

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

Test Report

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Commercial-in-confidence

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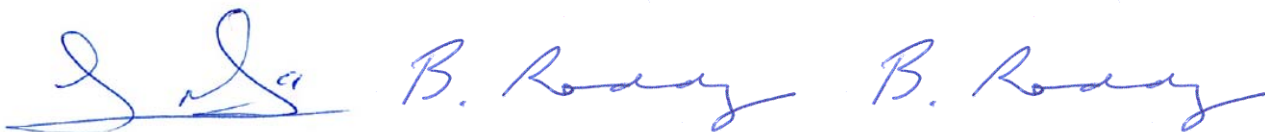
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9 July 2014

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

Sponsored Investigation No. FSP 1634

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap Retro-fit Fire Collars protecting a plasterboard wall penetrated by nine (9) PEX (Cross-linked polyethylene) 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.

Section 10: Service Penetrations and Control Joints

1.5 Reference standard

Australian Standard 4072, Components for the protection of openings in fire-resistant separating elements, Part 1 - 2005, Service penetrations and control joints.

1.6 Test number

CSIRO Reference test number: FS 4418/3754

1.7 Test date

The fire-resistance test was conducted on 30 April 2014.

2 Description of specimen

2.1 General

The wall system, with an established fire-resistance level (FRL) of -/180/180 comprised a 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick Boral Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The wall was penetrated by nine (9) PEX (Cross-linked polyethylene) pipes protected by retro-fitted Snap Fire System fire collars.

For the purpose of the test, the specimens were referenced as Penetrations A, B, C, D, E, F, G, H and I.

Penetration A – 32R retrofitted fire collar protecting a PEX-b (16-mm SDR 11) stack pipe (80° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.1-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration B – 32R retrofitted fire collar protecting a PEX-a (16-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 2.3-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard

wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration C – 32R retrofitted fire collar protecting a PEX-b (20-mm SDR 11) stack pipe (60° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.1-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration D – 32R retrofitted fire collar protecting a PEX-a (20-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 3.9-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration E – 32R retrofitted fire collar protecting a PEX-b (25-mm SDR 11) stack pipe (180° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.6-mm fitted through the collar's sleeve. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration F – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration G – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (60° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through the a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration H – 32R retrofitted fire collar protecting a PEX-a (32-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

Penetration I – 32R retrofitted fire collar protecting a PEX-b (32-mm SDR 11) stack pipe (180° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

2.2 Dimensions

The overall dimension of the plasterboard wall was 1150-mm square, to suit the opening in the specimen containing frame.

2.3 Orientation

The plasterboard wall was placed vertically against the furnace chamber.

2.4 Selection, construction and installation of the specimen and the supporting construction

Service penetration construction and installation was organised by the sponsor.

CSIRO was not involved in the selection of the materials.

3 Documentation

The following documents were supplied or referenced by the sponsor as a complete description of the specimen and should be read in conjunction with this report:

Drawing titled “Penetration #A – PEX-b (16-mm SDR 11) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #B – PEX-a (16-mm SDR 7.4) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #C – PEX-b (20-mm SDR 11) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #D – PEX-a (20-mm SDR 7.4) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #E – PEX-b (25-mm SDR 11) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #F – PEX-a (25-mm SDR 7.4) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #G – PEX-a (25-mm SDR 7.4) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #H – PEX-a (32-mm SDR 7.4) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #I – PEX-b (32-mm SDR 11) Stack”, dated 5 May 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered 32R-T, dated 13 May 2014, by Snap Fire Systems Pty Ltd.

4 Equipment

4.1 Furnace

The furnace had a nominal opening of 1000-mm x 1000-mm for attachment of vertical or horizontal specimens.

The furnace was lined with refractory bricks and materials with the thermal properties as specified in AS 1530.4-2005 and was heated by combustion of a mixture of natural gas and air.

4.2 Temperature

The temperature in the furnace chamber was measured by four type K, 3-mm diameter, and 310 stainless steel Mineral Insulated Metal Sheathed (MIMS) thermocouples. Each thermocouple was housed in high-nickel steel tubes opened at the exposed end.

The temperatures of the specimen were measured by glass-fibre insulated and sheathed K-type thermocouples with a wire diameter of 0.5-mm.

Location of the thermocouples on the unexposed face of the specimen is shown in photograph 2.

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 23°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 180 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 (h:mm:ss)	Observation
0:01:35	- Fluing visible from Penetration D.
0:02:27	- Fluing visible from Penetration F.
0:03:05	- Fluing visible from Penetration B.
0:03:15	- Fluing visible from Penetration E.
0:03:30	- Fluing visible from Penetration A.
0:03:45	- Fluing visible from Penetration C.
0:04:12	- Fluing from Penetration B stopped.
0:04:50	- Fluing from Penetration C stopped.
0:05:10	- Fluing from Penetration E and A stopped.
0:05:54	- Fluing visible from Penetration H.
0:06:03	- Fluing visible from Penetration G.
0:06:15	- Fluing visible from Penetration I. Fluing from Penetration D stopped.
0:07:00	- Fluing from Penetration F stopped.
0:07:45	- Fluing from Penetration I stopped.
0:08:05	- Fluing from Penetration G stopped.
0:09:04	- Fluing from Penetration H stopped.
0:27:00	- Fluing visible again from Penetration H.
0:35:00	- Fluing from Penetration H stopped.
0:54:00	- Fluing visible again from Penetration H
0:57:00	- Fluing visible again from Penetration G.
1:36:00	- <u>Insulation failure of penetration H</u> – maximum temperature rise of 180 deg C is exceeded on the pipe.

- 1:37:00 - Insulation failure of penetration G – maximum temperature rise of 180 deg C is exceeded on the pipe.
- 2:14:00 - Insulation failure of penetration E – maximum temperature rise of 180 deg C is exceeded on the pipe.
- 2:15:00 - Penetration G – pipe has come away from the collar. Cotton pad applied, no ignition.
Penetration H – charring is visible on paper around the collar and a crack is noted on pipe near collar.
Penetration E – softening and deformation of pipe \approx 200-mm along the pipe from the collar.
- 2:49:00 - The opening on Penetration G has been blocked by intumescent material.
Insulation failure of penetration I – maximum temperature rise of 180 deg C is exceeded on the pipe.
- 2:58:00 - Penetration B – the pipe has melted away exposing a hole. Cotton pad test applied, no ignition.
- 2:59:00 - Insulation failure of penetration B – maximum temperature rise of 180 deg C is exceeded on the pipe.
- 3:01:00 - 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 curves of temperature versus time associated with Penetration A.
 Figure 4 shows curves of temperature versus time associated with Penetration B.
 Figure 5 shows curves of temperature versus time associated with Penetration C.
 Figure 6 shows curves of temperature versus time associated with Penetration D.
 Figure 7 shows curves of temperature versus time associated with Penetration E.
 Figure 8 shows curves of temperature versus time associated with Penetration F.
 Figure 9 shows curves of temperature versus time associated with Penetration G.
 Figure 10 shows curves of temperature versus time associated with Penetration H.
 Figure 11 shows curves of temperature versus time associated with Penetration I.

8.5 Performance

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

Penetration A – 32R retrofitted fire collar protecting a PEX-b (16-mm SDR 11) stack pipe (180° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - no failure at 180 minutes

Penetration B – 32R retrofitted fire collar protecting a PEX-a (16-mm SDR 7.4) stack pipe (120° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - 179 minutes

Penetration C – 32R retrofitted fire collar protecting a PEX-b (20-mm SDR 11) stack pipe (60° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - no failure at 180 minutes

Penetration D – 32R retrofitted fire collar protecting a PEX-a (20-mm SDR 7.4) stack pipe (120° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - no failure at 180 minutes

Penetration E – 32R retrofitted fire collar protecting a PEX-b (25-mm SDR 11) stack pipe (180° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - 134 minutes

Penetration F – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (120° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - no failure at 180 minutes

Penetration G – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (60° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - 97 minutes

Penetration H – 32R retrofitted fire collar protecting a PEX-a (32-mm SDR 7.4) stack pipe (120° brackets)

Structural adequacy - not applicable

Integrity - no failure at 180 minutes

Insulation - 96 minutes

Penetration I – 32R retrofitted fire collar protecting a PEX-b (32-mm SDR 11) stack pipe (180° brackets)

Structural adequacy	-	not applicable
Integrity	-	no failure at 180 minutes
Insulation	-	169 minutes

This report details methods of construction, the test conditions and the results obtained when 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 A	-	-/180/180;
Penetration B	-	-/180/120;
Penetration C	-	-/180/180;
Penetration D	-	-/180/180;
Penetration E	-	-/180/120;
Penetration F	-	-/180/180;
Penetration G	-	-/180/90;
Penetration H	-	-/180/90; and
Penetration I	-	-/180/120

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', is written over a horizontal line.

Mario Lara
Testing Officer

Appendices

Appendix A – Temperature measurement locations

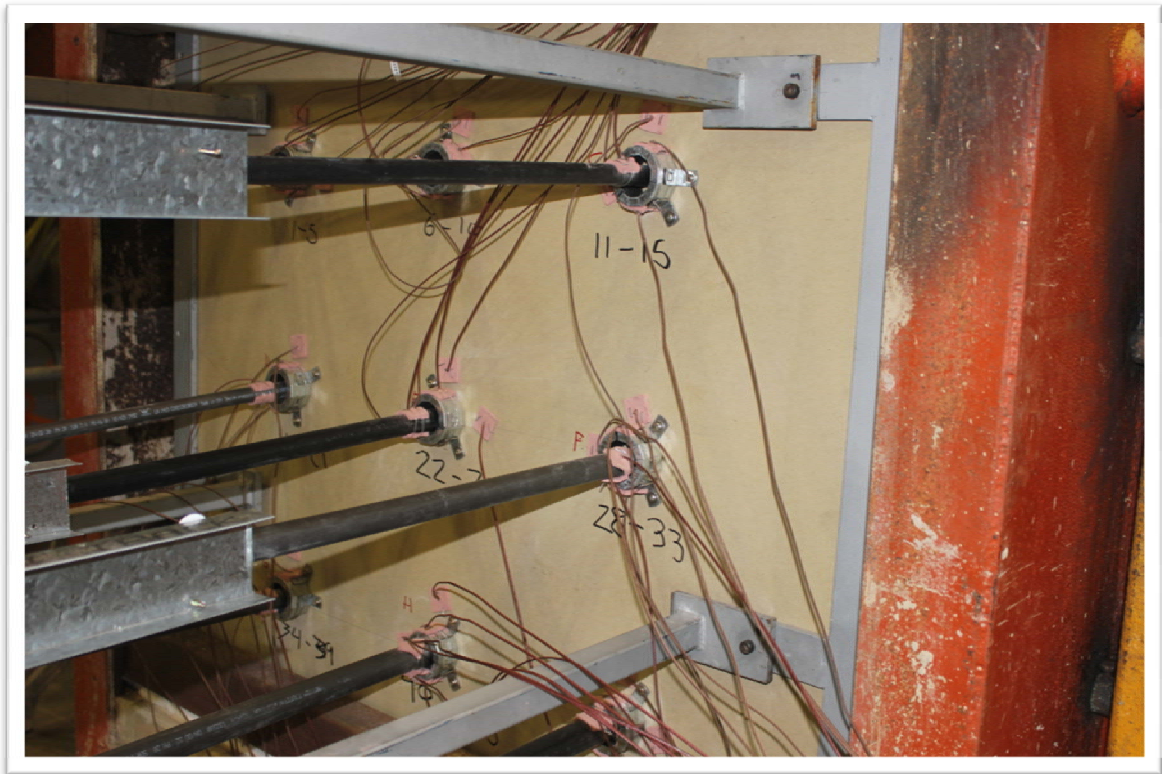
Measurement Location		
Group location	T/C Position	T/C designation
Specimen		
Penetration A	On wall - 25-mm from pipe	S1
	On wall - 25-mm from pipe	S2
	On collar	S3
	On collar	S4
	On pipe - 25-mm from collar	S5
Penetration B	On wall - 25-mm from pipe	S6
	On wall - 25-mm from pipe	S7
	On collar	S8
	On collar	S9
	On pipe - 25-mm from collar	S10
Penetration C	On wall - 25-mm from pipe	S11
	On wall - 25-mm from pipe	S12
	On collar	S13
	On collar	S14
	On pipe - 25-mm from collar	S15
Penetration D	On wall - 25-mm from pipe	S16
	On wall - 25-mm from pipe	S17
	On collar	S18
	On collar	S19
	On pipe - 25-mm from collar	S20
Penetration E	On wall - 25-mm from pipe	S21
	On wall - 25-mm from pipe	S22
	On wall - 25-mm from pipe	S23
	On collar	S24
	On collar	S25
Penetration F	On pipe - 25-mm from collar	S26
	On pipe - 25-mm from collar	S27
	On wall - 25-mm from pipe	S28
	On wall - 25-mm from pipe	S29
	On collar	S30
	On collar	S31
	On pipe - 25-mm from collar	S32
	On pipe - 25-mm from collar	S33

Penetration G	On wall - 25-mm from pipe	S34
	On wall - 25-mm from pipe	S35
	On collar	S36
	On collar	S37
	On pipe - 25-mm from collar	S38
	On pipe - 25-mm from collar	S39
Penetration H	On wall - 25-mm from pipe	S40
	On wall - 25-mm from pipe	S41
	On collar	S42
	On collar	S43
	On pipe - 25-mm from collar	S44
	On pipe - 25-mm from collar	S45
Penetration I	On wall - 25-mm from pipe	S46
	On wall - 25-mm from pipe	S47
	On collar	S48
	On collar	S49
	On pipe - 25-mm from collar	S50
	On pipe - 25-mm from collar	S51

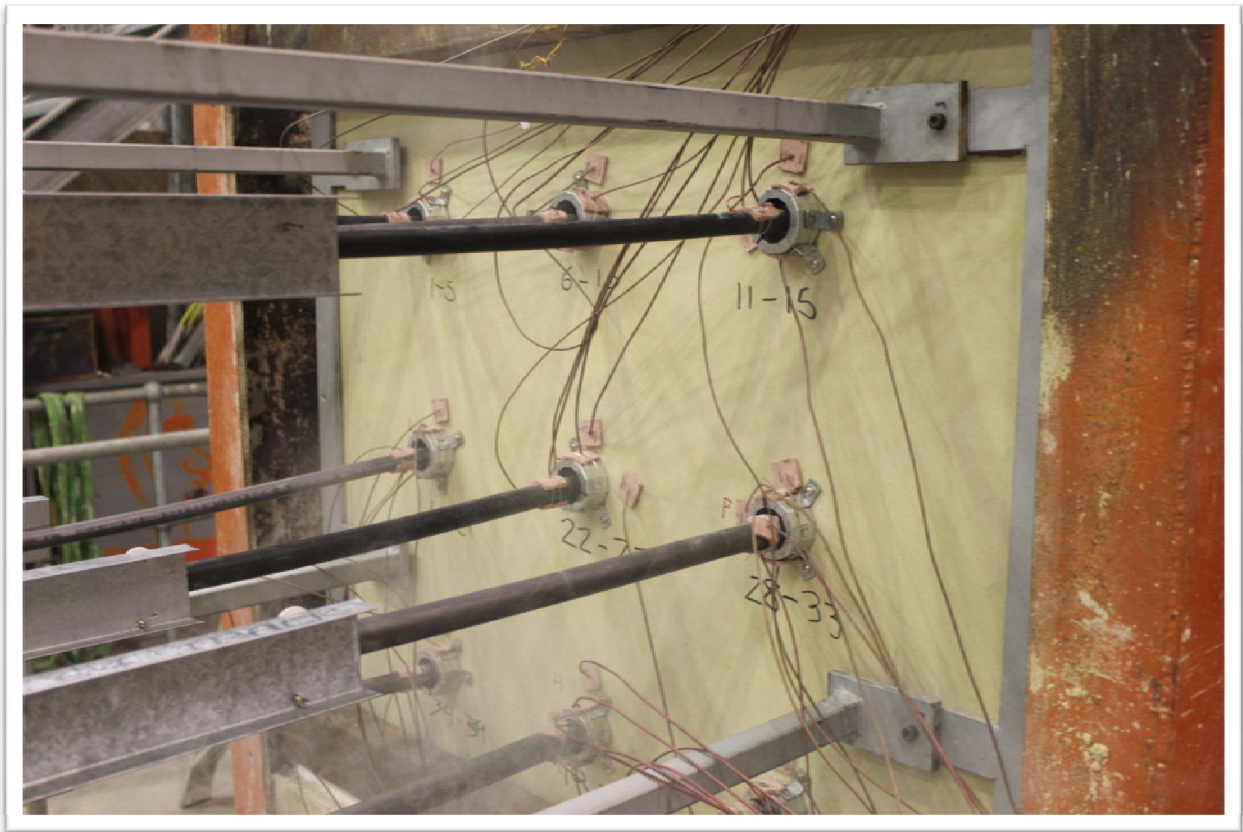
Appendix B – Photographs



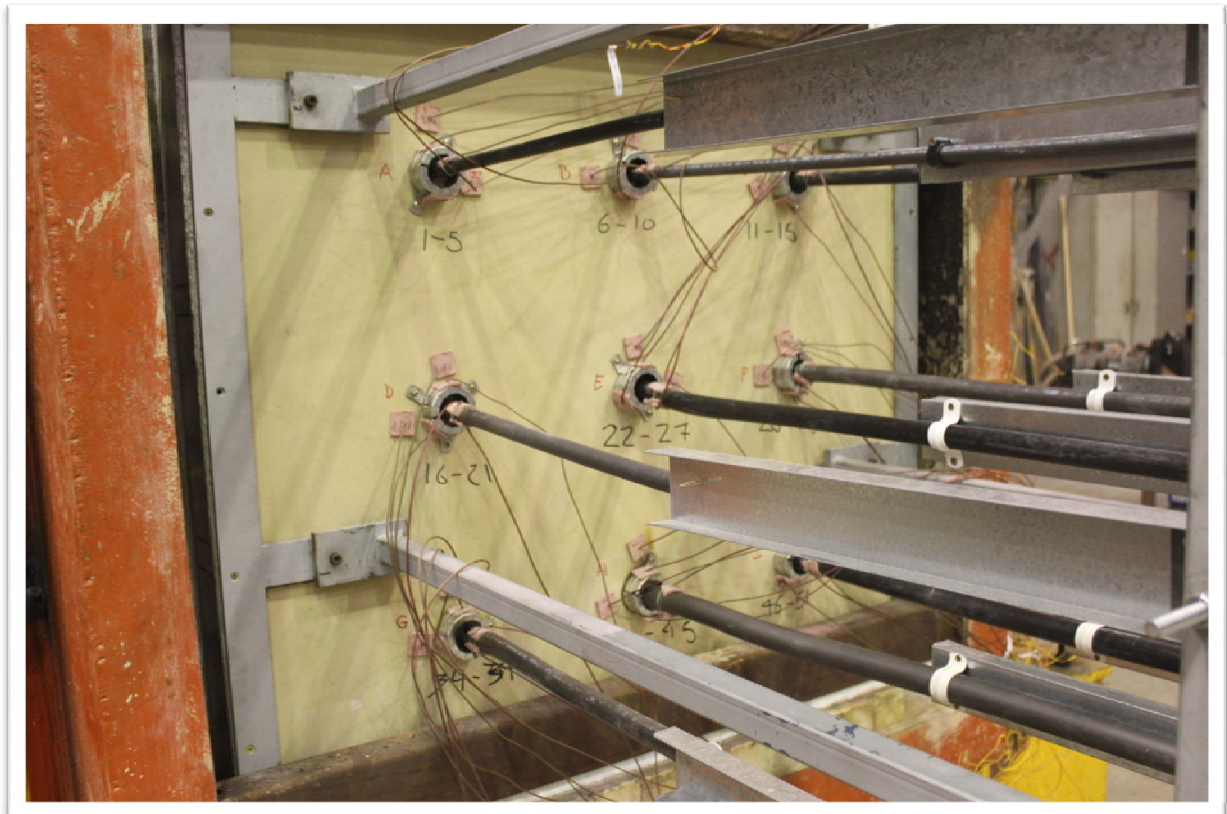
PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



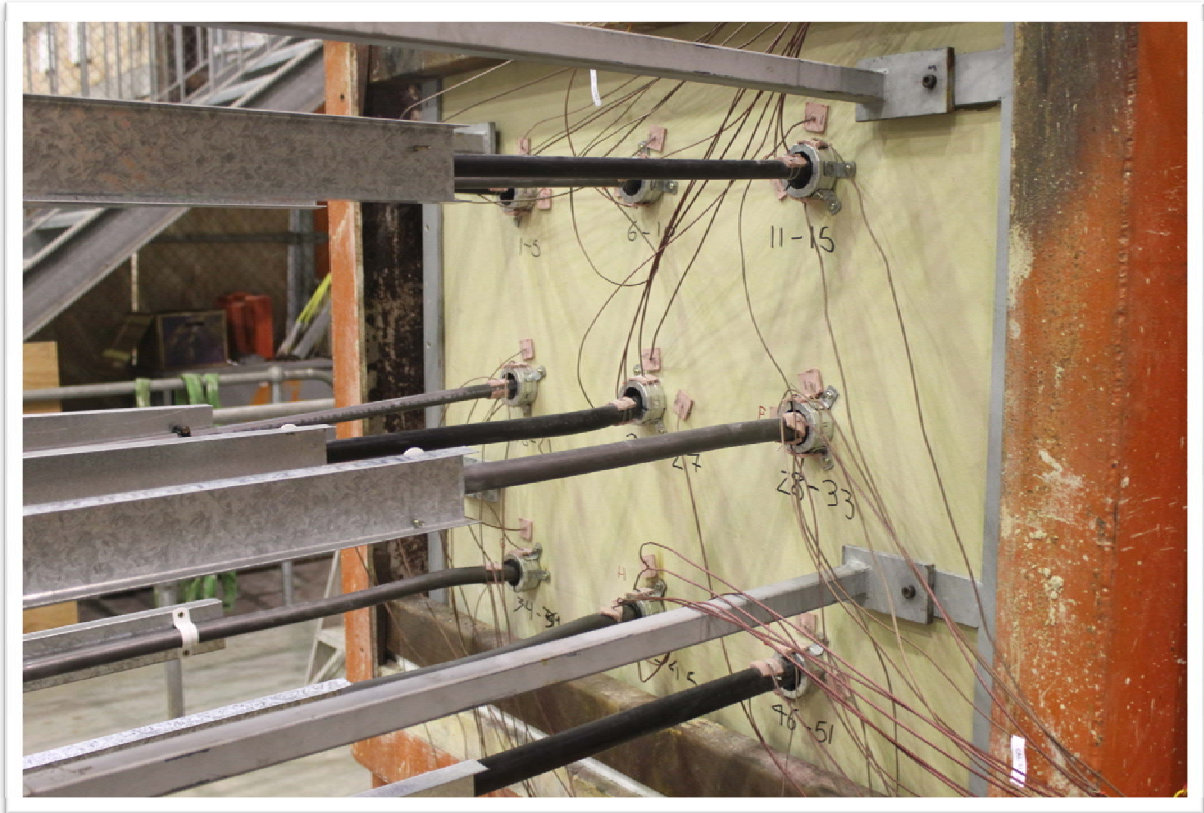
PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



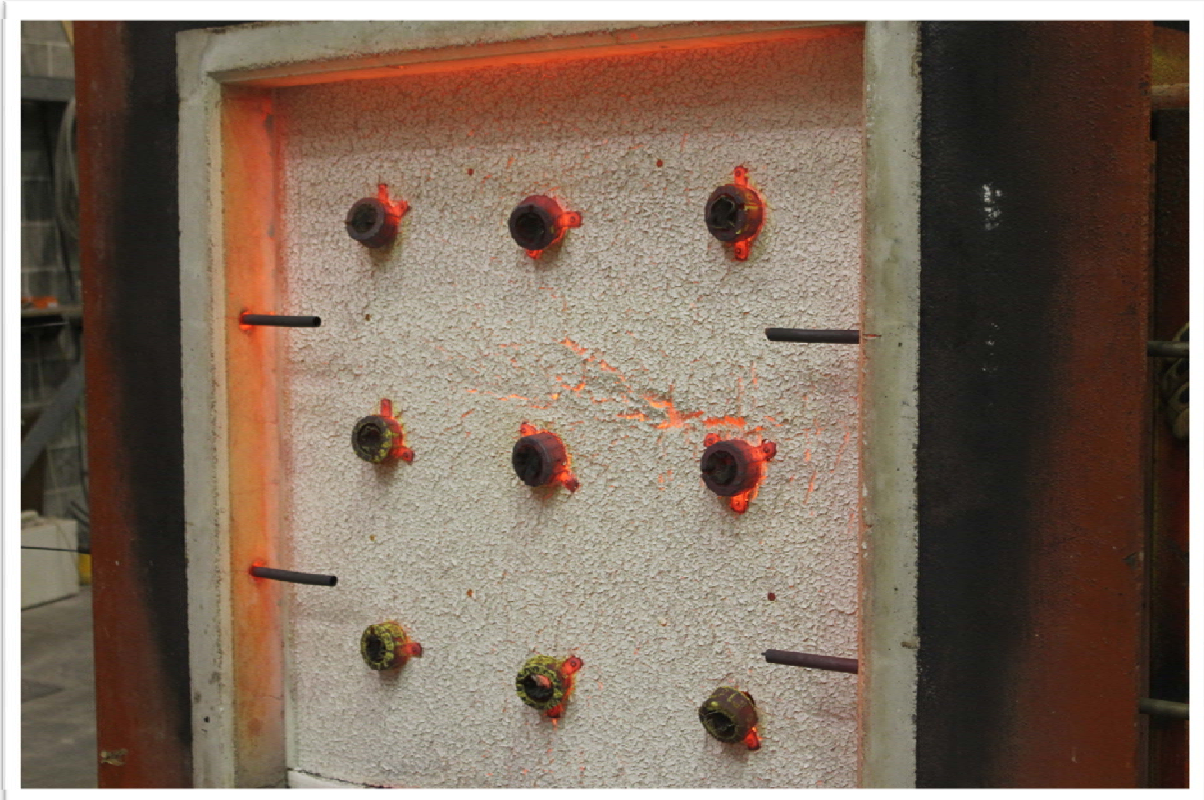
PHOTOGRAPH 3 – SPECIMENS AFTER 60 MINUTES OF TESTING



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

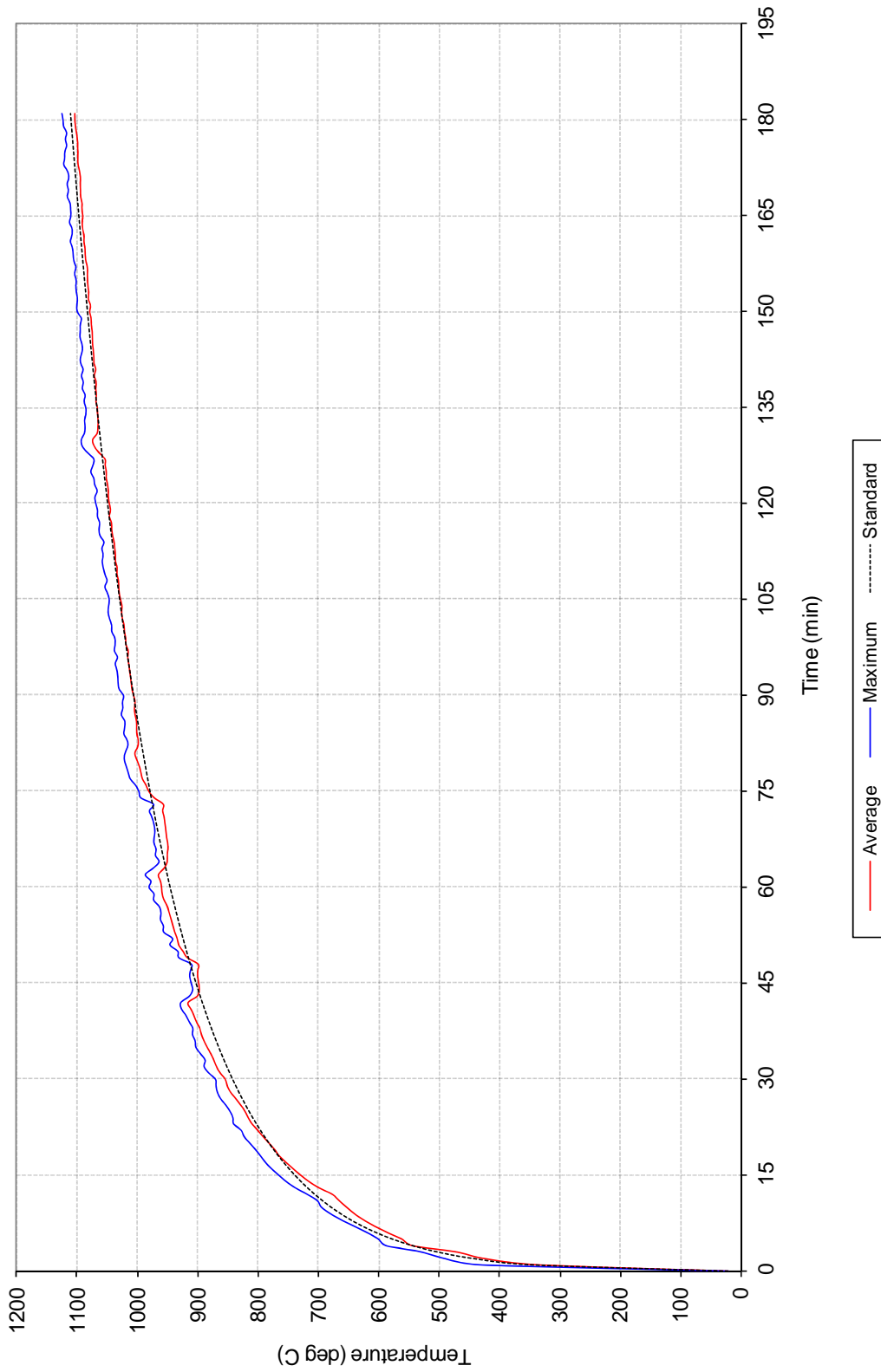


FIGURE 1 – FURNACE TEMPERATURE

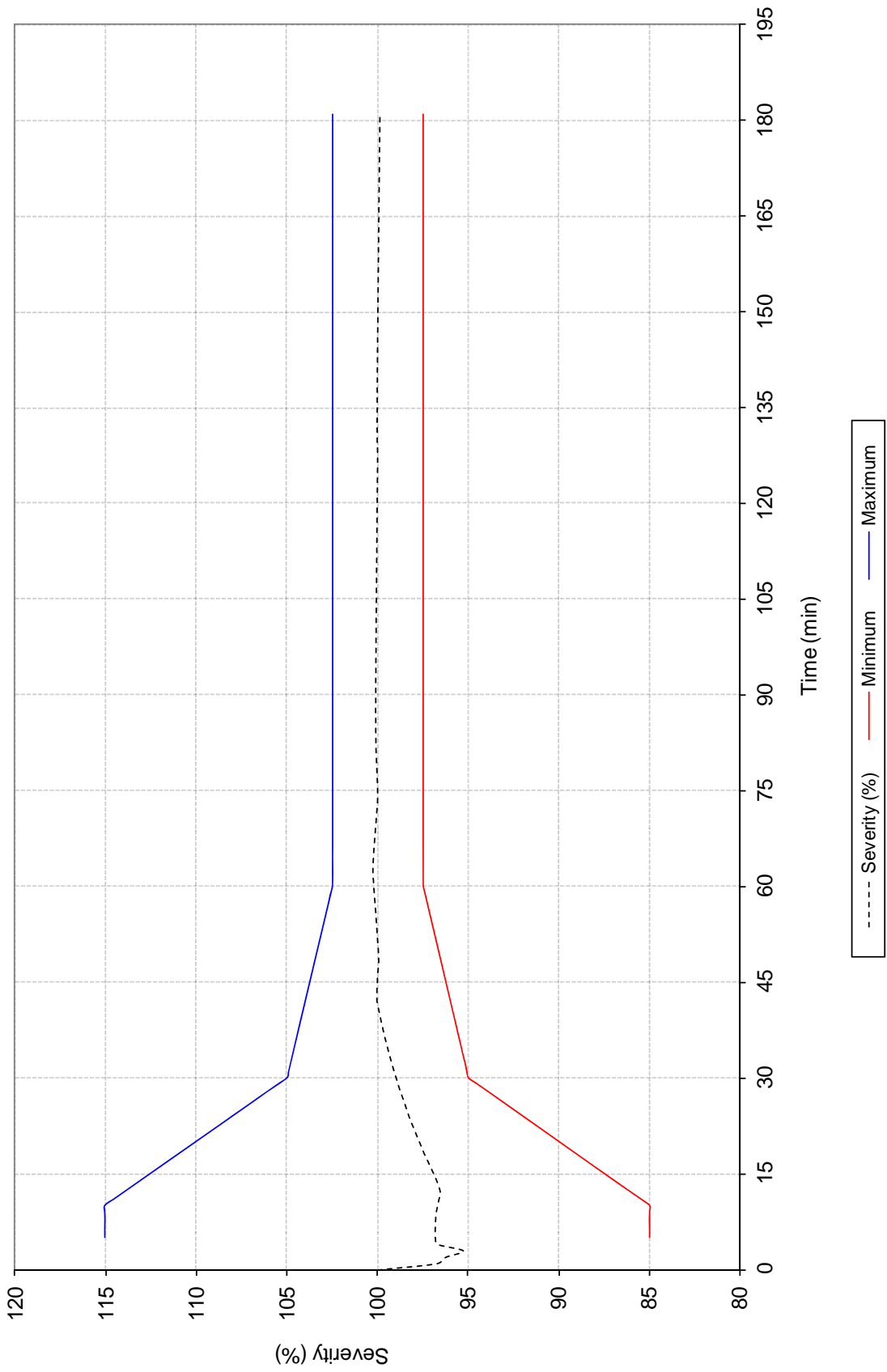


FIGURE 2 – FURNACE SEVERITY

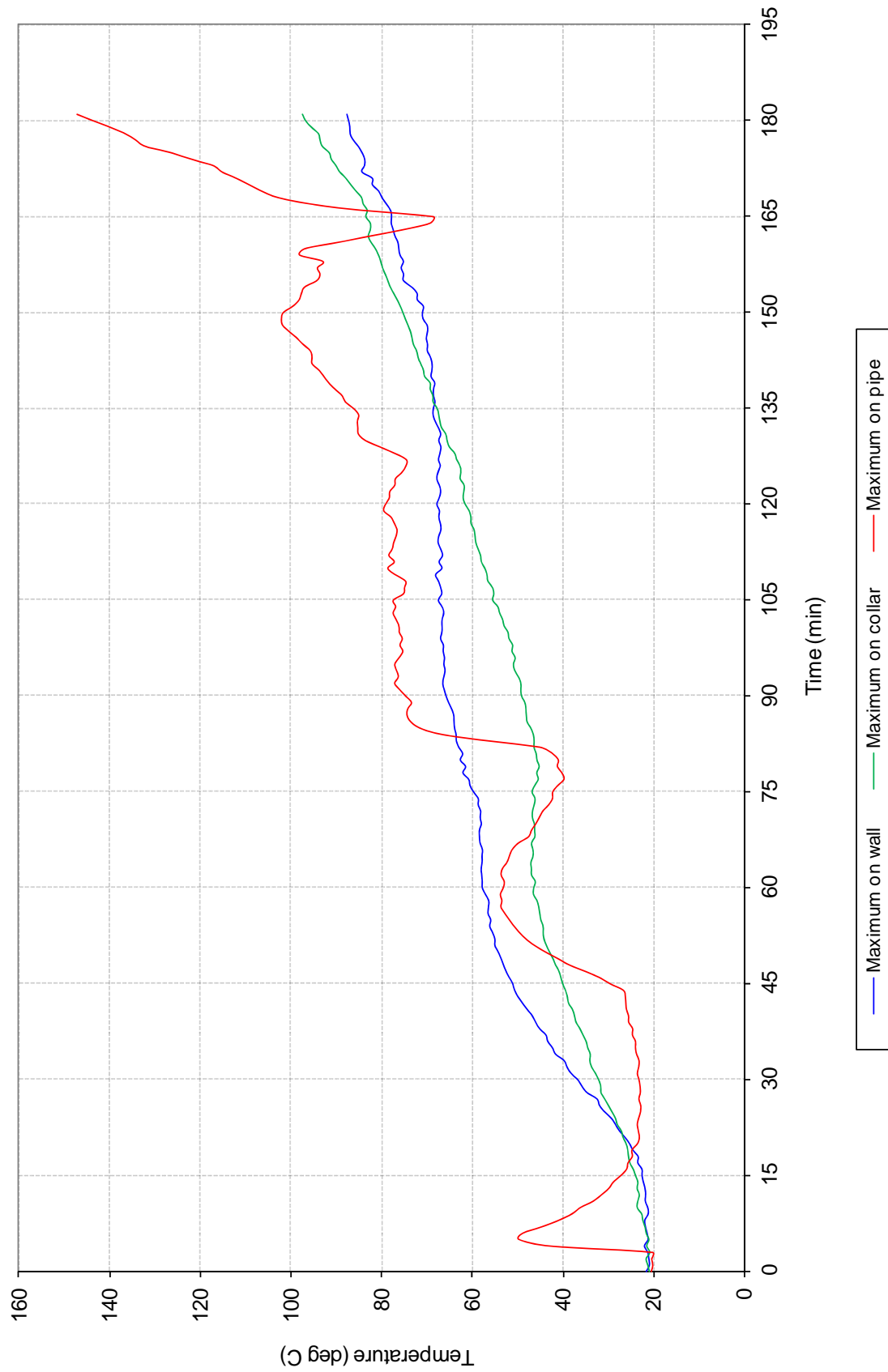


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION A

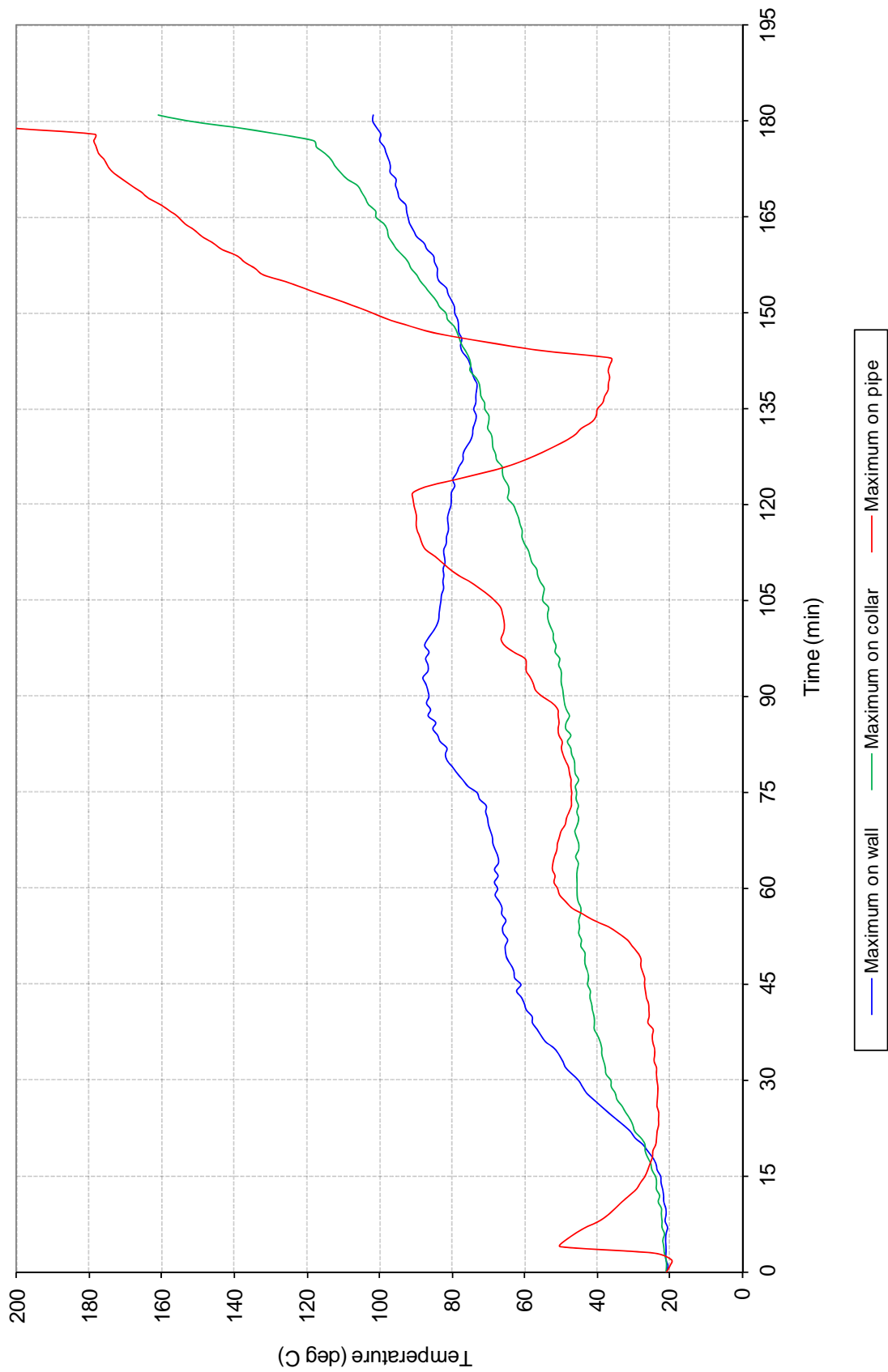


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION B

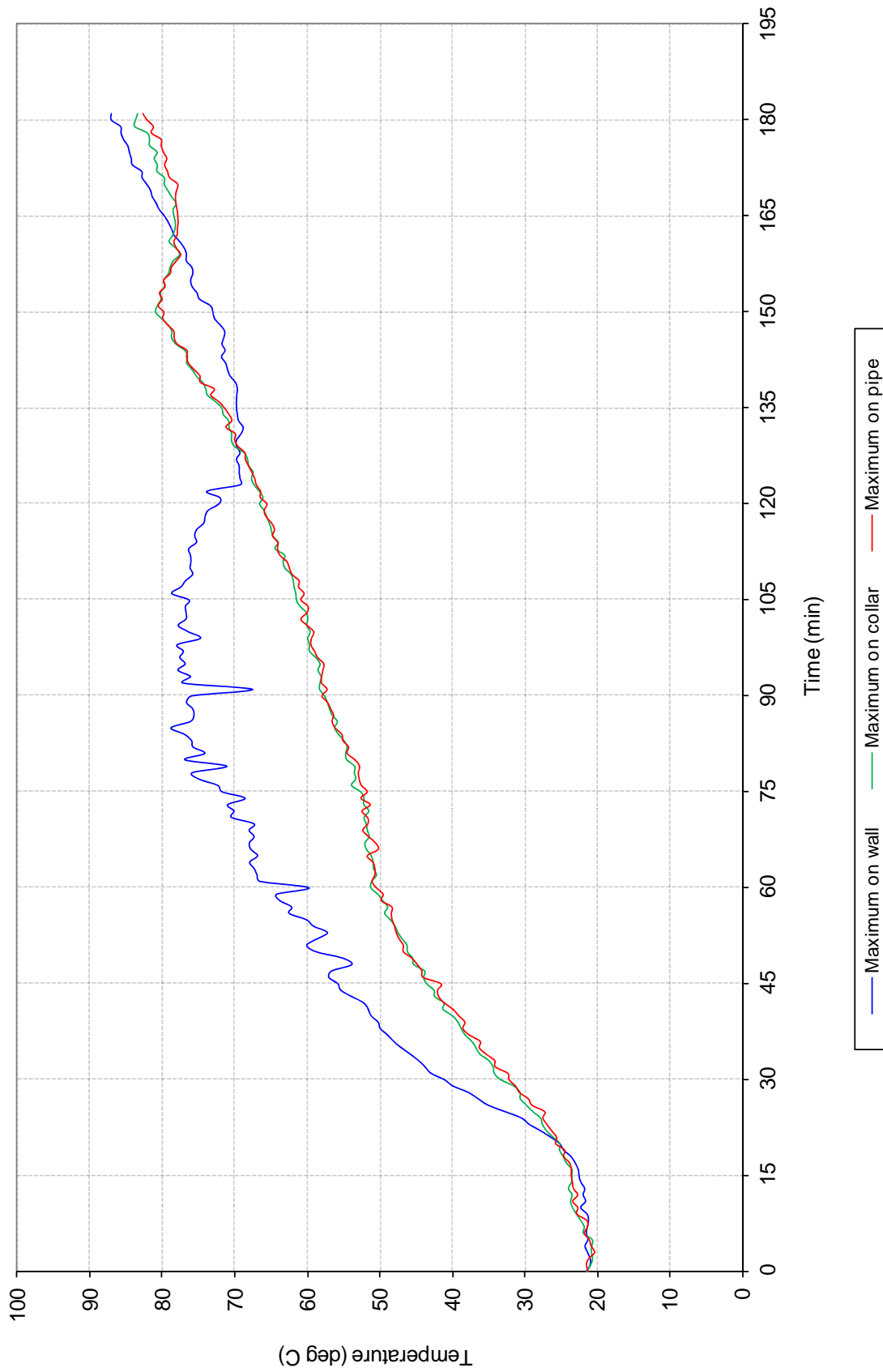


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION C

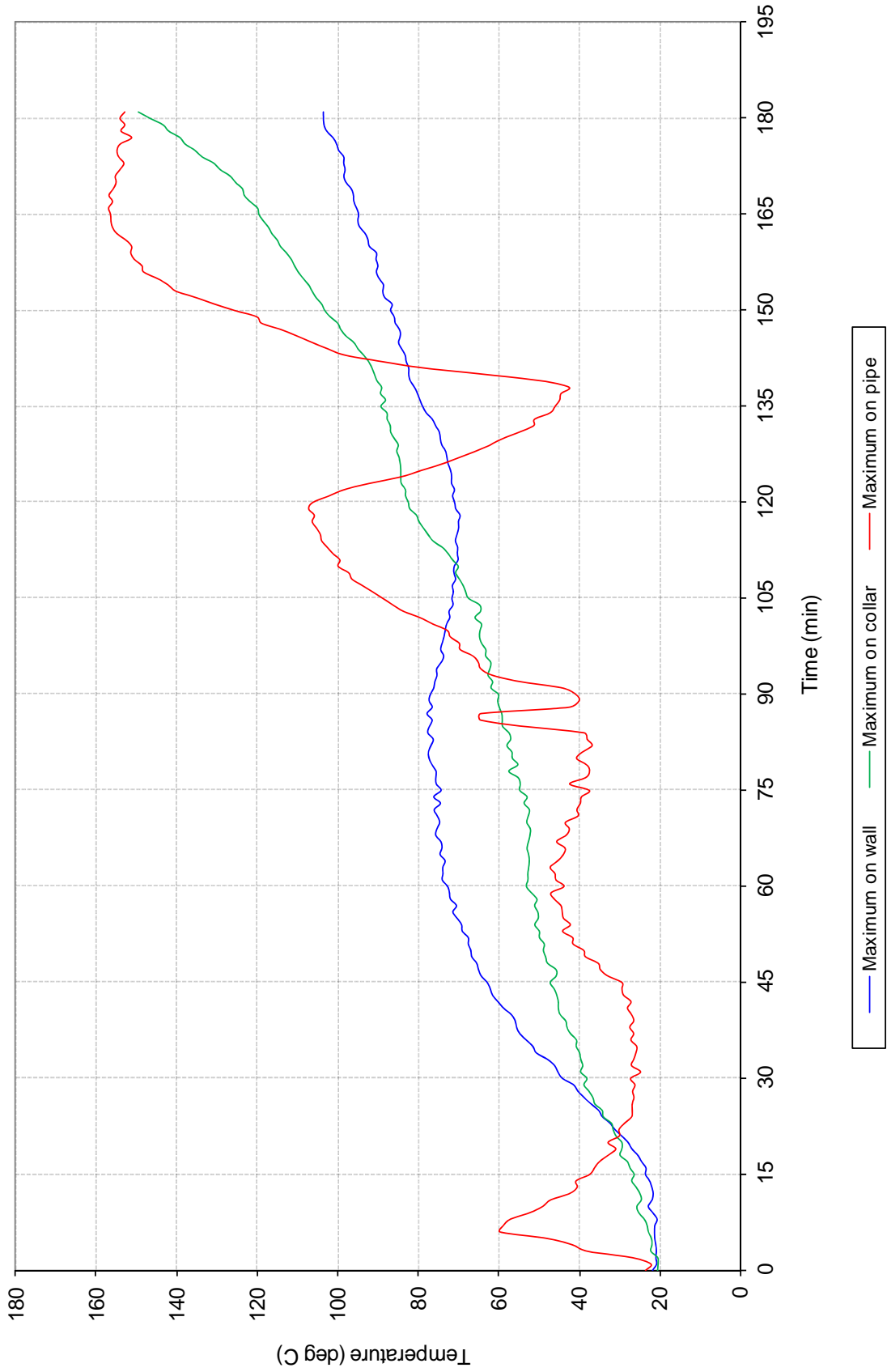


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION D

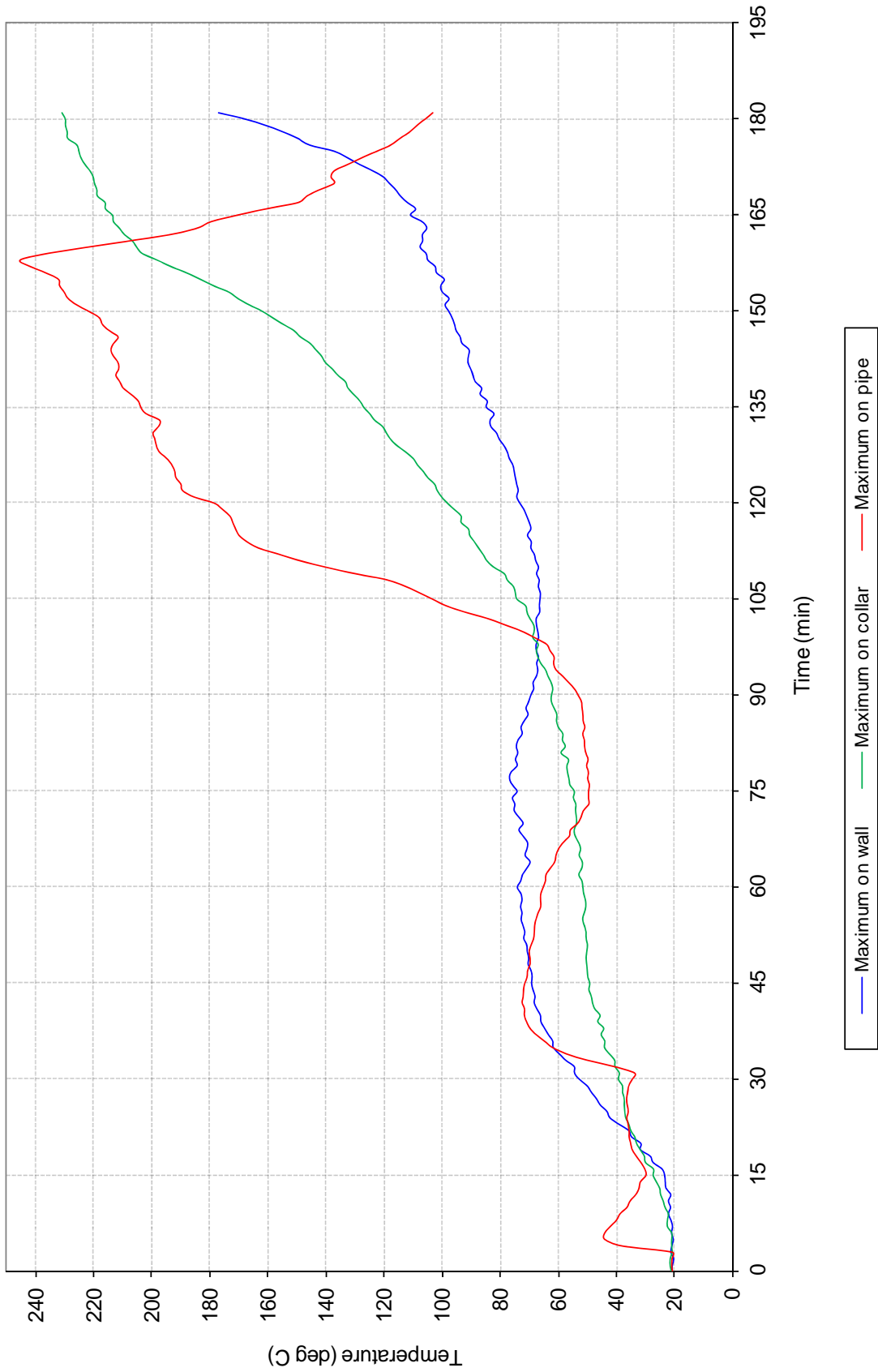


FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION E

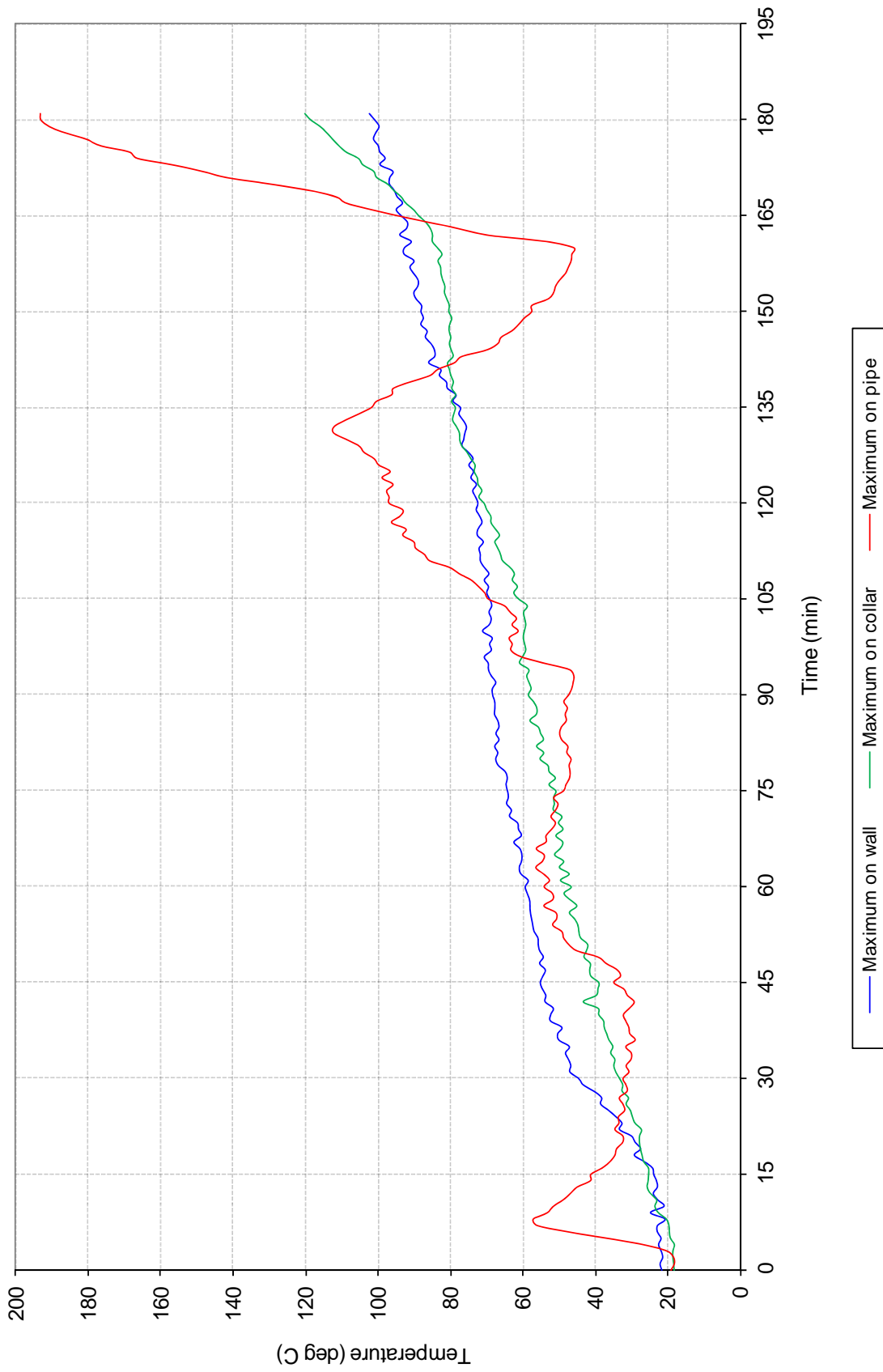


FIGURE 8 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION F

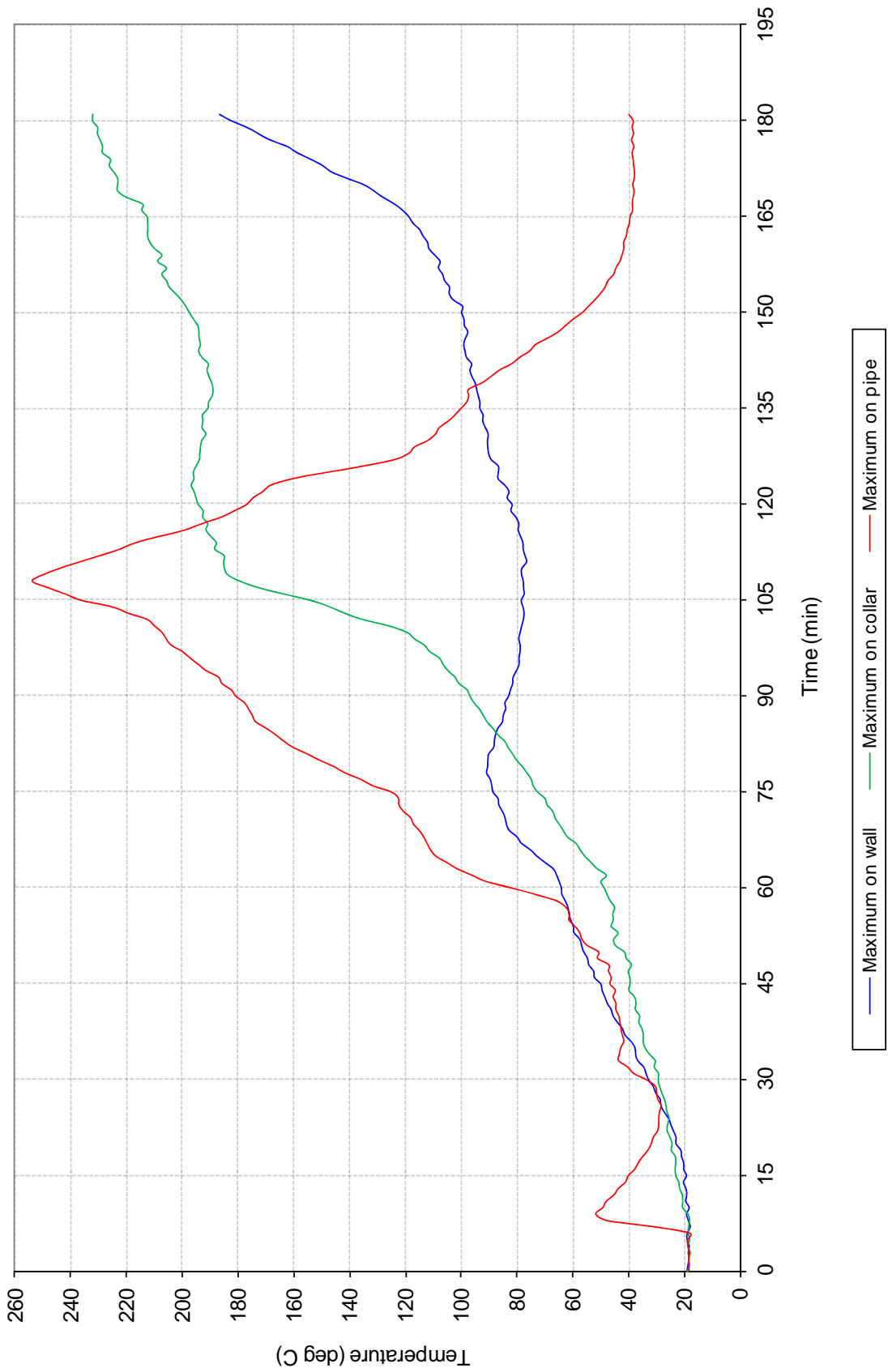


FIGURE 9 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION G

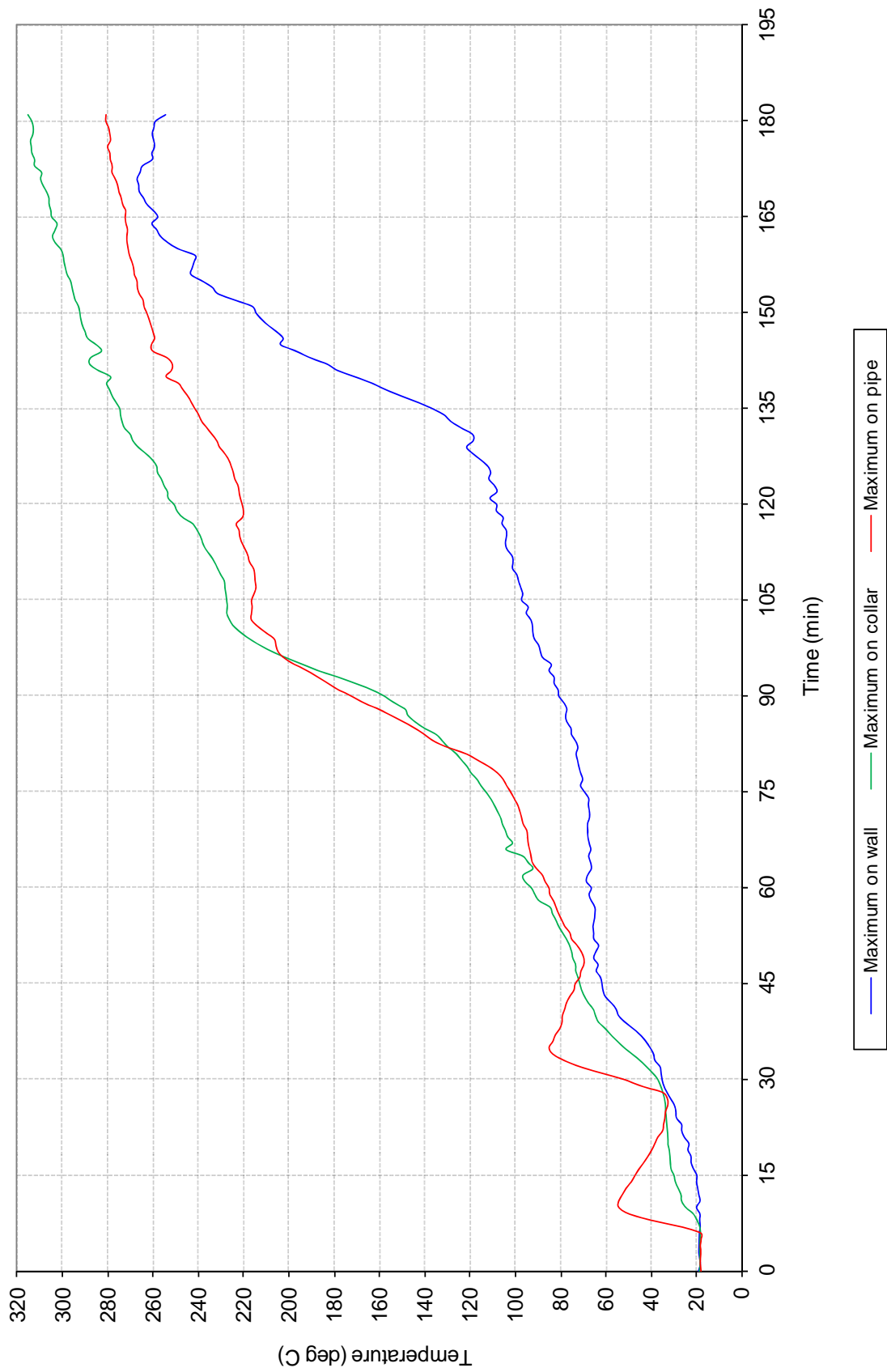


FIGURE 10 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION H

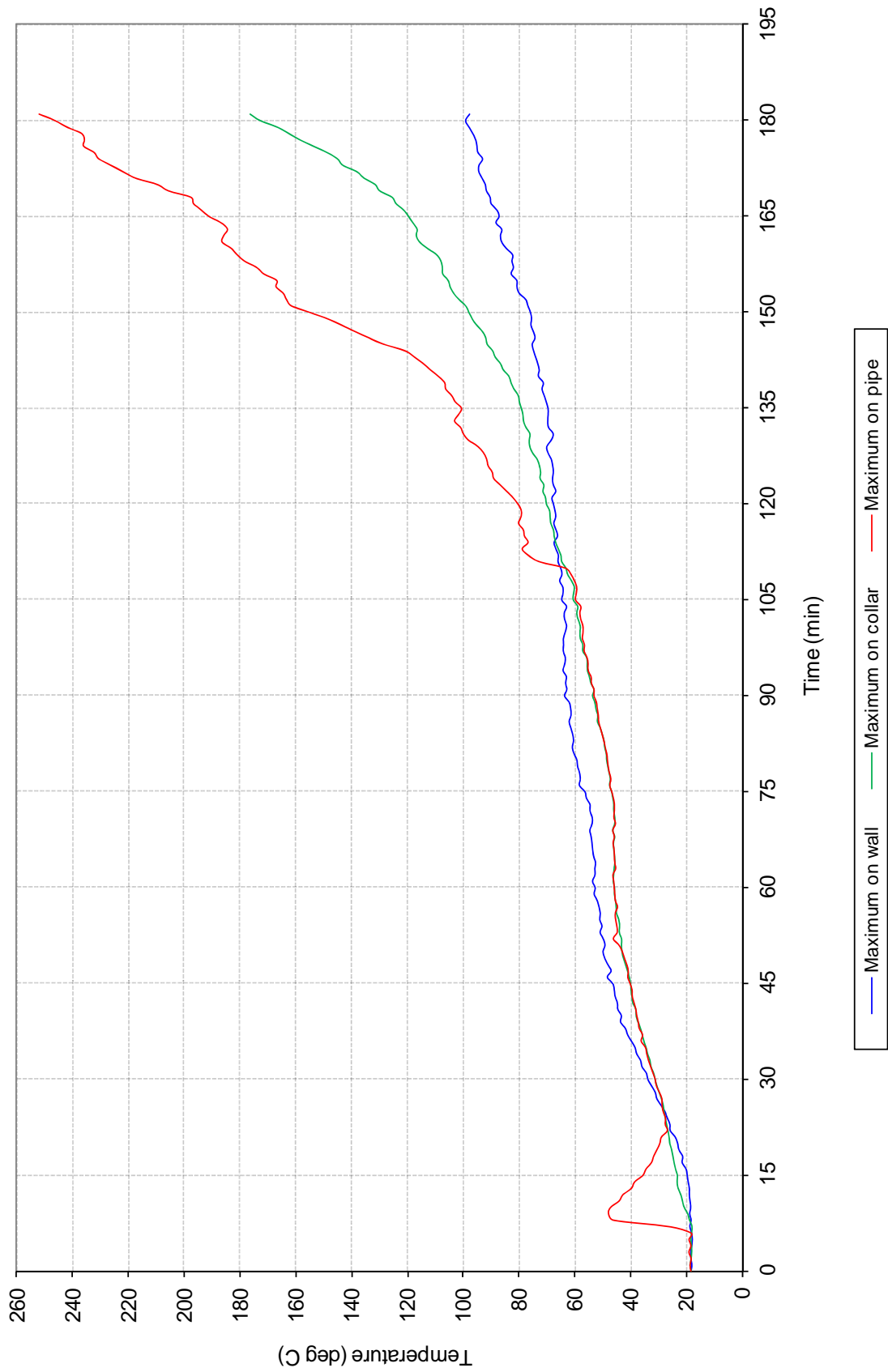
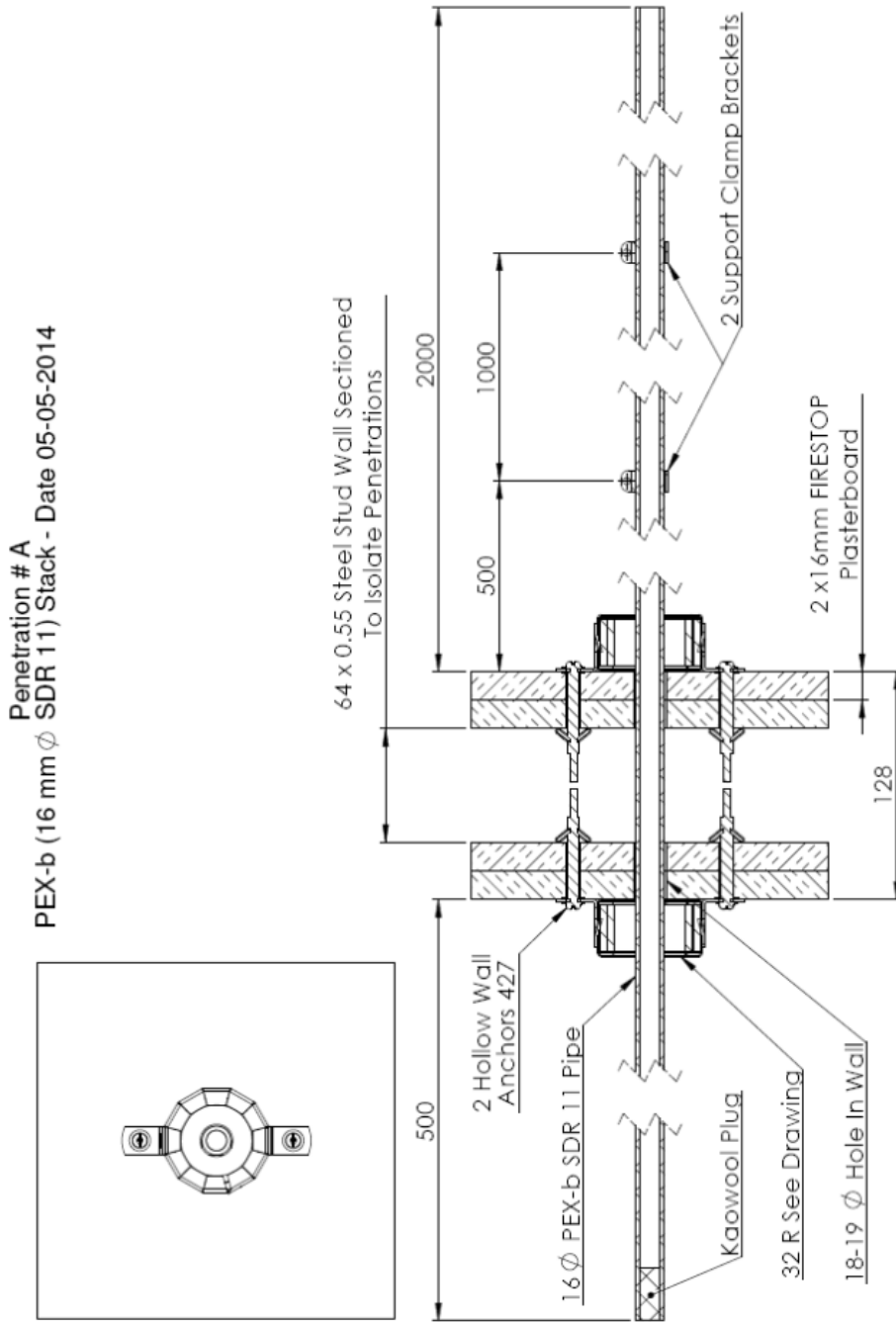


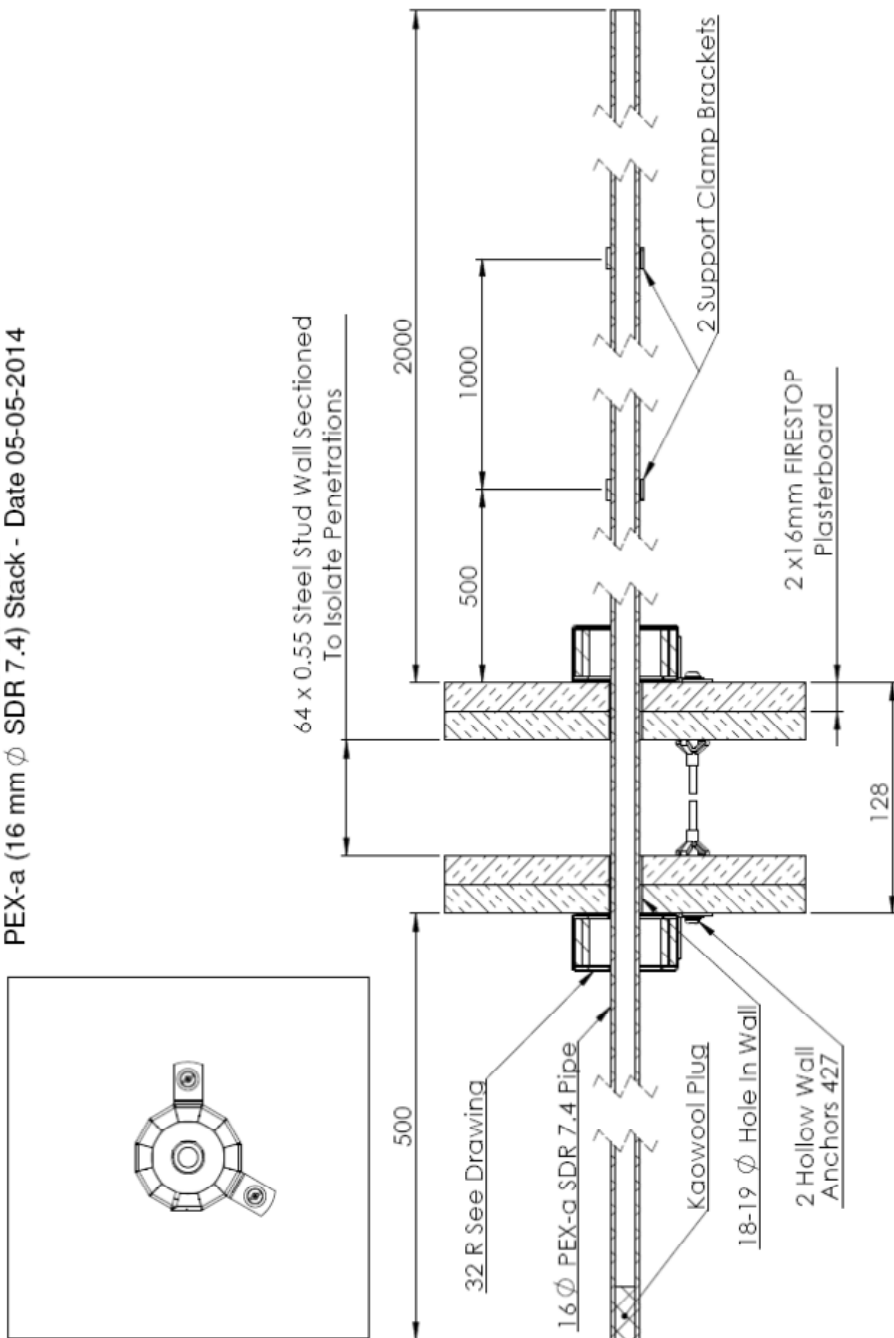
FIGURE 11 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION I

Appendix D – Installation drawings



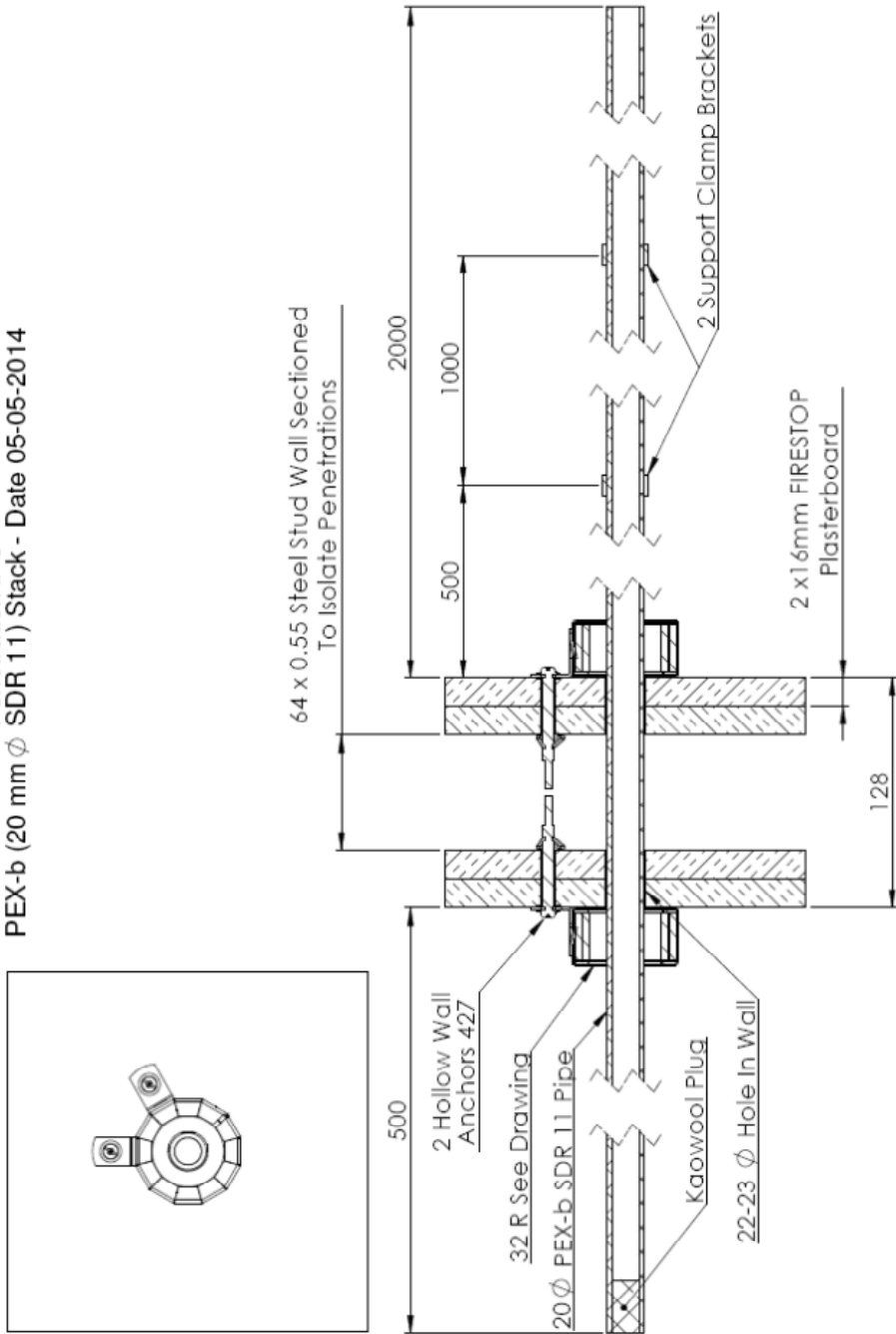
DRAWING TITLED “PENETRATION #A – PEX-B (16-MM SDR 11) STACK” DATED 5 MAY 2104, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # B
 PEX-a (16 mm ϕ SDR 7.4) Stack - Date 05-05-2014



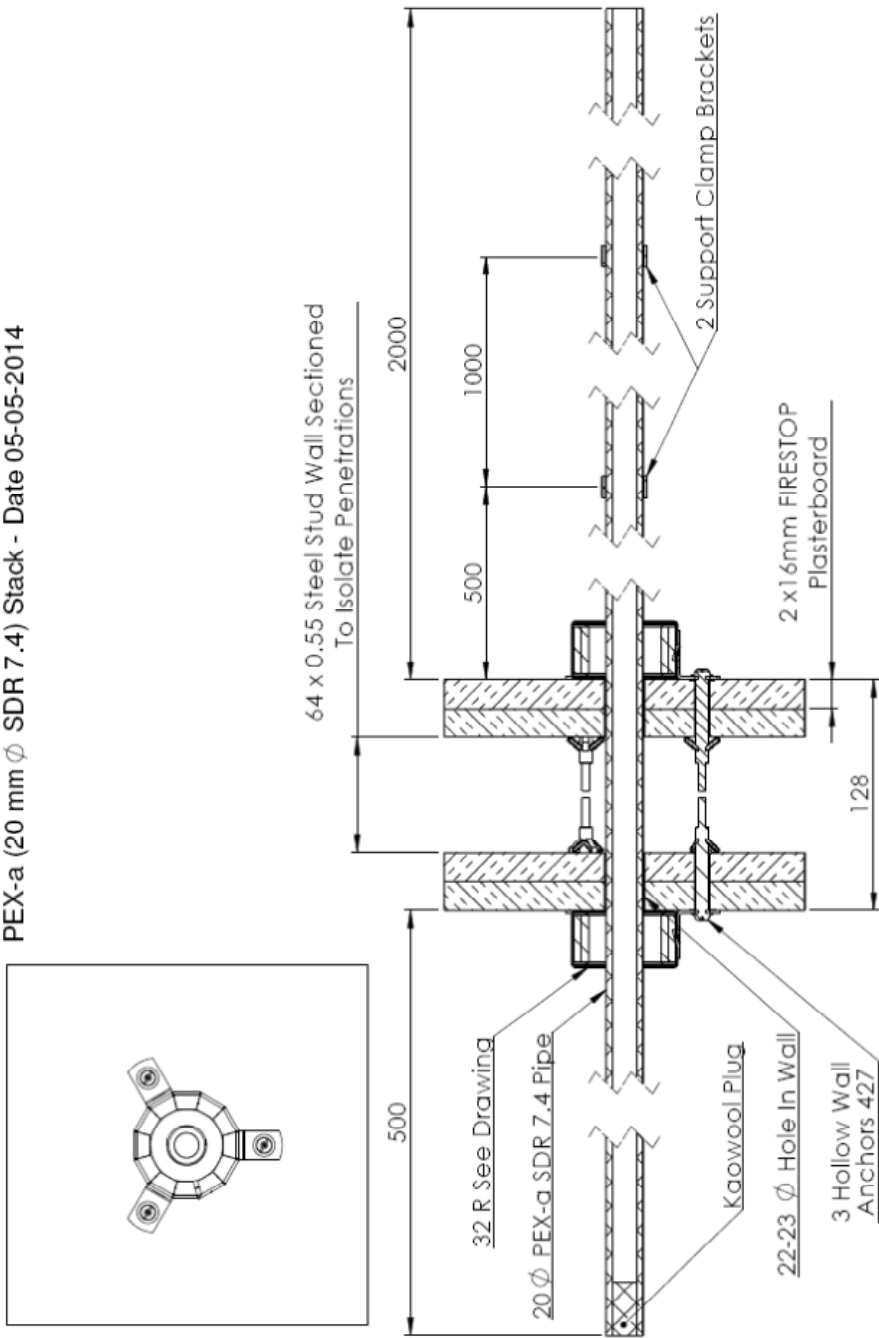
DRAWING TITLED "PENETRATION #B – PEX-A (16-MM SDR 7.4) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # C
 PEX-b (20 mm ϕ SDR 11) Stack - Date 05-05-2014



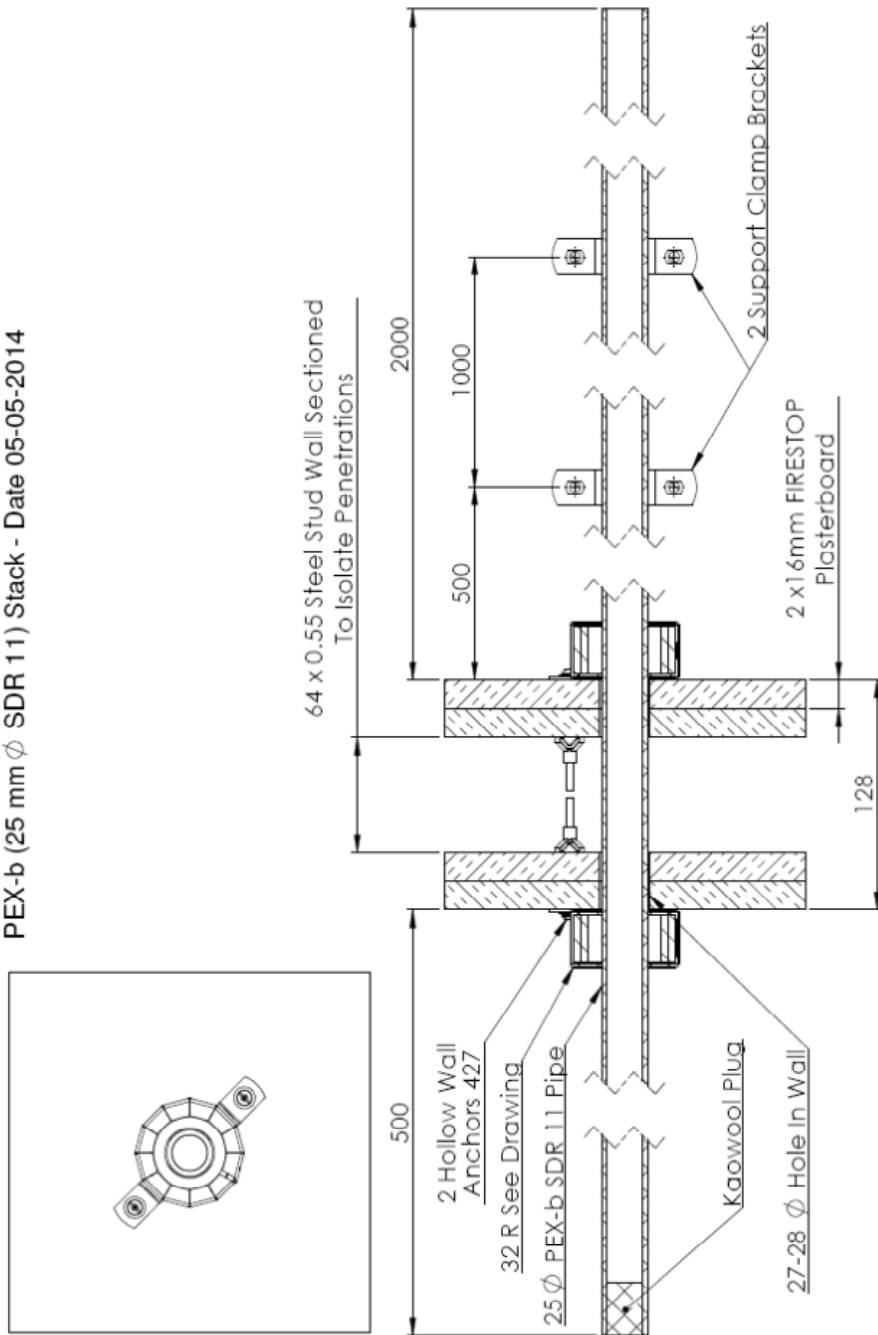
DRAWING TITLED "PENETRATION #C – PEX-B (20-MM SDR 11) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # D
 PEX-a (20 mm ϕ SDR 7.4) Stack - Date 05-05-2014



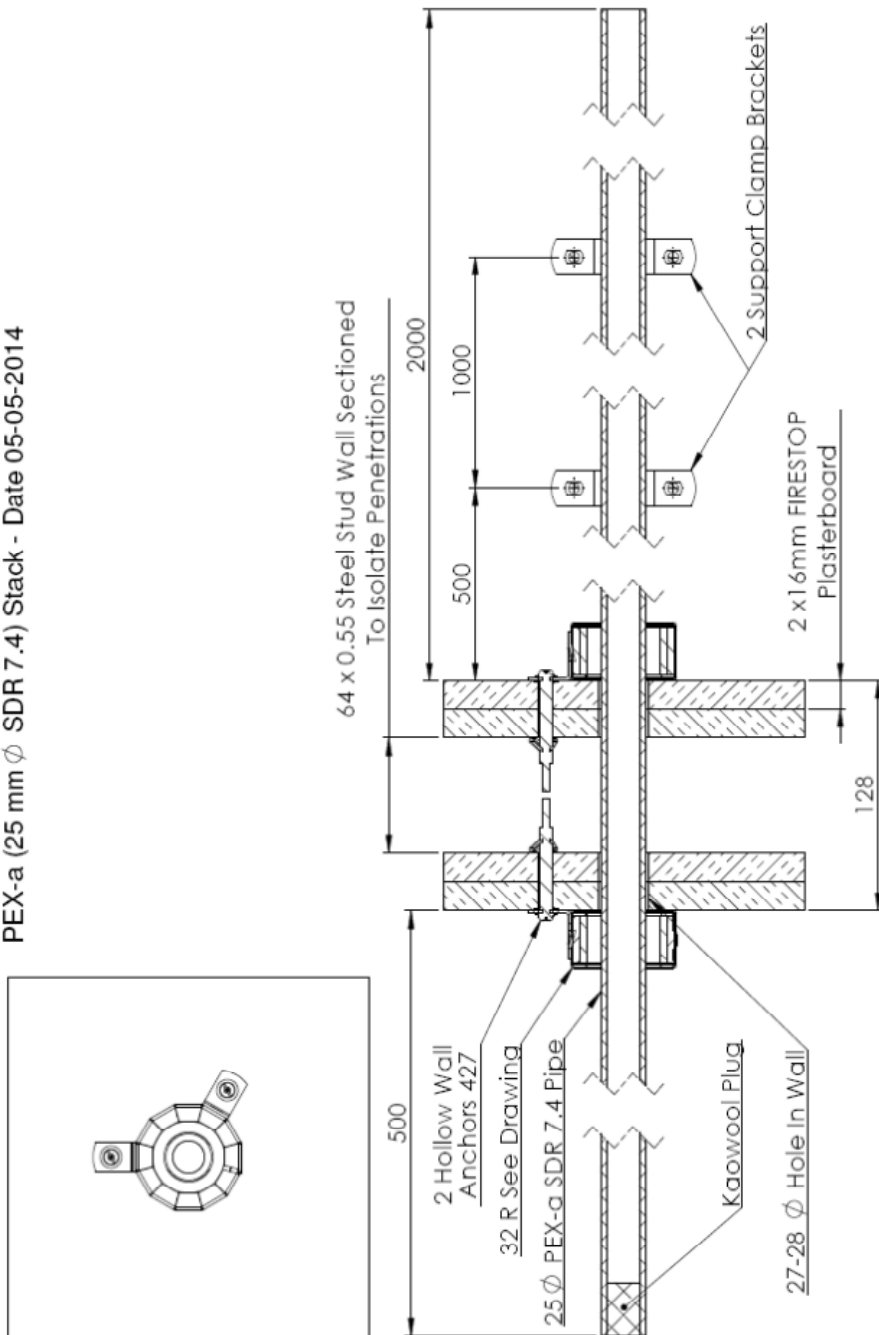
DRAWING TITLED "PENETRATION #D – PEX-A (20-MM SDR 7.4) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # E
 PEX-b (25 mm ϕ SDR 11) Stack - Date 05-05-2014



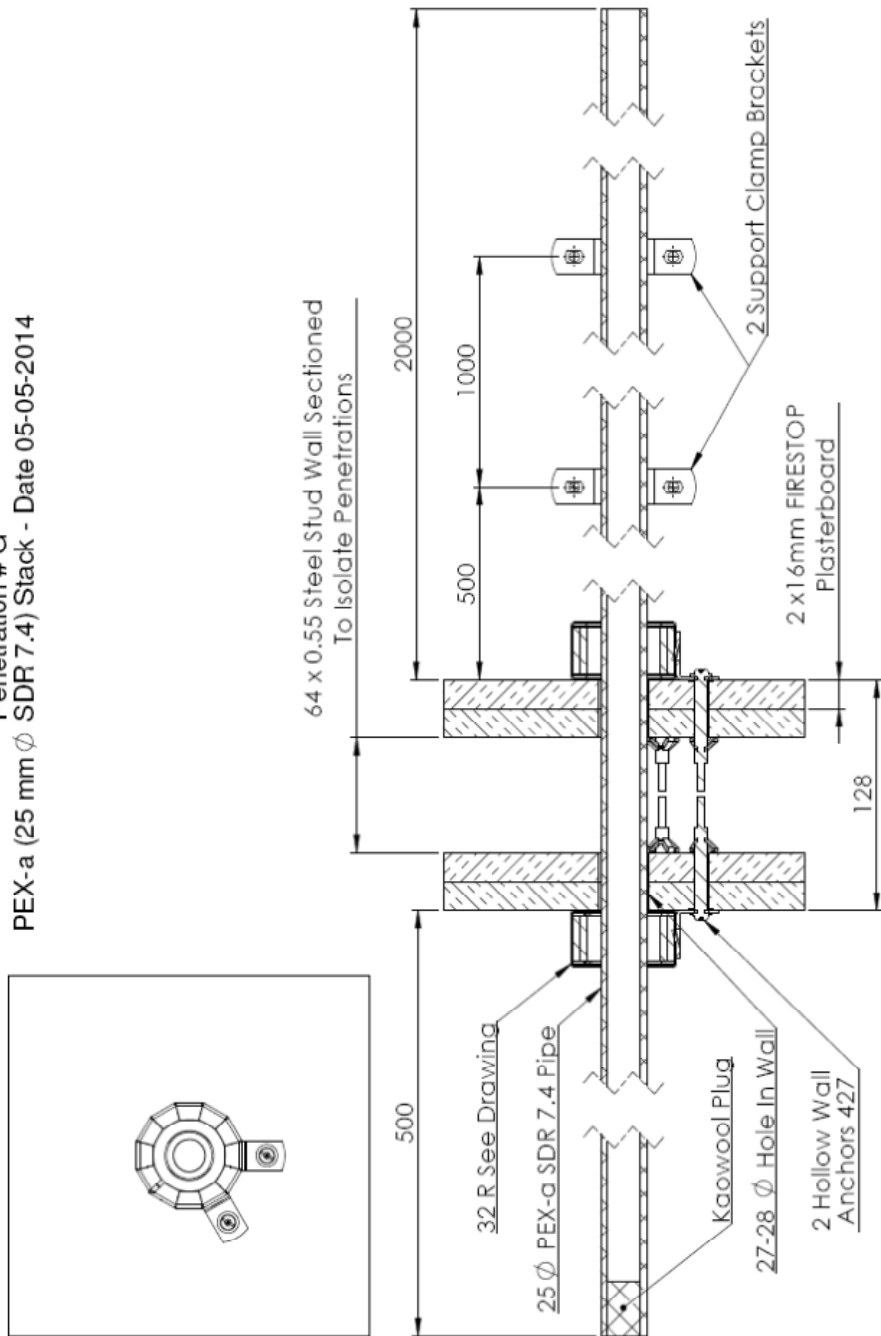
DRAWING TITLED "PENETRATION #E – PEX-B (25-MM SDR 11) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # F
 PEX-a (25 mm ϕ SDR 7.4) Stack - Date 05-05-2014



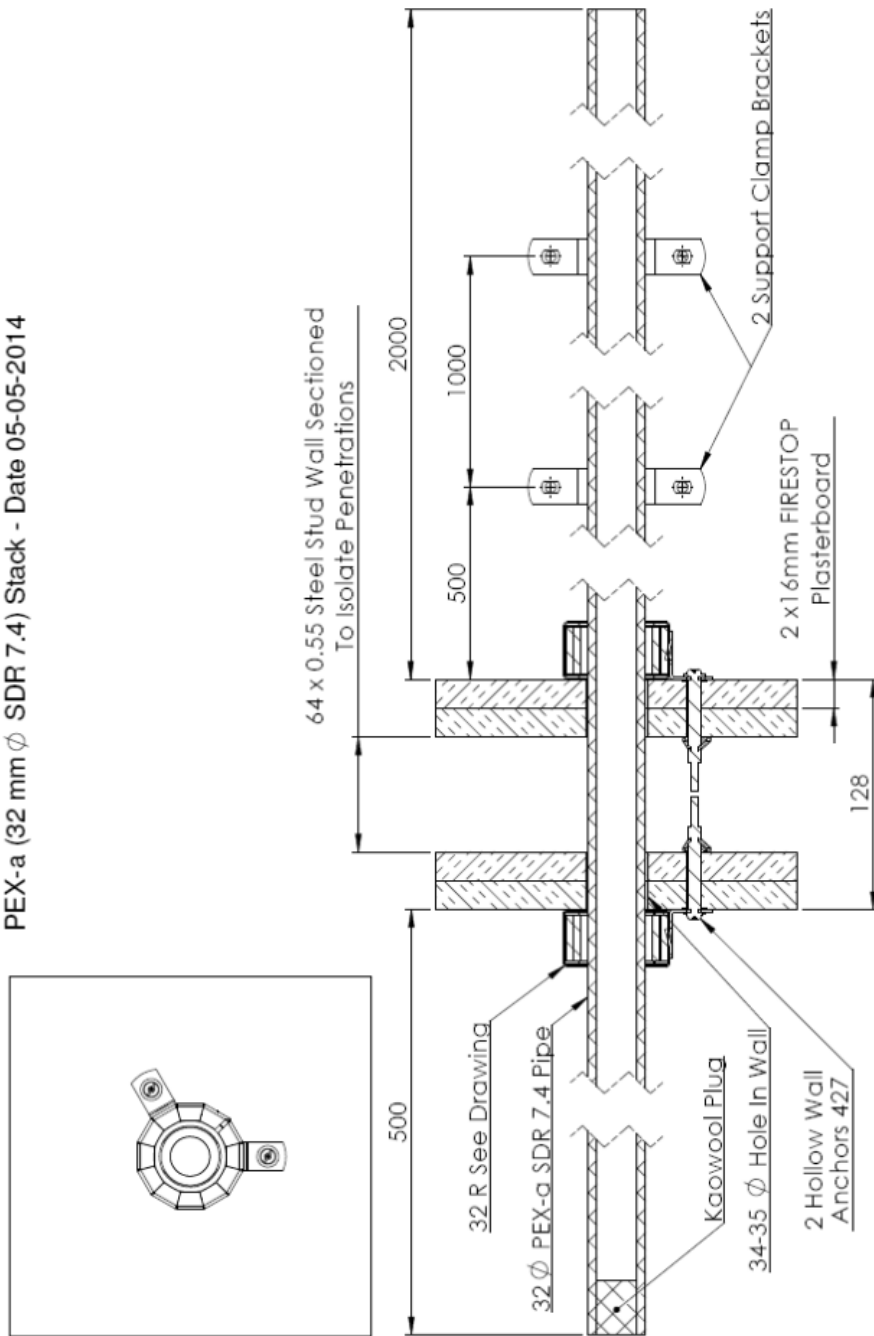
DRAWING TITLED "PENETRATION # F – PEX-A (25-MM SDR 7.4) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # G
 PEX-a (25 mm ϕ SDR 7.4) Stack - Date 05-05-2014



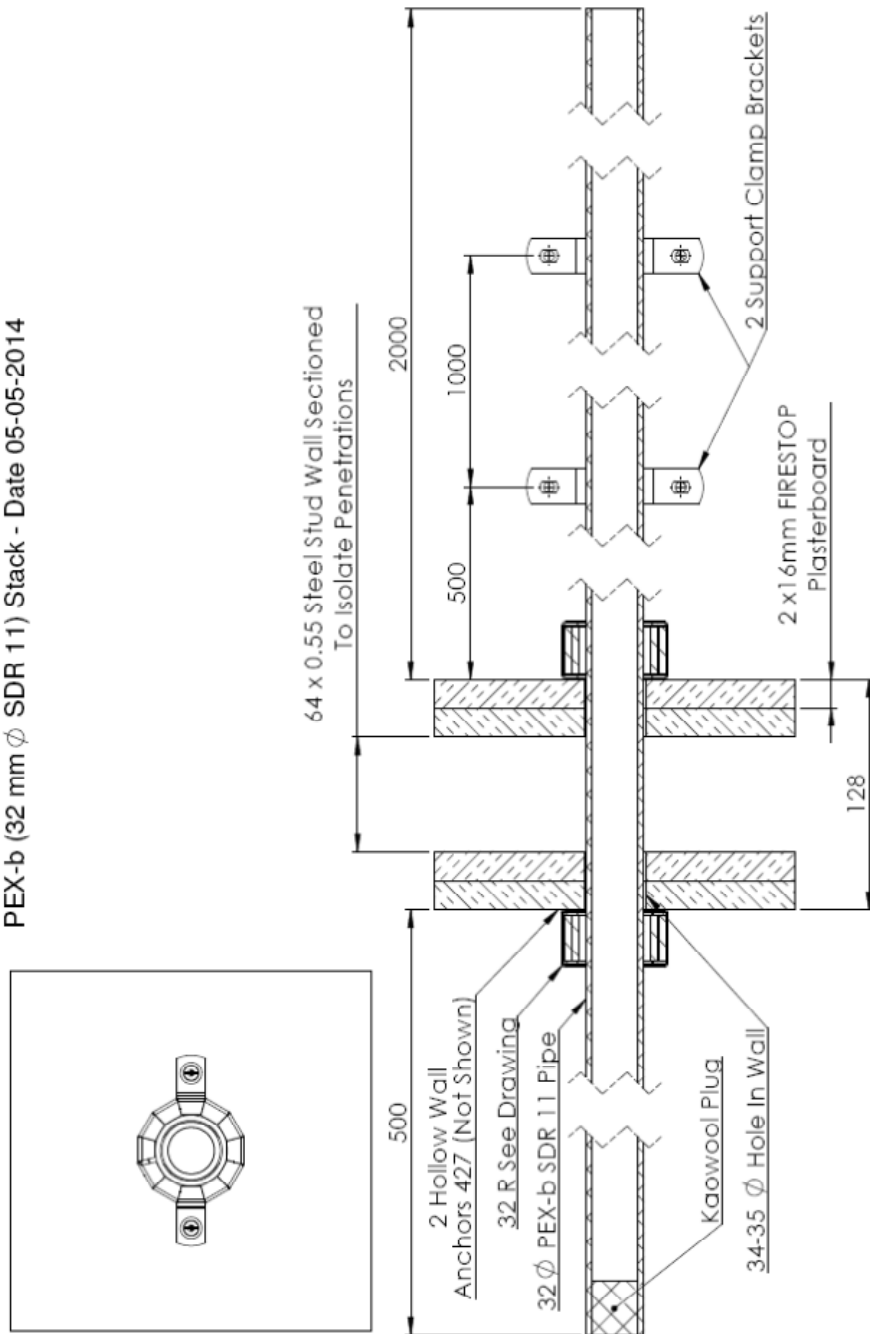
DRAWING TITLED "PENETRATION #G – PEX-A (25-MM SDR 7.4) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # H
 PEX-a (32 mm ϕ SDR 7.4) Stack - Date 05-05-2014



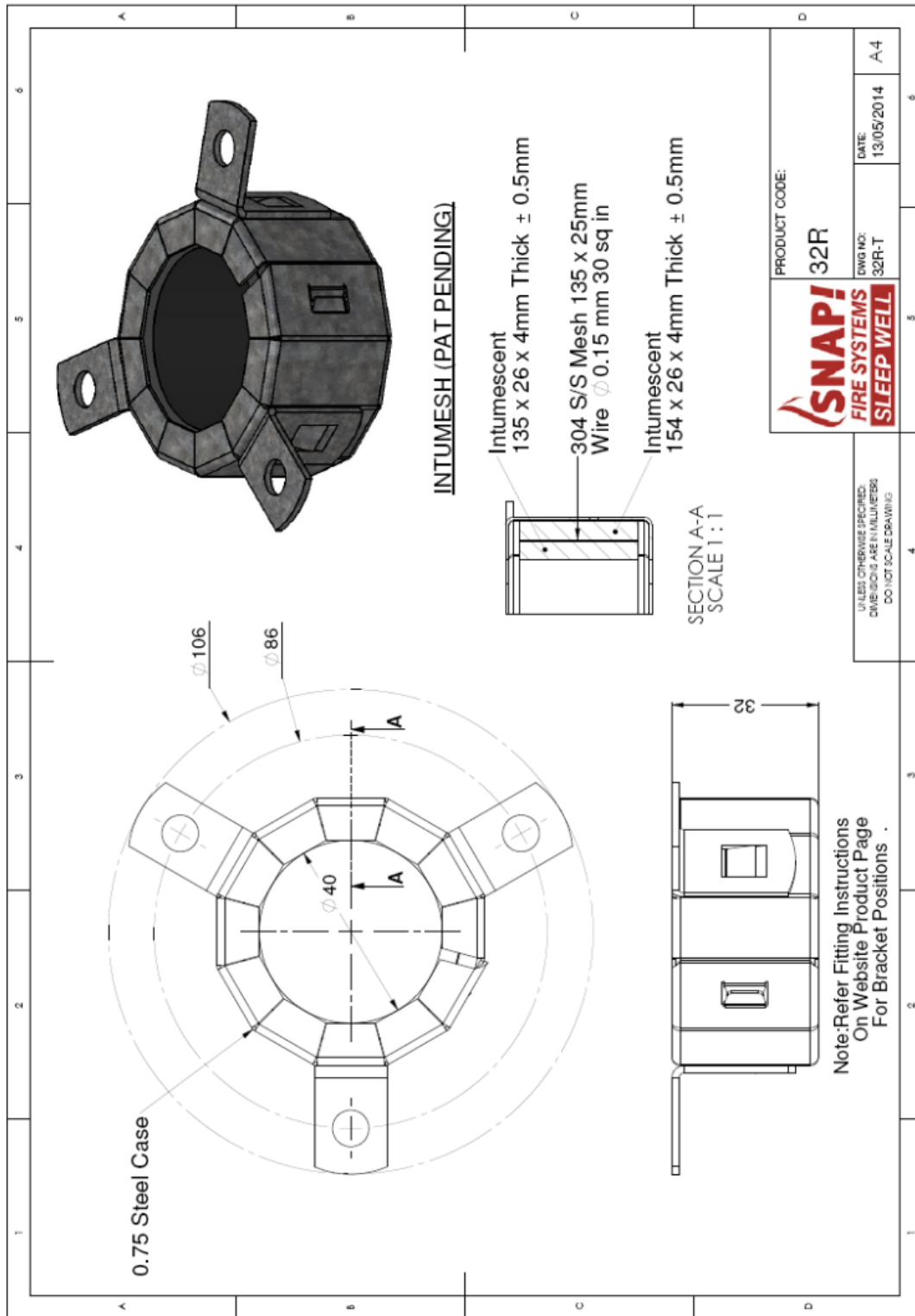
DRAWING TITLED "PENETRATION #H – PEX-A (32-MM SDR 7.4) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Penetration # 1
 PEX-b (32 mm ϕ SDR 11) Stack - Date 05-05-2014



DRAWING TITLED "PENETRATION #1 – PEX-B (32-MM SDR 11) STACK" DATED 5 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix E – Specimen Drawings



DRAWING NUMBERED 32R-T, DATED 13 MAY 2014, BY SNAP FIRE SYSTEMS PTY LTD.

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 5444 • ABN 41 687 119 230		
<h1>Certificate of Test</h1>		No. 2550
<small>"Copyright CSIRO 2014 ©" Copying or alteration of this report without written authorisation from CSIRO is forbidden.</small>		
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 1634.		
Product Name: Penetration A – 32R retrofitted fire collar protecting a PEX-b (16-mm SDR 11) stack pipe (180° brackets)		
Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 180° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.1-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.		
The element of construction described above satisfied the following criteria for fire-resistance for the period stated.		
Structural Adequacy	not applicable	
Integrity	no failure at 180 minutes	
Insulation	no failure at 180 minutes	
and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/180/180. The FRL is applicable for exposure to the fire from the same direction as tested.		
This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance.		
Testing Officer: Mario Lara	Date of Test:	30 April 2014
Issued on the 8 th day of July 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 1634.

Product Name: Penetration B – 32R retrofitted fire collar protecting a PEX-a (16-mm SDR 7.4) stack pipe (120° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 120° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 2.3-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	179 minutes

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

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

Testing Officer: Mario Lara Date of Test: 30 April 2014

Issued on the 8th day of July 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 1634.

Product Name: Penetration C – 32R retrofitted fire collar protecting a PEX-b (20-mm SDR 11) stack pipe (60° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.1-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

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

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

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Testing Officer: Mario Lara Date of Test: 30 April 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 1634.

Product Name: Penetration D – 32R retrofitted fire collar protecting a PEX-a (20-mm SDR 7.4) stack pipe (120° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 3.9-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

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

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

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

Testing Officer: Mario Lara Date of Test: 30 April 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 1634.

Product Name: Penetration E – 32R retrofitted fire collar protecting a PEX-b (25-mm SDR 11) stack pipe (180° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.6-mm fitted through the collar's sleeve. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	134 minutes

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

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

Testing Officer: Mario Lara Date of Test: 30 April 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 1634.

Product Name: Penetration F – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (120° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

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

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

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Testing Officer: Mario Lara Date of Test: 30 April 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 1634.

Product Name: Penetration G – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (60° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	97 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/180/90. 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 Date of Test: 30 April 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 1634.

Product Name: Penetration H – 32R retrofitted fire collar protecting a PEX-a (32-mm SDR 7.4) stack pipe (120° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 120° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	96 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/180/90. The FRL is applicable for exposure to the fire from the same direction as tested.

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Testing Officer: Mario Lara Date of Test: 30 April 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 1634.

Product Name: Penetration I – 32R retrofitted fire collar protecting a PEX-b (32-mm SDR 11) stack pipe (180° brackets)

Description: The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40 mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135 mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427. The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000 mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy	not applicable
Integrity	no failure at 180 minutes
Insulation	169 minutes

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

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

Testing Officer: Mario Lara Date of Test: 30 April 2014

Issued on the 8th day of July 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

COPY OF CERTIFICATE OF TEST – NO. 2558

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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