

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

Test Report

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Commercial-in-confidence

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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 | 5 |
| 2.3 | Orientation..... | 5 |
| 2.4 | Conditioning..... | 6 |
| 3 | Documentation | 6 |
| 4 | Equipment..... | 6 |
| 4.1 | Furnace | 6 |
| 4.2 | Temperature | 6 |
| 4.3 | Measurement system | 6 |
| 5 | Ambient temperature | 6 |
| 6 | Departure from standard | 7 |
| 7 | Termination of test | 7 |
| 8 | Test results | 7 |
| 8.1 | Critical observations | 7 |
| 8.2 | Furnace temperature..... | 7 |
| 8.3 | Furnace severity..... | 7 |
| 8.4 | Specimen temperature..... | 7 |
| 8.5 | Performance | 8 |
| 9 | Fire-resistance level (FRL) | 8 |
| 10 | Field of direct application of test results | 8 |
| 11 | Tested by | 8 |
| | Appendices | 9 |
| | Appendix A – Measurement location | 9 |
| | Appendix B – Photographs | 10 |
| | Appendix C – Furnace Temperature | 13 |
| | Appendix D – Installation drawings..... | 16 |
| | Appendix E – Specimen Drawings | 17 |
| | Appendix F – Certificates | 18 |
| | References | 19 |

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

Sponsored Investigation No. FSP 1736

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 three (3) floor wastes and one (1) stack pipe.

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 4488/3861

1.7 Test date

The fire-resistance test was conducted on 20 May 2015.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by three (3) floor waste systems and one (1) stack pipe 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/NZS 1260 - PVC-U pipes and fittings for drain, waste and vent application;
- AS/NZS 7671:2010 'Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings - Polypropylene (PP)(ISO 7671:2003), MOD'; and
- EN 1451-1:2000 'Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Polypropylene (PP). Specifications for pipes, fittings and the system'.
- One (1) HDPE pipe manufactured in accordance with AS/NZS 5065:2005 'Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications'

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

Penetration 2 – H50 S-RR cast-in fire collar protecting a 40-mm diameter High Density Polyethylene (HDPE) pipe

The SNAP Cast-in H50 S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 100-mm diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-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 268-mm x 55-mm stainless steel mesh as shown in drawing numbered H50 S-RR-T dated 29 September 2015, by SNAP Fire Systems Pty Ltd.

The penetrating service comprised a 40-mm HDPE stack pipe, with a wall thickness of 3.3-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-15-S Penetration # 2 – 40mm HDPE Pipe – Stack – H50S-RR" dated 19 November 2015, 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 grout backfill to 20-mm.

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-15-S Penetration # 2 – 40mm HDPE Pipe – Stack – H50S-RR” dated 19 November 2015, by Snap Fire Systems Pty Ltd.

Drawing numbered H50 S-RR-T, dated 29 September 2015, 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 |
|---------------|--|
| 2 minutes - | Fluing is visible on Penetration 2. |
| 10 minutes - | Penetration 2 is no longer fluing. |
| 40 minutes - | Moisture is forming around the base of Penetrations 2 and 4. |
| 180 minutes - | No change noted. |
| 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 2.

8.5 Performance

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

Penetration 2 – H50 S-RR cast-in fire collar protecting a 40-mm diameter High Density Polyethylene (HDPE) 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 2 - -/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

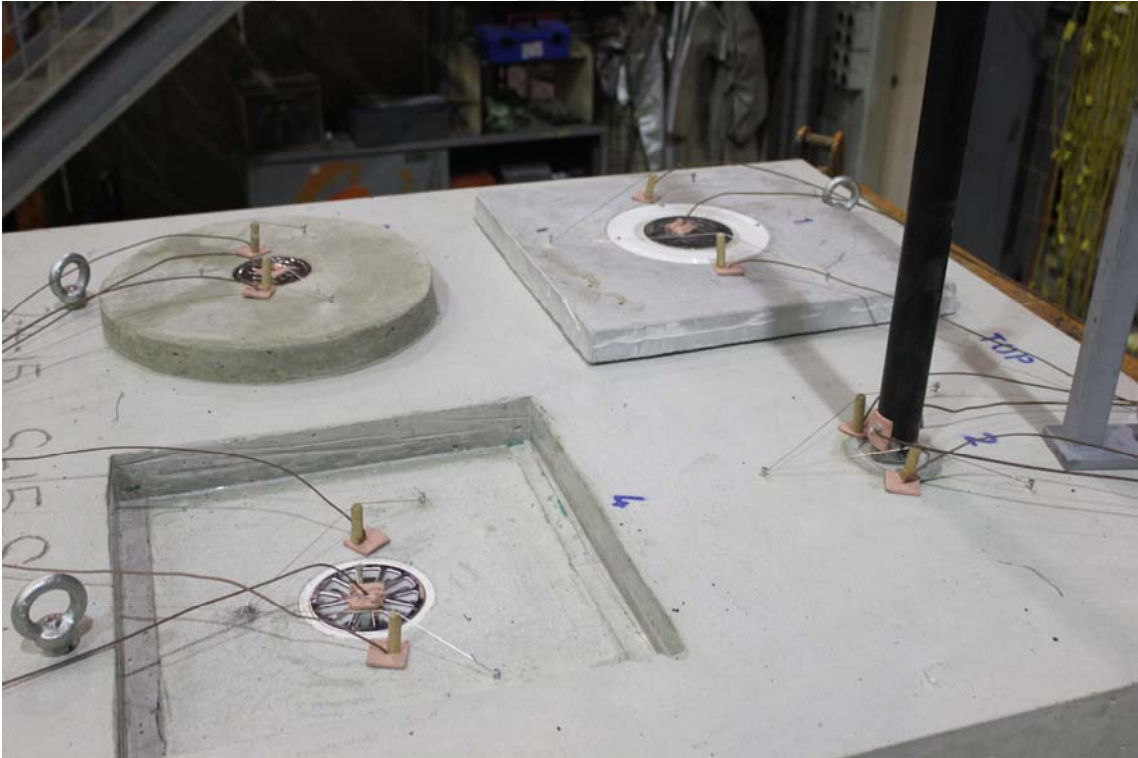
| Measurement Location | | |
|----------------------|---------------------------|-----------------|
| Group location | T/C Position | T/C designation |
| Specimen | | |
| | | |
| Penetration 2 | On slab– 25-mm from pipe | S4 |
| | On slab– 25-mm from pipe | S5 |
| | On pipe – 25-mm from slab | S6 |
| | On pipe – 25-mm from slab | S7 |

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Appendix B – Photographs



PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMEN PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING



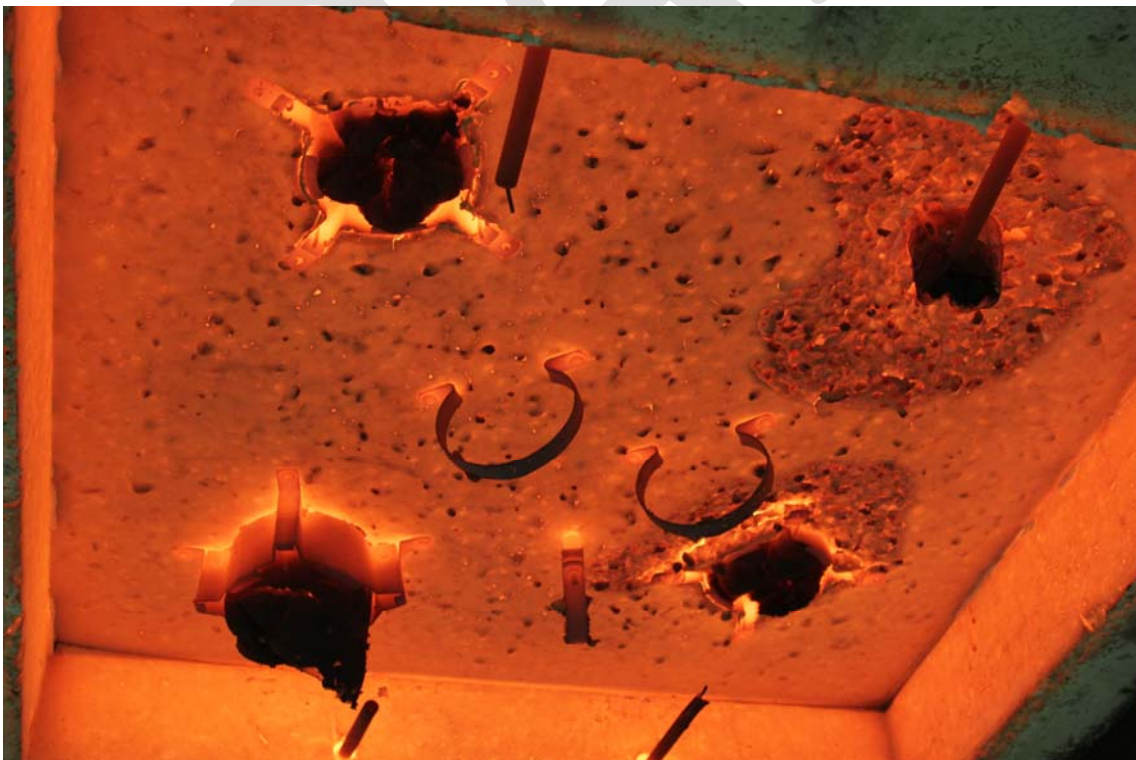
PHOTOGRAPH 3 – SPECIMENS AFTER 60 MINUTES OF TESTING



PHOTOGRAPH 4 – SPECIMENS AFTER 120 MINUTES OF TESTING



PHOTOGRAPH 5 – SPECIMENS AFTER 180 MINUTES OF TESTING



PHOTOGRAPH 6 – EXPOSED FACE OF SPECIMENS AT CONCLUSION OF TESTING

Appendix C – Furnace Temperature

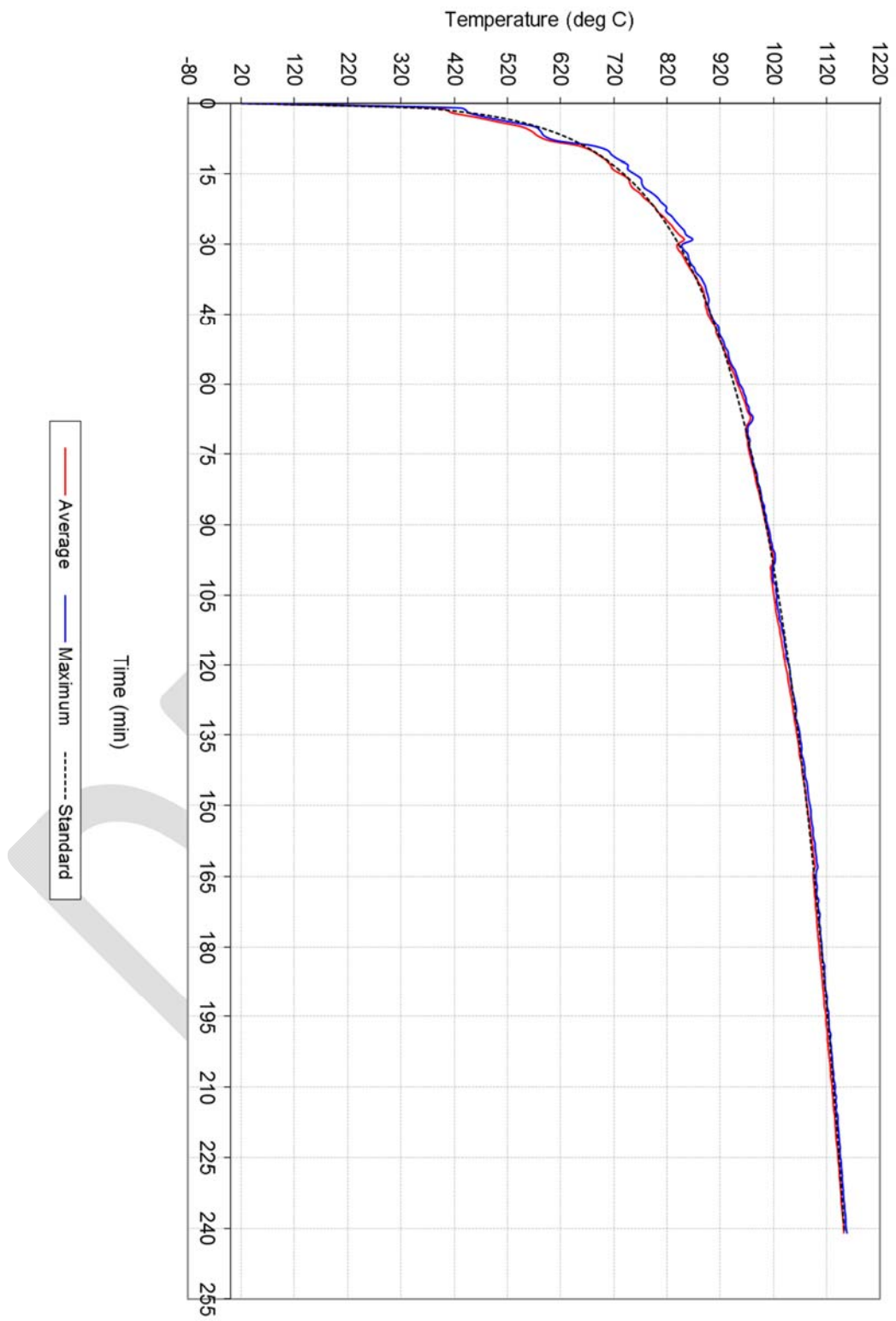


FIGURE 1 – FURNACE TEMPERATURE

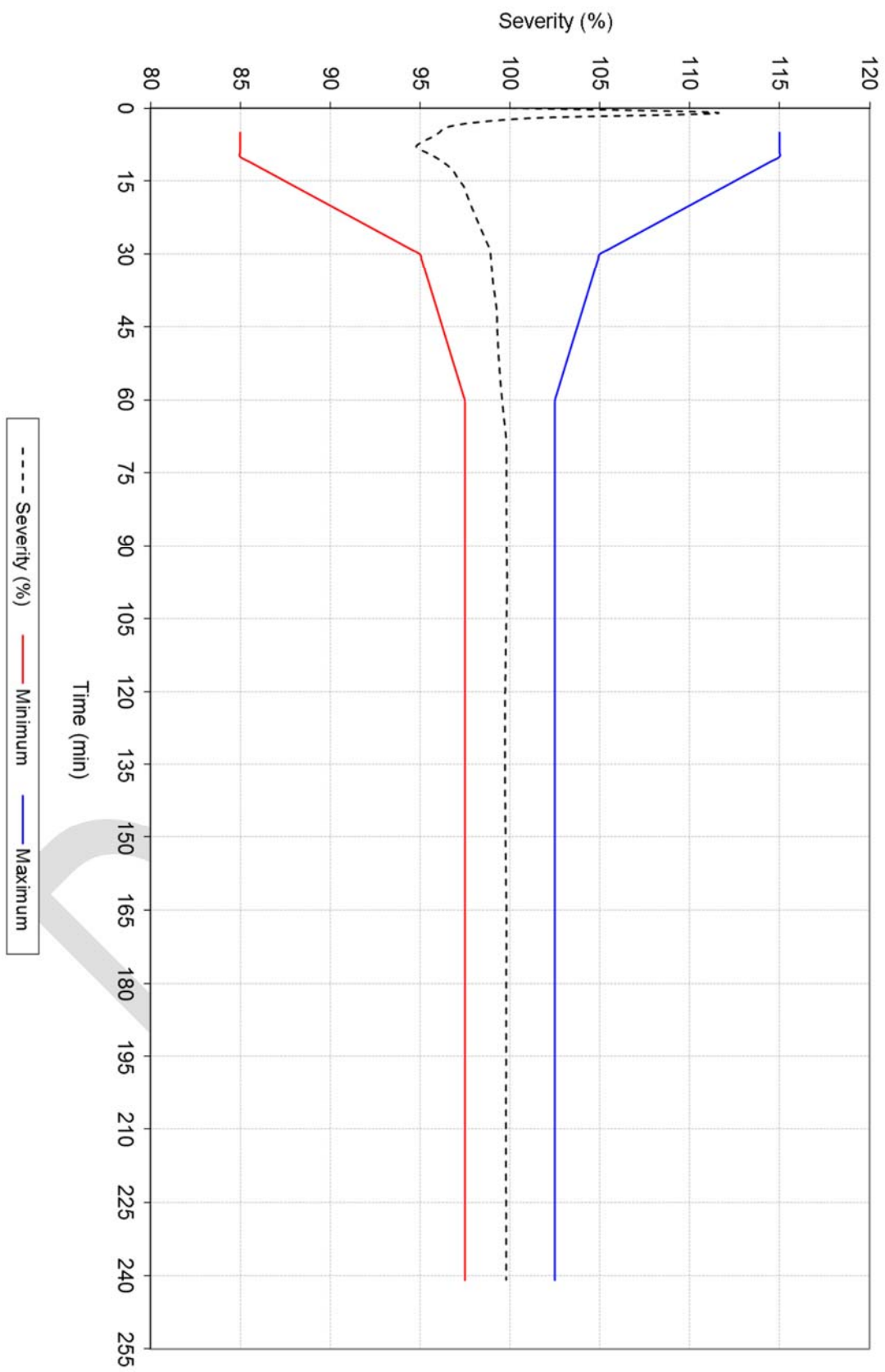


FIGURE 2 – FURNACE SEVERITY

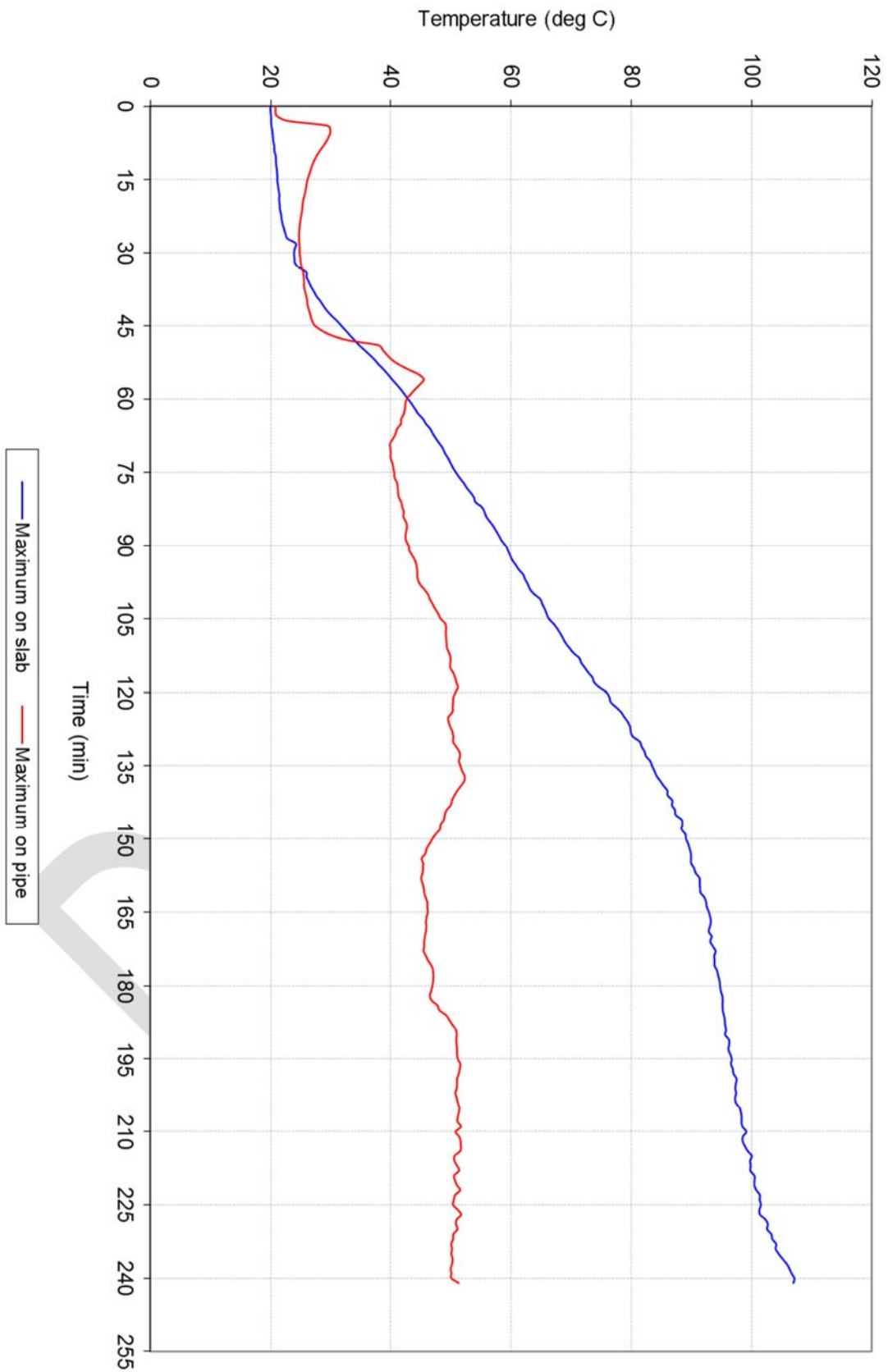
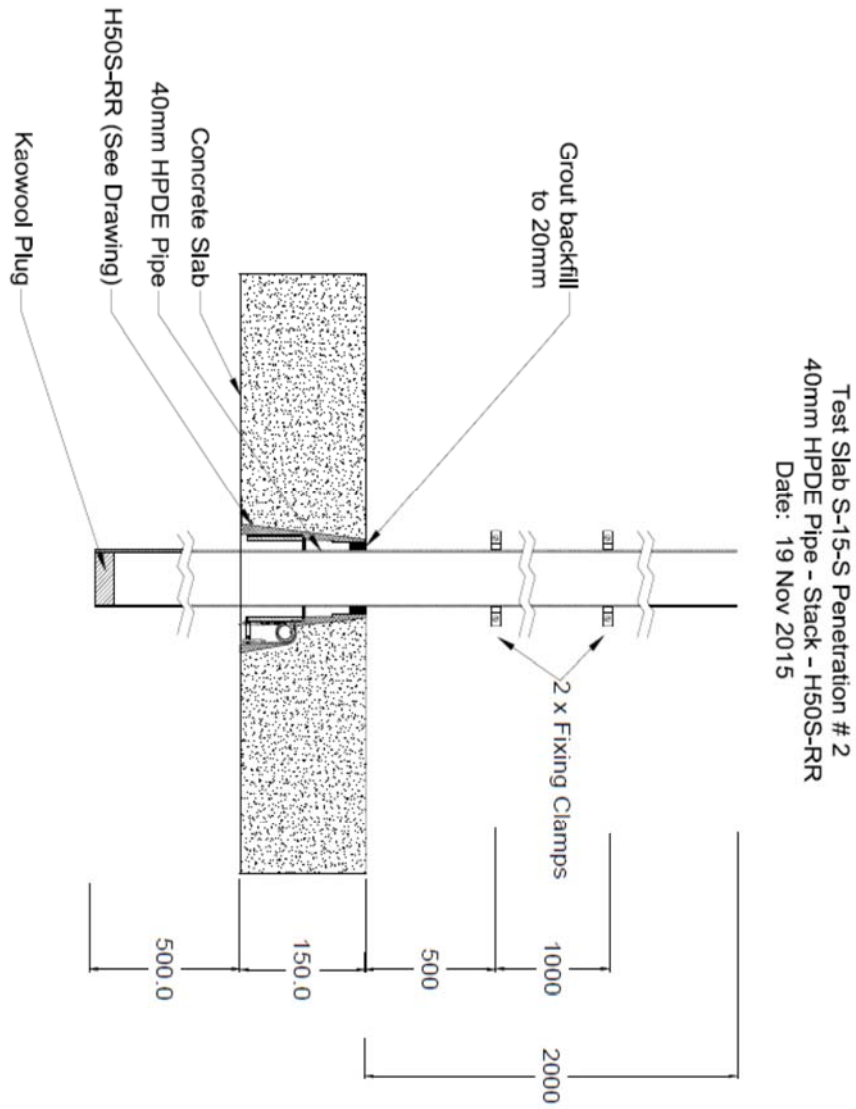


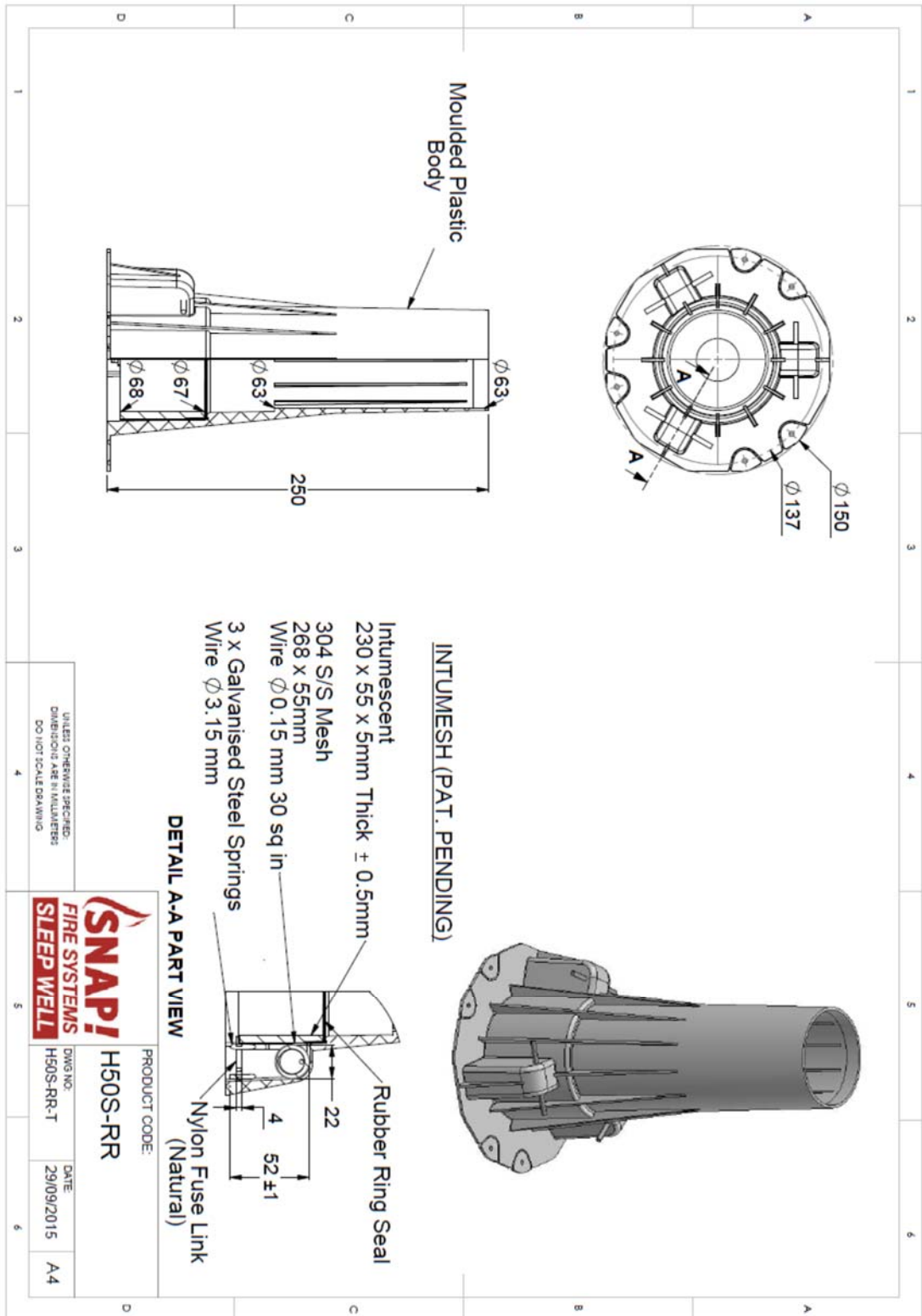
FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION 2

Appendix D – Installation drawings



DRAWING TITLED "TEST SLAB S-15-S PENETRATION # 2 – 40MM HDPE PIPE – STACK – H50S-RR" DATED 19 NOVEMBER 2015, BY SNAP FIRE SYSTEMS PTY LTD.

Appendix E – Specimen Drawings



DRAWING NUMBERED H50 S-RR-T, DATED 29 SEPTEMBER 2015, 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. 2716 |
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| This is to certify that the element of construction described below was tested by the CSIRO Division of Materials Science and Engineering in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2005 on behalf of: | | |
| Snap Fire Systems Pty Ltd Unit 2/160 Redland Bay Road CAPALABA QLD | | |
| A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 1736. | | |
| Product Name: Penetration 2 – H50 S-RR cast-in fire collar protecting a 40-mm diameter High Density Polyethylene (HDPE) pipe | | |
| Description: | The sponsor identified the specimen as a SNAP Cast-in H50 S-RR fire collar protecting an 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by a 40-mm HDPE stack pipe. The SNAP Cast-in H50 S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 67-mm inner diameter and a 100-mm diameter base flange. The 250-mm high collar casing incorporated a 230-mm x 55-mm x 5-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 268-mm x 55-mm stainless steel mesh as shown in drawing numbered H50 S-RR-T dated 29 September 2015, by SNAP Fire Systems Pty Ltd. The penetrating service comprised a 40-mm HDPE stack pipe, with a wall thickness of 3.3-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-15-S Penetration # 2 – 40mm HDPE Pipe – Stack – H50S-RR" dated 19 November 2015, 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 grout backfill to 20-mm. | |
| | Structural Adequacy | not applicable |
| | Integrity | no failure at 241 minutes |
| | Insulation | no failure at 241 minutes |
| and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/240/240. The FRL is applicable for exposure to the fire from the same direction as tested. | | |
| This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance. | | |
| Testing Officer: | Mario Lara-Ledermann | Date of Test: 20 May 2015 |
| Issued on the 31 st day of March 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. 2716

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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