

TEST REPORT

Fire resistance test in accordance with AS1530.4-2014 of various pipe and cable services in a 137mm thick CLT wall system protected by various sealants and collars

EWFA Report No:

54783400.1

Report Sponsor:

Multiplex Australasia 499 Swanston St, Melbourne VIC 3000

Test Date:

26 April 2018

Testing, calibrating, advising

DOCUMENT REVISION STATUS

Date Issued	Issue No	Description
11/07/2018	54783400.1	Initial Issue

CONTACT INFORMATION

Exova Warringtonfire Aus Pty Ltd - ABN 81 050 241 524

NATA Registered Laboratory

Unit 2, 409-411 Hammond Road Dandenong Victoria 3175 Australia

T: +61 (0)3 9767 1000

SIGNATORIES

Prepared by

atich Chan

Patrick Chan

Reviewed by

Mandeep Kamal

GENERAL CONDITIONS OF USE

This report may only be reproduced in full without modifications by the report sponsor only. Copies, extracts or abridgments of this report in any form shall not be made distributed or published by other organisations or individuals without the permission in writing from a Director of Exova Warringtonfire Aus Pty Ltd.



CONTENTS

1	Construction Details Test Assembly Test Specimens Assembly and Installation Methods Orientation	4 4 5 5
2	Schedule of Components	6
3	Test Procedure Statement of compliance Variations to test method Pre-test conditioning Sampling / Specimen Selection Ambient Temperature Test Duration Instrumentation and Equipment	17 17 17 17 17 17 17 17
4	Test Measurements Furnace Temperature and Pressure Measurements Specimen Temperatures Observations	18 18 18 18
5	Test Results	18
6	Application of Test Results Test Limitations Variations from the Tested Specimens Uncertainty of measurement	21 21 21 21
APPENDIX 1	DRAWINGS OF TEST ASSEMBLY	22
APPENDIX 2	TEST OBSERVATIONS	27
APPENDIX 3	DIRECT FIELD OF APPLICATIONA 3.1GeneralA 3.2Separating elementsA3.3Plastics pipes	33 33 33 33
APPENDIX 4	INSTRUMENTATION POSITIONS	36
APPENDIX 5	TEST DATA A 5.1 Furnace Temperature A 5.2 Furnace Pressure A 5.3 Specimen Temperatures	42 42 42 43
APPENDIX 6	PHOTOGRAPHS	55



1 CONSTRUCTION DETAILS

TEST ASSEMBLY

The test assembly comprised a nominal 1200mm wide \times 1200mm high \times 137mm thick CLT wall system.

The CLT wall system comprised of 5 layers of timber $(33 \times 19 \times 33 \times 19 \times 33$ thickness) which perpendicular to each other.

TEST SPECIMENS

The test specimen comprised of 18-off pipes and cables services. The services were protected by Promaseal –A Sealant, Promaseal UniCollar, Hilti Firestop intumescent sealant CP 611a, Hilti Firestop acrylic sealant CP 606, Hilti Firestop CFS-C P 50 collar, Hilti foam, BOSS FireMastic 300 and BOSS Maxicollar.

The test specimen is summarised in the table below.

The full description of the specimen is provided in Figures A1.1 to A1.5 and the 'Schedule of Components' in Section 2.

Specimen No	Penetration service	Size (Bundle size)	Core hole size	Protection system
1	MISO 25NB			Promaseal -A Sealant
2	Metal Steel pipe	Ø33.5mm	Ø50mm	Hilti Firestop acrylic sealant CP 606
3	Bundle of Tricab 70mm ² Flexible cable	Ø17.3mm/ Ø40.6mm	Ø50mm	Promaseal -A Sealant
4				Promaseal Conduct Collar
5	Rehau Rautitan Platinum 20mm	Ø20.1mm	Ø24mm	Hilti Firestop CFS-C P 50 with Hilti Firestop intumescent sealant CP 611a infill.
6				BOSS Maxicollar
7		Ø7.1mm/ Ø15.3mm		Promaseal -A Sealant
8	3 × Panduit TX6A (CAT6a)		Ø45mm	Hilti Firestop acrylic sealant CP 606
9				BOSS FireMastic 300
10	Gas PEX pipe	Ø20mm	Ø45mm	Hilti firestop intumescent sealant CP 611a
11	E y Electro	Ø12.1mm	Ø45mm	Promaseal -A Sealant
12	Cable 2.5mm ²	5.4mm /		Hilti Firestop acrylic sealant CP 606
13	ZOTL	Ø20.4mm		BOSS FireMastic 300
14	Trade PEX DN 20	Ø20.1mm	Ø45mm	Hilti firestop intumescent sealant CP 611a
15	Rehau Rautitan		Ø45mm	Hilti firestop intumescent sealant CP 611a
16	Platinum	Ø20.1mm		Hilti foam
17	20mm		Ø60mm	BOSS FireMastic HPE
18	Sharkbite 20mm	Ø20.2mm	Ø45mm	Hilti firestop intumescent sealant CP 611a



ASSEMBLY AND INSTALLATION METHODS

The wall system and the services were installed into the test frame by representatives of Exova Warringtonfire at Exova Melbourne between the 9 March 2018 and 20 March 2018. The test sponsor supplied the fire protection systems and penetration services.

ORIENTATION

The test assembly was asymmetrical as pipe supports were located on the unexposed side only.



2 SCHEDULE OF COMPONENTS

Item	Description		
	Separating Element		
	Product	137mm thick CLT (Cross laminated timber)	
	Size	1200mm wide x 1200mm high x 137mm thick	
	Density	≥380kg/m ³ (Provided by client)	
1	Layer of timber	5 layers	
	Layer timber thick	Top layer: 33mm Second layer: 19mm Third layer: 33mm Forth layer: 19mm Bottom layer: 33mm	
		Service Protection	
	Product name	Hilti Firestop Sealant CP606a	
	Depth	30mm	
2	Installation	The sealant was applied in the annular gap between the metal pipe/cables and the wall system. The sealant was finished flush to the surface of the wall system on both the exposed and unexposed sides.	
	Product name	Hilti Eiroston Intumoscont Sociant CP 611a	
	Dopth		
3		The sealant was applied in the annular gap between the Pex pipe/cables and the wall system. The sealant was finished flush to the surface of the wall system on the exposed and unexposed side.	
	Installation	The sealant was also applied into the space between the Firestop CFS-C P50 collars and the pipe on both the exposed and unexposed sides.	
		See Appendix 1 for more details.	
	Product name	Hilti Firestop Foam	
	Depth	137mm	
4	Installation	The foam was injected into the annular gap between the Pex pipe and the wall system to full depth. After the foam had expanded, the excessive foam was removed and the foam was finished flush to the surface of the wall system on both the exposed and unexposed sides. See Appendix 1 for more details.	
	Product name	Hilti Firestop CFS-C P50	
5	Collar size	OD: Ø68mm ID: Ø51.5mm Height: 23mm Metal thickness:0.6mm Support bracket: 21mm × 21mm × 40.3mm No. layer of intumescent:1 Intumescent stripe size: 20mm × 183.6mm × 6.2mm	
	Intumescent density	1318kg/m ³	



Item	Description	
	Installation	The collars were installed on both the exposed and unexposed side of the wall system with two-off 8G × 75mm long screws with Ø40mm washer.
		collar and the pipe to full depth on both exposed and unexposed sides.
	Product name	BOSS FireMastic 300
	Depth	25mm
6	Installation	The mastic was applied in the annular gap between the cables and the wall system. The mastic was finished off with a nominal 5mm 45° fillet on both sides. The mastic was also applied to the space between the BOSS Maxicollar
		collars and the pipe on both the exposed and unexposed sides. See Appendix 1 for more detail.
	Product name	BOSS FireMastic HPE
	Depth	25mm
7	Installation	The mastic was applied in the annular gap between the plastic pipe and the wall system. Mastic was finished flush to the surface of the wall system on both the exposed and unexposed sides.
		See Appendix 1 for more detail.
	Product name	BOSS 25mm Maxicollar Collar
8	Size	ID: Ø30mm OD: Ø48mm Height:31.6mm Collar metal thickness: 1mm Mounting stripe:25mm × 15mm × 1mm No. of intumescent stripe:2 First layer of intumescent: 89.12mm × 29.96mm × 2.4mm Second layer of intumescent: 106 5mm × 29.8mm × 2.2mm
	Intumescent	1213kg/m ³
	Installation	The collars were installed on both the exposed and unexposed side of the wall system with three-off M8 × 100mm long screws with Ø40mm washer. BOSS FireMastic 300 was applied the gap between the collar and the pipe to full depth on both exposed and unexposed sides.
	Product name	Promaseal – A Sealant
9	Sealant depth	20mm
	Installation	The sealant was applied in the annular gap between the cables/pipe and the wall system. The sealant was finished off with a nominal 50mm 45° fillet on both sides.
40	Dreaduret	See Appendix 1 for more details.
10	Product name	Promaseal Conduit Collar



Item	Description	
		ID: Ø32mm
		OD: Ø52mm
		Height:52mm
	Size	Collar metal thickness: 0.66mm
		Mounting clips:33mm × 20mm × 0.66mm
		No. of intumescent stripe:1
		Intumescent strip size:180mm × 50mm × 10mm
	Intumescent density	1235kg/m ³
	Installation	The collars were installed on both the exposed and unexposed side of the wall system with 8M × 75mm course thread screw.
		See Appendix 1 for more details.
		Penetration services
	Product name	MISO 25NB Metal steel pipe
11	Material	Steel
	Size	OD: Ø33.5mm ID: Ø 27.3mm
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80
12	Material	Pe-Xa
12	Size	OD: Ø 20.4mm
		ID: Ø13.7mm
	Product name	GAS PEX AUSTRALIA-RIFEN AS 4176/ATS5200.478 Lic No. SMK 02564 20 × 2.5 Class 500, Gas PE-xb/AL/PE-xb
13	Material	PE-Xb/AL/PE-Xb
	Size	OD: Ø 20.2mm
	Size	ID: Ø14.3mm
	Product name	Trade Water AS 2492 WM 74647/1 DN20 20 × 2.8 SDR7.4 PN 20 Pex-a
14	Material	PEX-a
14	0:	OD: Ø 20.1mm
	Size	ID: Ø13.2mm
	Product name	SharkBite Mustard PEX pipe
15	Material	PEX
10	Size	OD: Ø 20.2mm
	5120	ID: Ø13.2mm
	Product name	Tricab 70mm ² Cable
16	Core	Single
	Sizo	OD: Ø17.3mm
	Size	Core: 10.8mm
	Product name	Panduit TX6A (CAT 6a) cable
17	Core	12
17		OD: Ø7.1mm
	Size	Core: Ø1.85mm



ltem	Description				
	Product name	NEXAN OLEX TPS Cable			
18	Core	2C+E			
		Overall size: 11.7mm × 5.3mm			
	Size	Core OD: Ø3.8mm			
		Earth OD: Ø3.8mm			
		Penetration service			
	SERVICE 1				
	Pipe				
	Product name	MISO 25NB Metal steel pipe			
	Size	Ø33.5mm			
	Core hole size	Ø50mm			
	Annular gap	8.3mm			
		The pipe was installed at the centre of the core hole with 8.3mm annular gap.			
		The pipe protruded 500mm from the exposed side and 500mm from the			
19	Installation	500mm away from the unexposed side of the wall system.			
		The pipe was sealed with sealant on the exposed side.			
		See Figure A1.5 in Appendix 1 for more details.			
	Penetration protection				
	Product Name	Promaseal –A Sealant			
	Sealant depth	20mm			
	Installation	The sealant was applied in the annular gap between the pipe and the wall system. The sealant finished off with a nominal 50mm 45° fillet on both side.			
	Service 2				
	Pipe				
	Product name	MISO 25NB Metal steel pipe			
	Size	Ø33.5mm			
	Core hole size	Ø50mm			
	Annular gap	8.3mm			
		The pipe was installed at the centre of the core hole with 8.3mm annular gap.			
20		The pipe protruded 500mm from the exposed side and 500mm from the			
	Installation	500mm away from the unexposed side of the wall system.			
		The pipe was sealed with sealant on the exposed side.			
		See Figure A1.3 in Appendix 1 for more details.			
	Penetration protection				
	Product Name	Hilti Firestop sealant CP606a			
	Sealant depth	30mm			



ltem	Description		
	Installation	The sealant was applied in the annular gap between the pipe and the wall system. The sealant was finished off flush with the surface of the wall on both side. See Figure A1.2 in Appendix 1 for more details.	
		Service 3	
	Coblo		
	Product name	Tricab 70mm ² Cable	
	Size	OD: Ø17.3mm	
	No. of cable	4	
	Core hole size	 Ø50mm	
	Annular gap	4.5mm	
	<u>,</u> 34b	The cable was installed at the centre of the core hole with 4 5mm annular gap	
21	Installation	The cable protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cable was supported at 300mm and 500mm away from the unexposed side of the wall system.	
		See Figure A1.2 in Appendix 1 for more details.	
	Penetration pro	tection	
	Product Name	Promaseal –A Sealant	
	Location	20mm	
	Installation	The sealant was applied in the annular gap between the pipe and the wall system. The sealant was finished off with a nominal 50mm 45° fillet on both sides.	
	Service 4		
	Pipe		
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80	
	Size	OD: Ø20.4mm	
	Core hole size	Ø24mm	
	Annular gap	1.8mm	
22	Installation	The pipe was installed at the centre of the core hole with 1.8mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system. The pipe was sealed on both the exposed side and the unexposed side.	
		See Figure A1.5 in Appendix 1 for more details.	
	Penetration protection		
	Product Name	Promaseal Conduit Collar (CFC 32)	
	Installation	The collars were installed on both the exposed and unexposed side and fixed to the wall system with M8 × 75mm course thread screws.	
	I	Service 5	
	Pipe		
23	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80	
	Size	OD: Ø20.4mm	



ltem	Description		
	Core hole size	Ø24mm	
	Annular gap	1.8mm	
		The pipe was installed at the centre of the core hole with 1.8mm annular gap.	
	Installation	The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system.	
		The pipe was sealed on both the exposed side and the unexposed side.	
	Demotration was	See Figure A1.3 in Appendix 1 for more details.	
	Product Name	Hilti Firestop CFS-C P50 and Hilti Firestop Intumescent Sealant CP611a	
	Installation	The collars were installed on both the exposed and unexposed side and fixed to the wall system with M8 \times 75mm course thread screws with Ø40mm washer.	
	instanation	The Firestop Intumescent Sealant CP611a was applied into the space between the Firestop CFS-C P50 collars and the pipe on both the exposed and unexposed side.	
		Service 6	
	Pipe		
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80	
	Size	OD: Ø20.4mm	
	Core hole size	Ø24mm	
	Annular gap	1.8mm	
24	Installation	The pipe was installed at the centre of the core hole with 1.8mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system.	
		The pipe was sealed on both the exposed side and the unexposed side.	
		See Figure A1.2 in Appendix 1 for more details.	
	Penetration prot	rection	
	Product Name	BOSS 25mm Maxicollar Collar and BOSS FireMastic 300	
	Installation	The collars were installed on both the exposed and unexposed side and fixed to the wall system with M8 × 100mm course thread screws with Ø40mm washer. The BOSS FireMastic 300 was applied into the space between the BOSS 25mm Maxicollar and the pipe on both the exposed and unexposed side.	
		Service 7	
	Cable		
25	Product name	Panduit TX6A (CAT 6a) cable	
	Size	OD: Ø7.1mm	
20	No. of cable	3	
	Core hole size	Ø45mm	
	Annular gap	14.8mm	



ltem	Description		
	Installation	The cables were installed at the centre of the core hole with 14.8mm annular gap. The cable protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cable was supported at 300mm and 500mm away from the unexposed side of the wall system. See Figure A1.4 in Appendix 1 for more details	
	Penetration protection		
	Product Name	Promaseal – A Sealant	
	Sealant depth	20mm	
	Installation	The sealant was applied in the annular gap between the pipe and the wall system. The sealant was finished off with a nominal 50mm 45° fillet on both side.	
		Service 8	
	Cable		
	Product name	Panduit TX6A (CAT 6a) cable	
	Size	OD: Ø7.1mm	
	No. of cable	3	
	Core hole size	Ø45mm	
	Annular gap	14.8mm	
26	Installation	The cables were installed at the centre of the core hole with 14.8mm annular gap. The cable bundle protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cables were supported at 300mm and 500mm away from the unexposed side of the wall system.	
	Ponotration prot		
	Product Name	Hilti Fireston Sealant CP606	
	Sociant donth	30mm	
	Installation	The sealant was applied in the annular gap between the pipe and the wall system. The sealant finished off flushed with the surface of the wall on both side.	
		Service 9	
	Cable		
	Product name	Panduit TX6A (CAT 6a) cable	
	Size	OD: Ø7.1mm	
	No. of cable	3	
27	Core hole size	Ø45mm	
	Annular gap	14.8mm	
	Installation	The cables were installed at the centre of the core hole with 14.8mm annular gap. The cables protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cables were supported at 300mm and 500mm away from the unexposed side of the wall system. See Figure A1.3 in Appendix 1 for more details	



 $\ensuremath{\mathbb{C}}$ Exova Warringtonfire Aus Pty Ltd 2018

ltem	Description		
	Penetration protection		
	Product Name	BOSS FireMastic 300	
	Sealant depth	25mm	
	Installation	The mastic was applied to the annular gap between the wall system and pipe on both exposed and unexposed sides to 25mm depth. The mastic was finished flush on the surface of the wall system.	
		Service 10	
	Pipe		
	Product name	GAS PEX AUSTRALIA-RIFEN AS 4176/ATS5200.478 Lic No. SMK 02564 20 × 2.5 Class 500, Gas PE-xb/AL/PE-xb	
	Size	OD: Ø20.2mm	
	Core hole size	Ø45mm	
	Annular gap	12.4mm	
28	Installation	The pipe was installed at the centre of the core hole with 12.4mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system.	
		The pipe was sealed on both the exposed side and the unexposed side.	
	Ponotration prot		
	Penetration pro	Hilti Eiroston Intumoscont Scolant CP 611a	
	Sealant denth	30mm	
	Installation	The sealant was applied to the annular gap between the wall system and pipe on both exposed and unexposed side to 30mm depth. The sealant was finished flush on the surface of the wall system.	
		Service 11	
	Cable		
	Product name	NEXAN OLEX TPS Cable	
	Size	11.7mm × 5.3mm	
	No. of cable	5	
	Core hole size	Ø45mm	
	Annular gap	9.3mm	
29		The cable bundle was installed at the centre of the core hole with 9.3mm annular gap.	
23	Installation	The cables protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cables were supported at 300mm and 500mm away from the unexposed side of the wall system.	
	Ponetration prof		
	Product Name	Promaseal _A sealant	
	Sealant donth	20mm	
		The sealest was applied in the appular gap between the pipe and the wall	
	Installation	system. The sealant finished off with a nominal 50mm 45° fillet on both side.	



ltem	Description		
		Service 12	
	Cable		
	Product name	NEXAN OLEX TPS Cable	
	Size	11.7mm × 5.3mm	
	No. of cable	5	
	Core hole size	Ø45mm	
	Annular gap	9.3mm	
30	Installation	The cable was installed at the centre of the core hole with 9.3mm annular gap. The cable protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cable was supported at 300mm and 500mm away from the unexposed side of the wall system.	
		See Figure A1.5 in Appendix 1 for more details.	
	Penetration prot		
	Product Name	Hilti Firestop Sealant CP606a	
	Sealant depth	30mm	
	Installation	The sealant was applied to the annular gap between the wall system and cable on both exposed and unexposed side with 30mm depth. The sealant was finished flush on the surface of the wall system.	
	Service 13		
	Cable		
	Product name	NEXAN OLEX TPS Cable	
	Size	11.7mm × 5.3mm	
	No. of cable	5	
	Core hole size	Ø45mm	
	Annular gap	9.3mm	
31	Installation	The cable bundle was installed at the centre of the core hole with 9.3mm annular gap. The cables protruded 500mm from the exposed side and 500mm from the unexposed side of the wall system. The cables were supported at 300mm and 500mm away from the unexposed side of the wall system. See Figure A1.2 in Appendix 1 for more details.	
	Penetration protection		
	Product Name	BOSS FireMastic 300	
	Location	25mm	
	Installation	The mastic was applied to the annular gap between the wall system and cable on both exposed and unexposed side with 25mm depth. The mastic was finished off with a nominal 5mm 45° fillet on both sides.	
	Service 14		
	Pipe		
30	Product name	Trade Water AS 2492 WM 74647/1 DN20 20 × 2.8 SDR7.4 PN 20 Pex-a	
52	Size	OD: Ø20.1mm	
	Core hole size	Ø45mm	



ltem	Description				
	Annular gap	12.4mm			
		The pipe was installed at the centre of the core hole with 12.4mm annular gap.			
	Installation	The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system.			
		The pipe was sealed on both the exposed side and the unexposed sides.			
		See Figure A1.2 in Appendix 1 for more details.			
	Penetration protection				
	Product Name	Hilti Firestop Intumescent Sealant CP 611a			
	Sealant depth	30mm			
	Installation	The sealant was applied to the annular gap between the wall system and pipe on both exposed and unexposed side with 30mm depth. The sealant was finished flush on the surface of the wall system.			
		Service 15			
	Pipe				
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80			
	Size	OD: Ø20.4mm			
	Core hole size	Ø45mm			
	Annular gap	12.3mm			
33	Installation	The pipe was installed at the centre of the core hole with 12.3mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system. The pipe was sealed on both the exposed side and the unexposed sides.			
	Deve starstile as a set	See Figure A1.5 in Appendix 1 for more details.			
	Prenetration protection				
	Product Name	Hilti Firestop Intumescent Sealant CP 611a			
	Sealant depth				
	Installation	The sealant was applied to the annular gap between the wall system and pipe on both exposed and unexposed side to 30mm depth. The sealant was finished flush on the surface of the wall system.			
		Service 16			
	Pipe				
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80			
	Size	OD: Ø20.4mm			
	Core hole size	Ø45mm			
34	Annular gap	12.3mm			
	Installation	The pipe was installed at the centre of the core hole with 12.3mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system. The pipe was sealed on both the exposed side and the unexposed sides.			
		See Figure A1.4 in Appendix 1 for more details.			



ltem	Description			
	Penetration protection			
	Product Name	Hilti Firestop Foam		
	Depth	Depth of the wall system (137mm)		
	Installation	The foam was injected into the annular gap between the Pex pipe and the wall system to full depth. After the foam had expanded, the excessive foam was removed and the foam was finished flush to the surface of the wall system on both the exposed and unexposed sides.		
		Service 17		
	Pipe			
	Product name	Rautitan platinum 20 × 2.8 1132310 DN/OD20 PN20 SDR7.4 Pe-Xa 80		
	Size	OD: Ø20.4mm		
	Core hole size	Ø45mm		
	Annular gap	12.3mm		
35	Installation	The pipe was installed at the centre of the core hole with 12.3mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system. The pipe was sealed on both the exposed side and the unexposed sides. See Figure A1.3 in Appendix 1 for more details.		
	Penetration prot	ection		
	Product Name	BOSS FireMastic HPE		
	Depth	25mm		
	Installation	The sealant was applied to the annular gap between the wall system and pipe on both exposed and unexposed side to 25mm depth. The sealant was finished flush on the surface of the wall system.		
		Service 18		
	Cable			
	Product name	SharkBite Mustard PEX pipe		
	Size	OD: Ø20.2mm		
	Core hole size	Ø45mm		
	Annular gap	12.4mm		
36	Installation	The pipe was installed at the centre of the core hole with 12.4mm annular gap. The pipe protruded 500mm from the exposed side and 2000mm from the unexposed side of the wall system. The pipe was supported at 500mm and 1500mm away from the unexposed side of the wall system. The pipe was sealed on both the exposed side and the unexposed sides. See Figure A1.2 in Appendix 1 for more details.		
	Penetration protection			
	Product Name	Hilti Firestop Intumescent Sealant CP 611a		
	Location	30mm		
	Installation	The sealant was applied to the annular gap between the wall system and pipe on both exposed and unexposed side to 30mm depth. The sealant was finished flush on the surface of the wall system.		



3 TEST PROCEDURE

STATEMENT OF COMPLIANCE

The test was performed in accordance with the requirements of AS1530.4-2014 Sections 2 & 10 subject to the variations below.

VARIATIONS TO TEST METHOD

The furnace pressure was above the limits stated in AS 1530.4-2014, clause 2.11.3.1(c) by 1Pa between 40-45 minutes. See table A5.2 for details. Due to the state of the penetrations at that time and the subsequent failure times, the increase in pressure is unlikely to have invalidated the FRL results.

PRE-TEST CONDITIONING

The construction of the specimen was finished on the 20 March 2018 and was tested on 26 March 2018. During this period the test specimen was subject to normal laboratory temperatures and relative humidity conditions.

SAMPLING / SPECIMEN SELECTION

The laboratory was not involved in the sampling or selection of the test specimen for the fire resistance test.

AMBIENT TEMPERATURE

The ambient temperature at the start of the test was 19°C and did not vary significantly during the test.

TEST DURATION

The test duration was 91 minutes.

INSTRUMENTATION AND EQUIPMENT

The instrumentation was provided in accordance with AS1530.4-2014 and as detailed below:

The furnace temperature was measured by 4-off mineral insulated metal sheathed Type K thermocouples with wire diameters not greater than 1mm and overall diameter of 3mm with the measuring junction insulated from the sheath. The thermocouples protruded a minimum of 25mm from steel supporting tubes.

The non-fire side specimen temperatures were measured by Type K thermocouples with wire diameters less than 0.5mm soldered to 12mm diameter \times 0.2mm thick copper discs covered by 30mm \times 30mm \times 2.0 mm inorganic insulating pads. The thermocouple positions are described in Table A4.1, and are shown on Figure 4.1 in Appendix 4.

A roving thermocouple was available to measure temperatures at positions that appeared hotter than the positions monitored by the fixed thermocouples.

The furnace pressure was measured 400mm above the lower control joint at mid-height of the wall.

Cotton pads were available during the test to assess the performance under the criteria for integrity.



4 TEST MEASUREMENTS

FURNACE TEMPERATURE AND PRESSURE MEASUREMENTS

Furnace temperature and pressure data are provided in Figure A5.1 and Table A5.1 in Appendix 5.

SPECIMEN TEMPERATURES

Specimen temperature data is provided in A 5.3 and Table A5.2 in Appendix 5.

OBSERVATIONS

A table that includes observations of the significant behaviour of the specimen and details of the occurrence of the various performance criteria specified in AS1530.4-2014 is provided in Appendix 2. Photographs of the specimen are included in Appendix 6.

5 TEST RESULTS

The specimens listed below achieved the following performance when tested in accordance with AS1530.4-2014, Section 2 & 10 subject to the variations listed in Section 3.

Service	Criteria	Result
	Structural Adequacy	Not applicable
4	Integrity	No failure at 91 minutes
1	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
2	Integrity	No failure at 91 minutes
2	Insulation	Failure at 77 minutes
	FRL	-/90/60
	Structural Adequacy	Not applicable
2	Integrity	No failure at 91 minutes
3	Insulation	Failure at 58 minutes
	FRL	-/90/30
	Structural Adequacy	Not applicable
4	Integrity	No failure at 91 minutes
4	Insulation	Failure at 45 minutes
	FRL	-/90/30
	Structural Adequacy	Not applicable
F	Integrity	No failure at 91 minutes
5	Insulation	Failure at 53 minutes
	FRL	-/90/30
	Structural Adequacy	Not applicable
6	Integrity	No failure at 91 minutes
0	Insulation	No failure at 91 minutes
	FRL	-/90/90
7	Structural Adequacy	Not applicable



Service	Criteria	Result
	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
0	Integrity	No failure at 91 minutes
0	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
٩	Integrity	No failure at 91 minutes
3	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
10	Integrity	No failure at 91 minutes
10	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
11	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
12	Integrity	No failure at 91 minutes
12	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
13	Integrity	No failure at 91 minutes
10	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
14	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
15	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
16	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90
	Structural Adequacy	Not applicable
17	Integrity	No failure at 91 minutes
	Insulation	No failure at 91 minutes
	FRL	-/90/90

Service	Criteria	Result
	Structural Adequacy	Not applicable
10	Integrity	No failure at 91 minutes
10	Insulation	Failure at 61 minutes
	FRL	-/90/60



6 APPLICATION OF TEST RESULTS

TEST LIMITATIONS

The results of this fire test may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions. The results only relate to the behaviour of the specimen of the element of the construction under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they necessarily reflect the actual behaviour in fires.

VARIATIONS FROM THE TESTED SPECIMENS

This report details the methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the general procedure outlined in AS1530.4. 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 addressed by this report. It is recommended that any proposed variation to the tested configuration other than as permitted under the field of direct application specified in Appendix 3 should be referred to the test sponsor in the first instance to obtain appropriate documentary evidence of compliance from Exova Warringtonfire Aus Pty Ltd or another Registered Testing Authority.

UNCERTAINTY OF MEASUREMENT

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.



APPENDIX 1 DRAWINGS OF TEST ASSEMBLY



Figure A1.1: Plan of Test Specimen, Exposed side





Figure A1.2: Cross section 1-1





Figure A1.3: Cross section 2-2





Figure A1.4: Cross section 3-3





Figure A1.5: Cross section 4-4



APPENDIX 2 TEST OBSERVATIONS

Time		Observations	
min	sec	Observations	
		Service 1	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 2	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
63	00	Intumescent sealant had expanded	
77	05	TC 017 on the pipe, 25mm away from the wall system recorded a temperature of 199°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 017 exceeded the initial temperature by more than 180°C.	
78	00	The intumescent sealant had expanded significantly	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 3	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
03	49	Smoke emission appeared from the sealant fillet	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
58	30	TC 022 on the cable, 25mm away from the sealant fillet recorded a temperature of 199°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 022 exceeded the initial temperature by more than 180°C.	
60	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	

The following include observations of the significant behaviour of the specimen.



Time		Observations	
min	sec	Observations	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 4	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
05	35	Smoke venting appeared from the end of the pipe	
18	18	Smoke venting had ceased	
25	52	Smoke venting had restarted but in small volume	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
45	25	TC 032 on the pipe, 25mm away from the collar recorded a temperature of 199°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 032 exceeded the initial temperature by more than 180°C.	
54	30	Deformation appeared on the pipe near the wall system	
60	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
64	30	Smoke venting appeared from the end of the pipe	
82	59	Intumescent was expanding and falling off from the collar. Discolouration had appeared on the CLT above the fire collar. Smoke emission appeared from the collar	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
	Service 5		
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
17	00	Smoke venting appeared from the end of the pipe	
20	58	Smoke venting had ceased	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
37	46	Smoke venting from the end of the pipe had restarted	
53	30	TC 038 on the pipe, 25mm away from the collar recorded a temperature of 199°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 038 exceeded the initial temperature by more than 180°C.	
54	00	Smoke venting appeared from the end of the pipe	
54	30	Deformation appeared on the pipe near the wall system	
60	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
64	30	Smoke venting appeared from the end of the pipe	
82	59	The intumescent sealant had expanded	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	



Time		Observations	
min	sec	- Observations	
91	00	Test stopped at the request of the sponsor.	
	-	Service 6	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
23	44	Smoke venting appeared from the end of the pipe	
28	40	Smoke venting had ceased	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 7	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 8	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
Service 9			
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	



Time		Observations	
min	sec		
	I	Service 10	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
42	37	Smoke venting appeared from the end of the pipe	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
-		Service 11	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
02	11	Smoke emission appeared from the sealant	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
Service 12			
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 13	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
Service 14			
00	00	Fire resistance test commenced and the ambient temperature was approximately	



Time			
min	sec	Observations	
		19°C.	
05	02	Smoke venting appeared from the end of the pipe	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
52	49	Smoke venting appeared from the end of the pipe	
54	00	Smoke venting appeared from the end of the pipe	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
64	30	Smoke venting appeared from the end of the pipe	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 15	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
01	37	Smoke venting appeared from the end of the pipe	
20	58	Smoke venting had ceased	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
64	30	Smoke venting appeared from the end of the pipe	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 16	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
04	48	Smoke venting appeared from the end of the pipe	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
54	00	Smoke venting appeared from the end of the pipe	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
64	30	Smoke venting appeared from the end of the pipe	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 17	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
05	35	Smoke venting appeared from the end of the pipe	
30	00	The specimen had continued to maintain integrity and insulation in accordance with	



Time		Observations	
min	sec	Observations	
		AS 1530.4-2014	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	
		Service 18	
00	00	Fire resistance test commenced, and the ambient temperature was approximately 19°C.	
18	18	Smoke venting had ceased	
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
52	49	Smoke venting appeared from the end of the pipe	
54	00	Smoke venting appeared from the end of the pipe	
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014	
61	35	TC 146 on the pipe, 25mm away from the wall recorded a temperature of ??°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 146 exceeded the initial temperature by more than 180°C.	
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4-2014	
91	00	Test stopped at the request of the sponsor.	



APPENDIX 3 DIRECT FIELD OF APPLICATION

A 3.1 GENERAL

AS1530.4-2014 indicates that the results of the fire test contained in the test report are directly applicable without reference to the testing authority to similar constructions where one or more of the changes have been made:

A 3.2 SEPARATING ELEMENTS

Results obtained for sealing systems in various types of masonry and concrete construction may be applied as follows:

- a) For elements manufactured from similar types of concrete or masonry, the results of the prototype test may be applied to materials of density within ±15% of the tested specimen. For greater variations, the opinion of a registered testing authority shall be obtained.
- b) Test results obtained in conjunction with hollow concrete blocks may be used in a solid concrete element of the same overall thickness. The reverse does not apply.
- c) Results obtained from framed wall systems may be applied to the performance of a system in concrete, masonry or solid gypsum blocks of greater or equal thickness to that of the tested prototype. The reverse does not apply.
- d) Results obtained from framed wall systems may be applied to similar walls having studs of the same material with sizes greater than the tested prototype.
- e) Results obtained from a prototype test may be applied to framed wall systems of similar construction but having thicker facings of the same material applied to the studs.

A 3.3 PLASTICS PIPES

A 3.3.1 General

In addition to the requirements of Clause A 3.2, test results may be directly applied to masonry and concrete elements thicker than the tested prototype when installed in accordance with Figure 10.12.5.1 (AS1530.4).

Results obtained from a particular test shall not be applied to plastics pipes of different diameters, wall thicknesses or material types.

Results obtained from tests on penetrations through vertical separating elements shall not be used to assess performance in horizontal elements, and vice versa.

As penetration seals for plastics pipes are dependent for activation upon exposure to fire conditions, they shall always be installed with the same orientation and fire exposure as was established in the fire-resistance test.

A 3.3.2 Services not perpendicular to the fire separation

Penetrations not perpendicular to the plane of the element are acceptable, provided the firestopping system has similar exposure and dimensions to the tested prototype.

A3.4 METAL PIPES

A 3.4.1 Sealing systems tested using standard configurations

The results may be applied to brass pipes of the same composition up to maximum outside diameter of 101.6 mm (normally 70/30 arsenical brass) and to copper and ferrous metal pipes having wall thicknesses greater than or equal to those listed in Table 10.12.3.1, provided the same penetration sealing system was used for the above penetrations in the same type of separating element and all the specimens achieved the required FRL.

NOTE: For information on standard configurations, see Appendix F.



TABLE 10.12.3.1

Nominal size	Actual OD (outside diameter)	Actual wall thickness
mm	mm	mm
32	31.75	0.91
40	38.10	0.91
50	50.80	0.91
65	63.50	0.91
80	76.20	1.22
90	88.90	1.22
100	101.60	1.22
125	127.00	1.42
150	152.40	1.63

METAL PIPE DEEMED TO HAVE EQUIVALENT FIRE RESISTANCE LEVELS

A3.4.2 Sealing systems tested not using standard configurations

Results obtained with a penetration sealing system protecting the opening around copper or brass pipes may be applied to pipes of the same material and to ferrous metal pipes having outside diameters not greater than the tested diameter, and wall thicknesses not less than the tested thickness.

NOTE: For information on standard configurations for metal pipes, see Appendix F.

A3.4.3 Shape and size of openings for penetration seals

For mineral-fibre, cast and gun-applied mastic seals, results obtained in openings with a smooth surface texture may be applied to openings having a rough surface texture.

A3.4.4 Insulated (lagged) metal pipes

Where fire test data on the insulation system are not available, penetration sealing systems that have been subjected to the standard test with uninsulated metal pipes may be used, provided the appropriate requirements of Clause 0 are satisfied and the following procedures are followed:

- a) If the insulation is non-combustible or is manufactured solely from mineral fibre, it shall be cut away where the service penetrates the separating element, and the opening shall be fire-stopped in accordance with the tested method.
- b) If the insulation is combustible, it shall be cut away for 1000 mm either side of the separating element (provided the pipe did not vent hot gases during the fire resistance test), and the pipe shall be fire-stopped in accordance with the tested method. A non-combustible lagging may be placed over the bare pipe. If venting occurs during the fire-resistance test at a time less than the required FRL, a fire test shall be carried out to evaluate the insulated pipe system.

A3.4.5 Alternative pipe materials

If an element is penetrated by-

- a) a pipe other than brass, copper or ferrous alloys;
- b) a pipe of cross-section other than circular; or
- c) a pipe outside the field of application specified in this Standard for the standard test configuration,

then the results obtained from a single tested system may be applied to these pipes provided the—

i. melting point of the material is equal to or greater than the tested specimen;



- ii. surface area to mass ratio of a cross-section of the pipe is equal to or less than the tested specimen; and
- iii. thermal conductivity is equal to or less than the tested specimen diffusivity of the material.

A3.5 ELECTRICAL AND COMMUNICATION CABLES

Where standard configurations are used for electrical and communication cables, the results of tests may be applied to all PVC and XLPE insulated and PVC sheathed power and communication cables with copper conductors, provided the results are for the same penetration sealing system in the same separating element and all of the specimens achieved the designated FRL or greater.

NOTE: For information on recommended standard configurations for electrical and communication cables, see AS 1530.4-2014 Appendix D.



APPENDIX 4 INSTRUMENTATION POSITIONS











Figure A4.1: Unexposed surface thermocouple locations



Service	T/C No.	Description
	011	On the metal pipe, 25mm away from the sealant fillet
	012	On the metal pipe, 25mm away from the sealant fillet
	013	On the mid wide of the sealant fillet
I I	014	On the mid wide of the sealant fillet
	015	On the wall system, 25mm away from the sealant fillet
	016	On the wall system, 25mm away from the sealant fillet
	017	On the metal pipe, 25mm away from the wall system
2	018	On the metal pipe, 25mm away from the wall system
2	019	On the wall system, 25mm away from the metal pipe
	020	On the wall system, 25mm away from the metal pipe
	021	On the cables, 25mm away from the sealant fillet
	022	On the cables, 25mm away from the sealant fillet
2	023	On the mid wide of the sealant fillet
3	024	On the mid wide of the sealant fillet
	025	On the wall system, 25mm away from the sealant fillet
	026	On the wall system, 25mm away from the sealant fillet
	031	On the plastic pipe, 25mm away from the collar
	032	On the plastic pipe, 25mm away from the sealant fillet
4	033	On the mid wide of the collar
4	034	On the mid wide of the collar
	035	On the wall system, 25mm away from the collar
	036	On the wall system, 25mm away from the collar
	037	On the plastic pipe, 25mm away from the collar
5	038	On the plastic pipe, 25mm away from the collar
5	039	On the wall system, 25mm away from the collar
	040	On the wall system, 25mm away from the collar
	041	On the plastic pipe, 25mm away from the collar
	042	On the plastic pipe, 25mm away from the collar
6	043	On the mid wide of the collar
0	044	On the mid wide of the collar
	045	On the wall system, 25mm away from the collar
	046	On the wall system, 25mm away from the collar
	051	On the cables, 25mm away from the sealant fillet
	052	On the cables, 25mm away from the sealant fillet
7	053	On the mid wide of the sealant fillet
· ·	054	On the mid wide of the sealant fillet
	055	On the wall system, 25mm away from the sealant fillet
	056	On the wall system, 25mm away from the sealant fillet
8	057	On the cables, 25mm away from the wall system

Table A4.1: Thermocouple Locations



Service	T/C No.	Description
	058	On the cables, 25mm away from the wall system
	059	On the wall system, 25mm away from the cables
	060	On the wall system, 25mm away from the cables
	101	On the cables, 25mm away from the wall system
0	102	On the cables, 25mm away from the wall system
9	103	On the wall system, 25mm away from the cables
	104	On the wall system, 25mm away from the cables
	106	On the plastic pipe, 25mm away from the collar
40	107	On the plastic pipe, 25mm away from the collar
10	108	On the wall system, 25mm away from the collar
	109	On the wall system, 25mm away from the collar
	111	On the cables, 25mm away from the sealant fillet
	112	On the cables, 25mm away from the sealant fillet
44	113	On the mid wide of the sealant fillet
11	114	On the mid wide of the sealant fillet
	115	On the wall system, 25mm away from the sealant fillet
	116	On the wall system, 25mm away from the sealant fillet
	117	On the cables, 25mm away from the wall system
40	118	On the cables, 25mm away from the wall system
12	119	On the wall system, 25mm away from the cables
	120	On the wall system, 25mm away from the cables
	121	On the cables, 25mm away from the wall system
40	122	On the cables, 25mm away from the wall system
13	123	On the wall system, 25mm away from the cables
	124	On the wall system, 25mm away from the cables
	126	On the plastic pipe, 25mm away from the wall system
4.4	127	On the plastic pipe, 25mm away from the wall system
14	128	On the wall system, 25mm away from the plastic pipe
	129	On the wall system, 25mm away from the plastic pipe
	131	On the plastic pipe, 25mm away from the wall system
45	132	On the plastic pipe, 25mm away from the wall system
15	133	On the wall system, 25mm away from the plastic pipe
	134	On the wall system, 25mm away from the plastic pipe
	136	On the plastic pipe, 25mm away from the wall system
40	137	On the plastic pipe, 25mm away from the wall system
10	138	On the wall system, 25mm away from the plastic pipe
	139	On the wall system, 25mm away from the plastic pipe
	141	On the plastic pipe, 25mm away from the wall system
17	142	On the plastic pipe, 25mm away from the wall system
	143	On the wall system, 25mm away from the plastic pipe



Service	T/C No.	Description			
	144	the wall system, 25mm away from the plastic pipe			
18	146	On the plastic pipe, 25mm away from the wall system			
	147	On the plastic pipe, 25mm away from the wall system			
	148	On the wall system, 25mm away from the plastic pipe			
	149	On the wall system, 25mm away from the plastic pipe			



APPENDIX 5 TEST DATA



A 5.1 FURNACE TEMPERATURE

A 5.2 FURNACE PRESSURE

The furnace pressure was measured at 400mm above the lower control joint. The pressure in table below have been adjusted to reflect pressure at lowest control joint

Time	Pressure (Pa)	Time	Pressure (Pa)
(Minutes)	Avg.	(Minutes)	Avg.
5-10	16	50-55	18
10-15	15	55-60	14
15-20	18	60-65	14
20-25	18	65-70	16
25-30	16	70-75	17
30-35	16	75-80	15
35-40	15	80-85	15
40-45	17	85-90	15
45-50	19		

Table A5.1: Pressure







Figure A5.3: Specimen 2. Temperatures vs. time





Figure A5.5: Specimen 4. Temperatures vs. time





Figure A5.7: Specimen 6. Temperatures vs. time





Figure A5.9: Specimen 8. Temperatures vs. time





Figure A5.11: Specimen 10. Temperatures vs. time





Figure A5.13: Specimen 12. Temperatures vs. time





Figure A5.15: Specimen 14. Temperatures vs. time





Figure A5.17: Specimen 16. Temperatures vs. time





Figure A5.19: Specimen 18. Temperatures vs. time



Table A5.2: Test Specimen Temperatures

Sorvico	T/C	Description ²	٦	Limit ¹				
Service	No.		t=0	t=15	t=30	t=60	t=90	(Mins)
1	011	On the metal pipe	19	32	49	73	96	-
	012	On the metal pipe	19	33	50	73	97	-
	013	On the mid wide of the sealant fillet	19	32	51	81	95	-
	014	On the mid wide of the sealant fillet	19	29	48	77	91	-
	015	On the wall system	19	20	21	26	32	-
	016	On the wall system	19	20	24	36	47	-
	017	On the metal pipe	19	61	109	163	223	77
2	018	On the metal pipe	19	59	106	159	216	80
2	019	On the wall system	19	22	36	58	73	-
	020	On the wall system	19	21	26	39	49	-
	021	On the cables	20	45	114	201	262	60
	022	On the cables	20	45	118	203	248	58
2	023	On the mid wide of the sealant fillet	19	33	85	117	148	-
3	024	On the mid wide of the sealant fillet	19	29	69	108	128	-
	025	On the wall system	19	20	31	63	72	-
	026	On the wall system	19	20	23	32	40	-
	031	On the plastic pipe	20	33	59	160	182	-
	032	On the plastic pipe	20	38	68	226	257	45
	033	On the mid wide of the collar	19	22	25	79	168	-
4	034	On the mid wide of the collar	19	23	28	98	183	-
	035	On the wall system	19	19	21	30	45	-
	036	On the wall system	19	20	22	54	167	-
	037	On the plastic pipe	19	36	31	229	245	55
5	038	On the plastic pipe	19	37	33	238	241	53
5	039	On the wall system	19	19	22	31	44	-
	040	On the wall system	19	20	23	36	52	-
	041	On the plastic pipe	19	21	61	71	80	-
	042	On the plastic pipe	19	21	63	70	80	-
6	043	On the mid wide of the collar	19	20	33	56	63	-
0	044	On the mid wide of the collar	19	19	33	59	65	-
	045	On the wall system	19	20	23	38	49	-
	046	On the wall system	19	20	25	32	38	-
	051	On the cables	19	21	24	33	39	-
	052	On the cables	19	21	25	34	41	-
7	053	On the mid wide of the sealant fillet	19	20	26	45	57	-
	054	On the mid wide of the sealant fillet	19	20	27	53	63	-
	055	On the wall system	19	20	21	25	31	-



	056	On the wall system	19	19	21	31	38	-
	057	On the cables	19	29	43	79	80	-
8	058	On the cables	19	30	45	85	85	-
	059	On the wall system	19	20	21	30	37	-
	060	On the wall system	19	20	25	42	49	-
	101	On the cables	20	28	39	62	91	-
•	102	On the cables	19	26	33	48	66	-
5	103	On the wall system	19	20	23	35	45	-
	104	On the wall system	19	20	22	30	37	-
	106	On the plastic pipe	19	46	51	80	139	-
10	107	On the plastic pipe	19	46	51	79	134	-
10	108	On the wall system	19	23	30	47	61	-
	109	On the wall system	19	22	25	33	40	-
	111	On the cables	20	27	90	91	88	-
	112	On the cables	19	31	69	85	122	-
11	113	On the mid wide of the sealant fillet	19	22	40	69	80	-
	114	On the mid wide of the sealant fillet	19	21	36	68	80	-
	115	On the wall system	19	20	21	29	36	-
	116	On the wall system	19	20	22	36	45	-
	117	On the cables	19	48	90	112	157	-
12	118	On the cables	19	43	86	122	154	-
12	119	On the wall system	19	20	25	37	48	-
	120	On the wall system	19	22	39	63	74	-
	121	On the cables	20	45	89	134	160	-
13	122	On the cables	20	49	94	149	190	-
15	123	On the wall system	19	22	38	59	71	-
	124	On the wall system	19	22	28	40	50	-
	126	On the plastic pipe	19	122	82	129	163	-
14	127	On the plastic pipe	19	105	77	114	148	-
14	128	On the wall system	19	23	39	50	62	-
	129	On the wall system	19	22	25	30	36	-
	131	On the plastic pipe	20	58	48	35	100	-
15	132	On the plastic pipe	20	69	54	39	115	-
10	133	On the wall system	19	21	22	24	31	-
	134	On the wall system	19	23	28	35	59	-
	136	On the plastic pipe	19	133	83	116	117	-
16	137	On the plastic pipe	19	179	100	144	154	-
	138	On the wall system	19	22	24	31	39	-
	139	On the wall system	19	24	30	49	63	-
17	141	On the plastic pipe	19	70	71	69	48	-
	142	On the plastic pipe	19	73	77	67	45	-



	143	On the wall system	19	22	37	55	60	-
	144	On the wall system	19	22	26	33	39	-
18	146	On the plastic pipe	19	177	49	187	153	61
	147	On the plastic pipe	19	167	48	163	142	63
	148	On the wall system	19	24	34	48	69	-
	149	On the wall system	19	22	25	30	40	-

Notes

1

Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.

- ² Refer to Appendix 4 for locations of thermocouples as only a generic description is included in the table.
- ³ No insulation failure prior to thermocouple failure.
- # Thermocouple failure
- * Service failure
- '-' Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred.



APPENDIX 6 PHOTOGRAPHS



East

West

East

Figure A6.1: Unexposed face of specimen before commencement of the fire-resistance test



West

Figure A6.2: Exposed face of specimen before commencement of the fire-resistance test



West



East

Figure A6.3: Unexposed face of specimen at the end of the test.



Figure A6.4: Exposed face of specimen at the end of the test.



West