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

Test Report

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Client: Snap Fire Systems Pty Ltd

Commercial-in-confidence

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AUTHOR	REVIEWED BY	AUTHORISED BY
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23 December 2014	23 December 2014	23 December 2014

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Contents

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

Sponsored Investigation No. FSP 1652a

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap Cast-in Fire Collars protecting a concrete slab penetrated by one (1) Valsir-TRIPLUS Floorwaste and five (5) Valsir-TRIPLUS stack pipes.

1.2 Sponsor

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

1.3 Manufacturer

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

1.4 Test standard

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

1.5 Reference standard

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

1.6 Test number

CSIRO Reference test number: FS 4433/3770

1.7 Test date

The fire-resistance test was conducted on 14 July 2014.

2 Description of specimen

2.1 General

The specimen comprised a 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by one (1) Valsir-TRIPLUS Floorwaste and five (5) Valsir-TRIPLUS stack pipes protected by cast-in Snap Fire System fire collars.

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

The Valsir-TRIPLUS pipes are stated to be constructed of a homopolymer polypropylene for inner and outer layers (1200kg/m^3 density), and mix of polypropylene and mineral loads for the middle layer (1400kg/m^3 density). The pipes are stated to be constructed in accordance with AS 7671:2003.

Penetration 1 – H150 S-RR cast-in fire collar protecting a 160-mm diameter Valsir-TRIPLUS Stack

The SNAP Cast-in H150 S-RR fire collar comprised a 2-mm thick polypropylene casing with a 179-mm inner diameter and a 287-mm diameter base flange. The 110-mm high collar casing incorporated a 588-mm x 110-mm x 6-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised four stainless steel springs bound with nylon fuse links and a 640-mm x 109-mm stainless steel mesh as shown in drawing numbered H150 S-RR-T dated 24 January 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 160-mm Valsir-TRIPLUS stack pipe, with a wall thickness of 5.4-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #1 – valsir-TRIPLUS (160-mm OD) Stack" dated 20 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was filled with Fullers Firesound sealant.

Penetration 2 – H100 S-RR cast-in fire collar protecting a 110-mm diameter Valsir-TRIPLUS pipe

The SNAP Cast-in H100 S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 207-mm diameter base flange. The 105-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 460-mm x 85-mm stainless steel mesh as shown in drawing numbered H100 S-RR-T dated 24 June 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm Valsir-TRIPLUS stack pipe, with a wall thickness of 3.9-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #2 – valsir-TRIPLUS (110-mm OD) Stack" dated 20 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a 10-mm bed of Fullers Firesound fire sealant.

Penetration 3 – L40S cast-in fire collar protecting a 40-mm diameter Valsir-TRIPLUS pipe

The SNAP Cast-in L40S fire collar comprised a 1.6-mm thick polypropelyne casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 86-mm high collar casing incorporated a 240-mm x 58-mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 280-mm x 58-mm stainless steel mesh as shown in drawing numbered L40S-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 40-mm Valsir-TRIPLUS stack pipe, with a wall thickness of 2.1-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #3 – valsir-TRIPLUS (40-mm OD) Stack" dated 20 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a 10-mm bead of Fullers Firesound fire sealant.

Penetration 4 – L80S cast-in fire collar protecting a 75-mm diameter Valsir-TRIPLUS pipe

The SNAP Cast-in L80S fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 207-mm diameter base flange. The 123-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 460-mm x 85-mm stainless steel mesh as shown in drawing numbered L80S-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 75-mm Valsir-TRIPLUS 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 "Penetration #4 – valsir-TRIPLUS (75-mm OD) Stack" dated 20 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and the slab was sealed with a 10-mm bead of Fullers Firesound fire sealant.

Penetration 5 – L100FWS cast-in fire collar protecting a 110-mm diameter Valsir-TRIPLUS floor waste

The SNAP Cast-in L100FWS fire collar comprised a 1.6-mm thick polypropylene casing with an 126.5-mm inner diameter and a 207-mm diameter base flange. The 116-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material. The closing mechanism comprised three stainless steel springs bound with nylon fuse links and a 460-mm x 85-mm stainless steel mesh as shown in drawing numbered L100FWS-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm Valsir-TRIPLUS pipe, with a wall thickness of 3.4-mm fitted through the collar's sleeve. The floor waste system was fitted on the unexposed face with a Chrome brass floor waste grate. On the exposed side of the slab, a TRIPLUS Siphon Trap was connected to the penetrating pipe with a gland nut within the collar, supported by 2 x M10 HKD clamps fixed to the concrete slab as shown in drawing titled "Penetration #5 – valsir-TRIPLUS (110-mm OD) Floorwaste" dated 20 June 2014, by Snap Fire Systems Pty Ltd.

The trap was filled with water before the start of the test to the level shown in drawing titled "Penetration #5 – valsir-TRIPLUS (110-mm OD) Floorwaste" dated 25 June 2014, by Snap Fire Systems Pty Ltd.

Penetration 6 – H50 S-RR cast-in fire collar protecting a 50-mm diameter Valsir-TRIPLUS pipe

The SNAP Cast-in H50 S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 70.5-mm inner diameter and a 146-mm diameter base flange. The 76-mm high collar casing incorporated a 240-mm x 58-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three galvanised steel springs bound with nylon fuse links and a 280-mm x 58-mm stainless steel mesh as shown in drawing numbered H50 S-RR-T dated 2 September 2014, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 50-mm Valsir-TRIPLUS stack pipe, with a wall thickness of 2.2-mm fitted through the collar's sleeve. The pipe projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the concrete slab as shown in drawing titled "Penetration #6 – valsir-TRIPLUS (50-mm OD) Stack" dated 20 June 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

On the unexposed face, the annular gap between the pipe and slab was sealed with sand and cement backfill.

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.

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

The construction was organised by the sponsor, and 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 #1 – valsir-TRIPLUS (160-mm OD) Stack” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #2 – valsir-TRIPLUS (110-mm OD) Stack” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #3 – valsir-TRIPLUS (40-mm OD) Stack” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #4 – valsir-TRIPLUS (75-mm OD) Stack” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #5 – valsir-TRIPLUS (110-mm OD) Floorwaste” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing titled “Penetration #6 – valsir-TRIPLUS (50-mm OD) Stack” dated 20 June 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered H150 S-RR-T dated 24 January 2014, by SNAP Fire Systems Pty Ltd.

Drawing numbered H100 S-RR-T dated 24 June 2014, by SNAP Fire Systems Pty Ltd.

Drawing numbered L40S-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

Drawing numbered L80S-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

Drawing numbered L100FWS-T dated 25 June 2014, by SNAP Fire Systems Pty Ltd.

Drawing numbered H50 S-RR-T dated 2 September 2014, by SNAP Fire Systems Pty Ltd.

4 Equipment

4.1 Furnace

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

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

4.2 Temperature

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

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

Location of the thermocouples on the unexposed face of the specimen are described in Appendix A.

4.3 Measurement system

The primary measurement system comprised a multiple-channel data logger, scanning at one minute intervals during the test.

5 Ambient temperature

The temperature of the test area was 21°C at the commencement of the test.

6 Departure from standard

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

7 Termination of test

The test was terminated at 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 visible from Penetration 2 and Penetration 4.
4 minutes -	Smoke is visible from Penetration 5 (floor waste).
-	Cotton wool pad applied over Penetration 5 (floor waste) – No ignition.
5 minutes -	Smoke is visible from Penetrations 1 and 2. Penetration 4 has ceased fluing.
11 minutes -	Light smoke is visible from Penetration 1.
12 minutes -	Spalling noises can be heard from the specimen.
15 minutes -	Smoke is fluing from Penetration 5.
44 minutes -	Penetrations are no longer fluing.
48 minutes -	Smoke is being emitted from Penetrations 3 and 5.
57 minutes -	Water is pooling on the unexposed face of the slab.
183 minutes -	Insulation failure of Penetration 1: maximum temperature rise limit of 180°C measured on the slab.
241 minutes -	Test terminated

8.2 Furnace temperature

Figure 1 shows the standard curves of temperature versus time for heating the furnace chamber and the actual curves of average and maximum temperature versus time recorded during the heating period.

8.3 Furnace severity

Figure 2 shows the curve of furnace severity versus time during the heating period.

8.4 Specimen temperature

Figure 3 shows the curve of maximum temperature versus time associated with Penetration 1.

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

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

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

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

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

8.5 Performance

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

<u>Penetration 1 – H150 S-RR cast-in fire collar protecting a 160-mm diameter valsir-TRIPLUS pipe</u>		
Structural adequacy	-	Not applicable
Integrity	-	No failure at 241 minutes
Insulation	-	183 minutes
<u>Penetration 2 – H100 S-RR cast-in fire collar protecting a 110-mm diameter valsir-TRIPLUS pipe</u>		
Structural adequacy	-	not applicable
Integrity	-	no failure at 241 minutes
Insulation	-	no failure at 241 minutes

Penetration 3 – L40S cast-in fire collar protecting a 40-mm diameter valsir-TRIPLUS pipe

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

Penetration 4 – L80S cast-in fire collar protecting a 75-mm diameter valsir-TRIPLUS pipe

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

Penetration 5 – L100FWS cast-in fire collar protecting a 110-mm diameter floor waste

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

Penetration 6 – H50 S-RR cast-in fire collar protecting a 50-mm diameter valsir-TRIPLUS pipe

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

This report details methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variation with respect to size, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

9 Fire-resistance level (FRL)

For the purpose of building regulations in Australia, the FRL's of the test specimens were as follows:

Penetration 1	-	-/240/180;
Penetration 2	-	-/240/240;
Penetration 3	-	-/240/240;
Penetration 4	-	-/240/240;
Penetration 5	-	-/240/240; and
Penetration 6	-	-/240/240.

For the purposes of AS 1530.4-2005 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions.

10 Field of direct application of test results

The results of the fire test contained in this test report are directly applicable, without reference to the testing authority, to similar constructions where one or more changes listed in Clause 10.11 of AS 1530.4-2005, have been made provided no individual component is removed or reduced.

11 Tested by

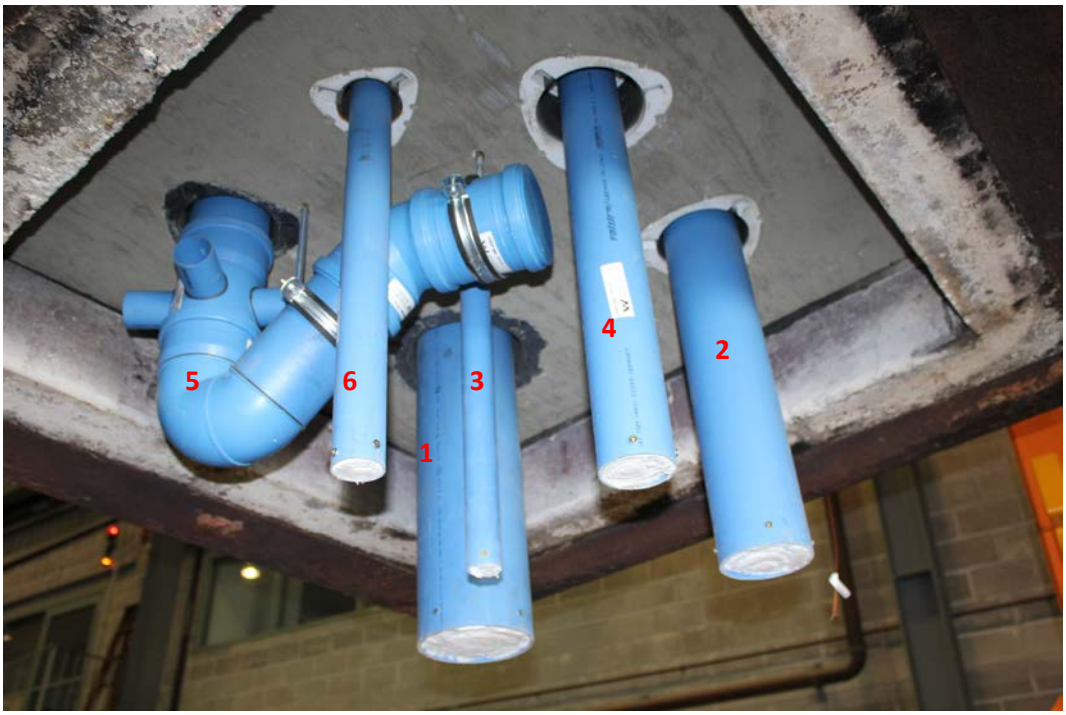
Mario Lara-Ledermann
Testing Officer

Appendices

Appendix A – Measurement location

Measurement Location		
Group location	**T/C Position**	**T/C designation**
Specimen		
Penetration 1	On slab 25-mm from pipe.	S1
	On slab 25-mm from pipe.	S2
	On pipe 25-mm from slab.	S3
	On pipe 25-mm from slab.	S4
Penetration 2	On slab 25-mm from pipe.	S5
	On slab 25-mm from pipe.	S6
	On pipe 25-mm from slab.	S7
	On pipe 25-mm from slab.	S8
Penetration 3	On slab 25-mm from pipe.	S9
	On slab 25-mm from pipe.	S10
	On pipe 25-mm from slab.	S11
	On pipe 25-mm from slab.	S12
Penetration 4	On slab 25-mm from pipe.	S13
	On slab 25-mm from pipe.	S14
	On pipe 25-mm from slab.	S15
	On pipe 25-mm from slab.	S16
Penetration 5	On slab 25-mm from pipe.	S17
	On slab 25-mm from pipe.	S18
	On step 25-mm from slab.	S19
	On step 25-mm from slab.	S20
	On grate	S21
Penetration 6	On slab 25-mm from pipe.	S22
	On slab 25-mm from pipe.	S23
	On pipe 25-mm from slab.	S24
	On pipe 25-mm from slab.	S25

Appendix B – Photographs



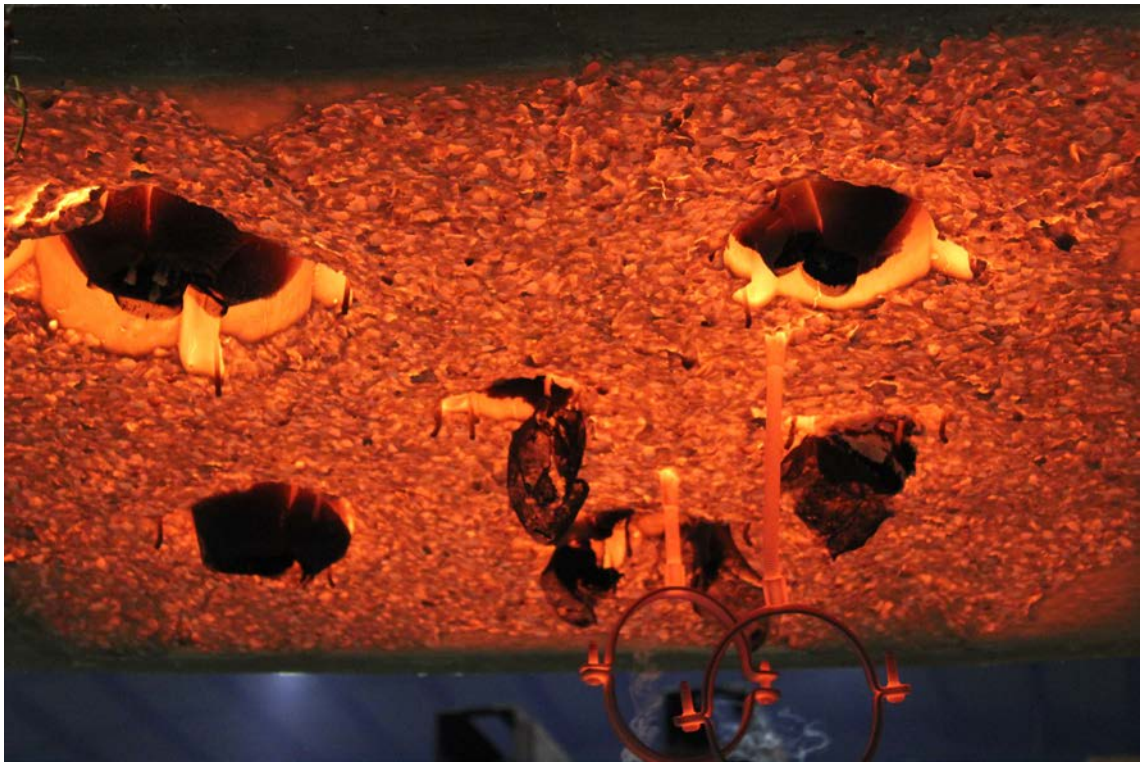
PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING

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

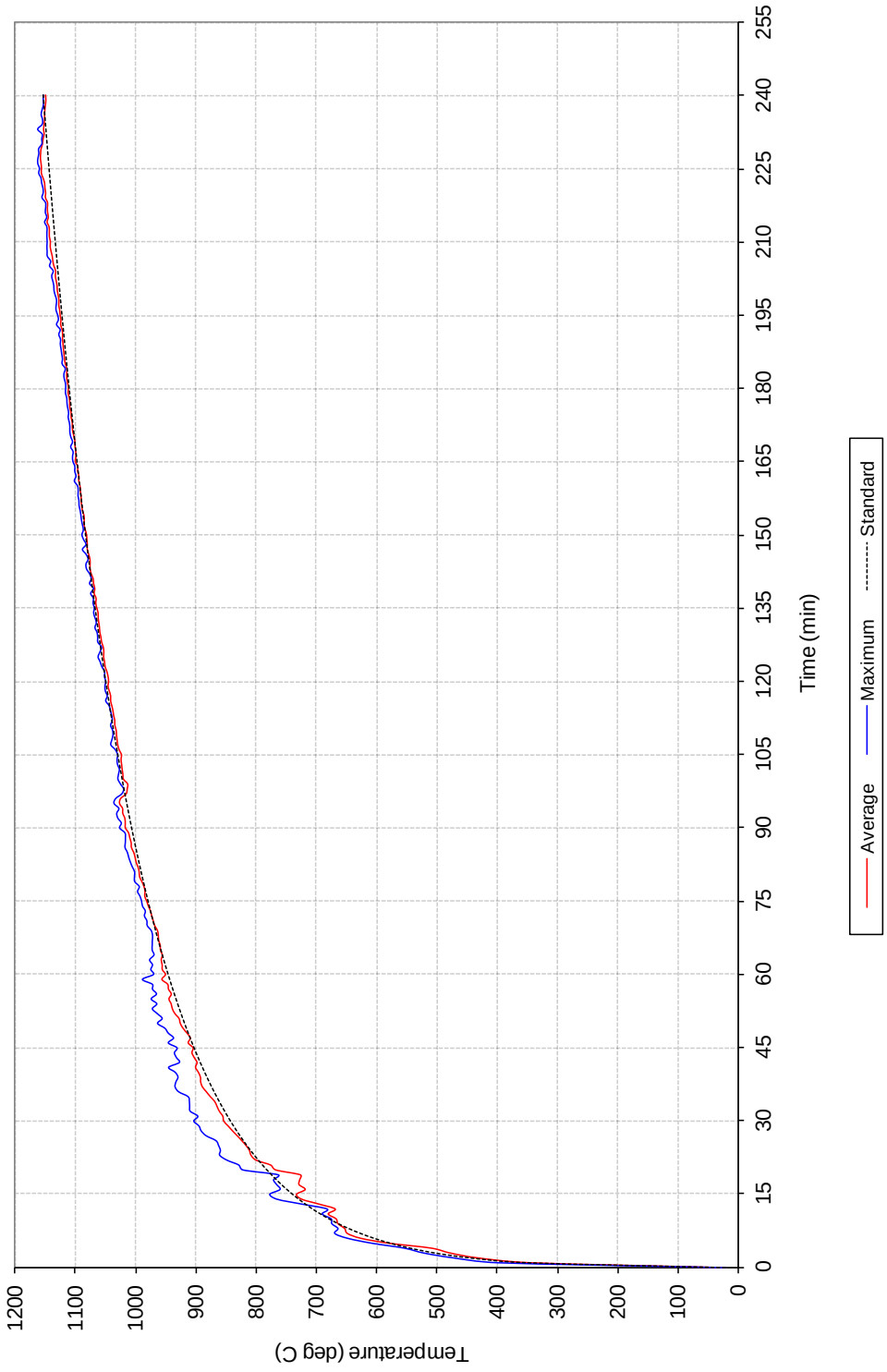

Temperature (deg C)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Time (min)
Average
Maximum
Standard

FIGURE 1 – FURNACE TEMPERATURE

FIGURE 2 – FURNACE SEVERITY

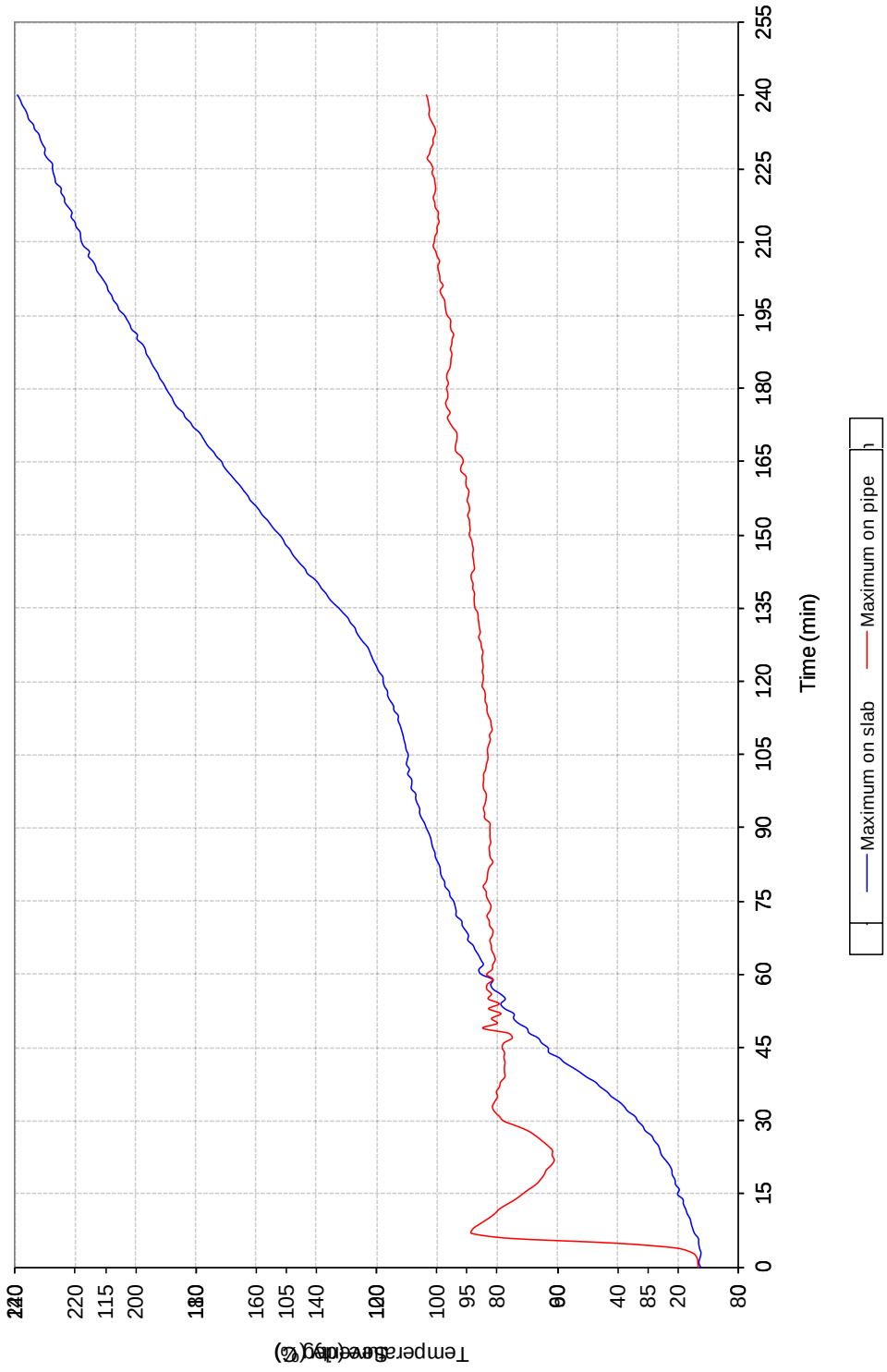


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 1

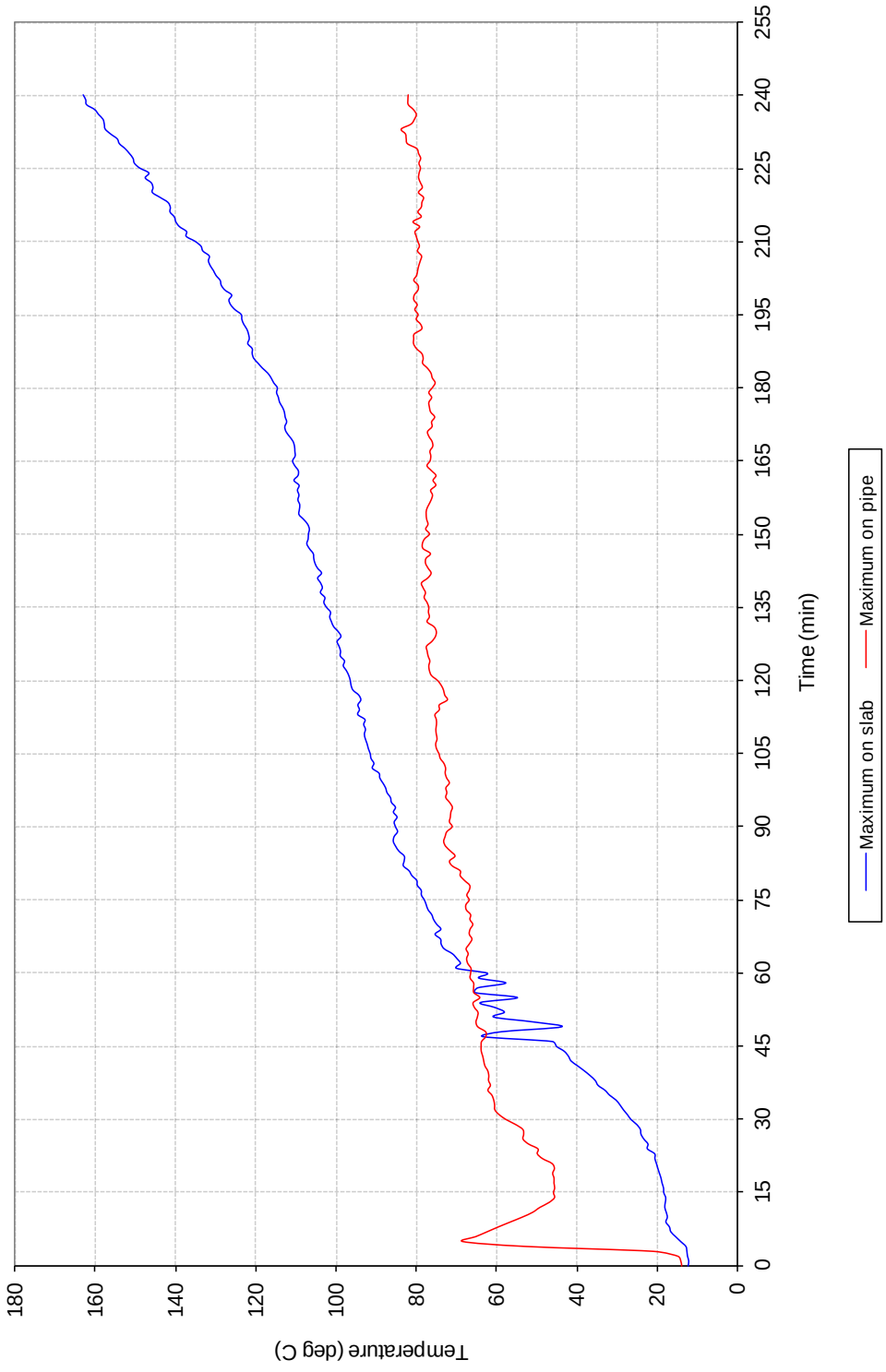

Temperature (deg C)
0
20
40
60
80
100
120
140
160
180
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Time (min)
Maximum on slab
Maximum on pipe

FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 2

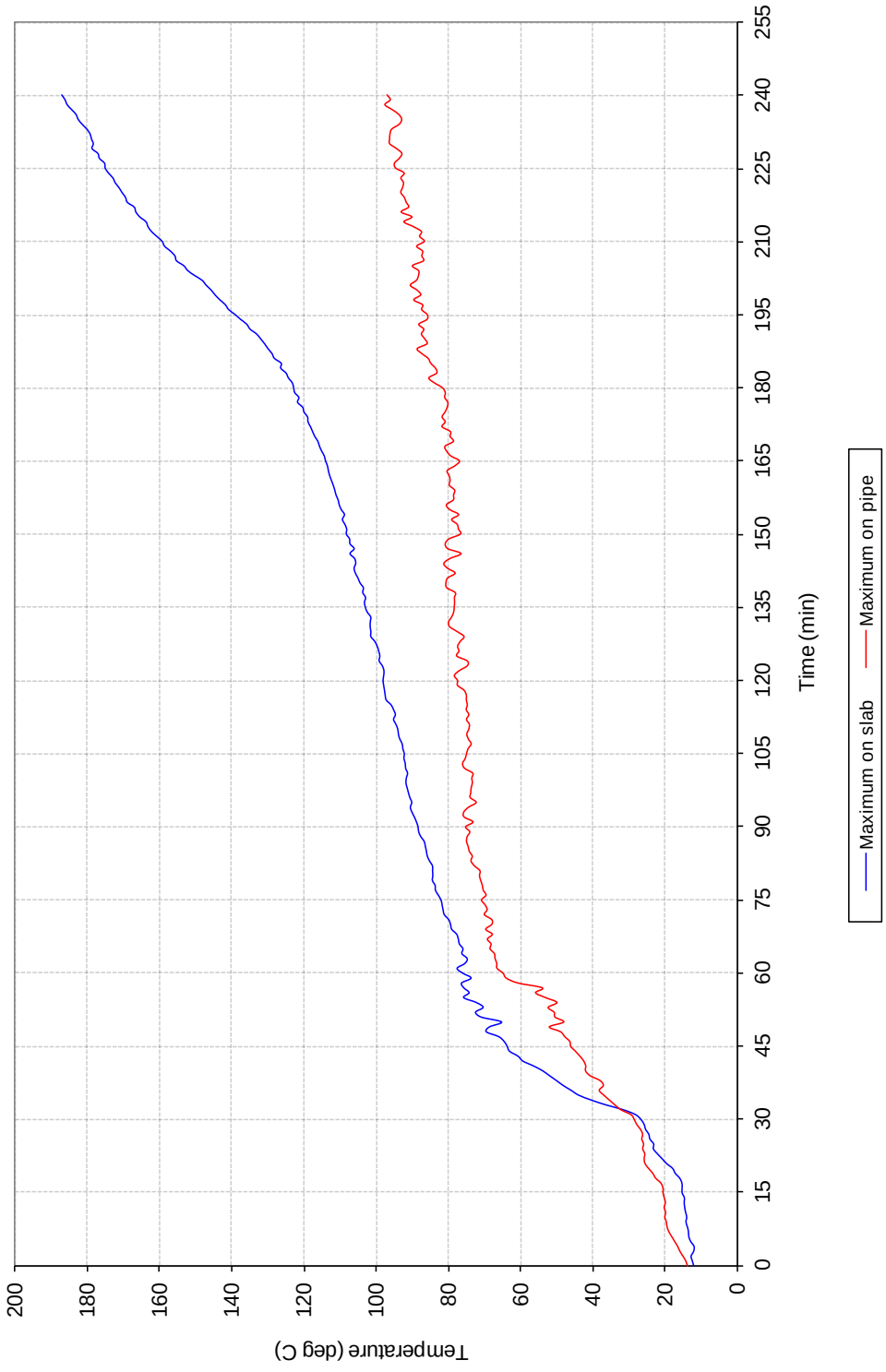

Temperature (deg C)
0
20
40
60
80
100
120
140
160
180
200
Time (min)
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Maximum on slab
Maximum on pipe

FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 3

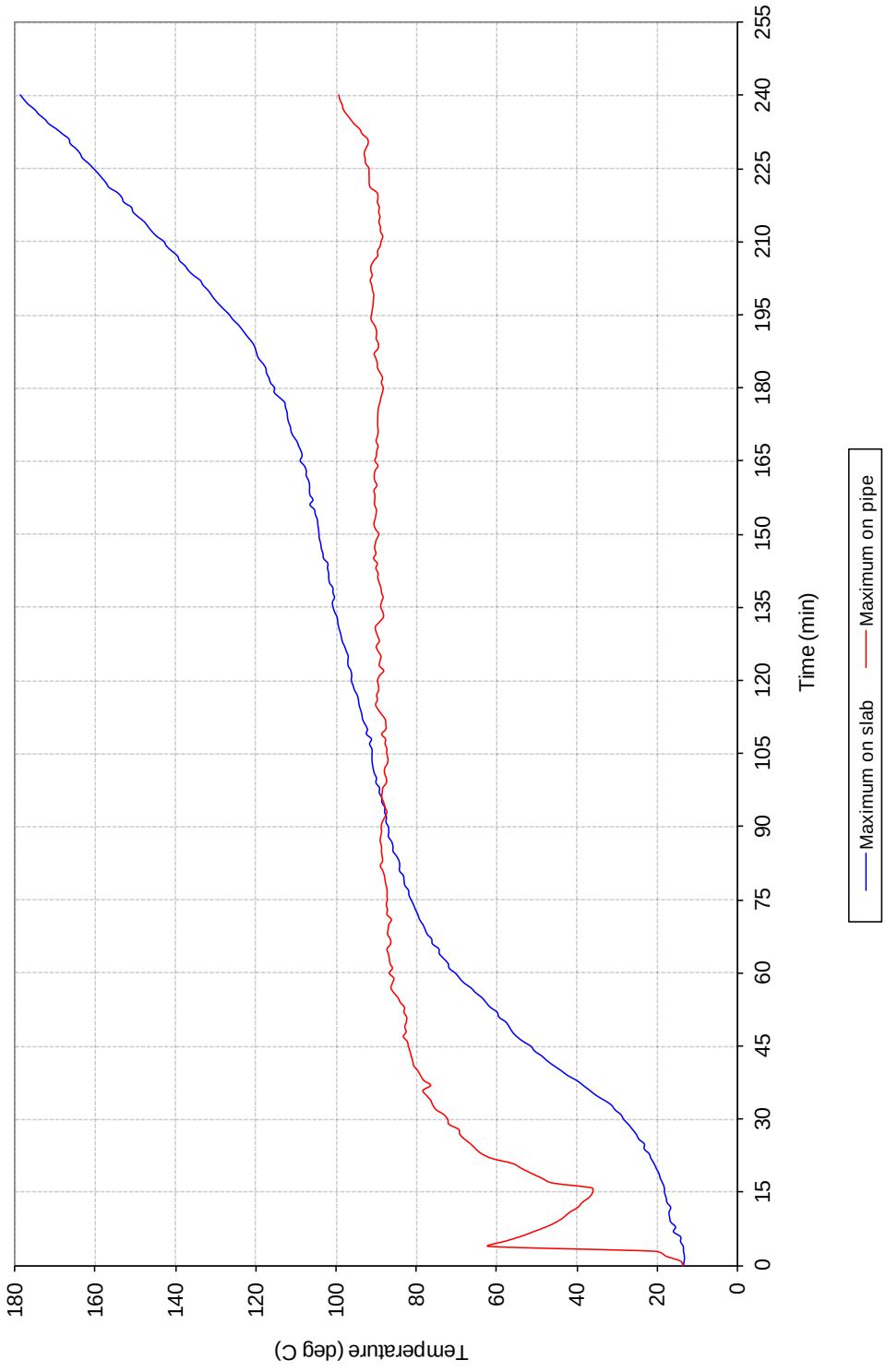

Temperature (deg C)
0
20
40
60
80
100
120
140
160
180
Time (min)
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Maximum on slab
Maximum on pipe

FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 4

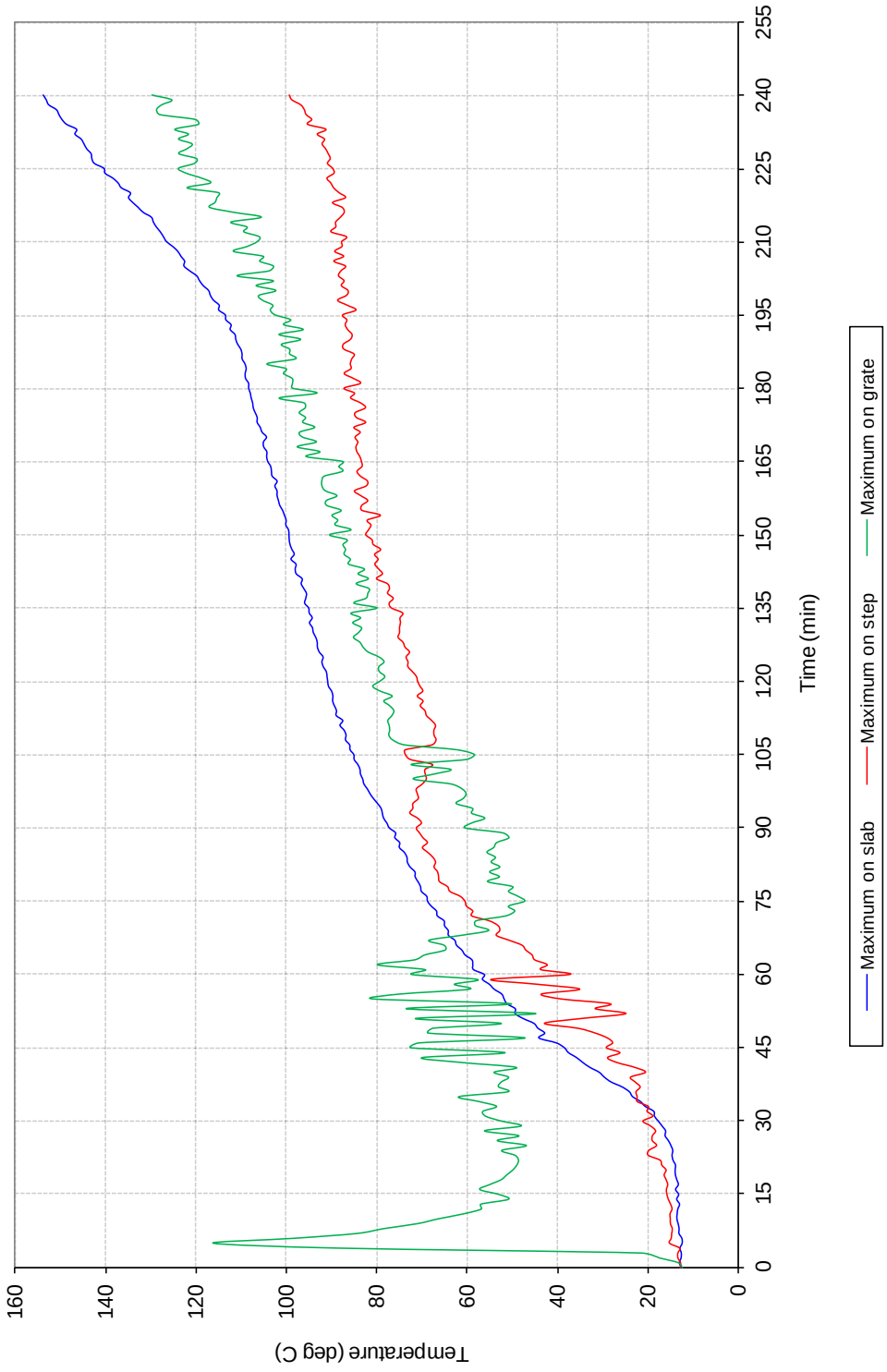

Temperature (deg C)
0
20
40
60
80
100
120
140
160
Time (min)
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Maximum on slab
Maximum on step
Maximum on grate

FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 5

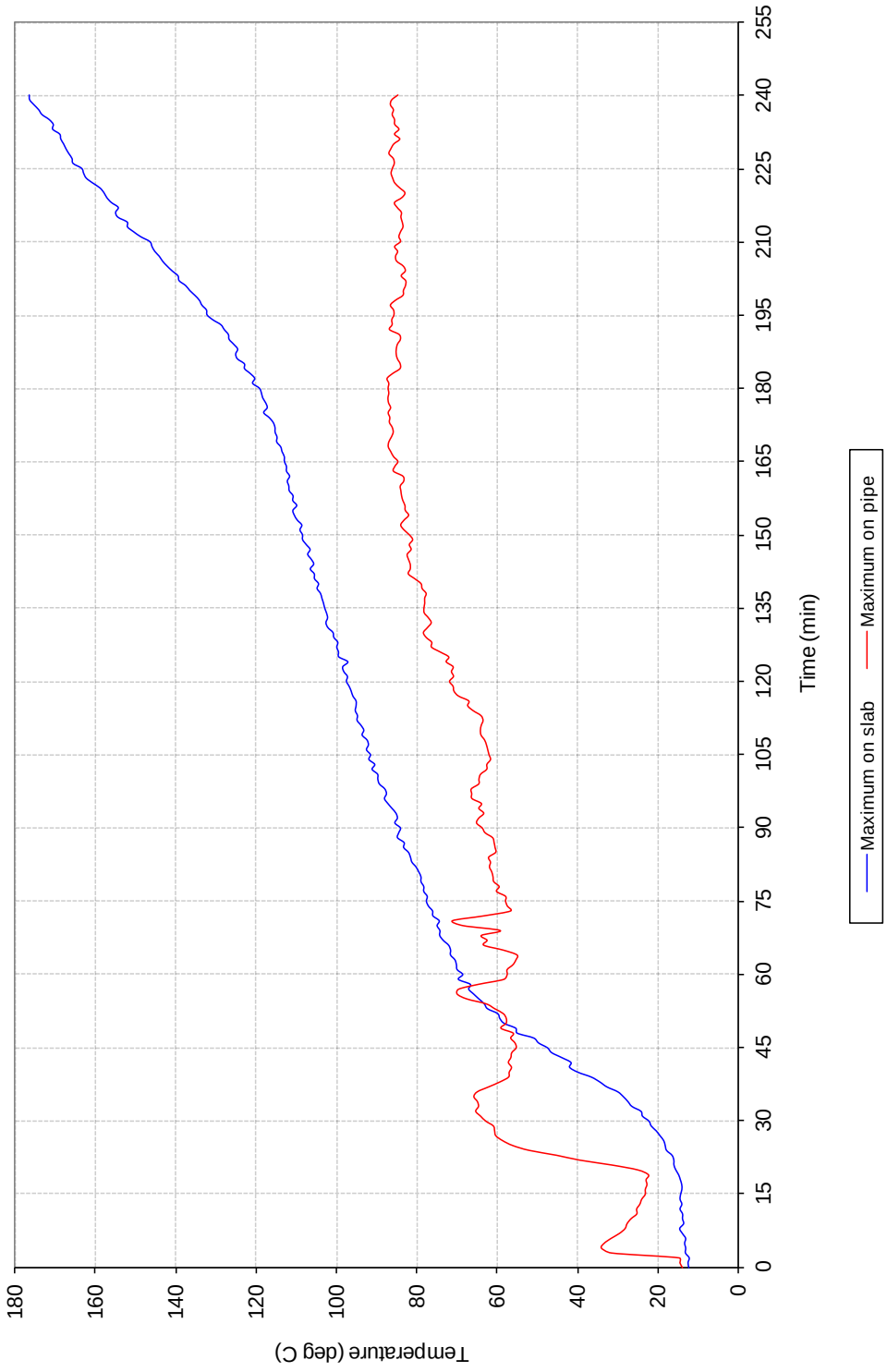
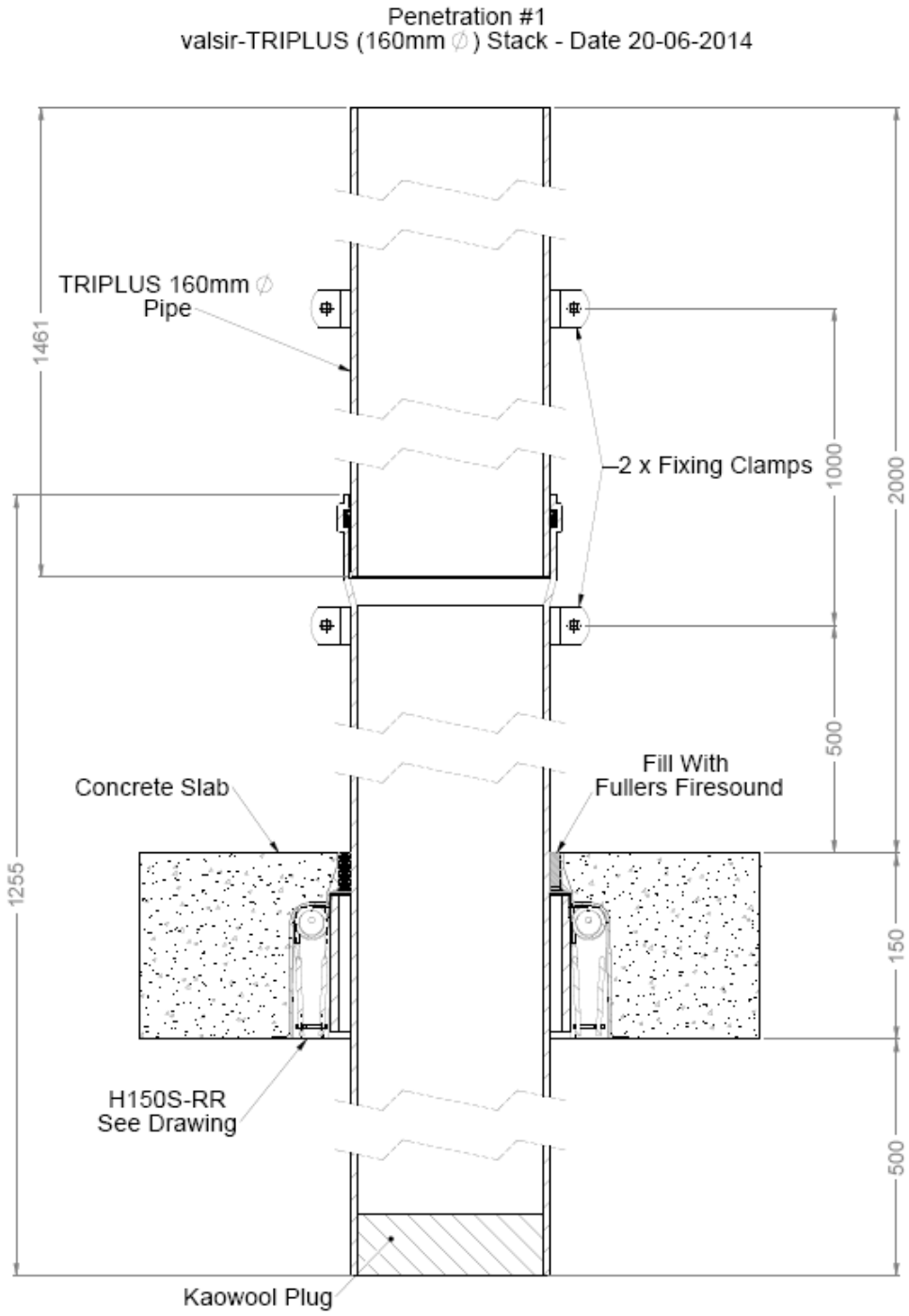
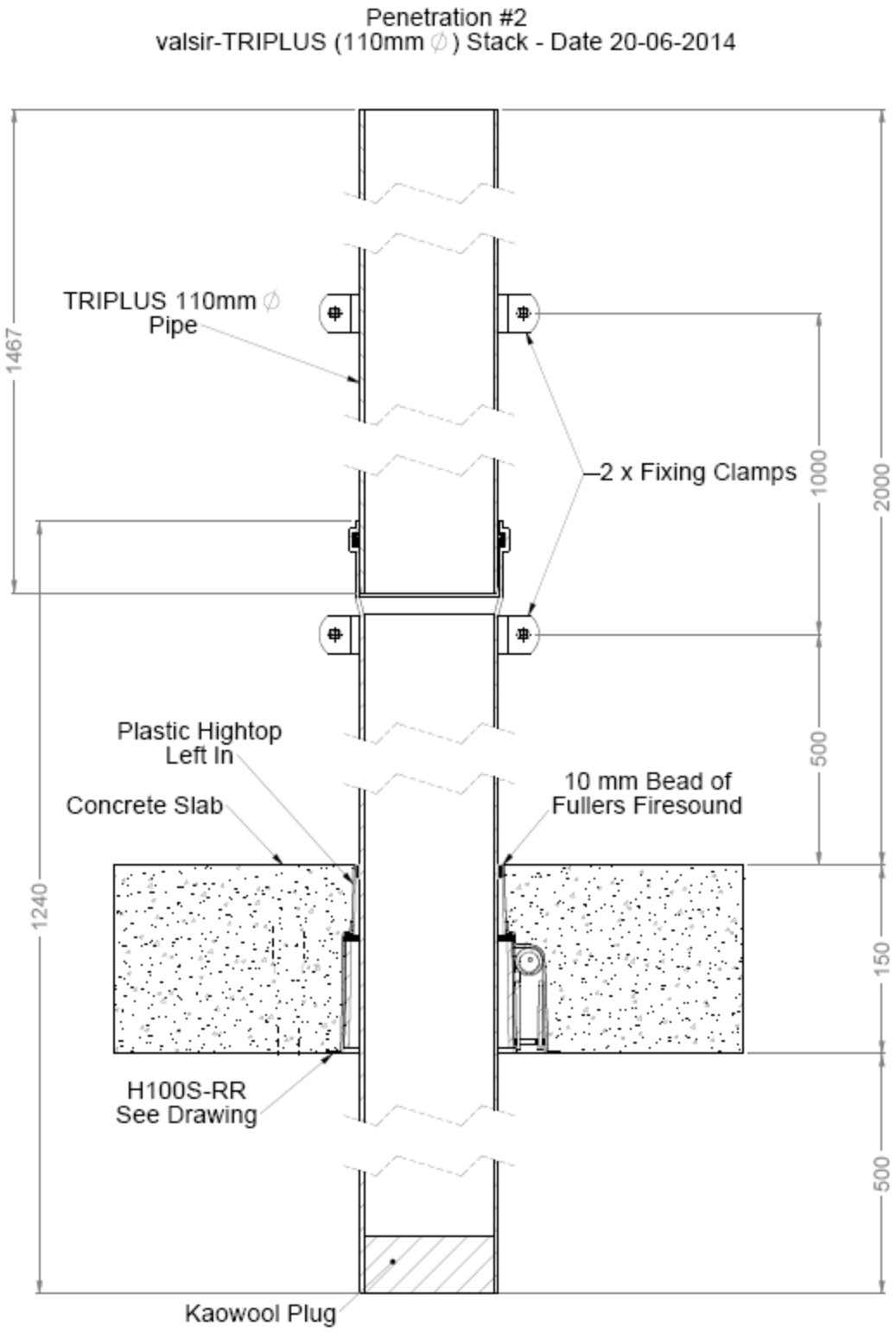

Temperature (deg C)
0
20
40
60
80
100
120
140
160
180
0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
Time (min)
Maximum on slab
Maximum on pipe

FIGURE 8 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 6

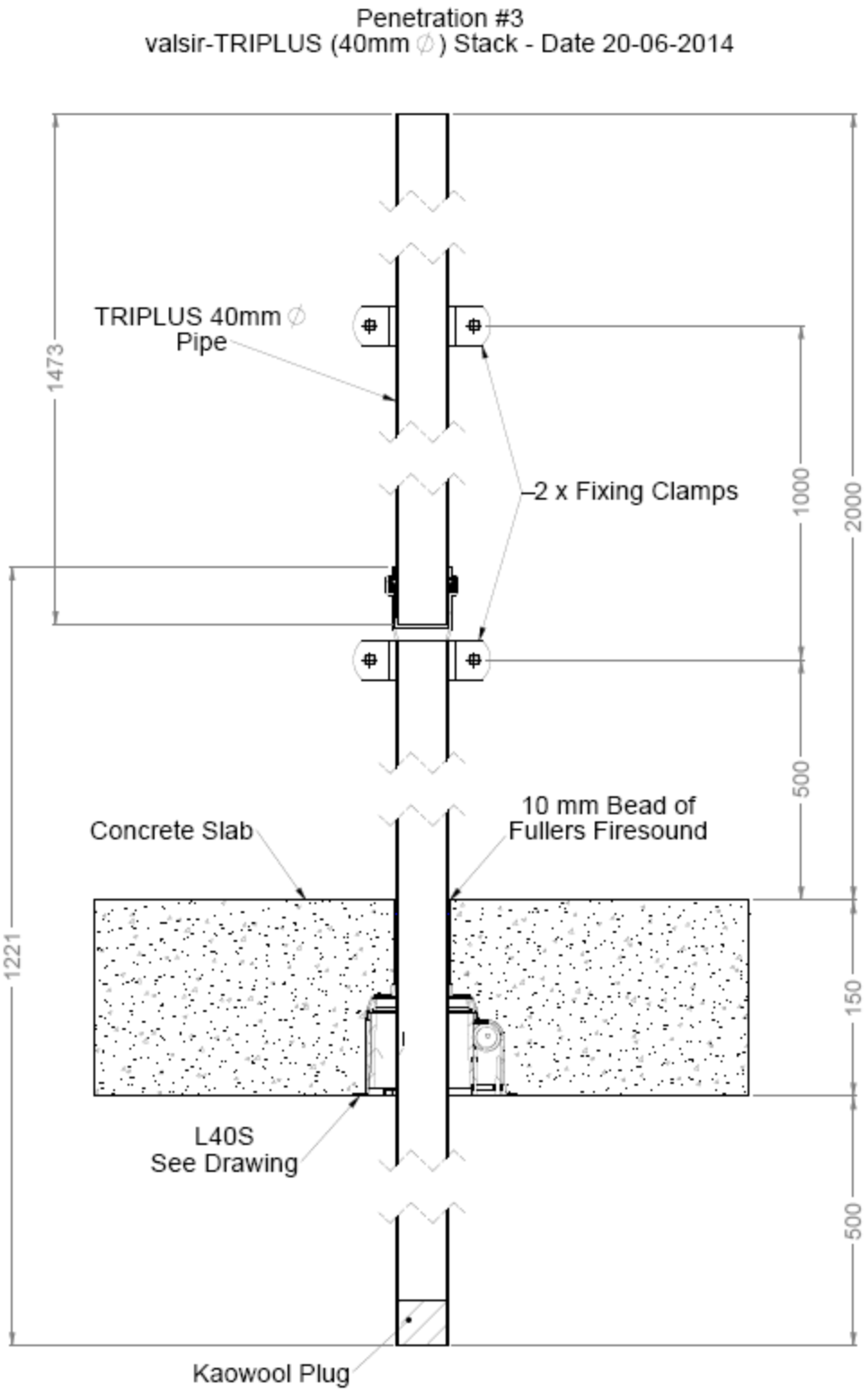
Appendix D – Installation drawings



DRAWING TITLED "PENETRATION #1 – VALSIR-TRIPLUS (160-MM OD) STACK" DATED 20 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING TITLED "PENETRATION #2 – VALSIR-TRIPLUS (110-MM OD) STACK" DATED 20 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



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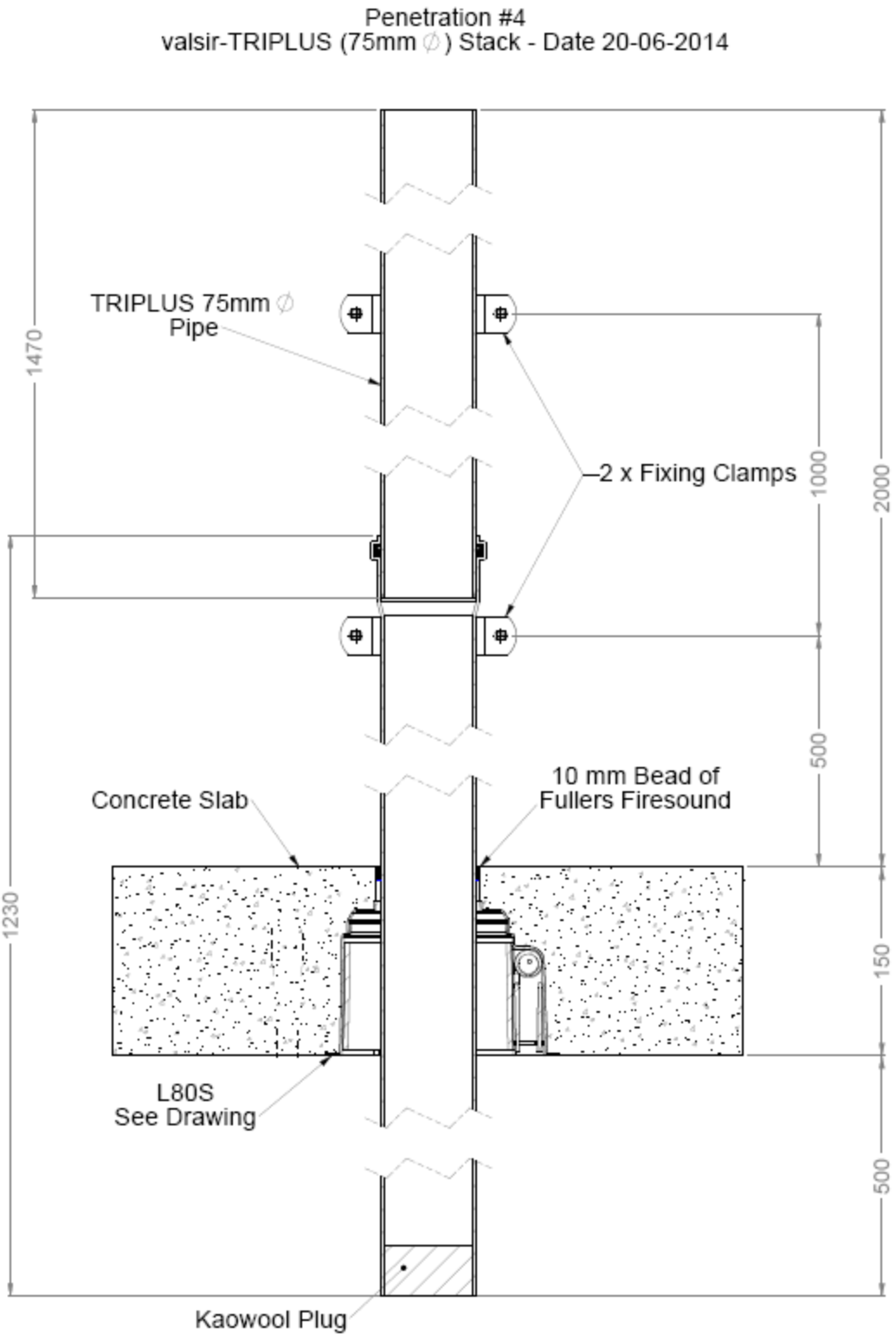
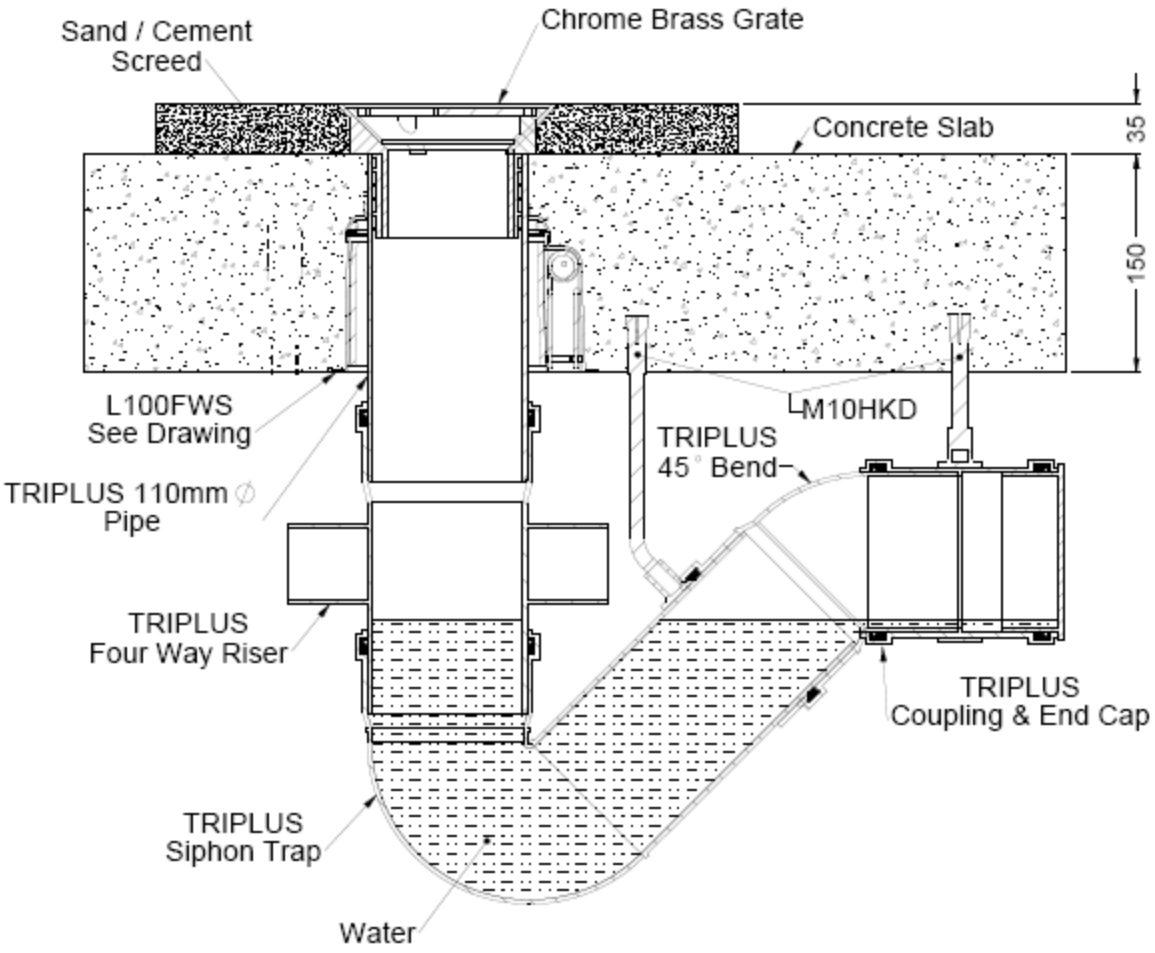
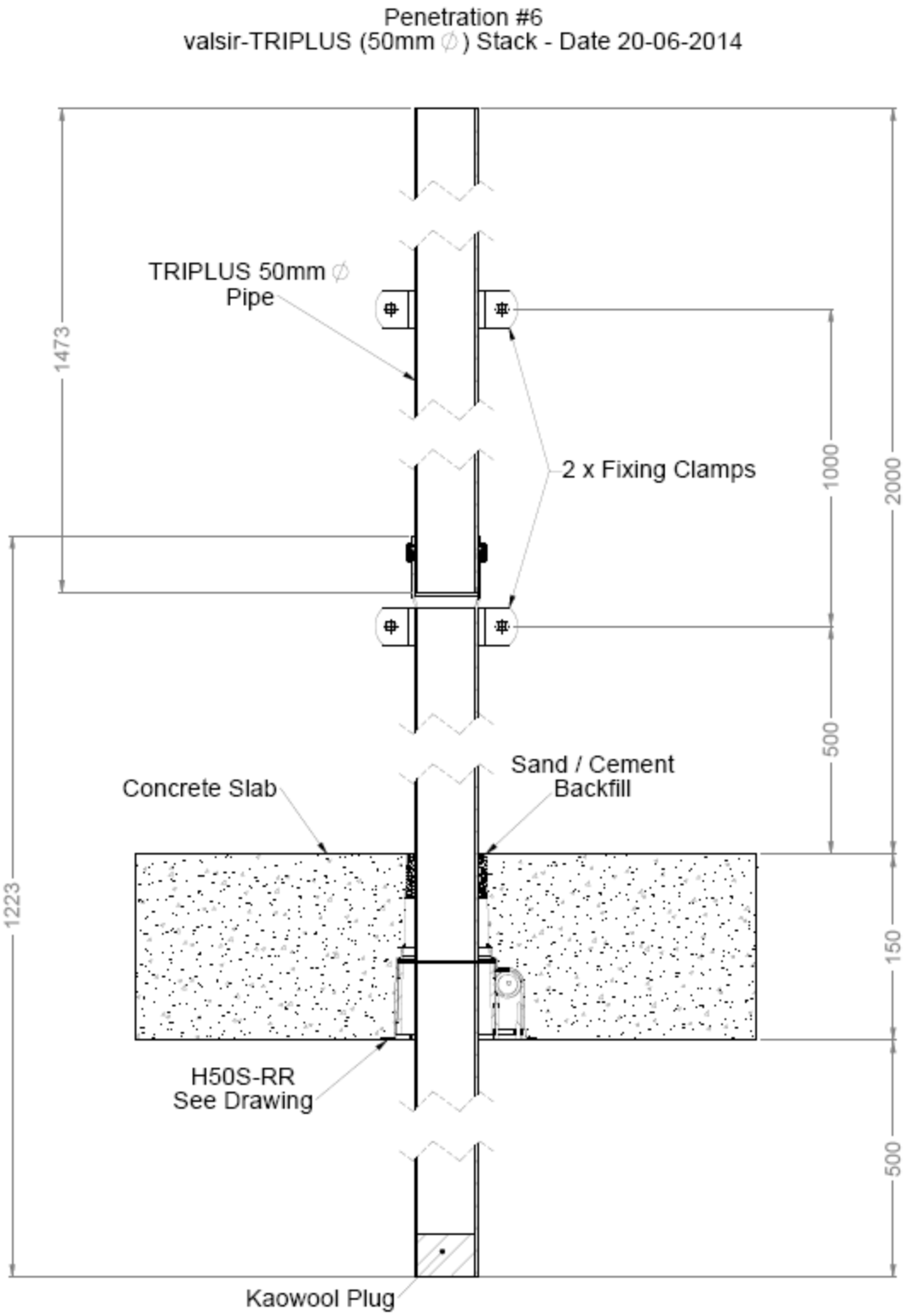


DRAWING TITLED "PENETRATION #4 – VALSIR-TRIPLUS (75-MM OD) STACK" DATED 20 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

Penetration #5
valsir-TRIPLUS (110mm ∅) Floorwaste - Date 20-06-2014

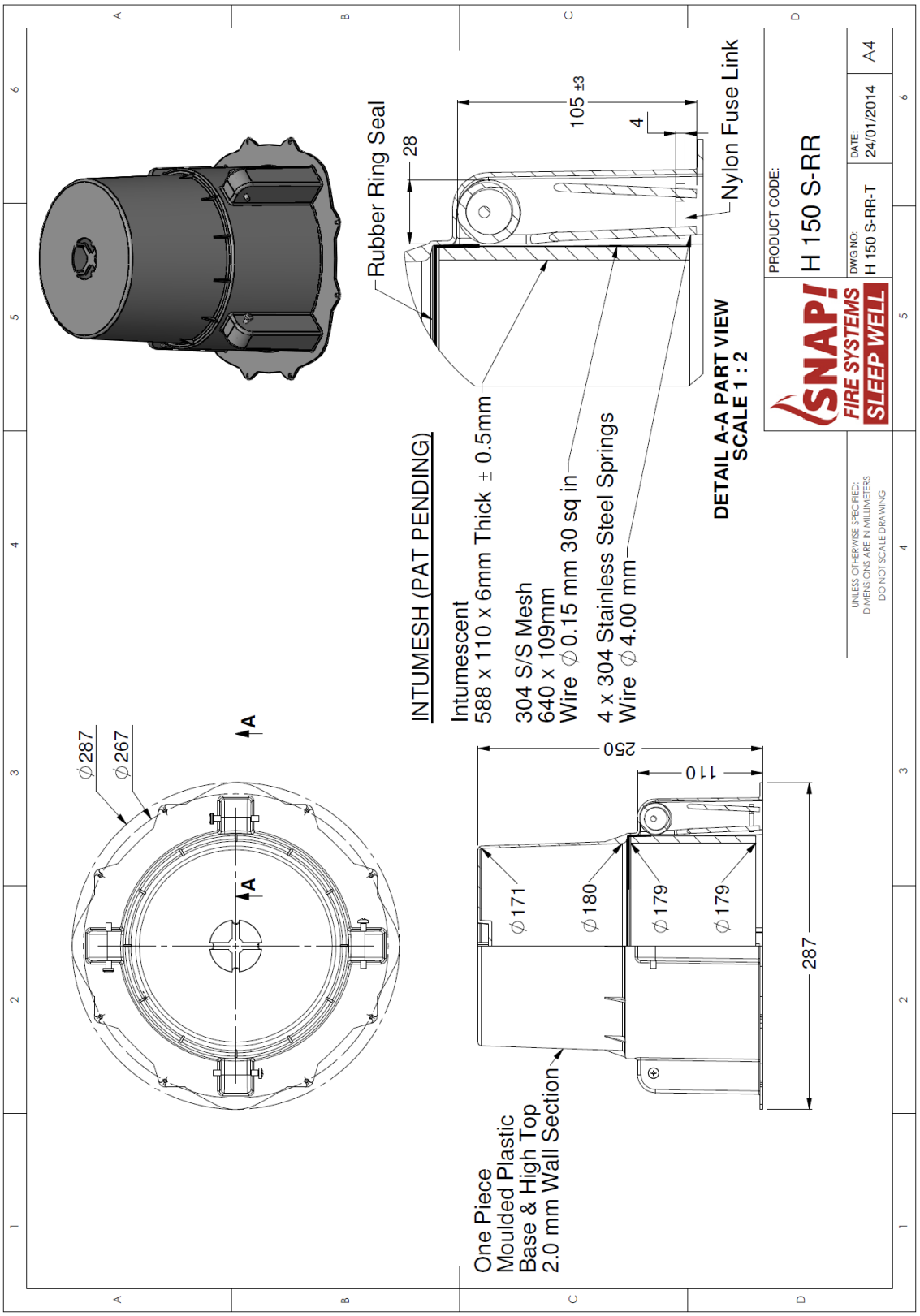


DRAWING TITLED "PENETRATION #5 – VALSIR-TRIPLUS (110-MM OD) FLOORWASTE" DATED 20 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

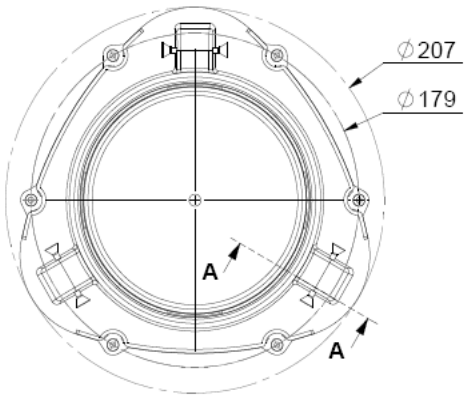


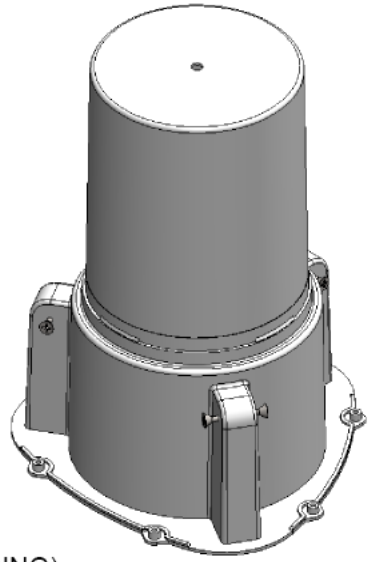
DRAWING TITLED "PENETRATION #6 – VALSIR-TRIPLUS (50-MM OD) STACK" DATED 20 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD

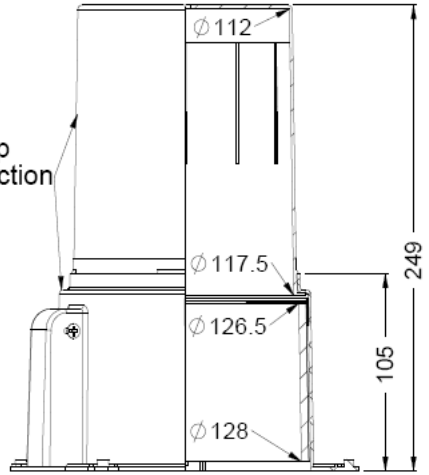
Appendix E – Specimen Drawings



DRAWING NUMBERED H150 S-RR-T DATED 24 JANUARY 2014, BY SNAP FIRE SYSTEMS PTY LTD







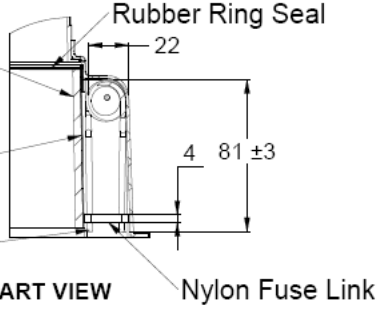
Moulded Plastic
Base & High Top
1.6 mm Wall Section

INTUMESH (PAT PENDING)

Intumescent
412 x 85 x 4mm Thick ± 0.5mm

304 S/S Mesh
460 x 85mm
Wire ∅0.15 mm 30 sq in

3 x Galvanised Steel Springs
Wire ∅3.15 mm



DETAIL A-A PART VIEW

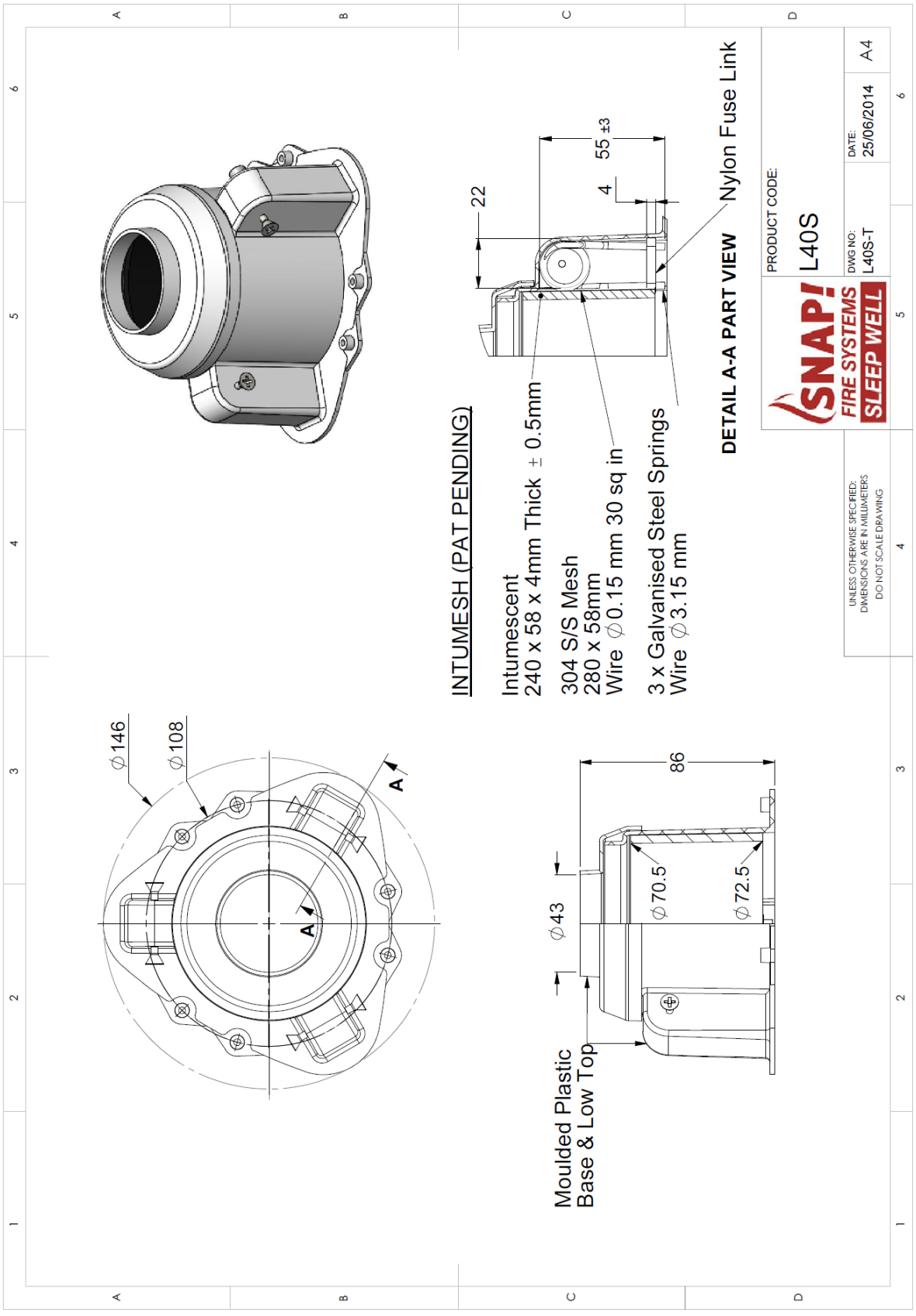
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
DO NOT SCALE DRAWING

SNAP! FIRE SYSTEMS SLEEP WELL

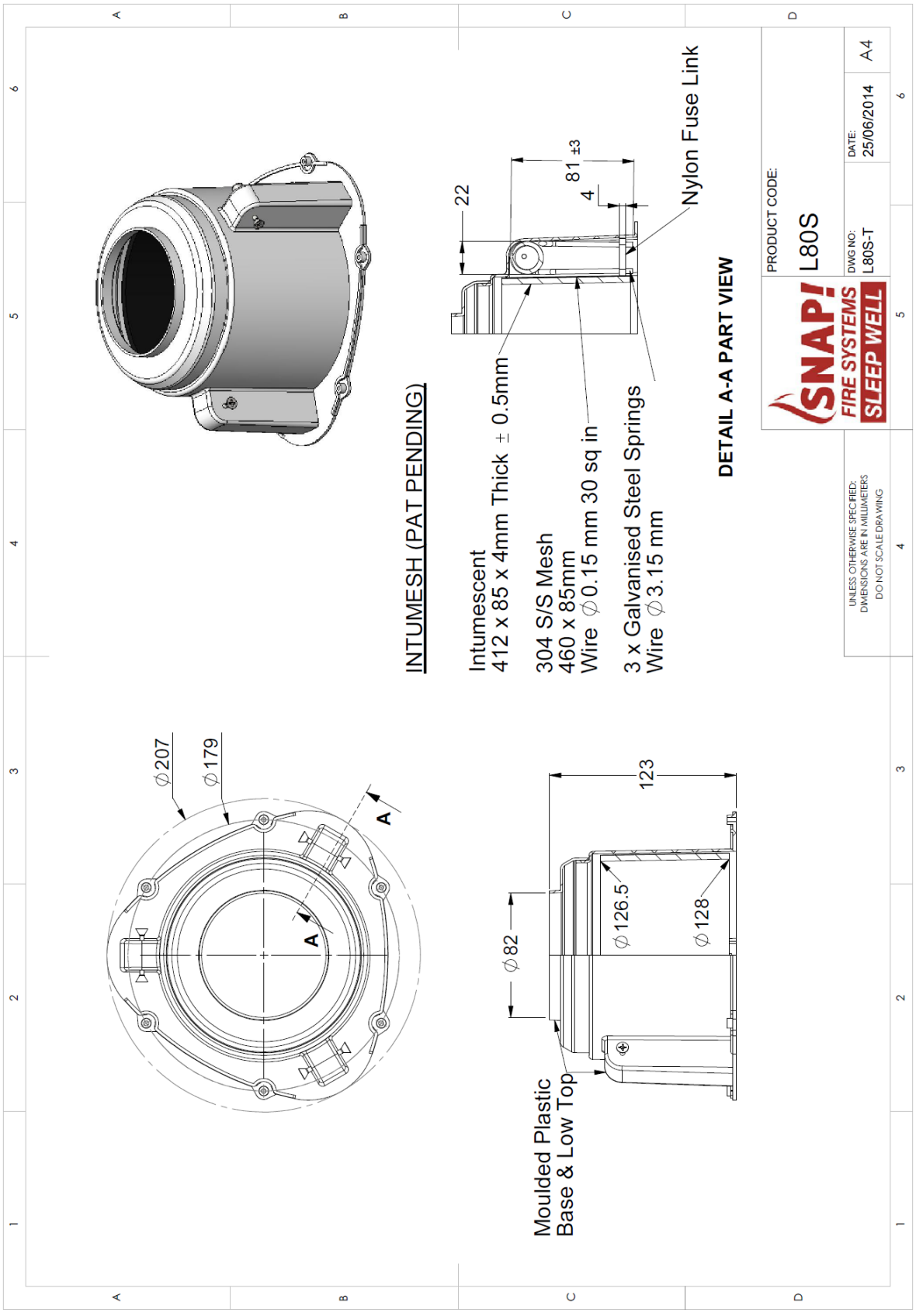
PRODUCT CODE:
H100S-RR

DWG NO: H100S-RR-T
DATE: 24/06/2014
A4

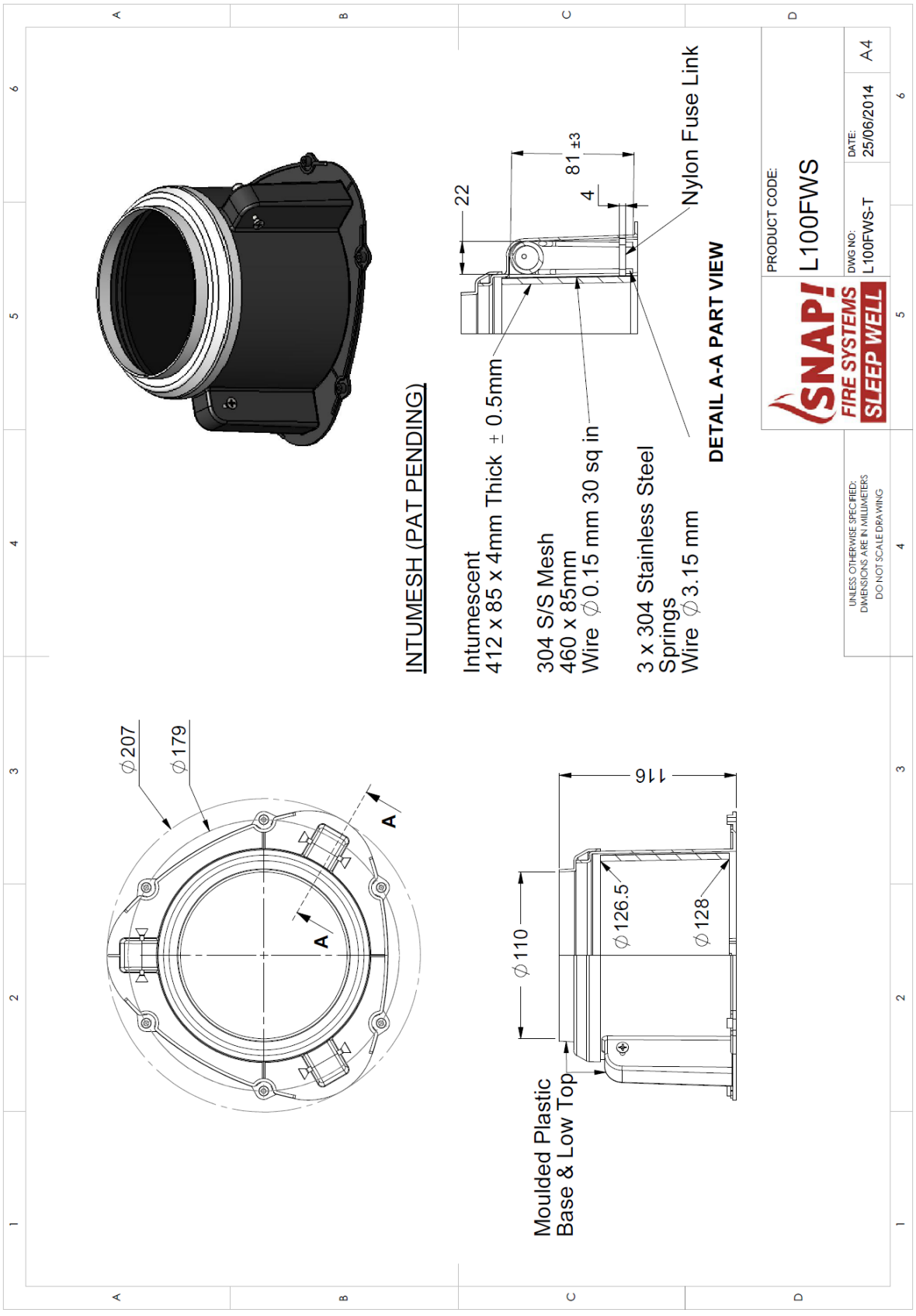
DRAWING NUMBERED H100 S-RR-T DATED 24 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING NUMBERED L40S-T DATED 25 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



DRAWING NUMBERED L80S-T DATED 25 JUNE 2014, BY SNAP FIRE SYSTEMS PTY LTD



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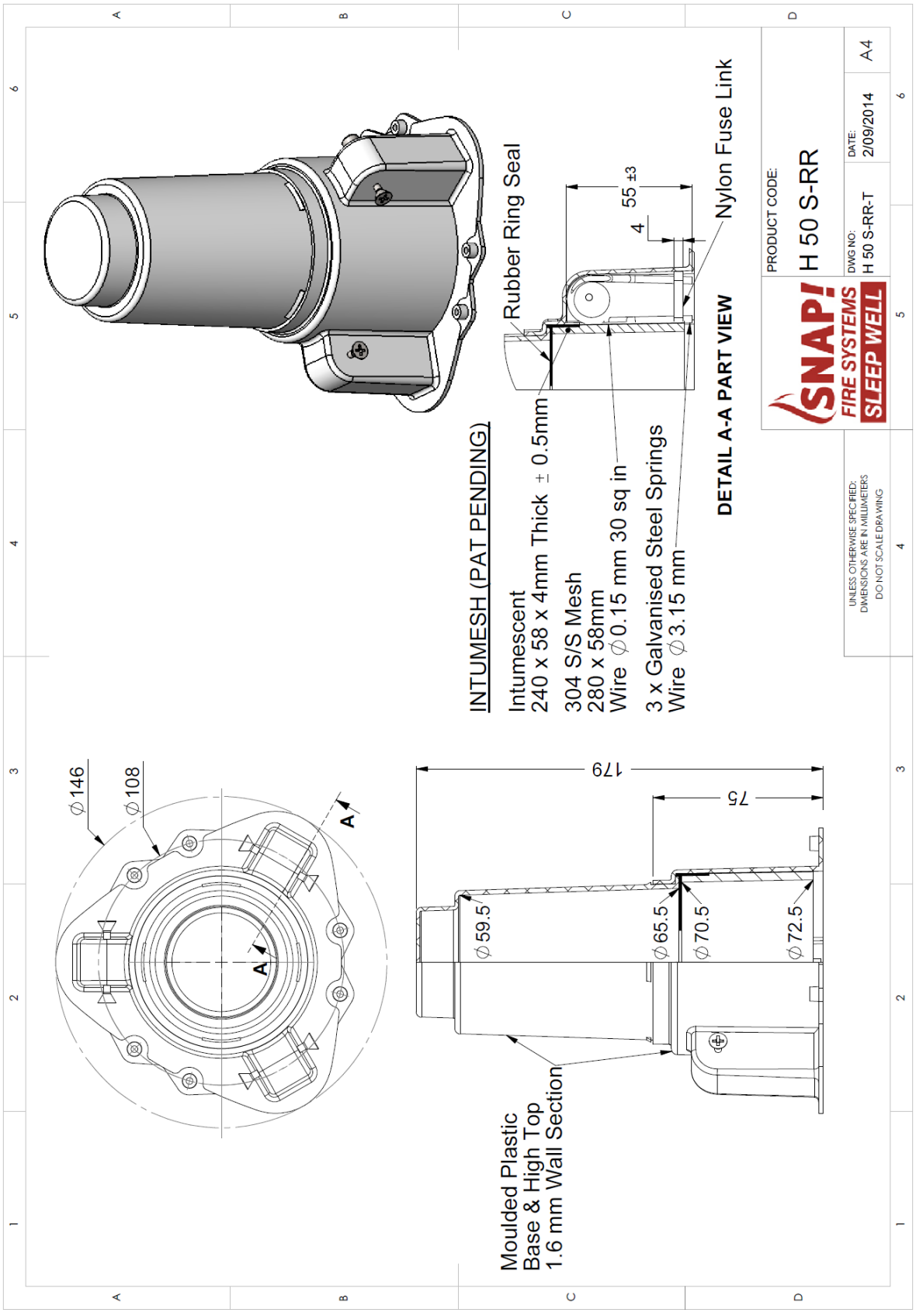

DRAWING NUMBERED H50 S-RR-T DATED 2 SEPTEMBER 2014, BY SNAP FIRE SYSTEMS PTY LTD

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.

Appendix F – Certificates

COPY OF CERTIFICATE OF TEST – NO. 2581A

COPY OF CERTIFICATE OF TEST – NO. 2582A

COPY OF CERTIFICATE OF TEST – NO. 2583A

COPY OF CERTIFICATE OF TEST – NO. 2584A

COPY OF CERTIFICATE OF TEST – NO. 2585A

COPY OF CERTIFICATE OF TEST – NO. 2586A

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