

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

Test Report

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Commercial-in-confidence

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

Sponsored Investigation No. FSP 1657

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 nine (9) +GF+ Georg Fischer Progef Polypropylene PP-H pipes.

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 4446/3772

1.7 Test date

The fire-resistance test was conducted on 11 September 2014.

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 nine (9) polypropylene homopolymer (PP-H) stack pipes protected by cast-in and retrofit Snap Fire System fire collars. The pipes are stated to be manufactured in accordance with DIN 8077, DIN 8078 & EN ISO 15494.

For the purpose of the test, the specimens were referenced as Penetrations 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Penetration 1 – H 50 FWS cast in fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP cast-in H 50 FWS fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240-mm x 58-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism incorporated three stainless steel springs, with nylon fuse links and a 280-mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 63-mm OD PP-H pipe, with a wall thickness of 6.2-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #1 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

Penetration 2 – H 50 FWS-RR cast-in fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240-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 280-mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 25-mm OD PP-H pipe, with a wall thickness of 2.7-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #2 – PP-H (25-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

Penetration 3 – 63 R retrofitted fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP Retrofit 63 R fire collar comprised a 0.75-mm steel casing with a 72-mm inner diameter and three fixing brackets clipped onto the collar casing. The 47-mm high collar casing incorporated 230-mm x 43-mm x 4-mm thick Intumesh intumescent material and a 240-mm x 42-mm stainless steel mesh as shown in drawing numbered 63 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 63-mm OD PP-H pipe, with a wall thickness of 6.2-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 as shown in drawing titled "Penetration #3 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

Penetration 4 – H 50 FWS-RR cast-in fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240-mm x 58-mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three stainless steel springs, with nylon fuse links and a 280-mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 40-mm OD PP-H pipe, with a wall thickness of 4.8-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 as shown in drawing titled "Penetration #4 – PP-H (40-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

Penetration 5 – 32 R retrofitted fire collar protecting a 32-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP Retrofit 32 R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and three fixing brackets clipped onto the collar casing. The 32-mm high collar casing incorporated 135-mm x 26-mm x 4-mm thick Intumesh intumescent material and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32 R-T dated 2 July 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 32-mm OD PP-H pipe, with a wall thickness of 3.8-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 as shown in drawing titled "Penetration #5 – PP-H (32-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

Penetration 6 – 50 R retrofitted fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP Retrofit 50 R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and three fixing brackets fixed onto the collar casing. The 47-mm high collar casing incorporated 200-mm x 43-mm x 4-mm thick Intumesh intumescent material and a 210-mm x 42-mm stainless steel mesh as shown in drawing numbered 50 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 40-mm OD PP-H pipe, with a wall thickness of 3.9-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 as shown in drawing titled "Penetration #6 – PP-H (40-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

Penetration 7 – H 50 FWS-RR cast-in fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240-mm x 58-mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three stainless steel springs, with nylon fuse links and a 280-mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 50-mm OD PP-H pipe, with a wall thickness of 5.1-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 as shown in drawing titled "Penetration #7 – PP-H (50-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

Penetration 8 – 32 R retrofitted fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP Retrofit 32 R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and three fixing brackets clipped onto the collar casing. The 32-mm high collar casing incorporated 135-mm x 26-mm x 4-mm thick Intumesh intumescent material and 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32 R-T dated 2 July 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 25-mm OD PP-H pipe, with a wall thickness of 2.7-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 as shown in drawing titled "Penetration #8 – PP-H (25-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

Penetration 9 – 50 R retrofitted fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

The SNAP Retrofit 50 R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and three fixing brackets fixed onto the collar casing. The 47-mm high collar casing incorporated 200-mm x 43-mm x 4-mm thick Intumesh intumescent material and a 210-mm x 42-mm stainless steel mesh as shown in drawing numbered 50 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 50-mm OD PP-H pipe, with a wall thickness of 5.3-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 as shown in drawing titled "Penetration #9 – PP-H (50-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

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 numbered Penetration #1 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #2 – PP-H (25-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #3 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #4 – PP-H (40-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #5 – PP-H (32-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd

Drawing numbered Penetration #6 – PP-H (40-mm OD) Stack” dated 10 June 2014, by Snap Fire Systems Pty Ltd

Drawing numbered Penetration #7 – PP-H (50-mm OD) Stack” dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #8 – PP-H (25-mm OD) Stack” dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered Penetration #9 – PP-H (50-mm OD) Stack” dated 10 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered H 50 FWS-T dated 26 September 2014, by SNAP Fire Systems.

Drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

Drawing numbered 63 R-T dated 4 November 2013, by SNAP Fire Systems.

Drawing numbered 32 R-T dated 2 July 2014, by SNAP Fire Systems.

Drawing numbered 50 R-T dated 4 November 2013, by SNAP Fire Systems.

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 241 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

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

Time	Observation
2 minutes -	Light smoke is visible from Penetrations 2 and 5 and the furnace flues.
3 minutes -	Smoke is visible from Penetration 9 only.
4 minutes -	Smoke is visible from Penetration 6 only.
6 minutes -	Smoke is visible from Penetrations 3, 7 and 9.
8 minutes -	Light smoke is visible from Penetrations 3 and 6. Increased smoke is visible from the furnace flues.
10 minutes -	No smoke is visible from the unexposed ends of the penetrations.
12 minutes -	Spalling noise is audible from the slab. Smoke quantity from the furnace flues has decreased.
14 minutes -	Further spalling noises can be heard from the slab.
17 minutes -	Little smoke is visible from the furnace flues. No penetrations are fluing. Spalling continues on the slab.
27 minutes -	Steam/moisture is visible from Penetrations 2, 5 and 8. Spalling noises has ceased.
50 minutes -	Steam/moisture is visible from Penetrations 2, 4, 5, 7 and 8.
75 minutes -	Little visible change noted on the unexposed face.
80 minutes -	The slab has dried out around the Penetrations.
120 minutes -	Little visible change noted on the unexposed face.
180 minutes -	The sealant at the base of Penetrations 5 and 8 has deformed slightly.
203 minutes -	Light smoke is visible from the base of Penetration 5.
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.

Figure 5 shows the curve of maximum temperature versus time associated with Penetration 3.

Figure 6 shows the curve of maximum temperature versus time associated with Penetration 4.

Figure 7 shows the curve of maximum temperature versus time associated with Penetration 5.

Figure 8 shows the curve of maximum temperature versus time associated with Penetration 6.

Figure 9 shows the curve of maximum temperature versus time associated with Penetration 7.

Figure 10 shows the curve of maximum temperature versus time associated with Penetration 8.

Figure 11 shows the curve of maximum temperature versus time associated with Penetration 9.

8.5 Performance

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

Penetration 1 – H 50 FWS cast in fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

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

Penetration 2 – H 50 FWS-RR cast-in fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 3 – 63 R retrofitted fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 4 – H 50 FWS-RR cast-in fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 5 – 32 R retrofitted fire collar protecting a 32-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 6 – 50 R retrofitted fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 7 – H 50 FWS-RR cast-in fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 8 – 32 R retrofitted fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Structural adequacy - not applicable

Integrity - no failure at 241 minutes

Insulation - no failure at 241 minutes

Penetration 9 – 50 R retrofitted fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

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;
Penetration 3	-	-/240/240;
Penetration 4	-	-/240/240;
Penetration 5	-	-/240/240;
Penetration 6	-	-/240/240;
Penetration 7	-	-/240/240;
Penetration 8	-	-/240/240; and
Penetration 9	-	-/240/240;

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

A handwritten signature in blue ink, appearing to read 'M. Lara-Ledermann', written over a horizontal line.

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 pipe	S1
	On slab 25-mm from pipe.	S2
	On pipe 25-mm from slab.	S3
	On pipe 25-mm from slab.	S4
Penetration 2	On slab 25-mm from pipe.	S5
	On slab 25-mm from pipe.	S6
	On grout.	S7
	On grout.	S8
	On pipe 25-mm from slab	S9
	On pipe 25-mm from slab.	S10
Penetration 3	On slab 25-mm from pipe.	S11
	On slab 25-mm from pipe.	S12
	On pipe 25-mm from slab.	S13
	On pipe 25-mm from slab.	S14
Penetration 4	On slab 25-mm from pipe.	S15
	On slab 25-mm from pipe.	S16
	On grout.	S17
	On grout.	S18
	On pipe 25-mm from slab	S19
	On pipe 25-mm from slab.	S20
Penetration 5	On slab 25-mm from pipe.	S21
	On slab 25-mm from pipe.	S22
	On pipe 25-mm from slab.	S23
	On pipe 25-mm from slab.	S24
Penetration 6	On slab 25-mm from pipe.	S25
	On slab 25-mm from pipe.	S26
	On pipe 25-mm from slab.	S27
	On pipe 25-mm from slab.	S28
Penetration 7	On slab 25-mm from pipe.	S29
	On slab 25-mm from pipe.	S30
	On grout.	S31
	On grout.	S32
	On pipe 25-mm from slab	S33

	On pipe 25-mm from slab.	S34
Penetration 8	On slab 25-mm from pipe.	S35
	On slab 25-mm from pipe.	S36
	On pipe 25-mm from slab.	S37
	On pipe 25-mm from slab.	S38
Penetration 9	On slab 25-mm from pipe.	S39
	On slab 25-mm from pipe.	S40
	On pipe 25-mm from slab.	S41
	On pipe 25-mm from slab.	S42

Appendix B - Photographs



PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



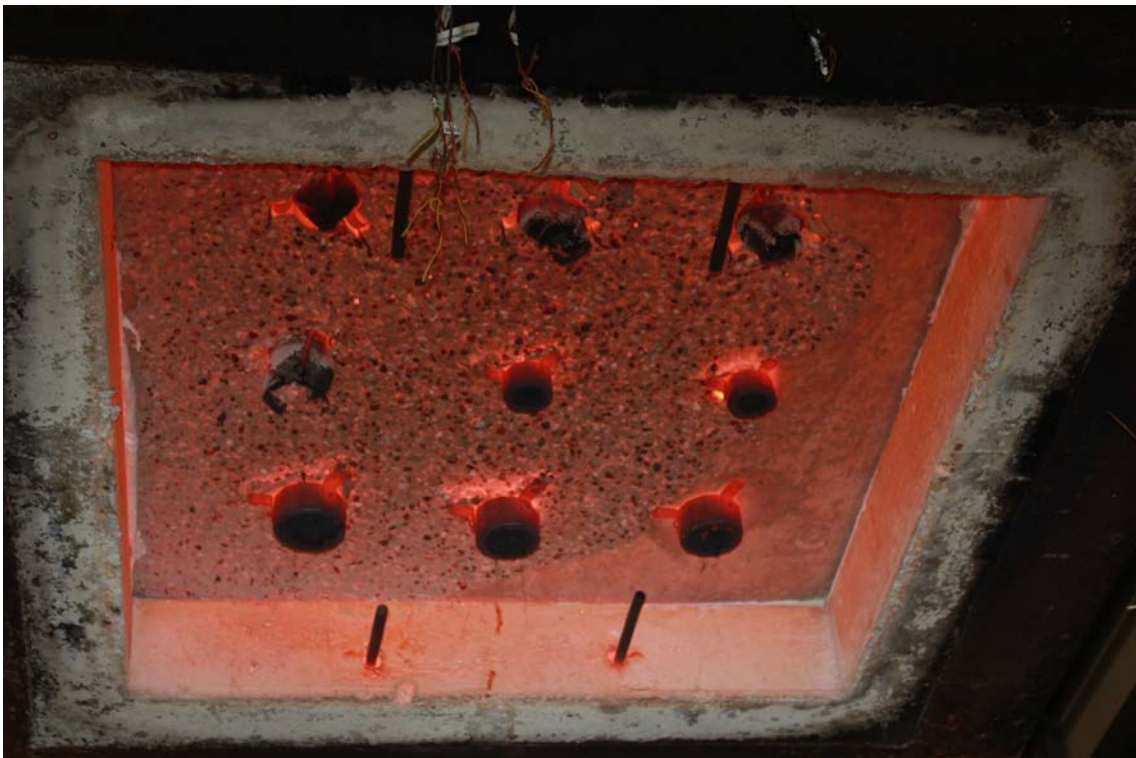
PHOTOGRAPH 3 – SPECIMENS AFTER 60 MINUTES OF TESTING



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

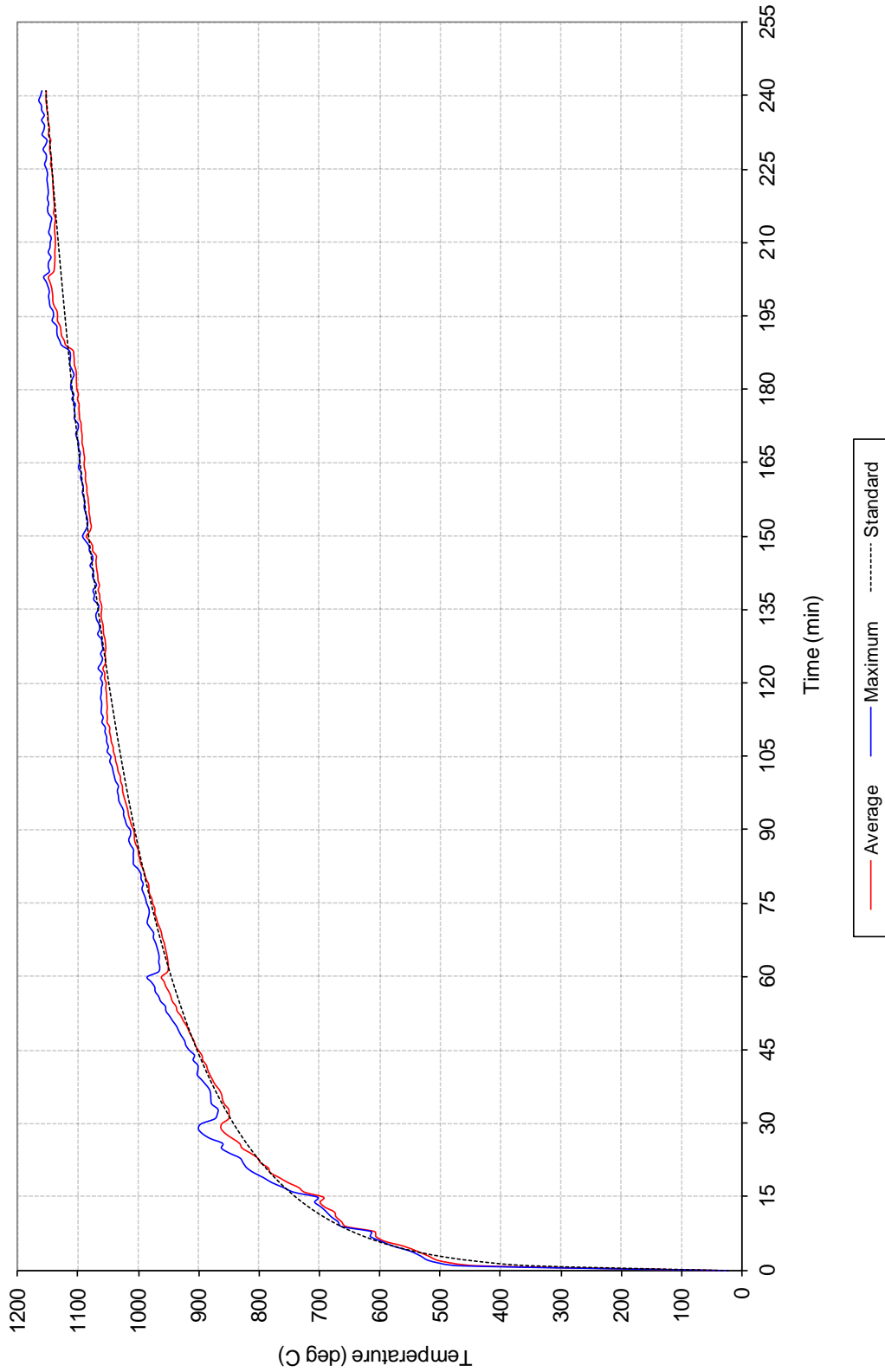


FIGURE 1 – FURNACE TEMPERATURE

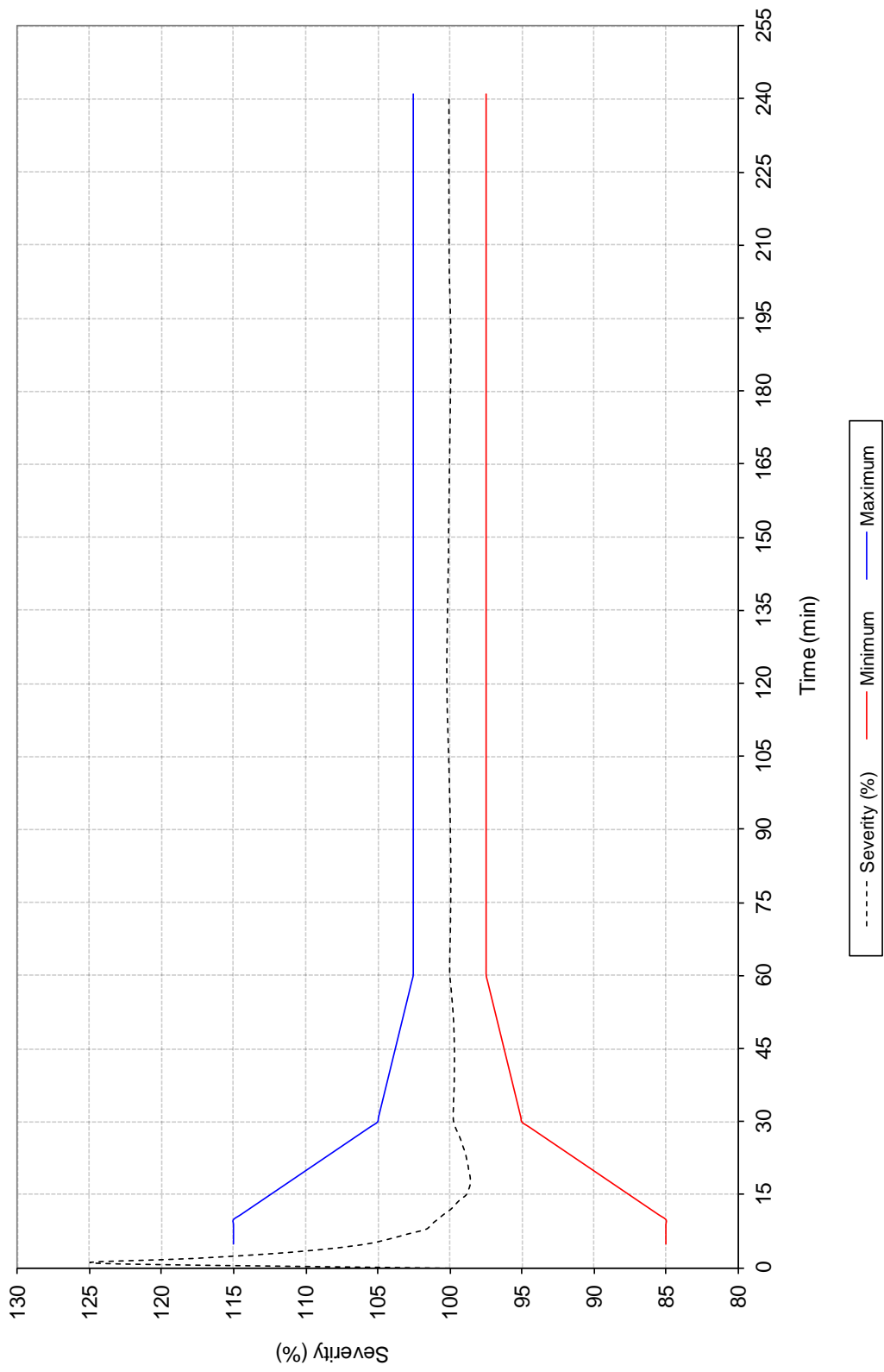


FIGURE 2 – FURNACE SEVERITY

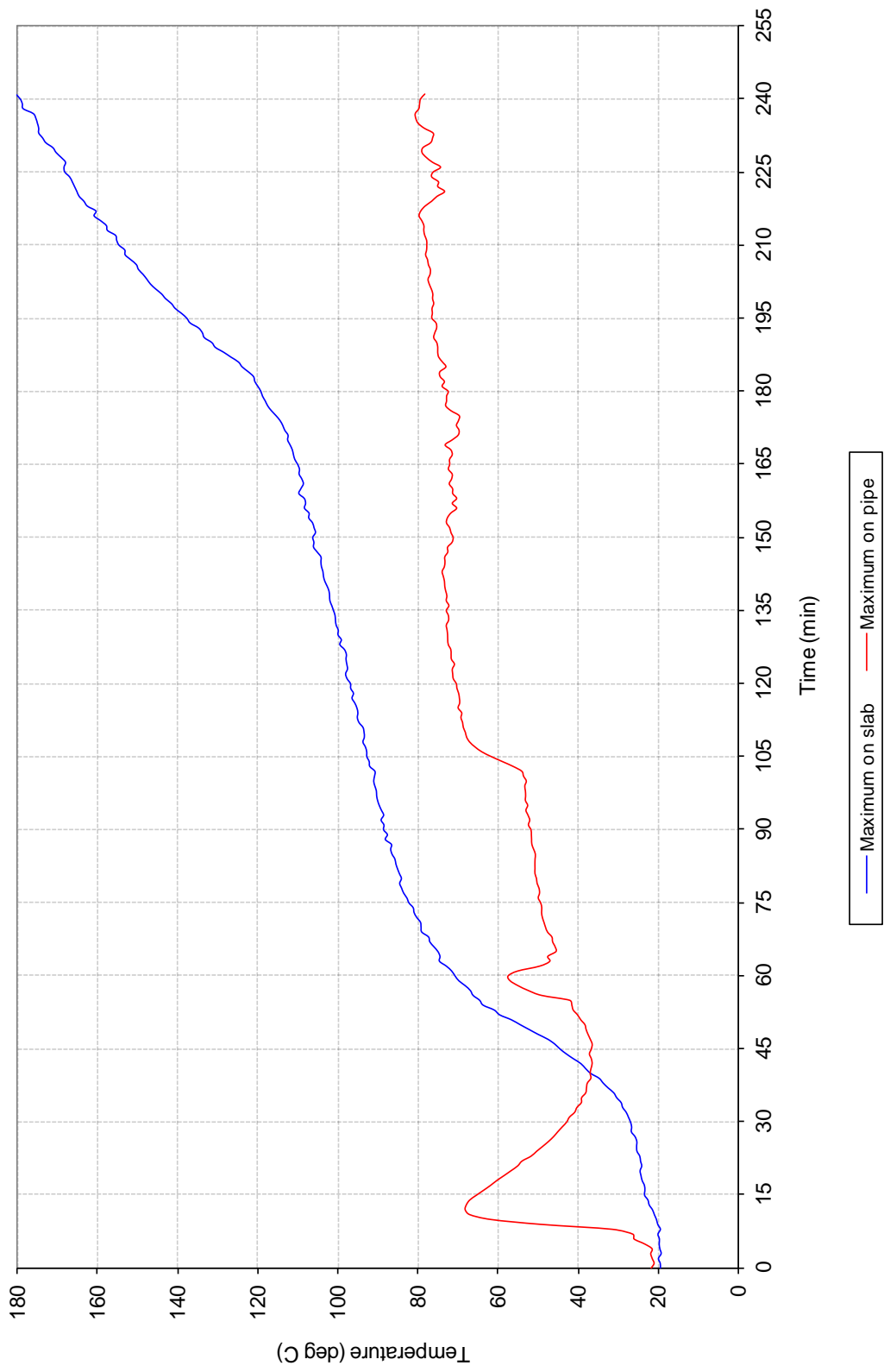


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 1

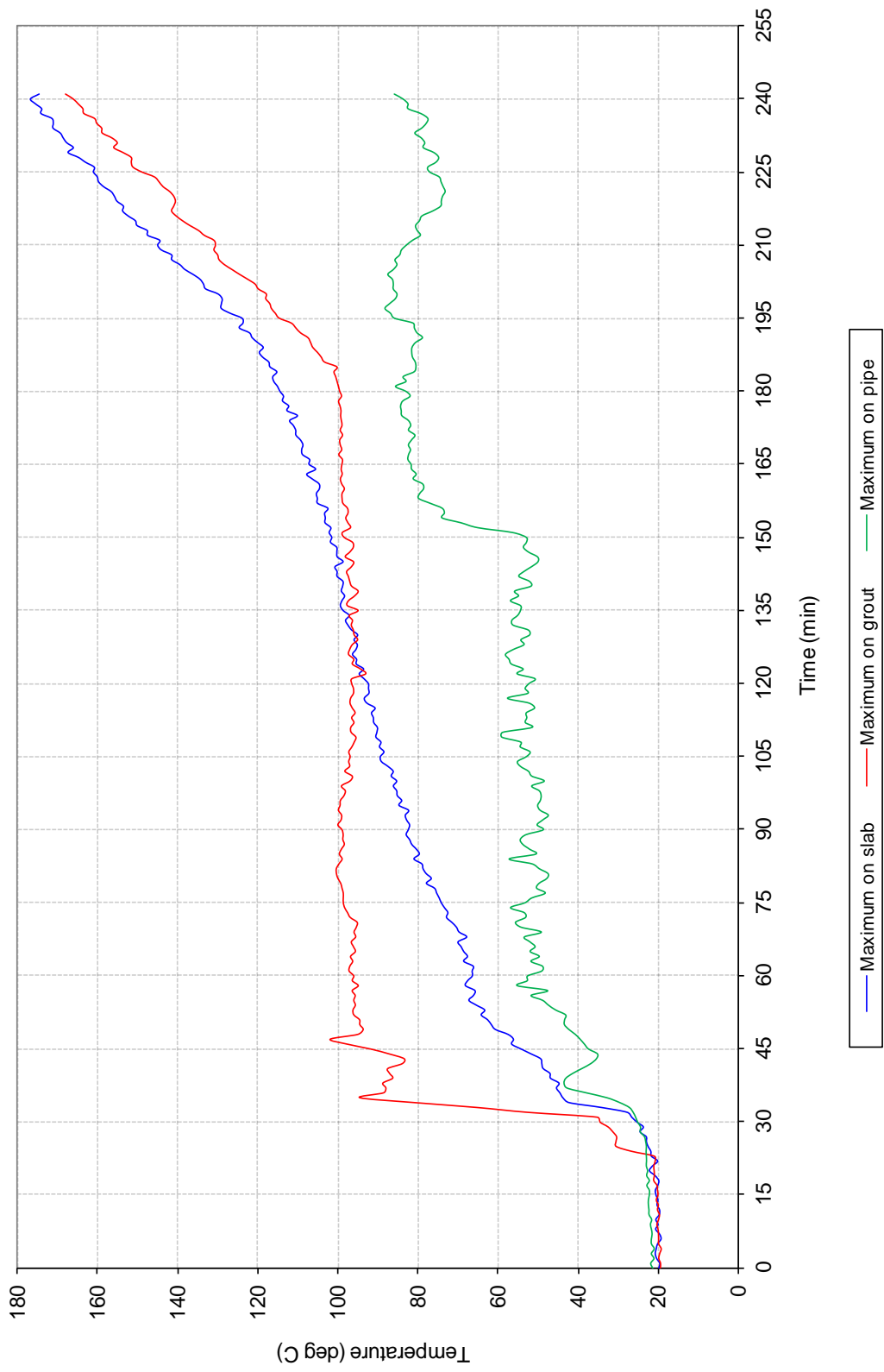


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 2

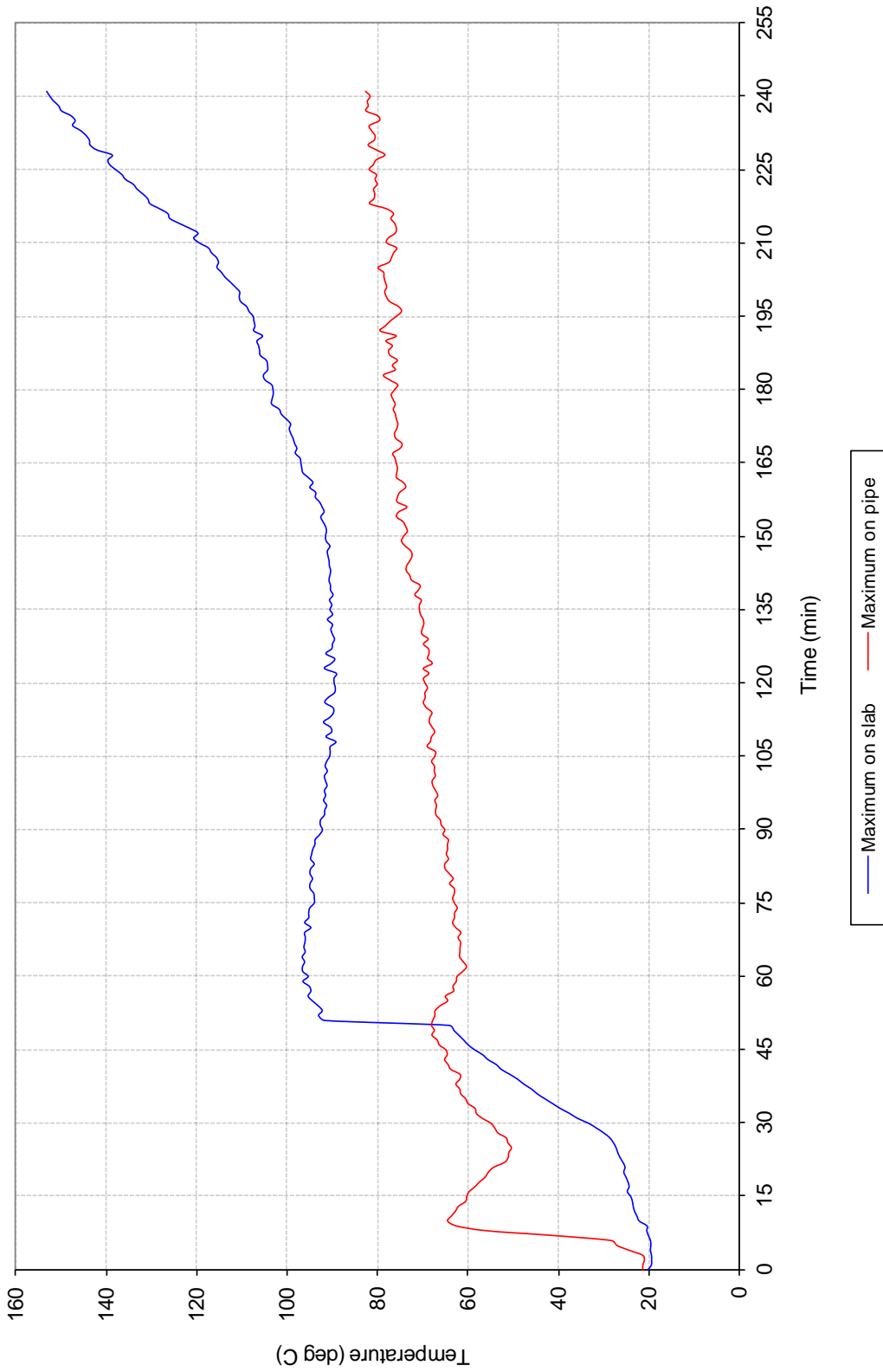


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 3

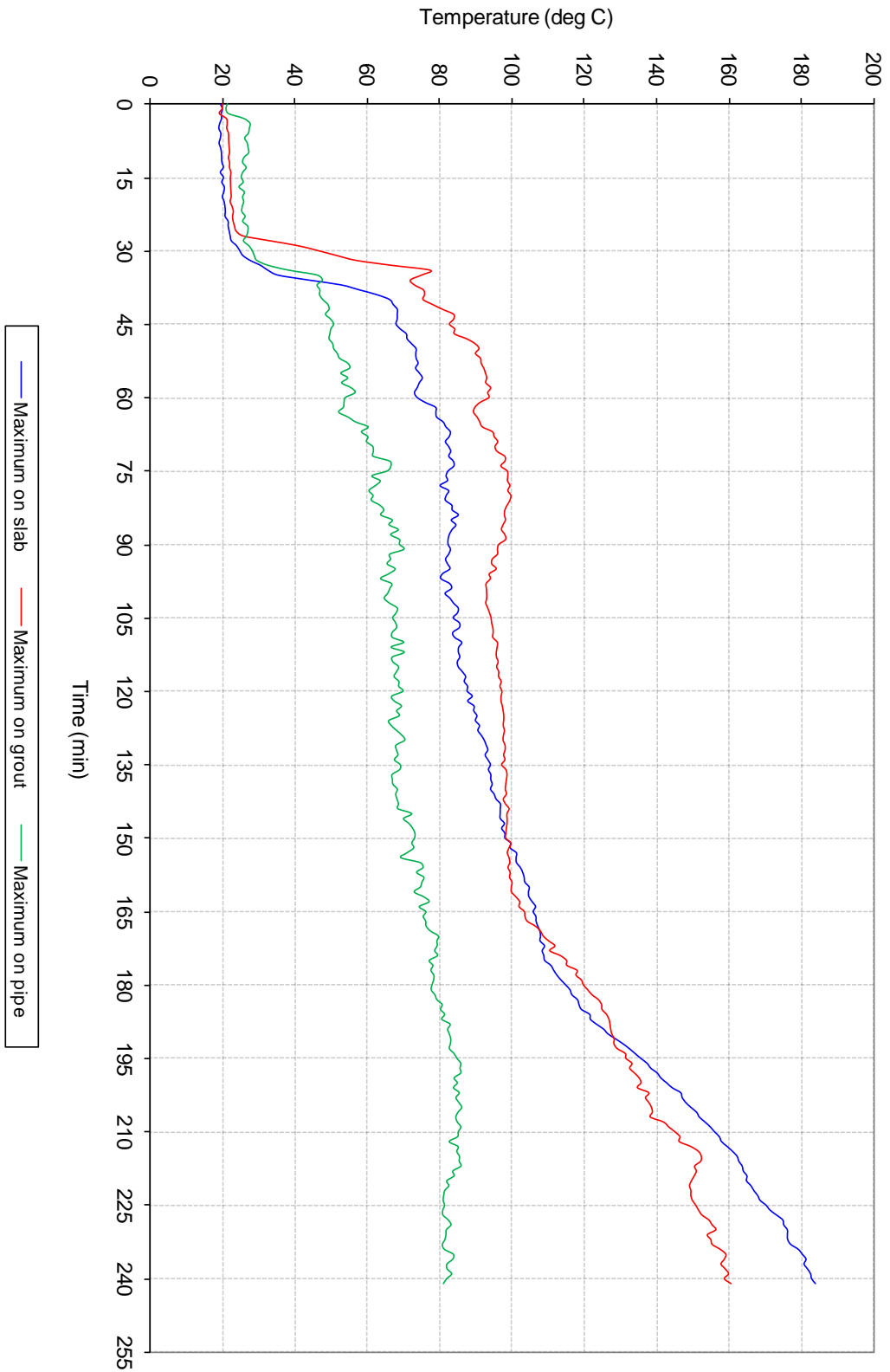


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 4

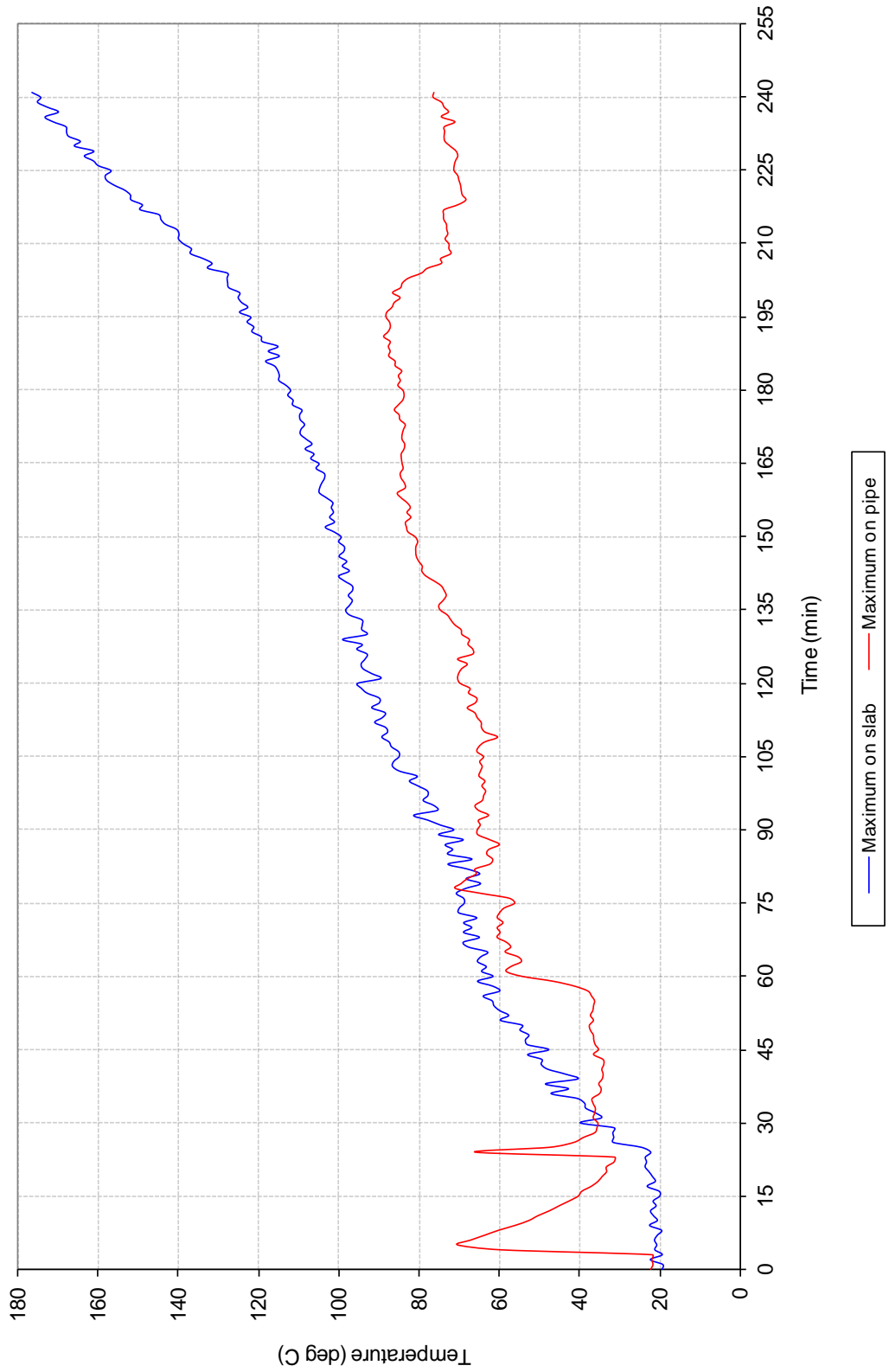


FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 5

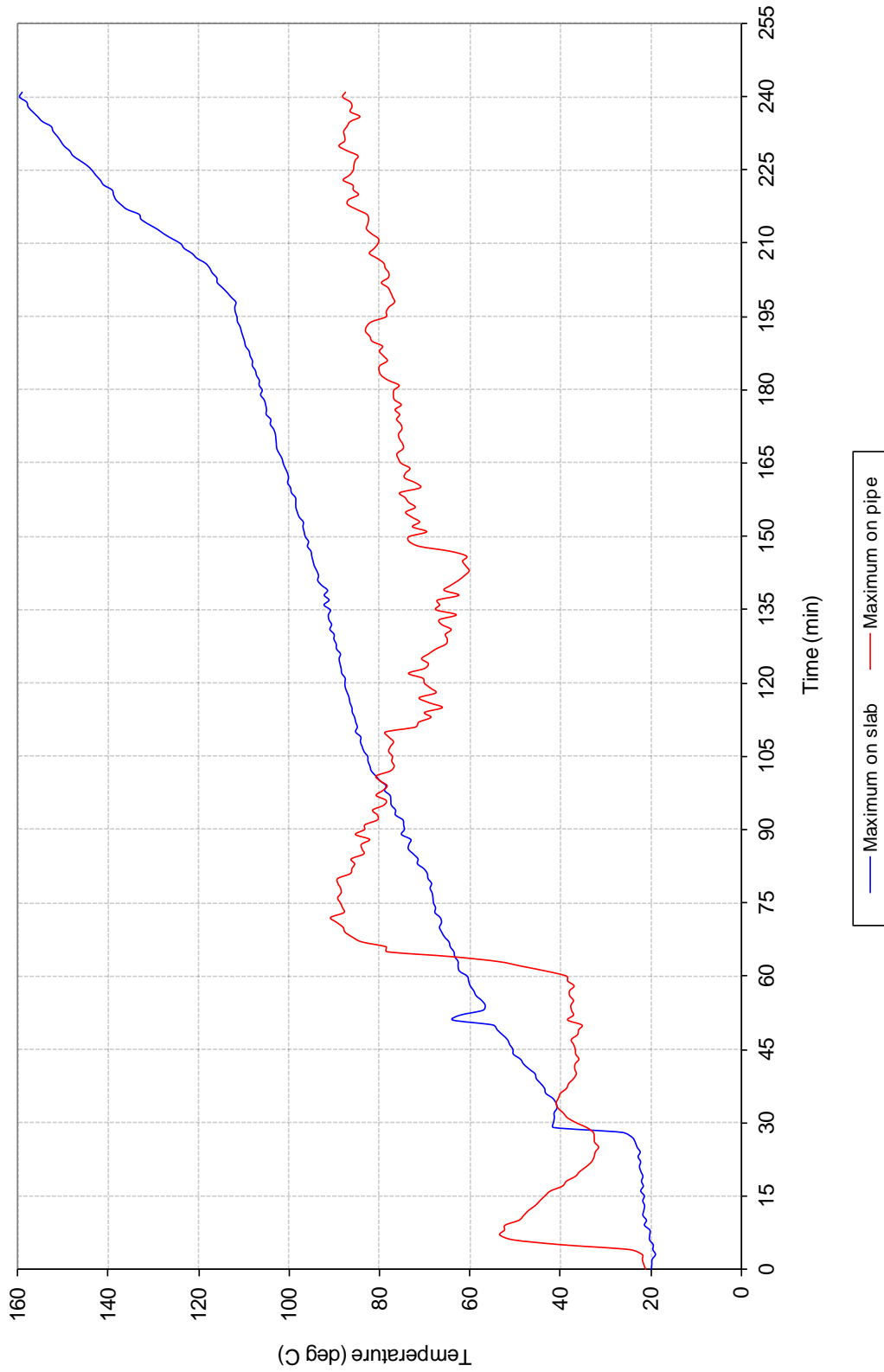


FIGURE 8 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 6

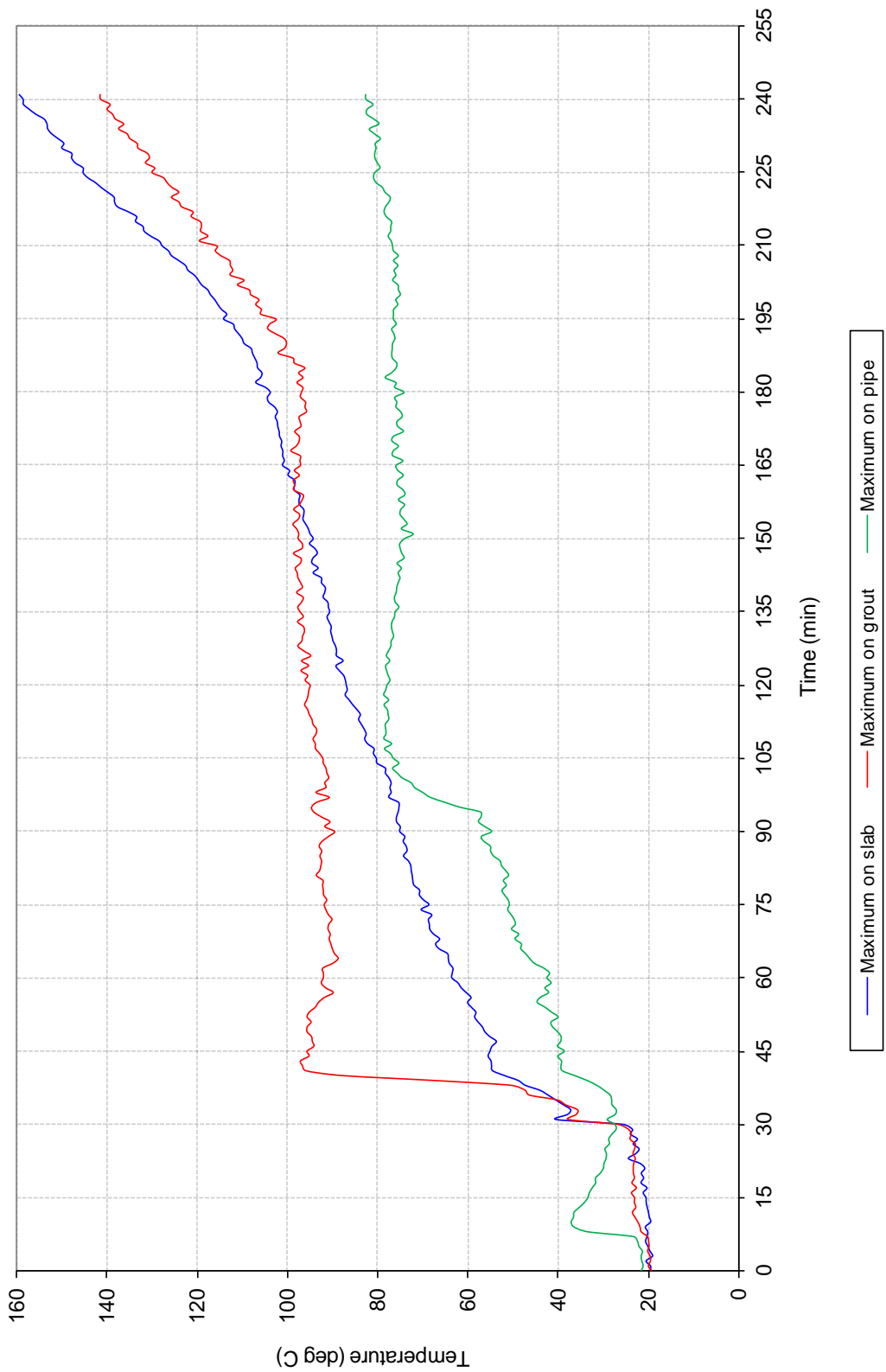


FIGURE 9 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 7

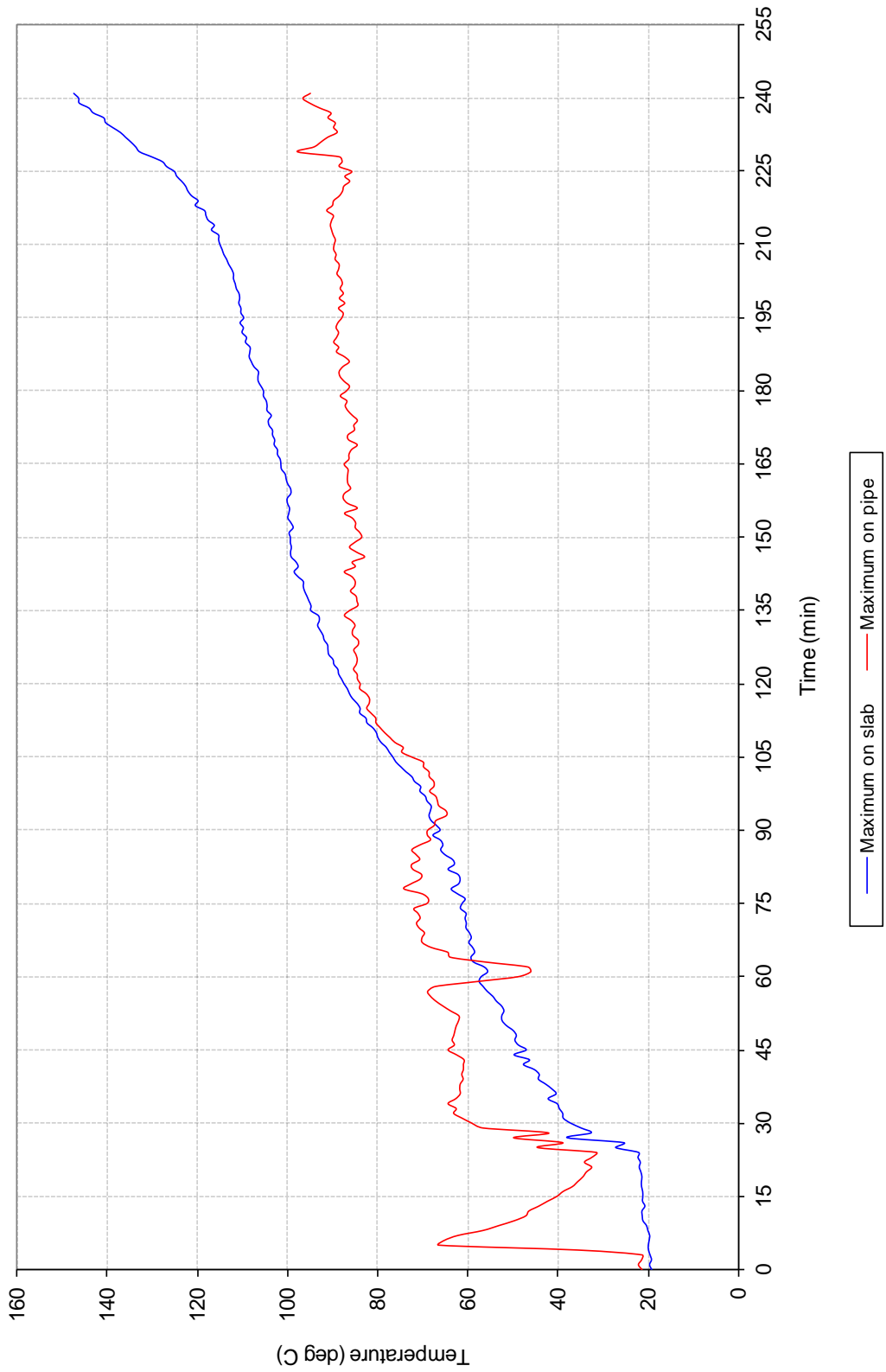


FIGURE 10 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 8

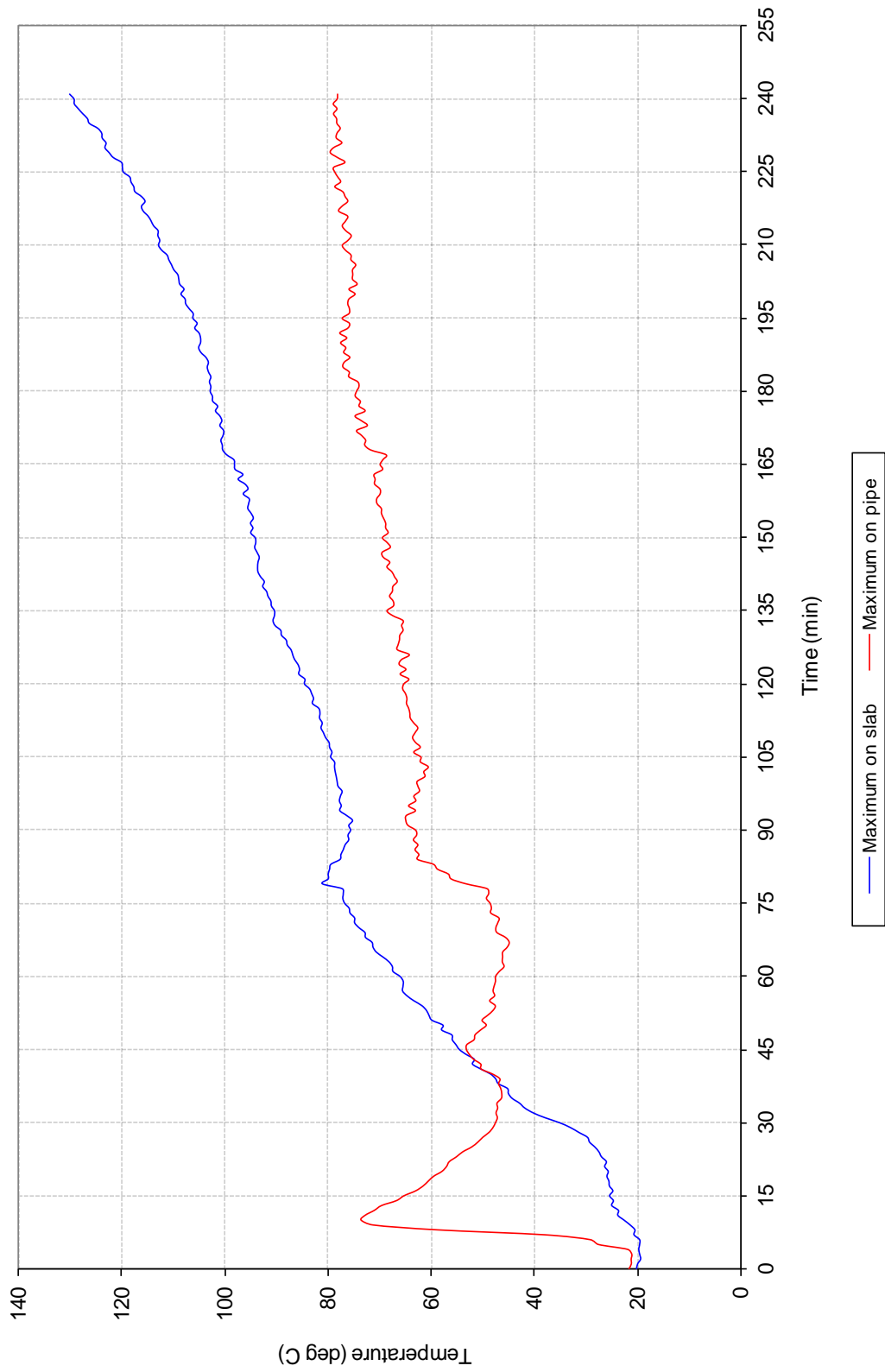
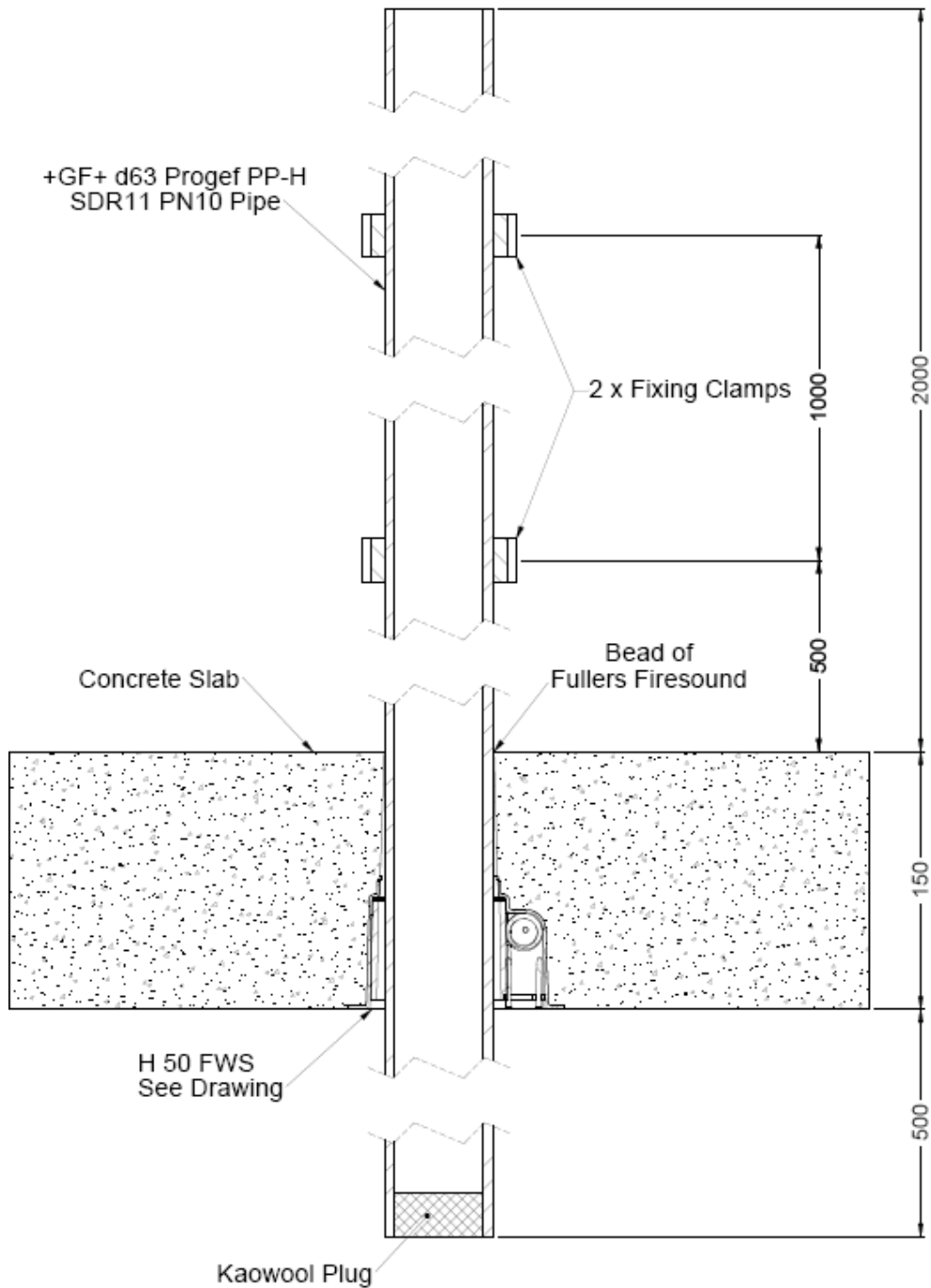


FIGURE 11 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 9

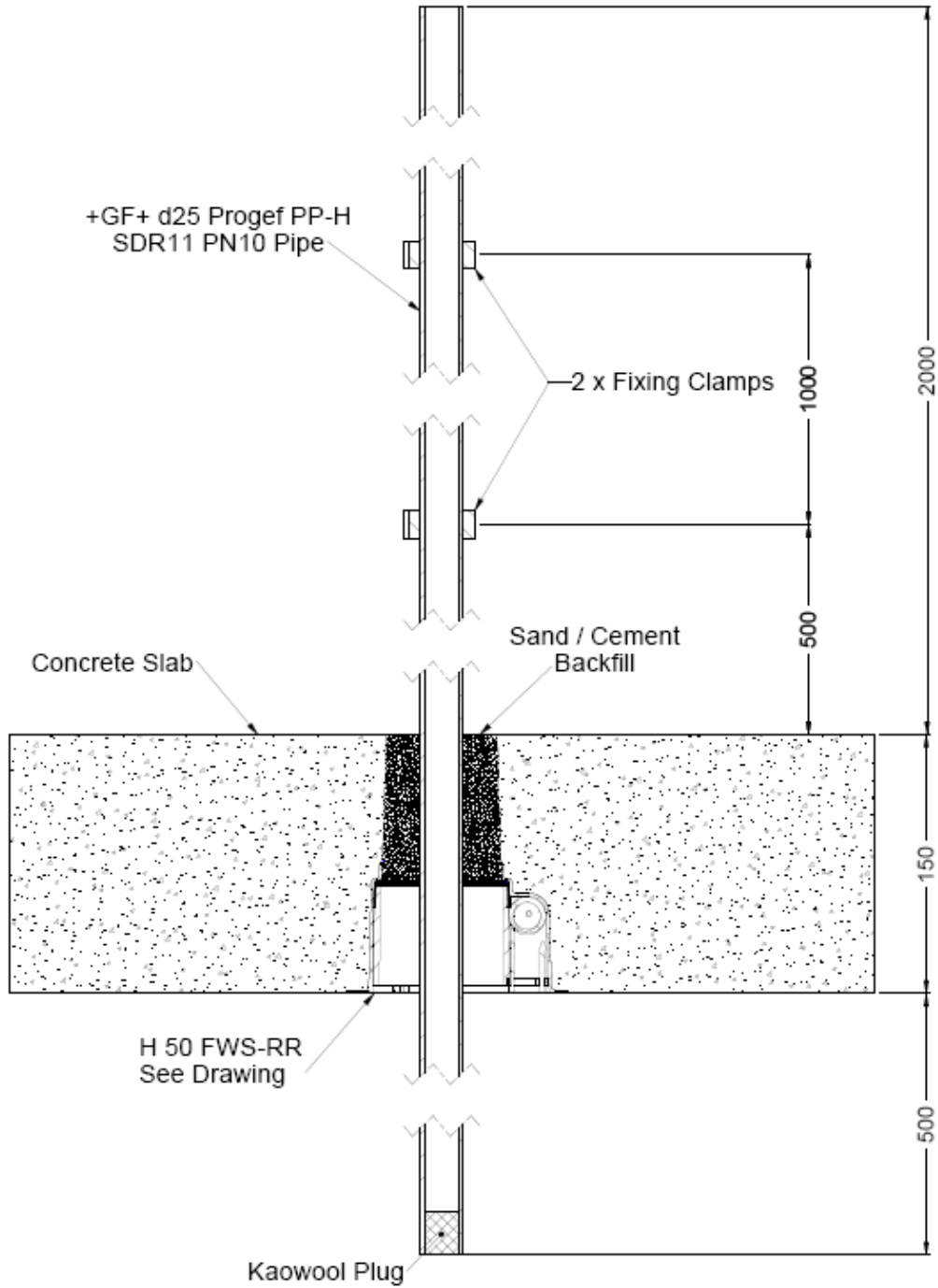
Appendix D – Installation drawings

Penetration #1
PP-H (63mm ϕ) Stack - Date 10-06-2014



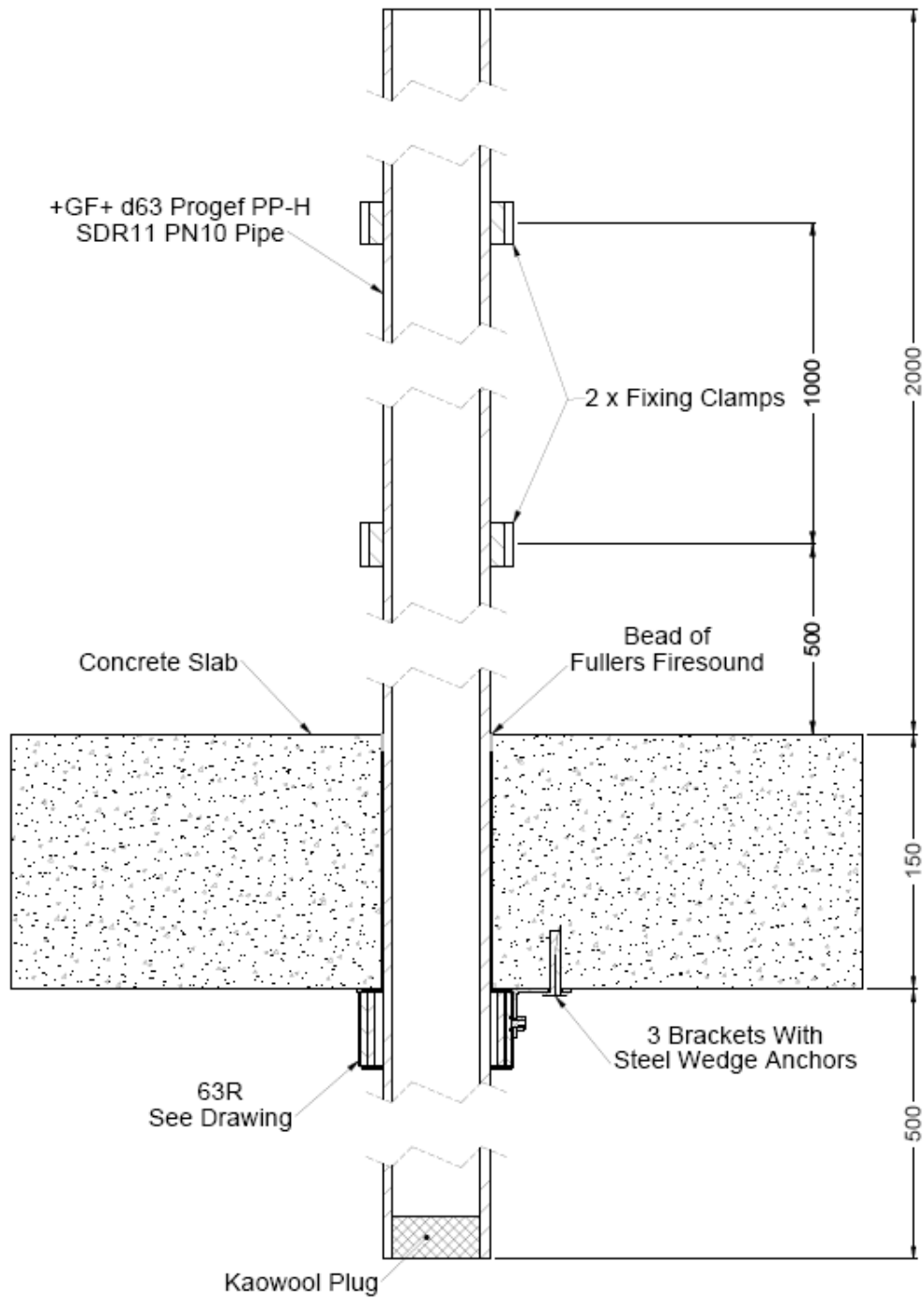
DRAWING NUMBERED PENETRATION #1 – PP-H (63-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #2
PP-H (25mm ϕ) Stack - Date 10-06-2014



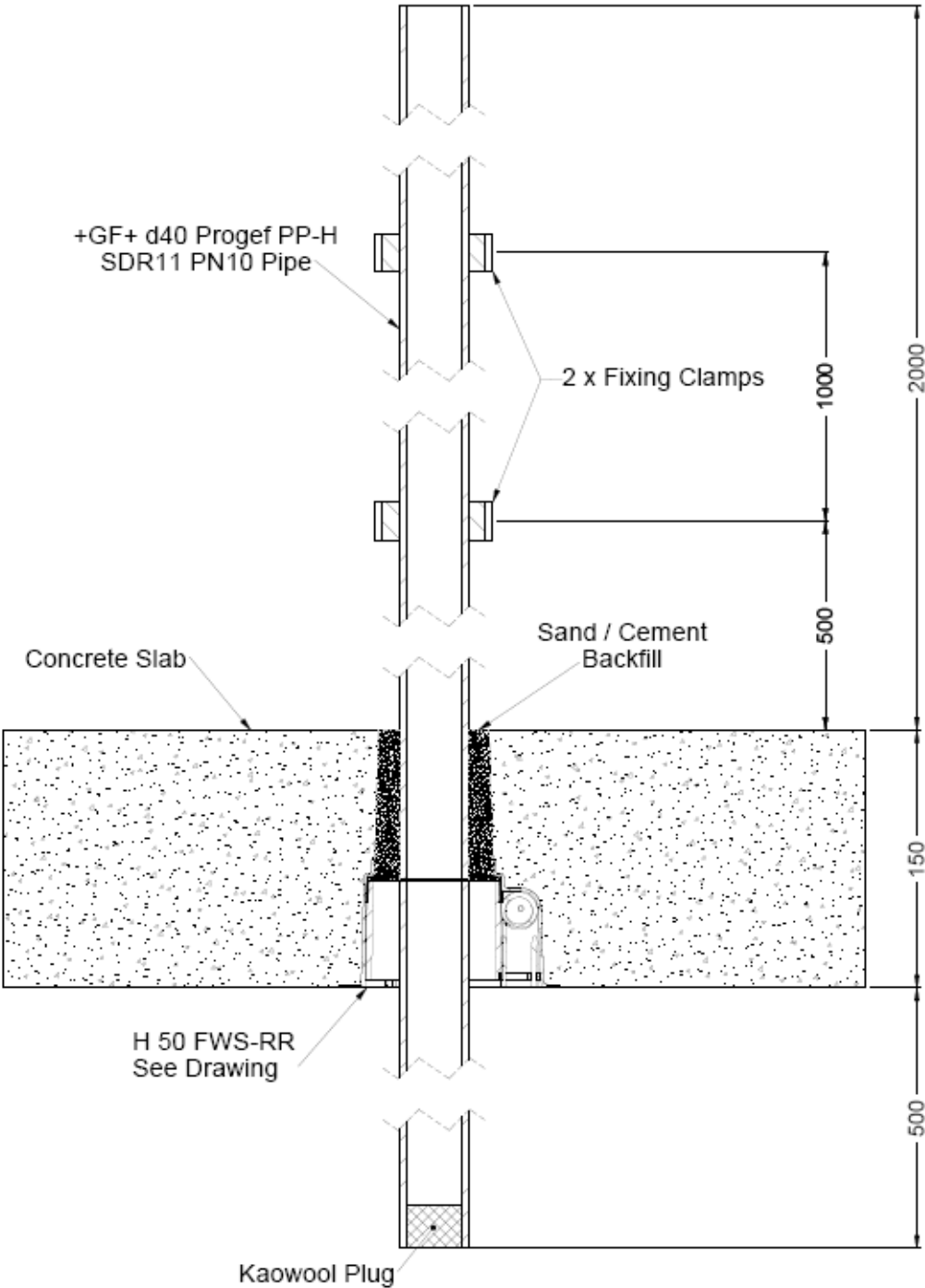
DRAWING NUMBERED PENETRATION #2 – PP-H (25-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #3
PP-H (63mm ϕ) Stack - Date 10-06-2014



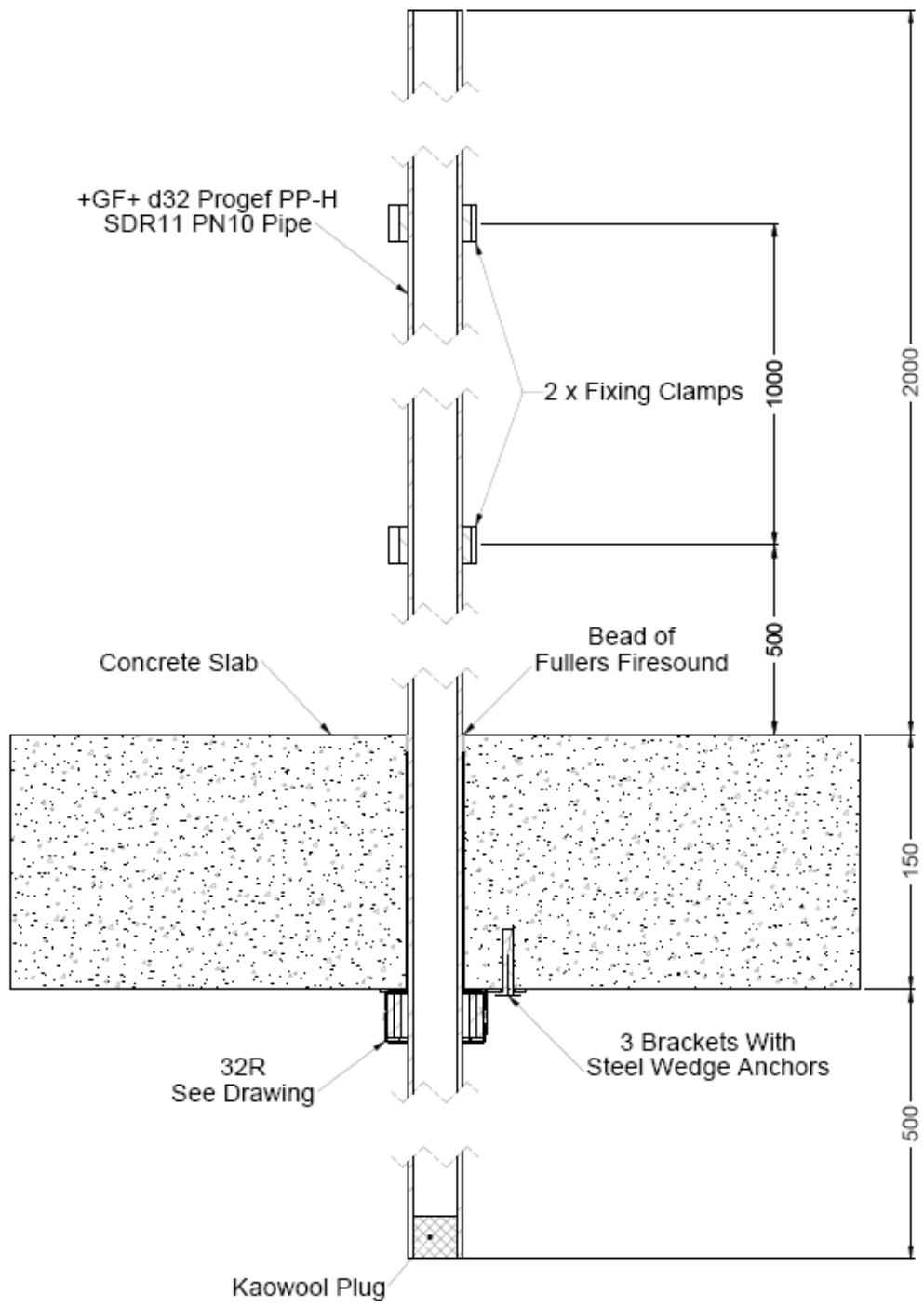
DRAWING NUMBERED PENETRATION #3 – PP-H (63-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #4
PP-H (40mm ϕ) Stack - Date 10-06-2014



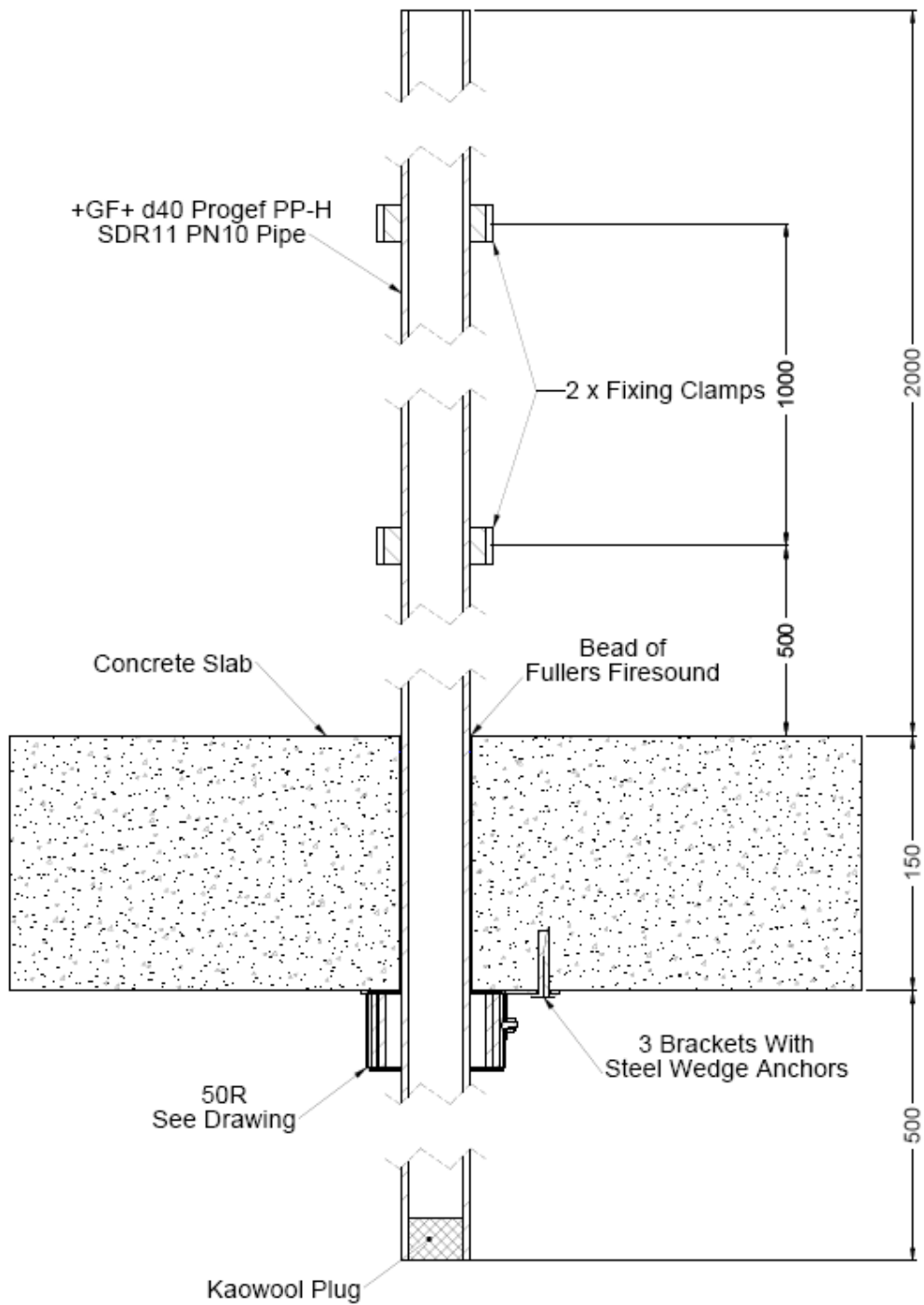
DRAWING NUMBERED PENETRATION #4 – PP-H (40-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #5
PP-H (32mm ϕ) Stack - Date 10-06-2014



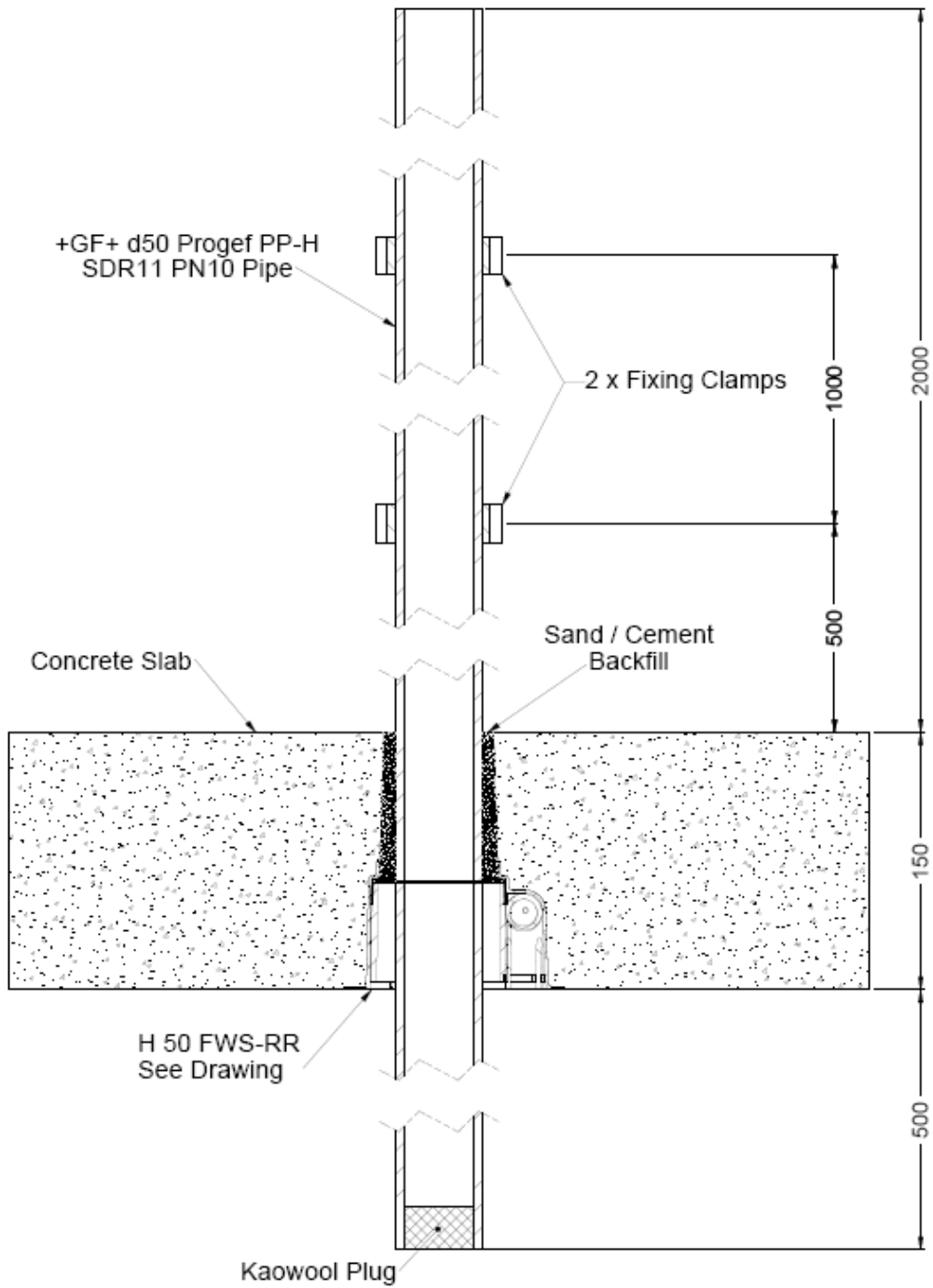
DRAWING NUMBERED PENETRATION #5 – PP-H (32-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #6
PP-H (40mm ϕ) Stack - Date 10-06-2014



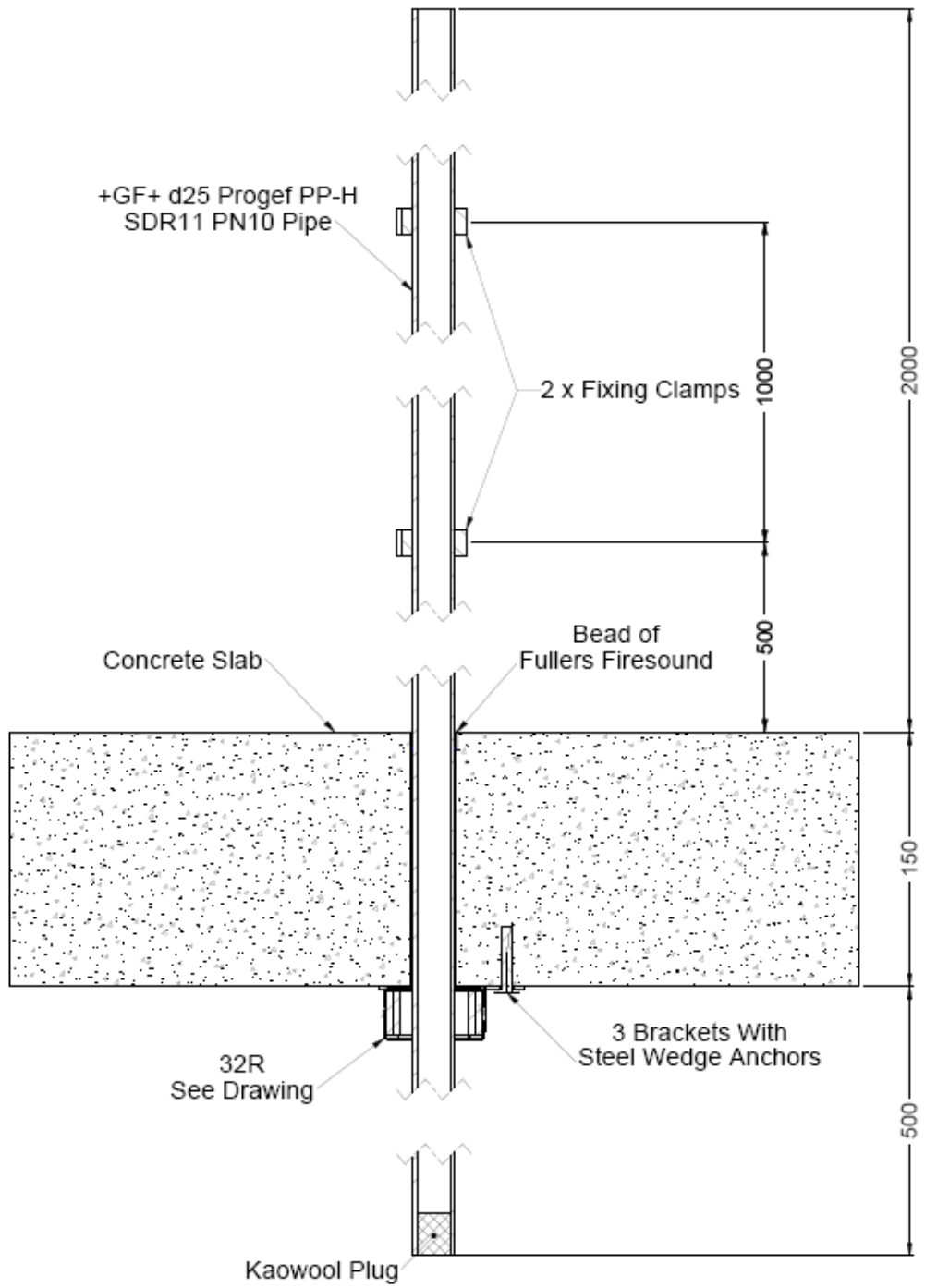
DRAWING NUMBERED PENETRATION #6 – PP-H (40-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #7
PP-H (50mm \varnothing) Stack - Date 10-06-2014



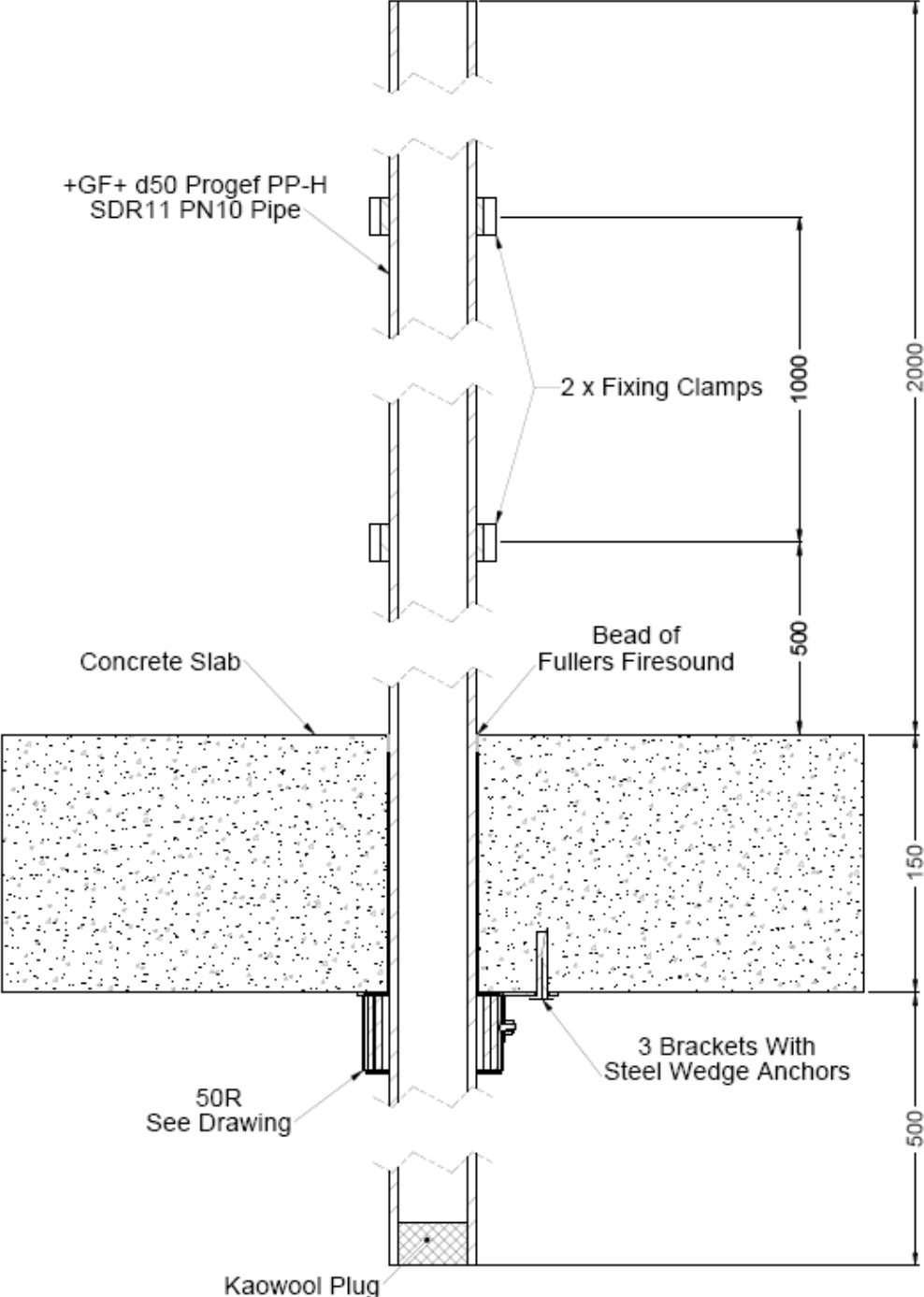
DRAWING NUMBERED PENETRATION #7 – PP-H (50-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #8
PP-H (25mm ϕ) Stack - Date 10-06-2014



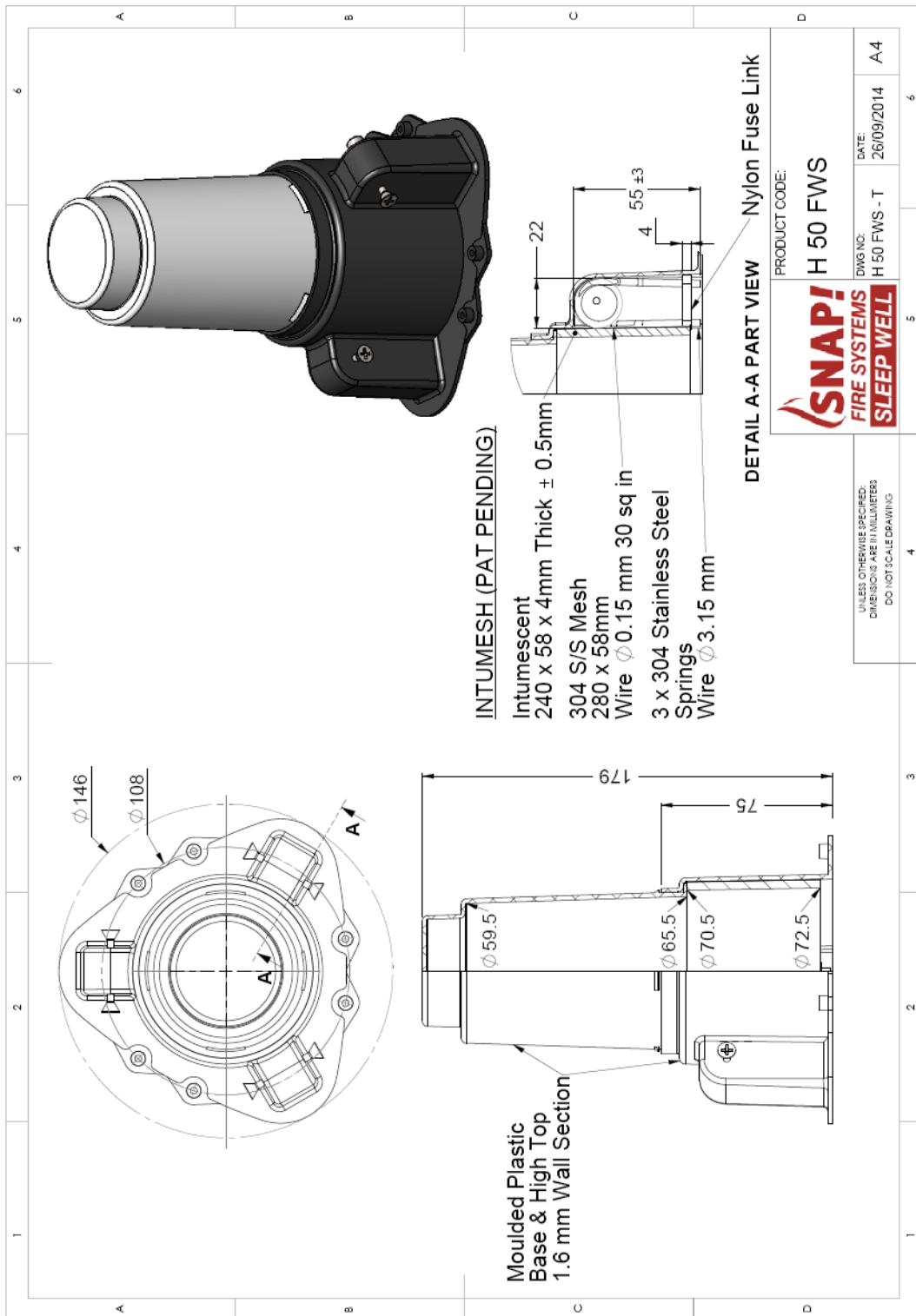
DRAWING NUMBERED PENETRATION #8 – PP-H (25-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #9
 PP-H (50mm \varnothing) Stack - Date 10-06-2014

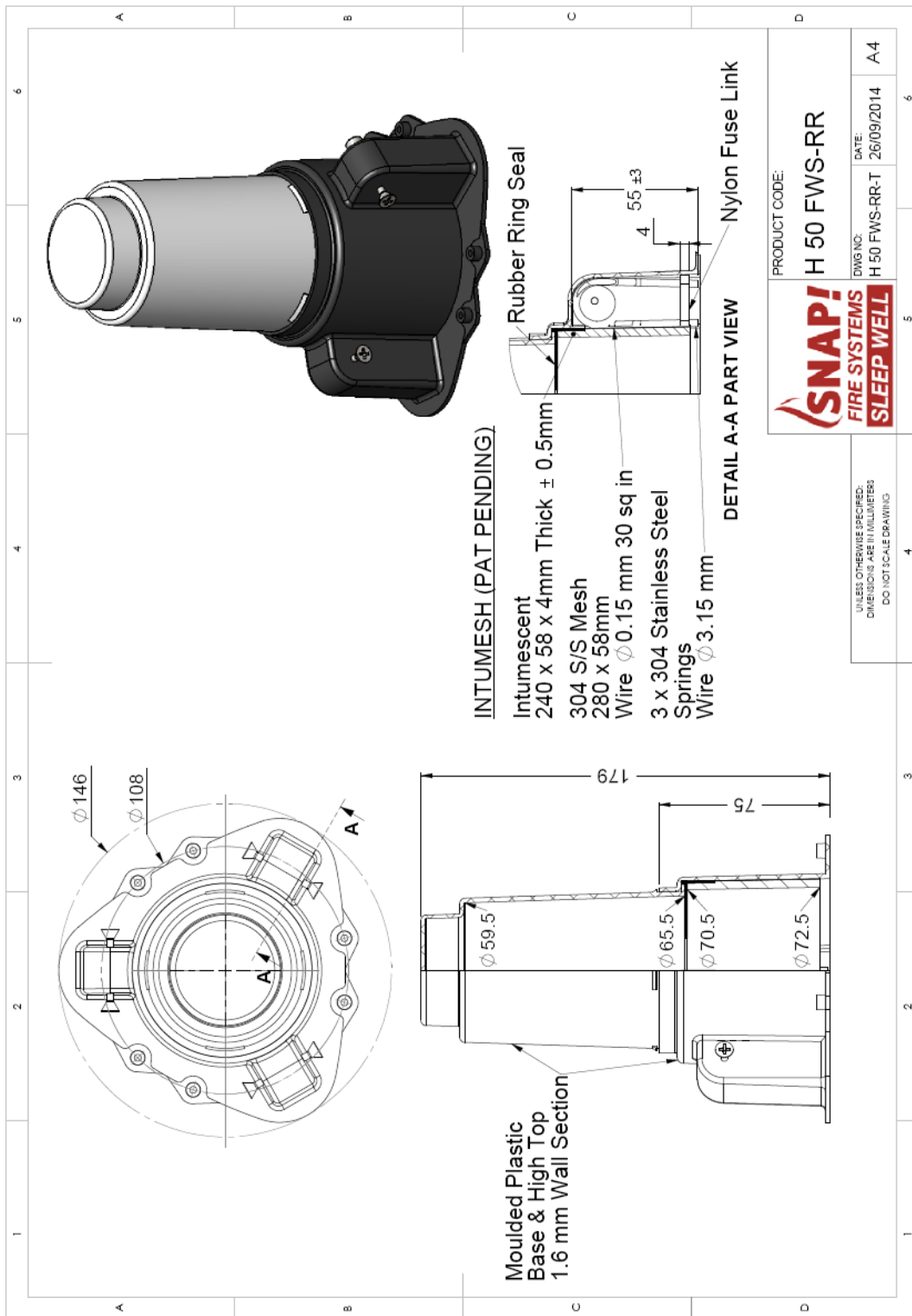


DRAWING NUMBERED PENETRATION #9 – PP-H (50-MM OD) STACK” DATED 10 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

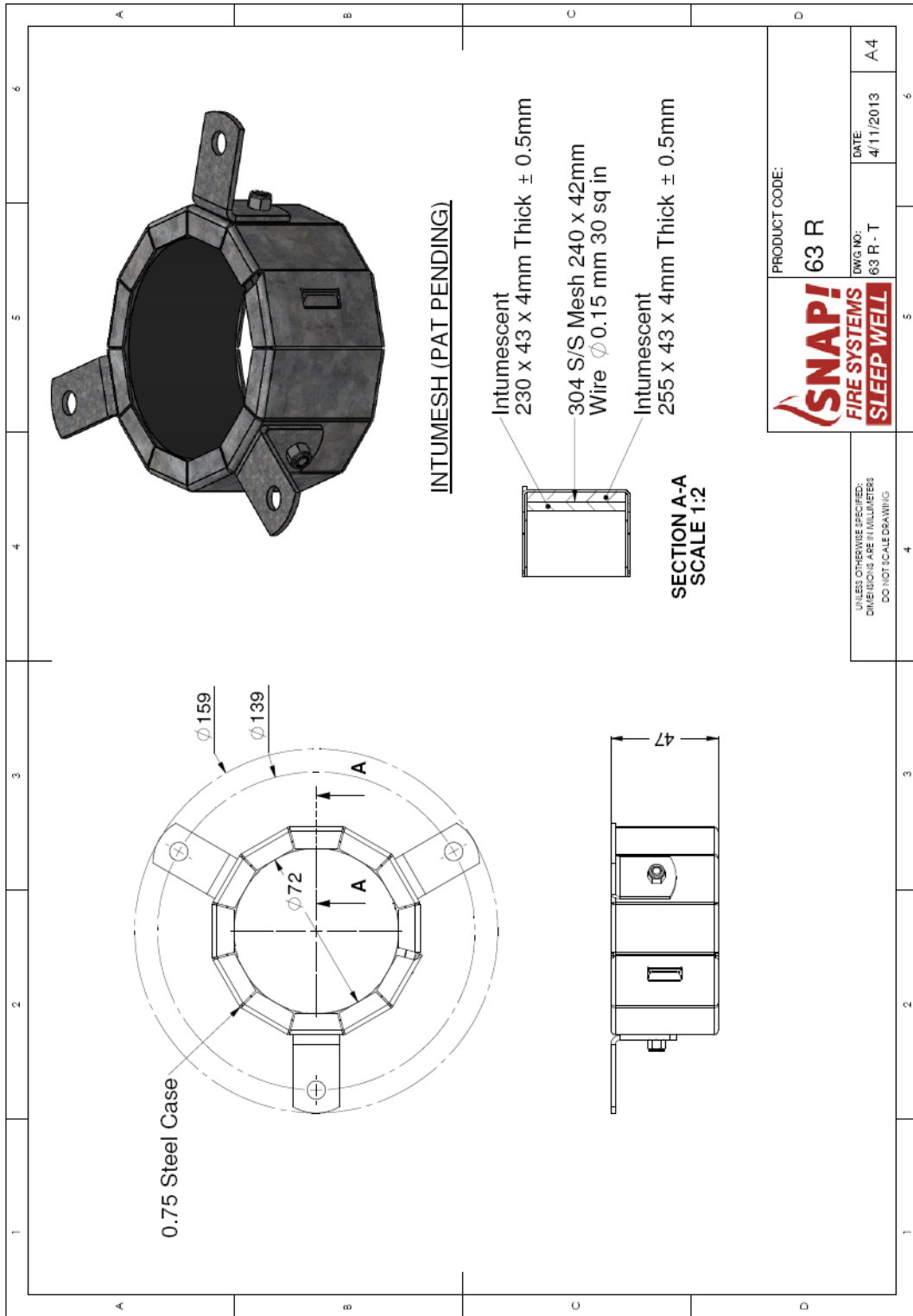
Appendix E – Specimen Drawings



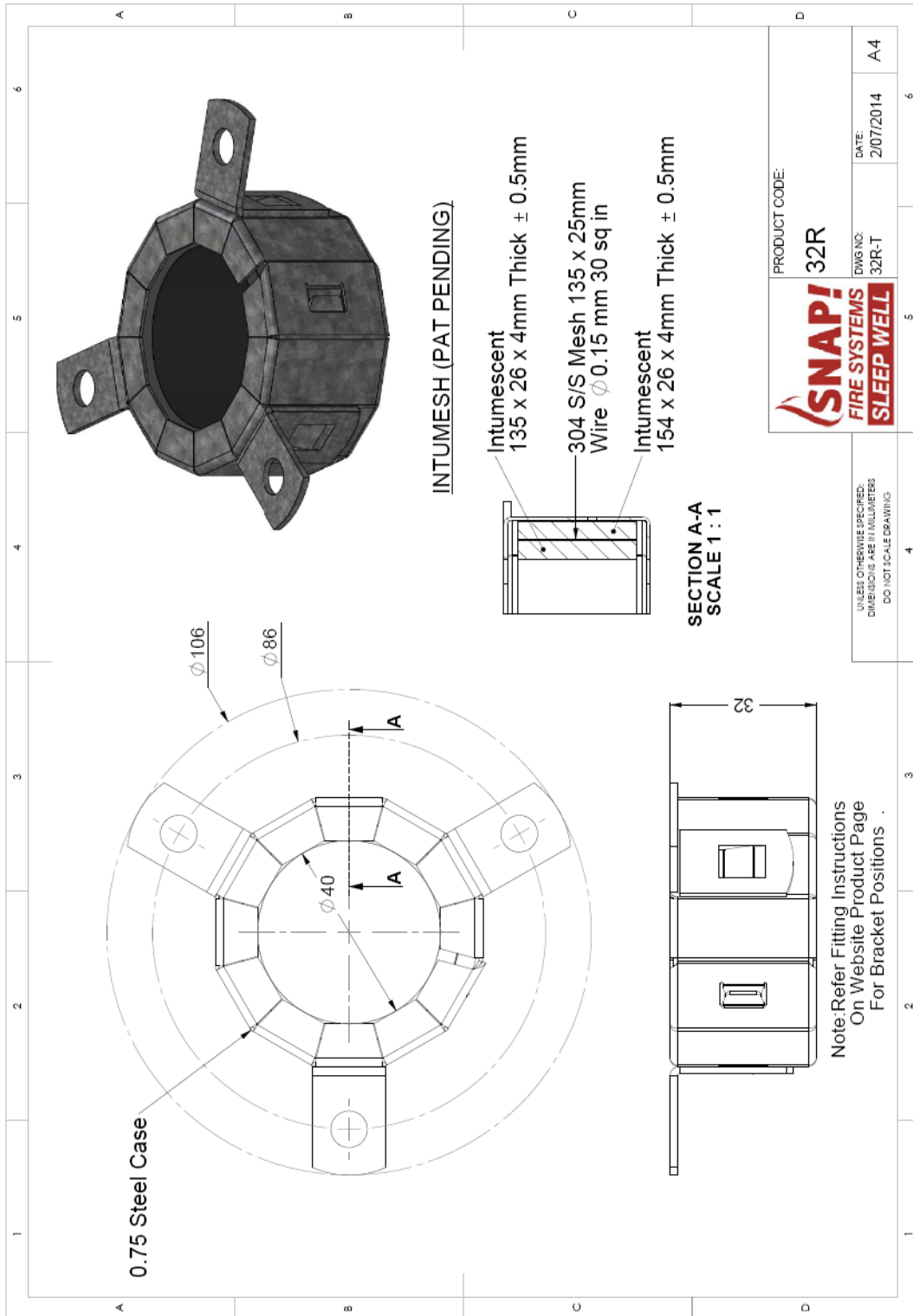
DRAWING NUMBERED H 50 FWS-T DATED 26 SEPTEMBER 2014, BY SNAP FIRE SYSTEMS



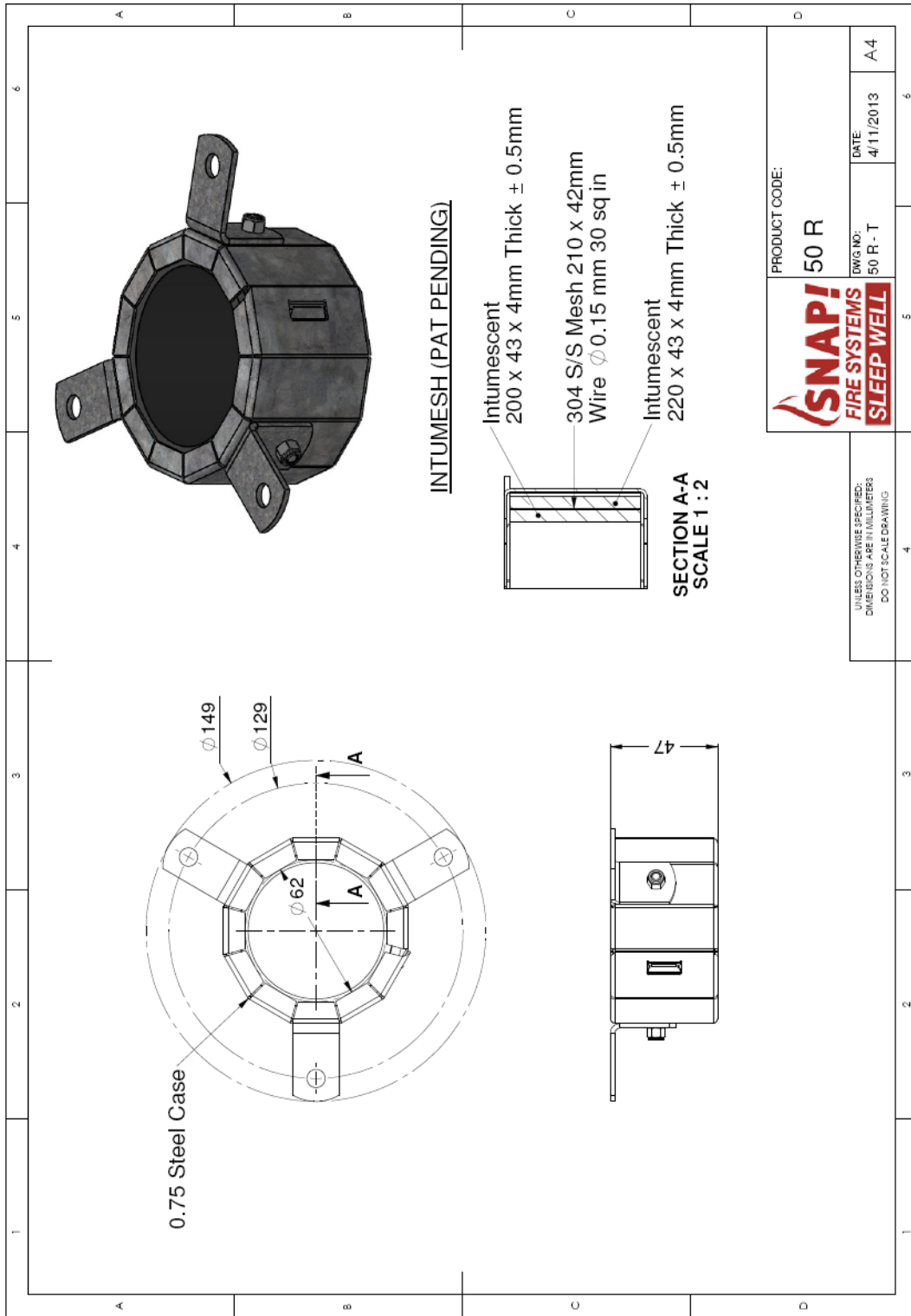
DRAWING NUMBERED H 50 FWS-RR-T DATED 26 SEPTEMBER 2014, BY SNAP FIRE SYSTEMS



DRAWING NUMBERED 63 R-T DATED 4 NOVEMBER 2013, BY SNAP FIRE SYSTEMS






DRAWING NUMBERED 32 R-T DATED 2 JULY 2014, BY SNAP FIRE SYSTEMS



DRAWING NUMBERED 50 R-T DATED 4 NOVEMBER 2013, BY SNAP FIRE SYSTEMS

Appendix F – Certificates

INFRASTRUCTURE TECHNOLOGIES www.csiro.au		
14 Julius Avenue, North Ryde NSW 2113 PO Box 310, North Ryde NSW 1670, Australia T (02) 9490 3444 • ABN 41 687 119 230		
<h1>Certificate of Test</h1>		
		No. 2591
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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 1657.		
Product Name:	Penetration 1 – H 50 FWS cast in fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe.	
Description:	The SNAP cast-in H 50 FWS fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5 mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240 mm x 58 mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism incorporated three stainless steel springs, with nylon fuse links and a 280 mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-T dated 26 September 2014, by SNAP Fire Systems.	
	The penetrating service comprised a 63-mm OD PP-H pipe, with a wall thickness of 6.2-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500 mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #1 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool plug.	
	On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.	
	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 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: 11 September 2014
Issued on the 24 th day of November 2014 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	

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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 1657.

Product Name: Penetration 2 – H 50 FWS-RR cast-in fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5 mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240 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 280 mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 25-mm OD PP-H pipe, with a wall thickness of 2.7-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500 mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #2 – PP-H (25-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

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 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:** 11 September 2014

Issued on the 24th day of November 2014 without alterations or additions.

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Manager, Fire Testing and Assessments



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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 1657.

Product Name: Penetration 3 – 63 R retrofitted fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP Retrofit 63 R fire collar comprised a 0.75-mm steel casing with a 72-mm inner diameter and three fixing brackets clipped onto the collar casing. The 47-mm high collar casing incorporated 230 mm x 43 mm x 4-mm thick Intumesh intumescent material and a 240 mm x 42-mm stainless steel mesh as shown in drawing numbered 63 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 63-mm OD PP-H pipe, with a wall thickness of 6.2-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 as shown in drawing titled "Penetration #3 – PP-H (63-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

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 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: 11 September 2014

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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 1657.

Product Name: Penetration 4 – H 50 FWS-RR cast-in fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5 mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240 mm x 58 mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three stainless steel springs, with nylon fuse links and a 280 mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 40-mm OD PP-H pipe, with a wall thickness of 4.8-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 as shown in drawing titled "Penetration #4 – PP-H (40-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

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 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: 11 September 2014

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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 1657.

Product Name: Penetration 5 – 32 R retrofitted fire collar protecting a 32-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP Retrofit 32 R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and three fixing brackets clipped onto the collar casing. The 32-mm high collar casing incorporated 135 mm x 26 mm x 4-mm thick Intumesh intumescent material and a 135 mm x 25 mm stainless steel mesh as shown in drawing numbered 32 R-T dated 2 July 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 32-mm OD PP-H pipe, with a wall thickness of 3.8-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 as shown in drawing titled "Penetration #5 – PP-H (32-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

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 FRL is applicable for exposure to the fire from the same direction as tested.

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Testing Officer: Mario Lara-Ledermann Date of Test: 11 September 2014

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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 1657.

Product Name: Penetration 6 – 50 R retrofitted fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP Retrofit 50 R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and three fixing brackets fixed onto the collar casing. The 47-mm high collar casing incorporated 200 mm x 43 mm x 4-mm thick Intumesh intumescent material and a 210 mm x 42-mm stainless steel mesh as shown in drawing numbered 50 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 40-mm OD PP-H pipe, with a wall thickness of 3.9-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 as shown in drawing titled "Penetration #6 – PP-H (40-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

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 FRL is applicable for exposure to the fire from the same direction as tested.

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Testing Officer: Mario Lara-Ledermann Date of Test: 11 September 2014

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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 1657.

Product Name: Penetration 7 – H 50 FWS-RR cast-in fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP cast-in H 50 FWS-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5 mm inner diameter and a 146-mm diameter base flange. The 75-mm high collar casing incorporated a 240 mm x 58 mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three stainless steel springs, with nylon fuse links and a 280 mm x 58-mm stainless steel mesh as shown in drawing numbered H 50 FWS-RR-T dated 26 September 2014, by SNAP Fire Systems.

The penetrating service comprised a 50-mm OD PP-H pipe, with a wall thickness of 5.1-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 as shown in drawing titled "Penetration #7 – PP-H (50-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

The annular gap between the pipe and the slab was backfilled with sand and cement compound.

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 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:** 11 September 2014

Issued on the 24th day of November 2014 without alterations or additions.

Brett Roddy
Manager, Fire Testing and Assessments



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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 1657.

Product Name: Penetration B – 32 R retrofitted fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progefl Polypropylene PP-H stack pipe

Description: The SNAP Retrofit 32 R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and three fixing brackets clipped onto the collar casing. The 32-mm high collar casing incorporated 135 mm x 26 mm x 4-mm thick Intumesh intumescent material and 135 mm x 25 mm stainless steel mesh as shown in drawing numbered 32 R-T dated 2 July 2014, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 25-mm OD PP-H pipe, with a wall thickness of 2.7-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 as shown in drawing titled "Penetration #8 – PP-H (25-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

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 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: 11 September 2014

Issued on the 24th day of November 2014 without alterations or additions.

Brett Roddy
Manager, Fire Testing and Assessments



This document is issued in accordance with NATA's accreditation requirements.
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COPY OF CERTIFICATE OF TEST – NO. 2598



Certificate of Test

No. 2599

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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 1657.

Product Name: Penetration 9 – 50 R retrofitted fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe

Description: The SNAP Retrofit 50 R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and three fixing brackets fixed onto the collar casing. The 47-mm high collar casing incorporated 200 mm x 43 mm x 4-mm thick Intumesch intumescent material and a 210 mm x 42-mm stainless steel mesh as shown in drawing numbered 50 R-T dated 4 November 2013, by SNAP Fire Systems. The collar was fixed to the underside of the slab with 3 brackets with Steel Wedge Anchors.

The penetrating service comprised a 50-mm OD PP-H pipe, with a wall thickness of 5.3-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 as shown in drawing titled "Penetration #9 – PP-H (50-mm OD) Stack" dated 10 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a bead of Fullers Firesound fire sealant.

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 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: 11 September 2014

Issued on the 24th day of November 2014 without alterations or additions.

Brett Roddy
 Manager, Fire Testing and Assessments



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References

The following informative documents are referred to in this Report:

- | | |
|----------------|---|
| AS 1530.4-2005 | 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. |

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FOR FURTHER INFORMATION

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