

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

Test Report

Author: Chris Wojcik
Report number: FSP 1758
Date: 1 November 2016

Client: Snap Fire Systems Pty Ltd

Commercial-in-confidence




Inquiries should be address to:

Fire Testing and Assessments	Author	The Client
Infrastructure Technologies	Infrastructure Technologies	Snap Fire Systems Pty Ltd
14 Julius Avenue	14 Julius Avenue	Building A, 1343 Wynnum Road
North Ryde, NSW 2113	North Ryde, NSW 2113	Tingalpa QLD 4173
Telephone +61 2 9490 5444	Telephone +61 2 9490 5500	Telephone +61 7 3390 5420

Report Status and Revision History:

VERSION	STATUS	DATE	DISTRIBUTION	ISSUE NUMBER
Revision A	Draft for review	31/08/2016	CSIRO/SNAP	FSP 1758
Revision B	Final for issue	01/11/2016	CSIRO/SNAP	FSP 1758

Report Authorization:

AUTHOR	REVIEWED BY	AUTHORISED BY
Chris Wojcik	Brett Roddy	Brett Roddy
		
1 November 2016	1 November 2016	1 November 2016

Use of this Report

Use of Reports – Testing

This report is subject to binding obligations under which it was prepared. In particular, the Report must not be used:

- *as a means of endorsement; or*
- *in a company prospectus or notification to a Stock Exchange document for capital raising, without the prior written consent of CSIRO.*

The Report may be published verbatim and in full, provided that a statement is included on the publication that it is a copy of the Report issued by CSIRO.

Excerpts of the Report may not be published.

Use of Reports – Consultancy

This report is subject to binding obligations under which it was prepared. In particular, the Report may only be used for the following purposes:

- *the information in the Report may be used by the party that commissioned the Report for its internal business operations (but not licensing to third parties);*
- *the report may be copied for distribution within the organisation that commissioned the Report;*
- *copies of the Report (or extracts of the Report) may be distributed to contractors and agents of the organisation that commissioned the Report who have a need for the Report for its internal business operations. Any extracts of the Report distributed for this purpose must clearly note that the extract is part of a larger Report held by the organisation that commissioned the Report and which has been prepared by CSIRO.*

The name, trade mark or logo of the CSIRO must not be used without the prior written consent of CSIRO.

The Report must not be used as a means of endorsement without the prior written consent of CSIRO.

Copyright and disclaimer

© 2016 CSIRO To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Contents

1	Introduction	4
1.1	Identification of specimen	4
1.2	Sponsor	4
1.3	Manufacturer	4
1.4	Test standard	4
1.5	Reference standard.....	4
1.6	Test number.....	4
1.7	Test date	4
2	Description of specimen	5
2.1	General.....	5
2.2	Dimensions	7
2.3	Orientation.....	7
2.4	Conditioning.....	7
3	Documentation	7
4	Equipment.....	8
4.1	Furnace	8
4.2	Temperature	8
4.3	Measurement system	8
5	Ambient temperature	8
6	Departure from standard	8
7	Termination of test	9
8	Test results	9
8.1	Critical observations	9
8.2	Furnace temperature.....	9
8.3	Furnace severity.....	10
8.4	Specimen temperature.....	10
8.5	Performance	10
9	Fire-resistance level (FRL)	12
10	Field of direct application of test results	12
11	Tested by	12
	Appendices	13
	Appendix A – Measurement location	13
	Appendix B – Photographs	14
	Appendix C – Furnace Temperature	18
	Appendix D – Installation drawings.....	26
	Appendix E – Specimen Drawings	32
	Appendix F – Certificates	35
	References	41

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

Sponsored Investigation No. FSP 1758

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap Cast-in and Retrofit Fire Collars protecting a 150-mm thick concrete slab penetrated by nine (9) stack pipes.

1.2 Sponsor

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

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.

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 4582/3982

1.7 Test date

The fire-resistance test was conducted on 6 June 2016.

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) stack pipes protected by Cast-in and Retrofit Snap Fire System fire collar.

The pipes used in the test are stated to be manufactured in accordance with:

- AS 4176.1-2010 : Multilayer pipes for pressure applications - Multilayer piping systems for hot and cold water plumbing applications - General (ISO 21003-1:2008, MOD)

For the purpose of the test, the specimens were referenced as Penetrations 1, 2, 3, 4, 5, 6, 7, 8 and 9. Six (6) specimens are included in this report (Penetration 1, 3, 4, 5, 6 and 9). Documents containing a complete description of each specimen were supplied by the sponsor and are retained on file.

Penetration 1 – GAS50 Retrofit collar protecting a 40-mm diameter Valsir Pex-Al-Pex pipe

The SNAP Retrofit GAS50 collar comprised a 0.95-mm thick steel casing with a 57-mm inner diameter and a 127-mm diameter base flange. The 91-mm high collar casing incorporated a layer of 215-mm x 85-mm x 4-mm thick Intumescent material and a layer of 190-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 190 x 84-mm as shown in drawing numbered GAS50-B-T dated 16 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 40-mm Valsir Pexal stack pipe, with a wall thickness of 3.5-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 1 – 40mm Valsir Pexal Pipe and SNAP Gas50 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

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

Penetration 3 – GAS63 Retrofit collar protecting a 63-mm diameter Valsir Pex-Al-Pex pipe

The SNAP Retrofit GAS63 collar comprised a 0.95-mm thick steel casing with a 67-mm inner diameter and a 121-mm diameter base flange. The 91-mm high collar casing incorporated a layer of 265-mm x 85-mm x 4-mm thick Intumescent material and a layer of 235-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 230 x 84-mm as shown in drawing numbered GAS63-B-T dated 20 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 63-mm Valsir Pexal stack pipe, with a wall thickness of 5-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 3 – 63mm Valsir Pexal Pipe and SNAP Gas63 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

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

Penetration 4 – GAS32 Retrofit collar protecting a 20-mm diameter Valsir Pex-Al-Pex pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 20-mm Valsir Pexal stack pipe, with a wall thickness of 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 "Test Slab S-16-D Penetration # 4 – 20mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Bostik Fireban 1.

Penetration 5 – GAS32 Retrofit Collar protecting a 26-mm diameter Valsir Pex-Al-Pex pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 26-mm Valsir Pexal stack pipe, with a wall thickness of 3-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 "Test Slab S-16-D Penetration # 5 – 26mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

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

Penetration 6 – GAS32 Retrofit Collar protecting a 32-mm diameter Valsir Pex-Al-Pex pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 32-mm Valsir Pexal stack pipe, with a wall thickness of 3-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 6 – 32mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

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

Penetration 9 – GAS32 Retrofit Collar protecting a 16-mm diameter Valsir Pex-Al-Pex pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 16-mm Valsir Pexal stack pipe, with a wall thickness of 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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 9 – 16mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug.

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

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 "Test Slab S-16-D Penetration # 1 – 40mm Valsir Pexal Pipe and SNAP Gas50 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing titled "Test Slab S-16-D Penetration # 3 – 63mm Valsir Pexal Pipe and SNAP Gas63 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing titled "Test Slab S-16-D Penetration # 4 – 20mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing titled "Test Slab S-16-D Penetration # 5 – 26mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing titled "Test Slab S-16-D Penetration # 6 – 32mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing titled “Test Slab S-16-D Penetration # 9 – 16mm Valsir Pexal Pipe and SNAP Gas32 Collar” dated 19 August 2016, by Snap Fire Systems Pty Ltd.

Drawing numbered GAS50-B-T, dated 16 September 2016, by Snap Fire Systems Pty Ltd.

Drawing numbered GAS32-T, dated 14 September 2016, by Snap Fire Systems Pty Ltd.

Drawing numbered GAS63-B-T, dated 20 September 2016, 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 17°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
3 minutes -	Smoke is being emitted from the furnace flues.
6 minutes -	Smoke is fluing from Penetrations 3, 4 and 9.
8 minutes -	Smoke fluing from Penetration 9 has stopped and is continuing from Penetration 3.
10 minutes -	Smoke is fluing from Penetration 1 and 3.
12 minutes -	Smoke has ceased to flue from Penetration 3 and 4.
21 minutes -	Fluing from Penetration 1 and 3 has diminished.
24 minutes -	Moisture is evident on the slab surface.
45 minutes -	Sealant at the base of Penetration 1, 3, 5 and 6 has swelled.
60 minutes -	Slight fluing is evident at the end of pipes on Penetration 4.
90 minutes -	No visible change.
104 minutes -	<u>Insulation failure</u> – Maximum temperature rise limit of 180K achieved on Penetration # 2.
123 minutes -	Smoke is increasing from the end of pipe of Penetration 3.
127 minutes -	<u>Insulation failure</u> - Maximum temperature rise limit of 180K achieved on Penetration # 1.
145 minutes -	<u>Insulation failure</u> - Maximum temperature rise limit of 180K achieved on Penetration # 3.
150 minutes -	Smoke is evident from the end of pipes, Penetration 1, 3, 5 and 6.
180 minutes -	Discolouration is noted at the base of pipe, Penetration 1.
210 minutes -	No noticeable change.
240 minutes -	No noticeable change.
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 3.

Figure 5 shows the curve of maximum temperature versus time associated with Penetration 4.

Figure 6 shows the curve of maximum temperature versus time associated with Penetration 5.

Figure 7 shows the curve of maximum temperature versus time associated with Penetration 6.

Figure 8 shows the curve of maximum temperature versus time associated with Penetration 9.

8.5 Performance

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

Penetration 1 – GAS50 Retrofit collar protecting a 40-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy	-	not applicable
Integrity	-	No failure 241 minutes
Insulation	-	127 minutes

Penetration 3 – GAS63 Retrofit collar protecting a 63-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy	-	not applicable
Integrity	-	No failure 241 minutes
Insulation	-	145 minutes

Penetration 4 – GAS32 Retrofit collar protecting a 20-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy - not applicable

Integrity - No failure 241 minutes

Insulation - No failure 241 minutes

Penetration 5 – GAS32 Retrofit Collar protecting a 26-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy - not applicable

Integrity - No failure 241 minutes

Insulation - No failure 241 minutes

Penetration 6 – GAS32 Retrofit Collar protecting a 32-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy - not applicable

Integrity - No failure 241 minutes

Insulation - No failure 241 minutes

Penetration 9 – GAS32 Retrofit Collar protecting a 16-mm diameter Valsir Pex-Al-Pex pipe

Structural adequacy - not applicable

Integrity - No failure 241 minutes

Insulation - No failure 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	-	-/240/120	Penetration 5	-	-/240/240
Penetration 3	-	-/240/120	Penetration 6	-	-/240/240
Penetration 4	-	-/240/240	Penetration 9	-	-/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



Russell Collins
Testing Officer

Appendices

Appendix A – Measurement location

Measurement Location		
Group location	T/C Position	T/C designation
Specimen		
Specimen 1 – white PEX-Al-PEX 40mm pipe protected with Gas50	On west of collar	S1
	On east of collar	S2
	West side of pipe 25-mm from collar	S3
	East side of pipe 25-mm from collar	S4
Specimen 3 – white PEX-Al-PEX 63mm pipe protected with Gas63	On west of collar	S9
	On east of collar	S10
	West side of pipe 25-mm from collar	S11
	East side of pipe 25-mm from collar	S12
Specimen 4 – white PEX-Al-PEX 20mm pipe protected with Gas32	On west of collar	S13
	On east of collar	S14
	West side of pipe 25-mm from collar	S15
	East side of pipe 25-mm from collar	S16
Specimen 5 – white PEX-Al-PEX 26mm pipe protected with Gas32	On west of collar	S17
	On east of collar	S18
	West side of pipe 25-mm from collar	S19
	East side of pipe 25-mm from collar	S20
Specimen 6 – white PEX-Al-PEX 32mm pipe protected with Gas32	On west of collar	S21
	On east of collar	S22
	West side of pipe 25-mm from collar	S23
	East side of pipe 25-mm from collar	S24
Specimen 9 – white PEX-Al-PEX 15mm pipe protected with Gas32	On west of collar	S33
	On east of collar	S34
	West side of pipe 25-mm from collar	S35
	East side of pipe 25-mm from collar	S36

Appendix B – Photographs



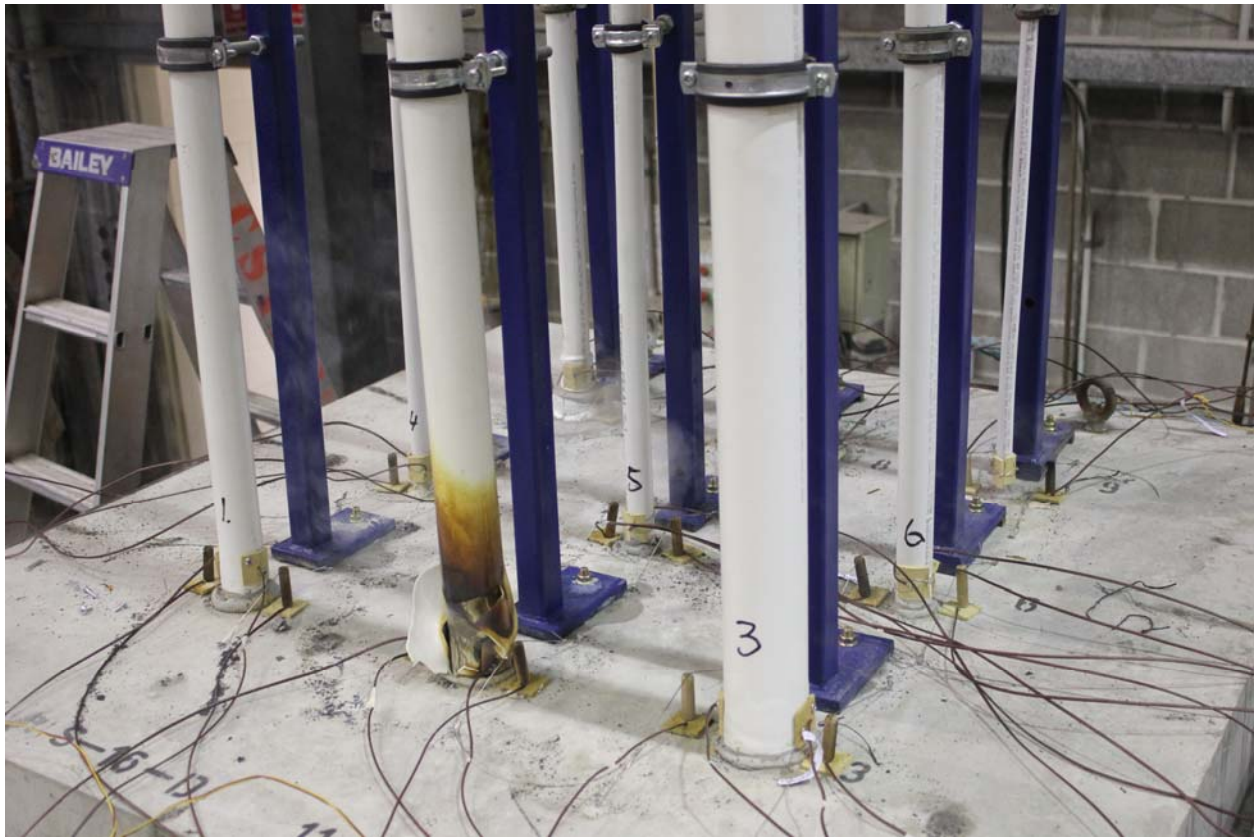
PHOTOGRAPH 1 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



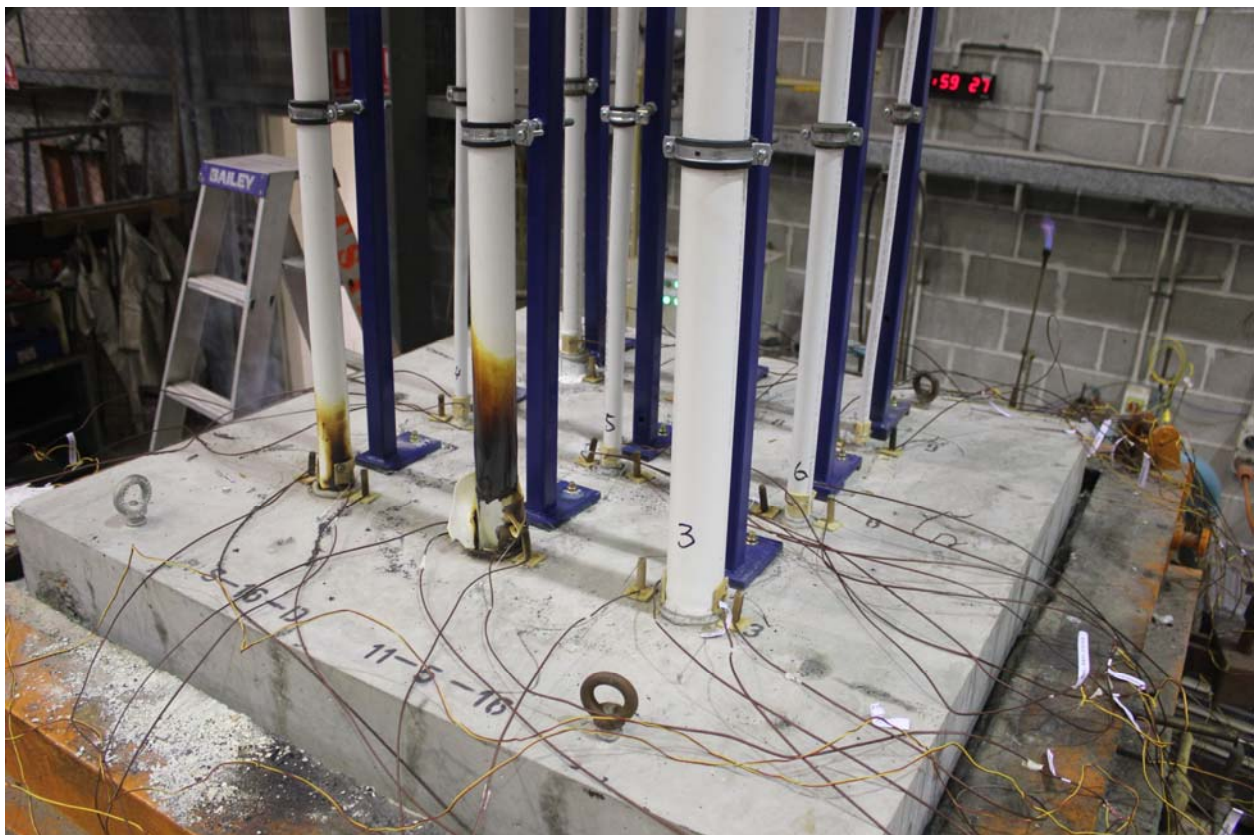
PHOTOGRAPH 2 – EXPOSED FACE OF SPECIMEN PRIOR TO TESTING



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

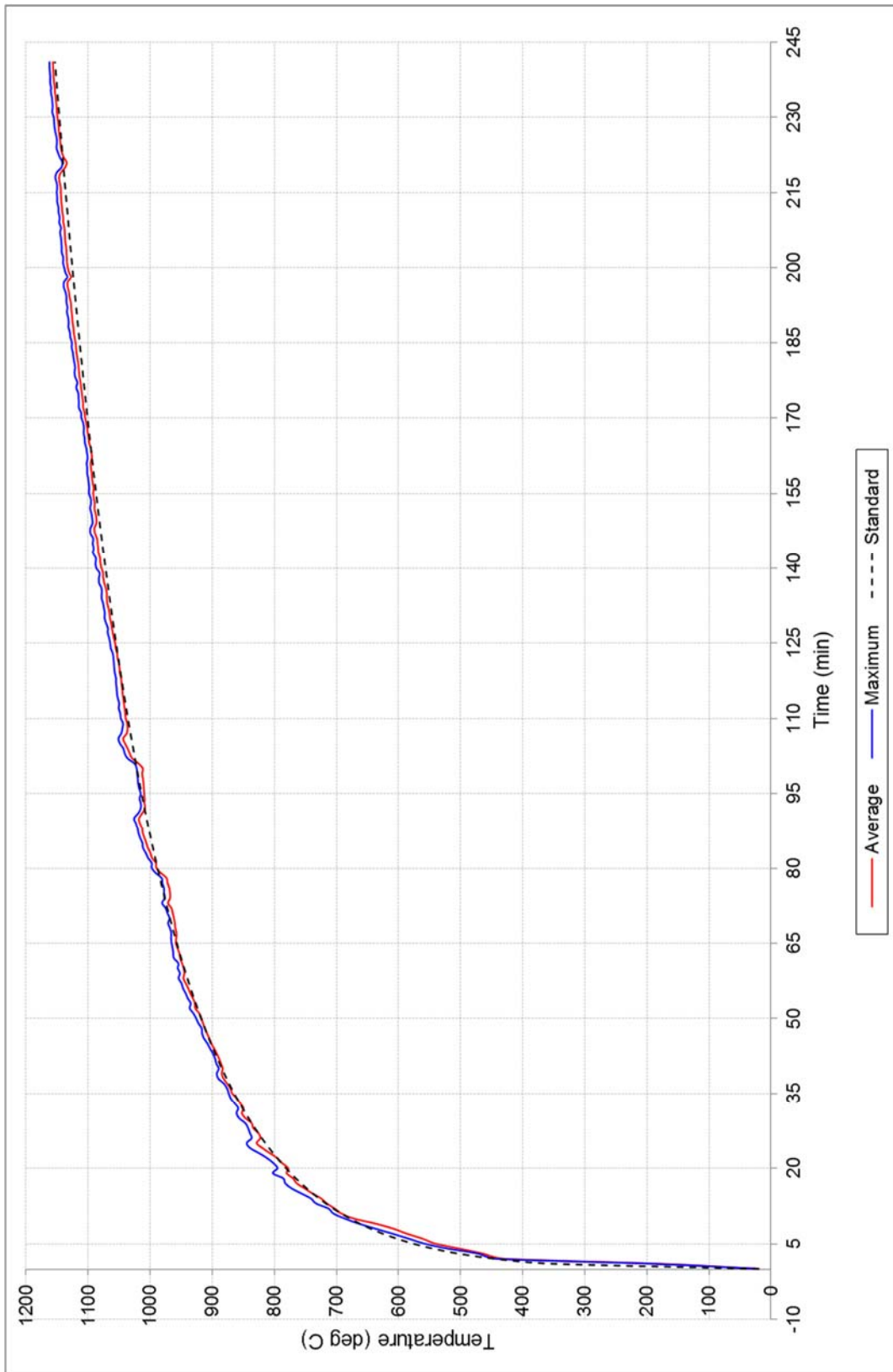


FIGURE 1 – FURNACE TEMPERATURE

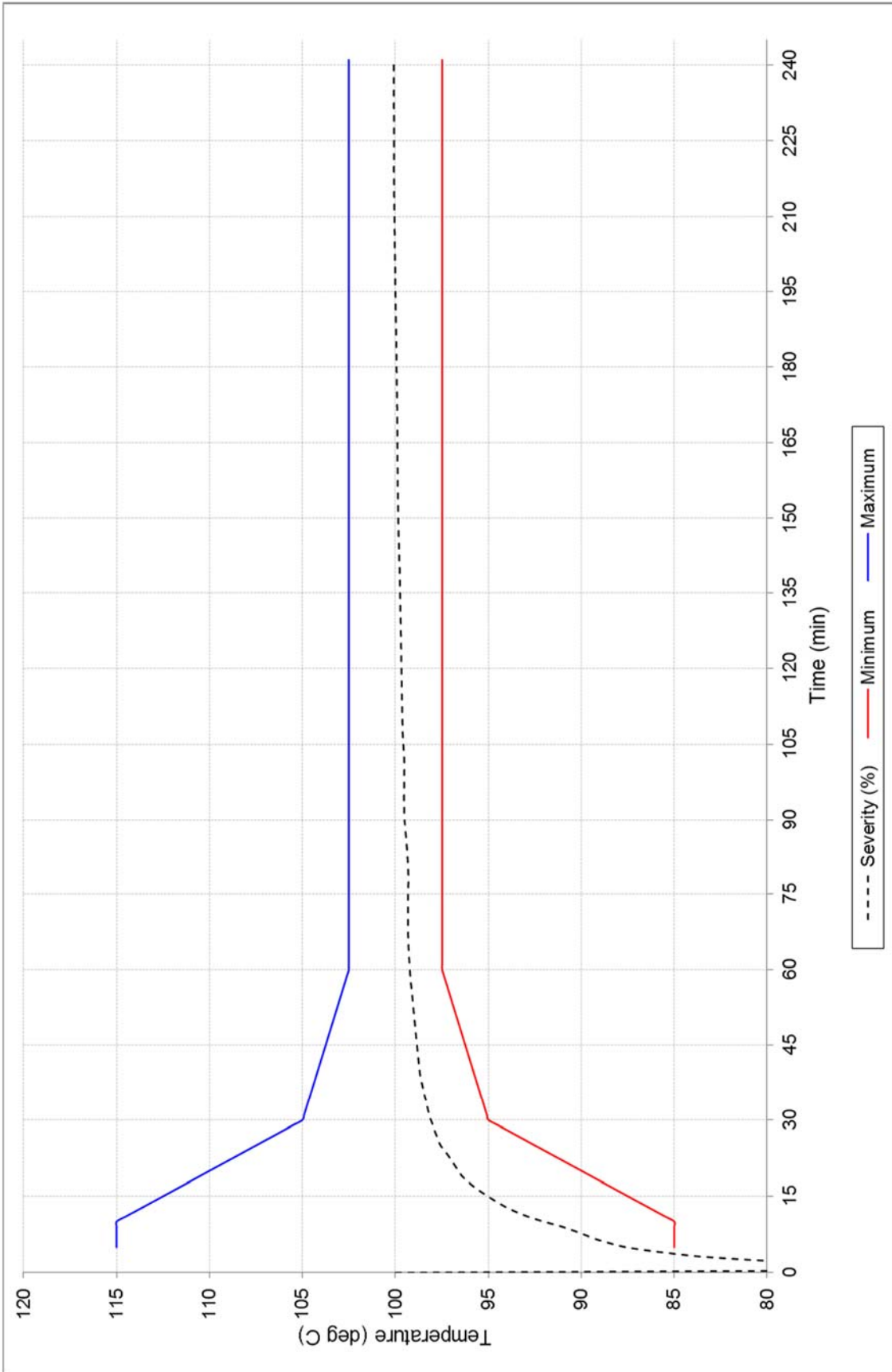


FIGURE 2 – FURNACE SEVERITY

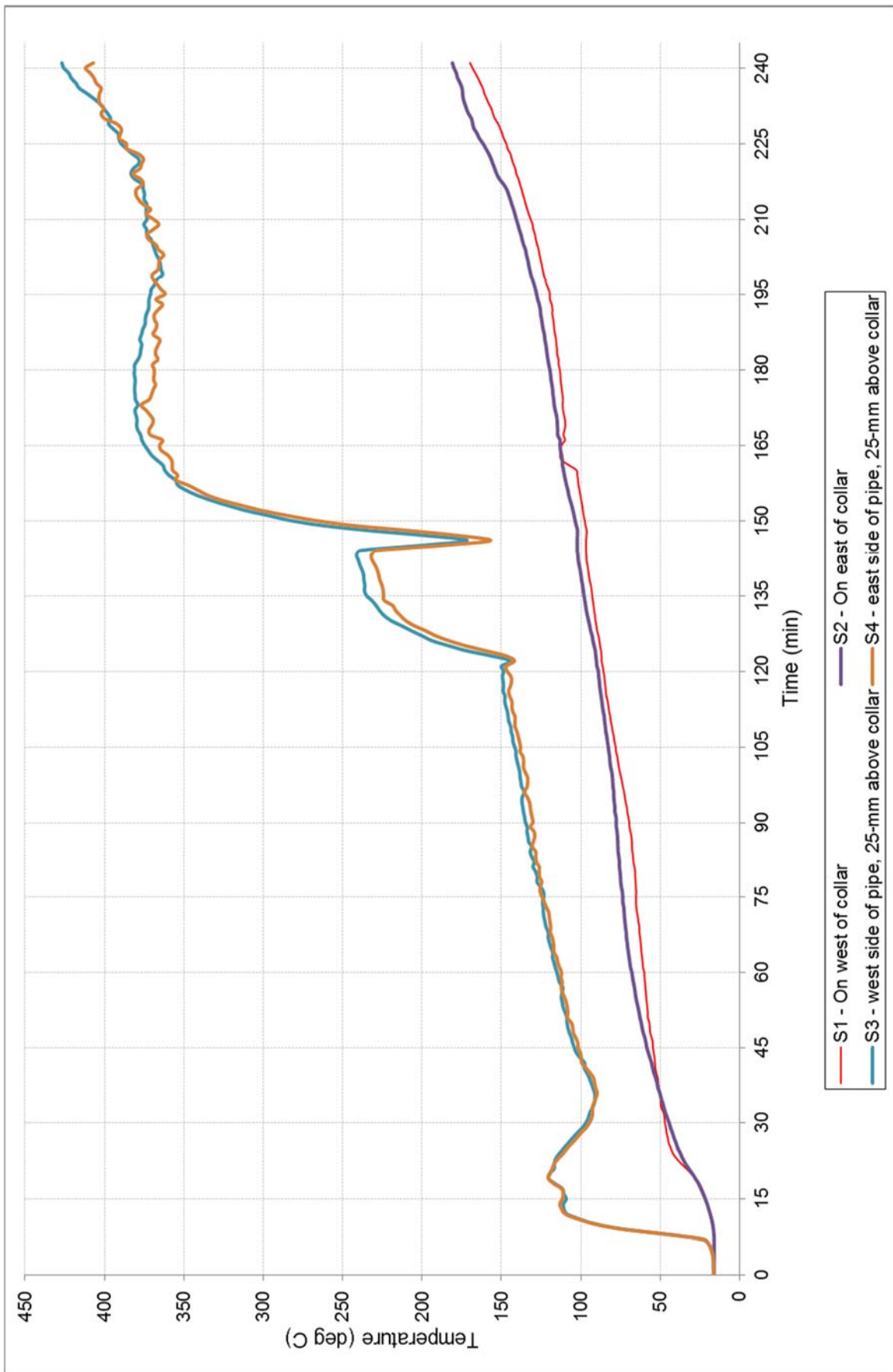


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 1

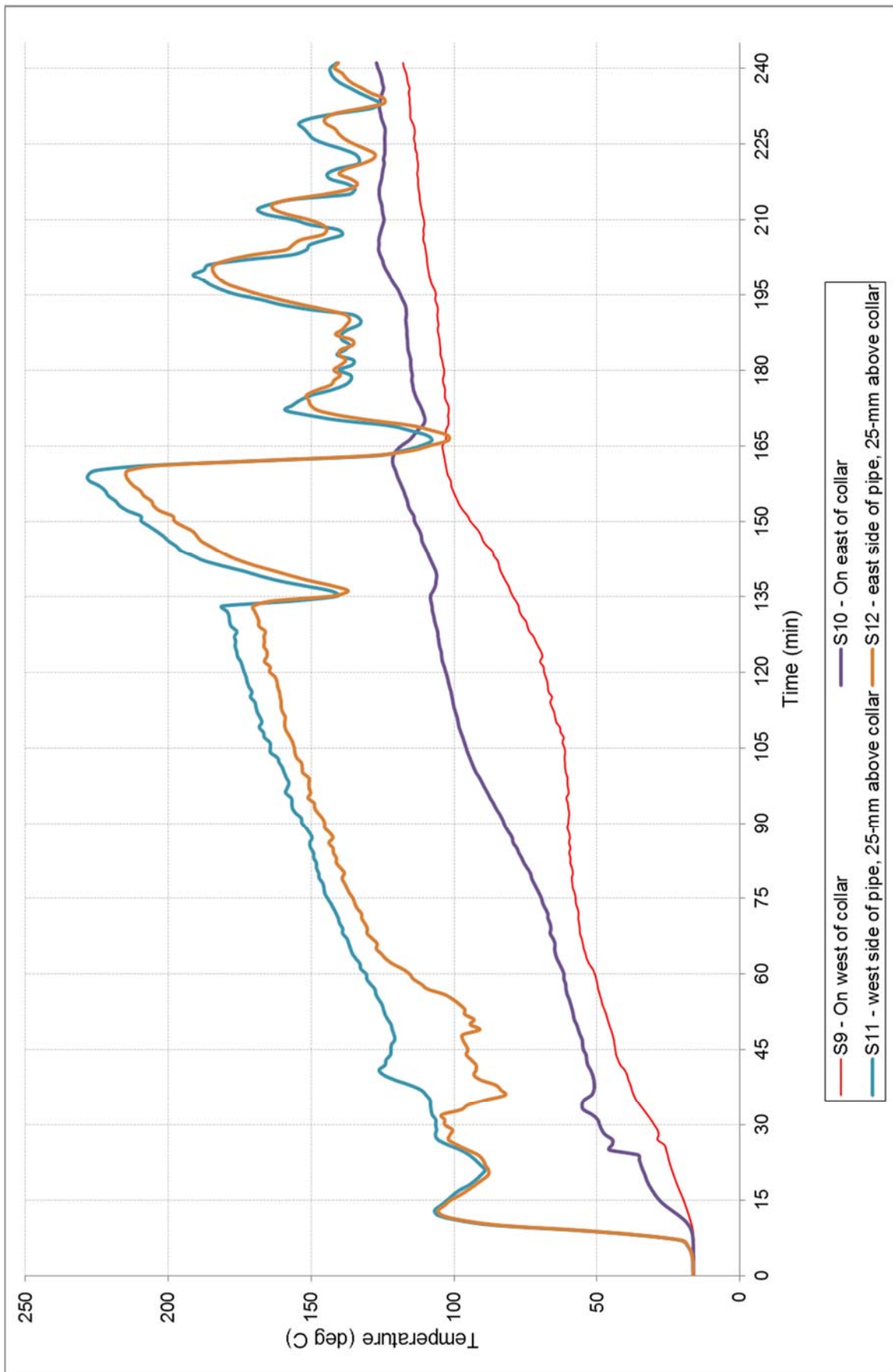


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 3

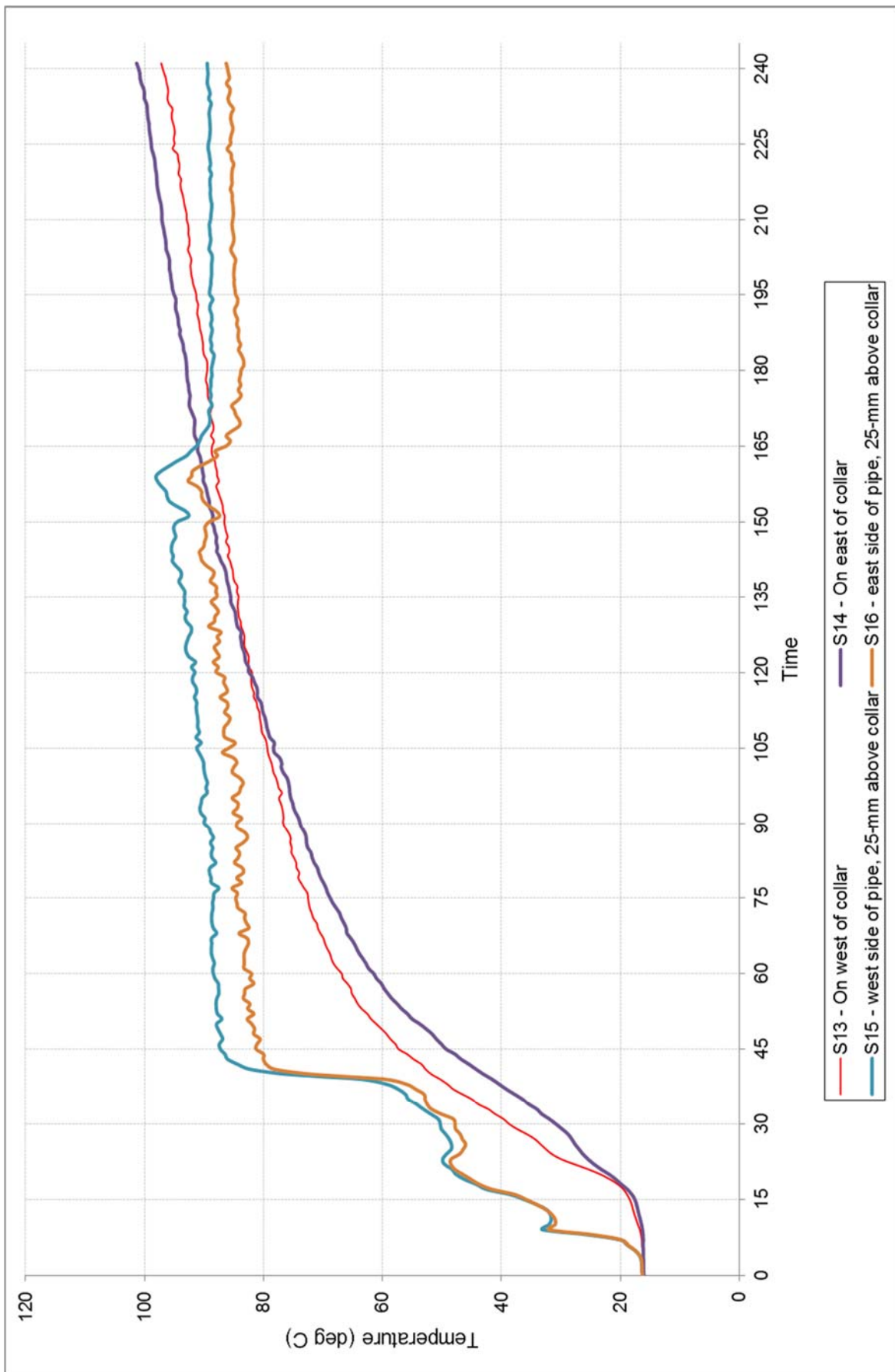


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 4

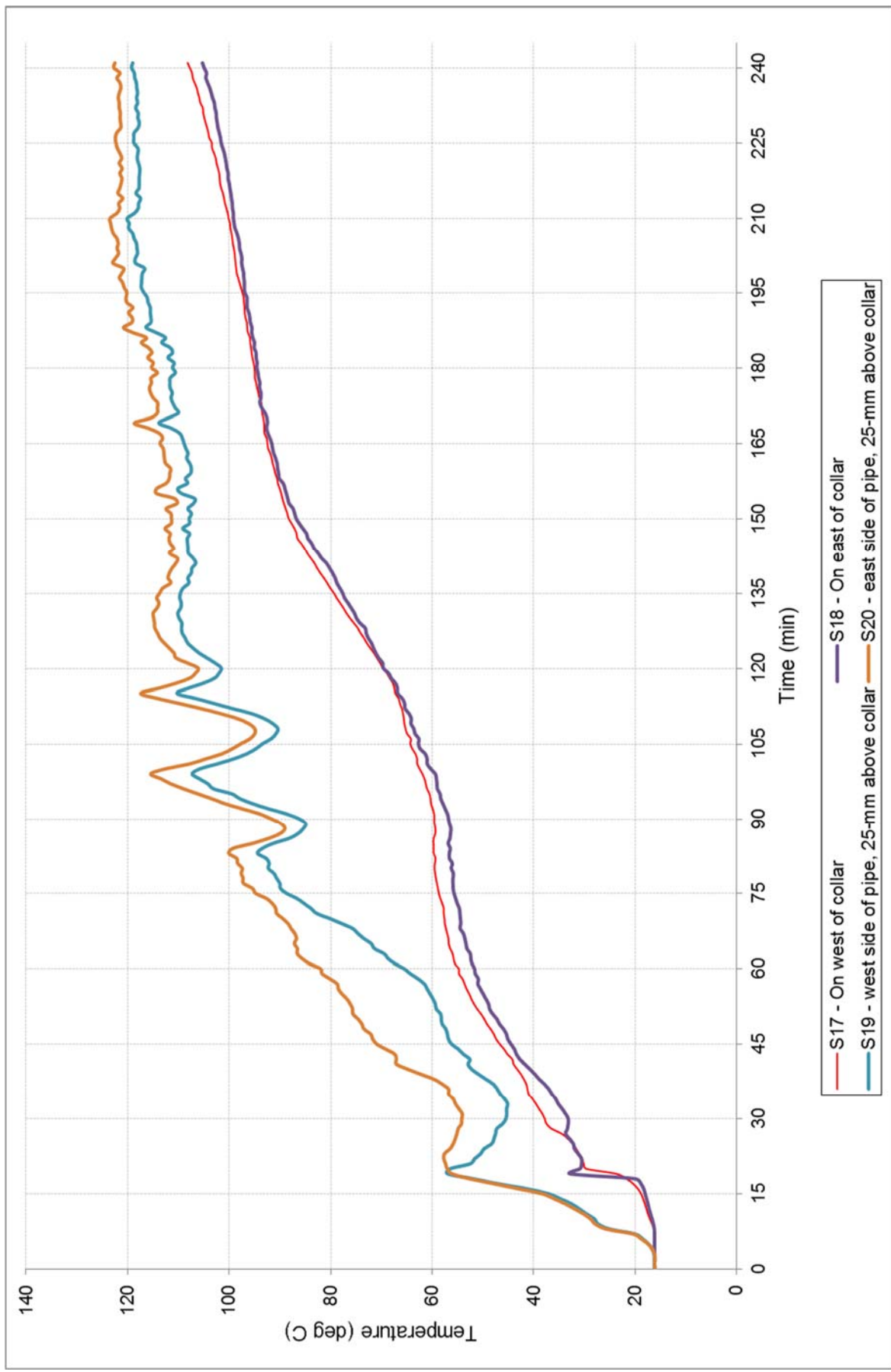


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 5

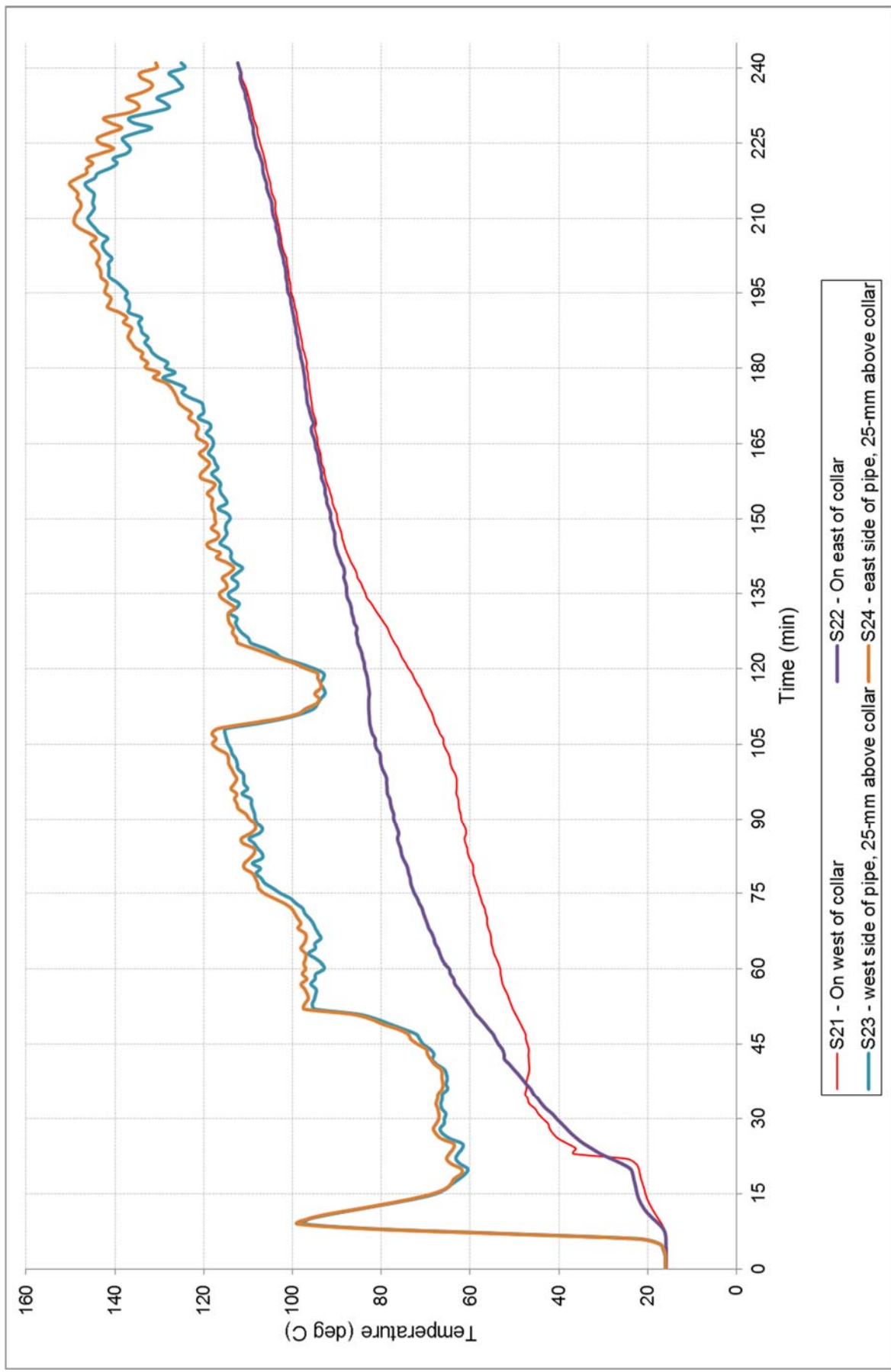


FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 6

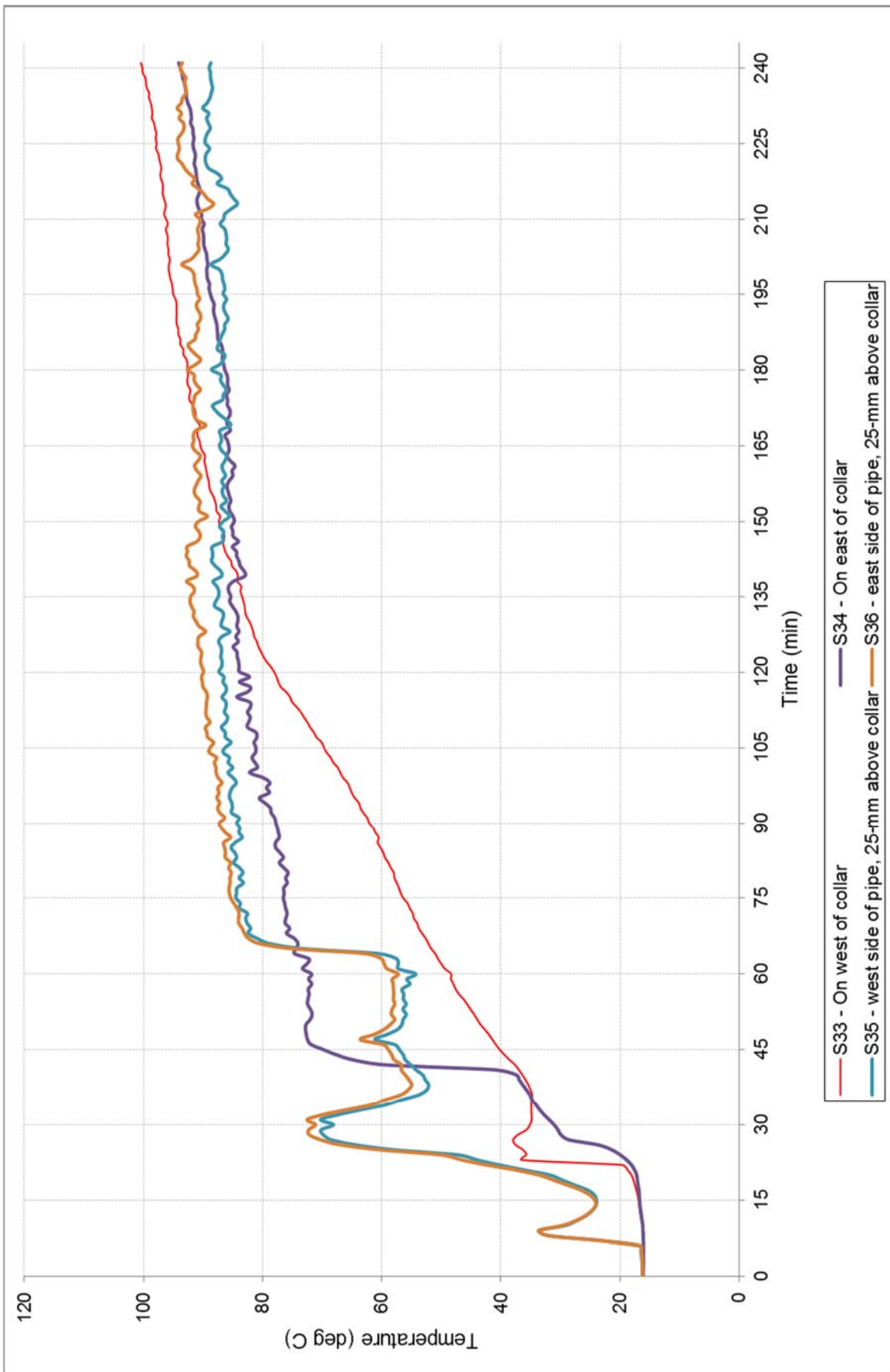
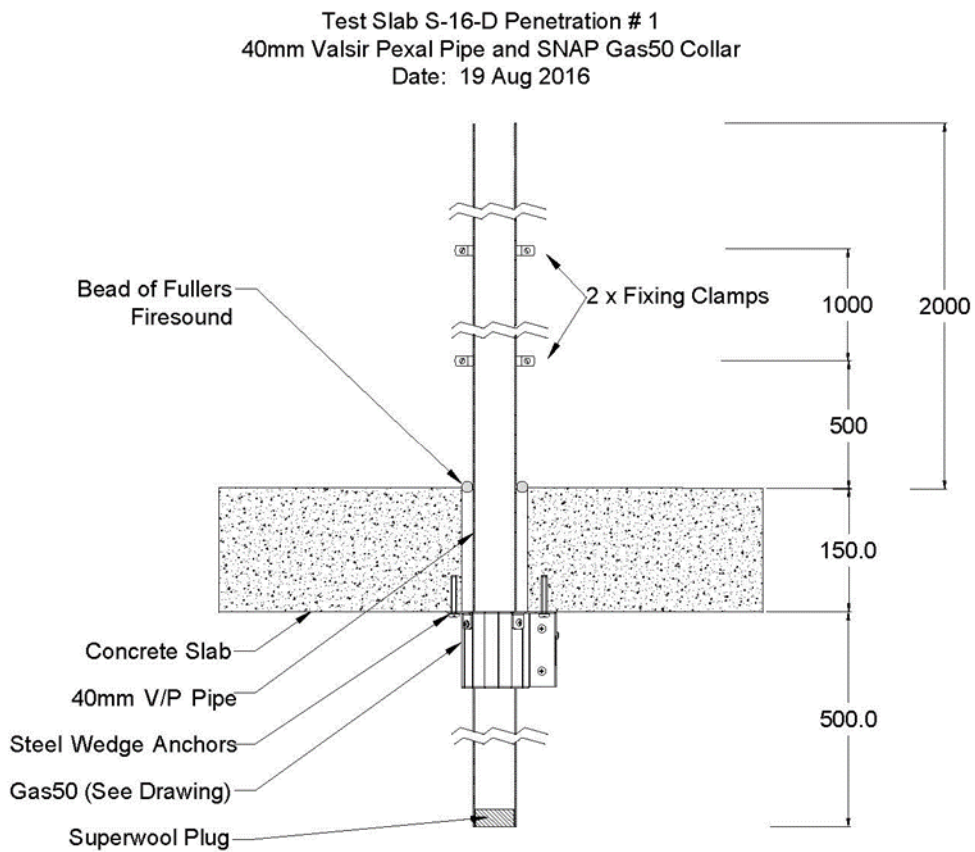


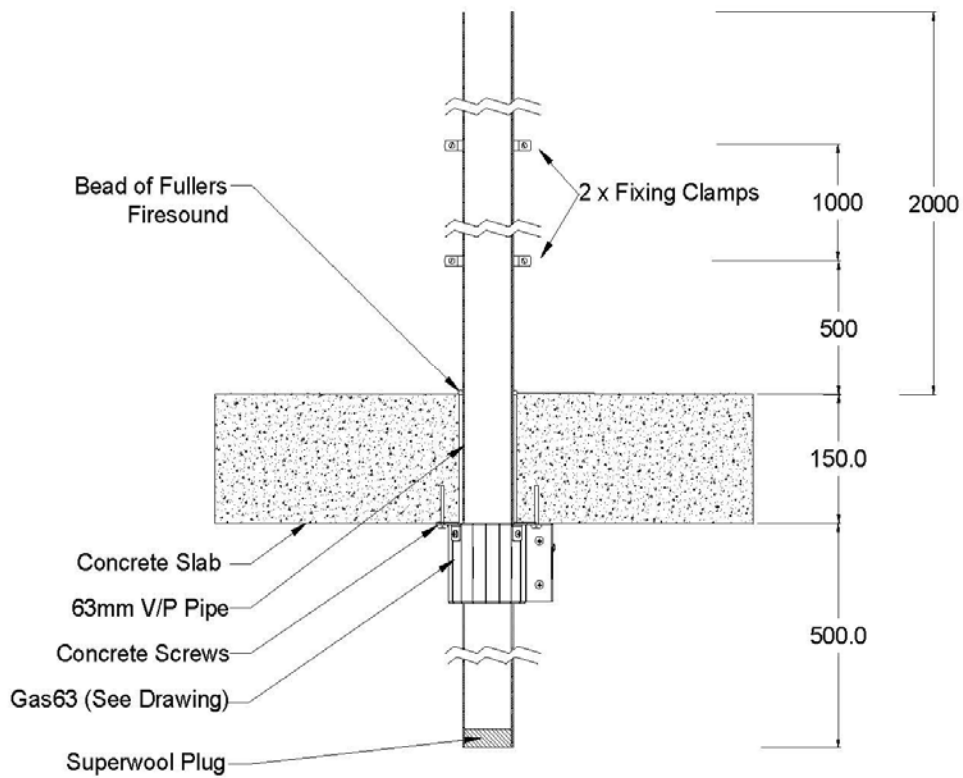
FIGURE 8 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 9

Appendix D – Installation drawings



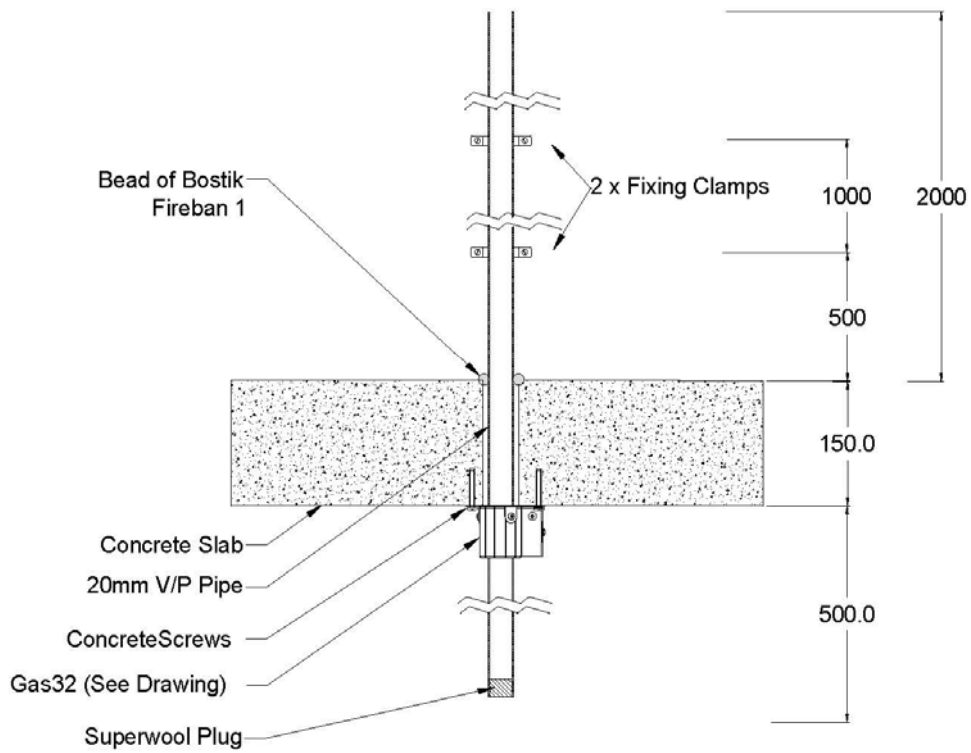
DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 1 – 40MM VALSIR PEXAL PIPE AND SNAP GAS50 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Test Slab S-16-D Penetration # 3
 63mm Valsir Pexal Pipe and SNAP Gas63 Collar
 Date: 19 Aug 2016



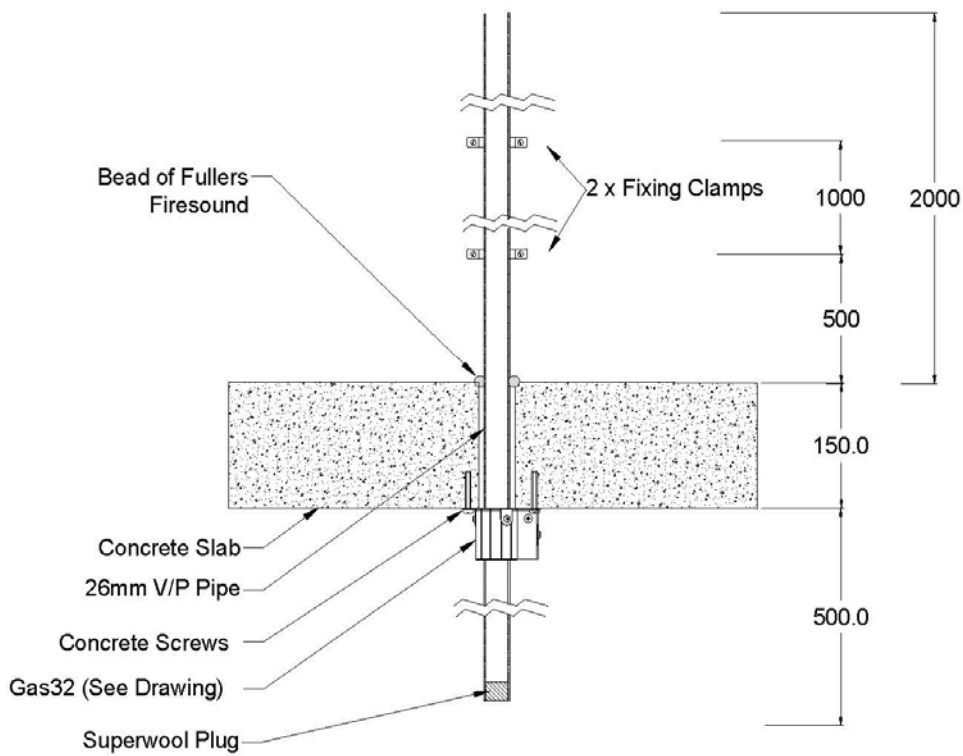
DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 3 – 63MM VALSIR PEXAL PIPE AND SNAP GAS63 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Test Slab S-16-D Penetration # 4
 20mm Valsir Pexal Pipe and SNAP Gas32 Collar
 Date: 19 Aug 2016



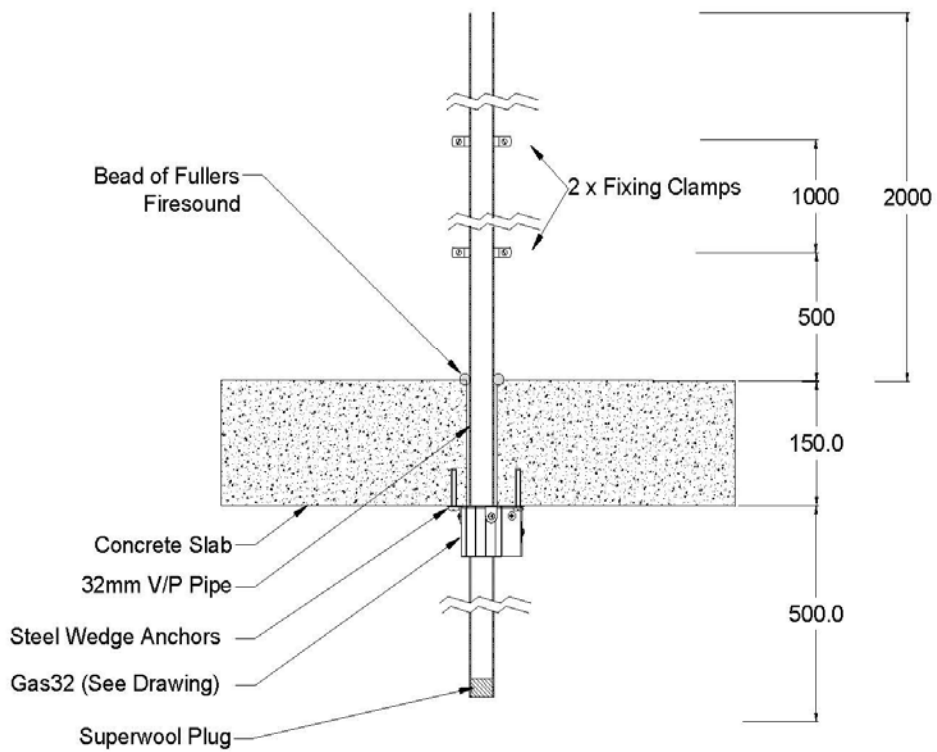
DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 4 – 20MM VALSIR PEXAL PIPE AND SNAP GAS32 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Test Slab S-16-D Penetration # 5
 26mm Valsir Pexal Pipe and SNAP Gas32 Collar
 Date: 19 Aug 2016



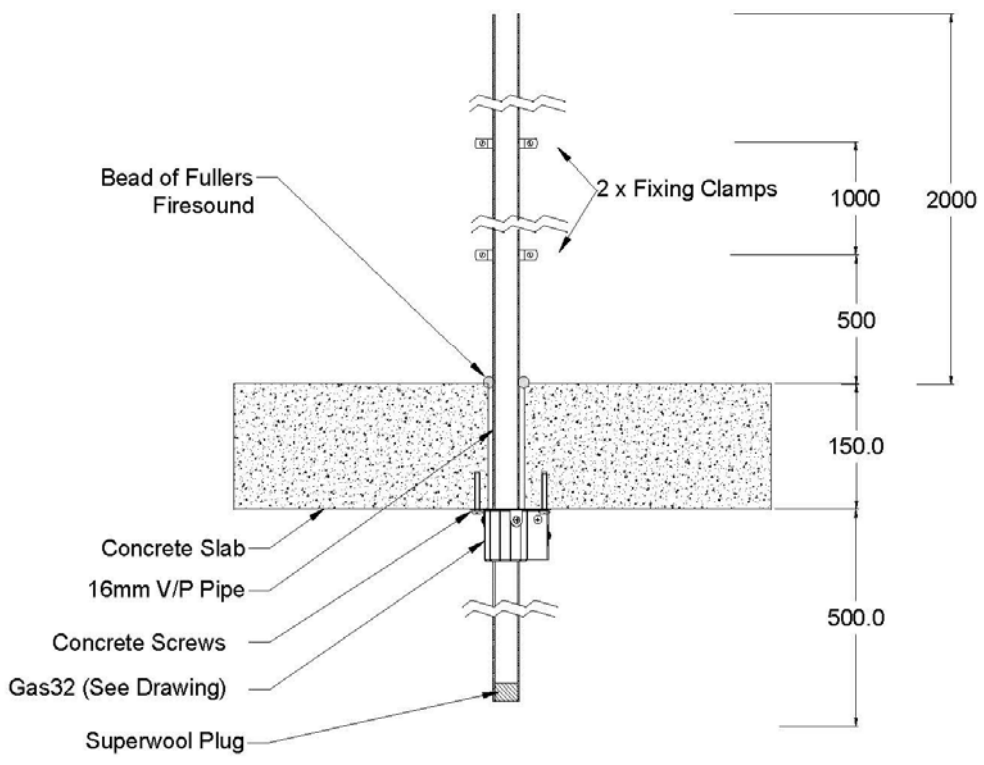
DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 5 – 26MM VALSIR PEXAL PIPE AND SNAP GAS32 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Test Slab S-16-D Penetration # 6
32mm Valsir Pexal Pipe and SNAP Gas32 Collar
Date: 19 Aug 2016



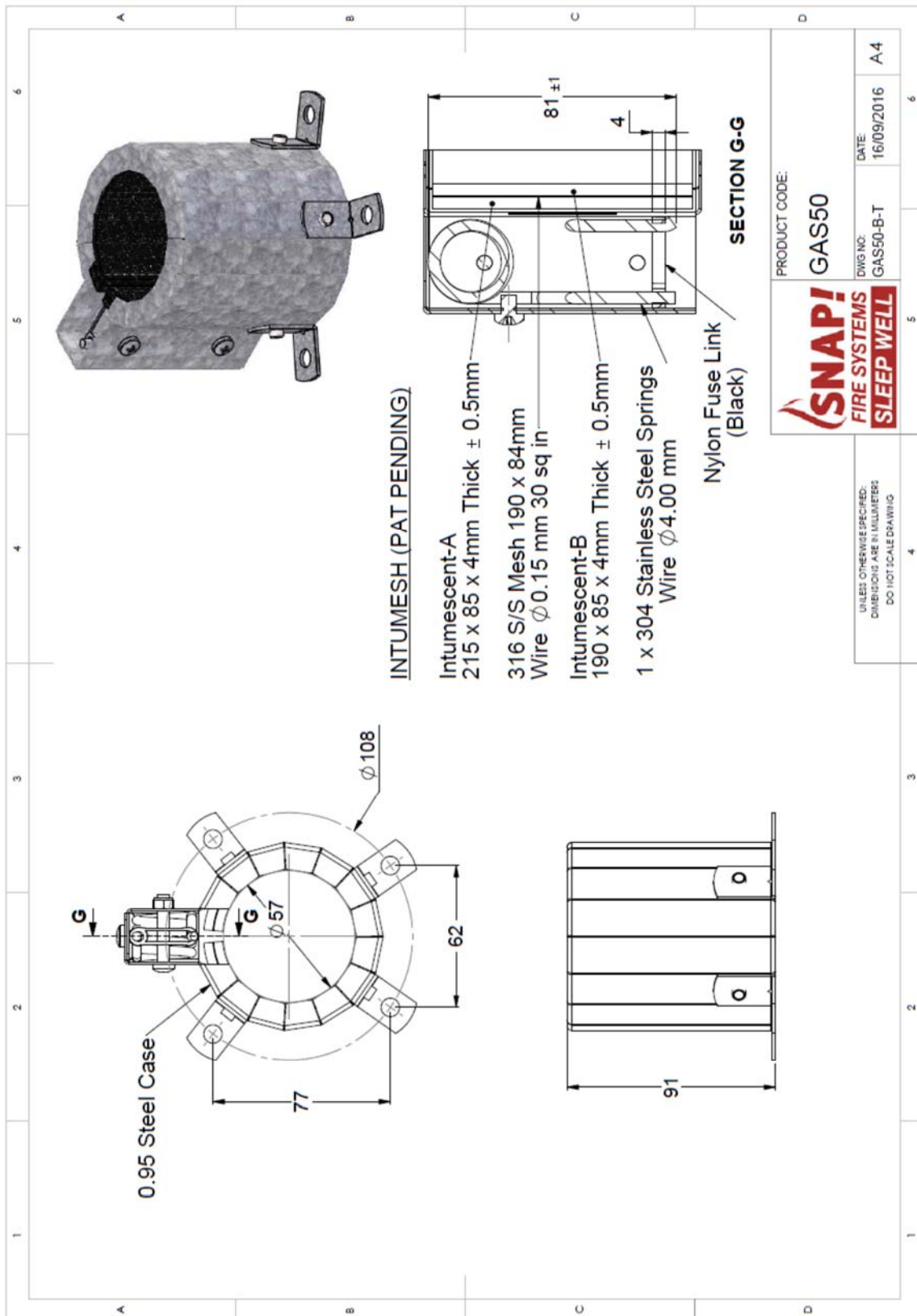
DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 6 – 32MM VALSIR PEXAL PIPE AND SNAP GAS32 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Test Slab S-16-D Penetration # 9
 16mm Valsir Pexal Pipe and SNAP Gas32 Collar
 Date: 19 Aug 2016

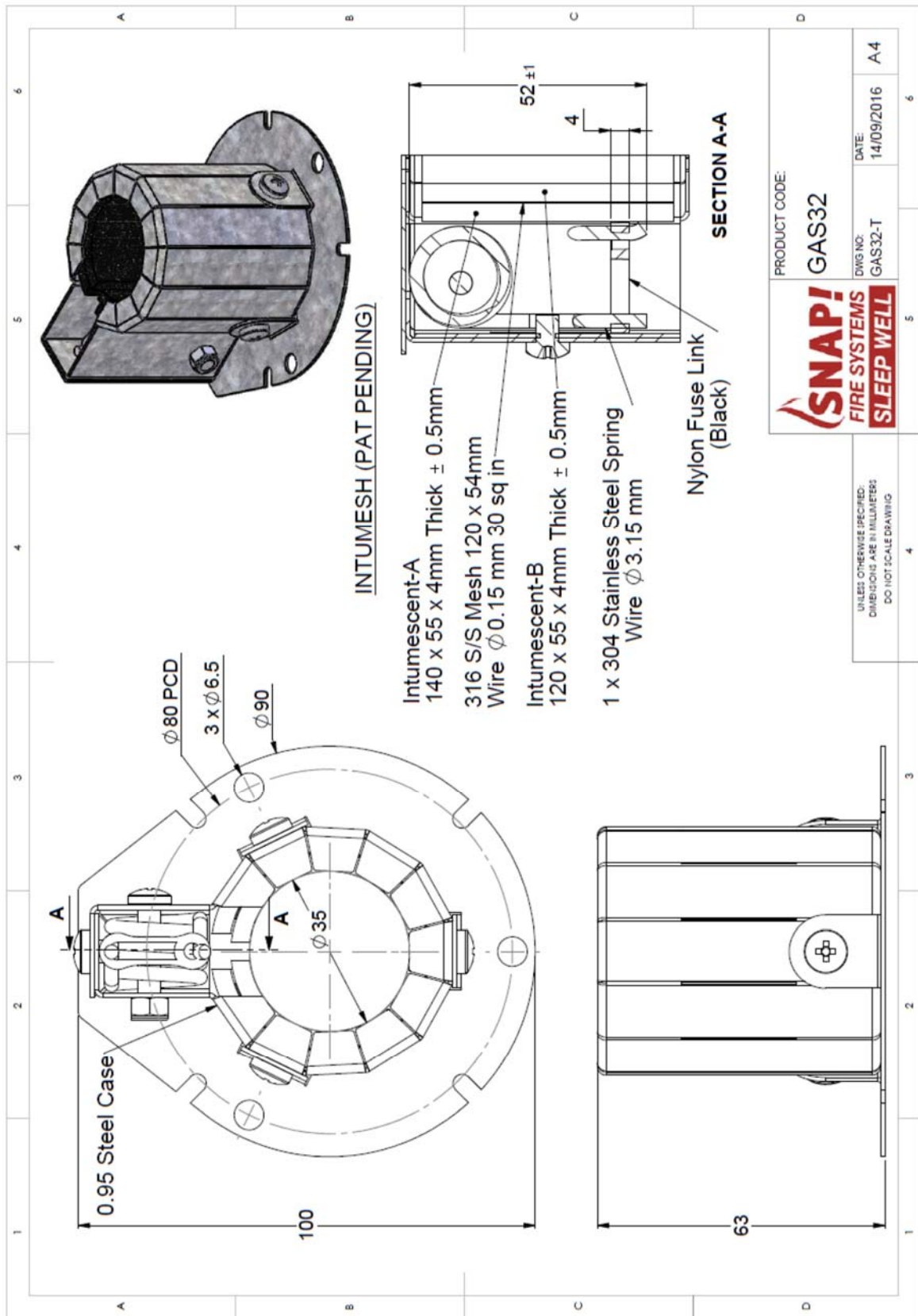


DRAWING TITLED "TEST SLAB S-16-D PENETRATION # 9 – 16MM VALSIR PEXAL PIPE AND SNAP GAS32 COLLAR" DATED 19 AUGUST 2016, BY SNAP FIRE SYSTEMS PTY LTD.

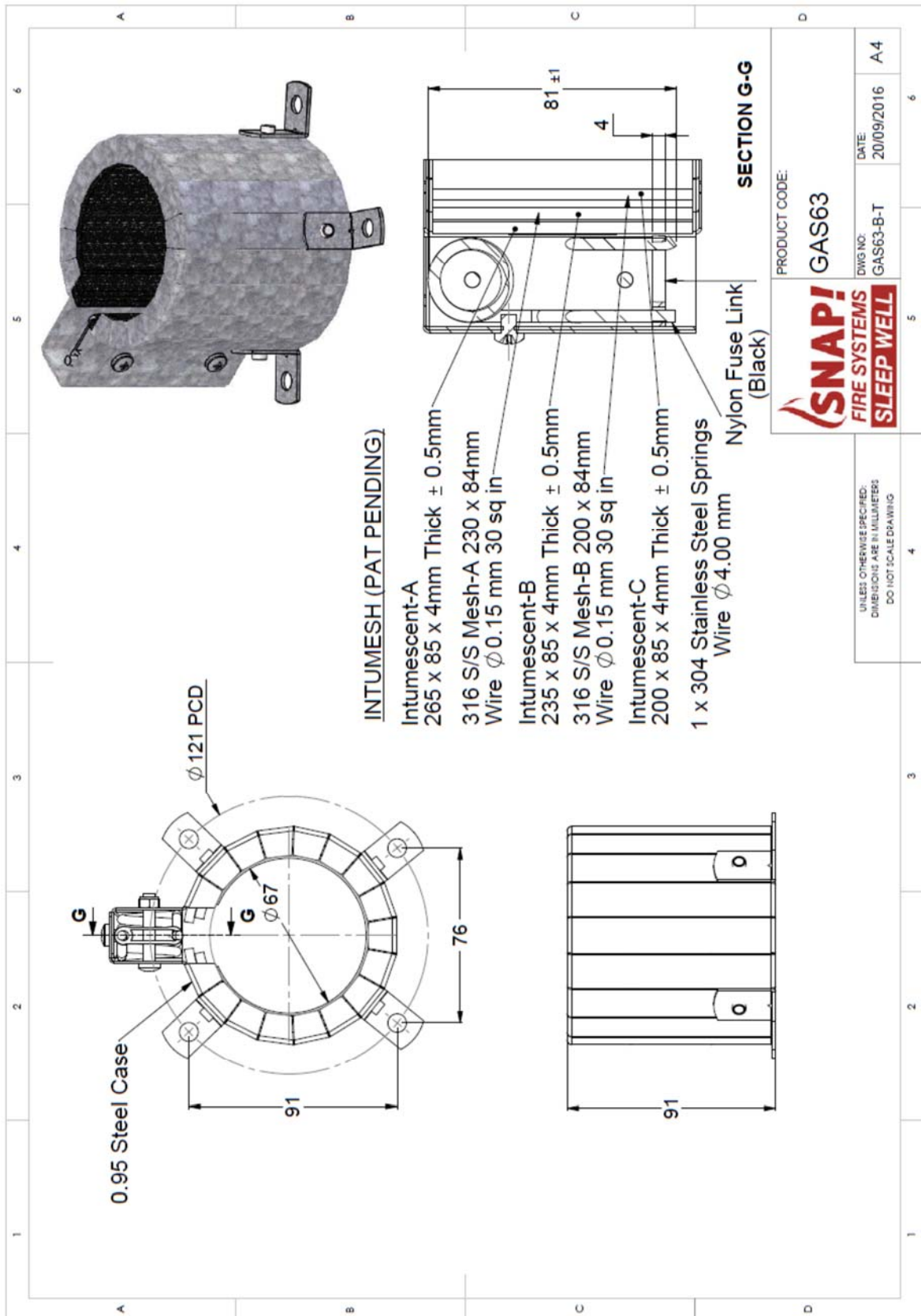
Appendix E – Specimen Drawings



DRAWING NUMBERED GAS50-B-T, DATED 16 SEPTEMBER 2016, BY SNAP FIRE SYSTEMS PTY LTD.






DRAWING NUMBERED GAS32-T, DATED 14 SEPTEMBER 2016, BY SNAP FIRE SYSTEMS PTY LTD.



DRAWING NUMBERED GAS63-B-T, DATED 20 SEPTEMBER 2016, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix F – Certificates

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		
<h2>Certificate of Test</h2>		
		No. 2841
<small>"Copyright CSIRO 2016 ©" Copying or alteration of this report without written authorisation from CSIRO is forbidden.</small>		
<p>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 4-2014 on behalf of:</p>		
Snap Fire Systems Pty Ltd Building A, 1343 Wynnum Road Tingalpa QLD 4173		
A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.		
Product Name: <u>Penetration 1 – GAS50 Retrofit collar protecting a 40-mm diameter Valsir Pex-Al-Pex pipe</u>		
Description: The SNAP Retrofit GAS50 collar comprised a 0.95-mm thick steel casing with a 57-mm inner diameter and a 127-mm diameter base flange. The 91-mm high collar casing incorporated a layer of 215-mm x 85-mm x 4-mm thick Intumescent material and a layer of 190-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 190 x 84-mm as shown in drawing numbered GAS50-B-T dated 16 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 40-mm Valsir Pexal stack pipe, with a wall thickness of 3.5-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 1 – 40mm Valsir Pexal Pipe and SNAP Gas50 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Fullers Firesound.		
Structural Adequacy		not applicable
Integrity		no failure at 241 minutes
Insulation		127 minutes
<p>and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/240/120. 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.</p>		
Testing Officer:	Russell Collins	Date of Test: 6 June 2016
Issued on the 1 st day of November 2016 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	

COPY OF CERTIFICATE OF TEST – NO. 2841



Certificate of Test

No. 2842

"Copyright CSIRO 2016 ©"
Copying or alteration of this report
without written authorisation from CSIRO is forbidden.

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 4-2014 on behalf of:

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.

Product Name: Penetration 3 – GAS63 Retrofit collar protecting a 63-mm diameter Valsir Pex-Al-Pex pipe

Description: The SNAP Retrofit GAS63 collar comprised a 0.95-mm thick steel casing with a 67-mm inner diameter and a 121-mm diameter base flange. The 91-mm high collar casing incorporated a layer of 265-mm x 85-mm x 4-mm thick Intumescent material and a layer of 235-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 230 x 84-mm as shown in drawing numbered GAS63-B-T dated 20 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 63-mm Valsir Pexal stack pipe, with a wall thickness of 5-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 3 – 63mm Valsir Pexal Pipe and SNAP Gas63 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Fullers Firesound.

Structural Adequacy	not applicable
Integrity	no failure at 241 minutes
Insulation	145 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/240/120. 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: Russell Collins

Date of Test: 6 June 2016

Issued on the 1st day of November 2016 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

COPY OF CERTIFICATE OF TEST – NO. 2842



Certificate of Test

No. 2843

"Copyright CSIRO 2016 ©"
 Copying or alteration of this report
 without written authorisation from CSIRO is forbidden.

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 4-2014 on behalf of:

Snap Fire Systems Pty Ltd
 Building A, 1343 Wynnum Road
 Tingalpa QLD 4173

A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.

Product Name: Penetration 4 – GAS32 Retrofit collar protecting a 20-mm diameter Valsir Pex-Al-Pex pipe

Description: The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 20-mm Valsir Pexal stack pipe, with a wall thickness of 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 "Test Slab S-16-D Penetration # 4 – 20mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Bostik Fireban 1.

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: Russell Collins Date of Test: 6 June 2016

Issued on the 1st day of November 2016 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



Certificate of Test

No. 2844

"Copyright CSIRO 2016 ©"
Copying or alteration of this report
without written authorisation from CSIRO is forbidden.

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 4-2014 on behalf of:

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.

Product Name: Penetration 5 – GAS32 Retrofit Collar protecting a 26-mm diameter Valsir Pex-Al-Pex pipe

Description: The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 26-mm Valsir Pexal stack pipe, with a wall thickness of 3-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 "Test Slab S-16-D Penetration # 5 – 26mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Fullers Firesound.

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: Russell Collins Date of Test: 6 June 2016

Issued on the 1st day of November 2016 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

COPY OF CERTIFICATE OF TEST – NO. 2844



Certificate of Test

No. 2845

"Copyright CSIRO 2016 ©"
Copying or alteration of this report
without written authorisation from CSIRO is forbidden.

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 4-2014 on behalf of:

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.

Product Name: Penetration 6 – GAS32 Retrofit Collar protecting a 32-mm diameter Valsir Pex-Al-Pex pipe

Description: The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 32-mm Valsir Pexal stack pipe, with a wall thickness of 3-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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Test Slab S-16-D Penetration # 6 – 32mm Valsir Pexal Pipe and SNAP Gas32 Collar" dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Fullers Firesound.

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: Russell Collins Date of Test: 6 June 2016

Issued on the 1st day of November 2016 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

COPY OF CERTIFICATE OF TEST – NO. 2845



Certificate of Test

No. 2846

“Copyright CSIRO 2016 ©”
Copying or alteration of this report
without written authorisation from CSIRO is forbidden.

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 4-2014 on behalf of:

Snap Fire Systems Pty Ltd
Building A, 1343 Wynnum Road
Tingalpa QLD 4173

A full description of the test specimen are detailed in the Division's Sponsored Investigation report numbered FSP 1758.

Product Name: Penetration 9 – GAS32 Retrofit Collar protecting a 16-mm diameter Valsir Pex-Al-Pex pipe

Description: The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 100-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd. The penetrating service comprised a 16-mm Valsir Pexal stack pipe, with a wall thickness of 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 1500-mm from the unexposed face of the concrete slab as shown in drawing titled “Test Slab S-16-D Penetration # 9 – 16mm Valsir Pexal Pipe and SNAP Gas32 Collar” dated 19 August 2016, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Superwool Plug. On the unexposed face, the annular gap between the pipe and slab was sealed with a bead of Fullers Firesound.

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: Russell Collins Date of Test: 6 June 2016

Issued on the 1st day of November 2016 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

COPY OF CERTIFICATE OF TEST – NO. 2846

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---

CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.

FOR FURTHER INFORMATION

Infrastructure Technologies

Brett Roddy
Team Leader, Fire Testing and Assessments
t +61 2 94905449
e brett.rodny@csiro.au
w www.csiro.au/Organisation-Structure/Divisions/CMSE/Infrastructure-Technologies/Fire-safety.aspx