Fire-resistance test on fire collars protecting a CSR Hebel AAC block wall penetrated by services

Test Report

Author: Mario Lara-Ledermann
Report number: FSP 1668
Date: 24 December 2014

Client: Snap Fire Systems Pty Ltd

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	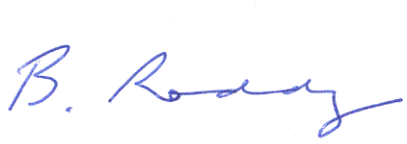	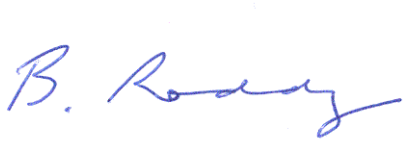
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Fire-resistance test on fire collars protecting a CSR Hebel AAC block wall penetrated by services

Sponsored Investigation No. FSP 1668

1 Introduction

1.1 Identification of specimen

The sponsor identified the specimen as Snap Retrofitted Fire Collars protecting a CSR Hebel block wall penetrated by one (1) Polyvinyl Chloride (PVC) stack pipe and one (1) High Density Polyethylene (HDPE) 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 4459/3795

1.7 Test date

The fire-resistance test was conducted on 11 November 2014.

2 Description of specimen

2.1 General

The specimen comprised a 150-mm thick CSR Hebel block wall, with a stated FRL of -/240/240, penetrated by one (1) Polyvinyl Chloride (PVC) stack pipe and one (1) High Density Polyethylene (HDPE) stack pipe.

For the purpose of the test, the specimens were referenced as Penetrations A and B. Only two specimens are included in this report.

The plastic pipes are stated to be manufactured in accordance with:

- Polyvinyl Chloride (PVC) pipe manufactured in accordance with AS/NSZ 1260.
- High Density Polyethylene (HDPE) pipe manufactured in accordance with ISO 770/8772.

Penetration # A – HP150 R retrofitted fire collar protecting a 160-mm High Density Polyethylene (HDPE) stack pipe

The SNAP retrofitted HP150 R collar comprised a 0.95-mm steel casing with a 175-mm inner diameter and a 326-mm diameter base flange. The 117-mm high collar casing incorporated a strip of 570-mm x 112-mm x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four 304 stainless steel springs, with nylon fuse links, and a 596-mm x 112-mm stainless steel mesh as shown in drawing numbered HP 150 R -T dated 3 November 2014, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 160-mm diameter High Density Polyethylene (HDPE) stack pipe, with a wall thickness of 6.9-mm fitted through a 175-mm diameter hole in the block wall. The pipe projected horizontally 2000-mm away from the unexposed face of the CSR Hebel block wall and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the CSR Hebel block wall as shown in drawing titled “Penetration #A – HDPE (160-mm OD) Stack” dated 11 November 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.

The annular gap between the pipe and the wall was sealed with a 20-mm deep bead of Fullers Firesound sealant.

Penetration # B – HP250 R retrofitted fire collar protecting a 250-mm diameter Polyvinyl Chloride Sandwich Construction (PVC-SC) stack pipe

The SNAP retrofitted HP250 R collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 460-mm diameter base flange. The 184-mm high collar casing incorporated two strips of Intumesh intumescent material, 910-mm x 179-mm x 12-mm thick and 958-mm x 179-mm x 2.5-mm thick. The closing mechanism comprised four stainless steel springs, with nylon fuse links, and a 949-mm x 179-mm 304 stainless steel mesh locate inbetween the intumescent strips as shown in drawing numbered HP 250 R-T dated 14 November 2014, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 250-mm diameter Polyvinyl Chloride Sandwich Construction (PVC-SC) stack pipe, with a wall thickness of 7.25-mm fitted through a 267-mm diameter hole in the block wall. The pipe projected horizontally 2000-mm away from the unexposed face of the CSR Hebel block wall and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the CSR Hebel block wall as shown in drawing titled "Penetration #B – PVC-SC (250-mm OD) Stack" dated 11 November 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a PVC End cap.

The annular gap between the pipe and the wall was sealed with a 20-mm deep bead of Fullers Firesound sealant.

2.2 Dimensions

The overall dimension of the CSR Hebel block wall was 1150-mm wide x 1150-mm long, to suit the opening in the specimen containing frame.

2.3 Orientation

The CSR Hebel block wall was placed vertically against the furnace chamber.

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 – HDPE (160-mm OD) Stack" dated 11 November 2014, by Snap Fire Systems Pty Ltd.

Drawing titled "Penetration #B – PVC-SC (250-mm OD) Stack" dated 11 November 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered HP 150 R-T dated 3 November 2014, by Snap Fire Systems Pty Ltd.

Drawing numbered HP 250 R-T dated 14 November 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 19°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 220 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 from Penetration #B.
3 minutes -	Dense smoke issues from Penetration #B.
5 minutes -	Fluing is visible from Penetration #A.
6 minutes -	Dense smoke issues from Penetration #A.
7 minutes -	Fluing has decreased from Penetration #B.
16 minutes -	Light smoke is visible from collar of Penetration #B.
21 minutes -	Fluing stops from collar of Penetration #B.
28 minutes -	Fluing is visible from Penetration #B.
36 minutes –	Light smoke is visible from collar of Penetration #A.

37 minutes -	Light smoke fluing from Penetration #B becomes dense.
117 minutes -	Brown-coloured condensate starts issuing forth from Penetration #B.
158 minutes –	Smoke is being emitted from base of Penetration # B. Smoke fluing through Penetration #A. Cotton pad test applied on Penetration #B – no failure.
166 minutes -	Intumescent material is visible at the base of Penetration #B.
178 minutes -	Cotton pad test applied on Penetration #B – no failure.
195 minutes -	Integrity failure on Penetration #B. Cotton pad test applied on the base of the pipe – Ignition noted (photograph 6).
203 minutes -	Insulation failure of penetration # B - maximum temperature rise of 180 deg C is exceeded on the pipe. Pipe of penetration B removed, remaining hole was plugged with ceramic fibre.
215 minutes -	Smoke is being emitted from base of Penetration #A.
217 minutes -	Intumescent material is visible at the base of Penetration A.
219 minutes -	Integrity failure on Penetration #A. Cotton pad test applied on the base of the pipe – Ignition noted (photograph 7).
220 minutes -	Insulation failure of penetration # A – maximum temperature rise of 180 deg C is exceeded on the pipe.
220 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 #A.

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

8.5 Performance

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

Penetration # A – HP150 R retrofitted fire collar protecting a 160-mm diameter High Density Polyethylene (HDPE) stack pipe

Structural adequacy	-	not applicable
Integrity	-	219 minutes
Insulation	-	220 minutes

Penetration # B – HP250 R retrofitted fire collar protecting a 250-mm diameter Polyvinyl Chloride Sandwich Construction (PVC-SC) stack pipe

Structural adequacy	-	not applicable
Integrity	-	195 minutes
Insulation	-	203 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 #A	-	-/180/180; and
Penetration #B	-	-/180/180.

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 A	On slab 25-mm from collar.	S1
	On slab 25-mm from collar.	S2
	On collar.	S3
	On collar.	S4
	On pipe 25-mm from collar.	S5
	On pipe 25-mm from collar.	S6
Penetration B	On slab 25-mm from collar.	S7
	On slab 25-mm from collar.	S8
	On collar.	S9
	On collar.	S10
	On pipe 25-mm from collar.	S11
	On pipe 25-mm from collar.	S12

Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING

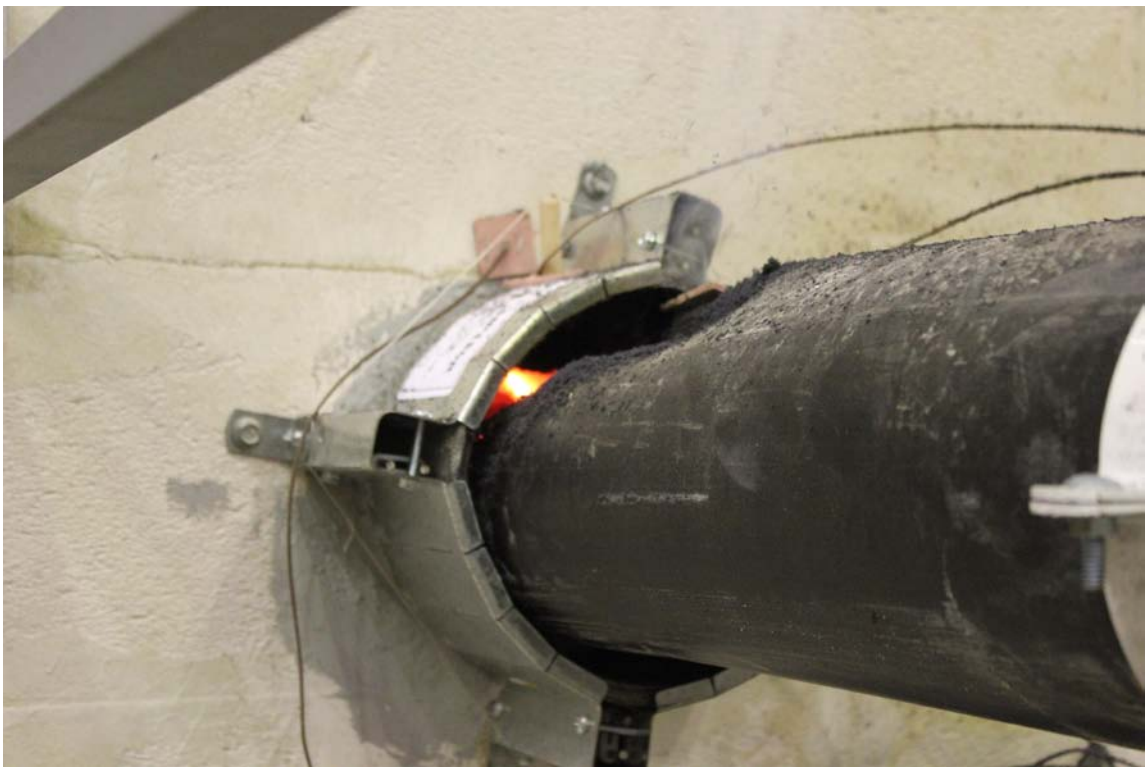
PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

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 – SPECIMEN #B AT 195 MINUTES OF TESTING



PHOTOGRAPH 7 – SPECIMEN #A AT 195 MINUTES OF TESTING

PHOTOGRAPH 8 – SPECIMENS AFTER 220 MINUTES OF TESTING

Appendix C – Furnace Temperature

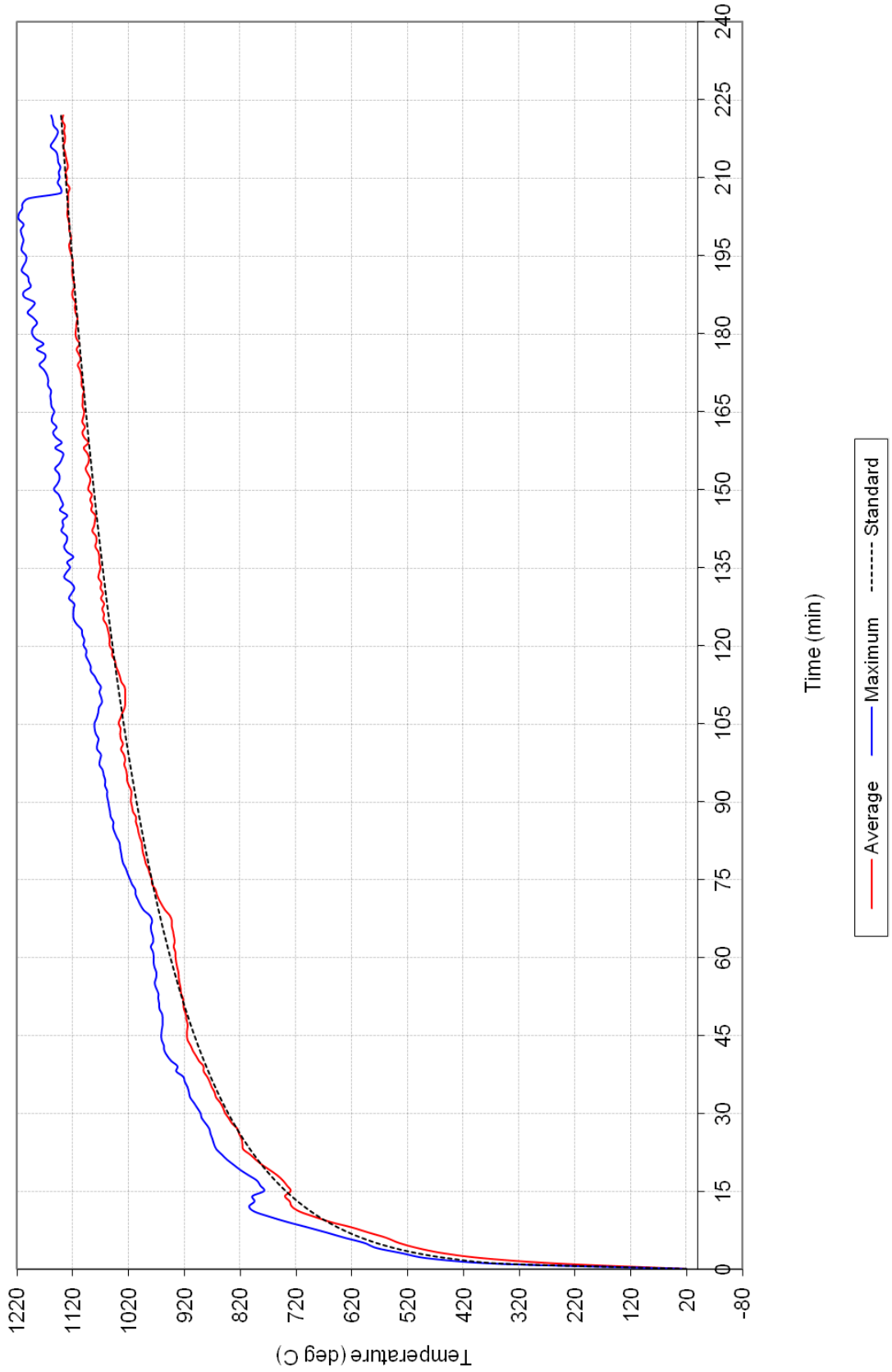


FIGURE 1 – FURNACE TEMPERATURE

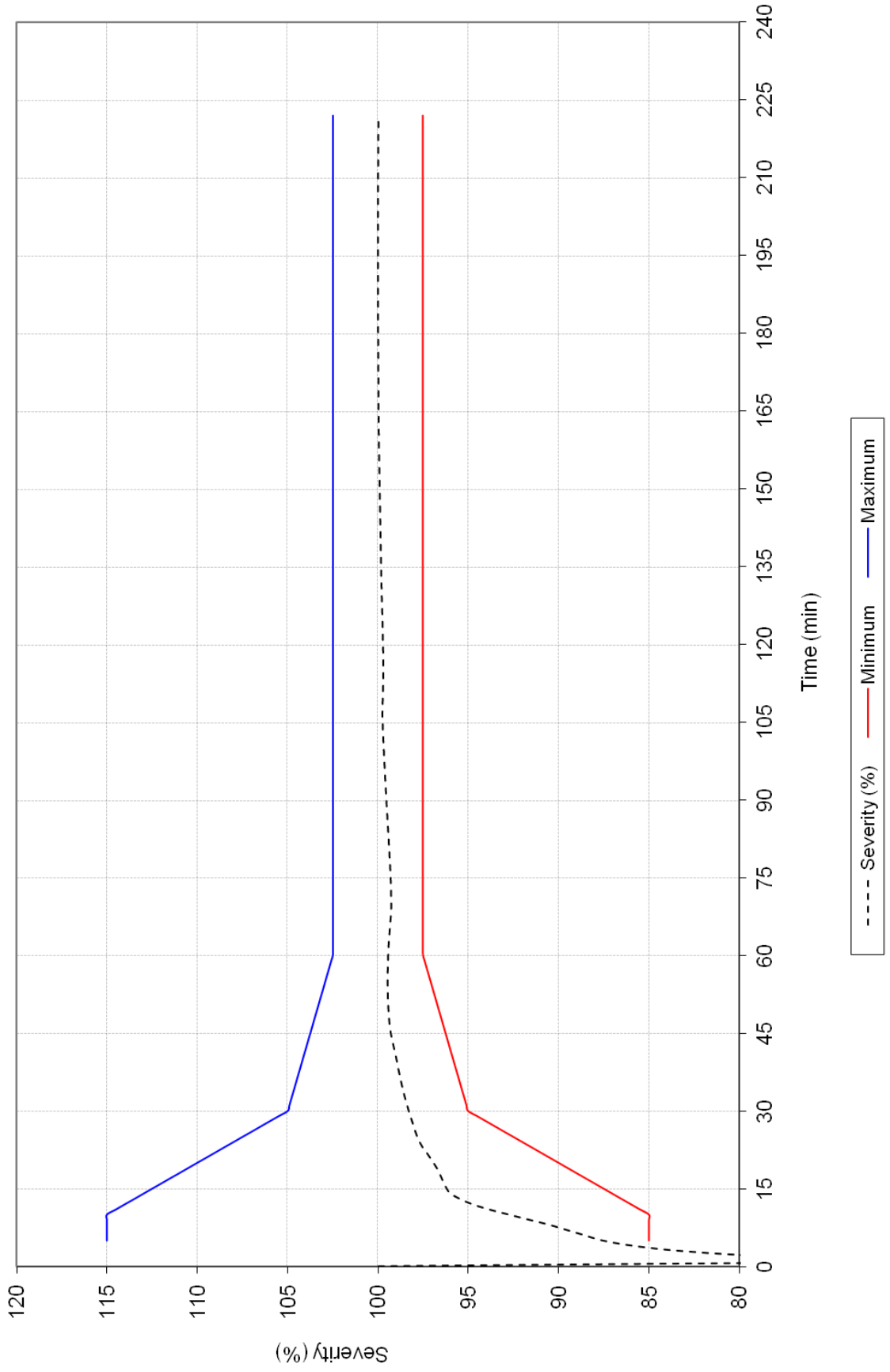


FIGURE 2 – FURNACE SEVERITY

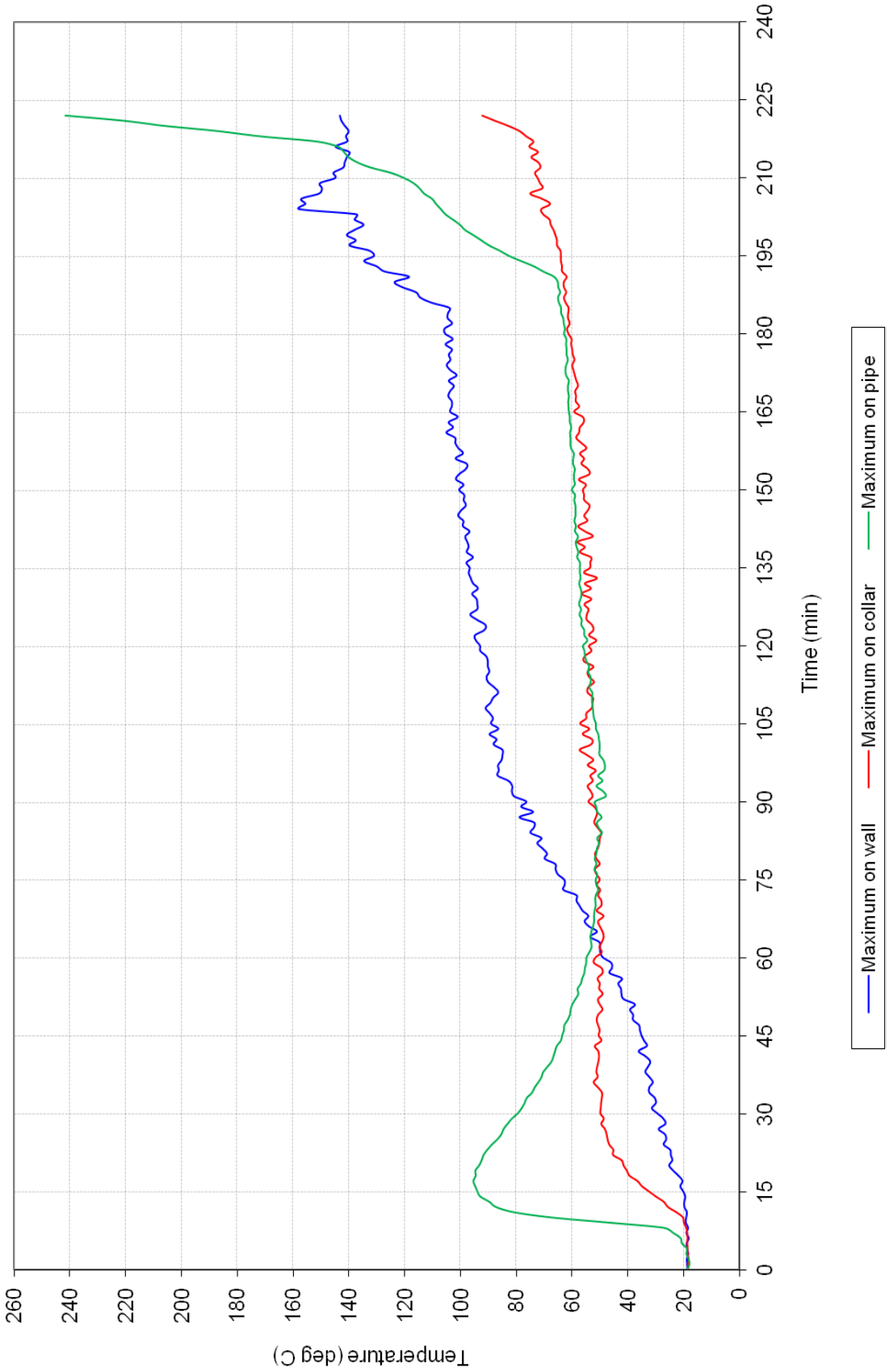


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION A

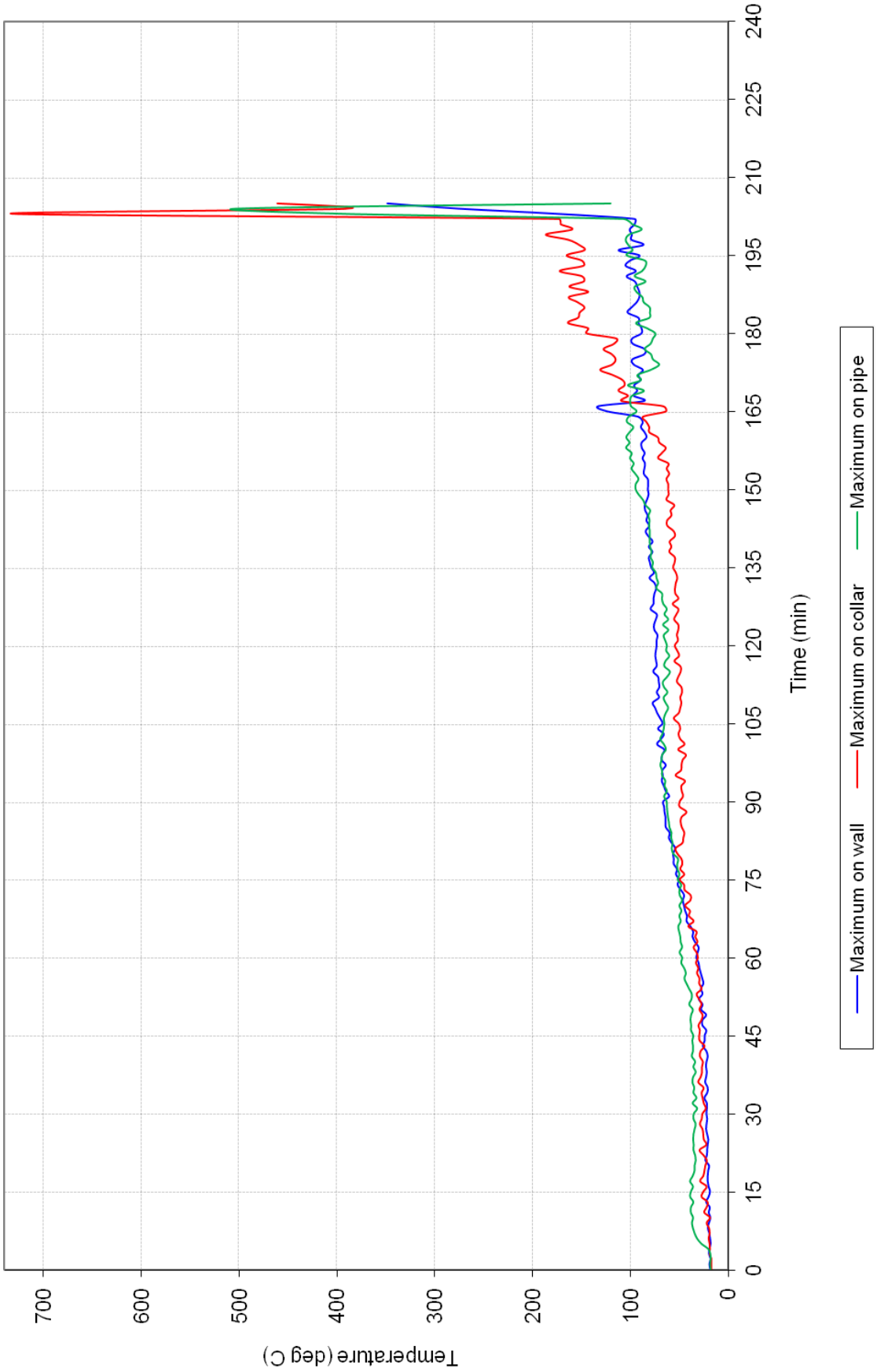
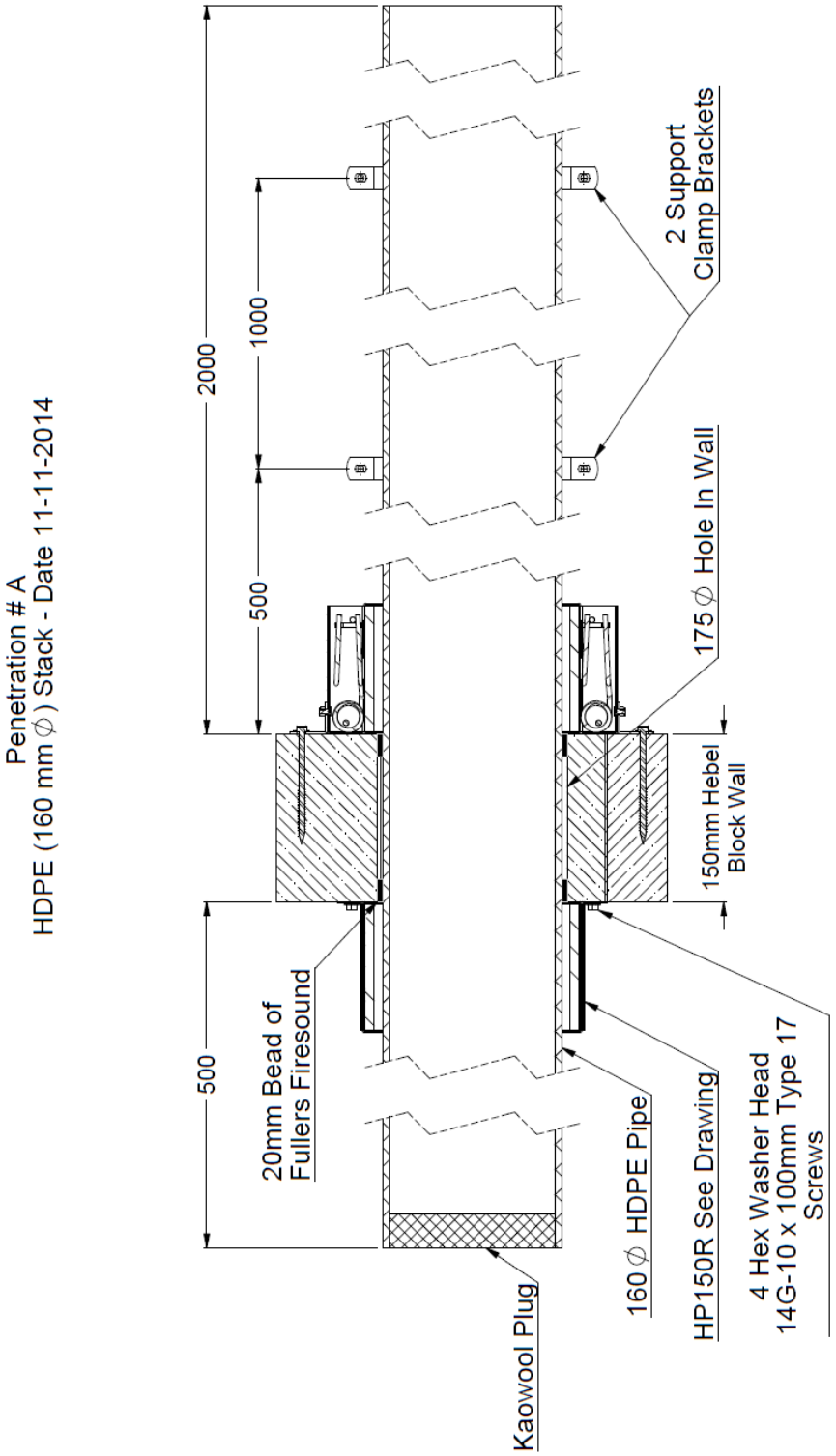
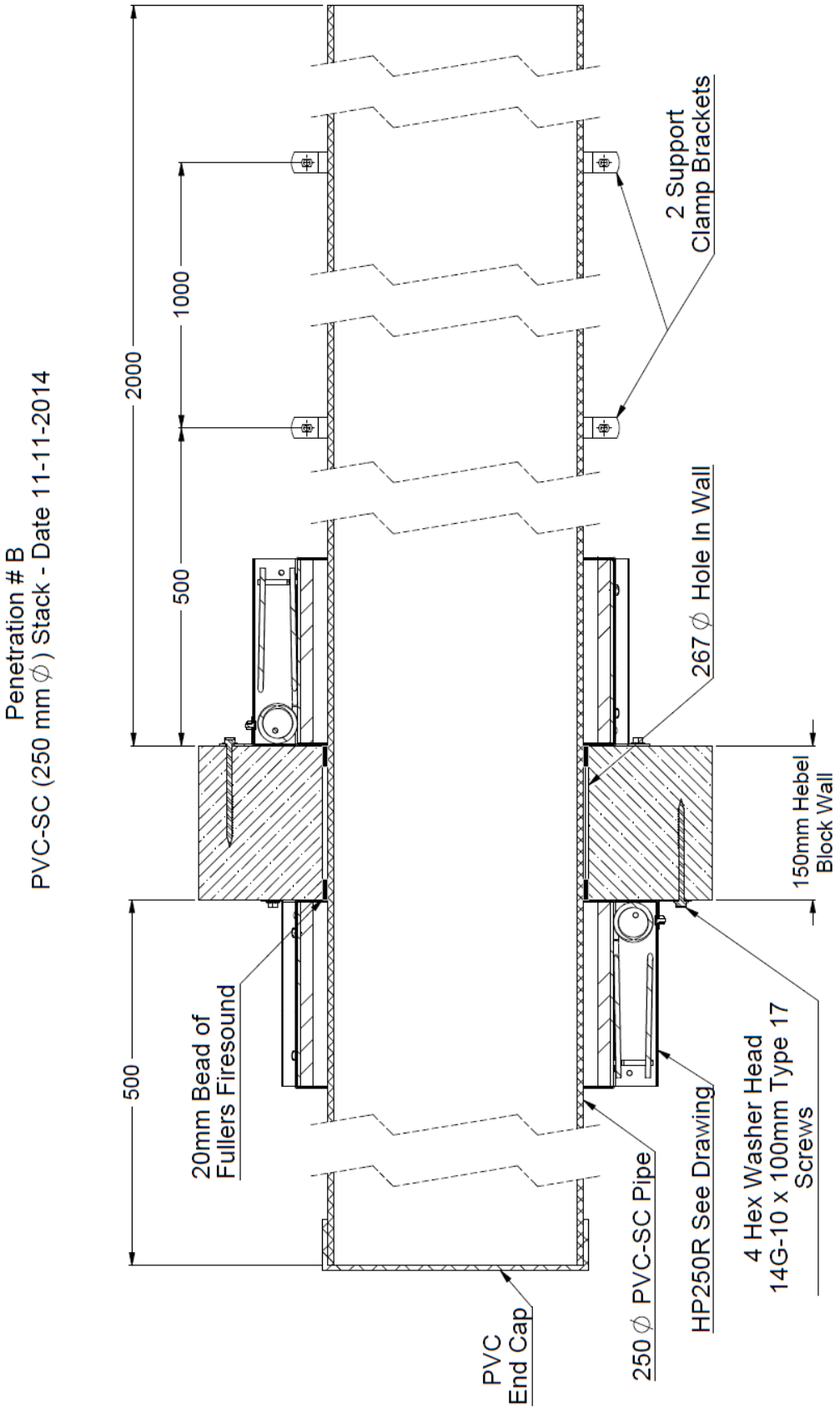


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH PENETRATION B

Appendix D – Installation drawings

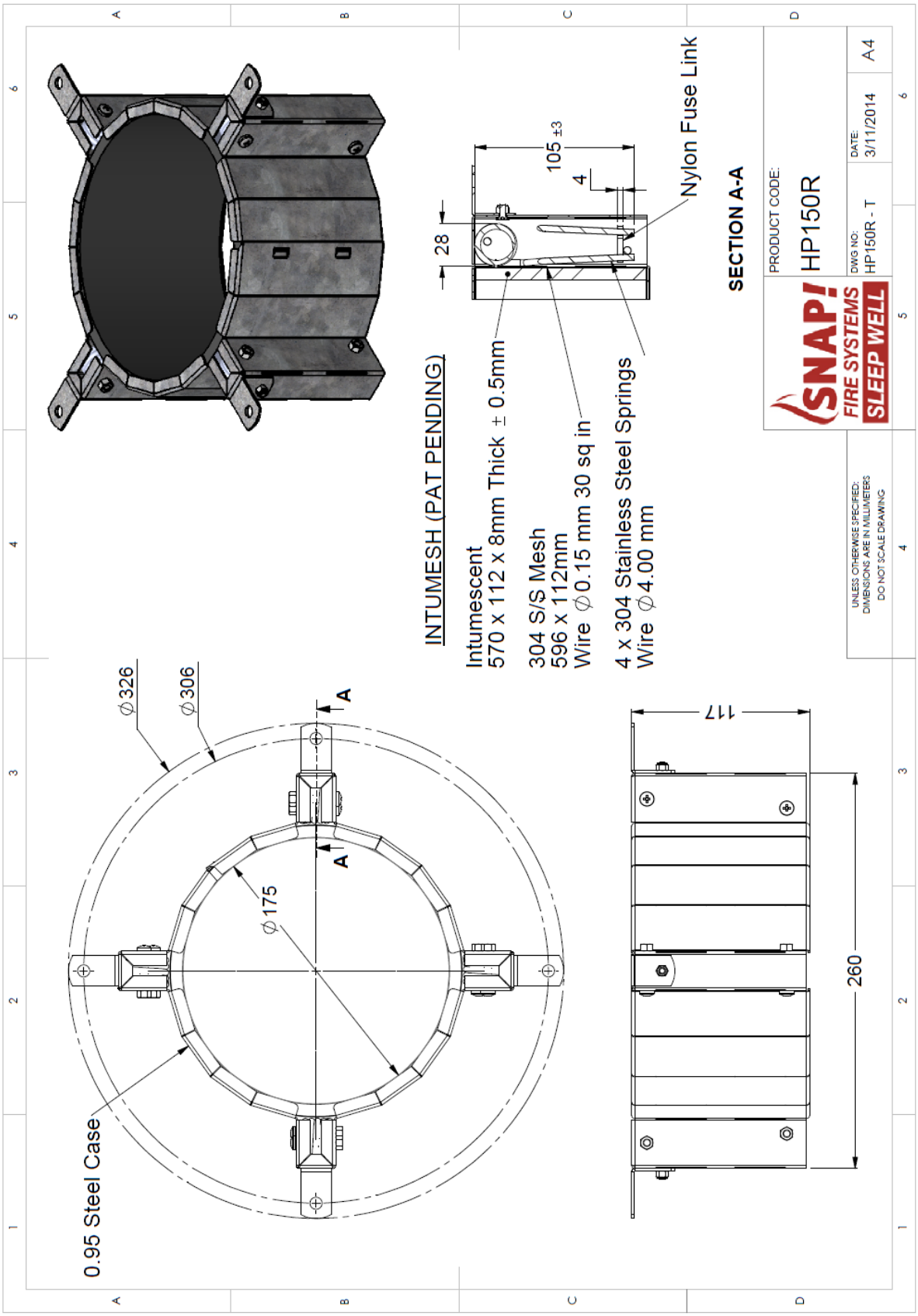


DRAWING TITLED "PENETRATION #A – HDPE (160-MM OD) STACK" DATED 11 NOVEMBER 2014, BY SNAP FIRE SYSTEMS PTY LTD

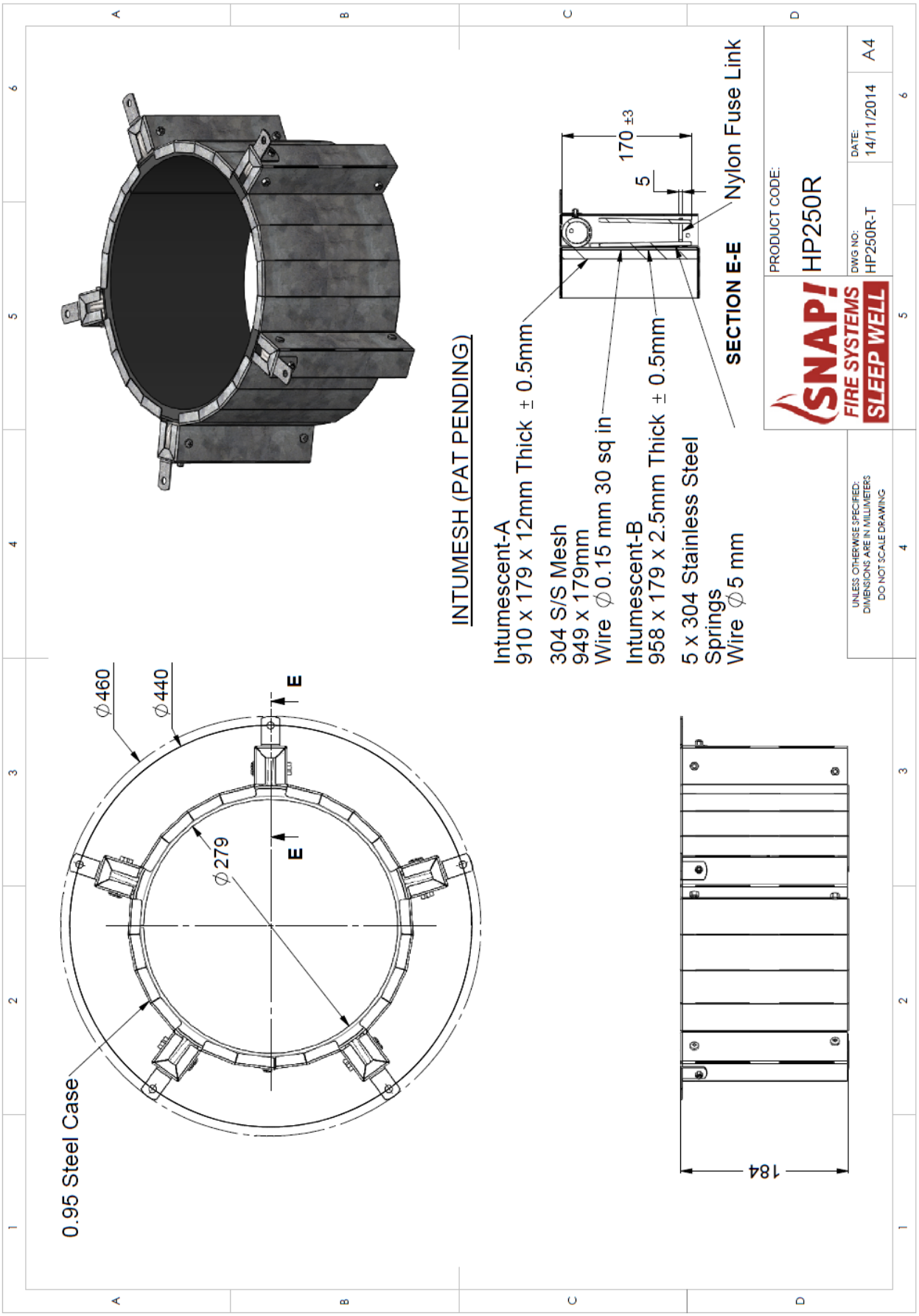


DRAWING TITLED "PENETRATION #B – PVC-SC (250-MM OD) STACK" DATED 11 NOVEMBER 2014, BY SNAP FIRE SYSTEMS PTY LTD

Appendix E – Specimen Drawings



DRAWING NUMBERED HP 150R-T DATED 3 NOVEMBER 2014, BY SNAP FIRE SYSTEMS PTY LTD.



DRAWING NUMBERED HP250R-T DATED 14 NOVEMBER 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

Certificate of Test

No. 2620

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 1668.

Product Name: Penetration # A – HP150 R retrofitted fire collar protecting a 160-mm High Density Polyethylene (HDPE) stack pipe

Description: The SNAP retrofitted HP150 R collar comprised a 0.95-mm steel casing with a 175-mm inner diameter and a 326-mm diameter base flange. The 117-mm high collar casing incorporated a strip of 570-mm x 112-mm x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four 304 stainless steel springs, with nylon fuse links, and a 596-mm x 112-mm stainless steel mesh as shown in drawing numbered HP 150 R -T dated 3 November 2014, by Snap Fire Systems Pty Ltd.
The penetrating service comprised a 160-mm diameter High Density Polyethylene (HDPE) stack pipe, with a wall thickness of 6.9-mm fitted through a 175-mm diameter hole in the block wall. The pipe projected horizontally 2000-mm away from the unexposed face of the CSR Hebel block wall and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the CSR Hebel block wall as shown in drawing titled "Penetration #A – HDPE (160-mm OD) Stack" dated 11 November 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a Kaowool Plug.
The annular gap between the pipe and the wall was sealed with a 20-mm deep bead of Fullers Firesound sealant.

Structural Adequacy	not applicable
Integrity	219 minutes
Insulation	220 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 fire from either direction.

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: 11 November 2014

Issued on the 22nd day of December 2014 without alterations or additions.

B. Roddy

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. 2620

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PO Box 310, North Ryde NSW 1670, Australia
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Certificate of Test

No. 2621

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 1668.

Product Name: Penetration # B – HP250 R retrofitted fire collar protecting a 250-mm diameter Polyvinyl Chloride Sandwich Construction (PVC-SC) stack pipe

Description: The SNAP retrofitted HP250 R collar comprised a 0.95-mm steel casing with a 279-mm inner diameter and a 460-mm diameter base flange. The 184-mm high collar casing incorporated two strips of Intumesh intumescent material, 910-mm x 179-mm x 12-mm thick and 958-mm x 179-mm x 2.5-mm thick. The closing mechanism comprised four stainless steel springs, with nylon fuse links, and a 949-mm x 179-mm 304 stainless steel mesh locate inbetween the intumescent strips as shown in drawing numbered HP 250 R-T dated 14 November 2014, by Snap Fire Systems Pty Ltd.
The penetrating service comprised a 250-mm diameter Polyvinyl Chloride Sandwich Construction (PVC-SC) stack pipe, with a wall thickness of 7.25-mm fitted through a 267-mm diameter hole in the block wall. The pipe projected horizontally 2000-mm away from the unexposed face of the CSR Hebel block wall and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the CSR Hebel block wall as shown in drawing titled "Penetration #B – PVC-SC (250-mm OD) Stack" dated 11 November 2014, by Snap Fire Systems Pty Ltd. On the exposed end, the pipe was capped with a PVC End cap.
The annular gap between the pipe and the wall was sealed with a 20-mm deep bead of Fullers Firesound sealant.

Structural Adequacy	not applicable
Integrity	195 minutes
Insulation	203 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 fire from either direction.

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: 11 November 2014

Issued on the 22nd day of December 2014 without alterations or additions.

B. Roddy

Brett Roddy
Manager, Fire Testing and Assessments

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COPY OF CERTIFICATE OF TEST – NO. 2621

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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