

Fire-resistance test on services penetrating a plasterboard wall

Test Report

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Client: Knauf Plasterboard Pty Limited

Commercial-in-confidence




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Fire-resistance test on services penetrating a plasterboard wall

Sponsored Investigation No. FSP 2084

1 Introduction

1.1 Identification of specimen

The sponsor identified the test specimens as four (4) services penetrating a Knauf plasterboard wall system protected by various fire stopping systems.

1.2 Sponsor

Knauf Plasterboard Pty Limited
31 Military Road
Matraville, NSW 2036

1.3 Manufacturer

Knauf Plasterboard Pty Limited
31 Military Road
Matraville, NSW 2036

BOSS Products (Australia) Pty Ltd
Unit 8, 15-23 Kumulla Rd
Caringbah NSW

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 4954/4438

1.7 Test date

The fire-resistance test was conducted on 12 February 2020.

2 Description of specimen


2.1 General

The specimens comprised of a PE-Xa Rehau Rautitan Pipe, a PVC pipe, a 3-piece tap faucet and a SHS support arm penetrating the unexposed face of a plasterboard wall protected by various fire stopping systems.

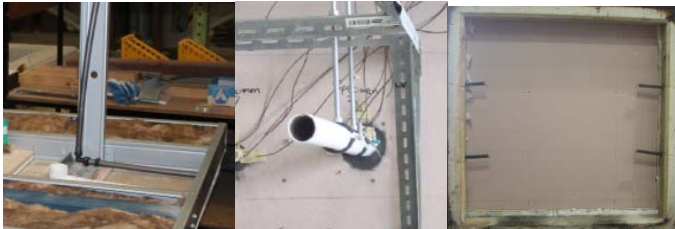
The penetrated wall system comprised a single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs to form a 118-mm thick wall system. The wall cavity was filled with 75-mm thick Knauf Earthwool insulation (density of 11 kg/m³). The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.

Specimen No.	Penetration details
1	A 20-mm diameter PE-Xa Rehau Rautitan pipe incorporating an elbow joint in the wall cavity penetrating a 55-mm aperture on the unexposed face protected with Fire Mastic-HPE sealant.
2	A 43-mm diameter PVC pipe incorporating an elbow joint in the wall cavity penetrating an 88-mm aperture on the unexposed face protected with Fire Mastic-HPE sealant.
3	A Hansgrohe wall mounted faucet incorporating a 3-piece hand basin tap set penetrating three 75-mm apertures on the unexposed face protected with FireMastic HPE sealant.
4	A SHS 65-mm x 65-mm x 6mm thick beam penetrating the unexposed face of the wall through a 75-mm x 75-mm square opening protected with Knauf Bindex Fire and Acoustic sealant and 13-mm thick FireShield plasterboard.


Specimen 1 – A 20-mm diameter PE-Xa Rehau Rautitan pipe incorporating an elbow joint in the wall cavity penetrating a 55-mm aperture on the unexposed face protected with Fire Mastic HPE sealant.

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
A 55-mm diameter aperture on the unexposed side of the 118-mm thick wall.	
PENETRATING SERVICE	
Description	A single PE-Xa Rehau Rautitan pipe incorporating a 90° elbow joint.
Size	A 20-mm OD pipe with a wall thickness of 2.8-mm incorporating a Rehau PX No.12 90-degree elbow. The pipe extended 2000-mm away from the unexposed face and approximately 500-mm upwards inside the wall cavity.
End conditions	The pipe end on the unexposed side and within the wall cavity were both left open.
Supports	Internally to the unexposed face wall at the elbow joint.
FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside the wall cavity on the exposed side, a nominal 190-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed with two 190-mm wide 50-mm x 50-mm x 0.7-mm BMT steel angles that were fixed to the C-studs using four 10g X 16-mm flat top drill point tek screws. A 405-mm long 0.55-mm BMT 92-mm wide J-track was then fixed to the two angles with 10g X 16-mm flat top drill point tek screws. The 20-mm PE-Xa pipe was then fixed at the elbow joint to the J-track using a Auspex Clip and a 25-mm metal tek screw. Inside the wall cavity on the exposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard with a 55-mm opening was fixed to the wall using 10g x 38-mm laminating screws at 200-mm centres. The annular gap between the pipe and the wall was sealed with FireMastic-HPE to a depth of approximately 26-mm and finished flush with the wall.
Photographs	 <div> <div>Inside the wall cavity</div> <div>Unexposed face</div> <div>Exposed face</div> </div>
Drawing	Drawings 1-4, title “Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield”, by Knauf Plasterboard Pty Ltd.


Specimen 2 – A 43-mm diameter PVC pipe incorporating an elbow joint in the wall cavity penetrating an 88-mm aperture on the unexposed face protected with Fire Mastic HPE sealant.

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
An 88-mm diameter aperture on the unexposed side of the 118-mm thick wall.	
PENETRATING SERVICE	
Description	A single Vinidex PVC pipe incorporating a 90° elbow.
Size	A 43-mm OD pipe with a wall thickness of 2.3-mm incorporating a with a 90° PVC elbow. The pipe extended 2000-mm away from the unexposed face and approximately 500-mm upwards inside the wall cavity.
End conditions	The pipe end on the unexposed side and within the wall cavity were both left open.
Supports	Internally to the unexposed face wall at the elbow joint.
FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside the wall cavity on the exposed side, a nominal 190-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed with two 190-mm wide 50-mm x 50-mm x 0.7-mm BMT steel angles that were fixed to the C-studs using four 10g X 16-mm flat top drill point tek screws. A 405-mm long 0.55-mm BMT 92-mm wide J-track was then fixed to the two angles with 10g x 16-mm flat top drill point tek screws. The 43-mm diameter PVC pipe was then fixed at the elbow joint to the track with a nylon coated metal saddle flush clip and 10g x 16-mm flat top drill point tek screws. Inside the wall cavity on the unexposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard with a 90-mm opening was fixed to the wall using 10g x 38-mm laminating screws at 200-mm centres. The annular gap between the pipe and the wall was sealed with FireMastic-HPE to a depth of approximately 26-mm and finished flush with the wall.
Photograph	 <div> <div>Inside the wall cavity</div> <div>Unexposed face</div> <div>Exposed face</div> </div>
Drawing	Drawings 1-4, title “Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield”, by Knauf Plasterboard Pty Ltd.

Specimen 3 – A Hansgrohe wall mounted faucet incorporating a 3-piece hand basin tap set penetrated three 75-mm apertures on the unexposed face protected with FireMastic HPE sealant.

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
Three 75-mm diameter apertures, 125-mm apart on the unexposed side of the 128-mm thick wall.	
PENETRATING SERVICE	
Description	A Hansgrohe (IAS SF009A) wall mounted faucet with an Axor Citterio (36107000) 3-piece wall sink set projecting out of the unexposed face of the wall and two PE-Xa Rehau Rautitan pipes (Red and Black) running through the wall cavity.
Size	Hansgrohe (IAS SF009A) wall mounted faucet with 41-mm OD plastic sleeves fixed over the spindle valves and tap outlet, connected to internal wall piping; 25-mm OD 4-mm thick PE-Xa Rehau Rautitan.
End conditions	The spout on the unexposed face was left open, the two tap spindle valves were in the closed position, and PE-Xa Rehau Rautitan pipes inside the wall were left open.
Supports	Internally to the exposed wall face, screwed through the wall mounted faucet.
FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside the wall cavity on the exposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed to wall with two x 200-mm wide 50-mm x 50-mm x 0.7 BMT steel angles that were fixed to the C-studs using four screws. A 200-mm high x 405-mm wide sheet of 12-mm plywood was then fixed over the steel angles using three 6g x 25-mm long fine thread bugle screws over each angle. The two corners of the faucet were then fixed to the plywood with two 6g x 25-mm long fine thread bugle screws. The three annular gaps around the plastic sleeves and the FireShield plasterboard wall were sealed with FireMastic-HPE to a depth of approximately 26-mm and finished flush with the wall. The chrome escutcheons plates were not installed for this test.
Photograph	 <div> <div>Inside the wall cavity</div> <div>Unexposed face</div> <div>Exposed face</div> </div>
Drawing	Drawings 1-4, title "Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield", by Knauf Plasterboard Pty Ltd.

Specimen 4 – A SHS 65-mm x 65-mm x 6mm thick beam penetrating the unexposed face of the wall through a 75-mm x 75-mm square opening protected with Knauf Bindex Fire and Acoustic sealant and 13-mm thick FireShield plasterboard.

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
A 75-mm x 75-mm square aperture on the unexposed side of 118-mm thick wall.	
PENETRATING SERVICE	
Description	A steel SHS support arm.
Size	A SHS 65-mm x 65-mm x 6mm thick arm welded at 90° to SHS 65-mm x 65-mm x 6mm beam. The arm extended 500-mm away from the unexposed face and the beam spanned the full height inside the wall cavity.
End conditions	The arm was left open on the unexposed side.
Supports	Self-supporting at the internal weld inside the wall cavity.
FIRE STOPPING SYSTEM	
Trade names	Knauf Bindex Fire and Acoustic sealant, FireShield plasterboard
Manufacturers	Knauf Plasterboard Pty Limited
Description	Knauf Bindex Fire and Acoustic sealant is a one-part acrylic sealant. 13-mm thick FireShield Plasterboard.
Application	The annular gap between the SHS arm and the wall was sealed with Knauf Bindex Fire and Acoustic sealant to a depth of 13-mm and finished flush with the wall. Four pieces of 13-mm thick FireShield plasterboard approximately 78-mm x 300-mm were then fixed around the base of the arm using two 12-gauge x 50-mm CSK self-tapping screws per sheet.
Photograph	 <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Inside the wall cavity Unexposed face Exposed face </div>
Drawing	Drawings 1-4, title “Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield”, by Knauf Plasterboard Pty Ltd.

2.2 Dimensions

The overall dimension of the framed wall was normally 1150-mm wide x 1150-mm long x 118-mm thick, to suit the opening in the specimen containing frame.

2.3 Orientation

The framed wall was placed vertically against the furnace chamber with the four penetrations extending from the unexposed side of the wall system.

2.4 Conditioning

The specimen construction was completed on 11 September 2019 and left to cure under standard laboratory atmospheric conditions until the test date.

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

The supporting wall 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:

- Drawings 1, 3 and 4, titled “Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield”, dated 26 February 2020 by Knauf Plasterboard Pty Ltd.
- Drawing 2, titled “Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield”, 10 February 2020 by Knauf Plasterboard Pty Ltd.
- Technical Data sheet titled “FireMastic-HPE” dated 2017 by BOSS Fire & Safety Pty Ltd
- Document labelled “Hydraulic wall fixtures apartments”, dated 19 June 2019 provide by Knauf.

No confidential information about the test specimen has been submitted to CSIRO Infrastructure Technologies.

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 specimens 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 24°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 91 minutes by the agreement with the sponsor.

8 Test results

8.1 Critical observations

The following observations were made during the fire-resistance test:

- 21 minutes - Smoke / steam has started venting from the mastic of Specimens 1, 2 and 3.
- 36 minutes - Smoke has started fluing from the end of the pipe of Specimen 2.
- 38 minutes - Smoke has started fluing from the end of the pipe of Specimen 1.
- 40 minutes - A small crack has developed between the mastic and the plasterboard wall around Specimens 2 and 3.
- 42 minutes - The smoke fluing from the end of the pipe of Specimen 2 has increased, whilst the smoke fluing from Specimen 1 has now ceased.

- 48 minutes - The PVC pipe of Specimen 2 has started to bow.
- 52 minutes - The mastic at the base of Specimen 3 has started to swell.
- 54 minutes - Fluid is dripping from the end of the PVC pipe of Specimen 2.
- 59 minutes - The level of smoke fluing from the pipe of Specimen 1 has decreased.
- 60 minutes - The plasterboard at the base of the wall has started to discolour.
- 66 minutes - The mastic around the tap handle and tap of Specimen 3 continues to swell.
- 69 minutes - The left tap handle has deflected out from the wall.
- 71 minutes - Smoke has started venting from the end of the SHS tube of Specimen 4.
- 75 minutes - The left tap handle has dropped off.
- 80 minutes - The right tap handle has dropped off.
- 85 minutes - The smoke fluing from the end of the pipe of Specimen 2 has almost ceased.
- 87 minutes - The plasterboard wall below Specimen 3 has started to discolour
- 91 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.

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

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

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

Figure 7 shows the curve of temperature versus time associated with the stud inside wall cavity.

Figure 8 shows the curve of temperature versus time associated with the SHS inside wall cavity.

8.5 Performance

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

Specimen 1 – A 20-mm diameter PE-Xa Rehau Rautitan pipe incorporating an elbow joint in the wall cavity penetrating a 55-mm aperture on the unexposed face protected with Fire Mastic HPE sealant.

Structural adequacy	-	Not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

Specimen 2 – A 43-mm diameter PVC pipe incorporating an elbow joint in the wall cavity penetrating an 88-mm aperture on the unexposed face protected with Fire Mastic HPE sealant.

Structural adequacy	-	Not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

Specimen 3 – A Hansgrohe wall mounted faucet incorporating a 3-piece hand basin tap set penetrated three 75-mm apertures on the unexposed face protected with FireMastic HPE sealant.

Structural adequacy	-	Not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

Specimen 4 – A SHS 65-mm x 65-mm x 6mm thick beam penetrating the unexposed face of the wall through a 75-mm x 75-mm square opening protected with Knauf Bindex Fire and Acoustic sealant and 13-mm thick FireShield plasterboard.

Structural adequacy	-	Not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 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:

Specimen 1	-/60/60
Specimen 2	-/60/60
Specimen 3	-/60/60
Specimen 4	-/60/60

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

The test was conducted on a wall system with an established FRL of -/60/60. The maximum FRL of any test specimen cannot exceed the FRL achieved by the wall 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.

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 1530.4-20014, have been made provided no individual component is removed or reduced.

11 Tested by



Peter Gordon
Testing Officer

Appendices

Appendix A – Measurement location

Specimen	T/C Position	T/C designation
SPECIMEN 1 – 20-mm OD PE-Xa Rehau Rautitan pipe, having a wall thickness of 2.8-mm penetrating the unexposed face of the wall through a 55-mm opening. The annular gap was sealed Boss FireMastic-HPE.	On P/B, 25-mm below mastic	S1
	On P/B, 25-mm right of mastic	S2
	On Mastic, below pipe	S3
	On Mastic, below pipe	S4
	On top of pipe, 25-mm from mastic	S5
	On bottom of pipe, 25-mm from mastic	S6
SPECIMEN 2 – 43-mm OD Iplex pipe (PVC) having a wall thickness of 2.3-mm penetrating the exposed face of the wall through an 88-mm opening. The annular gap around the pipe and the wall was sealed Boss FireMastic-HPE.	On P/B, 25-mm below mastic	S7
	On P/B, 25-mm right of mastic	S8
	On Mastic, below pipe	S9
	On Mastic, below pipe	S10
	On top of pipe, 25-mm from mastic	S11
	On bottom of pipe, 25-mm from mastic	S12
SPECIMEN 3 – Hansgrohe 3-piece hand basin tap set incorporated a right-angle breech, two brass spindle valve with a 40-mm OD plastic sleeve with two PE-Xa Rehau Rautitan pipes. Two Rehau PE-Xa Rehau Rautitan pipes 25-mm OD with a wall thickness of 4-mm remained inside the wall cavity. The two brass spindle valves and tap handles and a tap and a tap heads penetrated the unexposed side through three 75-mm openings. The annular gap between the wall and 40-mm OD plastic casting were sealed with Boss FireMastic-HPE to a depth of 26-mm and flush with the plasterboard wall.	On P/B, 25-mm below mastic	S13
	On P/B, 25-mm right of mastic	S14
	On Mastic, above cold tap handle	S15
	On Mastic, right side of cold tap handle	S16
	On top of cold tap handle	S17
	On right side of cold tap handle	S18
	On P/B, 25-mm below mastic	S19
	On P/B, 25-mm right of mastic	S20
	On Mastic, above tap	S21
	On Mastic, left side of tap	S22
	On top of tap	S23
	On left side of tap	S24
	On P/B, 25-mm below mastic	S25
	On P/B, 25-mm right of mastic	S26
	On Mastic, above hot tap handle	S27
	On Mastic, left side of hot tap handle	S28
	On top of hot tap handle	S29
	On left side of hot tap handle	S30

Specimen	T/C Position	T/C designation
SPECIMEN 4 – A SHS (Square Hollow Section) 65-mm x 65-mm x 6mm thick with a right-angle arm welded penetrating the unexposed face of the wall through a 75-mm opening. The annular gap between the SHS arm and the wall was sealed to a depth of 13-mm with Knauf Bindex Fire and Acoustic sealant; a single layer of 13-mm FireShield was then fixed around the Arm to a length of 300-mm. The SHS arm projected horizontally 500-mm away from the unexposed side.	On P/B wall, 25 mm above arm	S31
	On P/B wall, 25 mm right of arm	S32
	On P/B arm, 25 mm above wall	S33
	On P/B arm, 25 mm right of wall	S34
	On top of SHS, 25 mm from P/B on arm	S35
	On left side of SHS, 25 mm from P/B on arm	S36
Internal steel stud	On stud hot flange, mid height	S37
	On stud mid height web	S38
	On stud cold flange, mid height	S39
Internal SHS Tube	On exposed edge, mid height	S40
	On unexposed edge, mid height	S41
Rover		S42
Ambient		S43

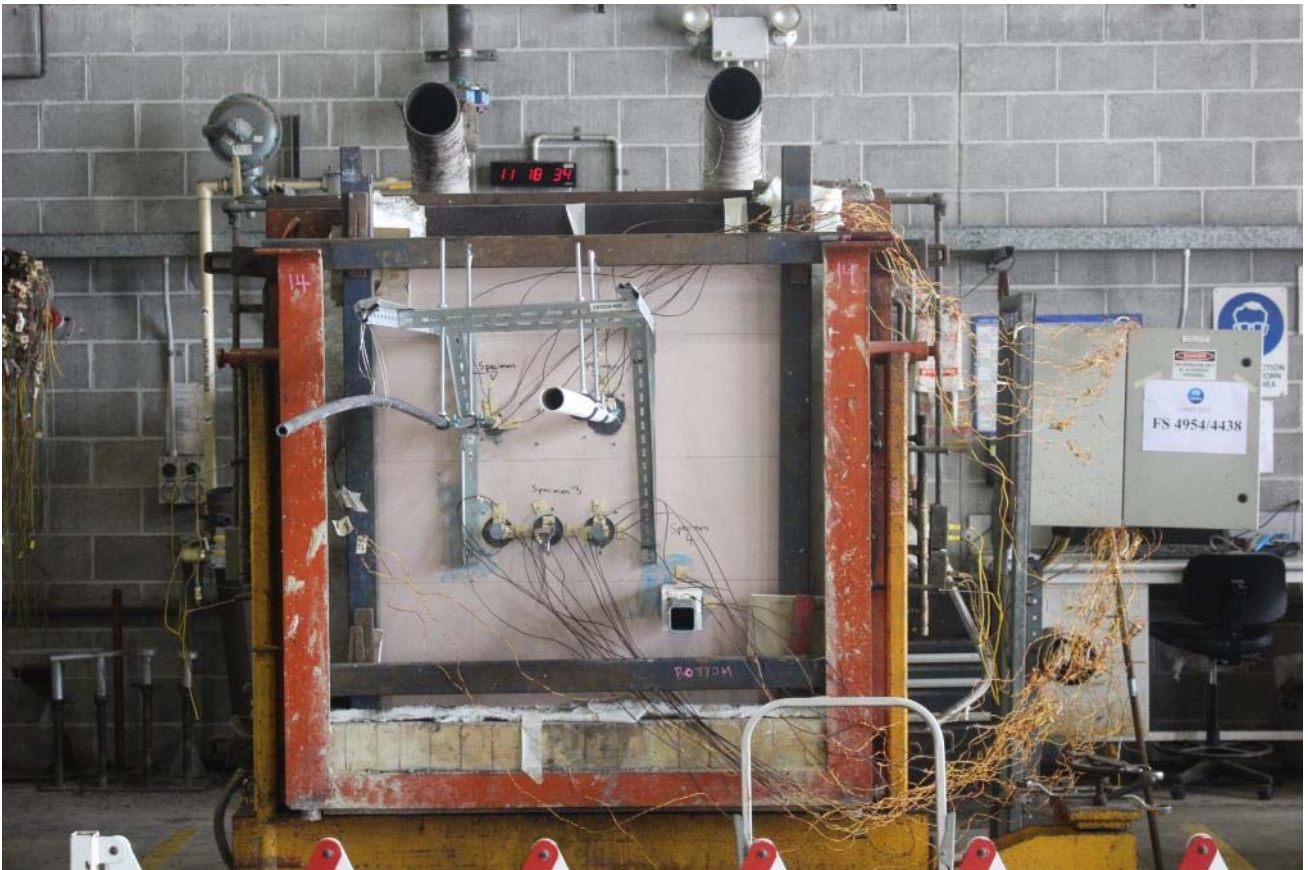
Appendix B – Test photographs



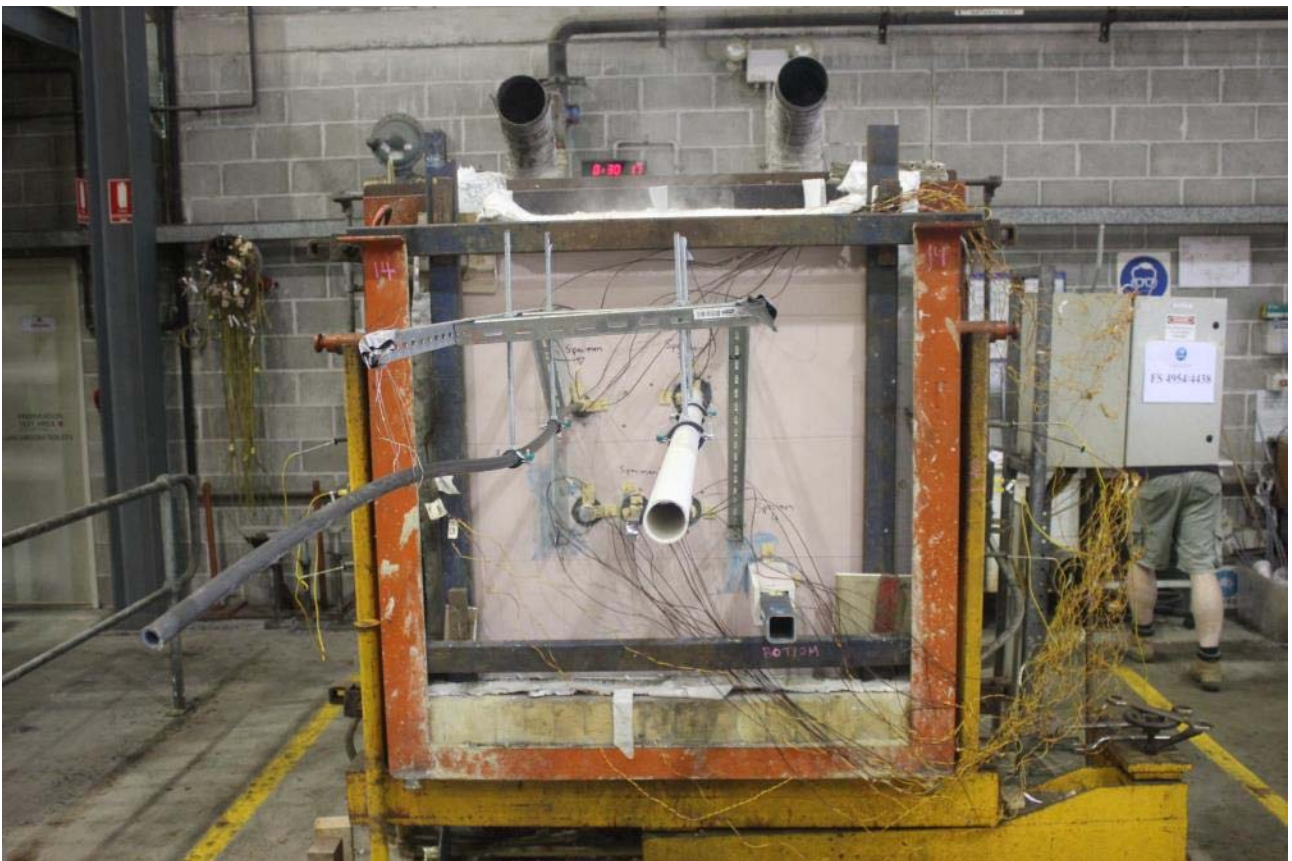
PHOTOGRAPH 1 – SPECIMENS DURING CONSTRUCTION PRIOR TO TESTING.



PHOTOGRAPH 2 – EXPOSED SIDE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 3 – UNEXPOSED SIDE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 4 – SPECIMENS AFTER 30 MINUTES OF TESTING



PHOTOGRAPH 5 – SPECIMENS AFTER 37 MINUTES OF TESTING



PHOTOGRAPH 6 – SPECIMENS AFTER 38 MINUTES OF TESTING



PHOTOGRAPH 7 – SPECIMENS AFTER 42 MINUTES OF TESTING



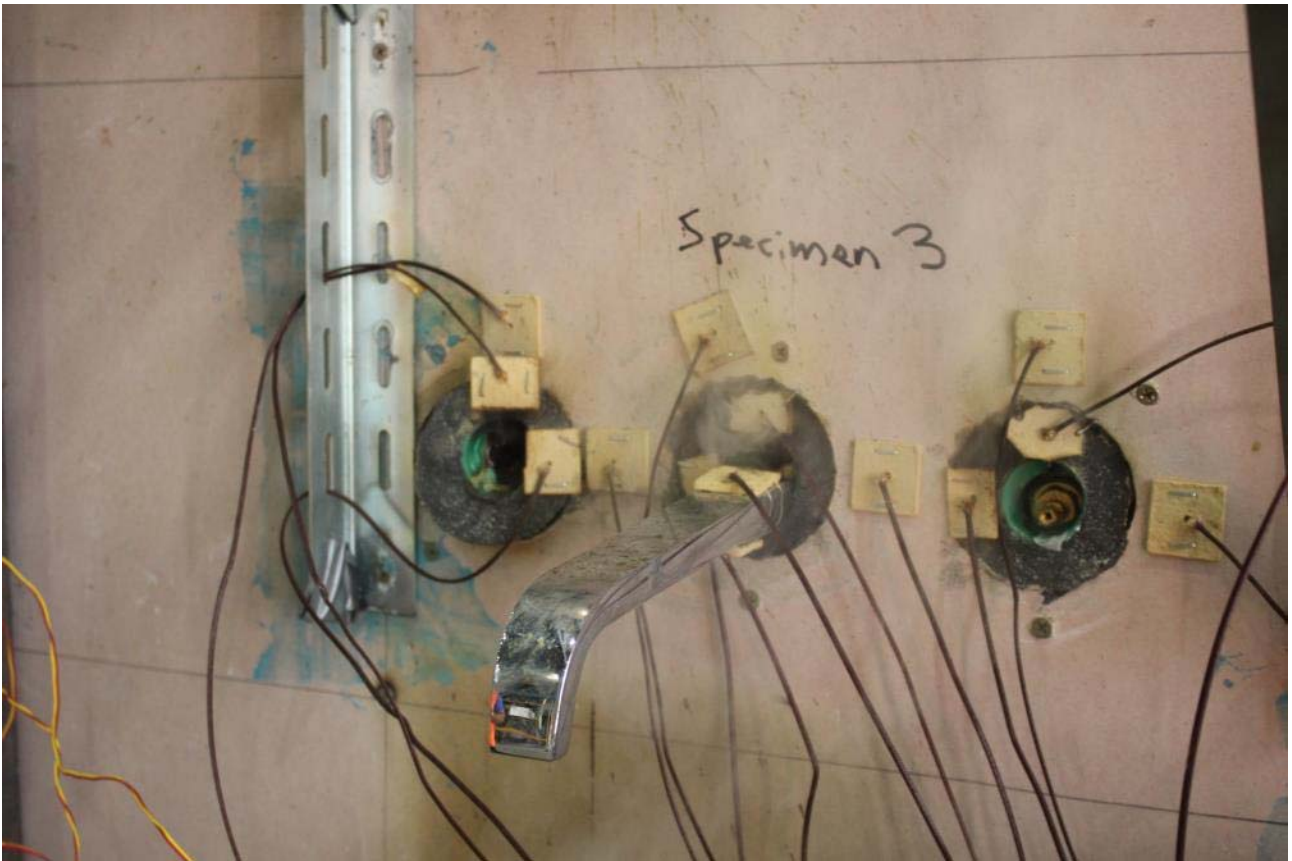
PHOTOGRAPH 8 – SPECIMENS AFTER 60 MINUTES OF TESTING



PHOTOGRAPH 9 – SPECIMEN 2 AFTER 71 MINUTES OF TESTING



PHOTOGRAPH 10 – SPECIMEN 3 AFTER 75 MINUTES OF TESTING



PHOTOGRAPH 11 – SPECIMEN 3 AFTER 83 MINUTES OF TESTING



PHOTOGRAPH 12 – SPECIMENS AFTER 90 MINUTES OF TESTING



PHOTOGRAPH 13 –EXPOSED FACE OF SPECIMENS AFTER THE CONCLUSION OF TESTING

Appendix C – Test data charts

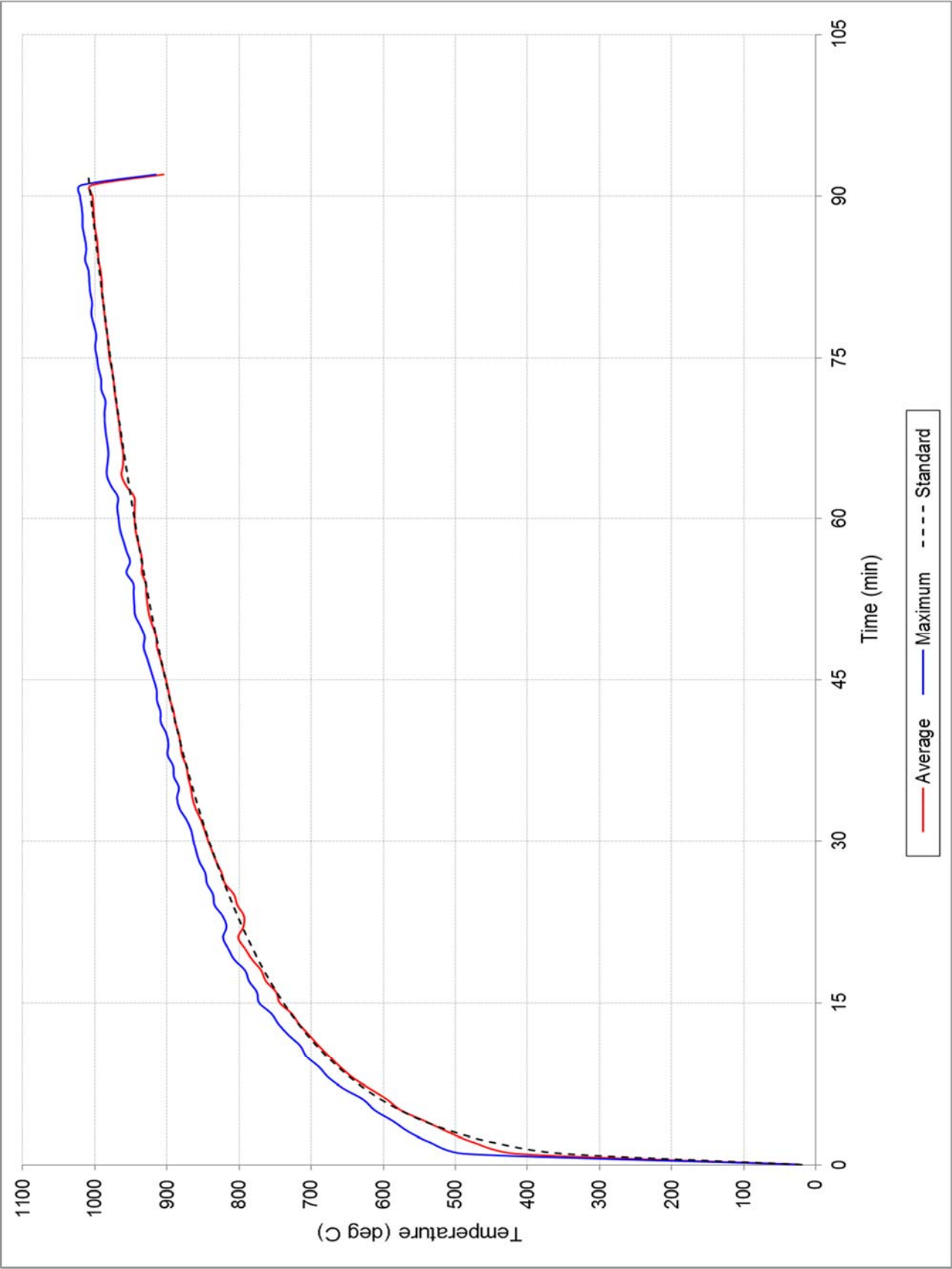


FIGURE 1 – FURNACE TEMPERATURE

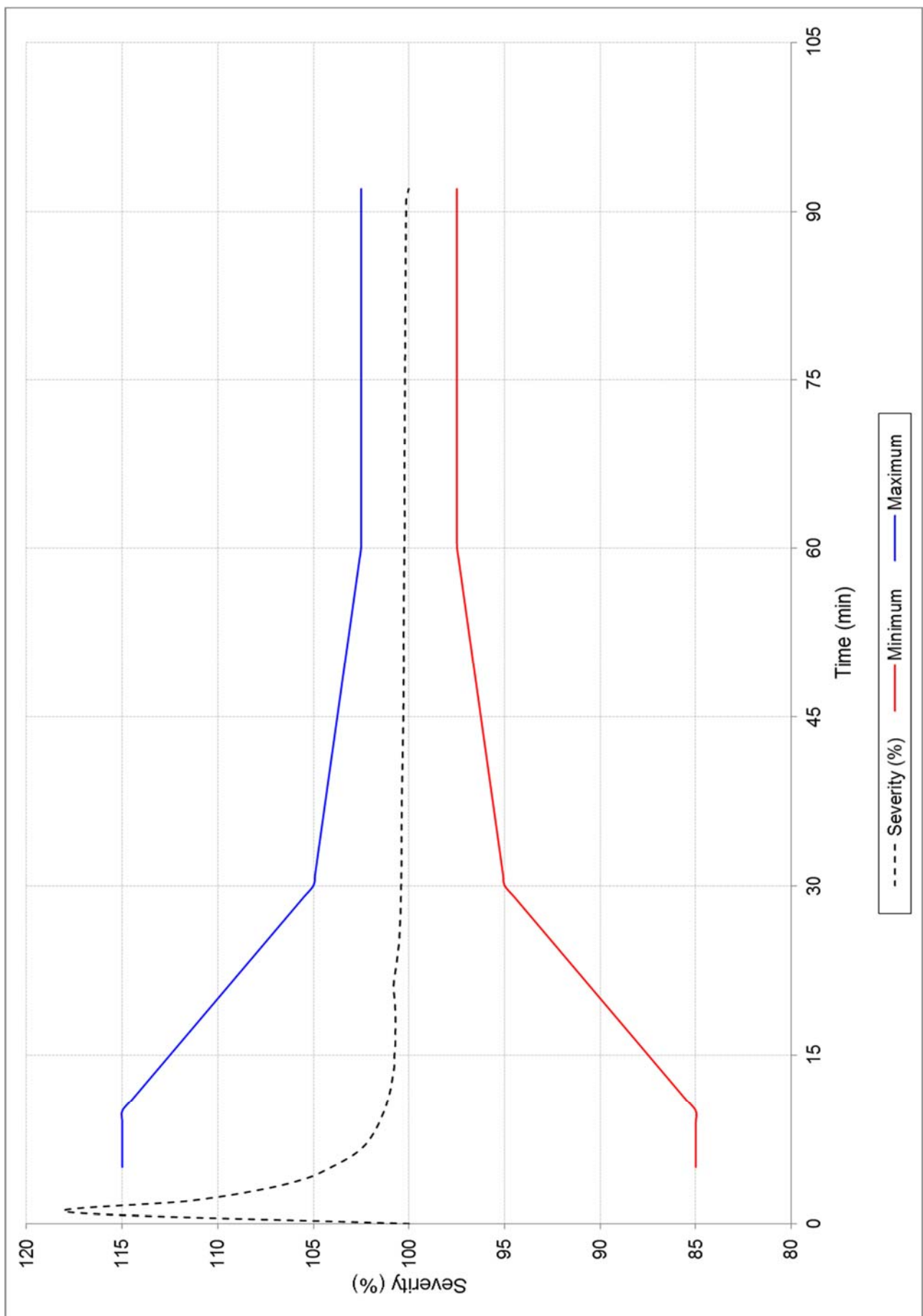


FIGURE 2 – FURNACE SEVERITY

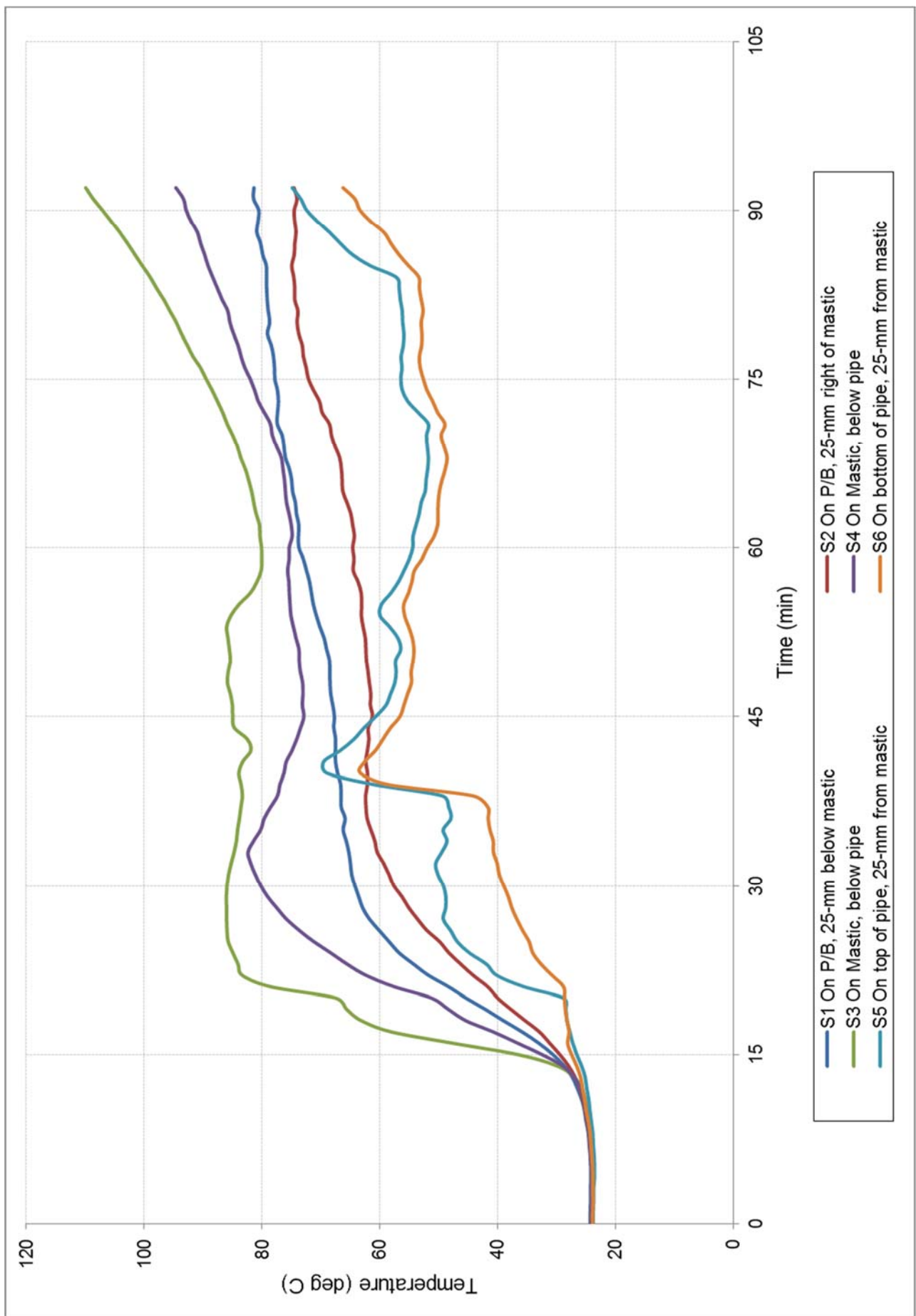


FIGURE 3 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

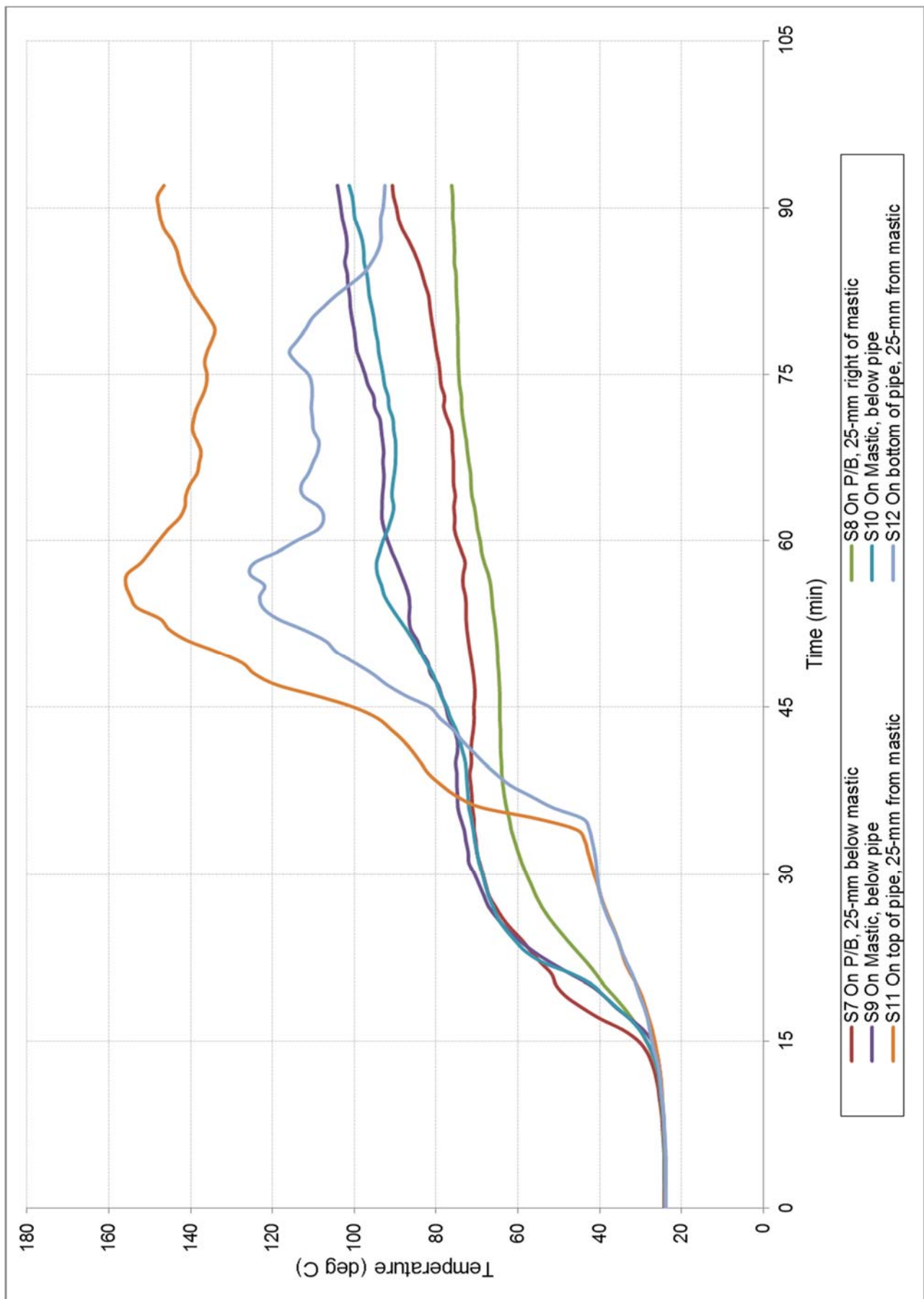


FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 2

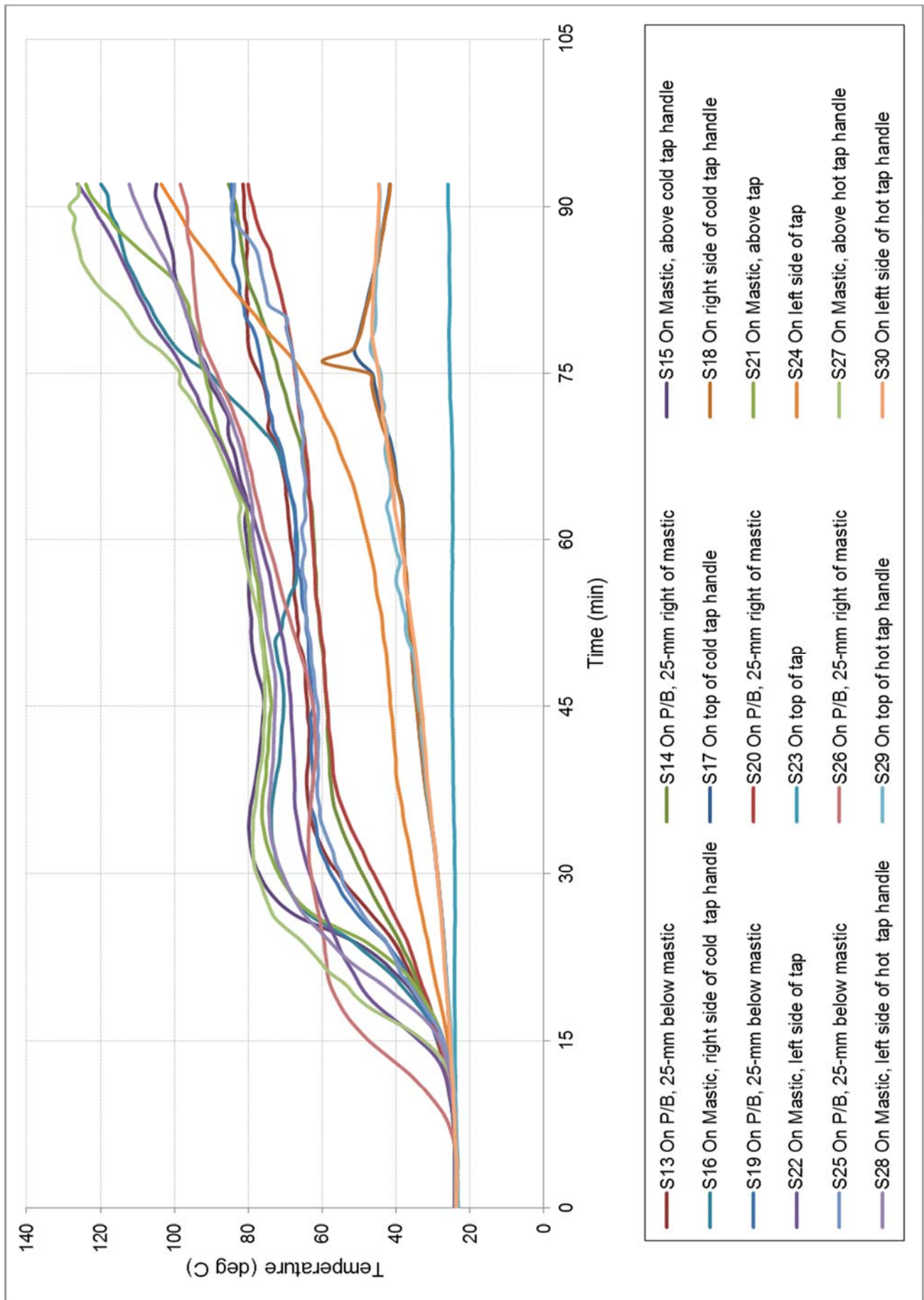


FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 3

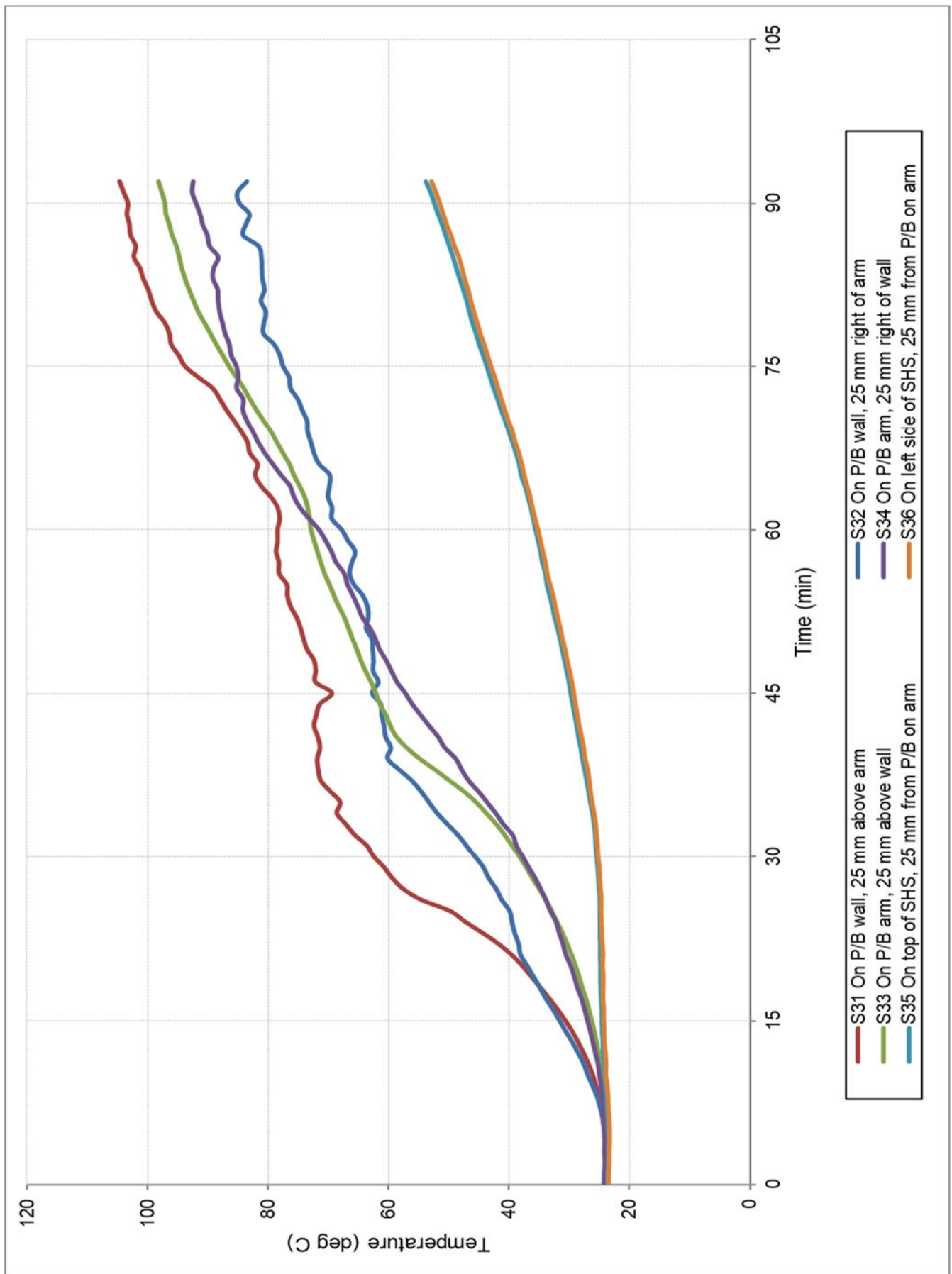


FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 4

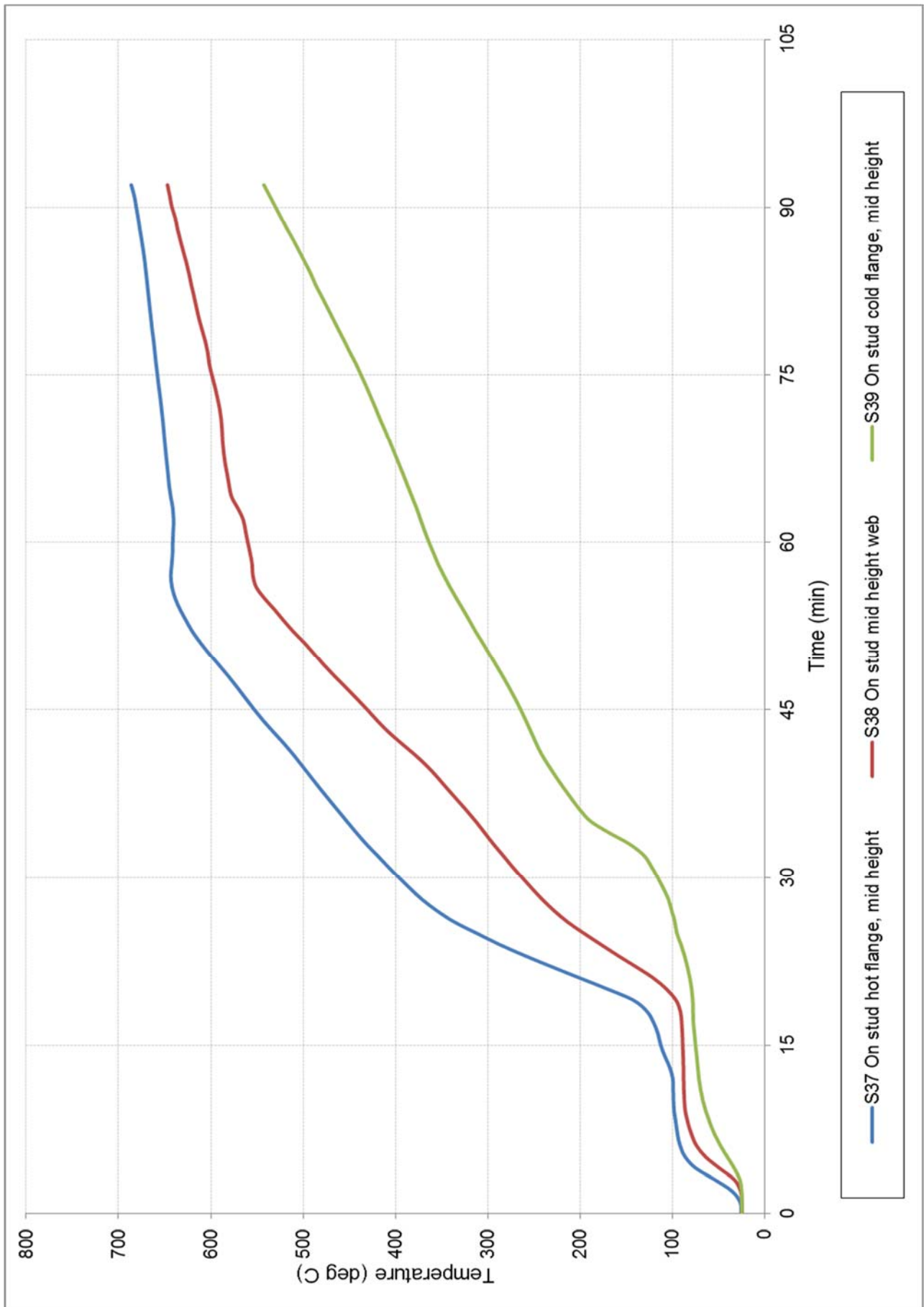


FIGURE 7 – SPECIMEN TEMPERATURE – STUD INSIDE WALL CAVITY

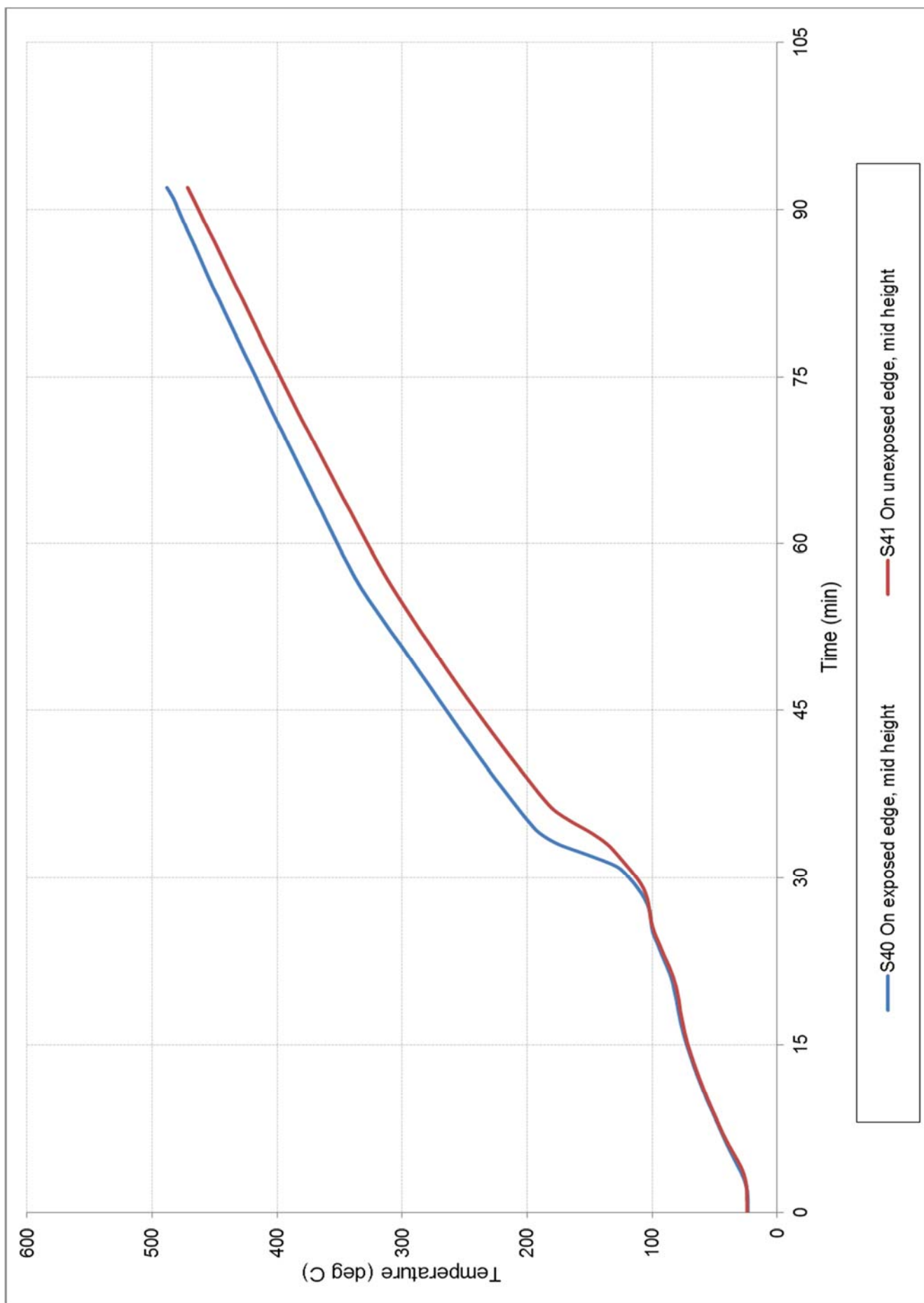
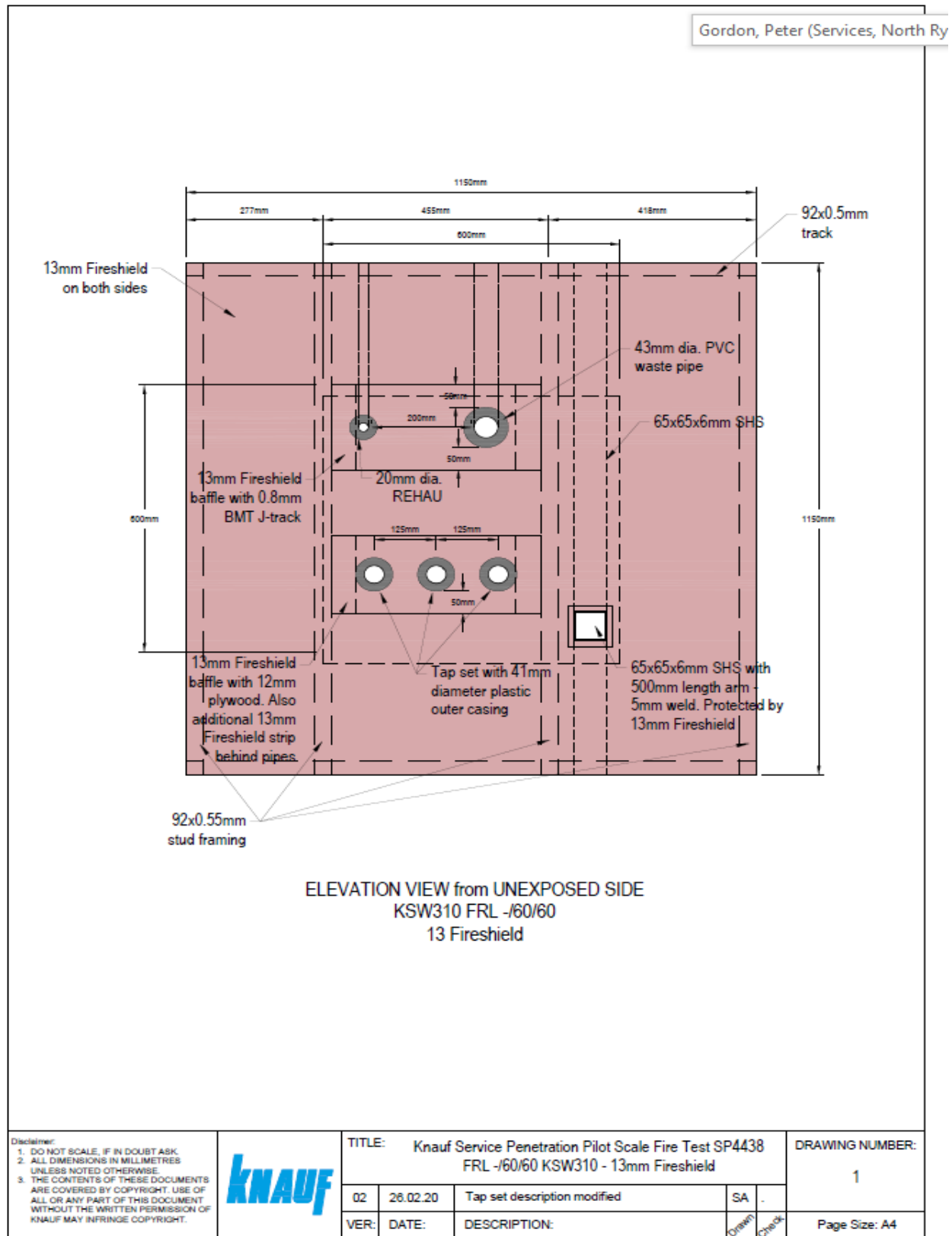
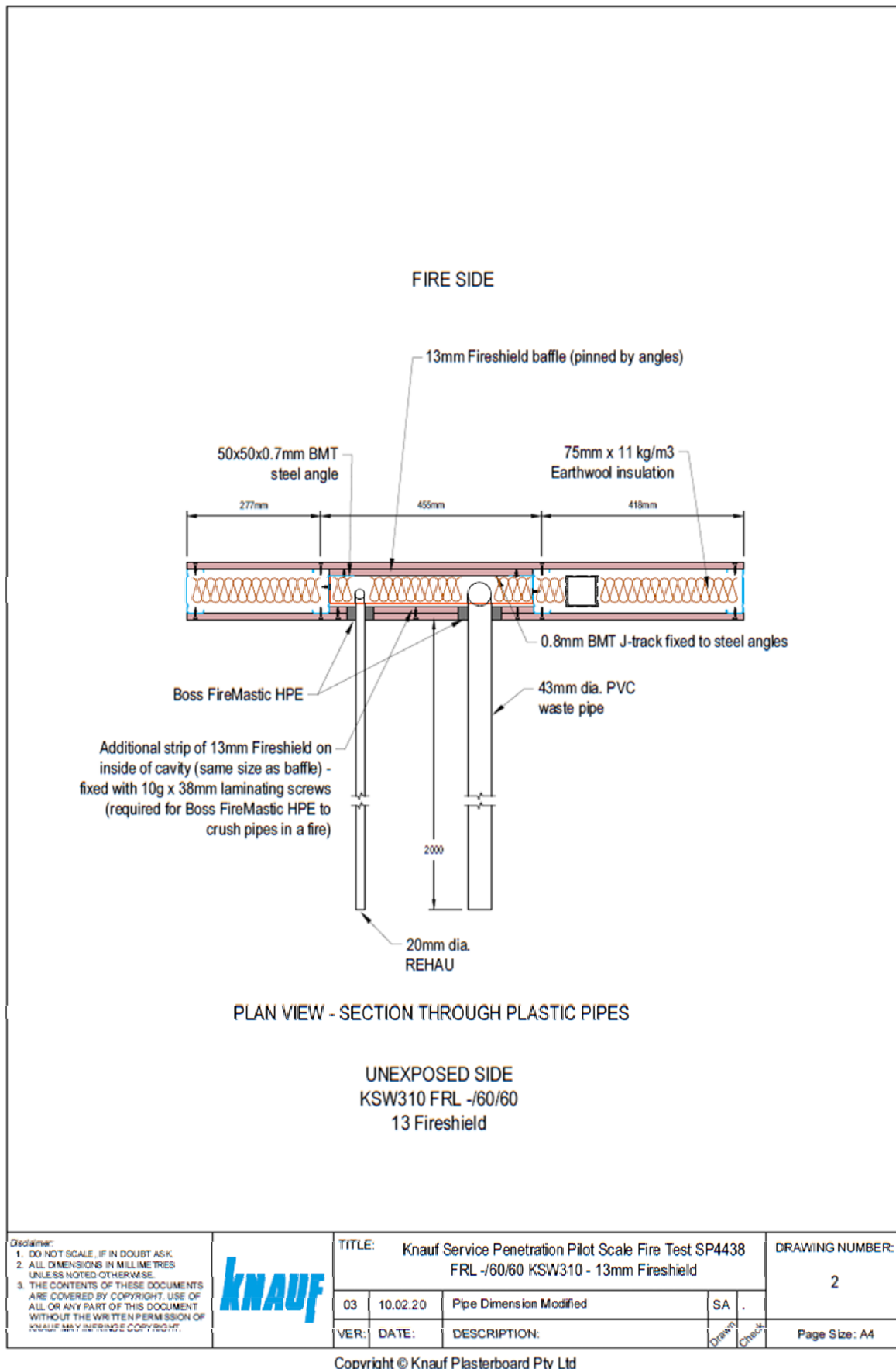


FIGURE 4 – SPECIMEN TEMPERATURE – SHS TUBE INSIDE CAVITY

Appendix D – Specimen drawings

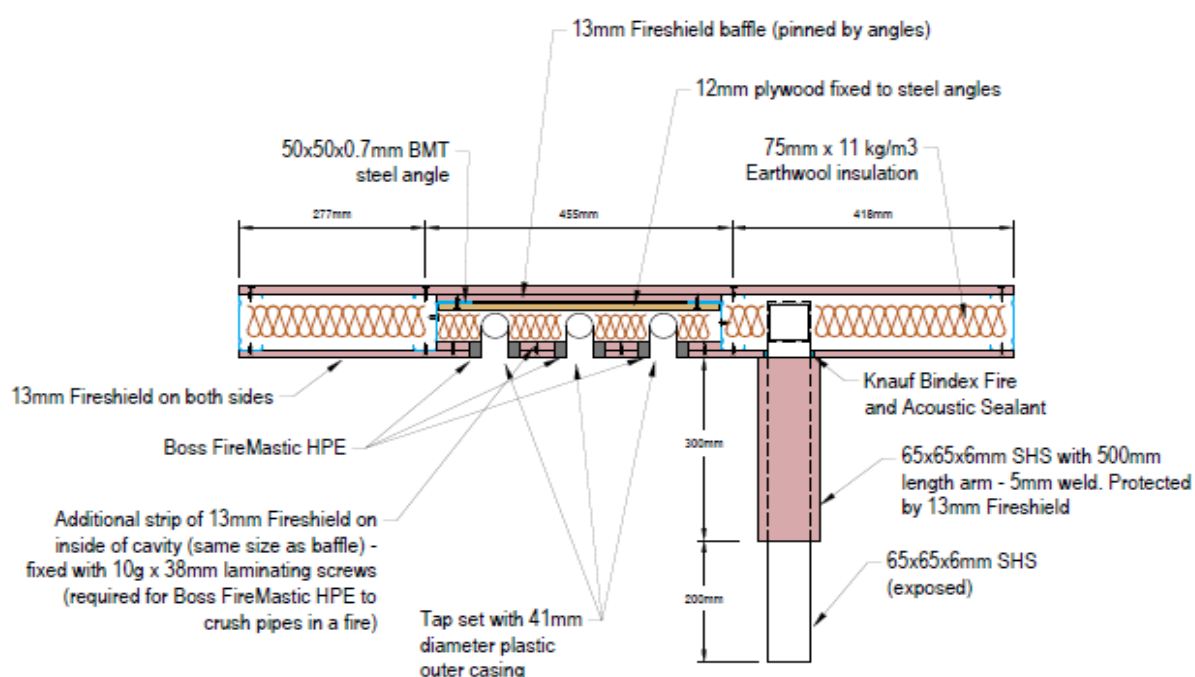


**DRAWING NUMBER 1, TITLED "KNAUF SERVICE PENETRATIONS PILOT SCALE FIRE TEST SP4438
FRL-/60/60 KSW310 – 13-MM FIRESHIELD", DATED 26 FEBRUARY 2020 BY KNAUF**



DRAWING NUMBER 2, TITLED “KNAUF SERVICE PENETRATIONS PILOT SCALE FIRE TEST SP4438 FRL-/60/60 KSW310 – 13-MM FIRESHIELD”, DATED 10 FEBRUARY 2020 BY KNAUF

FIRE SIDE



PLAN VIEW - SECTION THROUGH TAP SET AND SHS COLUMN & BEAM

UNEXPOSED SIDE
KSW310 FRL -/60/60
13 Fireshield

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TITLE: Knauf Service Penetration Pilot Scale Fire Test SP4438
FRL -/60/60 KSW310 - 13mm Fireshield

DRAWING NUMBER:

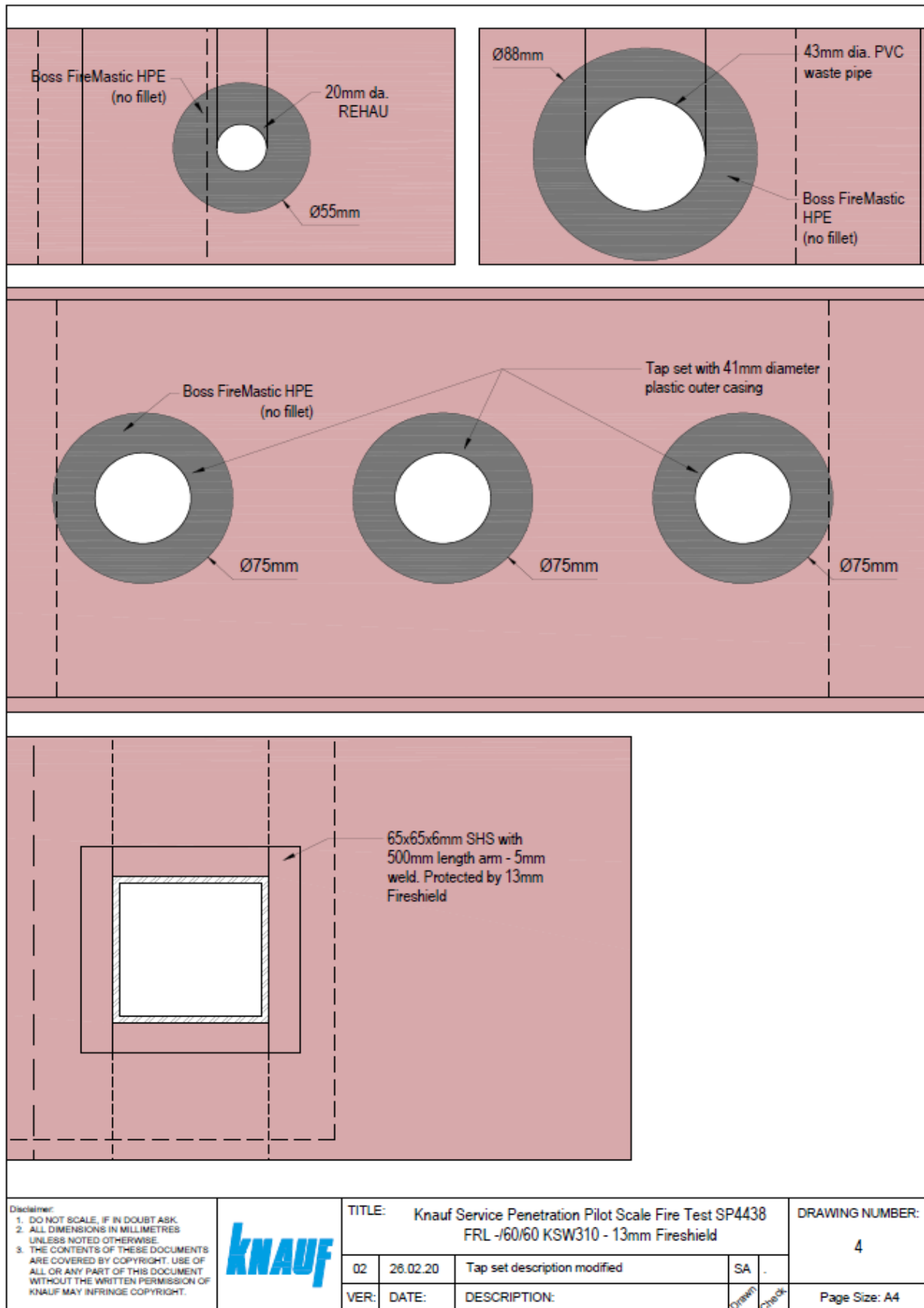
3

03	26.02.20	Tap set description modified	SA	-
VER:	DATE:	DESCRIPTION:	Drawn	Check

Page Size: A4

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DRAWING NUMBER 3, TITLED "KNAUF SERVICE PENETRATIONS PILOT SCALE FIRE TEST SP4438 FRL-/60/60 KSW310 – 13-MM FIRESHIELD", DATED 26 FEBRUARY 2020 BY KNAUF



DRAWING NUMBER 4, TITLED “KNAUF SERVICE PENETRATIONS PILOT SCALE FIRE TEST SP4439 FRL-/60/60 KSW310 – 13-MM FIRESHIELD”, DATED 26 FEBRUARY BY KNAUF

Appendix E – Copies of 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



Certificate of Test

No. 3389

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:

Knauf Plasterboard Pty Ltd
31 Military Road
Matraville NSW 2036

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 2084.

Product Name: A 20-mm diameter PE-Xa Rehau Rautitan pipe incorporating an elbow joint in the wall cavity penetrating a 55-mm aperture on the unexposed face protected with Fire Mastic HPE sealant (Specimen 1)

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
A 55-mm diameter aperture on the unexposed side of the 118-mm thick wall.	
PENETRATING SERVICE	
Description	A single PE-Xa Rehau Rautitan pipe incorporating a 90° elbow joint.
Size	A 20-mm OD pipe with a wall thickness of 2.8-mm incorporating a Rehau PX No.12 90-degree elbow. The pipe extended 2000-mm away from the unexposed face and approximately 500-mm upwards inside the wall cavity.
End conditions	The pipe end on the unexposed side and within the wall cavity were both left open.
Supports	Internally to the unexposed face wall at the elbow joint.

Page 1 of 2



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CERTIFICATE OF TEST NUMBERED 3389 (PAGE 1 OF 2)

FSP 2084 | page 36 of 45



Certificate of Test

No. 3389

FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside the wall cavity on the exposed side, a nominal 190-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed with two 190-mm wide 50-mm x 50-mm x 0.7-mm BMT steel angles that were fixed to the C-studs using four 10g X 16-mm flat top drill point tek screws. A 405-mm long 0.55-mm BMT 92-mm wide J-track was then fixed to the two angles with 10g X 16-mm flat top drill point tek screws. The 20-mm PE-Xa pipe was fixed at elbow joint to the J-track using a Auspex Clip and a 25-mm metal tek screw. Inside the wall cavity on the exposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard with a 55-mm opening was fixed to the wall using 10g x 38-mm laminating screws at 200-mm centres. The annular gap between the pipe and wall was sealed with FireMastic-HPE to a depth of approx. 26-mm and finished flush with wall.
Drawing	Drawings 1-4, title "Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield", by Knauf Plasterboard Pty Ltd.

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

Structural Adequacy	-	not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/60/60.

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same direction as tested. The FRL of the specimen is limited to that of the fire separating element. 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: 21 October 2019

Issued on the 6th day of May 2020 without alterations or additions.

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

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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:

Knauf Plasterboard Pty Ltd
31 Military Road
Matraville NSW 2036

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 2084.

Product Name: A 43-mm diameter PVC pipe incorporating an elbow joint in the wall cavity penetrating an 88 mm aperture on the unexposed face protected with Fire Mastic HPE sealant (Specimen 2)

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
An 88-mm diameter aperture on the unexposed side of the 118-mm thick wall.	
PENETRATING SERVICE	
Description	A single Vinindex PVC pipe incorporating a 90° elbow.
Size	A 43-mm OD pipe with a wall thickness of 2.3-mm incorporating a with a 90° PVC elbow. The pipe extended 2000-mm away from the unexposed face and approximately 500-mm upwards inside the wall cavity.
End conditions	The pipe end on the unexposed side and within the wall cavity were both left open.
Supports	Internally to the unexposed face wall at the elbow joint.

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Certificate of Test

No. 3390

FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside wall cavity on exposed side, a nominal 190-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed with two 190-mm wide 50-mm x 50-mm x 0.7-mm BMT steel angles that were fixed to C-studs using four 10g X 16-mm flat top drill point tek screws. A 405-mm long 0.55-mm BMT 92-mm wide J-track was then fixed to the two angles with 10g x 16-mm flat top drill point tek screws. The 43-mm dia. PVC pipe was then fixed at elbow joint to track with a nylon coated metal saddle flush clip and 10g x 16-mm flat top drill point tek screws. Inside wall cavity on unexposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard with a 90-mm opening was fixed to the wall using 10g x 38-mm laminating screws at 200-mm centres. The annular gap between pipe and wall was sealed with FireMastic-HPE to a depth of approx. 26-mm and finished flush with wall.
Drawing	Drawings 1-4, title "Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield", by Knauf Plasterboard Pty Ltd.

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

Structural Adequacy	-	not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/60/60.

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same direction as tested. The FRL of the specimen is limited to that of the fire separating element. 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: 21 October 2019

Issued on the 6th day of May 2020 without alterations or additions.

B. Roddy

Brett Roddy | Manager, Fire Testing and Assessments

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Certificate of Test

No. 3391

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Knauf Plasterboard Pty Ltd
31 Military Road
Matraville NSW 2036

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 2084.

Product Name: A Hansgrohe wall mounted faucet incorporating a 3-piece hand basin tap set penetrated three 75-mm apertures on the unexposed face protected with FireMastic HPE sealant (Specimen 3)

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
Three 75-mm diameter apertures, 125-mm apart on the unexposed side of the 128-mm thick wall.	
PENETRATING SERVICE	
Description	A Hansgrohe (IAS SF009A) wall mounted faucet with an Axor Citterio (36107000) 3-piece wall sink set projecting out of the unexposed face of the wall and two PE-Xa Rehau Rautitan pipes (Red and Black) running through the wall cavity.
Size	Hansgrohe (IAS SF009A) wall mounted faucet with 41-mm OD plastic sleeves fixed over the spindle valves and tap outlet, connected to internal wall piping; 25-mm OD 4-mm thick PE-Xa Rehau Rautitan.
End conditions	The spout on the unexposed face was left open, the two tap spindle valves were in the closed position, and PE-Xa Rehau Rautitan pipes inside the wall were left open.
Supports	Internally to the exposed wall face, screwed through the wall mounted faucet.

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Certificate of Test

No. 3391

FIRE STOPPING SYSTEM	
Trade names	FireMastic-HPE
Manufacturers	BOSS Fire & Safety Pty Ltd
Description	FireMastic-HPE is a graphite-based, thixotropic, one-part acrylic emulsion
Application	Inside wall cavity on exposed side, a nominal 200-mm high x 405-mm wide piece of 13-mm FireShield plasterboard was fixed to wall with two x 200-mm wide 50-mm x 50-mm x 0.7 BMT steel angles that were fixed to C-studs using four screws. A 200-mm high x 405-mm wide sheet of 12-mm plywood was then fixed over the steel angles using three 6g x 25-mm long fine thread bugle screws over each angle. The two corners of faucet were then fixed to the plywood with two 6g x 25-mm long fine thread bugle screws. The three annular gaps around plastic sleeves and the FireShield plasterboard wall were sealed with FireMastic-HPE to a depth of approximately 26-mm and finished flush with the wall. The chrome escutcheons plates were not installed for this test.
Drawing	Drawings 1-4, title "Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield", by Knauf Plasterboard Pty Ltd.

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

Structural Adequacy	-	not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/60/60.

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same direction as tested. The FRL of the specimen is limited to that of the fire separating element. 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: 21 October 2019

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No. 3392

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Knauf Plasterboard Pty Ltd
31 Military Road
Matraville NSW 2036

A full description of the test specimen and the complete test results are detailed in the Division's Sponsored Investigation report numbered FSP 2084.

Product Name: A SHS 65-mm x 65-mm x 6mm thick beam penetrating the unexposed face of the wall through a 75-mm x 75-mm square opening protected with Knauf Bindex Fire and Acoustic sealant and 13 mm thick FireShield plasterboard (Specimen 4)

SEPARATING ELEMENT	
The wall system contained single layer of 13 mm thick FireShield plasterboard on each side of 92 mm x 0.55 BMT C-studs. The wall cavity was filled with 75-mm thick Knauf Earthwool. The Knauf wall system (KSW310) has an established FRL of -/60/60 as detailed in BRANZ reports FAR 3210 and FAR 3230.	
TYPE AND SIZE OF CONSTRUCTION	
A 75-mm x 75-mm square aperture on the unexposed side of 118-mm thick wall.	
PENETRATING SERVICE	
Description	A steel SHS support arm.
Size	A SHS 65-mm x 65-mm x 6mm thick arm welded at 90° to SHS 65-mm x 65-mm x 6mm beam. The arm extended 500-mm away from the unexposed face and the beam spanned the full height inside the wall cavity.
End conditions	The arm was left open on the unexposed side.
Supports	Self-supporting at the internal weld inside the wall cavity.

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No. 3392

FIRE STOPPING SYSTEM	
Trade names	Knauf Bindex Fire and Acoustic sealant, FireShield plasterboard
Manufacturers	Knauf Plasterboard Pty Limited
Description	Knauf Bindex Fire and Acoustic sealant is a one-part acrylic sealant. 13-mm thick FireShield Plasterboard.
Application	The annular gap between the SHS arm and the wall was sealed with Knauf Bindex Fire and Acoustic sealant to a depth of 13-mm and finished flush with the wall. Four pieces of 13-mm thick FireShield plasterboard approximately 78-mm x 300-mm were then fixed around the base of the arm using two 12-gauge x 50-mm CSK self-tapping screws per sheet.
Drawing	Drawings 1-4, titled "Knauf Service Penetration Pilot Scale Fire test SP4438 FRL-/60/60 KSW310 13mm FireShield", by Knauf Plasterboard Pty Ltd.

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

Structural Adequacy	-	not applicable
Integrity	-	no failure at 91 minutes
Insulation	-	no failure at 91 minutes

and therefore for the purpose of Building Regulations in Australia, achieved a fire-resistance level (FRL) of -/60/60.

The fire-resistance level of the specimen is applicable when the system is exposed to fire from the same direction as tested. The FRL of the specimen is limited to that of the fire separating element. 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: 21 October 2019

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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. |

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w <https://www.csiro.au/en/Do-business/Services/Materials-infrastructure/Fire-safety>