Fire-resistance test on services penetrating a plasterboard wall system

Test Report

Author: Peter Gordon
Report number: FSP 2230
Date: 8 November 2021

Client: Trafalgar Group Pty Ltd

Commercial-in-confidence

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Fire-resistance test on services penetrating a plasterboard wall system

Sponsored Investigation No. FSP 2230

1 Introduction

1.1 Identification of specimen

The sponsor identified the test specimen as various sealing systems protecting service penetrations through a plasterboard wall system.

1.2 Sponsor

Trafalgar Group Pty Ltd
26A Ferndell Street
South Granville NSW 2142

1.3 Manufacturers

Trafalgar Group Pty Ltd
26A Ferndell Street
South Granville NSW 2142

1.4 Test standard

Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-2014, Fire-resistance tests for 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 5125/4687

1.7 Test date

The fire-resistance test was conducted on 28 September 2021.

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2 Description of specimen

2.1 General

The specimen comprised a 1000-mm wide x 800-mm high x 41-mm thick plasterboard wall system penetrated by multiple services including steel and copper pipes, coaxial cables, light and power cables, fibre optic cables and a PVC conduit protected with various sealing systems.

The separating element comprised a 41-mm thick plasterboard wall lined with a single layer of 25-mm thick Shaftliner board laminated to a 16-mm thick Firestop plasterboard sheet. The plasterboard wall system has an established FRL of -/60/60 (Boral wall system reference IW60.3) as detailed in CSIRO Fire Assessment report FCO-3367C dated 29 October 2021. The plasterboard wall was built into a brick opening within the specimen containing frame with a 230-mm thick concrete lintel located over the top of the wall.

For the purpose of the test, the four service penetrations are referenced as Specimens 1, 2, 3 and 4 respectively. Documents containing a complete description of each specimen were supplied by the sponsor and are retained on file.

Specimen No.	Service penetration details
1	A group of services including a steel pipe and various cables penetrating a 380-mm x 140-mm opening protected by a FyreBOX Slab-Mount, FyreFLEX sealant and Twrap.
2	Five 1.5-mm² 2-core+E TPS power cables penetrating a 32-mm diameter opening protected with 60-mm FyreBOARD Maxilite and FyreFLEX sealant.
3	A group of services including a steel pipe and various cables penetrating a 110-mm diameter opening protected by a 100-mm Round FyreBOX, FyreFLEX sealant and TWrap
4	A DN50 copper pipe penetrating a 76-mm diameter opening protected with FyreFLEX sealant and Twrap.

<u>Specimen 1 – A group of services penetrating a 380-mm x 140-mm opening protected by a FyreBOX Slab-Mount, FyreFLEX sealant and TWrap</u>

The penetrating services comprised a DN32 steel pipe, a 4-core +E power cable and group of three RG-6 Quad shield co-axial cables, a Category 6 network cable and a 25-mm NBN conduit with a single NBN cable located inside the conduit.

The DN32 steel pipe had an outside diameter of 42.9-mm and a wall thickness 3.2-mm. The Electra 10-mm^2 4-core + earth power cable had an orange XLPE sheath and a voltage rating of 0.6/1kV. The Optus RG-6 Quad shield co-axial cables each had an outside diameter of 6-mm, the Antsig Category 6 cable had an outside diameter of 6-mm, the Optus PVC conduit had an outside diameter of 25-mm with a wall thickness of 2-mm and incorporated a Fibre Optic NBN with an outside diameter of 15-mm located within the conduit.

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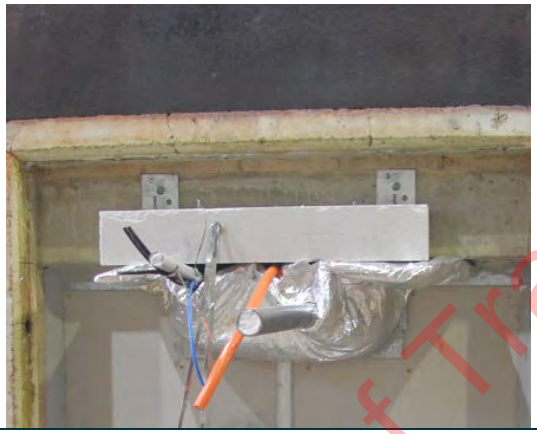
The cables, conduit and steel pipe penetrated a 380-mm wide x 140-mm high opening located at the top of the wall, with all services passing through the FyreBOX Slab-Mount. The cables and pipe projected horizontally 500-mm away from the unexposed face and 500-mm into the furnace chamber. The electrical conduit projected horizontally 2000-mm away from the unexposed face and 500-mm into the furnace chamber. Both the steel pipe and the NBN conduit were left open on the unexposed side and plugged with ceramic fibre (Superwool) on the exposed face.

The services were supported at approximately 500-mm and 1500-mm away from the plasterboard on unexposed face of the wall.

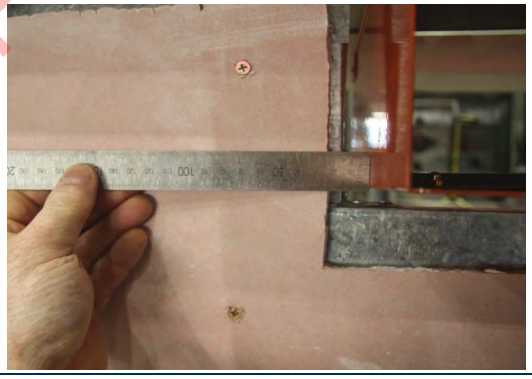
The FyreBOX 350 comprised a 350-mm wide x 125-mm high x 300-mm deep 'Slab Mounted' variant, constructed with a separate top plate that utilises a clip-together design to mate with the U-shaped lower section. This allows the top plate to be installed prior to wall construction. The FyreBOX top plate was mounted using 3 x M6 threaded bolts on both sides through pre-formed holes in the top plate, screwed into an AAC block which was used as a lintel extension to represent a concrete floor slab. Two top minor mounting plates (nominally 138-mm x 350-mm) were spot welded at each end on of the FyreBOX top plate with a 350-mm long x 50-mm wide x 1.5-mm thick GeeWhiz intumescent strip centrally located between the minor plates and sandwiched directly under the concrete lintel.



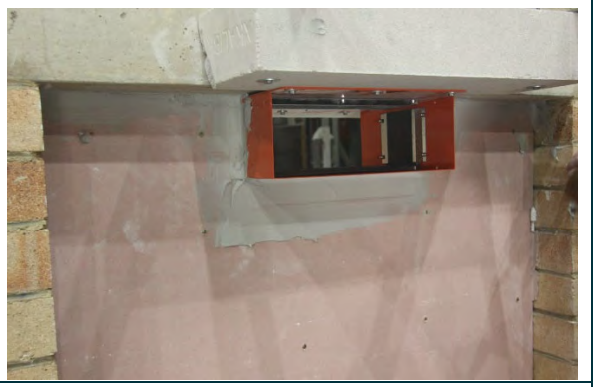
Exposed Side

Unexposed Side

The wall head track (a J-track 30-mm x 30-mm x 20-mm) was fitted and notched to fit around the FyreBOX footprint (160-mm wide x 125-mm high) and the 25-mm thick Shaftliner leaving a nominal 15-mm annular gap at the head of the wall. The annular gap on the unexposed face between the FyreBOX and the 16-mm plasterboard on the unexposed face measured nominally 15-mm at the head of the wall, 25-mm on the left side and 15-mm on the right side and 45-mm along the bottom. The annular gap between the FyreBOX and the head track was filled with FyreFLEX sealant and finished flush on both sides of the wall.



Annular gap between the wall and FyreBOX.



Annular gap filled with Fyreflex sealant.

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FyreBOX intumescent foam plugs measuring 40-mm thick x 125-mm x 380-mm were cut to suit the shapes of the penetrating services creating a snug friction fit between the service and the FyreBOX casing. These FyreBOX foam plugs were fitted to both sides of the FyreBOX.

On each side of the wall a single layer of TWrap foil encapsulated blanket measuring 300-mm long x 25-mm thick was fixed to the underside of the slab and around the services using three 10-gauge 75-mm screws with M6 washers. The TWrap extended 300-mm away from the plasterboard wall and 50-mm from each side of the FyreBOX as shown in drawing named 'Specimen 1', dated 27 September 2021 by Trafalgar Group Pty Ltd.

Specimen 2 – Five 1.5-mm² 2-core+E light cables penetrating a 32-mm diameter opening protected with a 60-mm FyreBOARD Maxilite and FyreFLEX sealant

The penetrating service comprised a group of five PVC sheathed 1.5-mm² 2-core+E lighting cables, penetrating the plasterboard wall through a 32-mm diameter hole. The lighting cables were fixed together with stainless-steel cable ties at 200-mm centres and projected horizontally 500-mm away from the unexposed face of the wall and 500 mm into the furnace chamber. On both sides of the wall the cables were supported 350-mm away from the plasterboard wall.

The annular gap between the cables and plasterboard wall was filled with FyreFLEX sealant to the full depth of the wall then finished with a 20-mm wide x 30-mm long fillet around the cables on the exposed face.

A 230-mm x 230-mm section of FyreBOARD Maxilite (blue) 60-mm thick board was fixed over the wall opening on the unexposed face of the plasterboard. The FyreBOARD Maxilite (blue) board was cut (vertically) into two halves to retrofit around the cables with a 32-mm diameter opening in the centre and was fixed to the wall using 10-gauge x 90-mm long plasterboard screws at nominally 150-mm centers.

The annular gap between the cables and Maxilite board was sealed to the full depth of the Maxilite with FyreFLEX Sealant. A bead of sealant nominally 10-mm x 10-mm was also placed around the perimeter of the board and over the Maxilite board joint, then a 20-mm wide x 30-mm long fillet was applied around the cables on both the unexposed face and the exposed of the wall as shown in drawing titled 'Specimen 2', dated 27 September 2021 by Trafalgar Group Pty Ltd.

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	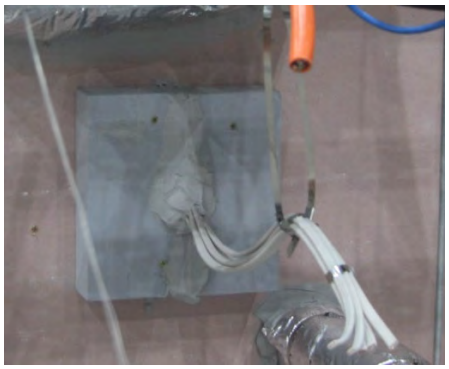
Exposed Side	Unexposed Side

Specimen 3 – A group of services penetrating a 110-mm diameter opening protected with a FyreBOX Mini Round 100, FyreFLANGEs and TWrap

The penetrating services comprised a NB32 steel sprinkler pipe, a 10-mm^2 3-core + E power cable and group of three RG-6 Quad shield co-axial cables, a Category 6 network cable and a 25-mm NBN conduit with an NBN cable located inside the conduit.

The DN32 steel pipe had an outside diameter of 43-mm and a wall thickness of 3.2-mm. The Electra 10-mm^2 3-core + E power cable had 16-mm outside diameter, a voltage rating of 0.6/1kV and an orange XLPE sheath. The Optus branded RG-6 Quad shield co-axial cables had an OD of 6-mm, the Category 6 cable had an OD of 6-mm and the Optus PVC conduit had an outside diameter of 25-mm with a wall thickness of 2-mm and incorporated a Fibre Optic NBN cable with an outside diameter of 15-mm located within the conduit.

The cables, conduit and steel pipe were fixed together with stainless-steel cable ties at 200-mm centres and penetrated the wall through a 110-mm diameter opening in the plasterboard. All the cables and the steel pipe projected horizontally 500-mm away from the unexposed face and 500-mm into the furnace chamber. The electrical conduit projected horizontally 2000-mm away from the unexposed face and 500-mm into the furnace chamber. Both the steel pipe and the NBN conduit were left open on the unexposed side and plugged with ceramic fibre (Superwool) on the exposed face.

The services were supported at approximately 500-mm and 1500-mm away from the plasterboard on unexposed face of the wall.

	
Exposed Side	Unexposed Side

A Trafalgar FyreBOX Mini Round 100 was fitted around the cables and placed into the 110-mm diameter hole in the plasterboard wall. On both sides of the wall, the annular gap between the FyreBOX and the plasterboard was filled with FyreFLEX sealant to the full depth of the wall linings (41-mm deep).

On both sides of the wall, steel mounting brackets (FyreFLANGE Mini Round 100) were fitted around the FyreBOX and fixed with 8g x 40-mm plasterboard screws in all four corners to restrain the FyreBOX in place. The FyreFLANGE comprised a 0.9-mm thick powder coated galvanized steel mounting bracket, having outside dimensions of 160-mm x 160-mm and a central 100-mm diameter opening with a 16-mm deep flanged piece. Each flange was fixed to the plasterboard linings, and each pair was fixed through the folded part of the metal flanges with a l 16-mm Tek screw above and below the FyreBOX Mini in the preformed fixing holes.

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The conduit pipe and cables were then lagged with a single layer of TWrap (25-mm thick foil encapsulated blanket with a stated density of 128Kg/m^3) which extended 300-mm from both sides of the wall, secured in place with two steel cable ties measuring 4.6-mm wide and positioned at 200-mm centers.

Specimen 4 - A DN50 copper pipe penetrating a 76-mm diameter opening protected with FyreFLEX sealant and Twrap

The penetrating service comprised a DN 50 Type B Copper pipe with a 50.8-mm outside diameter and a wall thickness of 1.22-mm. The pipe penetrated a 76-mm diameter opening in the wall as shown in drawing named 'Specimen 5' dated 23 March 2021 by Trafalgar Group Pty Ltd. The copper pipe projected horizontally, 500-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and was supported at nominally 500-mm from the unexposed face of the plasterboard wall. The copper pipe was open at the unexposed end and plugged with ceramic fibre (Superwool) on the exposed end.

	
Exposed Side	Unexposed Side

The annular gap between the pipe and the plasterboard wall was filled with FyreFLEX Sealant to the full depth of the wall, and then finished on both sides of the wall with a 30-mm wide x 30-mm long fillet around the pipe. The pipe was then lagged using a layer of TWrap (25-mm thick foil encapsulated blanket with a stated density of 128-Kg/m^3) which extended 300-mm from the exposed face and 300-mm on the unexposed face of the wall. The Twrap was fixed in place around the pipe with two 4.6-mm wide stainless-steel cable ties at 200-mm centres.

2.2 Dimensions

The specimen wall was nominally 1000-mm wide x 800-mm high x 41-mm thick with a 230-mm thick concrete lintel located over the top of the wall.

2.3 Orientation

The plasterboard wall was placed vertically against the furnace chamber and subjected to fire exposure from one side only.

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2.4 Conditioning

The specimen construction was completed on 17 August 2021 and left under standard laboratory atmospheric conditions until the test date.

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

The brick opening including the concrete lintel at the top of the wall was organised by CSIRO. The wall construction and specimen installation were 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:

- CSIRO Fire Assessment Report number FCO-3367, Revision C, dated 29 October 2020.
- Drawing name 'Test Overview' dated 27 September 2021 by Trafalgar Group Pty Ltd.
- Drawing name 'Wall Opening' dated 27 September 2021 by Trafalgar Group Pty Ltd.
- Drawing name 'Wall Construction' dated 27 September 2021 by Trafalgar Group Pty Ltd.
- Drawing names 'Specimen 1', 'Specimen 2', 'Specimen 3' and 'Specimen 4', all dated 27 September 2021 by Trafalgar Group Pty Ltd.
- Drawing named 'FyreBOX Mini Overview', 'Sheet 1 of 12', all date 13 July 2020 by Trafalgar Group Pty Ltd.
- Drawing named '20,400 – FyreBOX Slab Mount – Complete Drawing', 'Sheets 1 to 13', all dated 30 April 2018 by Trafalgar Group Pty Ltd.
- Document titled 'TWRAP Fire rated wrap' dated 26 May 2020 by Trafalgar Group Pty Ltd.
- Document titled 'MAXILITE Fire Rated Board' dated 1 January 2017 by Trafalgar Group Pty Ltd.
- Document titled 'Fyreflex Fire rated Sealant Technical guide service penetrations' dated 5 January 2020 by Trafalgar Group Pty Ltd.
- Technical brochure titled 'FyreBOX mini and FyreFLANGE' dated 26 November 2020 by Trafalgar Fire.

Confidential information about the test specimens has been submitted to CSIRO Infrastructure Technologies.

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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 Pressure

The furnace pressure was measured by a differential low-pressure transducer with a range of ± 50 Pa.

The pressure probe was located approximately 500-mm above the sill of the furnace.

4.4 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 11°C at the commencement of the test.

6 Departure from standard

The furnace pressure was outside the tolerances of the requirements of AS 1530.4-2014 for the short periods of time as shown in Figure 3. The test laboratory confirms that this minor departure in furnace pressure would not have significantly affected the results of this test.

7 Termination of test

The test was terminated at 98 minutes by the agreement with the sponsor.

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8 Test results

8.1 Critical observations

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

Time	Observation
0:40 minute -	Smoke is being emitted between the Twrap and services at the base of Specimen 1.
1 minute -	Smoke is being emitted between the Twrap and services at the base of Specimen 3.
5 minutes -	Smoke has started to flue from the end of the conduit of Specimen 1. The level of smoke from the Twrap and services of Specimens 1 and 3 has increased.
7 minutes -	Smoke has ceased fluing from the end of the conduit of Specimen 1. The level of smoke from the Twrap and services of Specimen 1 has reduced.
9 minutes -	The level of smoke from the Twrap and services of Specimen 3 has reduced.
10 minutes -	Smoke staining visible on the concrete lintel above Specimen 1.
12 minutes -	Light smoke is being emitted at the base of Specimens 1 and 3 between the wall and Twrap.
24 minutes -	Smoke venting at the base of Specimen 3 between the wall and the Twrap has ceased.
28 minutes -	Smoke venting at the base of Specimen 1 between the wall and the Twrap has reduced.
34 minutes -	The joint in the Maxilite panels of Specimen 2 has begun to split.
55 minutes -	The level of smoke from the Twrap and services of Specimen 3 has reduced.
58 minutes -	The sealant around the base of Specimen 4 has bubbled.
70 minutes -	Insulation failure of Specimen 3 - maximum temperature rise of 180K is exceeded on the FyreBOX flange (top right corner) at the base the specimen.
76 minutes -	Smoke has resumed fluing from the end of the conduit of Specimen 1. Sealant at the head of the wall adjacent to the Twrap of Specimen has begun to swell.
86 minutes -	The plasterboard wall behind the FyreBOX flange of Specimen 3 has begun to char.
90 minutes -	The plasterboard wall around the base of Specimen 2 has begun to char.
93 minutes -	The sealant around the cables at the at the base of Specimen 2 has begun to swell.
95 minutes -	The plasterboard wall around the base of Specimen 3 has begun to char.
96 minutes -	Insulation failure of Specimen 1 - maximum temperature rise of 180K is exceeded on the Plasterboard, 25-mm below the concrete slab.
98 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.

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8.4 Furnace pressure

Figure 3 shows the curve of average pressure versus time inside the furnace chamber recorded during the heating period.

8.5 Specimen temperature

Figure 4 shows the curve of temperature versus time associated with Specimen 1.

Figure 5 shows the curve of temperature versus time associated with Specimen 2.

Figure 6 shows the curve of temperature versus time associated with Specimen 3.

Figure 7 shows the curve of temperature versus time associated with Specimen 4.

8.6 Performance

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

Specimen 1 - A group of services penetrating a 380-mm x 140-mm opening protected by a FyreBOX Slab-Mount, FyreFLEX sealant and Twrap

Structural adequacy	-	not applicable
Integrity	-	no failure at 98 minutes
Insulation	-	96 minutes

Specimen 2 - Five 1.5-mm² 2-core+E light cables penetrating a 32-mm diameter opening protected with a 60-mm FyreBOARD Maxilite and FyreFLEX sealant

Structural adequacy	-	not applicable
Integrity	-	no failure at 98 minutes
Insulation	-	no failure at 98 minutes

Specimen 3 - A group of services penetrating a 110-mm diameter opening protected with a FyreBOX Mini Round 100, FyreFLANGEs and TWrap

Structural adequacy	-	not applicable
Integrity	-	no failure at 98 minutes
Insulation	-	70 minutes

Specimen 4 - A DN50 copper pipe penetrating a 76-mm diameter opening protected with FyreFLEX sealant and Twrap

Structural adequacy	-	not applicable
Integrity	-	no failure at 98 minutes
Insulation	-	no failure at 98 minutes

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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 AS 1530.4. Any significant variation with respect to size, construction details, loads, stresses, edge of end conditions, other than that 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 the measurement of fire resistance, it is not possible to provide a stated degree for 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 1530.4-2014, have been made provided no individual component is removed or reduced.

11 Tested by

Peter Gordon
Testing Officer

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Appendices

Appendix A – Measurement location

Specimen	T/C Position	T/C designation
Specimen 1 - A group of services penetrating a 380-mm x 140-mm opening protected by a FyreBOX Slab-Mount, FyreFLEX sealant and Twrap.	On sealant, head of the wall 25-mm from TWrap LHS	S1
	On sealant, head of the wall 25-mm from TWrap RHS	S2
	On lintel, head of the wall 25-mm from TWrap LHS	S3
	On lintel, head of the wall 25-mm from TWrap RHS	S4
	On P/B wall, 25-mm from TWrap LHS	S5
	On P/B wall, 25-mm below TWrap LHS	S6
	On mastic infill LHS bottom corner.	S7
	On mastic infill RHS bottom corner.	S8
	On TWrap 25-mm from wall LHS	S9
	On TWrap 25-mm from wall RHS	S10
	On top of steel pipe 25-mm from TWrap	S11
	On RHS of steel pipe bottom side 25-mm from TWrap	S12
	On LHS of large power cable, 25-mm from TWrap	S13
	On RHS of large power cable, 25-mm from TWrap	S14
	On co-axial cables LHS, 25-mm from TWrap	S15
	On Cat 6 cable LHS, 25-mm from TWrap	S16
	On the top of conduit, 25-mm from TWrap	S17
	On Conduit RHS, 25-mm from TWrap	S18
Specimen 2 - Five 1.5-mm² 2-core+E TPS power cable penetrating a 32-mm diameter opening protected with a 60-mm FyreBOARD Maxilite and FyreFLEX sealant.	On P/B wall, 25-mm above Maxilite on the joint.	S19
	On P/B wall, 25-mm left of Maxilite	S20
	On top edge of Maxilite, 25-mm from P/B wall	S21
	On left edge of Maxilite, 25-mm from P/B wall	S22
	On top side sealant	S23
	On right side of sealant	S24
	On top side of cables, 25-mm from sealant	S25
	On bottom side of cables, 25-mm from sealant.	S26

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Specimen	T/C Position	T/C designation
Specimen 3 - A group of services penetrating a 110-mm diameter opening protected by a 100-mm Round FyreBOX, FyreFLEX sealant and TWrap	On P/B wall, 25-mm above FyreBOX	S27
	On P/B wall, 25-mm right of FyreBOX	S28
	On FyreBOX flange, top right corner	S29
	On FyreBOX flange, bottom left corner	S30
	On top of TWrap 25-mm from FyreBOX	S31
	On bottom right side of TWrap 25-mm from FyreBOX	S32
	On conduit Top, 25-mm from TWrap	S33
	On Conduit RHS, 25-mm from TWrap	S34
	On co-axial cables LHS, 25-mm from TWrap	S35
	On Cat 6 cable LHS, 25-mm from TWrap	S36
	On top side of large power cable, 25-mm from TWrap.	S37
	On steel pipe 25-mm from TWrap Top	S38
Specimen 4 - An NB25 copper pipe penetrating a 76-mm diameter opening protected with FyreFLEX sealant and TWrap	On P/B wall, 25-mm above TWrap	S39
	On P/B wall, 25-mm right of TWrap	S40
	On mastic top side	S41
	On mastic RHS bottom corner.	S42
	On TWrap 25-mm from wall LHS	S43
	On TWrap 25-mm from wall RHS	S44
	On top of copper pipe 25-mm from TWrap	S45
	On RHS of copper pipe 25-mm from TWrap	S46
On wall	On top LHS corner of P/B wall	S47
	On top RHS corner of P/B wall	S48
Rover		S49
Ambient		S50

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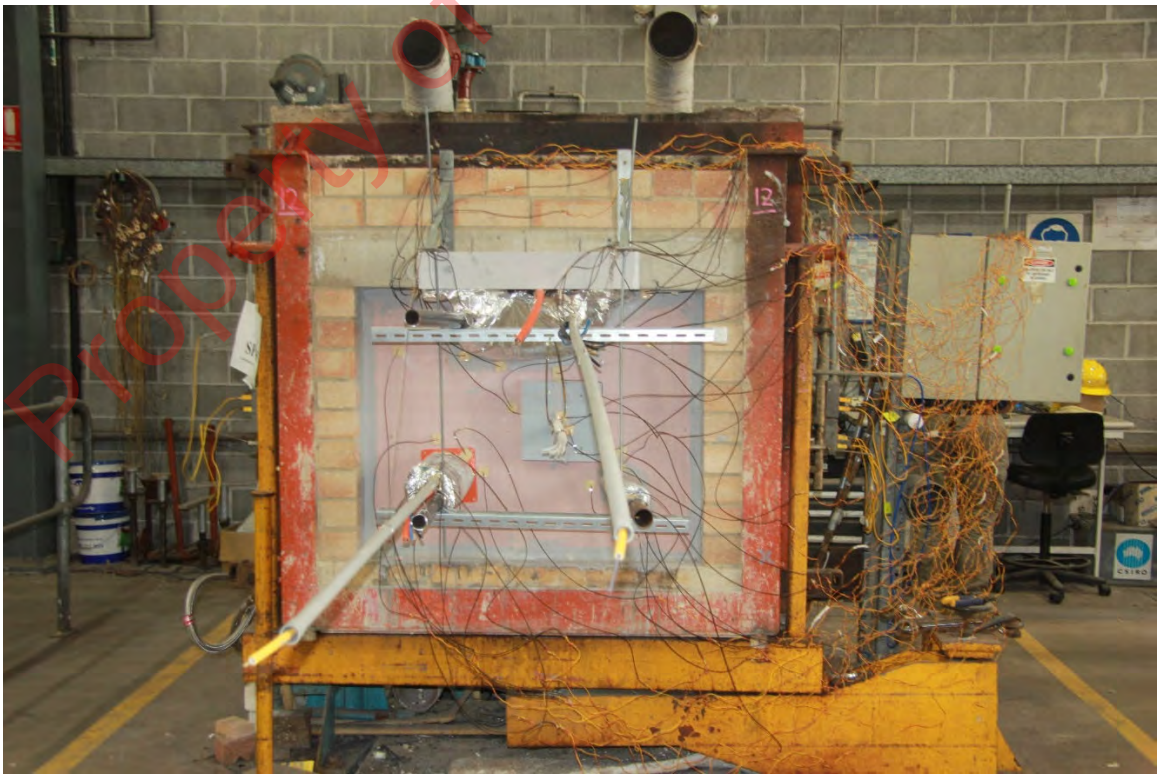
Appendix B – Photographs

PHOTOGRAPH 1 – EXPOSED FACE OF SPECIMENS PRIOR TO TESTING



PHOTOGRAPH 2 – UNEXPOSED FACE OF SPECIMENS PRIOR TO TESTING

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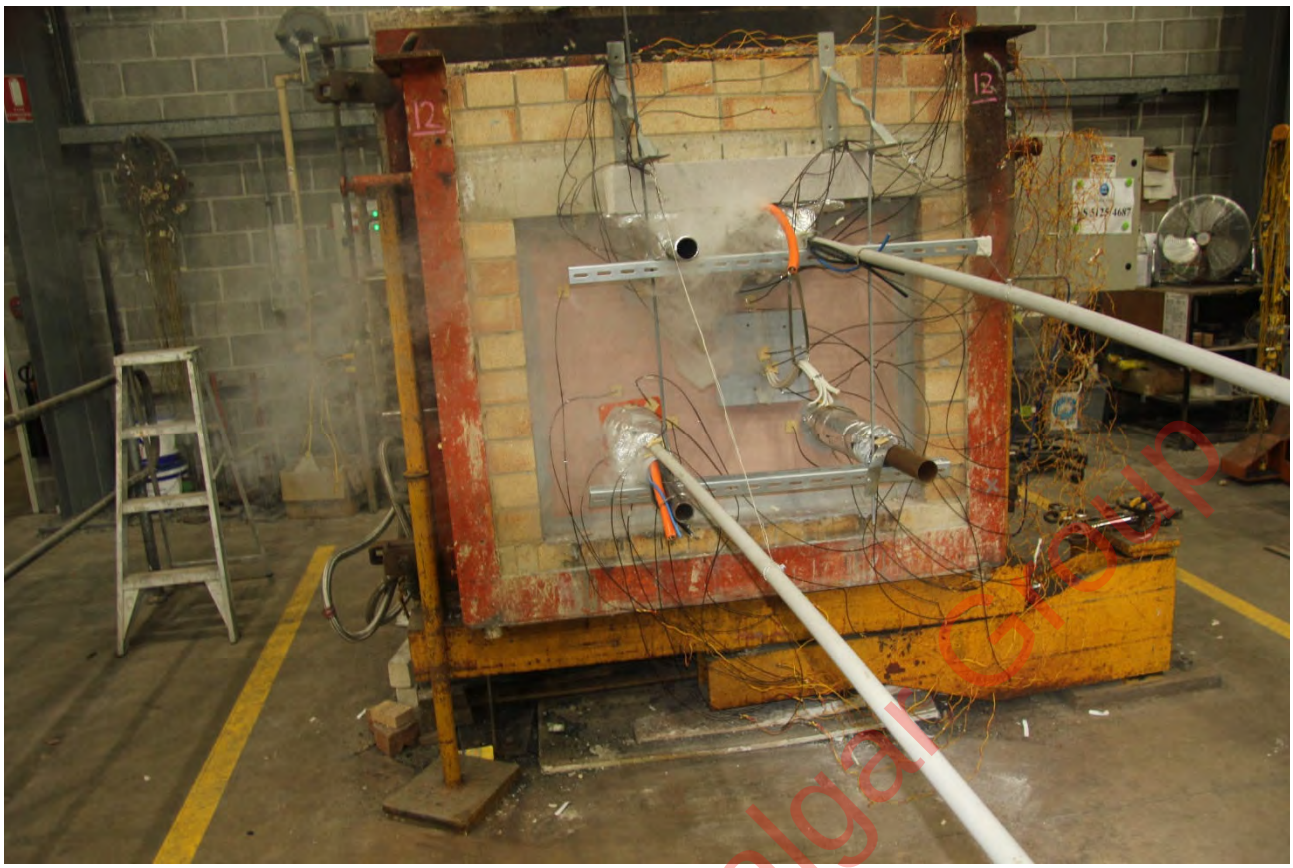

PHOTOGRAPH 3 – SPECIMENS AT 8 MINUTES INTO THE TEST

PHOTOGRAPH 4 – SPECIMENS AT 30 MINUTES INTO THE TEST

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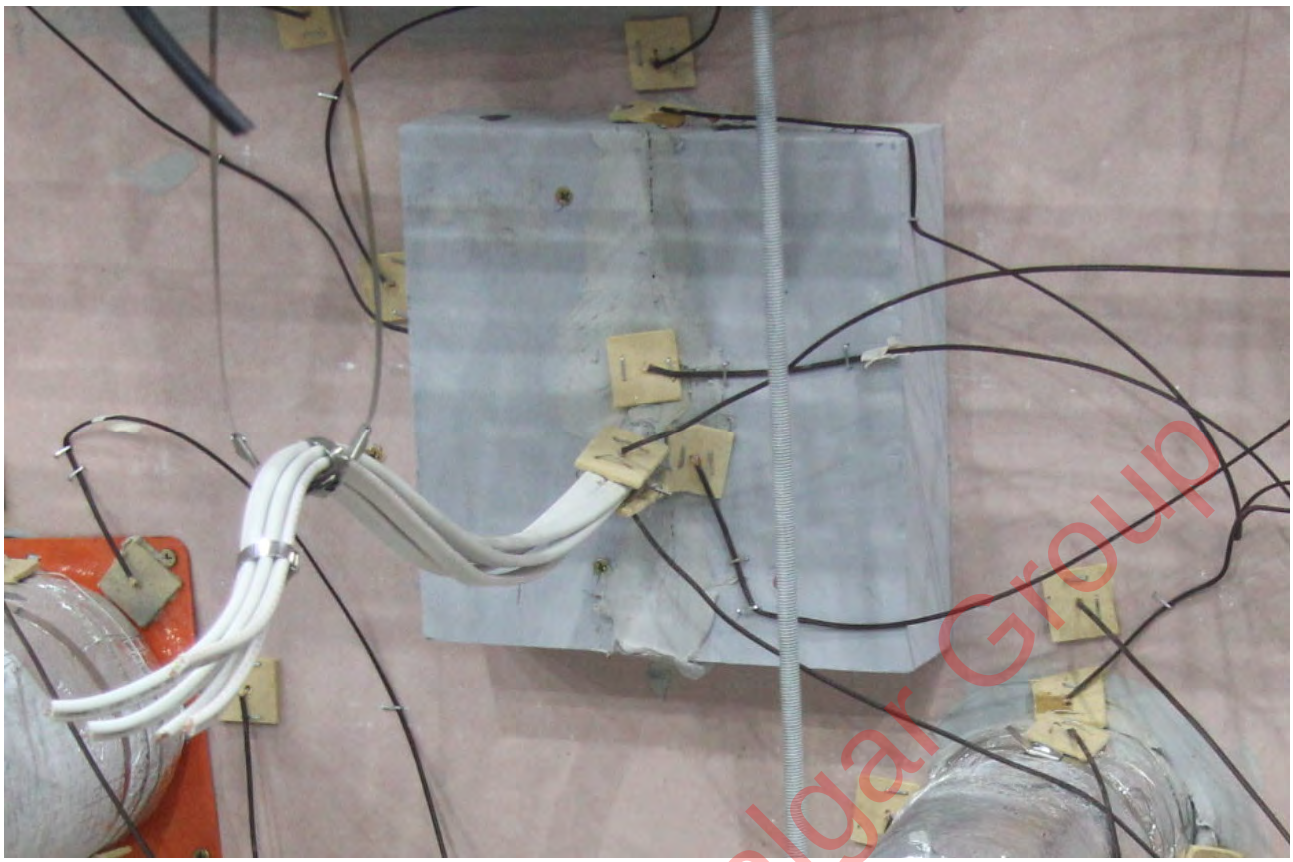

PHOTOGRAPH 5 –SPECIMEN 2 AT 34 MINUTES INTO THE TEST

PHOTOGRAPH 6 – SPECIMEN 4 AT 58 MINUTES INTO THE TEST

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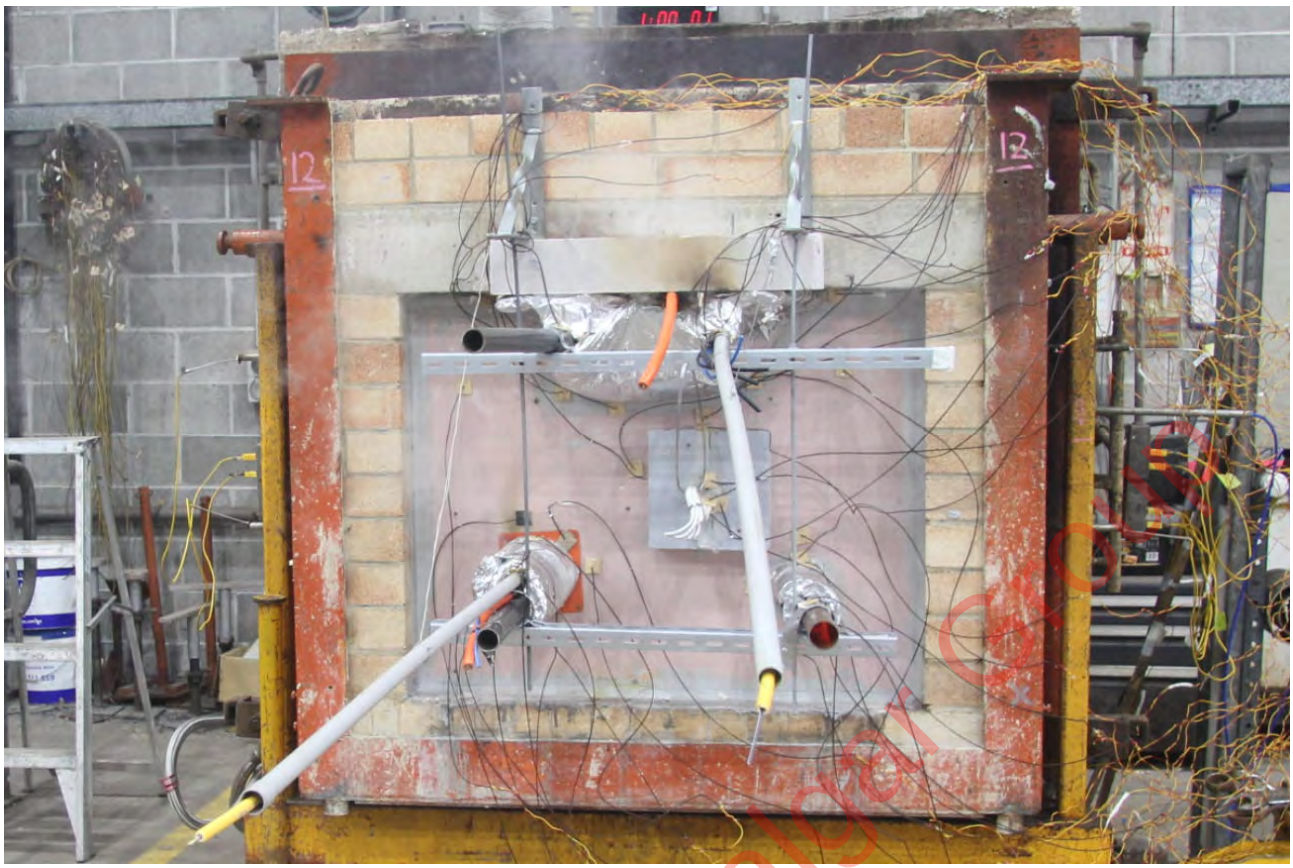
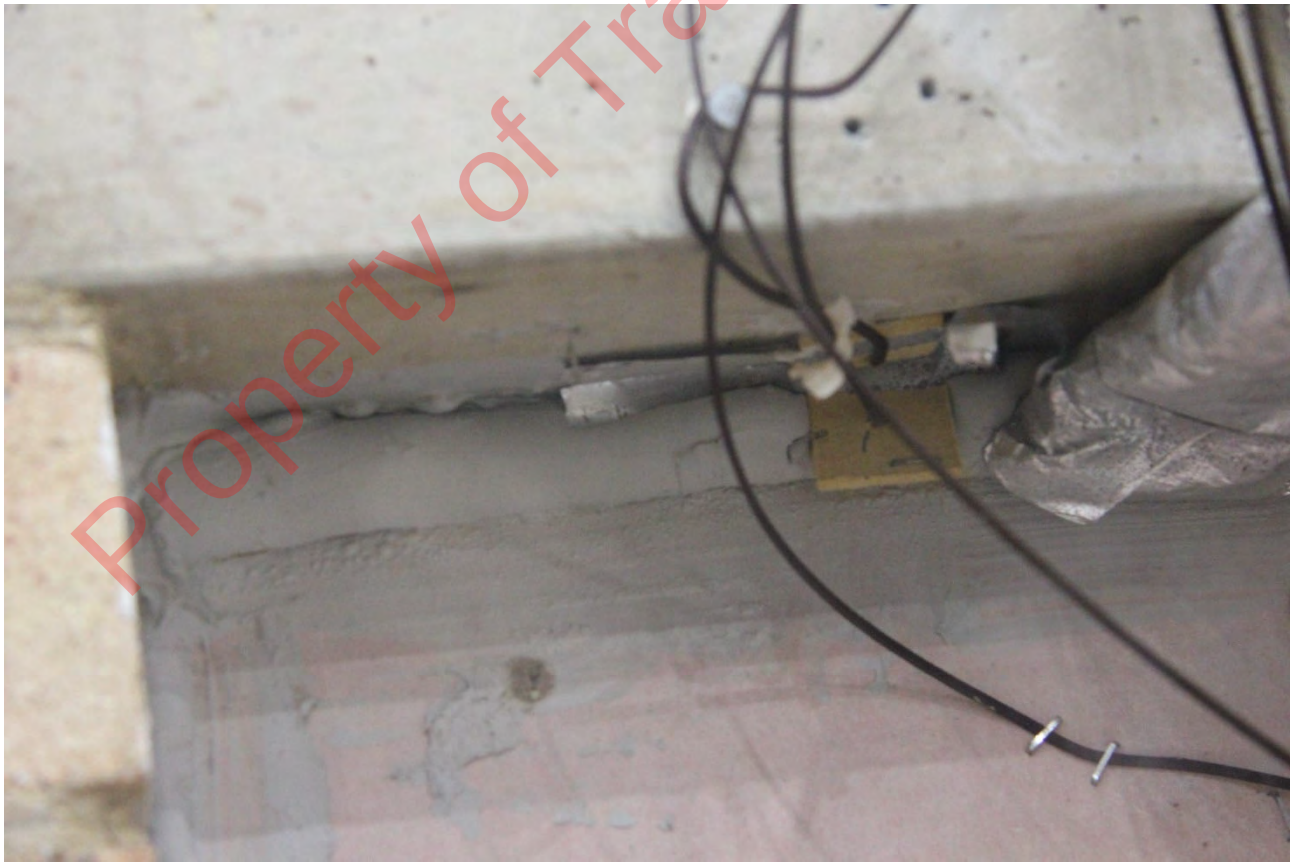


PHOTOGRAPH 7 – SPECIMENS AT 60 MINUTES INTO THE TEST



PHOTOGRAPH 8 – SPECIMEN 1 AT 76 MINUTES INTO THE TEST

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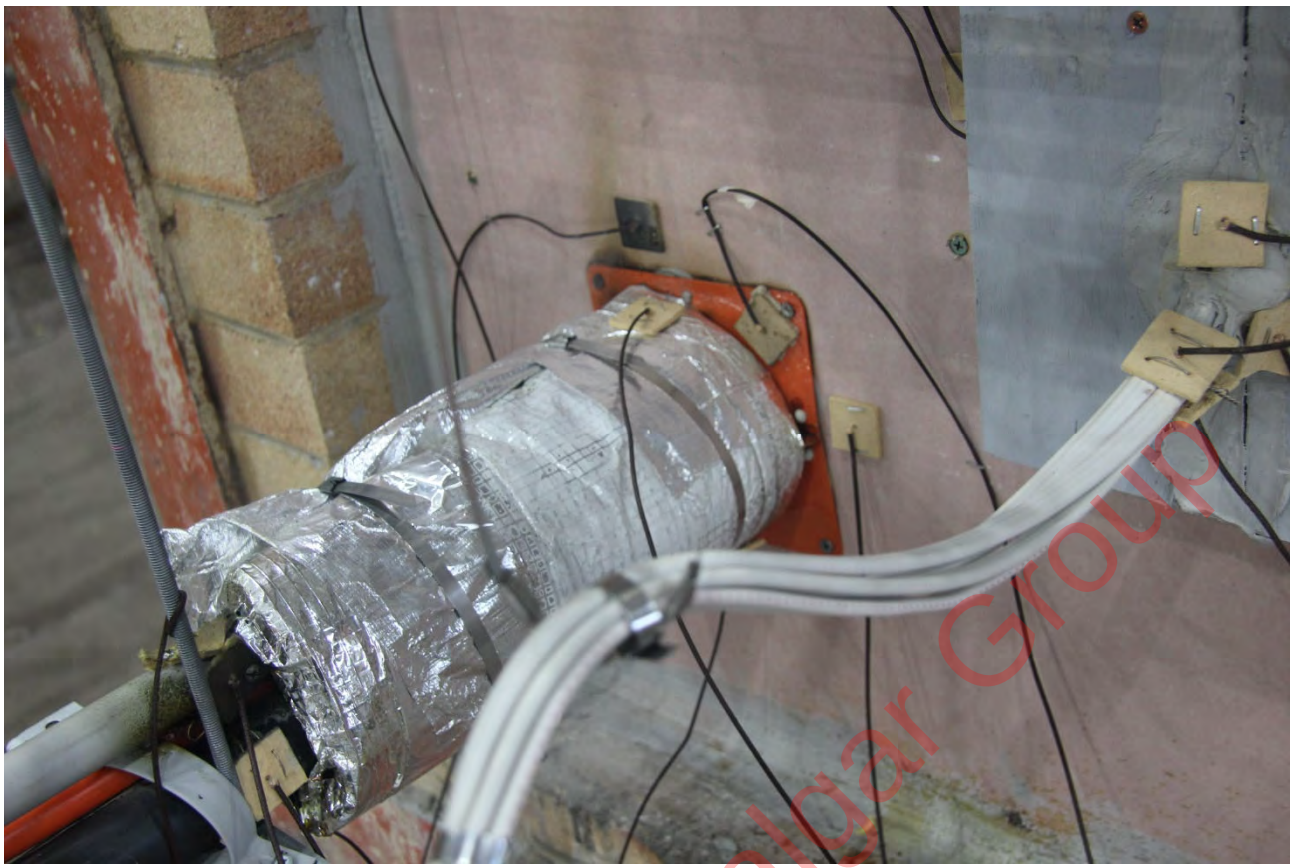
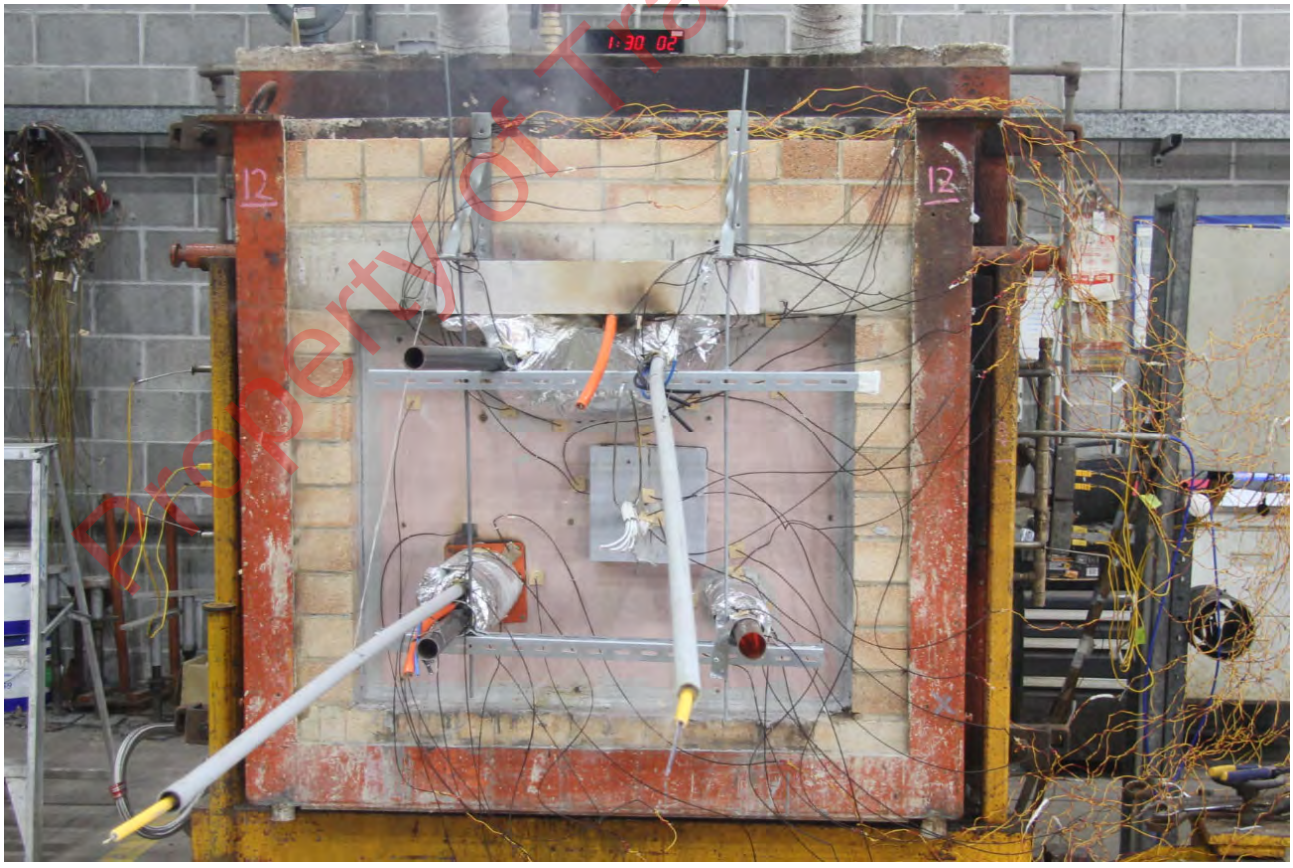


PHOTOGRAPH 9 – SPECIMEN 3 AT 86 MINUTES INTO THE TEST



PHOTOGRAPH 10 – SPECIMENS AT 90 MINUTES INTO THE TEST

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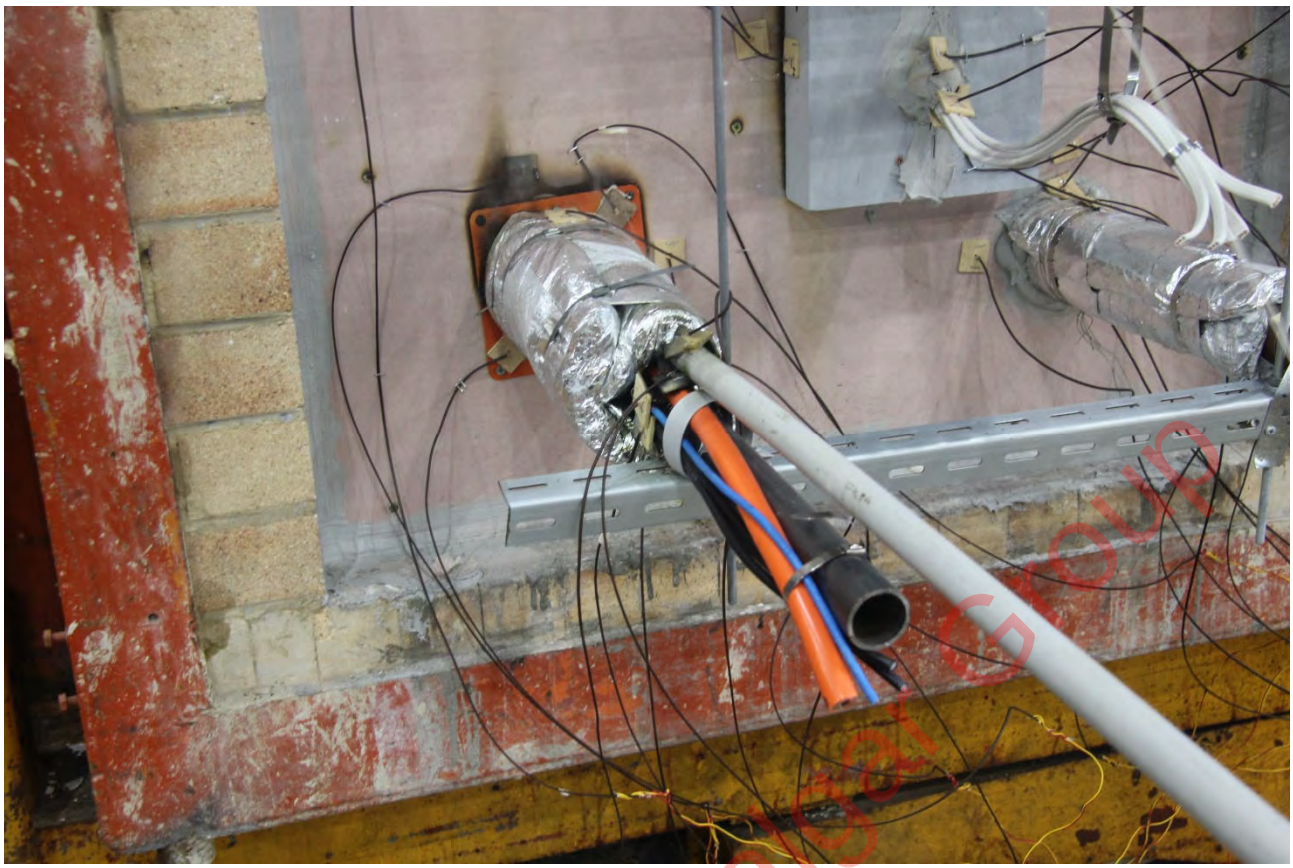
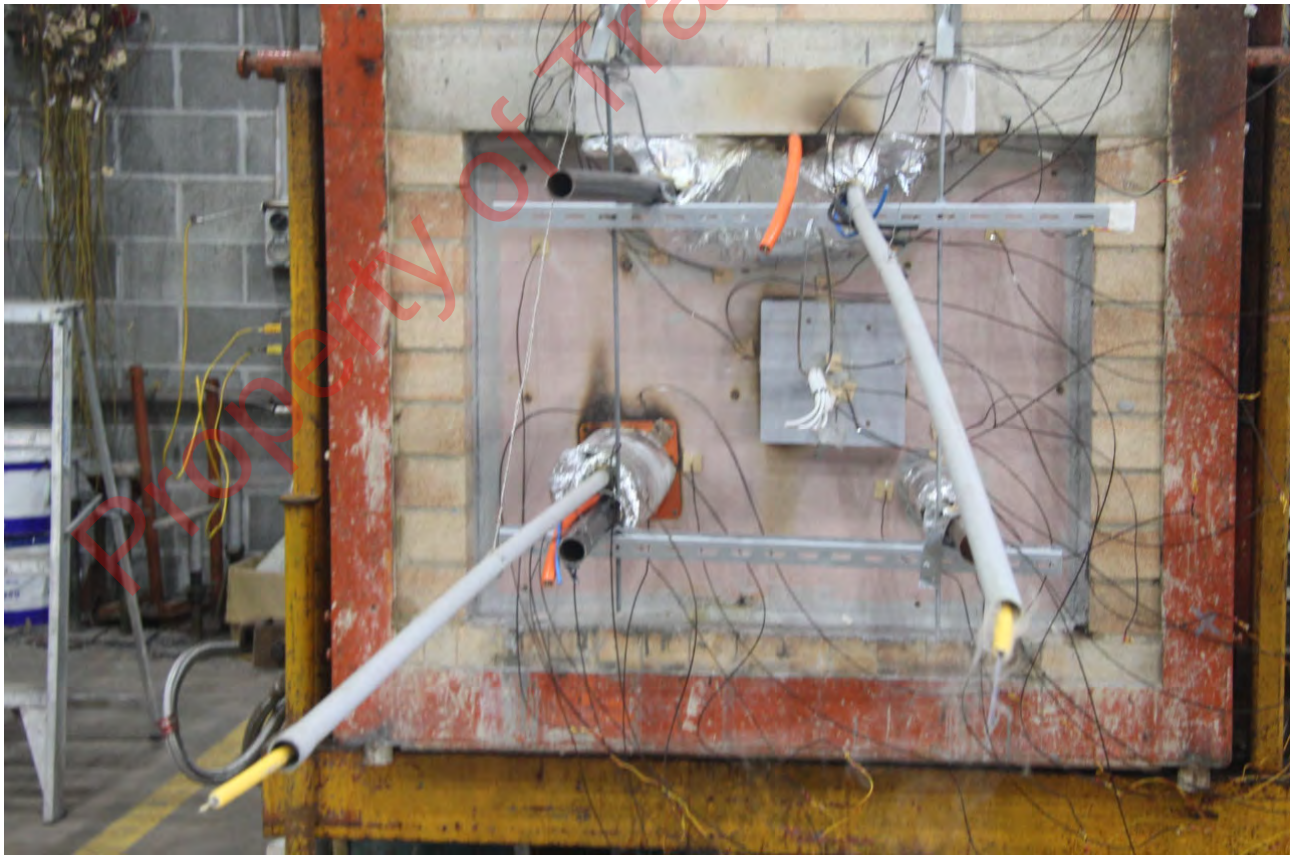


PHOTOGRAPH 11 – SPECIMEN 3 AT 95 MINUTES INTO THE TEST



PHOTOGRAPH 12 – UNEXPOSED FACE OF SPECIMENS AT THE CONCLUSION OF TESTING

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

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Appendix C – Test Data charts

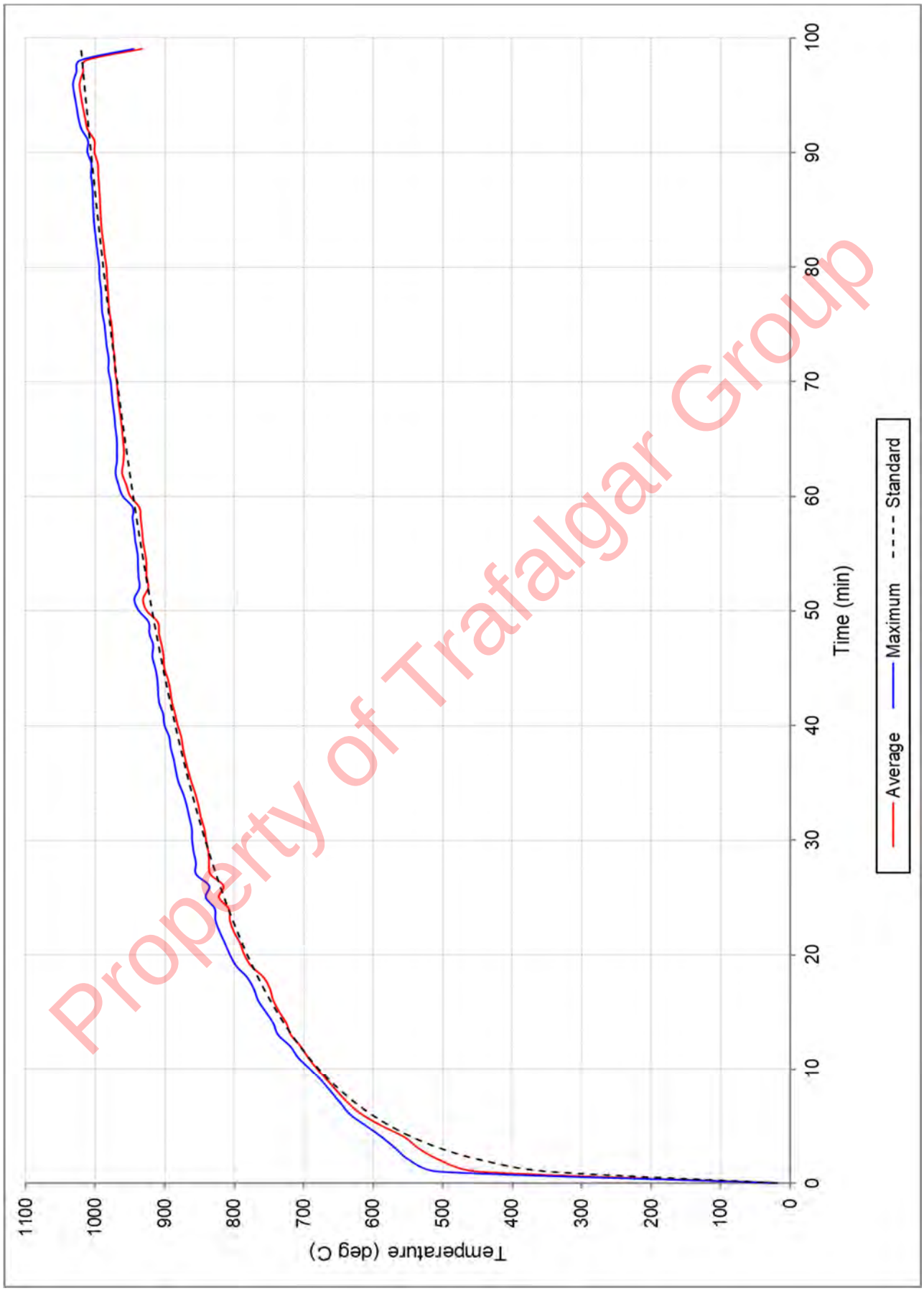

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FIGURE 1 – FURNACE TEMPERATURE

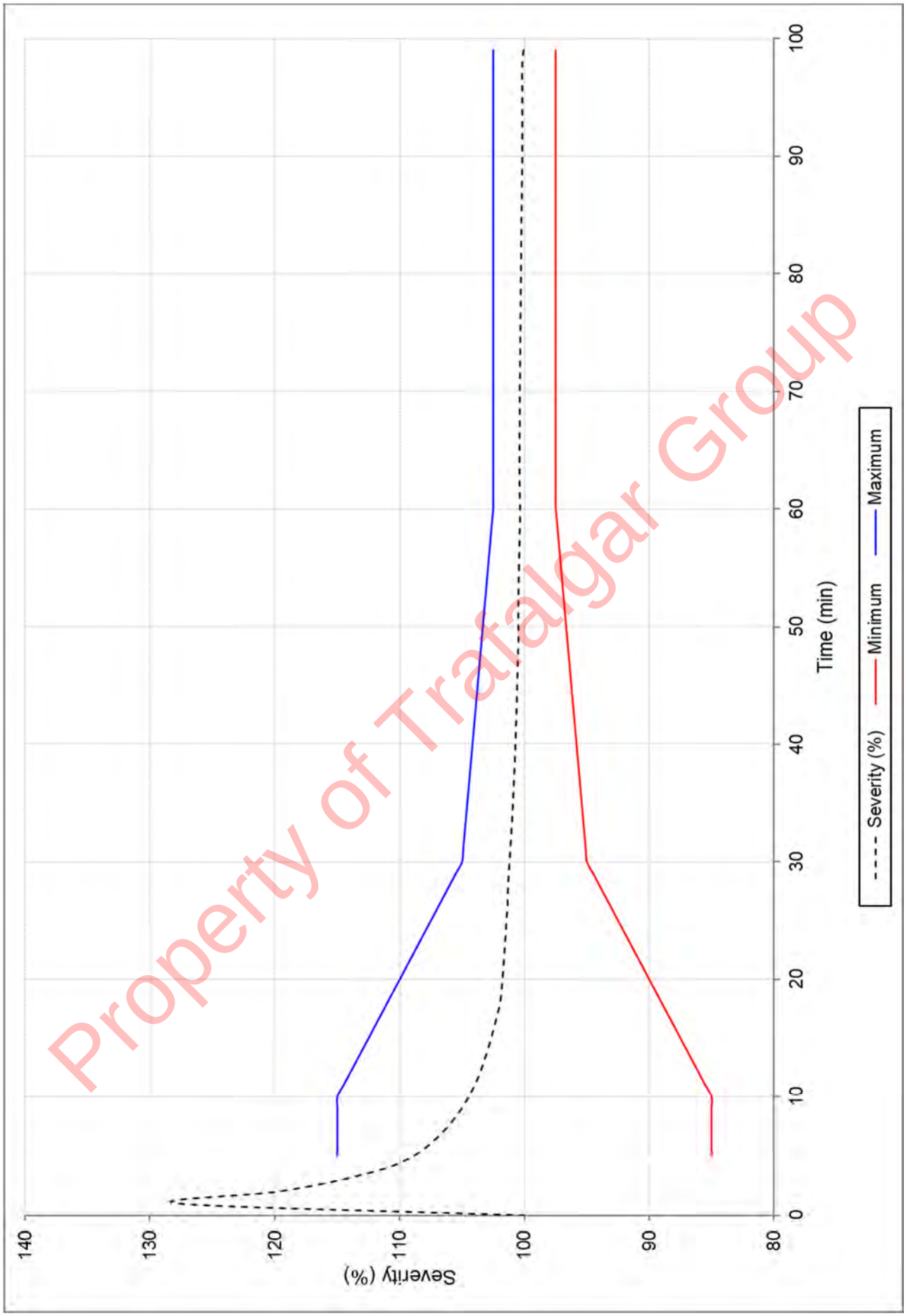

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FIGURE 2 – FURNACE SEVERITY

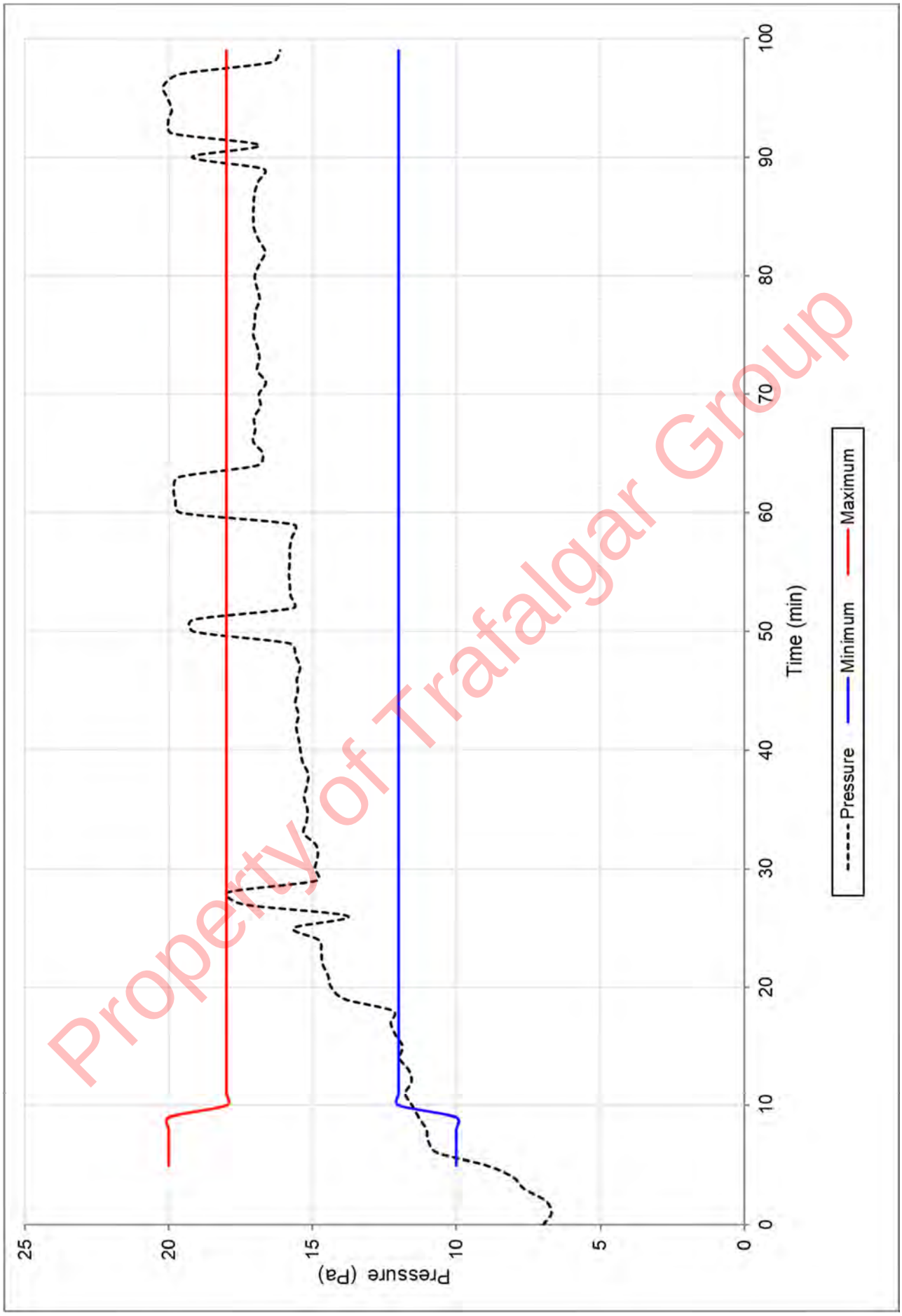

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FIGURE 3 – FURNACE PRESSURE

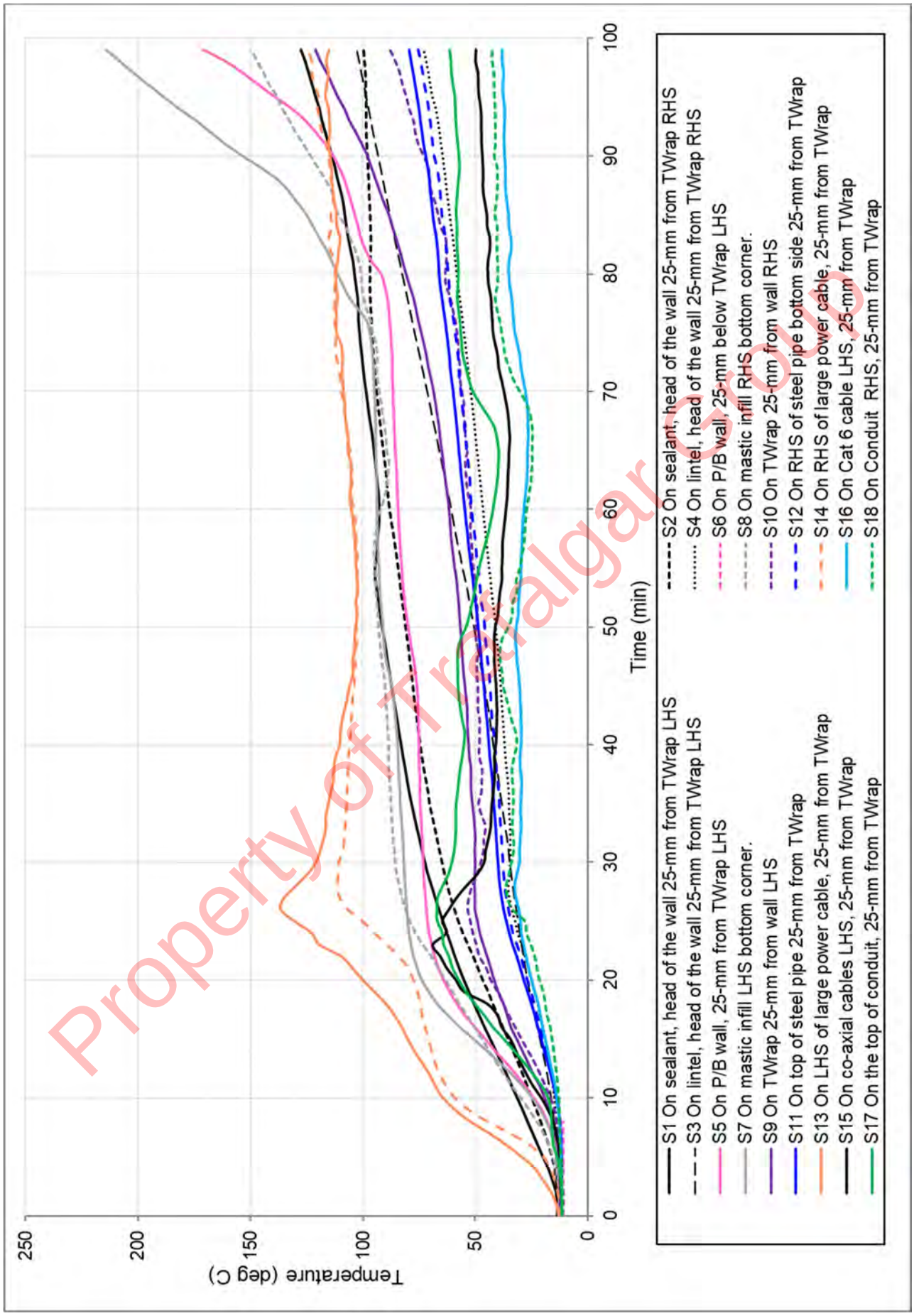

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FIGURE 4 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 1

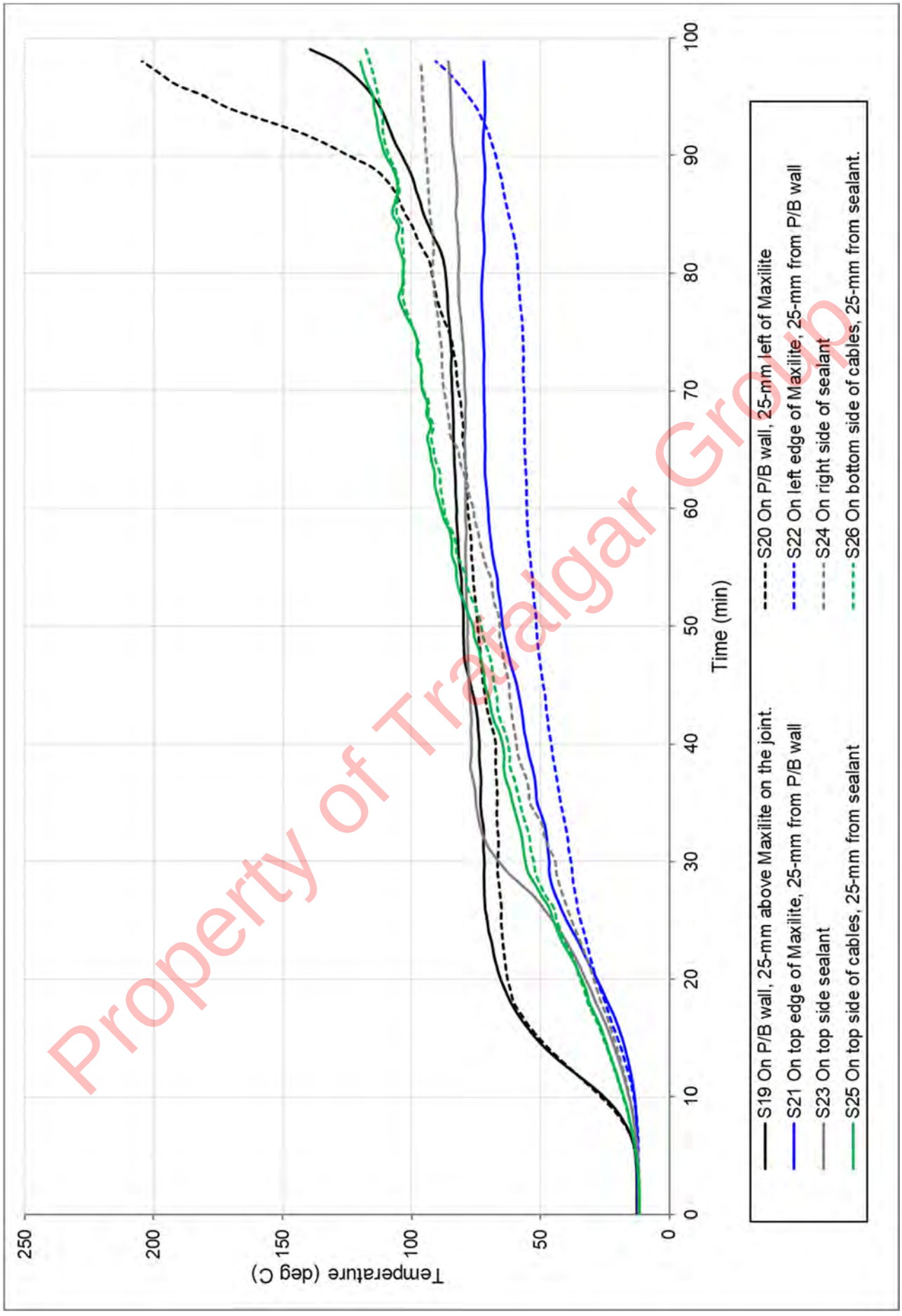

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FIGURE 5 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 2

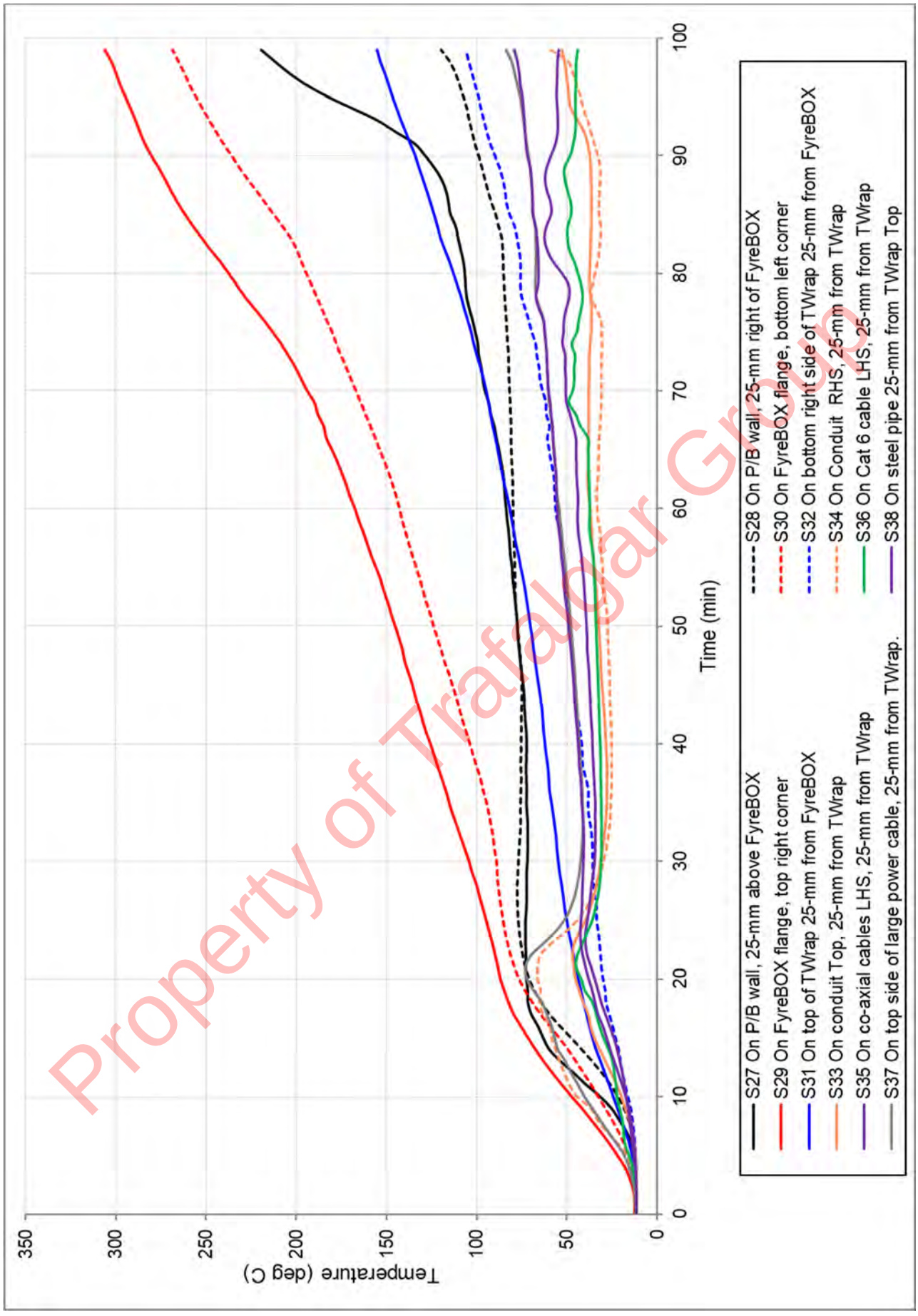

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FIGURE 6 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 3

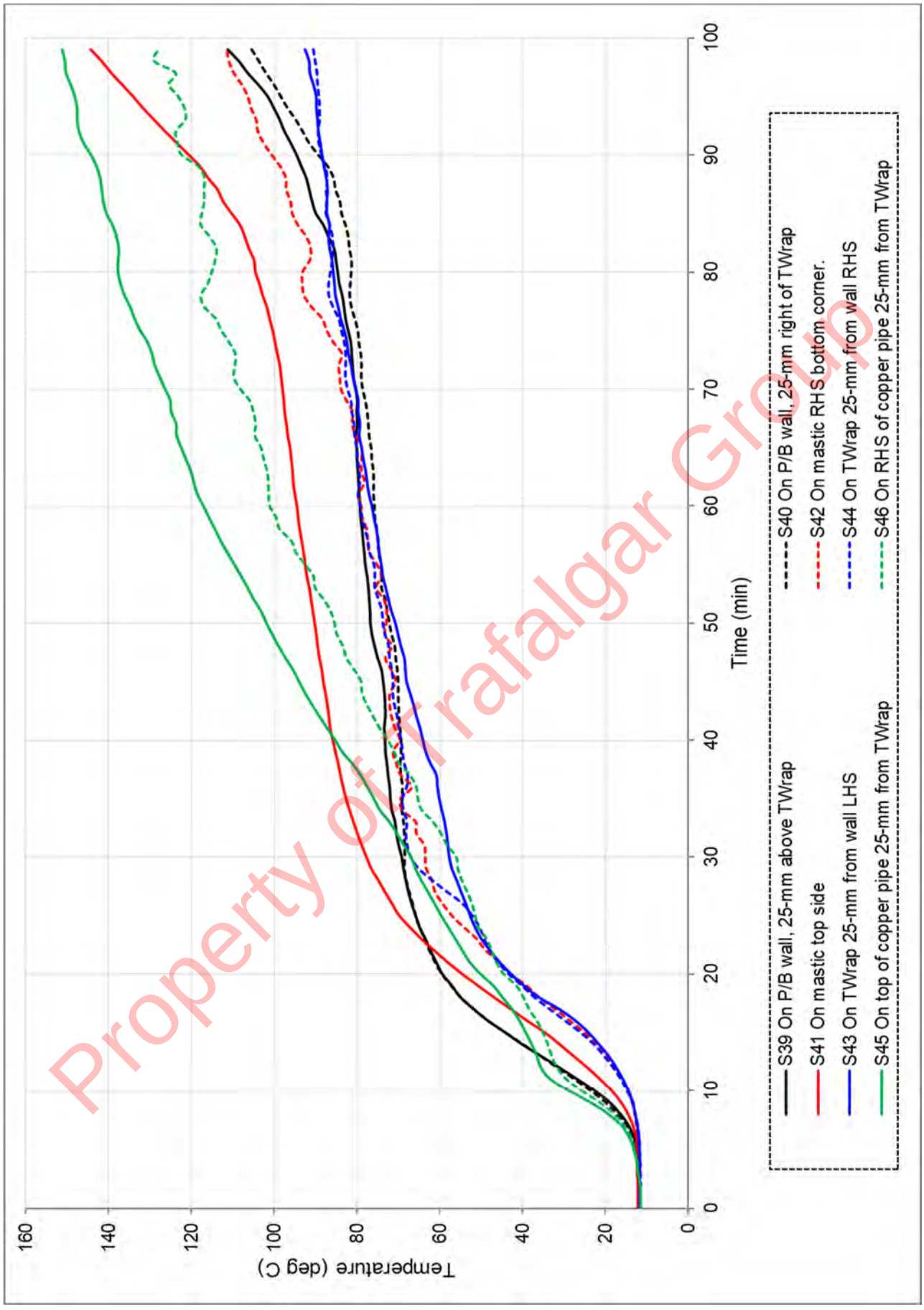

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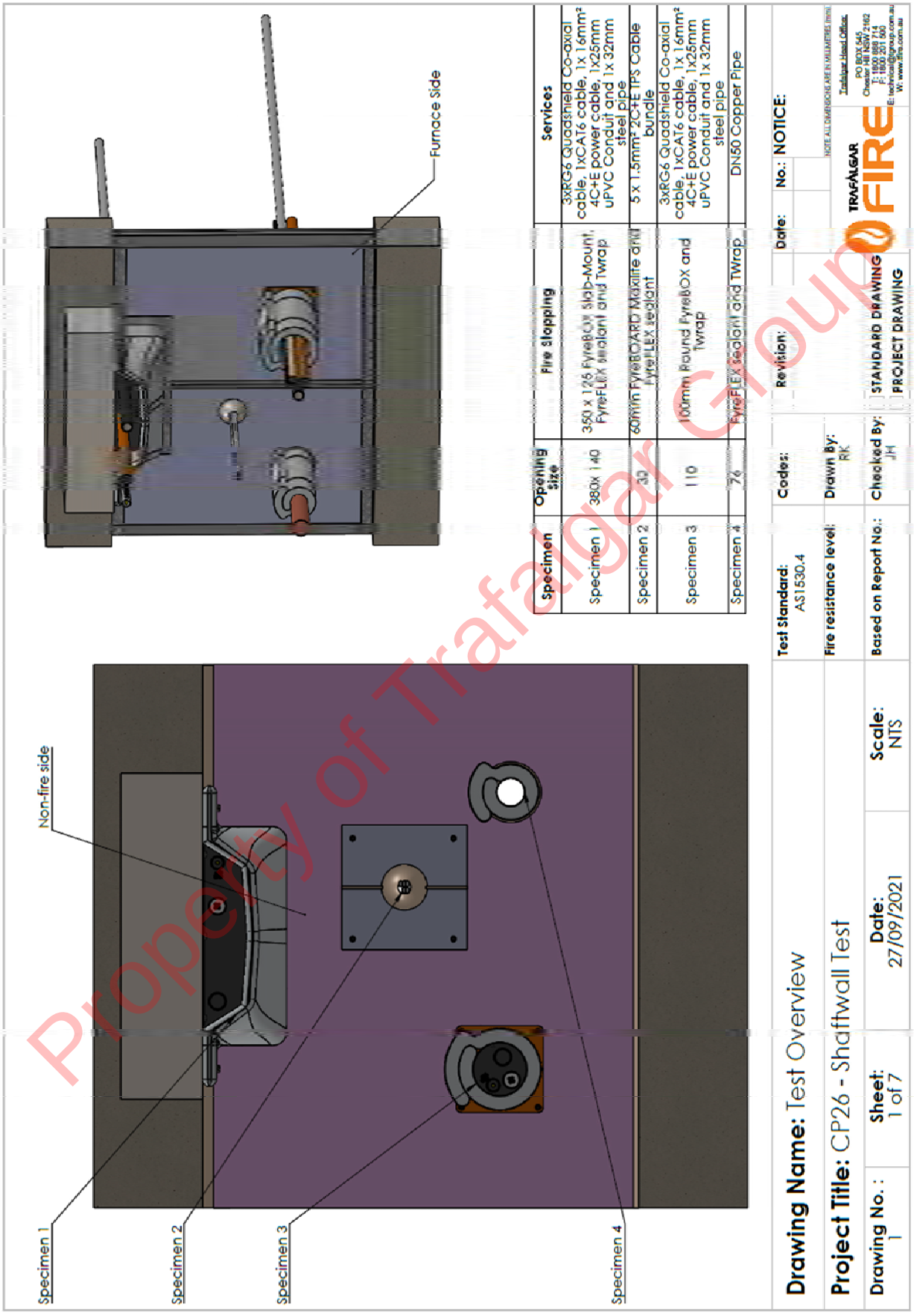
FIGURE 7 – SPECIMEN TEMPERATURE – ASSOCIATED WITH SPECIMEN 4

Appendix D – Installation drawings



Specimen	Opening Size	Fire stopping	Services
Specimen 1	380x 140	350 x 125 FyreBOX slab-Mount, FyreFLEX sealant and Twrap	3xRG6 Quadshield Co-axial cable, 1xCAT6 cable, 1x 16mm² 4C+E power cable, 1x25mm uPVC Conduit and 1x 32mm steel pipe
Specimen 2	30	60Min FyreBOARD Maxilite and FyreFLEX sealant	5 x 1.5mm² 2C+E TPS Cable bundle
Specimen 3	110	100mm Round FyreBOX and Twrap	3xRG6 Quadshield Co-axial cable, 1x 16mm² 4C+E power cable, 1x25mm uPVC Conduit and 1x 32mm steel pipe
Specimen 4	76	FyreFLEX sealant and Twrap	DN50 Copper Pipe

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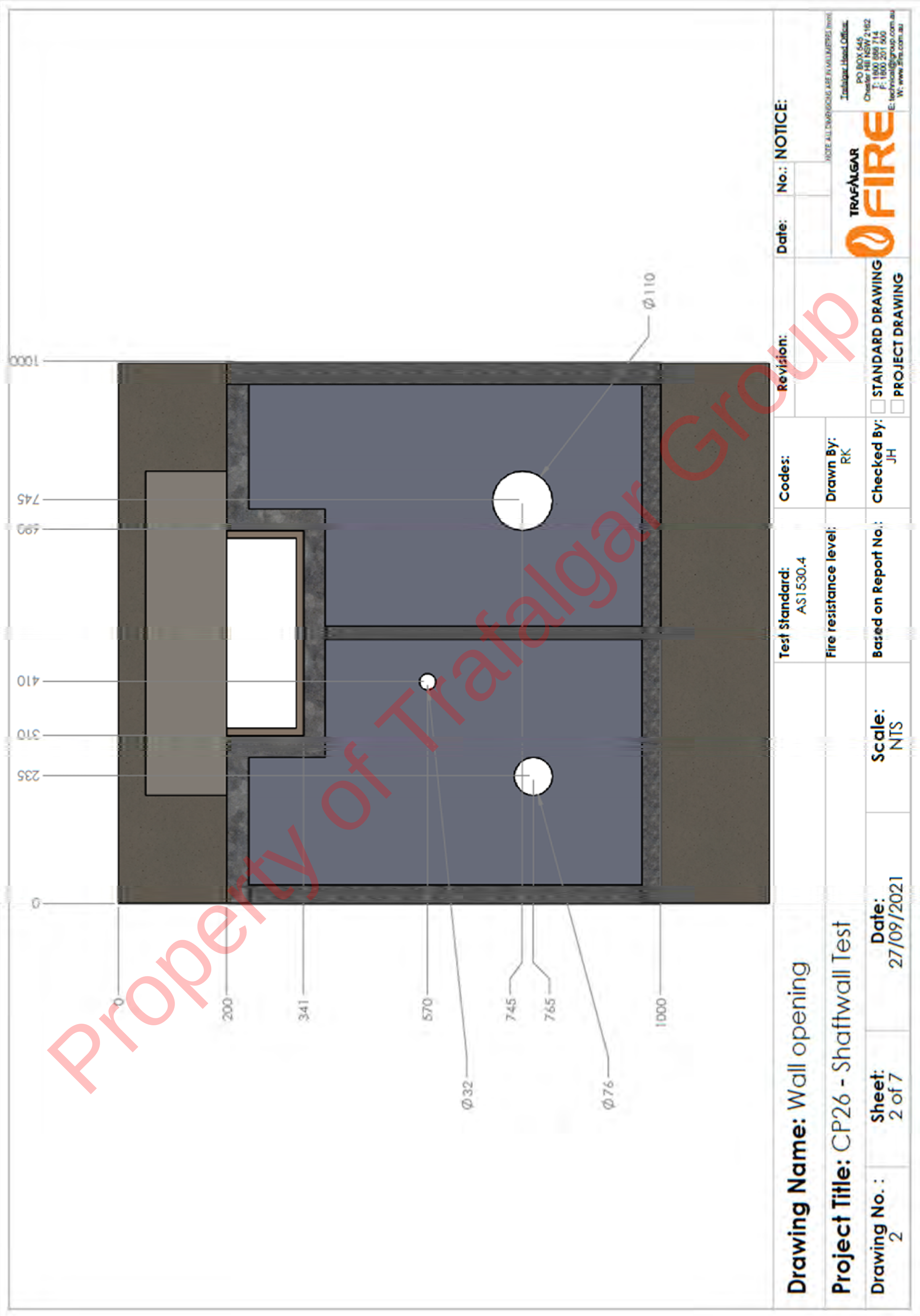
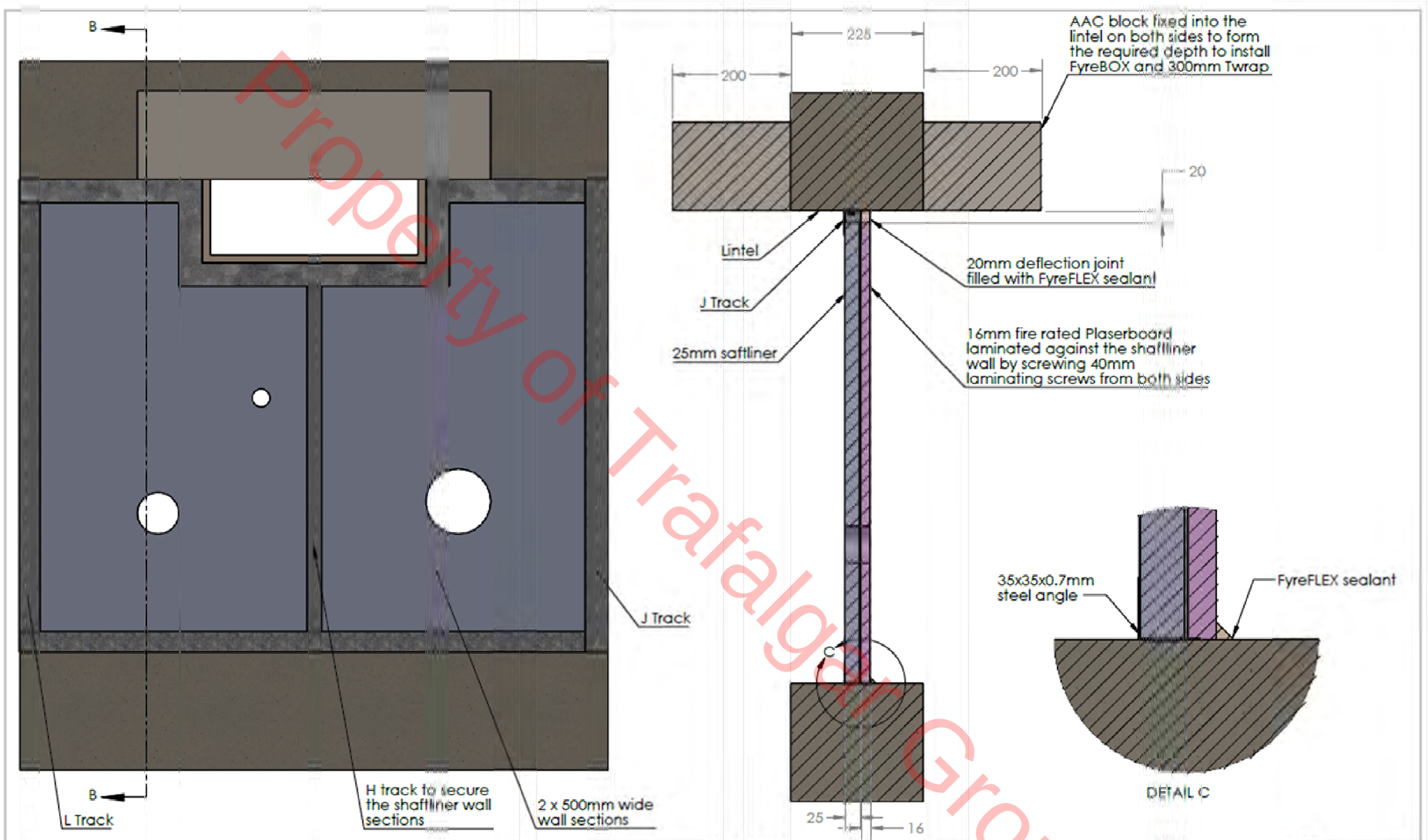
DRAWING TITLED 'TEST OVERVIEW', DATED 27 SEPTEMBER 2021, BY TRAFALGAR GROUP PTY LTD



DRAWING TITLED 'WALL OPENING', DATED 27 SEPTEMBER 2021, BY TRAFALGAR GROUP PTY LTD



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Drawing Name: Wall Construction

Project Title: CP26 - Shaftwall Test

Drawing No. :	Sheet:	Date:	Scale:	Test Standard:	Codes:	Revision:	Date:	No.:	NOTICE:
3	3 of 7	27/09/2021	NTS	AS1530.4					NOTE ALL DIMENSIONS ARE IN MILLIMETRES (mm)
				Fire resistance level:	Drawn By: RK				
				Based on Report No.:	Checked By: JH	☐ STANDARD DRAWING ☐ PROJECT DRAWING			

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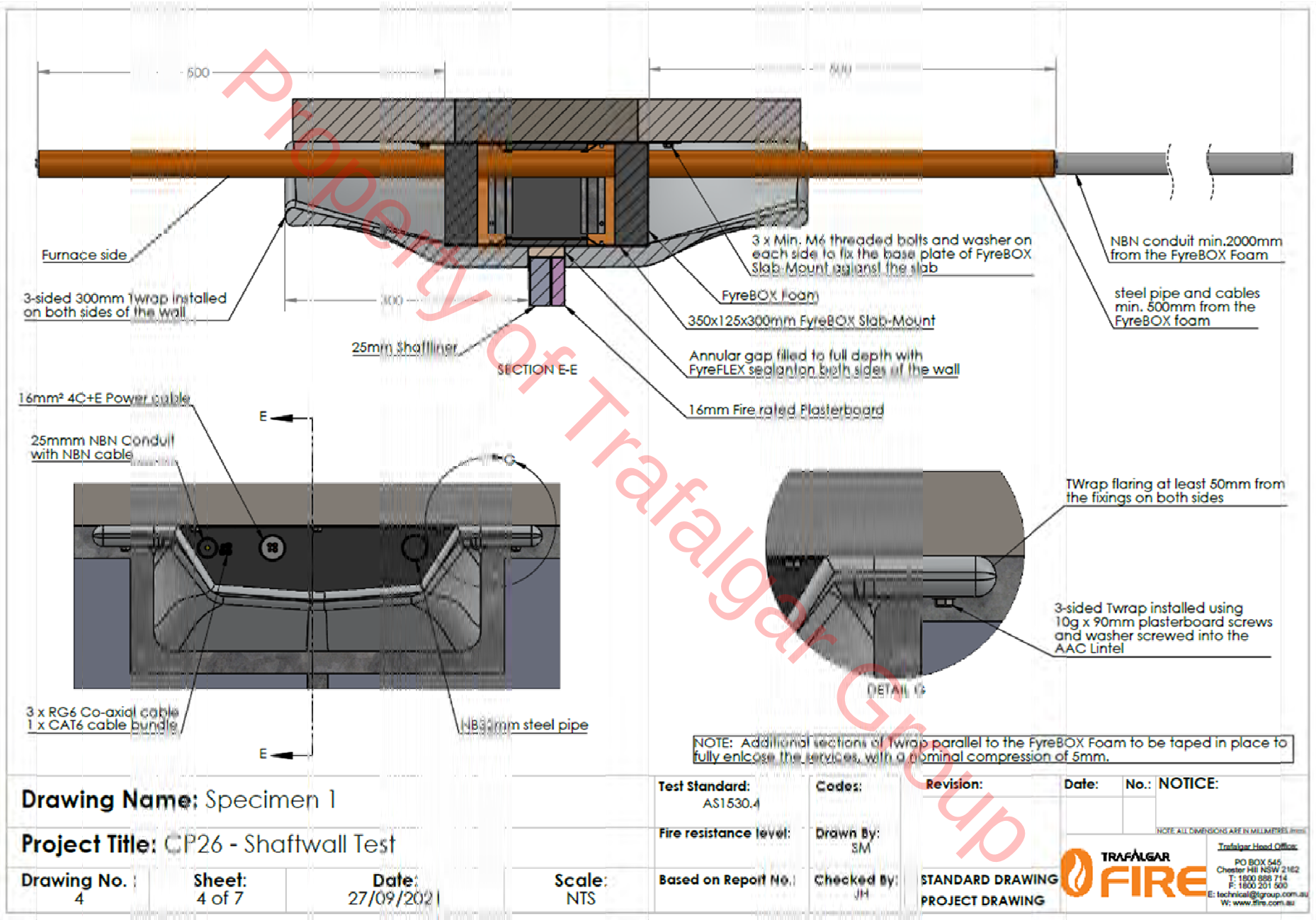
W: www.tfire.com.au



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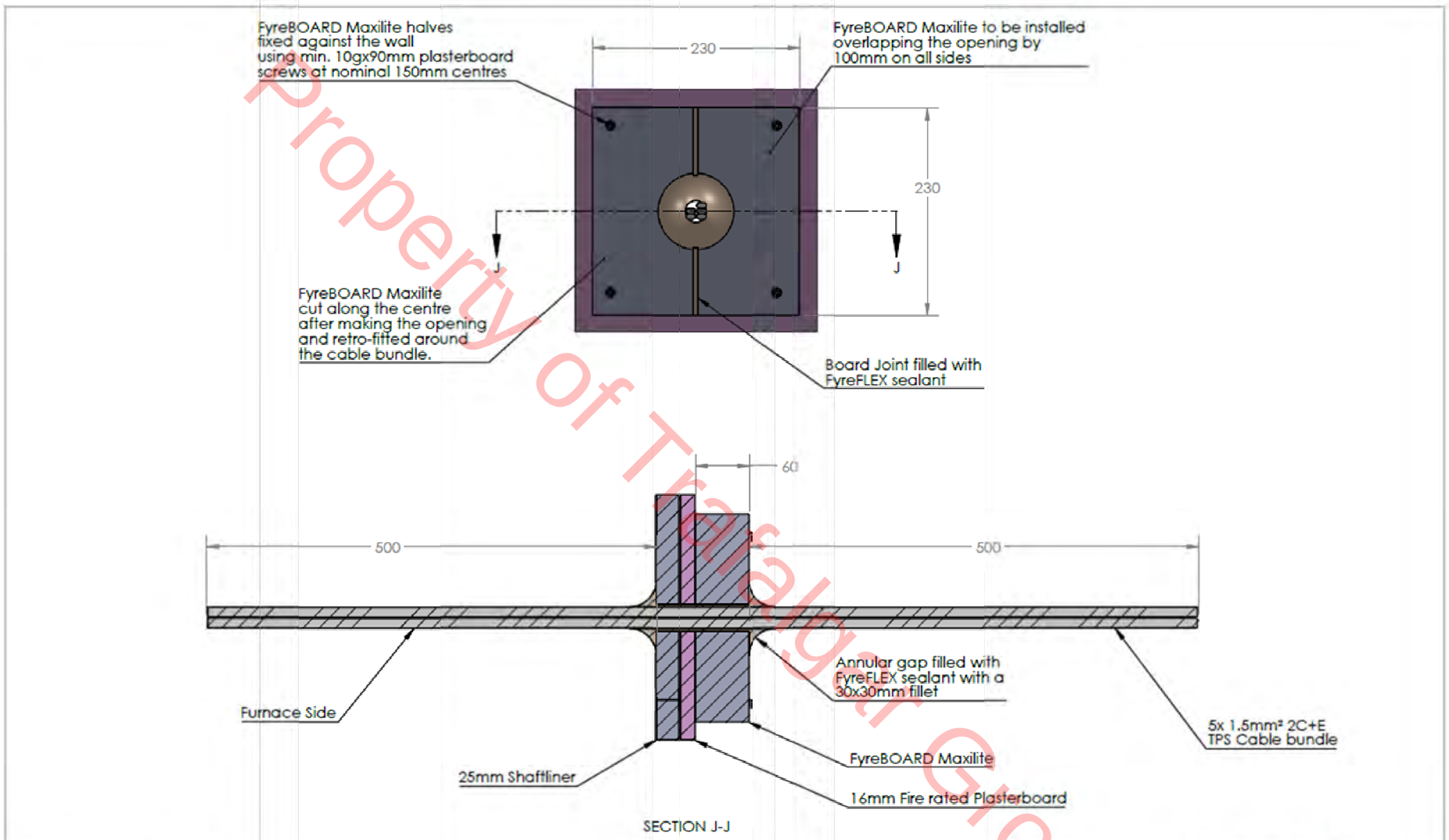

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Drawing Name: Specimen 2				**Test Standard:** AS1530.4	**Codes:**	**Revision:**	**Date:**	**No.:** **NOTICE:**
Project Title: CP26 - Shaftwall Test				**Fire resistance level:**	**Drawn By:** RK			
Drawing No. : 5	**Sheet:** 5 of 7	**Date:** 27/09/2021	**Scale:** NTS	**Based on Report No.:**	**Checked By:** JH	☐ STANDARD DRAWING ☐ PROJECT DRAWING		

NOTE: ALL DIMENSIONS ARE IN MILLIMETRES (mm)

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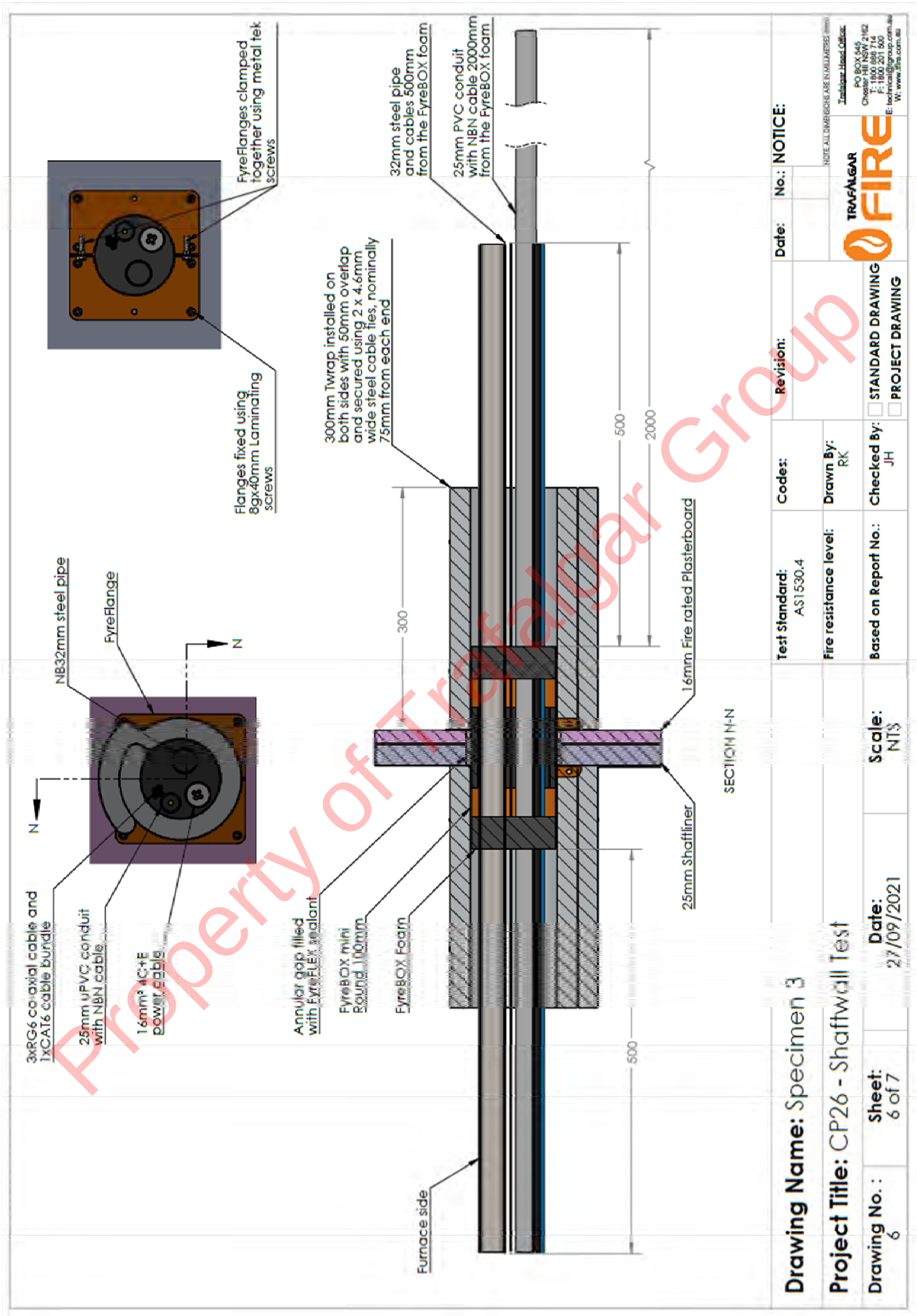
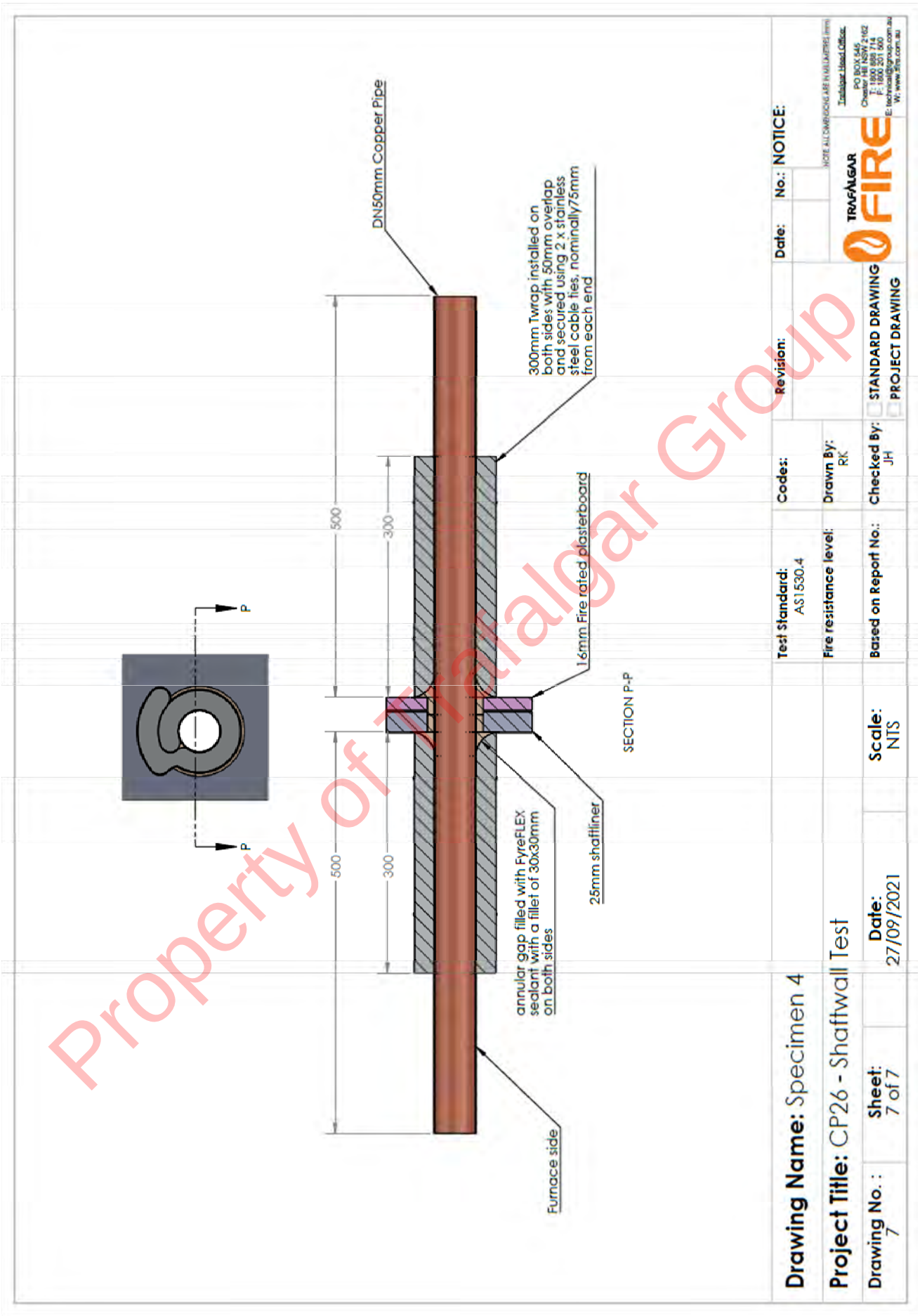


DRAWING TITLED 'SPECIMEN 3', DATED 27 SEPTEMBER 2021, BY TRAFALGAR GROUP PTY LTD



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DRAWING TITLED 'SPECIMEN 4', DATED 27 SEPTEMBER 2021, BY TRAFALGAR GROUP PTY LTD

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 for 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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