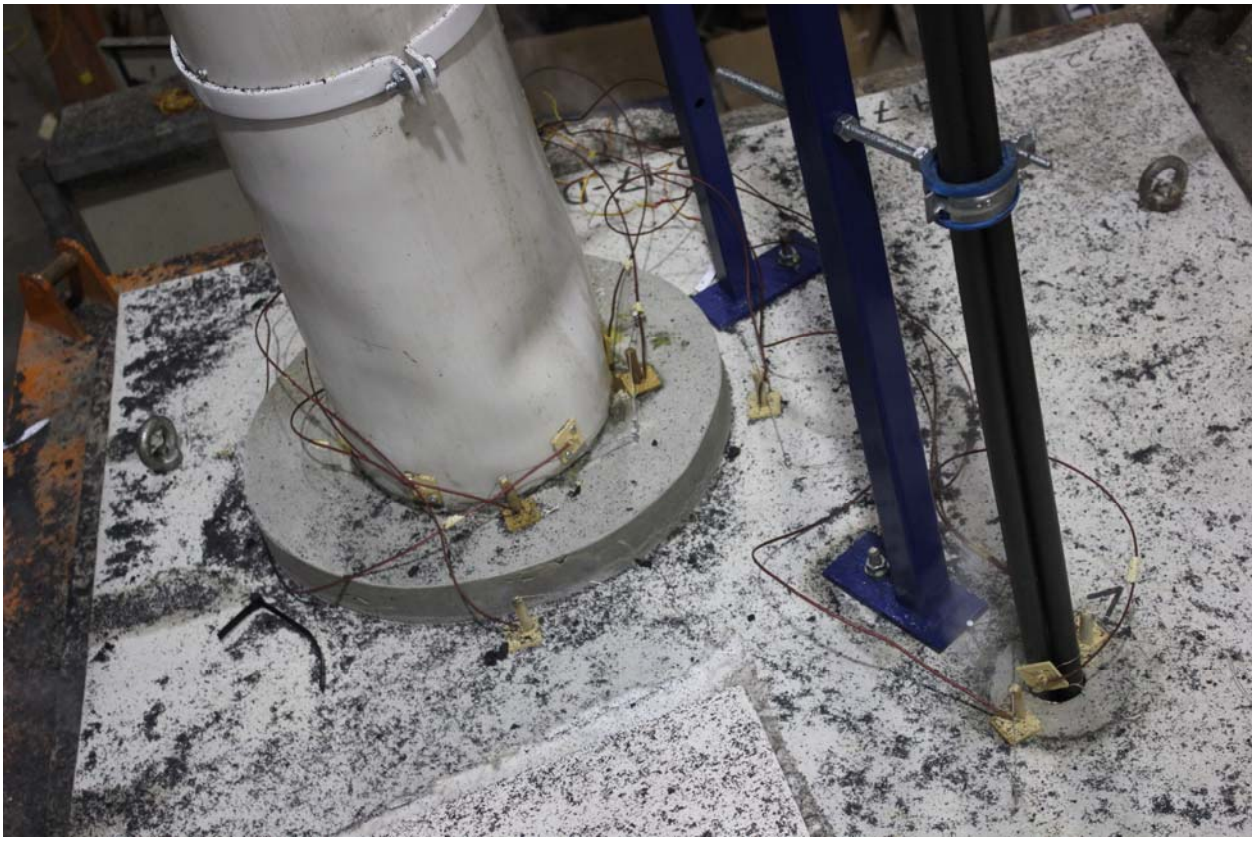
Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



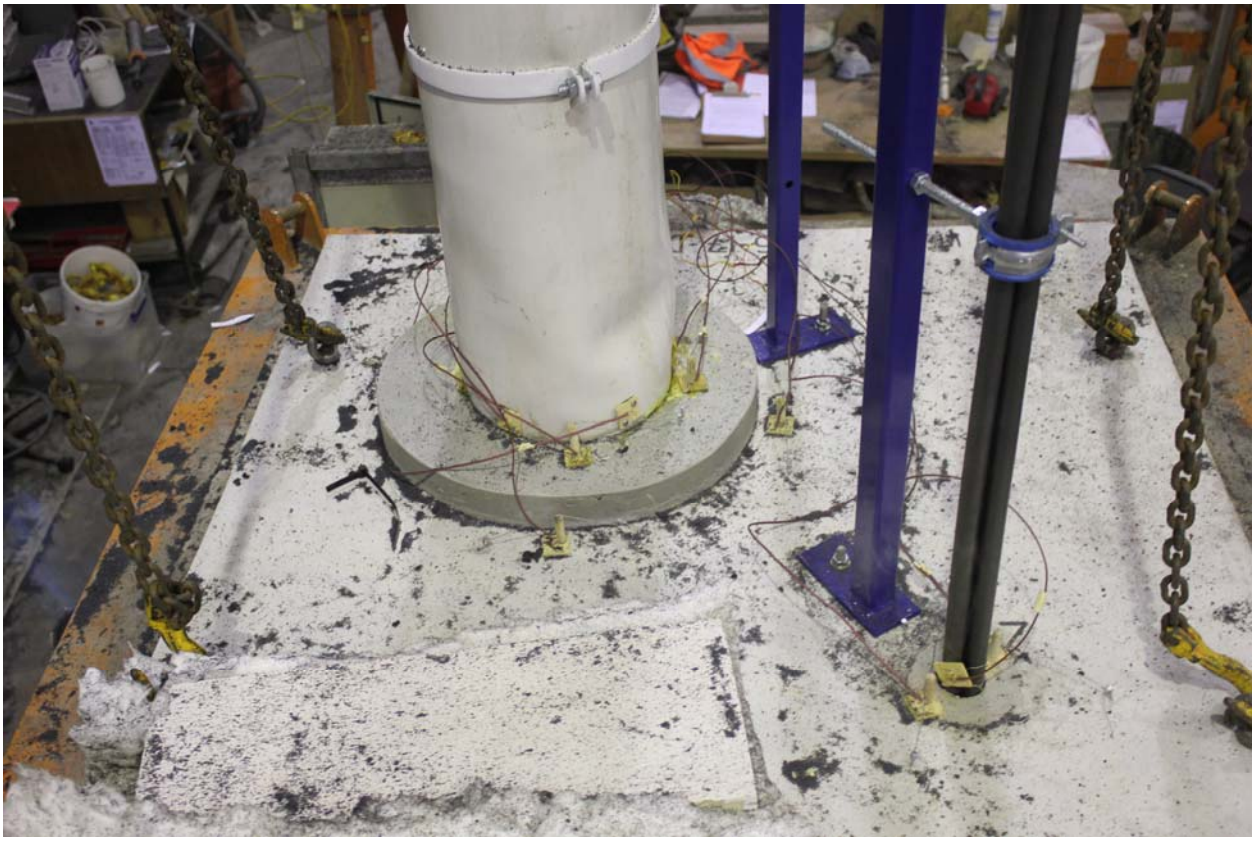
PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

PHOTOGRAPH 3 – SPECIMENS AFTER 60 MINUTES OF TESTING

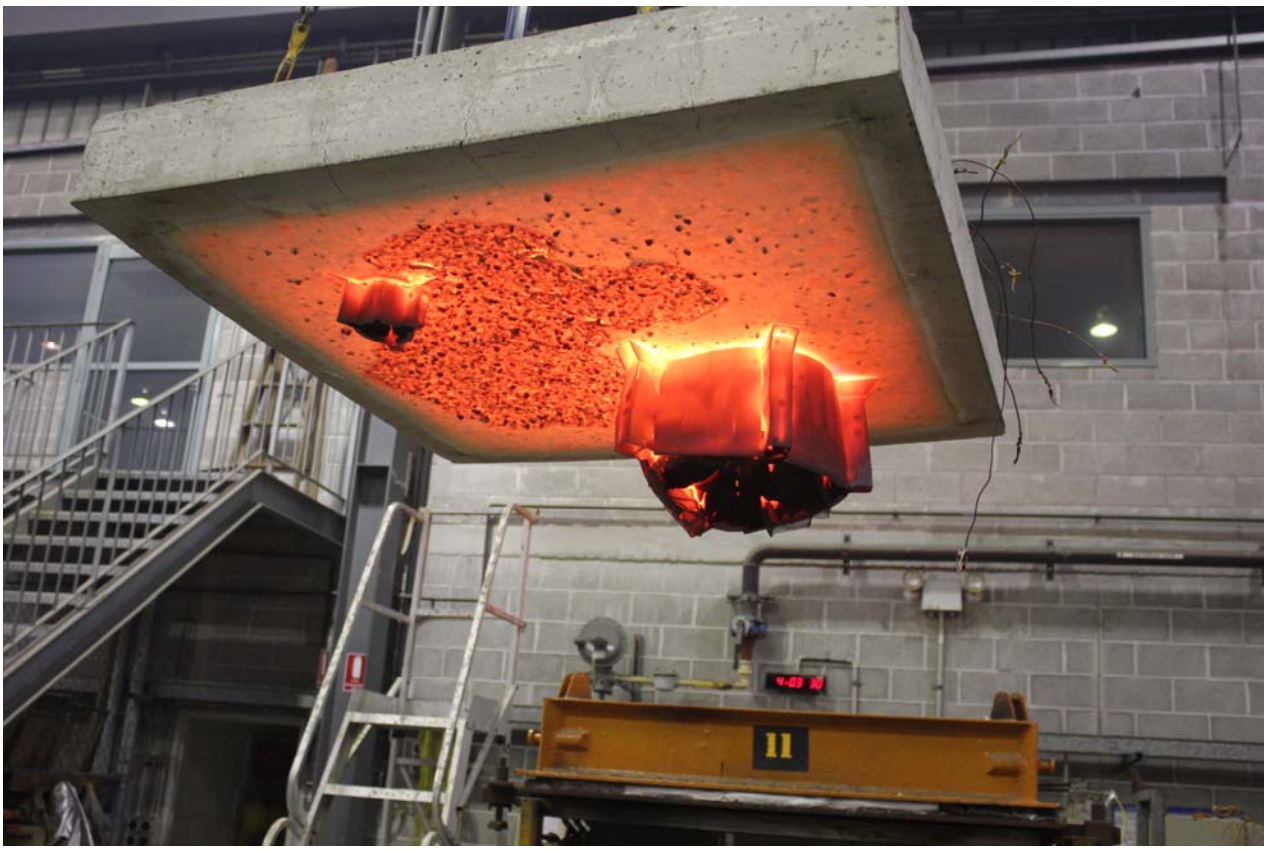


PHOTOGRAPH 4 – SPECIMENS AFTER 120 MINUTES OF TESTING

PHOTOGRAPH 5 – SPECIMENS AFTER 180 MINUTES OF TESTING



PHOTOGRAPH 6 – UNEXPOSED FACED OF SPECIMEN AT CONCLUSION OF TESTING



PHOTOGRAPH 7 – EXPOSED FACE OF SPECIMENS AT CONCLUSION OF TESTING

Appendix C – Furnace Temperature

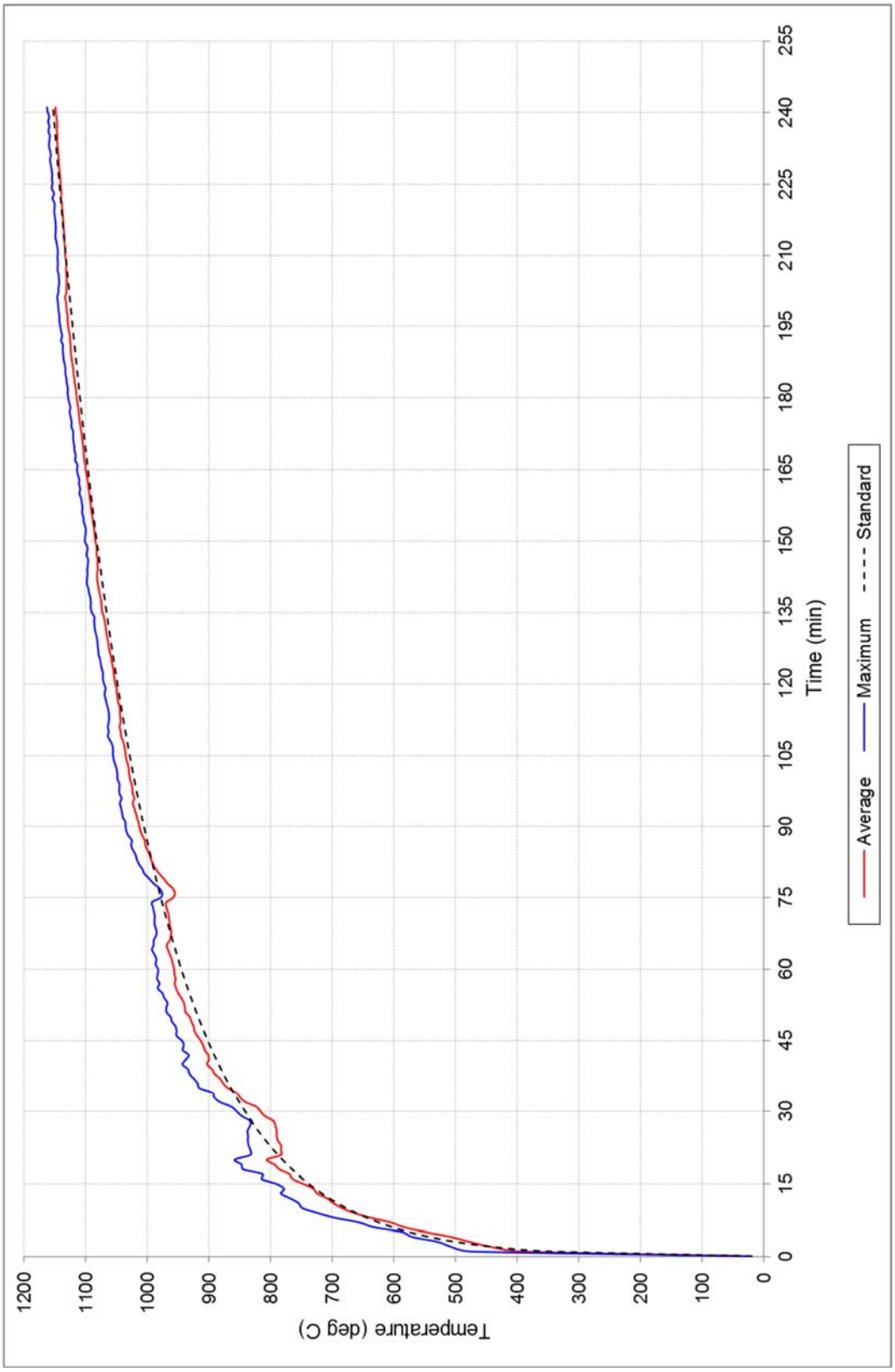


FIGURE 1 – FURNACE TEMPERATURE

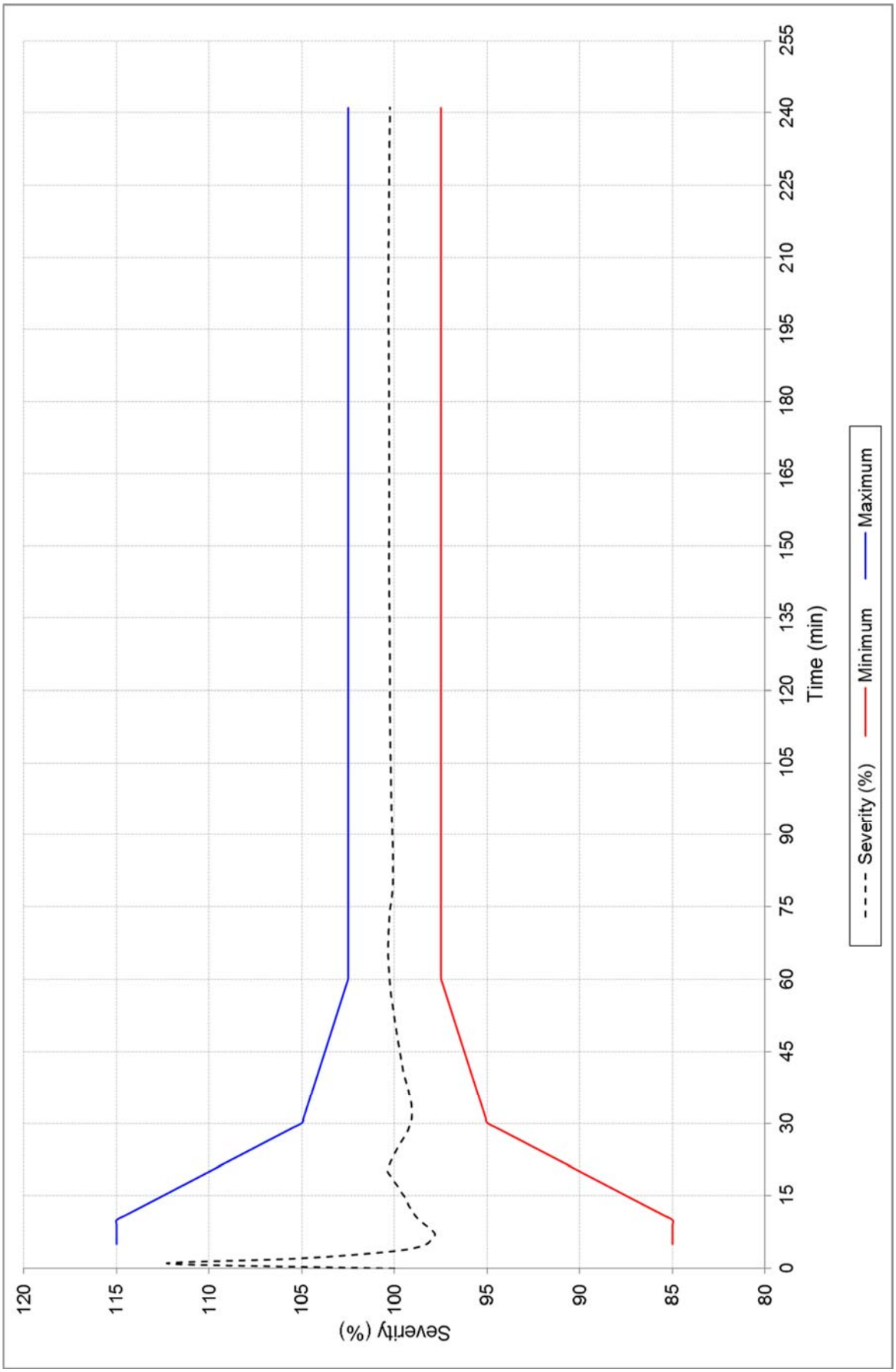


FIGURE 2 – FURNACE SEVERITY

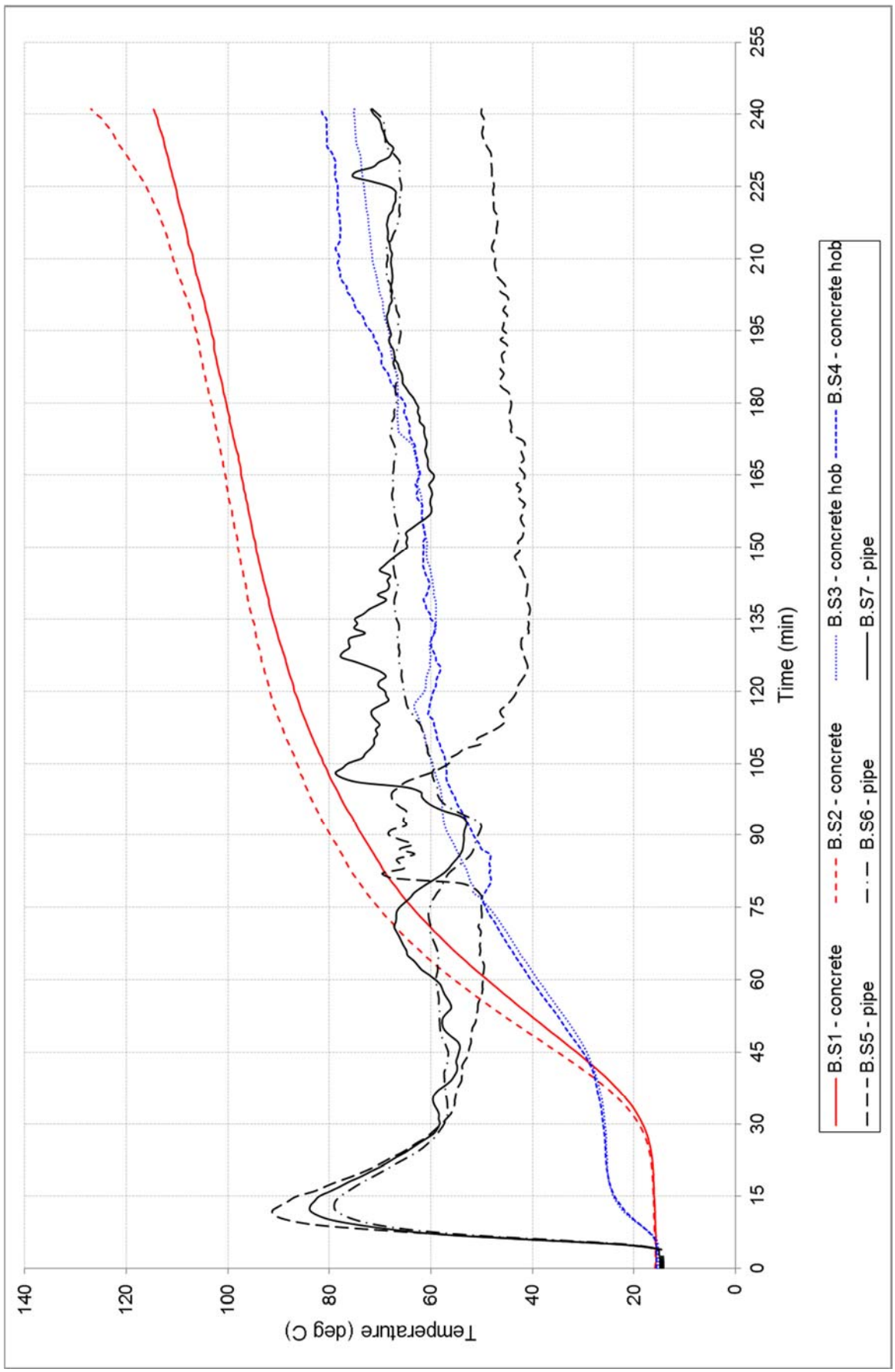


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION # 1

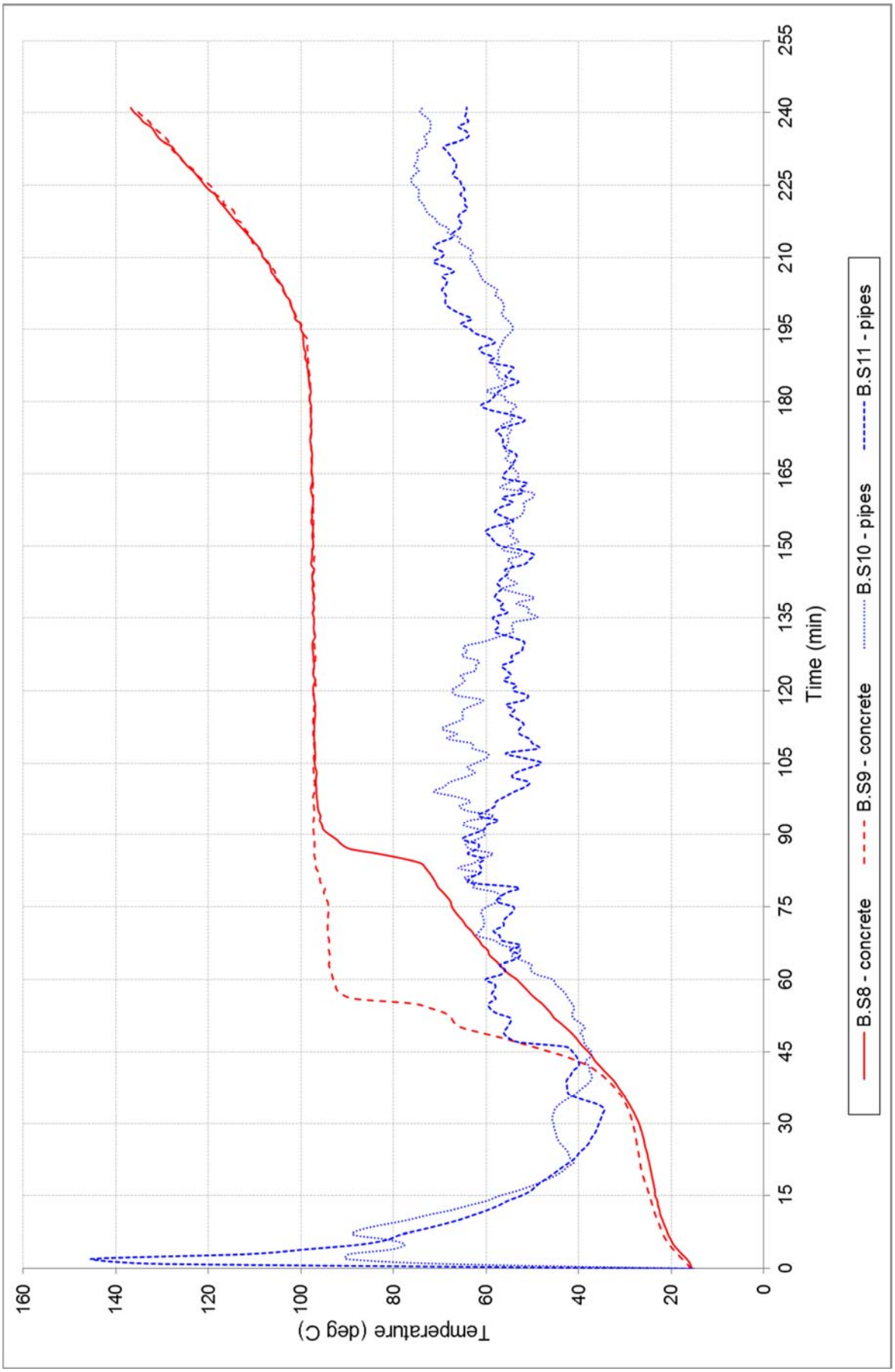
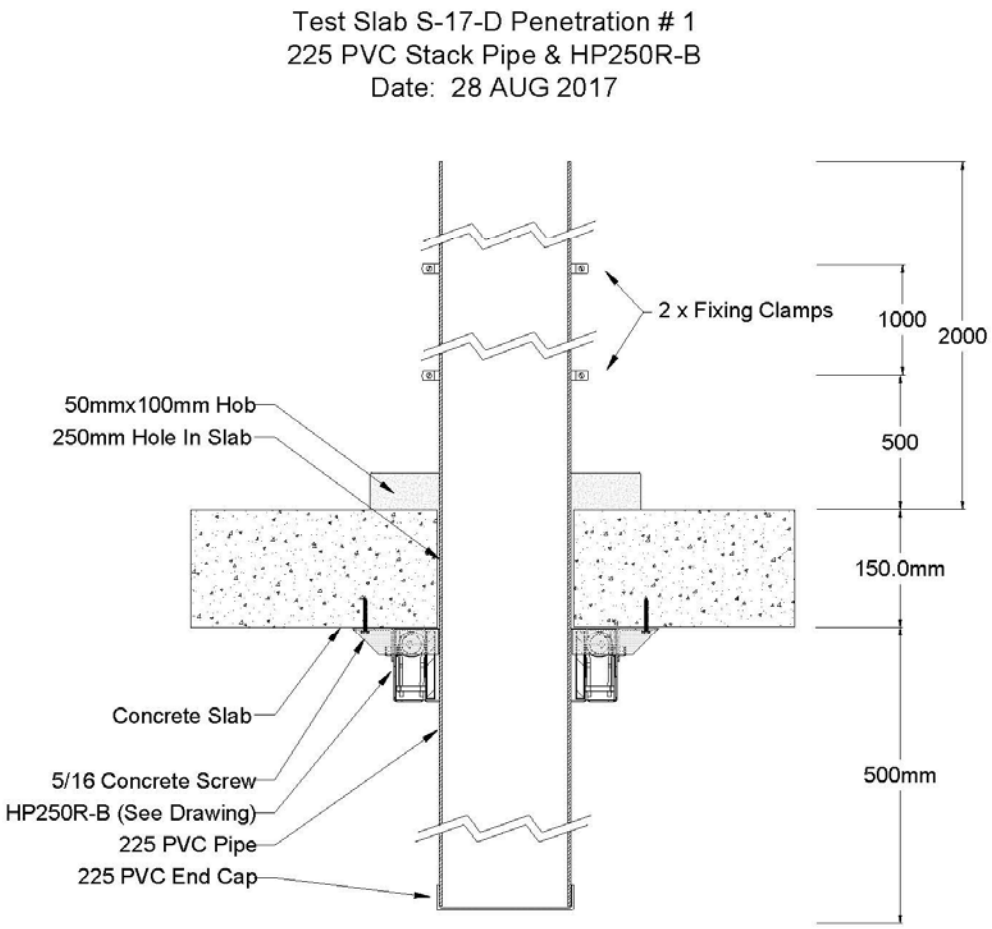
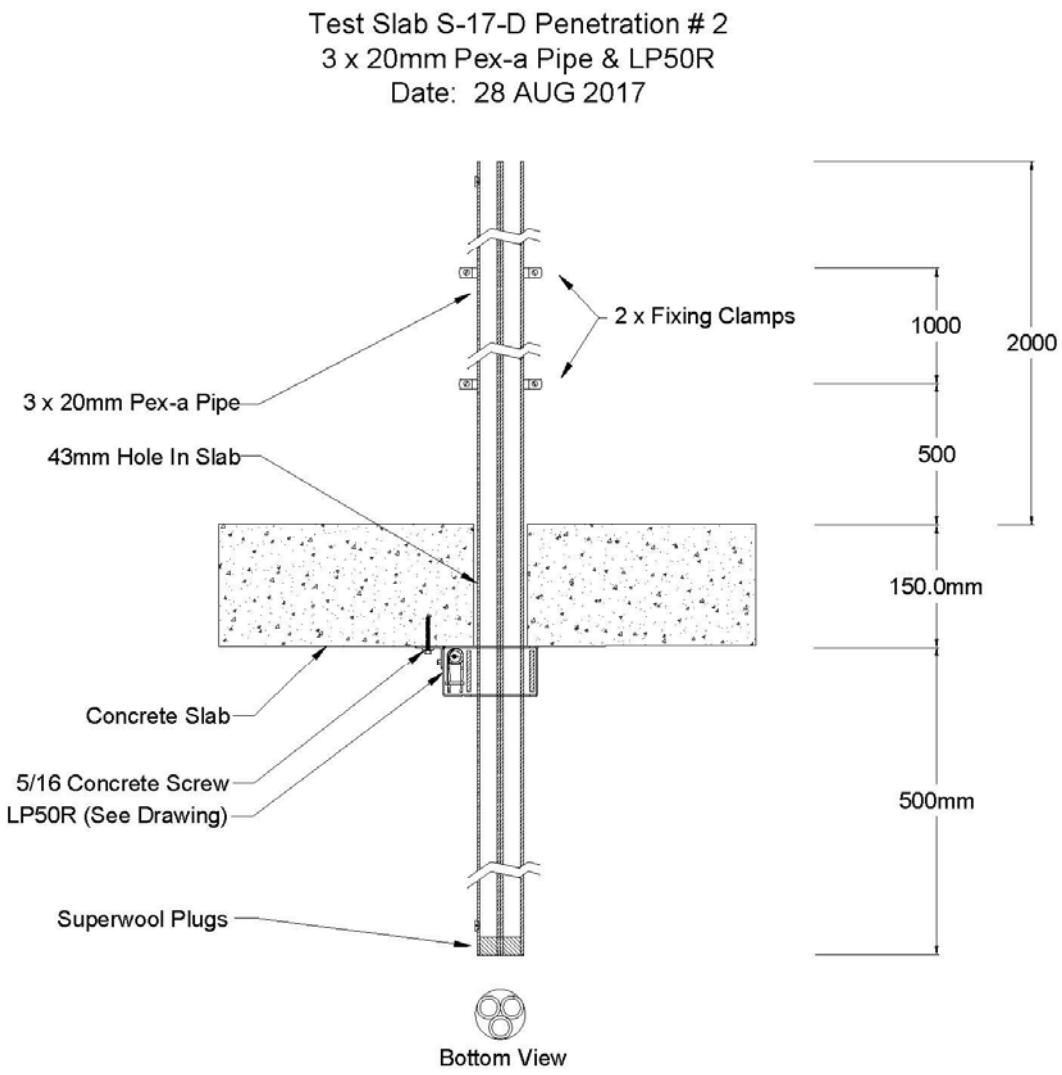


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION # 2

Appendix D – Installation drawings

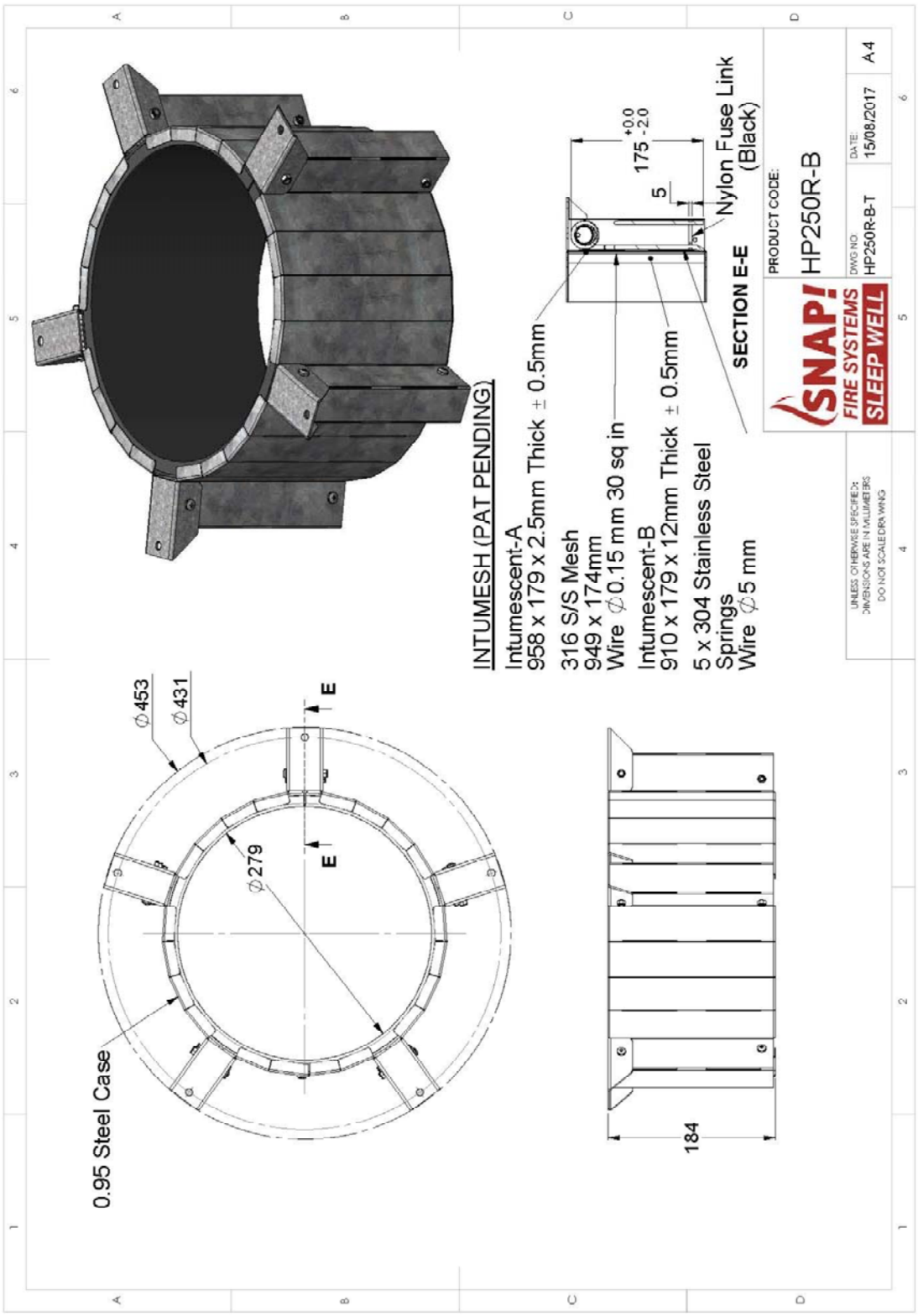


DRAWING TITLED "TEST SLAB S-17-D PENETRATION 1, 225-MM PVC STACK PIPE & HP250R-B" DATED 28 AUGUST 2017, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD.

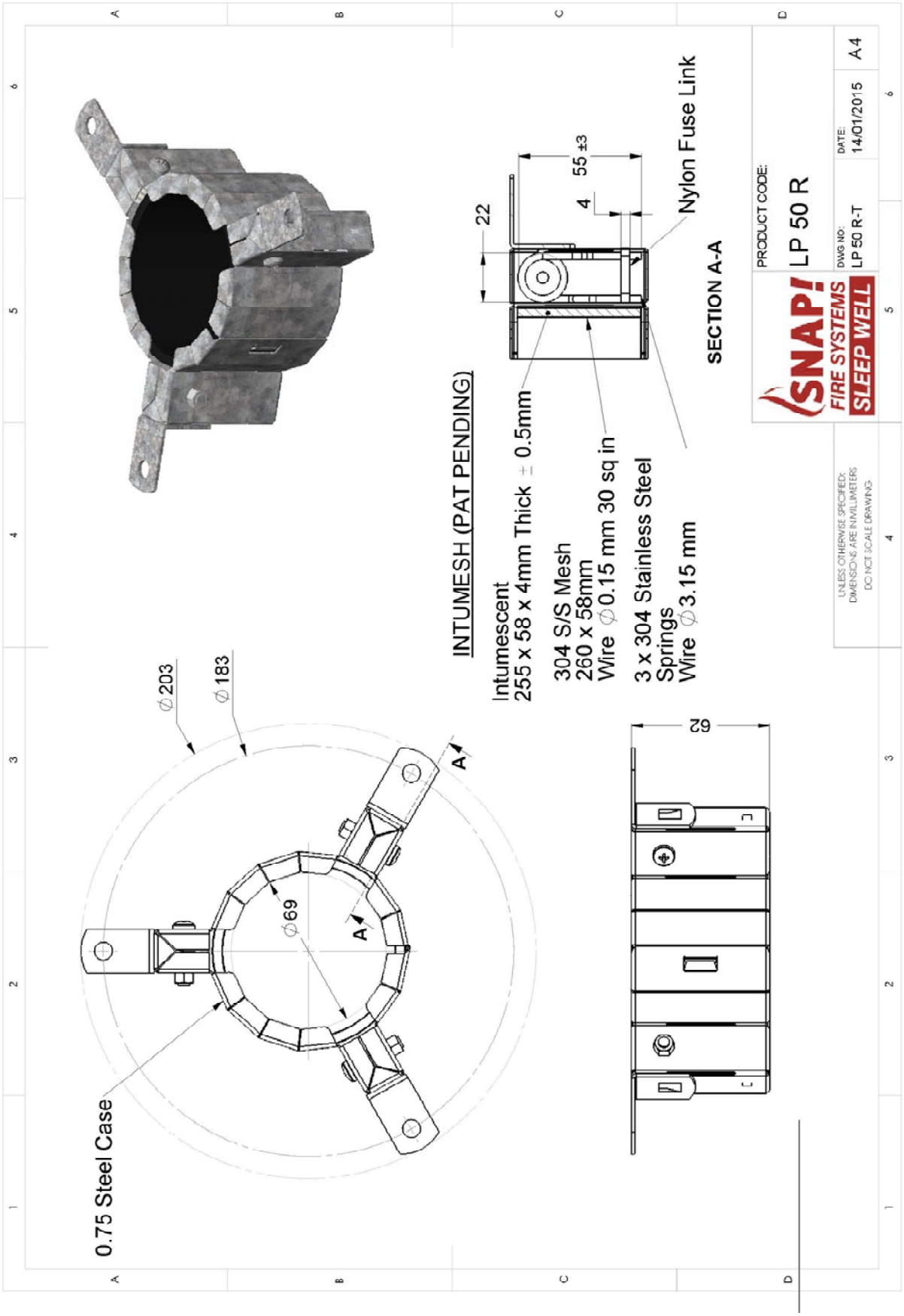


DRAWING TITLED "TEST SLAB S-17-D PENETRATION 2, 3 X 20-MM PEX-A PIPE & LP50R" DATED 28 AUGUST 2017, PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Appendix E – Specimen Drawings



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



DRAWING NUMBERED LP50 R-T DATED 14 JANUARY 2015, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix F – 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. 2988

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 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 Sponsored Investigation report numbered FSP 1849.

Product Name: Penetration 1 – HP250R-B Retrofit fire collar protecting a nominal 225-mm Polyvinyl Chloride (PVC) Stack Pipe

Description: The SNAP retrofitted HP250R-B collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 453-mm diameter base flange. The 175-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 dated 15 August 2017, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 225-mm PVC Stack Pipe, with a wall thickness of 7-mm fitted through the collar's sleeve. The pipe penetrated the 200-mm thick section of the slab through a 250-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-17-D Penetration 1, 225-mm PVC Stack Pipe & HP250R-B" dated 28 August 2017, provided by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a PVC End Cap.

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.

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: Chris Wojcik Date of Test: 31 July 2017

Issued on the 12th day of September 2017 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. 2988

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

Certificate of Test

No. 2989

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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 Sponsored Investigation report numbered FSP 1849.

Product Name: Penetration 2 – LP50R Retrofit fire collar protecting a nominal cluster of 3 x 20-mm Pex-a Pipes

Description: The SNAP retrofit LP50R fire collar comprised a 0.75-mm steel case with a 69-mm inner diameter and a 203-mm diameter base flange. The 62-mm high collar casing incorporated a 255-mm x 58-mm x 4-mm thick Intumesh intumescent material. The closing mechanism incorporated three stainless steel springs, with nylon fuse links and a 260-mm x 58-mm stainless steel mesh as shown in drawing numbered LP50R-T dated 14 January 2015, by SNAP Fire Systems Pty Ltd. The penetrating service comprised a cluster of 3 x 20-mm Pex-a Pipes, with an individual wall thickness of 3-mm fitted through the collar's sleeve. The pipes penetrated the slab through a 43-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-17-D Penetration 2, 3 x 20-mm Pex-a Pipe & LP50R" dated 28 August 2017, provided by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with Superwool Plugs.

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.

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.

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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.

-----end of report-----

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