

Fire-resistance test on a fire collar protecting a concrete slab penetrated by a single service

Test Report

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Commercial-in-confidence




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Sponsored Investigation No. FSP 2074

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as a SNAP HP400R High Profile Retro fire collar protecting a 200-mm thick concrete floor slab penetrated by a nominal 375-mm diameter PVC stack pipe.

1.2 Sponsor

IG6 Pty Ltd as trustee for the IG6 IP Trust
3 Skirmish Court
Victoria Point Qld 4165

1.3 Manufacturer

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

1.4 Test standard

Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2014, Fire-resistance tests of elements of construction.

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 4948/4485

1.7 Test date

The fire-resistance test was conducted on 16 January 2020.

2 Description of specimen

2.1 General

The specimen comprised an 1150-mm x 1150-mm x 200-mm thick concrete slab penetrated by a large PVC stack pipe protected with a SNAP HP400R High Profile Retro fire collar.

The penetrated slab comprised a 200-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 - Concrete structures.

The pipe 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.

For the purpose of the test, the specimen was referenced as Specimen 1. Documents containing a complete description of each specimen were supplied by the sponsor and are retained on file.

Specimen 1 – SNAP HP400R High Profile Retro fire collar protecting a nominal 375-mm Iplex Pipelines Polyvinyl Chloride (PVC-U) Stack Pipe

The SNAP HP400R High Profile Retro fire collar comprised a 0.95-mm steel casing with a 412-mm inner diameter and a 599-mm diameter base flange. The 230-mm high collar casing incorporated two strips of Intumesh intumescent material, Intumescent-A 1377-mm x 225-mm x 2.5-mm thick and Intumescent-B 1325-mm x 225-mm x 12-mm thick. The closing mechanism comprised seven equally spaced steel springs (fabricated using SPR-SS500-20 grade stainless steel wire having a diameter of 5-mm) held with nylon fuse links and a 1360-mm x 220-mm 316 stainless steel mesh located in between the two intumescent strips as shown in drawing title "SNAP 400 High Profile Retro", dated 6 January 2020, by Snap Fire Systems. The SNAP HP400R High profile Retro fire collar was fixed to the underside of the slab using seven 30-mm x 5-mm concrete screws.

The penetrating service comprised a 400-mm OD PVC-U Iplex Pipelines stack pipe, with a wall thickness of 13.2-mm fitted through the collar's sleeve. The pipe penetrated the 200-mm thick section of the slab through a 400-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500-mm from the unexposed face of the concrete slab as shown in drawing titled "Specimen # 1 375 PVC Stack Pipe & HP400R" dated 12 December 2019, by Snap Fire Systems Pty Ltd. The pipe was open at the unexposed end and closed with a PVC end cap on the exposed end.

2.2 Dimensions

The specimen comprised an 1150-mm x 1150-mm x 200-mm thick concrete slab 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 supporting floor construction and specimen 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 “Test Slab S-19-I Layout”, dated 12 December 2019 provided by Snap Fire Systems Pty Ltd.
- Drawing titled “Specimen #1 375mm PVC stack & HP400R”, dated 12 December 2019, provided by Snap Fire Systems Pty Ltd.
- Drawing titled “SNAP 400 High Profile Retro”, dated 6 January 2020, by Snap Fire Systems.

4 Equipment

4.1 Furnace

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

The furnace was lined with refractory bricks and materials with the thermal properties as specified in AS 1530.4-2014 and was heated by combustion of a mixture of natural gas and air.

4.2 Temperature

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

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

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

4.3 Measurement system

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

5 Ambient temperature

The temperature of the test area was 26°C at the commencement of the test.

6 Departure from standard

There were no departures from the requirements of AS 1530.4-2014.

7 Termination of test

The test was terminated at 168 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 -	Black smoke is being emitted from furnace flues.
4 minutes -	Smoke is being emitted from the base of pipe.
6 minutes -	Black smoke and flames are being emitted from the end of pipe.
8 minutes -	Flaming at the top of pipe has now ceased.
9 minutes -	The level of smoke being emitted from the end of the pipe has reduced.
10 minutes -	The colour of the smoke has now changed to grey and the quantity of smoke fluing has further reduced.
12 minutes -	The quantity of smoke being emitted from the end of pipe continues to reduce.
15 minutes -	Light smoke continues to vent at the base of pipe.
23 minutes -	The quantity of smoke being emitted has further reduced.
50 minutes -	The light smoke continues fluing from the end of pipe. The smoke venting from the base of pipe has almost ceased.
60 minutes -	Little visible change to specimen.
120 minutes -	Little visible change to specimen.
150 minutes -	The level of smoke fluing for the end of pipe has begun to increase and change in colour from light grey to yellow greenish.

- 162 minutes - The quantity of smoke venting from the base of pipe has begun to increase, with visible smoke staining at the of the pipe.
- 165 minutes - Black smoke and flames are being emitted from the end of the pipe. The glow of the furnace can be seen through a large gap around the base of the pipe. Cotton pad test applied over the gap at the base of pipe – no ignition noted at this time
- 167 minutes - Integrity failure – Sustained flaming at the base of pipe greater than 10 seconds observed
- 168 minutes - Insulation failure- maximum temperature rise of 180K is exceeded at the base of pipe 25-mm away from the concrete slab.
- 168 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 temperature versus time associated with Specimen 1.

8.5 Performance

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

Specimen 1 – SNAP HP400R High Profile Retro fire collar protecting a nominal 375-mm diameter Polyvinyl Chloride (PVC) Stack Pipe.

Structural adequacy	-	not applicable
Integrity	-	167 minutes
Insulation	-	168 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 specimen was -/120/120.

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same direction as tested.

For the purposes of AS 1530.4-2014 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions.

10 Field of direct application of test results

The results of the fire test contained in this test report are directly applicable, without reference to the testing authority, to similar constructions where one or more changes listed in Clause 10.12 of AS 1530.4-2014, have been made provided no individual component is removed or reduced.

11 Tested by



Peter Gordon
Testing Officer

Appendices

Appendix A – Measurement locations

SPECIMEN	T/C Position	T/C designation
Specimen 1 - The penetrating service comprised an Ipex 375-mm OD PVC Stack Pipe, with a wall thickness of 13.2-mm, protected with a HP400R Retrofit fire collar fitted through the collar's sleeve.	On top of the slab – 25-mm from pipe North	S1
	On top of the slab – 25-mm from pipe South/East	S2
	On top of the slab – 25-mm from pipe South/West	S3
	On Pipe 25-mm above slab North	S4
	On Pipe 25-mm above slab South/ East	S5
	On Pipe 25-mm above slab South /West	S6
Rover	Rover	S7
Ambient	Ambient	S8

Appendix B – Photographs



PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMEN PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMEN PRIOR TO TESTING



PHOTOGRAPH 3 – SPECIMEN AFTER 3 MINUTES OF TESTING



PHOTOGRAPH 4 – SPECIMEN AFTER 7 MINUTES OF TESTING



PHOTOGRAPH 5 – SPECIMEN AFTER 15 MINUTES OF TESTING



PHOTOGRAPH 6 – SPECIMEN AFTER 30 MINUTES OF TESTING



PHOTOGRAPH 7 – SPECIMEN AFTER 60 MINUTES OF TESTING



PHOTOGRAPH 8 – SPECIMEN AFTER 120 MINUTES OF TESTING



PHOTOGRAPH 9 – SPECIMEN AFTER 154 MINUTES OF TESTING



PHOTOGRAPH 10 – SPECIMEN AFTER 155MINUTES OF TESTING



PHOTOGRAPH 11 – SPECIMEN AFTER 165 MINUTES OF TESTING



PHOTOGRAPH 12 – SPECIMEN AFTER 165 MINUTES OF TESTING



PHOTOGRAPH 13 – SPECIMEN AFTER 167 MINUTES OF TESTING



PHOTOGRAPH 14 – EXPOSED FACE OF SPECIMEN AT THE CONCLUSION OF TESTING

Appendix C – Test data charts

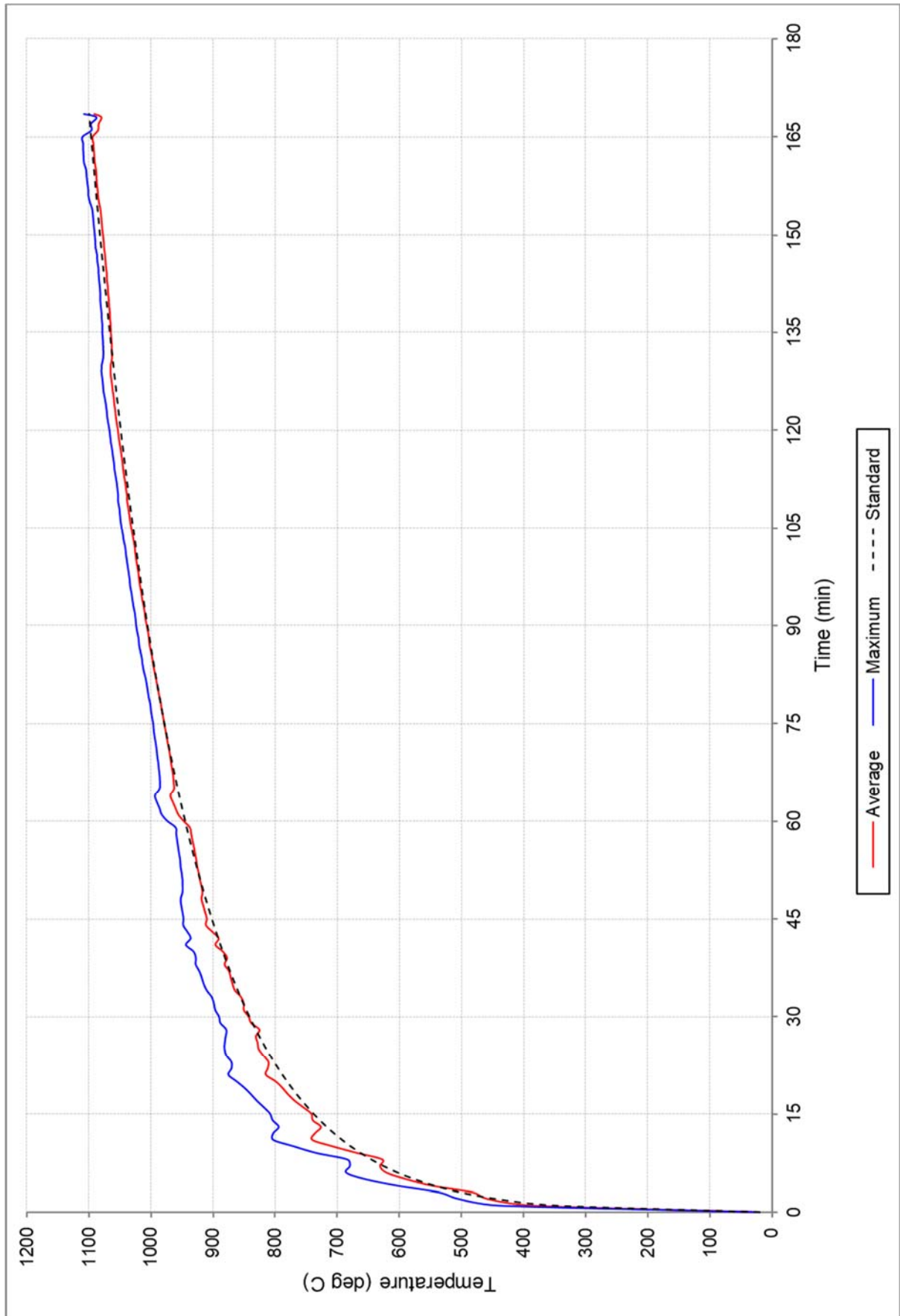


FIGURE 1 – FURNACE TEMPERATURE

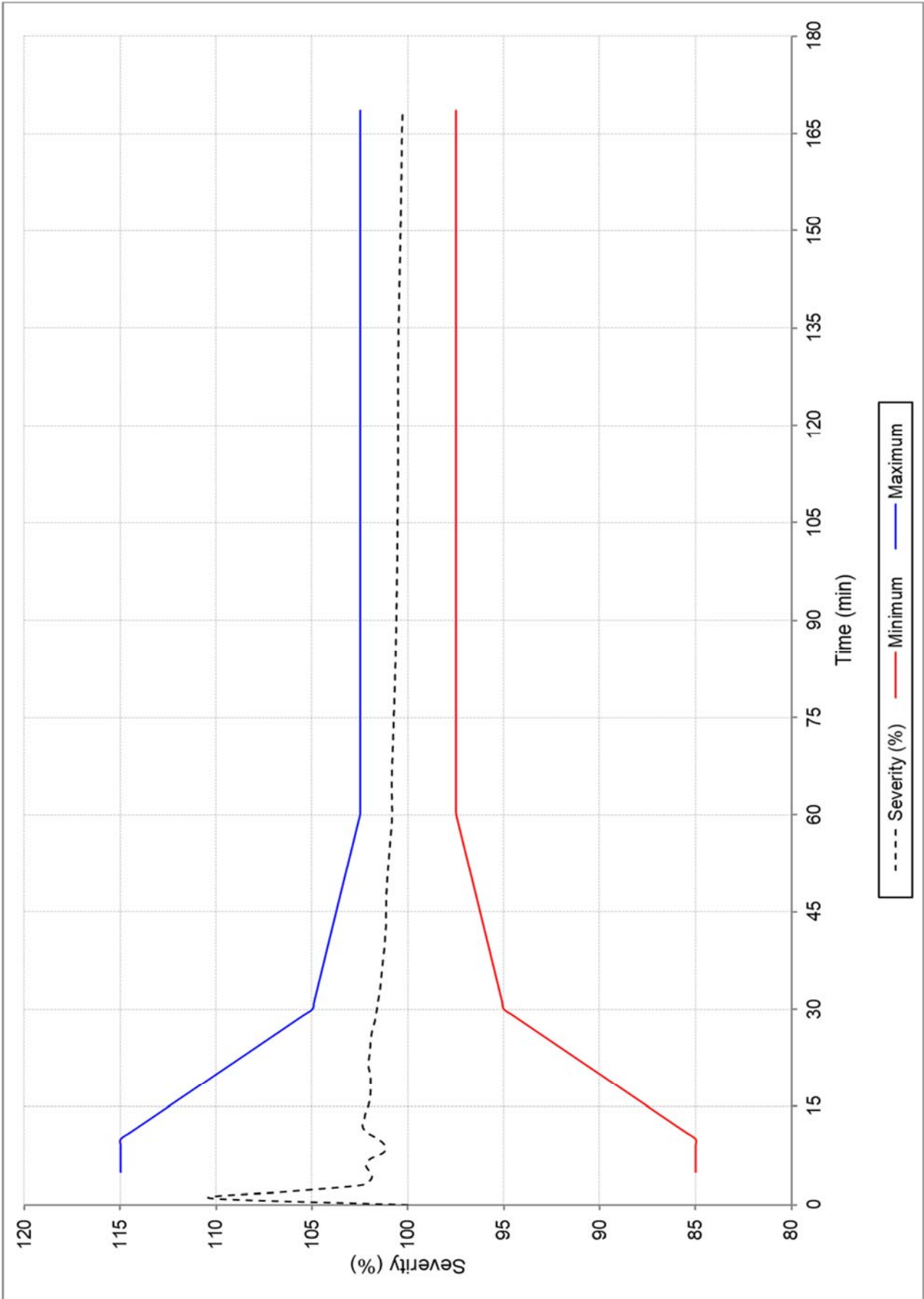


FIGURE 2 – FURNACE SEVERITY

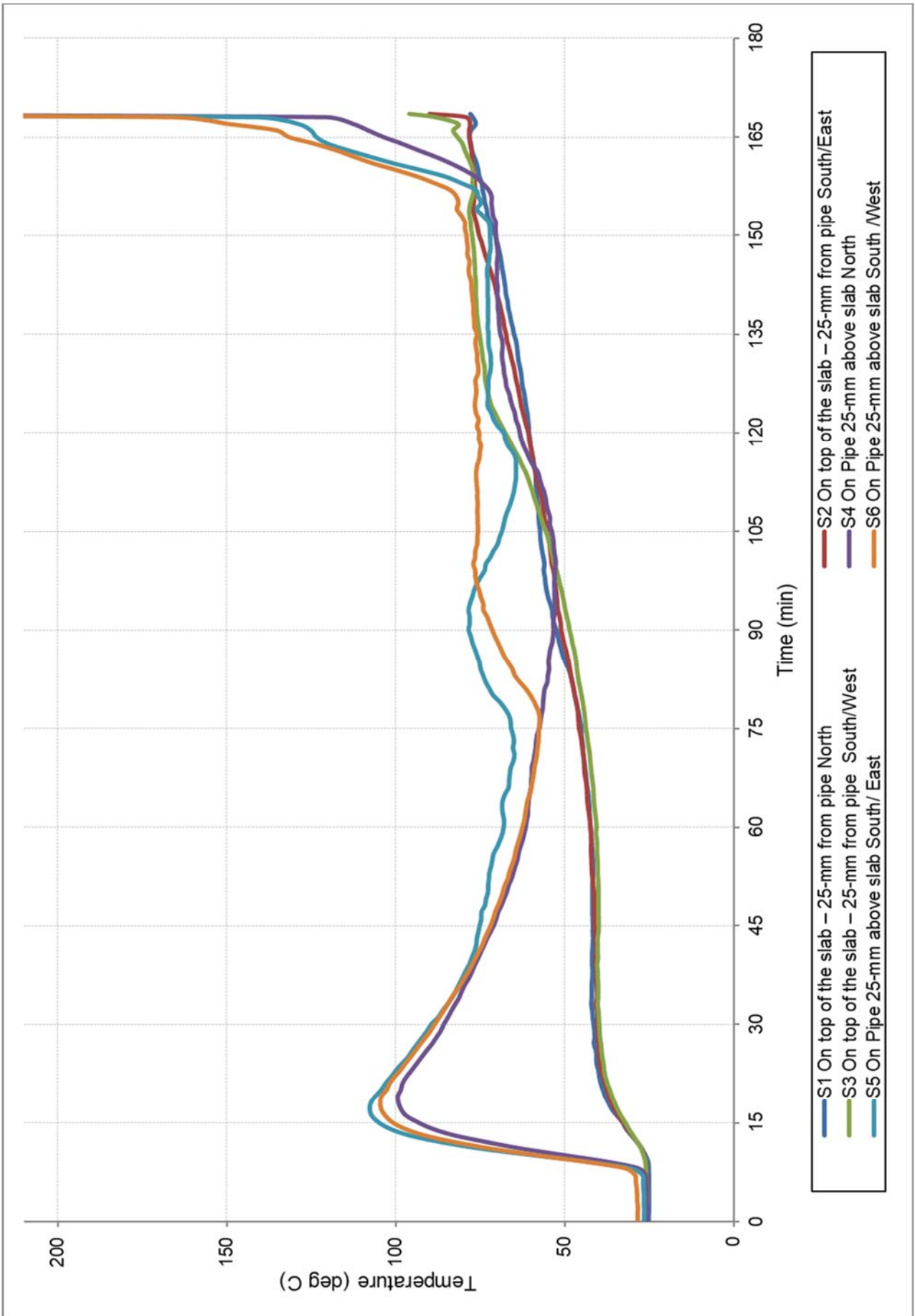
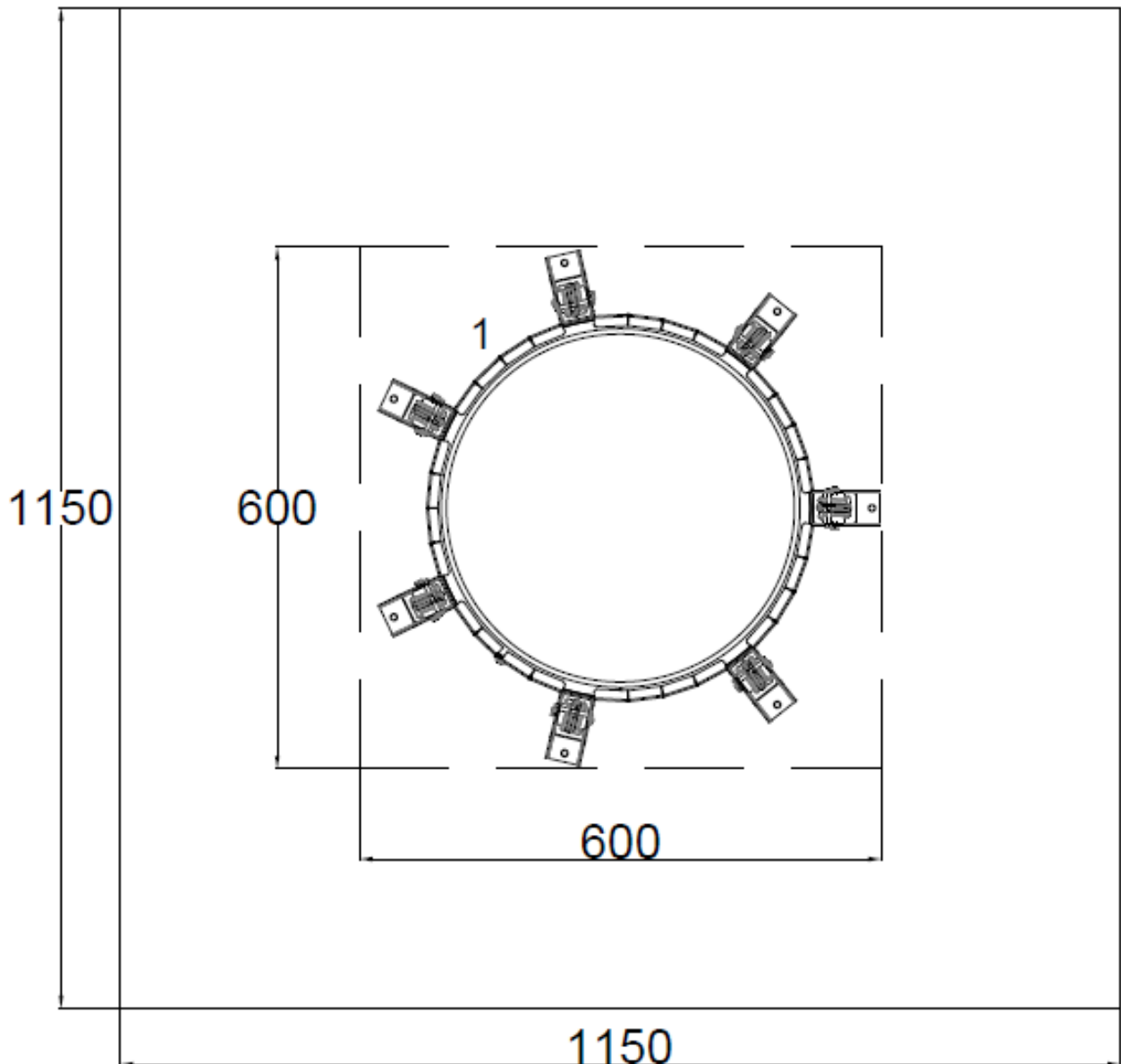


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

Snap Fire Systems Pty Ltd

Test Slab S-19-I Layout

Date: 12 DEC 2019



Penetration	Collar Code	Pipe Type	Pipe Diameter (mm)	Sealant
1	HP400R	PVC	375	n/a

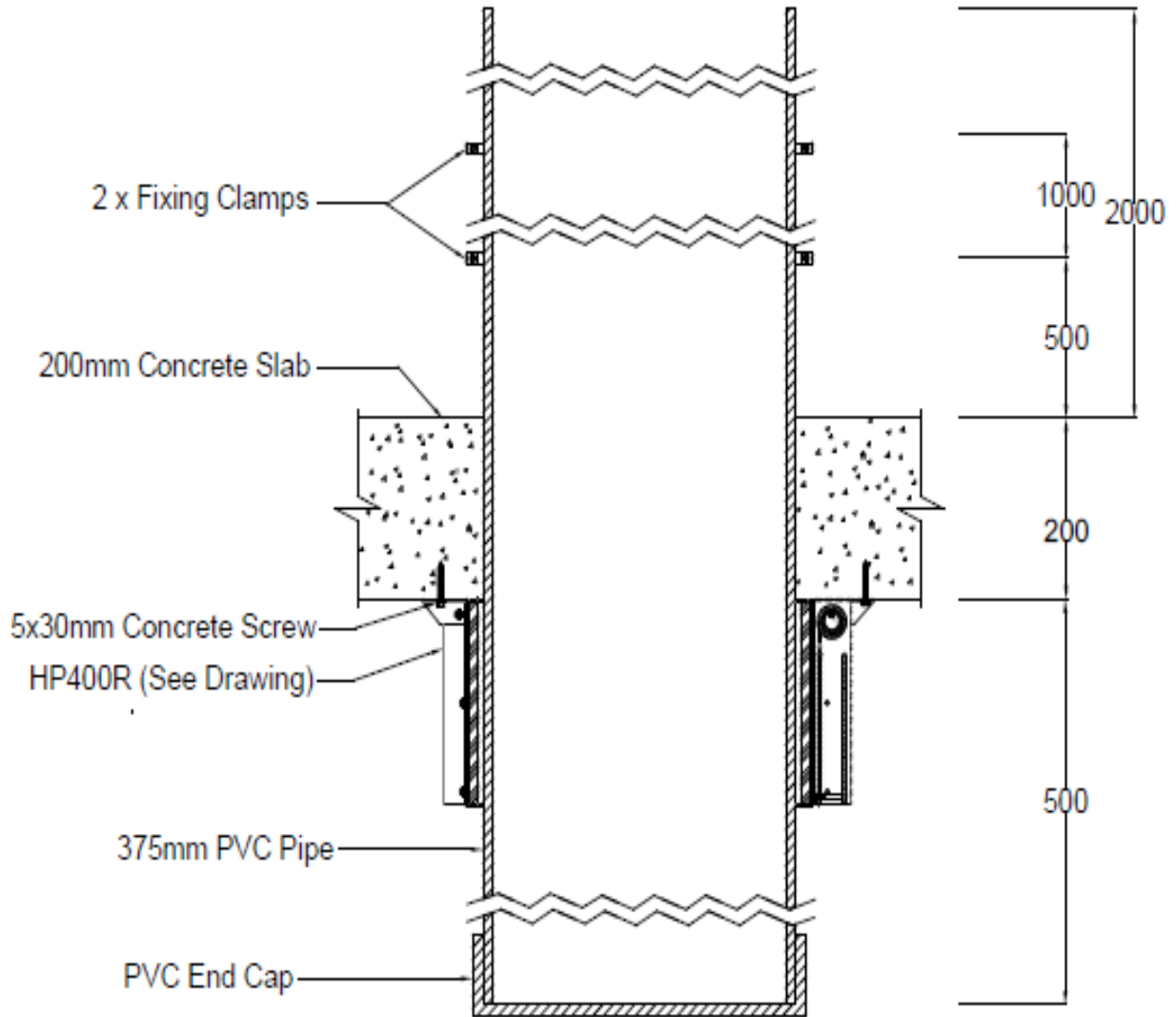
DRAWING TITLED "TEST SLAB S-19-I LAYOUT", PROVIDED BY SNAP FIRE SYSTEMS PTY LTD

Snap Fire Systems Pty Ltd

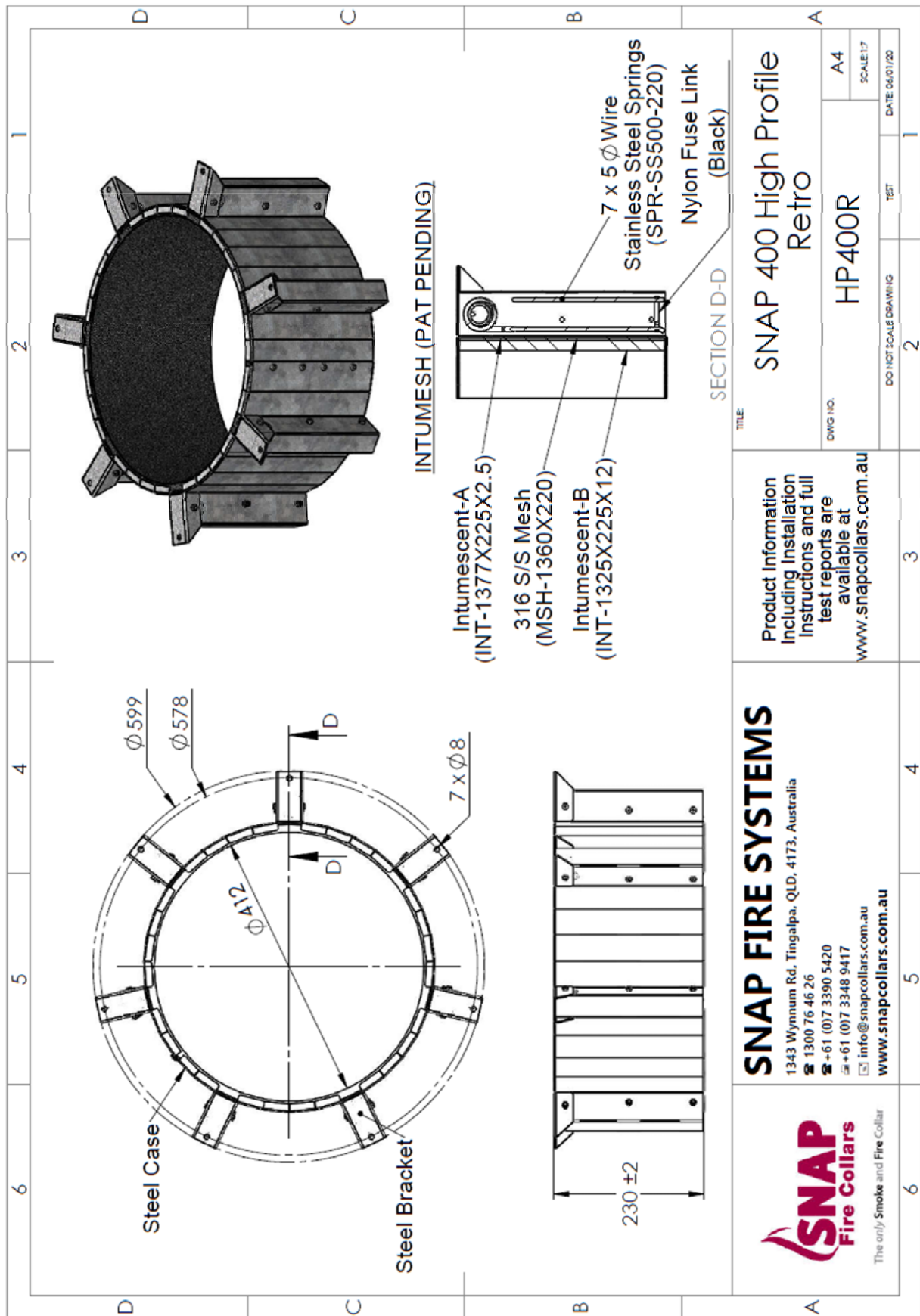
Specimen #1

375mm PVC Stack & HP400R

Date: 12 DEC 2019






Appendix E – Specimen Drawing



DRAWING TITLED "SNAP 400 HIGH PROFILE RETRO", 6 JANUARY 2020, BY SNAP FIRE SYSTEMS

Appendix F – Certificate(s) of Test

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. 3405
This is to certify that the element of construction described below was tested by CSIRO Infrastructure Technologies in accordance with Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4 Fire-resistance tests of elements of construction, 2014, Section 10: Service penetrations and control joints, on behalf of:		
IG6 Pty Ltd as trustee for the IG6 IP Trust 3 Skirmish Court Victoria Point Qld 4165		
A full description of the test specimen and the complete test results are detailed in the Division's report numbered FSP 2074.		
Product Name:	SNAP HP400R High Profile Retro fire collar protecting a nominal 375-mm Iplex Pipelines Polyvinyl Chloride (PVC-U) Stack Pipe (Specimen 1)	
Description:	The specimen comprised an 1150-mm x 1150-mm x 200-mm thick concrete slab penetrated by a large PVC stack pipe protected with a SNAP HP400R High Profile Retro fire collar. The penetrated slab comprised a 200-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 - Concrete structures. The SNAP HP400R High Profile Retro fire collar comprised a 0.95-mm steel casing with a 412-mm inner diameter and a 599-mm diameter base flange. The 230-mm high collar casing incorporated two strips of Intumesh intumescent material, Intumescent-A 1377-mm x 225-mm x 2.5-mm thick and Intumescent-B 1325-mm x 225-mm x 12-mm thick. The closing mechanism comprised seven equally spaced steel springs (fabricated using SPR S5500-20 grade stainless steel wire having a diameter of 5 mm) held with nylon fuse links and a 1360-mm x 220-mm 316 stainless steel mesh located in between the two intumescent strips as shown in drawing title "SNAP 400 High Profile Retro", dated 6 January 2020, by Snap Fire Systems. The SNAP HP400R High profile Retro fire collar was fixed to the underside of the slab using seven 30-mm x 5-mm concrete screws. The penetrating service comprised a 400-mm OD PVC-U Iplex Pipelines stack pipe, with a wall thickness of 13.2-mm fitted through the collar's sleeve. The pipe penetrated the 200-mm thick section of the slab through a 400-mm diameter opening and projected vertically 2000-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1500 mm from the unexposed face of the concrete slab as shown in drawing titled "Specimen # 1 375 PVC Stack Pipe & HP400R" dated 12 December 2019, by Snap Fire Systems Pty Ltd. The pipe was open at the unexposed end and closed with a PVC end cap on the exposed end.	
Performance observed in respect of the following AS 1530.4-2014 criteria		
Structural Adequacy	-	not applicable
Integrity	-	167 minutes
Insulation	-	168 minutes
and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/120/120.		
The fire-resistance level (FRL) of the specimen is applicable when the system is exposed to fire from the same direction as tested. The maximum FRL of any test specimen cannot exceed the FRL achieved by the system in which it was installed. For the purposes of AS 1530.4-2014 the results of these fire tests may be used to directly assess fire hazard, but it should be noted that a single test method will not provide a full assessment of fire hazard under all fire conditions. This certificate is provided for general information only and does not comply with regulatory requirements for evidence of compliance.		
Testing Officer:	Peter Gordon	Date of Test: 16 January 2020
Issued on the 11 th day of May 2020 without alterations or additions.		
 Brett Roddy Manager, Fire Testing and Assessments		
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	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 - Testing	

COPY OF CERTIFICATE OF TEST – NO. 3405

References

The following informative documents are referred to in this Report:

- | | |
|----------------|---|
| AS 1530.4-2014 | Methods for fire tests on building materials, components and structures Part 4: Fire-resistance tests of elements of building construction. |
| AS 4072.1-2005 | Components for the protection of openings in fire-resistant separating elements. Part 1: Service penetrations and control joints. |
| AS 3600-2018 | Concrete structures |

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