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

Test Report

Author: Chris Wojcik
Report number: FSP 1692
Date: 14 June 2017

Client: Snap Fire Systems Pty Ltd

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Report Authorization:

AUTHOR	REVIEWED BY	AUTHORISED BY
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14 June 2017	14 June 2017	14 June 2017

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

Sponsored Investigation No. FSP 1692

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap Cast-in Fire Collars protecting a 150-mm thick concrete slab penetrated by two (2) stack pipes and one (1) floor waste.

1.2 Sponsor

Snap Fire Systems Pty Ltd
Unit 2/160 Redland Bay Road
CAPALABA QLD

1.3 Manufacturer

Snap Fire Systems Pty Ltd
Unit 2/160 Redland Bay Road
CAPALABA QLD

1.4 Test standard

Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005, Fire-resistance tests of elements of construction.

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 4473/3837

1.7 Test date

The fire-resistance test was conducted on 9 February 2015.

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 two (2) stack pipes and one (1) floor wate protected by retrofit Snap Fire System fire collars. The pipes are stated to be manufactured in accordance with AS/NZS 1260: 2009 'PVC-U pipes and fittings for drain, waste and vent application' and AS/NZS 5065: 2005 'Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications'.

For the purpose of the test, the specimens were referenced as Penetrations 1, 2 and 3. Two (2) specimen are included in this report (Penetration 2 and 3).

Penetration 2 – LP100R retrofitted fire collar protecting a 110-mm diameter Polyvinyl Chloride (PVC-SC) pipe incorporating a floor waste

The SNAP LP100R retrofitted fire collar comprised a 0.95-mm steel casing with a 118-mm inner diameter and a 257-mm diameter base flange. The 62-mm high collar casing incorporated a 400-mm x 57-mm x 6-mm thick intumescent material. The closing mechanism comprised three stainless steel springs, nylon fuse links and a 415-mm x 120-mm stainless steel mesh, as shown in drawing numbered LP100R-T, dated 4 November 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 6.5-mm Zinc Hex Head Sleeve Anchors as shown in drawing titled "Test Slab S-15-C Penetration #2 110-mm SC-PVC Pipe w Fitting + LP100R on Floor Waste", dated 18 May 2015, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm OD PVC sandwich construction pipe, with a wall thickness of 1.6-mm fitted through the LP 100 R Snap fire collars. The floor waste system was fitted with a chromed brass floor waste grate. A 35-mm thick cement screed was laid on top of the concrete slab and finished flush with the floor grate. On the exposed side of the slab, a nominal 100-mm OD PVC gully trap was connected to the penetrating pipe, supported by an M10 HKD clamp fixed to the concrete slab. On the exposed face, the gully trap was capped using a PVC end cap.

The floor waste gully was charged with water to the level shown in drawing titled "Test Slab S-15-C Penetration #2 110-mm SC-PVC Pipe w Fitting + LP100R on Floor Waste", dated 18 May 2015, by Snap Fire Systems Pty Ltd.

Penetration # 3 – HP250 R retrofitted fire collar protecting a 250-mm diameter High Density Polyethylene (HDPE) stack pipe

The SNAP retrofitted HP250 R collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 460-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 nylon fuse links, and a 949-mm x 179-mm 304 stainless steel mesh located in between the intumescent strips as shown in drawing numbered HP 250 R-T dated 7 January 2015, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 250-mm diameter High Density Polyethylene (HDPE) stack pipe, with a wall thickness of 7.25-mm fitted through the collar's sleeve. The pipe projected vertically, 2000-mm above the concrete slab. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab. On the exposed side of the slab, the penetrating pipe was supported by 5 brackets with Steel Wedge Anchors fixed to the concrete slab. On the exposed face, the pipe was capped using a Kaowool plug.

On the unexposed face, the gap between the pipe and the slab was filled with a bead of Fullers Firesound as show in drawing titled "Penetration #3 – HDPE 250-mm stack", dated 13 April 2015, by Snap Fire Systems Pty Ltd.

2.2 Dimensions

The overall dimension of the concrete slab was 1150-mm wide x 1150-mm long, 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 titled “Penetration #2 - 110-mm SC-PVC Pipe w fitting + LP100R on floor waste”, dated 18 May 2015, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #3 – HDPE 250-mm stack”, dated 13 April 2015, by Snap Fire Systems Pty Ltd.

Drawing numbered HP250R-T, dated 7 January 2015, by Snap Fire Systems Pty Ltd.

Drawing numbered LP100R-T, dated 4 November 2014, 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 1530.4-2005 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 21°C at the commencement of the test.

6 Departure from standard

There were no departures from the requirements of AS 1530.4-2005.

7 Termination of test

The test was terminated at 230 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

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

Time	Observation
2 minutes -	Smoke is fluing from Penetration # 2 – floor waste.
5 minutes -	Smoke is fluing from Penetration 3.
8 minutes -	Smoke fluing from Penetration # 3 has decreased.
230 minutes -	Flaming is observed on the unexposed face of Penetration # 2. Flames have spread – affecting Penetration # 3. 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 2.

Figure 4 shows the curve of maximum temperature versus time associated with Penetration 3.

8.5 Performance

Performance observed in respect of the following AS 1530.4-2005 criteria:

Penetration 2 –LP100R retrofitted fire collar protecting a 110-mm diameter Polyvinyl Chloride (PVC-SC) pipe incorporating a floor waste

Structural adequacy	-	not applicable
Integrity	-	no failure at 230 minutes
Insulation	-	no failure at 163 minutes

Penetration # 3 – HP250 R retrofitted fire collar protecting a 250-mm diameter High Density Polyethylene (HDPE) stack pipe

Structural adequacy	-	not applicable
Integrity	-	no failure at 230 minutes
Insulation	-	no failure at 230 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 2	-	-/180/120
Penetration 3	-	-/180/180

For the purposes of AS 1530.4-2005 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 1530.4-2005, have been made provided no individual component is removed or reduced.

11 Tested by

Mario Lara-Ledermann
Testing Officer

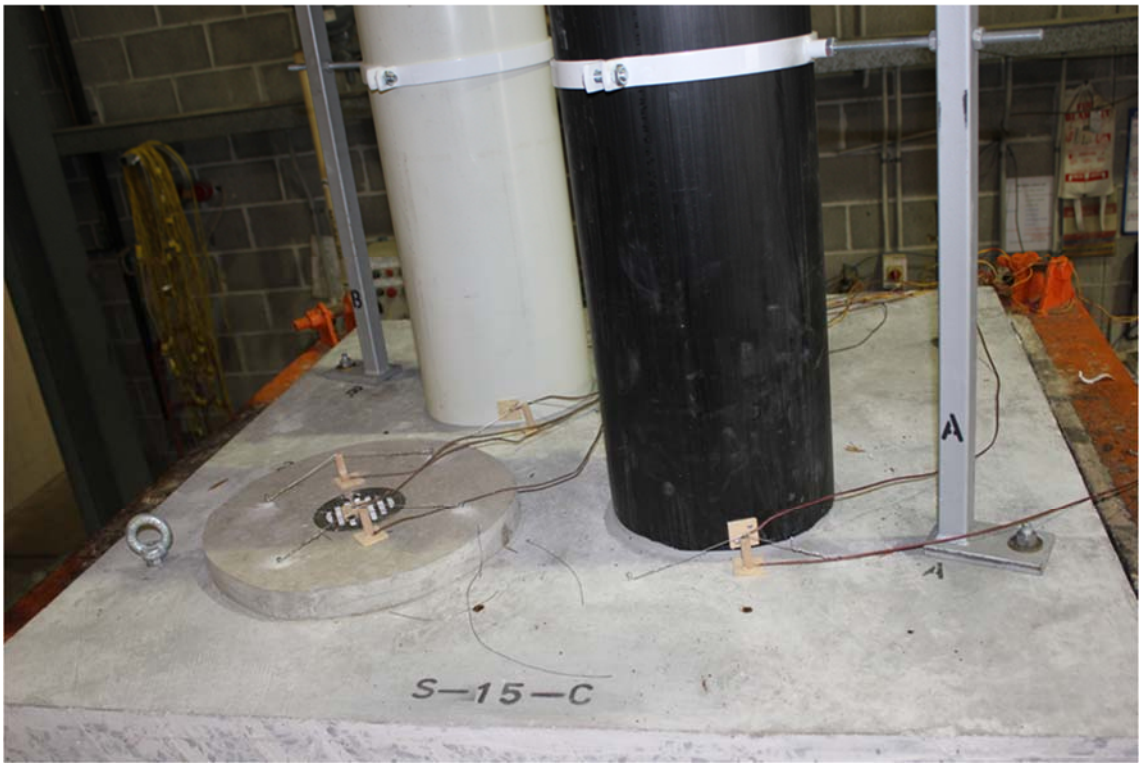
Appendices

Appendix A – Measurement location

Measurement Location		
Group location	**T/C Position**	**T/C designation**
Specimen		
Penetration 1	On slab – 25-mm from the pipe.	S1
	On slab – 25-mm from the pipe.	S2
	On pipe – 25-mm from the slab.	S3
	On pipe – 25-mm from the slab.	S4
Penetration 2	On grate.	S5
	On step – 25-mm from the grate.	S6
	On step – 25-mm from the grate.	S7
Penetration 3	On slab – 25-mm from the pipe.	S8
	On slab – 25-mm from the pipe.	S9
	On pipe – 25-mm from the slab.	S10
	On pipe – 25-mm from the slab.	S11

Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING

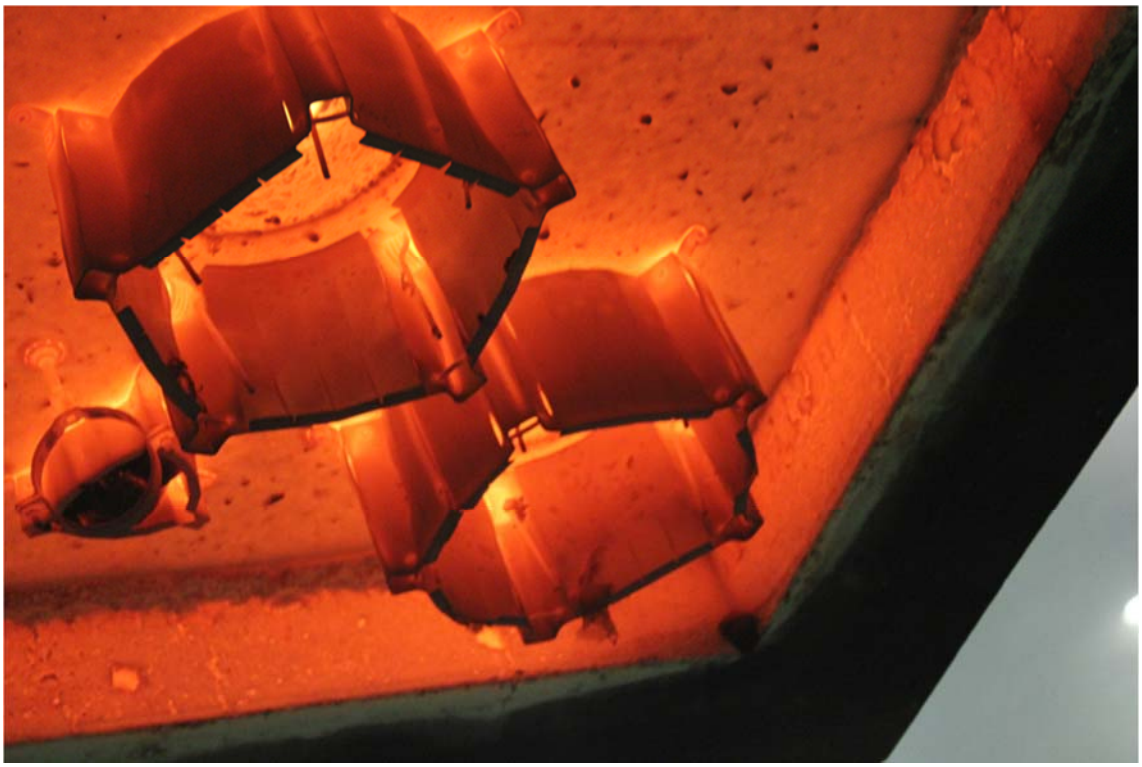


PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

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 – EXPOSED FACE OF SPECIMENS AT CONCLUSION OF TESTING

Appendix C – Furnace Temperature

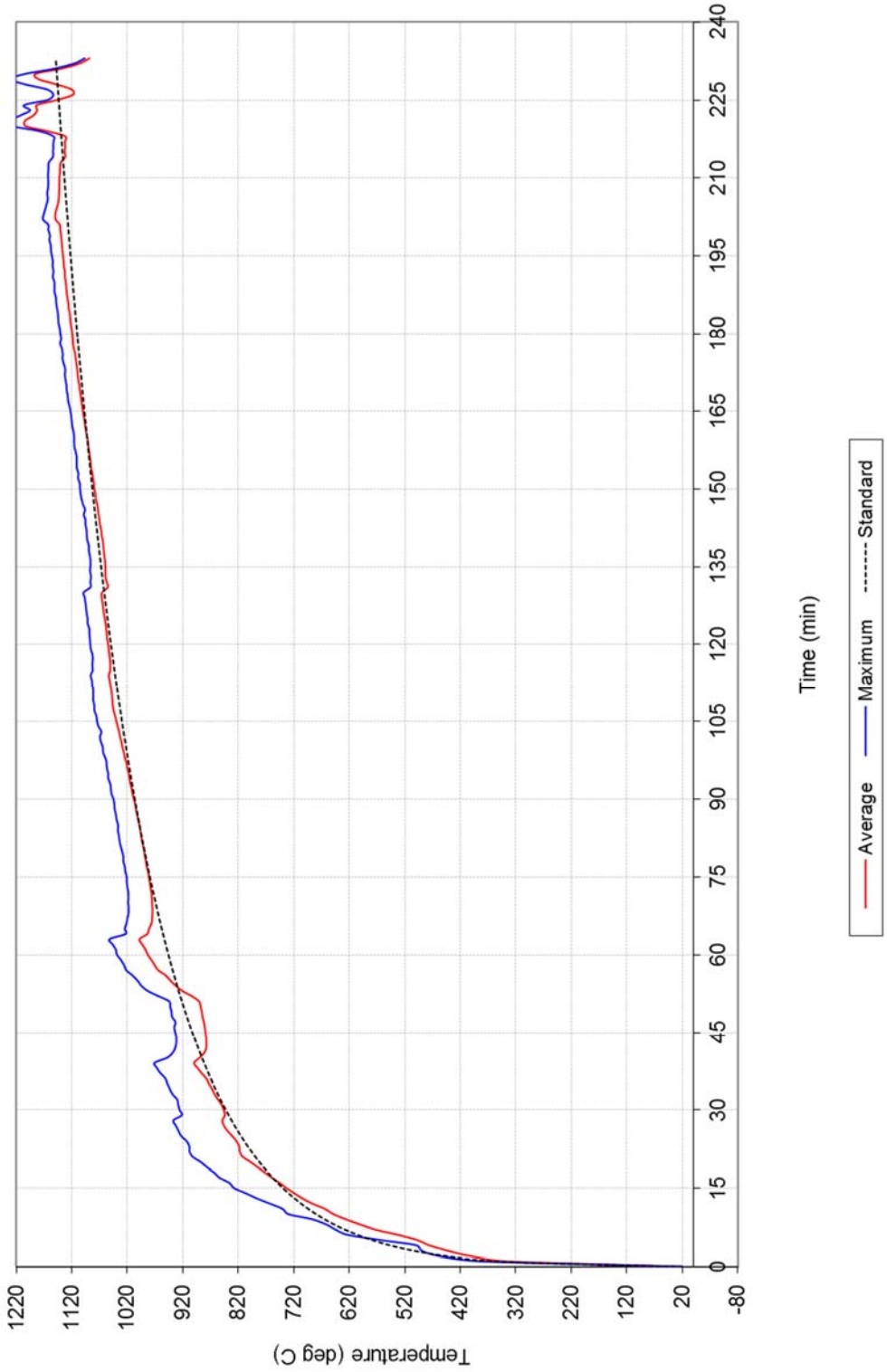


FIGURE 1 – FURNACE TEMPERATURE

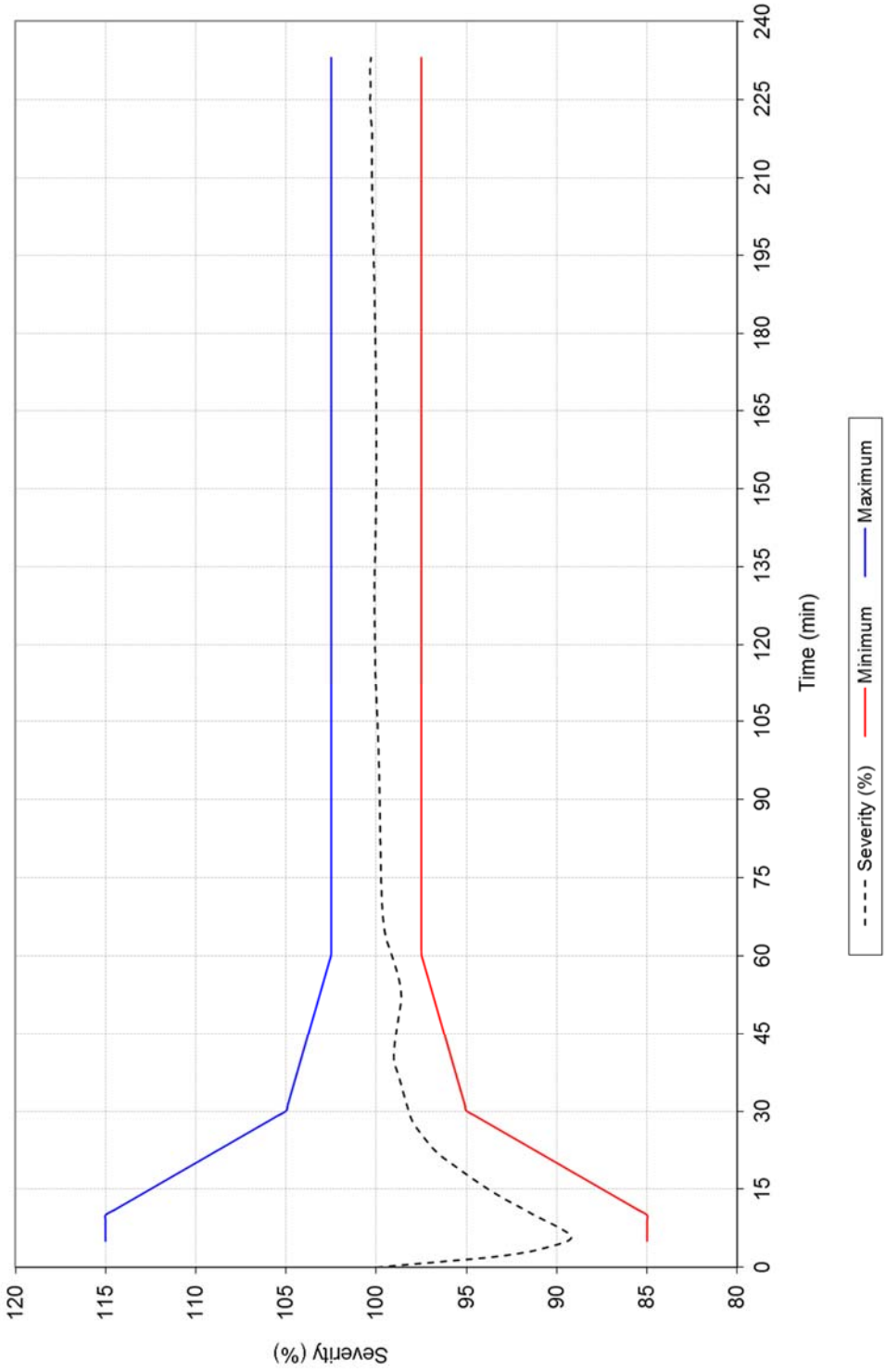


FIGURE 2 – FURNACE SEVERITY

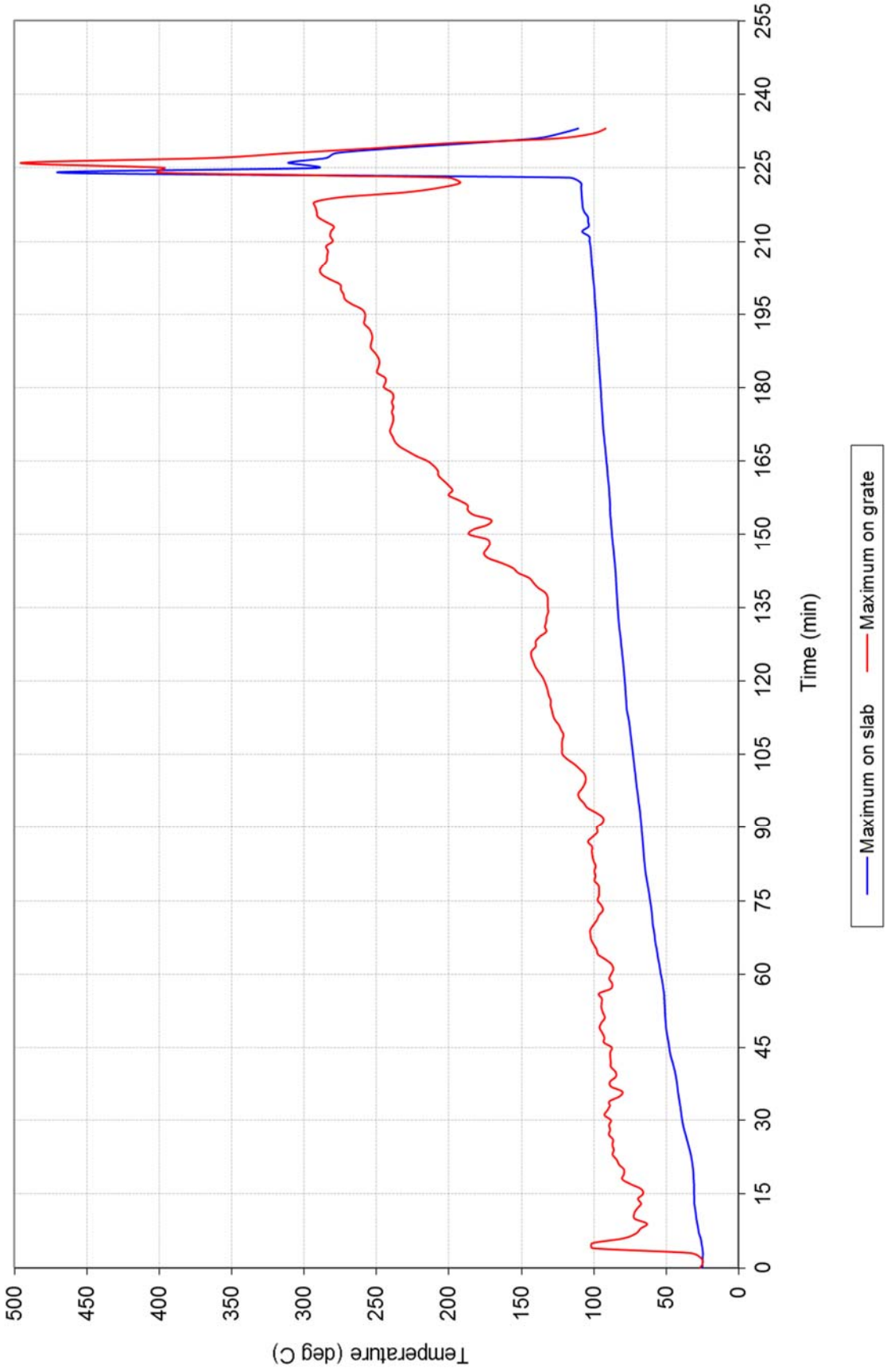


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 2

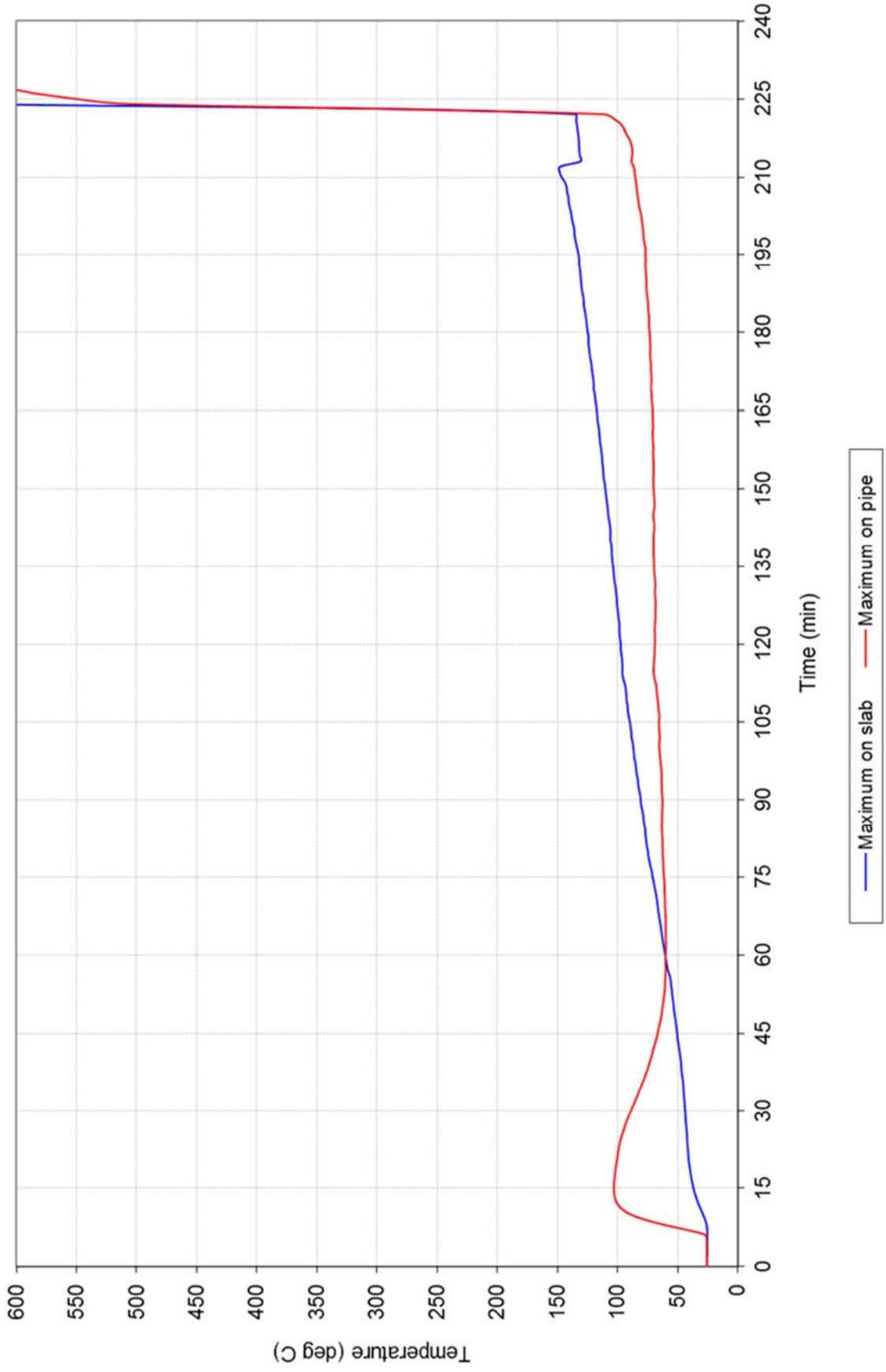
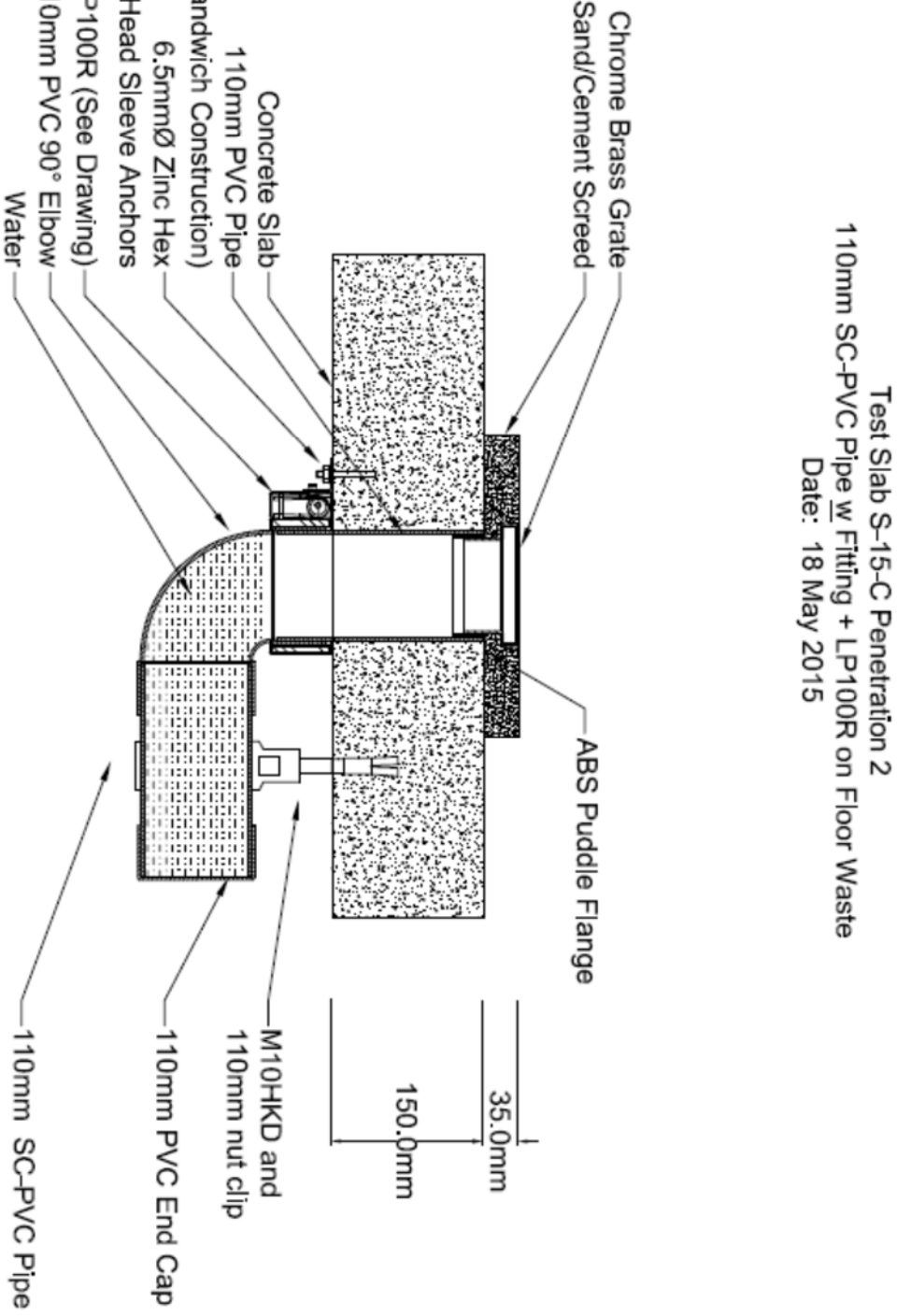


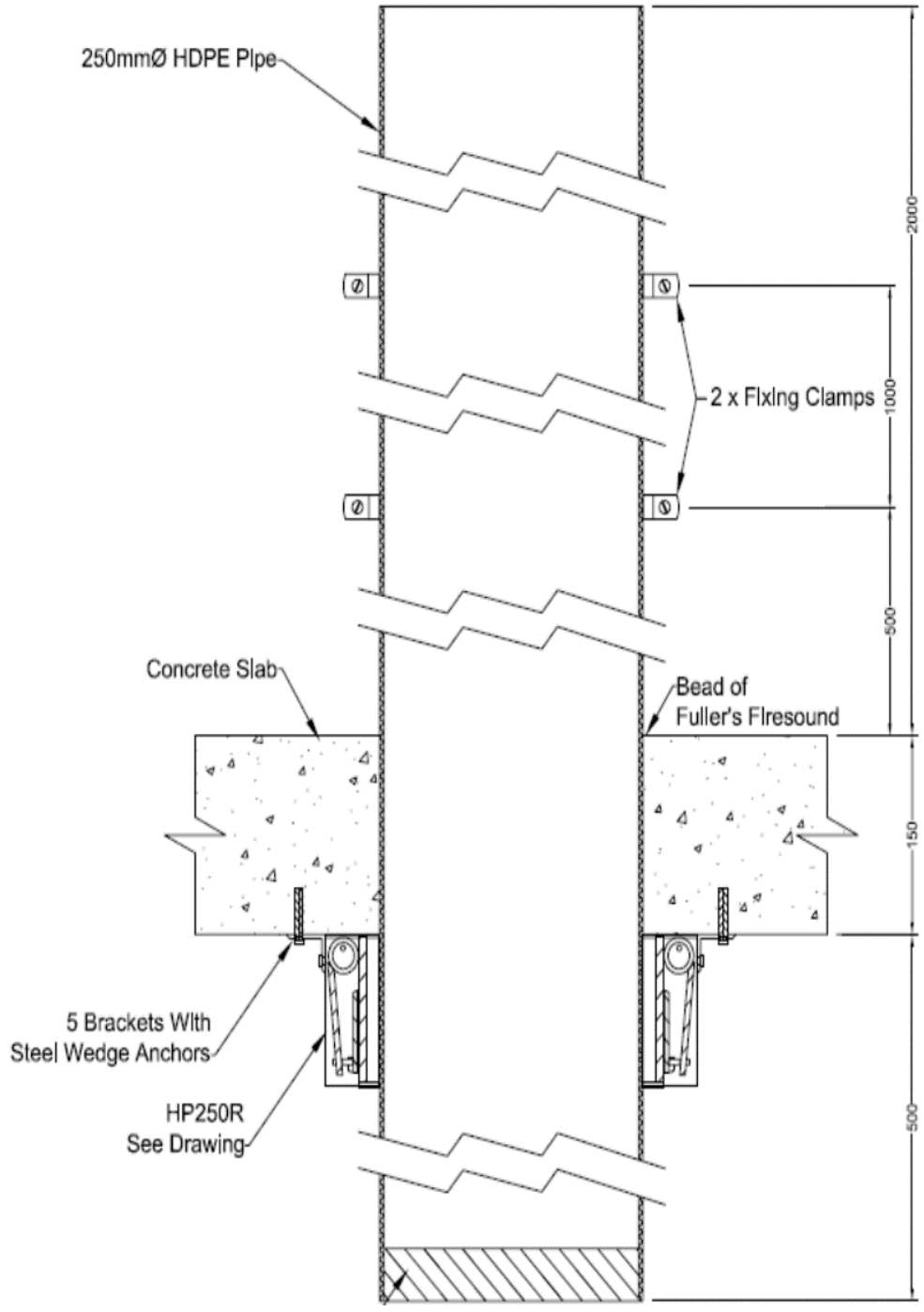
FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 3

Appendix D – Installation drawings



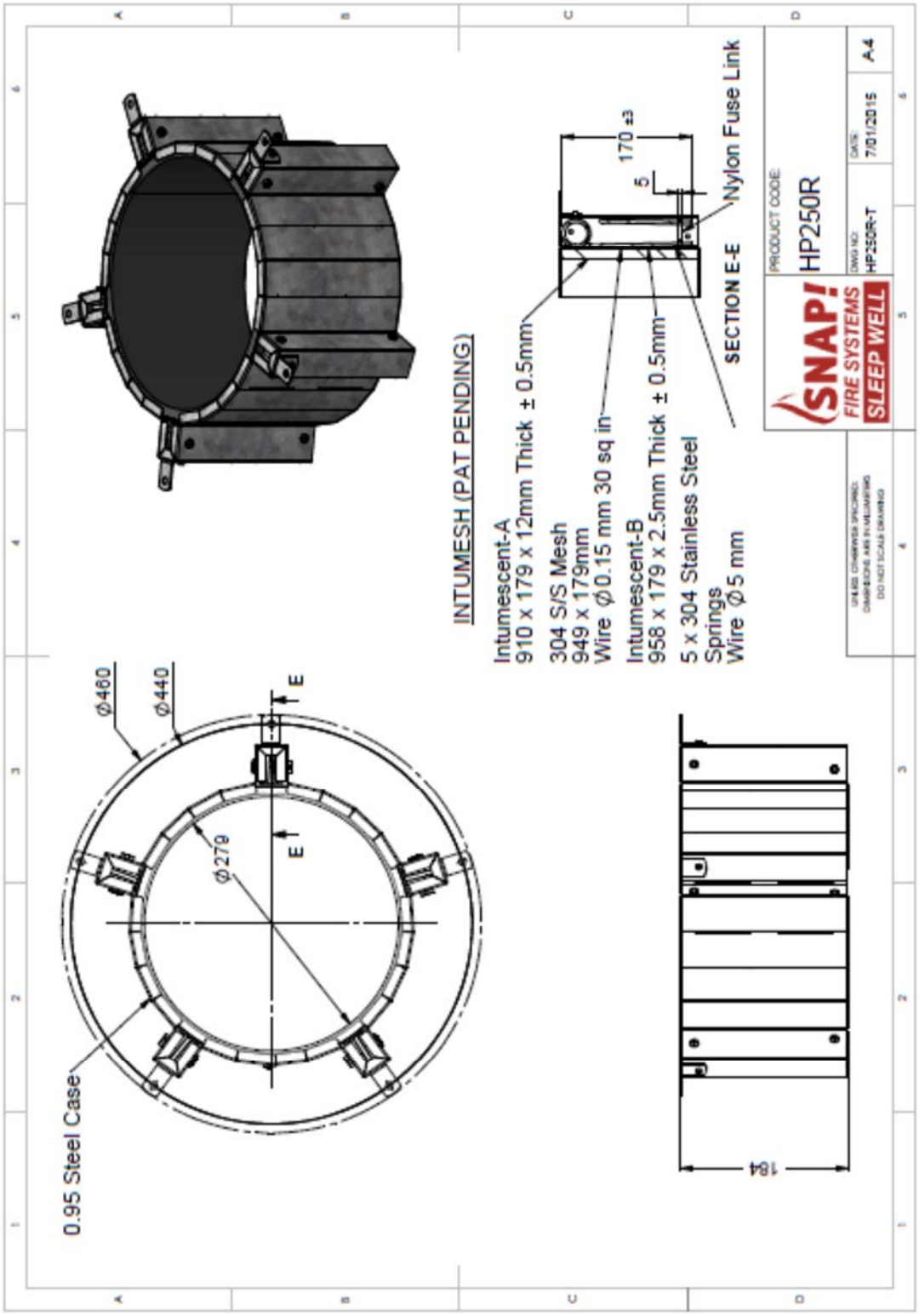
DRAWING TITLED "TEST SLAB S-15-C PENETRATION #2 110-MM SC-PVC PIPE W FITTING + LP100R ON FLOOR WASTE", DATED 18 MAY 2015, BY SNAP FIRE SYSTEMS PTY LTD.

PENETRATION # 3
HDPE 250-MM STACK
13 APR 2015

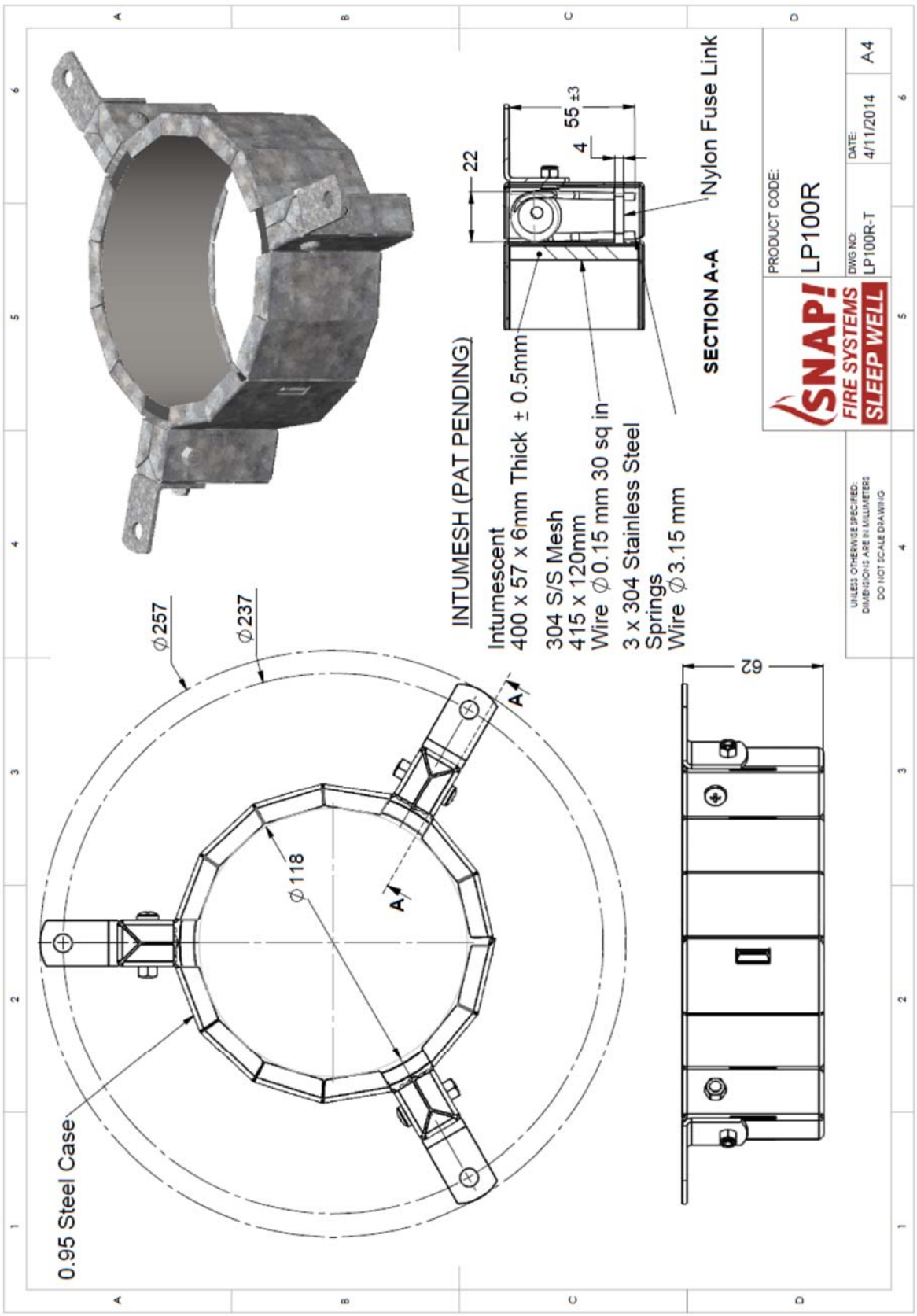


DRAWING NUMBERED "PENETRATION #3 – HDPE 250-MM STACK", DATED 13 APRIL 2015, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix E – Specimen Drawings



DRAWING NUMBERED HP 250 R-T DATED 7 JANUARY 2015, BY SNAP FIRE SYSTEMS PTY LTD.



DRAWING NUMBERED LP100R-T, DATED 4 NOVEMBER 2014, BY SNAP FIRE SYSTEMS.

Appendix F – Certificate(s) of Test

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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. 2948

This is to certify that the element of construction described below was tested by the CSIRO Division of Materials Science and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of:

Snap Fire Systems Pty Ltd
Unit 2/160 Redland Bay Road
CAPALABA QLD

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 1692.

Product Name: Penetration 2 – LP100R retrofitted fire collar protecting a 110-mm diameter Polyvinyl Chloride (PVC-SC) pipe incorporating a floor waste

Description: The SNAP LP100R retrofitted fire collar comprised a 0.95-mm steel casing with an 118-mm inner diameter and a 257-mm diameter base flange. The 62-mm high collar casing incorporated a 400-mm x 57-mm x 6-mm thick intumescent material. The closing mechanism comprised three stainless steel springs, nylon fuse links and a 415-mm x 120-mm stainless steel mesh, as shown in drawing numbered LP100R-T, dated 4 November 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 6.5-mm Zinc Hex Head Sleeve Anchors as shown in drawing titled "Test Slab S-15-C Penetration #2 110-mm SC-PVC Pipe w Fitting + LP100R on Floor Waste", dated 18 May 2015, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 110-mm OD PVC sandwich construction pipe, with a wall thickness of 1.6-mm fitted through the LP 100 R Snap fire collars. The floor waste system was fitted with a chromed brass floor waste grate. A 35-mm thick cement screed was laid on top of the concrete slab and finished flush with the floor grate. On exposed side of the slab, a nominal 100-mm OD PVC gully trap was connected to the penetrating pipe, supported by an M10 HKD clamp fixed to the concrete slab. On the exposed face, the gully trap was capped using a PVC end cap. The floor waste gully was charged with water to the level shown in drawing titled "Test Slab S-15-C Penetration #2 110-mm SC-PVC Pipe w Fitting + LP100R on Floor Waste", dated 18 May 2015, by Snap Fire Systems Pty Ltd.

Structural Adequacy	not applicable
Integrity	no failure at 230 minutes
Insulation	163 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/180/120. The FRL is applicable for exposure to the fire from the same direction as tested.

This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance.

Testing Officer: Mario Lara-Ledermann Date of Test: 9 February 2015

Issued on the 14th day of June 2017 without alterations or additions.

B. Roddy

Brett Roddy
Manager, Fire Testing and Assessments

This document is issued in accordance with NATA's accreditation requirements.
Accreditation No. 165 – Corporate Site No. 3625
Accredited for compliance with ISO/IEC 17025

COPY OF CERTIFICATE OF TEST – NO. 2948

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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. 2656

This is to certify that the element of construction described below was tested by the CSIRO Division of Materials Science and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of:

Snap Fire Systems Pty Ltd
Unit 2/160 Redland Bay Road
CAPALABA QLD

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 1692.

Product Name: Penetration # 3 – HP250 R retrofitted fire collar protecting a 250-mm diameter High Density Polyethylene (HDPE) stack pipe

Description: The SNAP retrofitted HP250 R collar comprised a 0.95-mm steel casing with a 279 mm inner diameter and a 460-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 nylon fuse links, and a 949 mm x 179-mm 304 stainless steel mesh located in between the intumescent strips as shown in drawing numbered HP 250 R-T dated 7 January 2015, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 250-mm diameter High Density Polyethylene (HDPE) stack pipe, with a wall thickness of 7.25-mm fitted through the collar's sleeve. The pipe projected vertically, 2000-mm above the concrete slab. The pipe was supported at 500 mm and 1000-mm from the unexposed face of the concrete slab. On the exposed side of the slab, the penetrating pipe was supported by 5 brackets with Steel Wedge Anchors fixed to the concrete slab. On the exposed face, the pipe was capped using a Kaowool plug. On the unexposed face, the gap between the pipe and the slab was filled with a bead of Fullers Firesound as show in drawing titled "Penetration #3 – HDPE 250-mm stack", dated 13 April 2015, by Snap Fire Systems Pty Ltd.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	no failure at 180 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/180/180. The FRL is applicable for exposure to the fire from the same direction as tested.

This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance.

Testing Officer: Mario Lara-Ledermann Date of Test: 9 February 2015

Issued on the 26th day of October 2015 without alterations or additions.

B. Roddy

Brett Roddy
Manager, Fire Testing and Assessments

NATA

This document is issued in accordance with NATA's accreditation requirements.
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Accredited for compliance with ISO/IEC 17025

COPY OF CERTIFICATE OF TEST – NO. 2656

References

The following informative documents are referred to in this Report:

AS 1530.4-2005	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.
AS/NZS 1260: 2009	PVC-U pipes and fittings for drain, waste and vent application
AS/NZS 5065: 2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications.

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