



Regulatory information report

Penetration systems tested in accordance with AS 1530.4:2014

Test sponsor: BOSS Fire & Safety P/L

Job number: RIR-FRT180137

Test date: 7 March 2019 Revision: R2.0

Amendment schedule

Version	Date	Information relating to report			
R1.0	30/05/2019	Description	Initial issue		
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R2.0	04/06/2019	Description			
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Exova Warringtonfire rebranded to Warringtonfire on 1 December 2018. Apart from the change to our brand name, no other changes have occurred. The introduction of our new brand name does not affect the validity of any existing documents we have previously issued.

Executive summary

This report documents the findings of the fire resistance test of penetration systems undertaken on 7 March 2019 in accordance with section 2 and 10 of AS 1530.4:2014. Warringtonfire Australia did the test at the request of BOSS Fire & Safety P/L.

The test specimen consisted of composite floor system penetrated by 7 penetration systems. A summary of the penetration systems is provided in Table 1.

Table 1 Test summary

Penetration system	Service	Primary fire-stopping protection	Second fire-stopping protection	Aperture size (mm)	FRL
A	Bundle of TPS cables	BOSS Batt	BOSS FireMastic - HPE™	Ø76mm	-/120/120
B	32mm PEX-A pipe	-	BOSS FireMastic – HPE™	Ø78mm	-/120/0
C	Pair Coil pipe 25mm uPVC Drain pipe	BOSS Batt	BOSS FireMastic – HPE™	Ø100mm	-/120/120
D	100mm uPVC DWV pipe	BOSS Batt	Boss MaxiCollar™ BOSS FireMastic – 300™	Ø127mm	-/120/120
E	Pair Coil 16mm + 10mm lagged copper pipe 25mm uPVC conduit 9 x TPS cables bundle 15 x CAT6 cable bundle 15 x Firesense cable bundle 32mm galvanised sprinkler pipe 32mm copper	BOSS Fire box	BOSS P40-MAK Wrap BOSS FireMastic - 300™	160mm x170mm	-/120/60
F	32mm copper pipe	-	BOSS FireMastic – 300™	Ø34mm	-/120/30
G	100mm uPVC DWV pipe	-	BOSS Drop in collar BOSS FireMastic – 300™	Ø155mm	-/120/90
H	75mm HDPE pipe	BOSS Batt	BOSS FireMastic – 300™ BOSS MaxiCollar™	Ø92mm	-/120/120
I	25mm uPVC conduit pipe	BOSS Batt	BOSS MaxiCollar™ BOSS FireMastic - 300™	Ø35mm	-/120/120

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1. Introduction

This report documents the findings of the fire resistance test of penetration systems undertaken on 7 March 2019 in accordance with section 2 and 10 of AS 1530.4:2014. Warringtonfire Australia did the test at the request of BOSS Fire & Safety P/L.

Table 2 Test sponsor details

Test Sponsor	Address
BOSS Fire & Safety P/L	15 – 23 Kumulla Road Caringbah NSW 2229 Australia

2. Construction details

Table 3 provides details of the test assembly. Table 4 provides a summary of the test specimen. A full description of the specimen is provided in Appendix A and Section 3. Table 5 shows the installation method and orientation of the test specimen.

Table 3 Test assembly

Item	Detail
Separating element	Composite floor system
Nominal separating element size	Width (w): 1830mm Long (L): 1590mm Thickness (t): Maximum: 130mm Minimum: 70mm
Number of penetration systems	9
Restraint conditions	Restrained on all edges

Table 4 Test specimen

Penetration system	Service	Primary fire-stopping protection	Second fire-stopping protection	Aperture size (mm)
A	Bundle of TPS cables	BOSS Batt	BOSS FireMastic - HPE™	Ø76mm
B	32mm PEX-A pipe	-	BOSS FireMastic – HPE™	Ø78mm
C	Pair Coil pipe 25mm uPVC Drain pipe	BOSS Batt	BOSS FireMastic – HPE™	Ø100mm
D	100mm uPVC DWV pipe	BOSS Batt	Boss MaxiCollar™ BOSS FireMastic – 300™	Ø127mm
E	Pair Coil 16mm + 10mm lagged copper pipe 25mm uPVC conduit 9 x TPS cables bundle 15 x CAT6 cable bundle 15 x Firesense cable bundle 32mm galvanised sprinkler pipe 32mm copper	BOSS Fire box	BOSS P40-MAK Wrap BOSS FireMastic - 300™	160mm x170mm
F	32mm copper pipe	-	BOSS FireMastic – 300™	Ø34mm
G	100mm uPVC DWV pipe	-	BOSS Drop in Collar BOSS FireMastic – 300™	Ø155mm
H	75mm HDPE pipe	BOSS Batt	BOSS FireMastic – 300™ BOSS MaxiCollar™	Ø92mm
I	25mm uPVC conduit pipe	BOSS Batt	BOSS MaxiCollar™ BOSS FireMastic - 300™	Ø35mm

Table 5 Installation method and orientation

Item	Detail
Start date of separating element construction	3 May 2018
Start date of penetration systems	29 January 2019
Completion date of test specimen construction and installation	7 March 2019
Separating element constructed by	The test sponsor.
Penetration system installed by	The test sponsor.
Orientation	Asymmetrical, due to all the services supports were on the unexposed side.

3. Schedule of components

Table 6 lists the schedule of components for the test specimen which were provided by the test sponsor and surveyed by Warringtonfire Australia.

Table 6 Schedule of components


Item	Description		
Separating element			
1.	Product name	Concrete	
	Density	2400kg/m³	
	Installation	The concrete was cast above the composite floor deck with steel reinforcement grid.	
2.	Item name	Composite floor deck	
	Product name	ComFlor® 60	
	Size	Overall: 1590mm long × 600mm wide × 75mm deep	
SE	Size	1830mm wide × 1820mm wide	
	Thickness	Maximum: 130mm Minimum: 70mm	
	Reinforcement grid	Name	F72 reinforcement mesh
		Size	Ø7mm
		Mesh size	200mm × 200mm
		Location	35mm up from the top of the composite floor deck
	Specification	The composite floor was comprised of three composite floor deckings jointed together at the bottom and concrete layer on the top. The concrete was reinforced by steel reinforcement grid.	
Fire-stopping protections			
Sealant			
3.	Product name	BOSS FireMastic – 300™	
	Density	Nominal 1560kg/m³ (provided by test sponsor)	
	Installation	<ul style="list-style-type: none">In the annular gap to 5mm depth between the service and the composite floor. The mastic was then finished flush on the unexposed side. (service D, I)In the annular gap to 5mm depth between the service and the BOSS Batt. The mastic was then finished flush on the BOSS Batt. (Service D, H, I)In the annular gap to 5mm depth between the service and the composite floor. The mastic was then finished with 10mm fillet on the unexposed side. (Service H)In the annular gap to 25mm depth between the service and the composite floor. The mastic was then finished with 10mm fillet on both exposed and unexposed side. (Service F)In the annular gap to 5mm depth between the composite floor and the metal sleeve, the mastic was then finished flush on the unexposed side. (Service G)In the annular gap to 5mm depth between the metal sleeve and the service, the mastic was then finished flush on the exposed and unexposed side (service G)At the interface between the BOSS Batt and the composite floor, 2mm mastic was applied. (Service A, C, D, H, I)	
4.	Product name	BOSS FireMastic - HPE™	

Item	Description		
	Density	Nominal 1300kg/m³ (provide by test sponsor)	
	Installation	<ul style="list-style-type: none">In the annular gap to 25mm depth between the services and the composite floor. The mastic was then finished flush on the unexposed side (Service A, C)In the 25mm x 25mm recess around the service in the BOSS Batt. The mastic was then finished flush on the exposed side of the BOSS Batt (Service A, C)In the annular gap to 25mm depth between the service and the composite floor. The mastic was then finished flush on both the exposed and unexposed side. (service B)	
Fire collar			
5.	Product name	BOSS 32mm MaxiCollar™	
	Collar details	Outer diameter (OD)	47mm
		Inner diameter (ID)	35mm
		Height (h)	30mm
		Outer shell thickness (t)	1mm
	Intumescent details	Number of layers	3
		Width (w)	30mm
		Thickness (t)	2.3mm
		Density	1121kg/m³
	Installation	The collar was installed on the exposed side of the BOSS Batt with three pig tail screws.	
6.	Product name	BOSS 75mm MaxiCollar™	
	Collar details	Outer diameter (OD)	98mm
		Inner diameter (ID)	78mm
		Height (h)	30mm
		Outer shell thickness (t)	1mm
	Intumescent details	Number of layers	4
		Width (w)	30mm
		Thickness (t)	2.3mm
		Density	1121kg/m³
	Installation	The collar was installed on the exposed side of the BOSS Batt with three pig tail screws.	
7.	Product name	BOSS 100mm MaxiCollar™	
	Collar details	Outer diameter (OD)	135mm
		Inner diameter (ID)	113mm
		Height (h)	30mm
		Outer shell thickness (t)	1mm
	Intumescent details	Number of layers	5
		Width (w)	30mm
		Thickness (t)	2.3mm
		Density	1146kg/m³
	Installation	The collar was installed on the exposed side of the BOSS Batt with three pig tail screws.	
8.	Product name	BOSS Drop in collar	
	Size	Outer diameter (OD)	120mm
		Inner diameter (ID)	111mm
		Height(h)	150mm

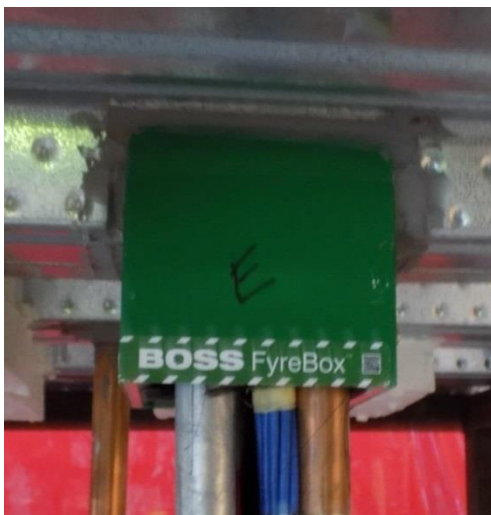
Item	Description		
		Outer shell thickness (t)	1.7mm
	Intumescent detail	Number of layers Width(w) Thickness(t) Density	4 40mm Nominal 2.0mm 1185kg/m³
	Installation	BOSS intumescent strips were installed at the mid-height of the metal sleeve. Then the metal sleeve was inserted into the core hole and secured to the composite floor with mechanical fixing on the unexposed side.	
Wrap			
9.	Item name	Insulation wrap	
	Product name	BOSS P40-MAK Wrap	
	Overall size	300mm wide × 40mm thick	
	Mineral fibre wool density	40kg/m³	
	Installation	The wrap was wrapped around the bundle of cables and pipes (service E) on the unexposed side. The wrap was secured with metal wire at approximately 50mm and 250mm from the separating element.	
Batts/Board			
10.	Item name	BOSS Batt	
	Product name	BOSS Bulkhead Batt	
	Size	270mm × 270mm (service A) 265mm × 265mm (service I) 290mm × 290mm (service H) 300mm × 300mm (service C) 330mm × 330mm (service D) For the Batt support for floor profile. 120mm (top base) × 186mm (bottom base) × 70mm (leg) Trapezoid shape (Service A, C, D, H, I)	
	Density	7kg/m²	
	Installation	The BOSS Batts were secured onto the separating element on the bottom rib of the decking with Four mechanical fixings. The gap between the top rib and the BOSS Batt was covered with trapezoid shape BOSS Batt. The cut edge and core hole of the BOSS Batt was painted with BOSS Ablating Coating.	
	Firebox		
11.	Item name	BOSS Fire box	
	Product name	BOSS FIRE Multi-Service Cable & Pipe transit	
	Size	150mm wide × 150mm high × 270mm deep (measured)	
	No. of intumescent bags in the box	8	
	Density	Nominal: 1160kg/m³ (measured)	
	Installation	The BOSS Fire box was inserted into the aperture and secured to the separating element with 20 × 40mm angle on the unexposed side. The annular gap between the BOSS Fire box and the separating element was filled with BOSS FireMastic – 300™. A 20mm × 20mm BOSS FireMastic -300™ fillet was applied around the BOSS Fire box on the unexposed side.	


Item	Description		
		The gap between the separating element and the BOSS Fire box was filled with BOSS FireMastic – 300™ and finished following profile of the composite floor deck.	
Services			
12.	Item name	25mm uPVC conduit	
	Product name	Aussie Duct BEP PVC UPVC Electrical AS/NZ2053 25mm MD-T	
	Size	Outer diameter (OD)	25.0mm (measured)
		Inner diameter (ID)	20.5mm (measured)
Thickness (t)		2.3mm (measured)	
13.	Item name	25mm uPVC pipe	
	Product name	iPlex pipeline Premium BEP PVC S1 PVC-U 25PN12	
	Size	Outer diameter (OD)	33.6mm (measured)
		Inner diameter (ID)	29.3mm (measured)
Thickness (t)		2.2mm (measured)	
14.	Item name	100mm uPVC DWV pipe	
	Product name	DPMHH100C Holman-DWV 1003 BEP PVC 100 PVC-U DWV SC SN6	
	Size	Outer diameter (OD)	109.8mm
		Inner diameter (ID)	103.3mm
Thickness (t)		3.3mm	
15.	Item name	32mm PEX-A pipe	
	Product name	Trade Pex Water AS 2492 WM 74647// DN32 32 × 4.4mm SDR7.4 PN20 PEX-a	
	Size	Outer diameter (OD)	32mm (measured)
		Inner diameter (ID)	21.3mm (measured)
Thickness (t)		5.4mm (measured)	
16.	Item name	75mm HDPE pipe	
	Product	GEBERIT DN 75 × 3 SDR 26 PE100 Series 12.5	
	Size	Outer diameter (OD)	75mm (measured)
		Inner diameter (ID)	68mm (measured)
Thickness (t)		3.5mm (measured)	
17.	Product name	32mm copper pipe	
	Size	Outer diameter (OD)	31.8mm (measured)
		Inner diameter (ID)	29.2mm (measured)
		Thickness (t)	1.3mm (measured)
18.	Product name	32mm galvanised sprinkler pipe	
	Size	Outer diameter (OD)	42.4mm
		Inner diameter (ID)	36.1mm
		Thickness (t)	3.1
19.	Product name	Ardent Fire Retardant Pair Coil Copper 13mm ¼" × 5/8"	
	Size (Large pipe)	Outer diameter (OD)	15.9mm (measured)
		Inner diameter (ID)	13.9mm (measured)
		Thickness (t)	1.0mm (measured)
	Size(Large pipe lagging)	Outer diameter (OD)	41.3mm (measured)
Inner diameter (ID)		15.9mm (measured)	
	Thickness (t)	12.7mm (measured)	


Item	Description		
	Size (Small pipe)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	6.3mm (measured) 4.6mm (measured) 0.9mm (measured)
	Size (Small pipe lagging)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	26.6mm (measured) 11.4mm (measured) 7.6mm (measured)
20.	Product name	Ardent Copper Fire Rated Pair Coil 13mm ¼" × 3/8"	
	Size (Large pipe)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	15.9mm (measured) 13.9mm (measured) 1.0mm (measured)
	Size(Large pipe lagging)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	41.3mm (measured) 15.9mm (measured) 12.7mm (measured)
	Size (Small pipe)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	9.7mm (measured) 6.4mm (measured) 1.7mm (measured)
	Size (Small pipe lagging)	Outer diameter (OD) Inner diameter (ID) Thickness (t)	35.4mm (measured) 9.7mm (measured) 12.9mm (measured)
21.	Item name	Power cable – 3 Core 2.5mm ²	
	Product name	Nexans Olex 2018 V-90 Electric cable 450/780V TUV2 1958EA CNCP07 TrustOlex	
	Overall size	12.5mm × 5.6mm (measured)	
22.	Item name	CAT6 Data cables	
	Product name	Serveredge E5960 Category 6 4PR 23 Aug UTP Solid PVC cable ANSI/ TIA-568-C.2 250MHz	
	Overall size	Outer diameter	6.4mm (measured)
23.	Item name	FireSense cable	
	Product name	FIRESENSE -TPSLD-1.50-2C-ELV-FIRE-LIGHT DUTY -AS/ACIF s008/9-ASA-181006-as/NZS 3013-WSX1-	
	Overall size	7mm x4.4mm	
Fixings			
24.	Item name	Collar fixing	
	Product name	Pig tail screws	
	Size	Ø9mm × 52mm long	
25.	Item name	Batt fixing	
	Product name	75mm long screw in Masonry Anchor with washer.	
		4 × screws and washers were used to secure each BOSS Batt to the separating element	
Penetration system A			
A	Service	Bundle of 22 × TPS cables	
	Service detail	Bundle outside diameter: Ø50mm The service protruded 500mm on the exposed side and 600mm on the unexposed side	

Item	Description	
	Service support	The service was supported by the pipe clamps on the unexposed side at 300mm and 500mm from the separating element
	Aperture size	Ø76mm
	Annual gap	Nominal 11.5mm
	Primary local fire-stopping protection	
	Protection	BOSS Batt
	Installation	270mm x 270mm BOSS Batt was installed on the bottom rib of the separating element. The gap between the Boss Batt and the top rib of the separating element was covered with trapezoid shape BOSS Batt. There was a Ø90mm x 25mm deep recess at the centre of the core hole at the exposed side.
	Secondary local fire-stopping protection	
	Protection	BOSS FireMastic – HPE™
	Installation	The annular gap between the service and the separating element was filled with BOSS FireMastic – HPE™ to a depth of 5mm and finished flush on the unexposed side. The recess between the service and the BOSS Batt was filled with BOSS FireMastic-HPE™ to a depth of 25mm (full depth of the recess) and finished flush on the exposed side. See Figure 2 and Figure 4 in Appendix A for more details.
Penetration system B		
B	Service	32mm PEX-A pipe
	Service detail	The service protruded 500mm on the exposed side and 2000mm on the unexposed side. The pipe was capped with BOSS FireMastic – 300™ on the exposed side. The service penetrated the thickest part of the separating element. The location of the service related to the composite floor deck is shown below: 
	Service support	The service was supported by the pipe clamp at 300mm and 1500mm from the separating element
	Aperture size	Ø78mm
	Annular gap	Nominal 24mm
	Local fire-stopping protection	
	Protection	BOSS FireMastic - HPE™

Item	Description	
	Installation	The annular gap between the service and the separating element was filled with BOSS FireMastic – HPE™ to a depth of 25mm supported. The mastic finished flush on the unexposed and followed the profile of the composite floor deck on the exposed side. See Figure 2 and Figure 5 in Appendix A for more details.
Penetration system C		
C	Service	16mm & 6mm Pair coil copper pipe with lagging and 25mm uPVC pipe
	Service detail	The bundle of pipes protruded 500mm on the exposed side and 500mm (Pair coil copper pipe), 2000mm (25mm uPVC pipe) on the unexposed side.
	Service support	The service was supported by the pipe clamp at 300mm, 500mm and 1500mm (25mm uPVC pipe) on the unexposed side. The copper pipe was capped by squeezing the end part and sealed with BOSS FireMastic – 300™ on the exposed side. The uPVC pipe was capped on exposed side with BOSS FireMastic -300™.
	Aperture size	Ø100mm
	Primary local fire-stopping protection	
	Protection	BOSS Batt
	Installation	300mm x 300mm BOSS Batt was installed on the bottom rib of the separating element. The gap between the Boss Batt and the top rib of the separating element was covered with trapezoid shape BOSS Batt. There was a 120mm x 109mm x 25mm deep recess at the centre of the core hole at the exposed side.
	Secondary local fire-stopping protection	
	Protection	BOSS FireMastic – HPE™
	Installation	The annular gap between the service and the separating element was filled with BOSS FireMastic – HPE™ in the depth of 25mm and finished flush on the unexposed side. The recess between the service and the BOSS Batt was filled with BOSS FireMastic-HPE™ in the depth of 25mm (full depth of the recess) and finished flush on the exposed side. See Figure 2 and Figure 6 in Appendix A for more details.
Penetration system D		
D	Service	100mm uPVC DWV pipe
	Service detail	The service protruded 500mm on the exposed side and 2000mm on the unexposed side. The pipe was capped on exposed side with uPVC pipe cap.
	Service support	The service was supported by the pipe clamps at 300mm and 1500mm from the separating element.
	Aperture size	Ø127mm
	Annular gap	Nominal 6.5mm
	Primary local fire-stopping protection	
	Protection	BOSS Batt
	Installation	330mm x 330mm BOSS Batt was installed on the bottom rib of the separating element. The gap between the BOSS Batt and the top rib of the separating element was covered with trapezoid shape BOSS Batt.
	Secondary local fire stopping protection	
	Protection	BOSS 100mm MaxiCollar™ & BOSS FireMastic - 300™

Item	Description	
	Installation	<p>The annular gap between the service and the separating element was filled with BOSS FireMastic -300™ at the depth of 5mm and finished flush on the unexposed side.</p> <p>The annular gap between the service and the BOSS Batt was filled with BOSS FireMastic – 300™ at the depth of 5mm and finished flush on the exposed side.</p> <p>BOSS 100mm MaxiCollar™ were installed on the exposed and secured to the BOSS Batt with pig tail screws.</p> <p>See Figure 2 and Figure 7 in Appendix A for more details.</p>
Penetration System E		
E	Service	Bundle of cables and pipes in BOSS Fire box
	Service component	<ul style="list-style-type: none"> • 8 x Power cable – 3 Core 2.5mm² • 15 x CAT6 data cables • 15 x FireSense cables • Ardent Copper Fire Rated Pair Coil 13mm 1/4" x 3/825mm UPVC conduit • Power cable – 3 Core 2.5mm² • 32mm galvanised sprinkler pipe • 32mm copper pipe
	Service detail	<p>The services protruded 500mm on the exposed side and 530mm (galvanised sprinkler pipe), 570mm (pair coil), 600mm (cables) & 2025mm (uPVC conduit) on the unexposed side.</p> <p>The galvanised sprinkler pipe was capped with metal plate on the exposed side.</p> <p>The pair coil was crimped at the end on the exposed side and sealed with BOSS FireMastic -300™.</p> <p>The uPVC conduit was capped with BOSS FireMastic – 300™.</p> <p>The service penetrated the thickest part of the separating element. The location of the service related to the composite floor deck is shown below:</p> 
	Service support	The services were supported by the pipe clamp at 500mm and 1500mm (uPVC conduit) from the separating element.
	Aperture size	160mm x 170mm
	Annular gap	Nominal 10 – 20mm
	Primary local fire-stopping protection	
	Protection	BOSS Fire box & BOSS FireMastic - 300™

Item	Description	
	Installation	<p>The BOSS Fire box was inserted into the aperture and secured with 20mm x 40mm angle from the unexposed side. The gap between the BOSS Fire box and separating element were filled with BOSS FireMastic 300™. The mastic was finished with 20mm x 20mm fillet on the unexposed side and finished following the profile of the composite floor deck on the exposed side.</p> <p>The cables and pipes were inserted into the BOSS Fire box and tied together with metal cable tie.</p>
	Secondary local fire stopping protection	
	Protection	BOSS P40-MAK Wrap
	Installation	<p>A layer of BOSS P40-MAK Wrap wrapped around the services and extended 300mm away from the separating element on the unexposed side.</p> <p>See Figure 2 and Figure 8 in Appendix A for more details.</p>
Penetration system F		
F	Service	32mm copper pipe
	Service detail	<p>The service protruded 500mm on both the exposed and the unexposed side. The pipe was capped with copper cap on the exposed side.</p> <p>The service penetrated the thickest part of the separating element. The location of the service related to the composite floor deck is shown below:</p> 
	Service support	The service was supported by the pipe clamp at 300mm and 500mm from the separating element
	Aperture size	Ø34mm
	Annular gap	Nominal 1mm
	Local fire-stopping protection	
	Protection	BOSS FireMastic – 300™
	Installation	<p>The annular gap between the service and the separating element was filled with BOSS FireMastic – 300™ to a depth of 25mm and finished with 10mm x 10 fillet on both the exposed and unexposed side.</p> <p>See Figure 2 and Figure 9 in Appendix A for more details.</p>
	Penetration system G	
G	Service	100mm uPVC DWV pipe
	Service detail	<p>The service protruded 500mm on the exposed side and 2000mm on the unexposed side. The pipe was capped with uPVC cap on the exposed side.</p> <p>The service penetrated the on the web of the composite floor deck where half of the service penetrated on the top rib and half of the service penetrated on the bottom rib. The location of the service related to the composite floor deck is shown below.</p>

Item	Description	
		
	Service support	The service was supported by the pipe clamp at 300mm and 1500mm from the separating element
	Aperture size	Ø155mm
	Annular gap	Nominal 27.5mm
	Local fire-stopping protection	
	Protection	BOSS DROP Collar (Three layers BOSS Intumescent strip) & BOSS FireMastic – 300™
	Installation	<p>The BOSS Drop in Collar was placed in from unexposed side & fixed with mechanical fixings.</p> <p>The BOSS FireMastic – 300™ was installed into the annular gap between the separating element, the service and the metal sleeve to a depth of 25mm. The mastic was finished flush on the unexposed side.</p> <p>The BOSS FireMastic – 300™ was installed into the annular gap between the separating element and the metal sleeve to a depth of 5mm depth. The mastic was finished following the profile of the composite floor deck.</p> <p>See Figure 2 and Figure 10 in Appendix A for more details.</p>
Penetration system H		
H	Service	75mm HDPE pipe
	Service detail	The service protruded 500mm on the exposed side and 2000mm on the unexposed side. The pipe was capped with BOSS FireMastic – 300™.
	Service support	The service was supported by the pipe clamps at 300mm and 1500mm from the separating element.
	Aperture size	Ø92mm
	Annular gap	Nominal 8.5mm
	Primary local fire stopping protection	
	Protection	BOSS Batt
	Installation	290mm x 290mm BOSS Batt was installed on the bottom rib of the separating element. The gap between the BOSS Batt and the top rib of the separating element was covered with trapezoid shape BOSS Batt.
	Secondary local fire stopping protection	
	Protection	BOSS 75mm MaxiCollar™ & BOSS FireMastic - 300™

Item	Description	
	Installation	<p>The annular gap between the service and the separating element was filled with BOSS FireMastic -300™ to a depth of 5mm and finished with 10mm x 10mm fillet on the unexposed side.</p> <p>The annular gap between the service and the BOSS Batt was filled with BOSS FireMastic – 300™ to a depth of 5mm and finished flush on the exposed side.</p> <p>BOSS 75mm MaxiCollar™ were installed on the exposed and secured to the BOSS Batt with pig tail screws.</p> <p>See Figure 2 and Figure 11 in Appendix A for more details.</p>
Protection system I		
I	Service	25mm uPVC conduit
	Service detail	The service protruded 500mm on the exposed side and 2000mm on the unexposed side. The pipe was capped with BOSS FireMastic – 300™.
	Service support	The service was supported by the pipe clamps at 300 and 1500mm from the separating element.
	Aperture size	Ø35mm
	Annular gap	Nominal 5mm
	Primary local fire-stopping protection	
	Protection	BOSS Batt
	Installation	265mm x 265mm BOSS Batt was installed on the bottom rib of the separating element. The gap between the Boss Batt and the top rib of the separating element was covered with trapezoid shape BOSS Batt
	Secondary local fire stopping protection	
	Protection	BOSS 32mm MaxiCollar™ & BOSS FireMastic - 300™
	Installation	<p>The annular gap between the service and the separating element was filled with BOSS FireMastic -300™ to a depth of 5mm and finished with 10mm x 10mm fillet on the unexposed side.</p> <p>The annular gap between the service and the BOSS Batt was filled with BOSS FireMastic – 300™ to a depth of 5mm and finished flush on the exposed side.</p> <p>BOSS 32mm MaxiCollar™ were installed on the exposed and secured to the BOSS Batt with pig tail screws.</p> <p>See Figure 2 and Figure 12 in Appendix A for more details.</p>

4. Test procedure

Table 7 details the test procedure for this fire resistance test.

Table 7 Test procedure

Item	Detail	
Statement of compliance	The test was performed in accordance with the requirements of section 2 and 10 of AS 1530.4:2014 appropriate for service penetrations.	
Variations	<ul style="list-style-type: none"> None 	
Pre-test conditioning	The construction and installation of the test specimen was completed on 7 March 2019. The test specimen was subjected to normal laboratory temperatures and conditions between the completion of construction of the test specimen and the start of the test.	
Sampling / specimen selection	The laboratory was not involved in sampling or selecting the test specimen for the fire resistance test.	
Ambient laboratory temperature	Start of the test	23°C
	Minimum temperature	23°C
	Maximum temperature	25°C
Test duration	121 minutes	
Instrumentation and equipment	<p>The instrumentation was provided in accordance with AS 1530.4:2014 as follow:</p> <ul style="list-style-type: none"> The furnace temperature was measured by four mineral insulated metal sheathed Type K thermocouples – with wire diameters not greater than 1mm, an overall diameter of 3mm, and 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 x 0.2mm thick copper discs covered by 30mm x 30mm x 2.0mm inorganic insulating pads. 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 at 100mm below the underside of the floor system and corrected to mid-height of the lowest penetration. Cotton pads were available during the test to assess the performance of the specimen under the criteria for integrity. 	

5. Test measurements and results

Table 9 in Appendix B includes observations of any significant behaviour of the specimen and details of the occurrence of the various performance criteria specified in AS 1530.4:2014.

Table 8 summarises the results the specimen achieved against the performance criteria listed in sections 2 and 10 of AS 1530.4:2014.

Table 8 Test results

Penetration system	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	Not applicable	-/120/120
	Integrity	No failure at 121 minutes	
	Insulation	No failure at 121 minutes	
B	Structural adequacy	Not applicable	-/120/0
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 17 minutes	
C	Structural adequacy	Not applicable	-/120/120
	Integrity	No failure at 121 minutes	
	Insulation	No failure at 121 minutes	
D	Structural adequacy	Not applicable	-/120/120
	Integrity	No failure at 121 minutes	
	Insulation	No failure at 121minutes	
E	Structural adequacy	Not applicable	-/120/60
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 85minutes	
F	Structural adequacy	Not applicable	-/120/30
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 33 minutes	
G	Structural adequacy	Not applicable	-/120/90
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 104 minutes	
H	Structural adequacy	Not applicable	-/120/120
	Integrity	No failure at 121 minutes	
	Insulation	No failure at 121 minutes	
I	Structural adequacy	Not applicable	-/120/120
	Integrity	No failure at 121 minutes	
	Insulation	No failure at 121 minutes	

6. Application of test results

6.1 Test limitations

The results of these fire tests may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

These 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, and they do not necessarily reflect the actual behaviour in fires.

6.2 Variations from the tested specimen

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 1530.4:2014. Any significant variation with respect to size, construction details, loads, stresses, edge or end conditions, other than that allowed under the field of direct application in the relevant test method, is not covered 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 C – should be referred to the test sponsor. They should then obtain appropriate documentary evidence of compliance from Warringtonfire Australia Pty Ltd or another registered testing authority.

6.3 Uncertainty of measurements

It is not possible to provide a stated degree of accuracy for the results, because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance.

Appendix A Drawings of test assembly

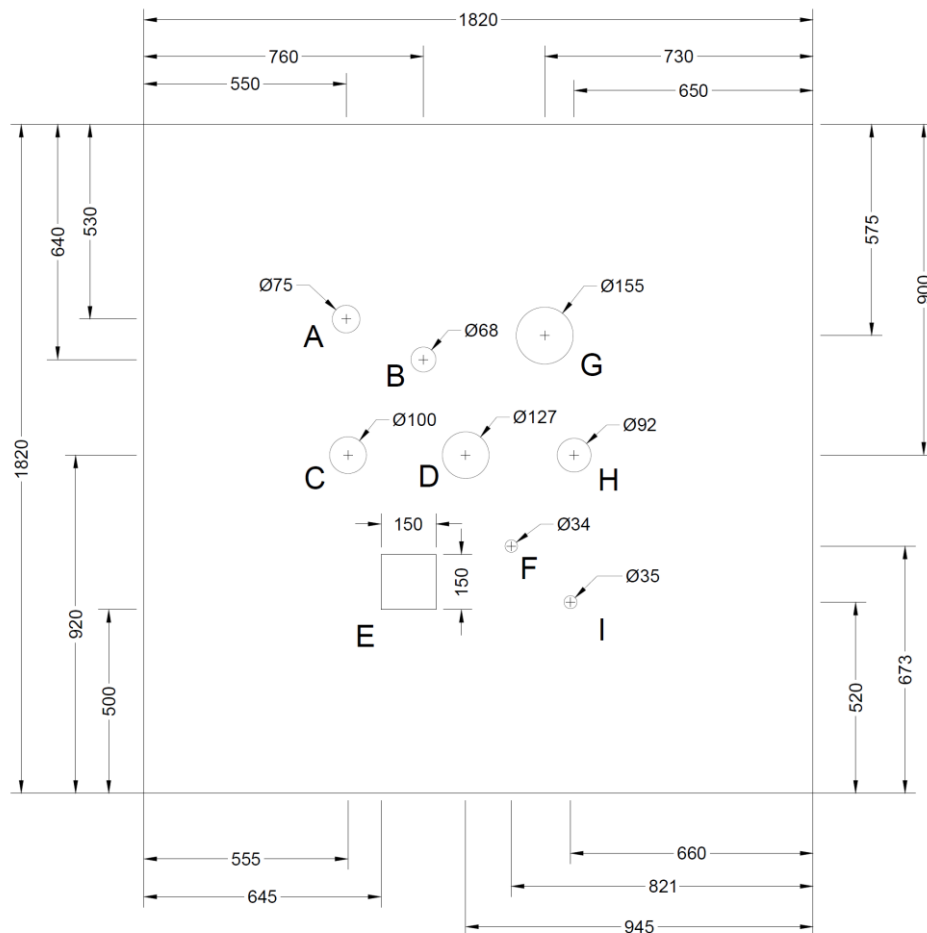


Figure 1 Plan view of test specimen (Core hole size and location on unexposed side)

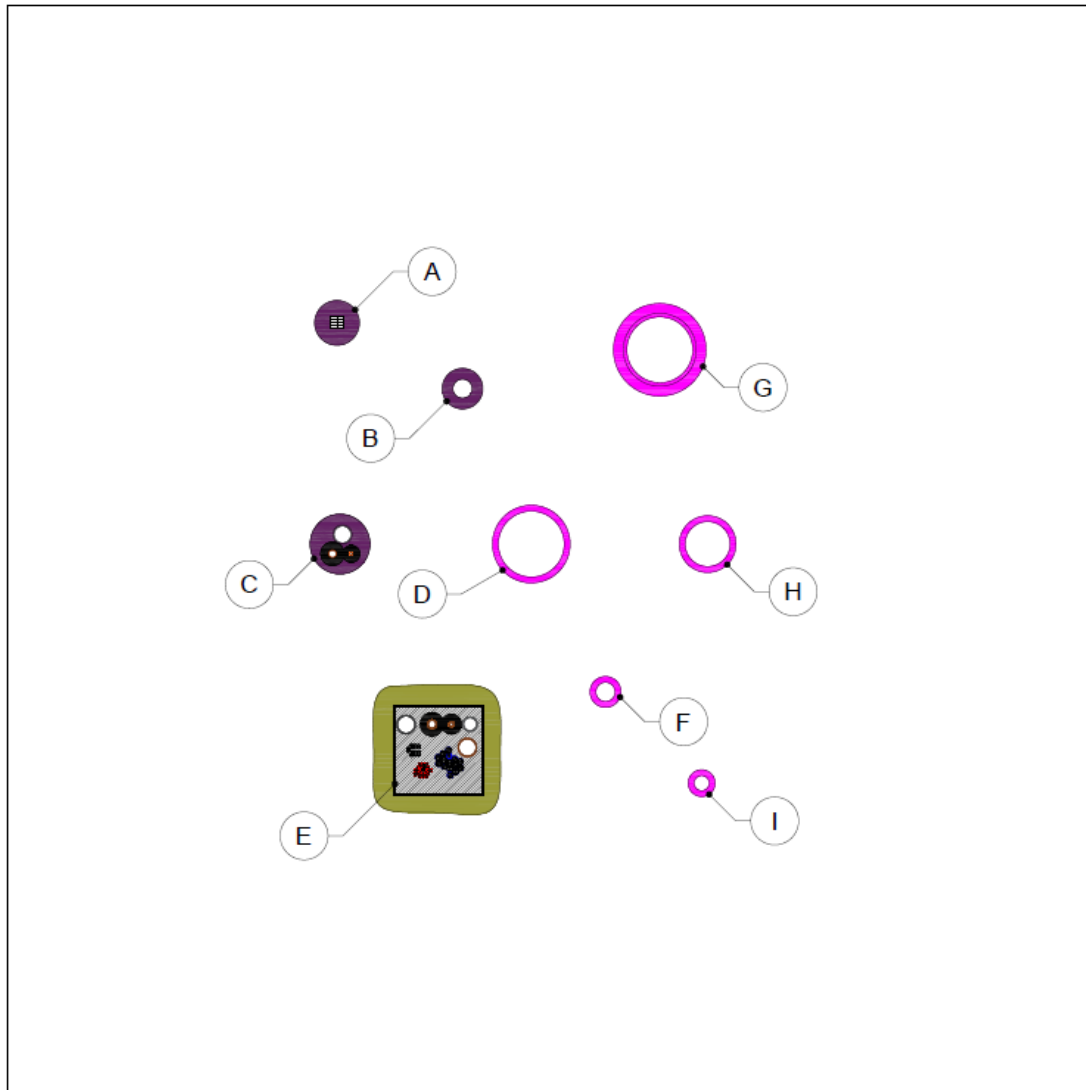


Figure 2 Plan view of test specimen (Unexposed side)

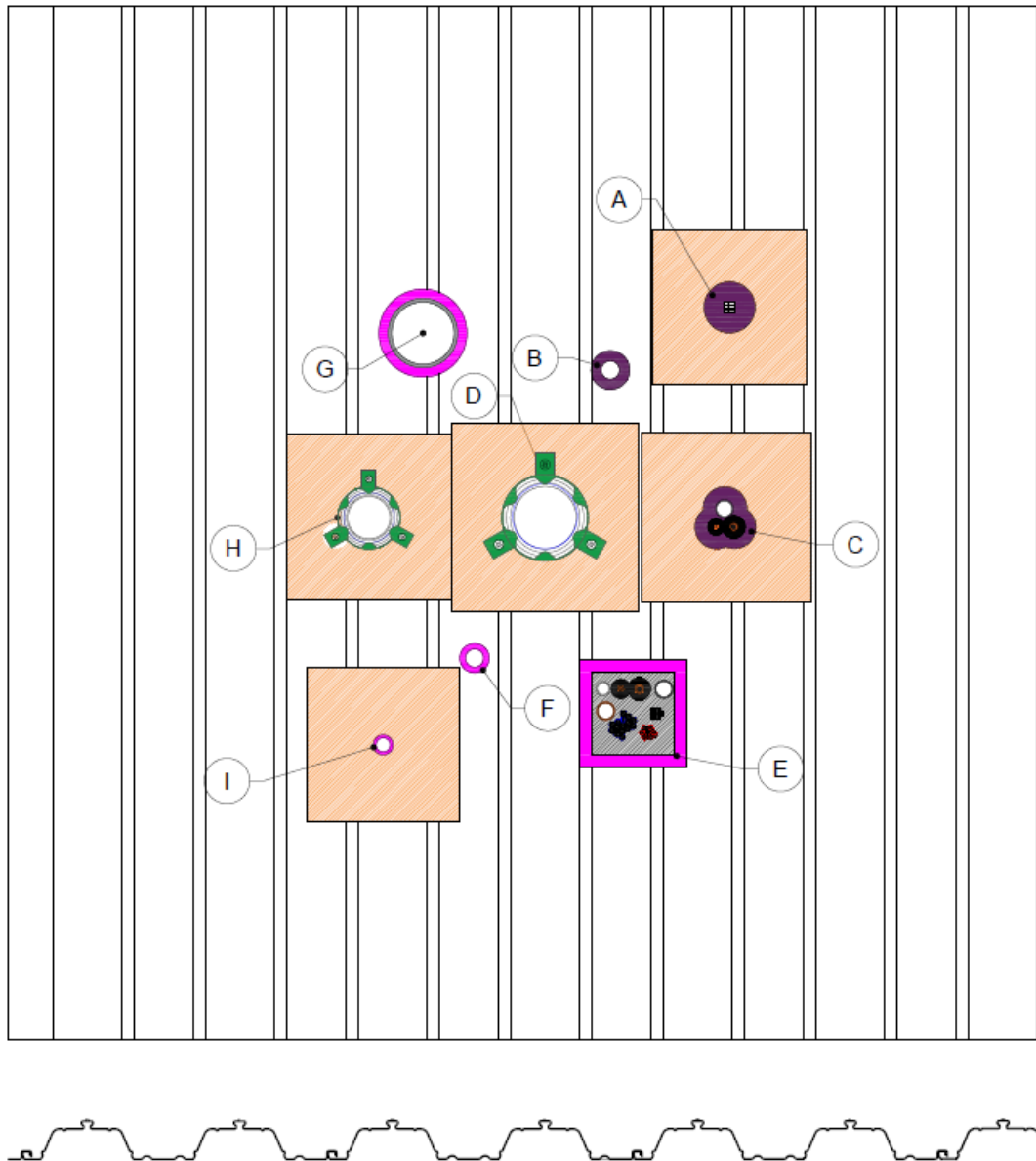


Figure 3 Plan view of test specimen (Unexposed side)

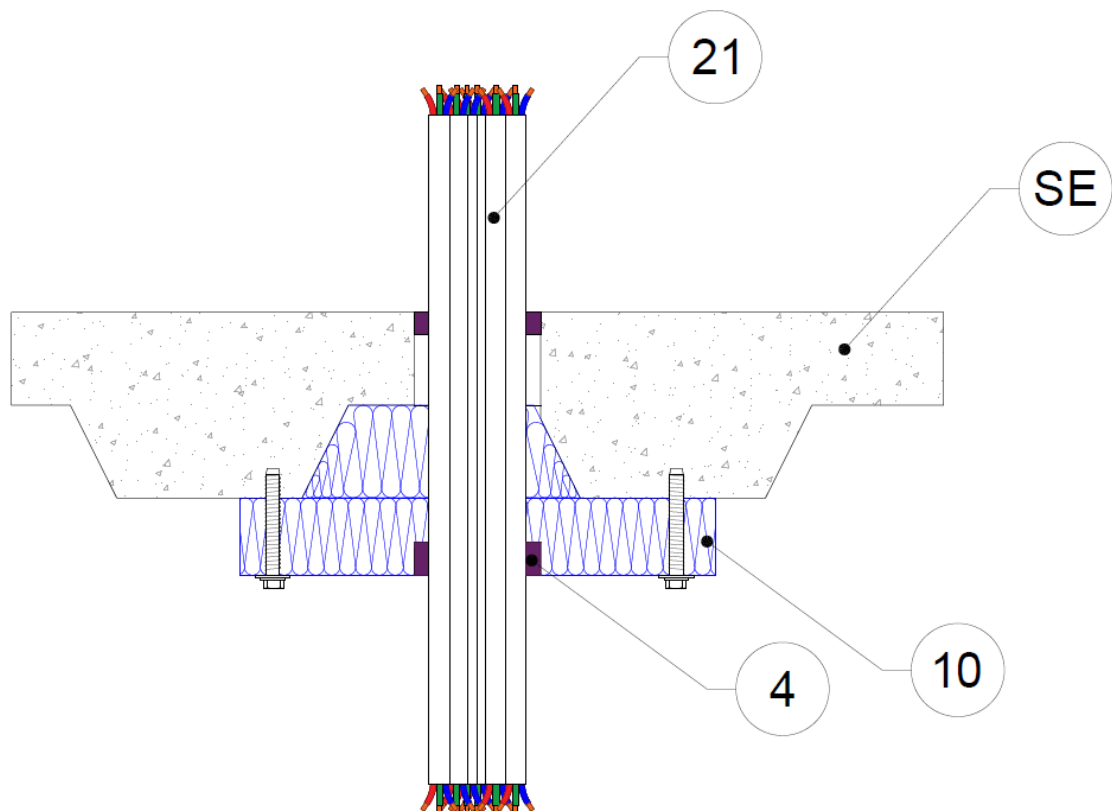


Figure 4 Cross-section Service A (drawing provided by client)

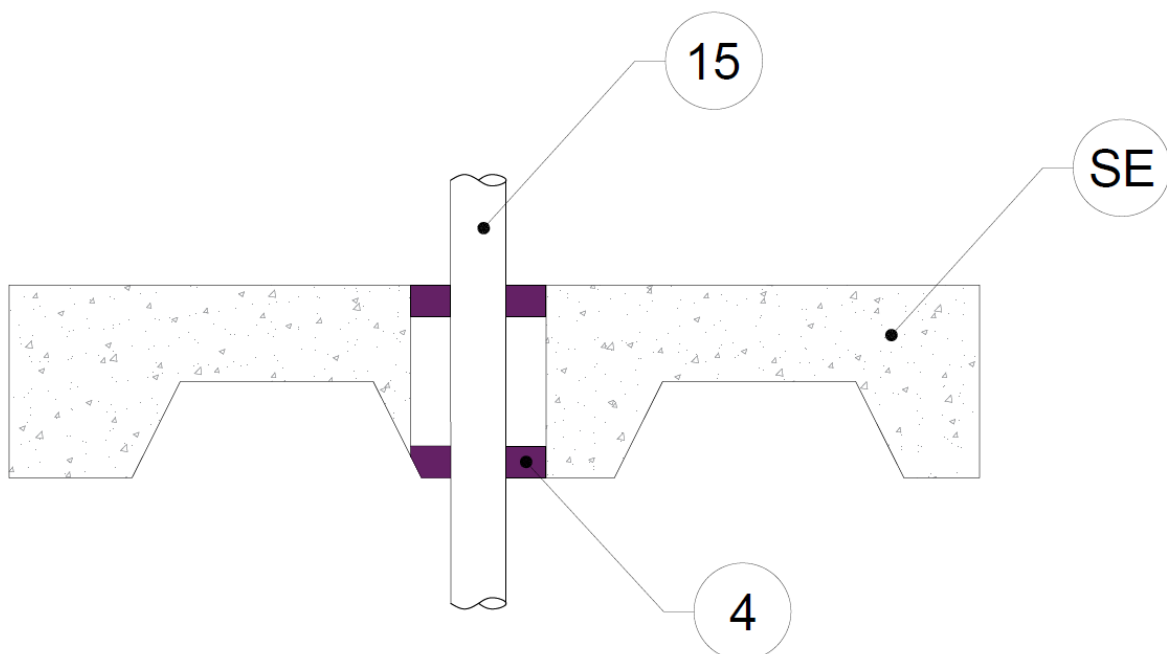


Figure 5 Cross-section Service B (drawing provided by client)

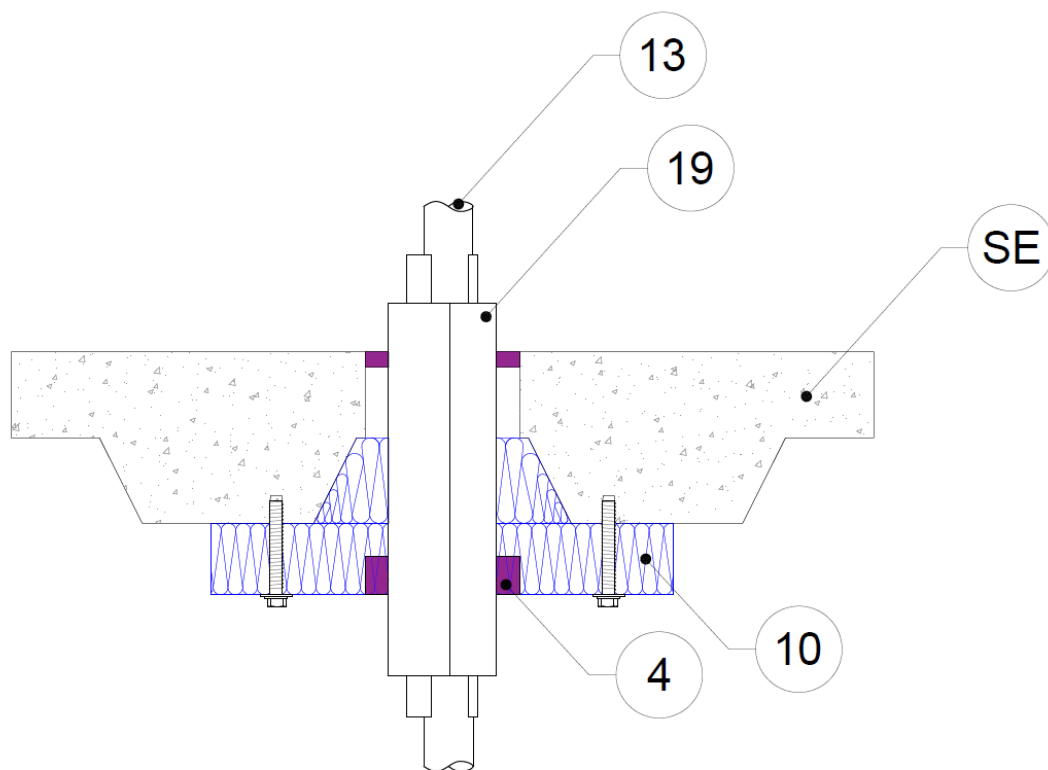


Figure 6 Cross-section Service C (drawing provided by client)

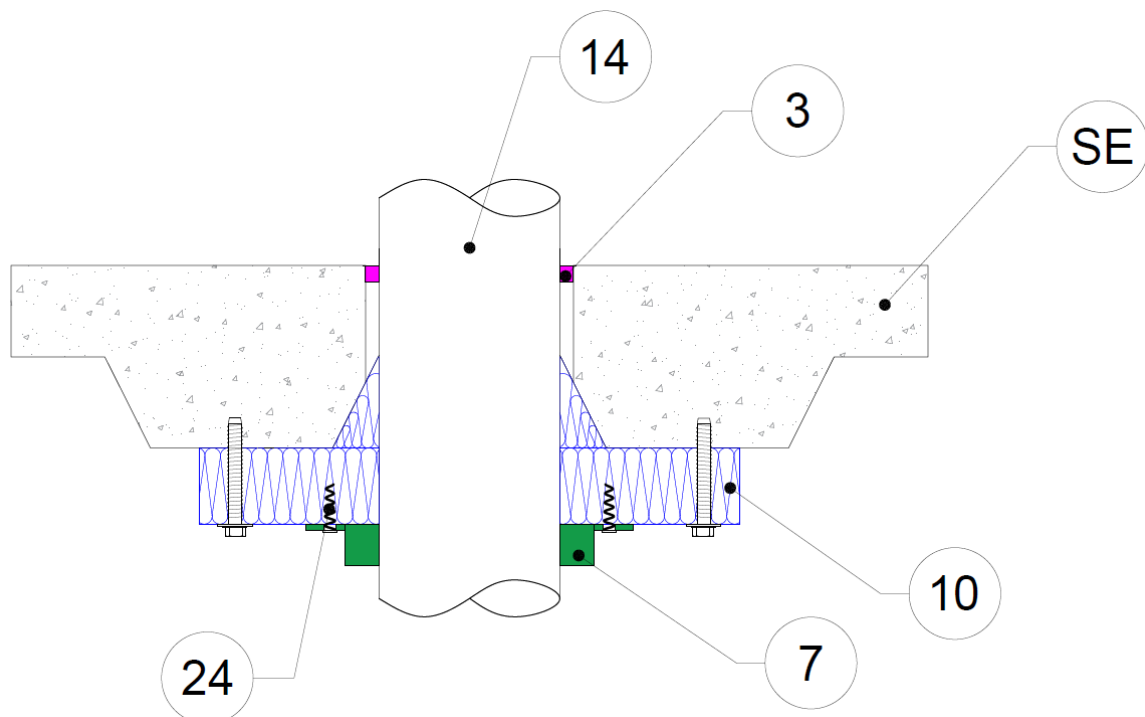
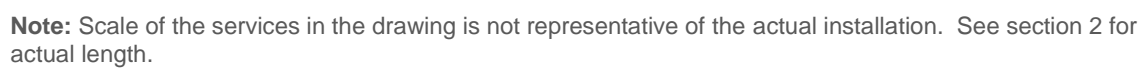


Figure 7 Cross-section Service D (drawing provided by client)



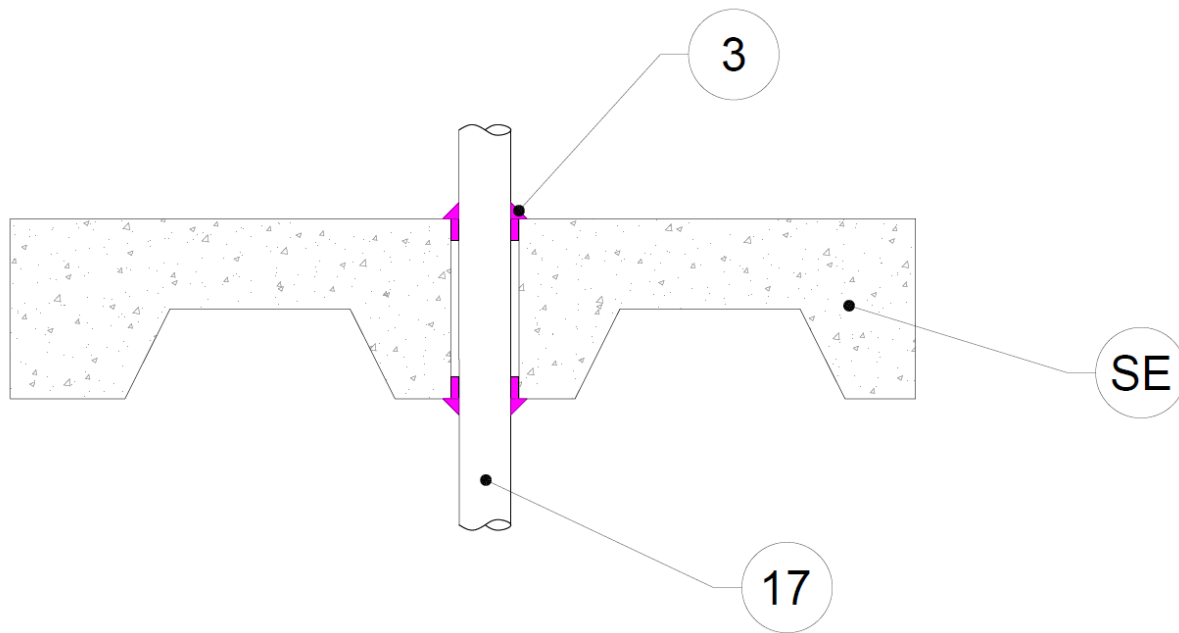


Figure 9 Cross-section Service F (drawing provided by client)

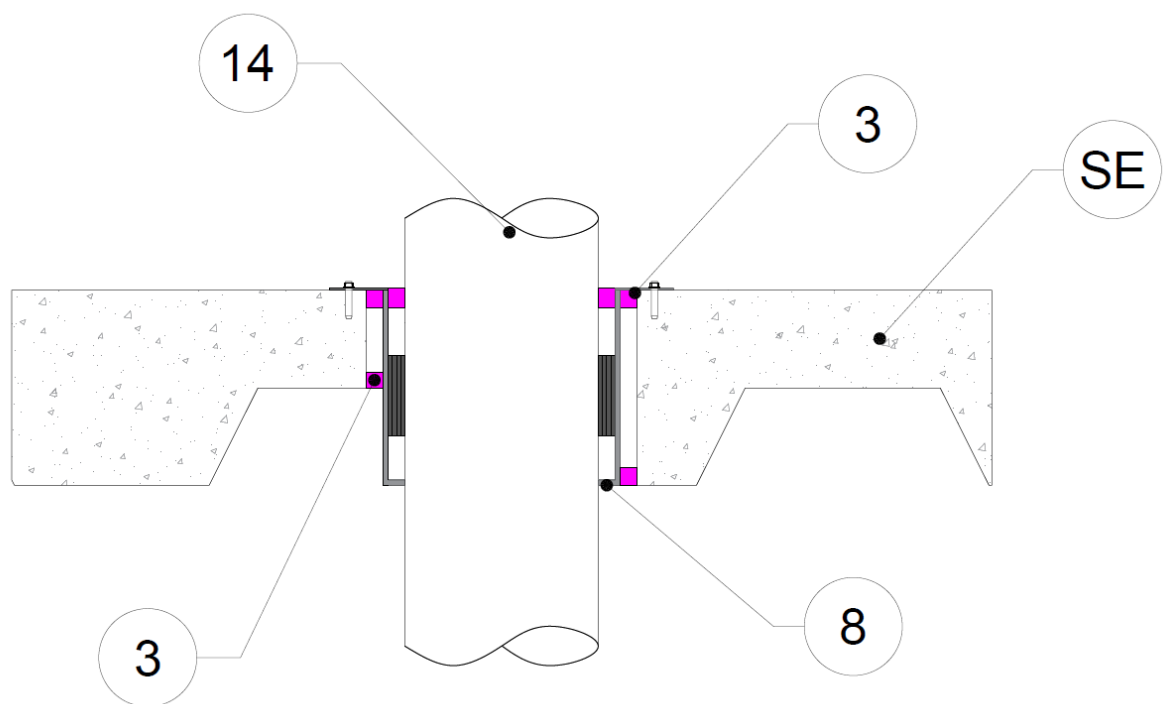


Figure 10 Cross-section Service G (drawing provided by client)

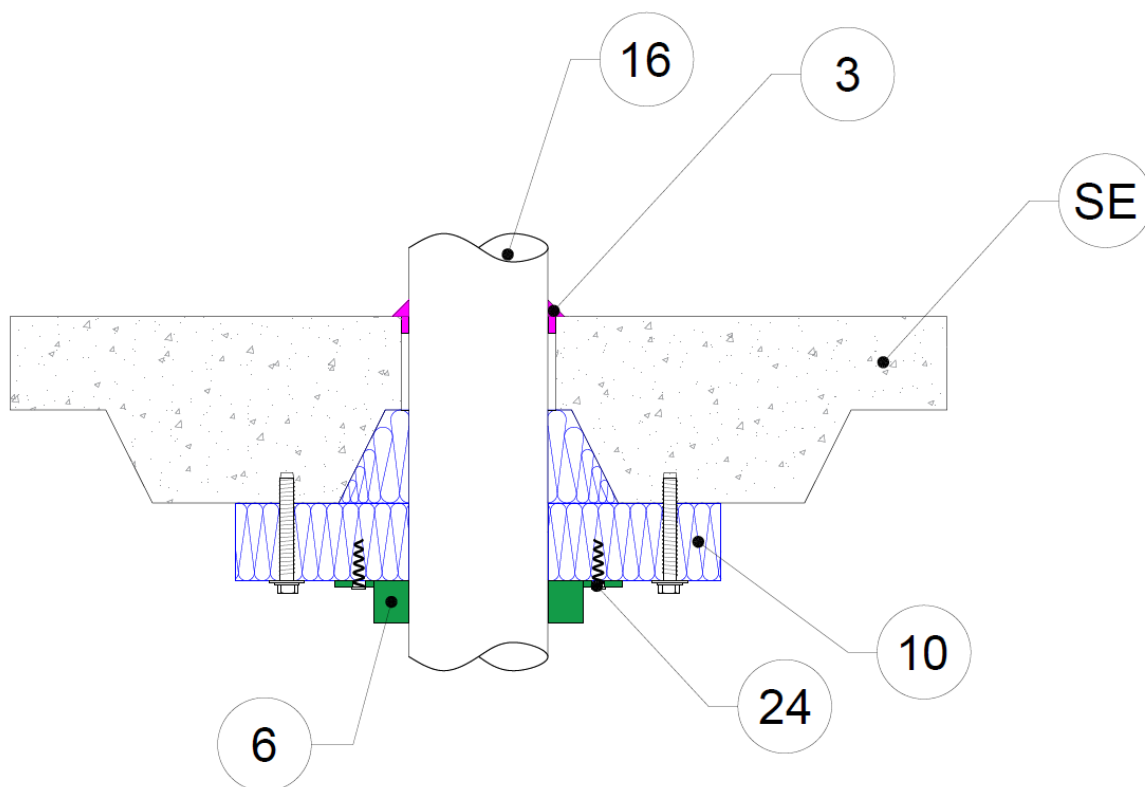


Figure 11 Cross-section Service H (drawing provided by client)

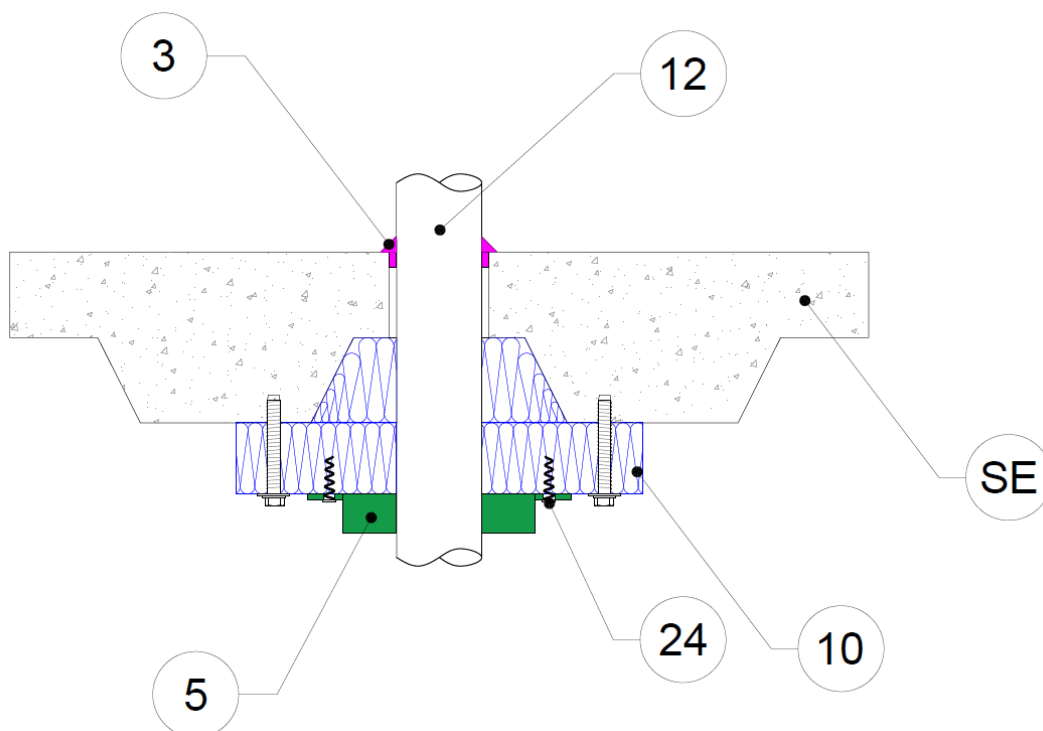


Figure 12 Cross-section Service I (drawing provided by client)

Appendix B Test observations

Table 9 shows observations of any significant behaviour of the specimen during the test.

Table 9 Test observations

Time		Observation
Min	Sec	
Penetration system A		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 21°C.
02	17	Smoke emission from the cables near the separating element.
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
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system B		
00	00	Fire resistance test commenced and the initial temperature of the specimen was approximately 21°C.
02	17	Smoke emission from the cables near the separating element.
14	58	Deformation appeared along the length of the pipe. Expanded intumescent was blowing from the end of the pipe.
17	00	TC 022 on the pipe recorded a temperature of 202°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.
30	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
60	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
70	15	The sealant had expanded and raise above the slab.
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
120	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system C		
00	00	Fire resistance test commenced and the initial temperature of the specimen was approximately 21°C.
00	51	Smoke emission appeared from the end of the pair coil.
02	17	Smoke emission from the cables near the separating element.
15	32	Expanded intumescent was blowing out from the end of the pipe.
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014

Time		Observation
Min	Sec	
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
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system D		
00	00	Fire resistance test commenced and the initial temperature of the specimen was approximately 22°C.
02	39	Smoke venting appeared from the end of the pipe.
03	37	Black smoke venting appeared from the end of the pipe.
03	58	Expanded intumescent was blowing out from the end of the pipe.
05	15	Deformation appeared at the base of the pipe.
06	19	The pipe had collapsed.
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
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system E		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 24°C.
00	30	Smoke emission appeared from the end of the insulation wrap.
04	37	Smoke emission appeared between the pipes and insulation.
08	20	Smoke emission appeared between the separating element and the Fire Box
15	32	Expanded intumescent was appeared from the end of the insulation wrap
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
45	24	The sealant had expanded, and the mastic fillet had lifted up.
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
85	50	TC 040 on the separating element recorded a temperature of 204°C. Failure of insulation in accordance with AS 1530.4:2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 040 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
120	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014

Time		Observation
Min	Sec	
121	00	The test stopped at the request of the sponsor.
Penetration system F		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 22°C.
08	33	Smoke emission from the mastic fillet and the end of the pipe.
11	50	The mastic fillet had been pushed up and detached from the separating element
14	01	The smoke venting from the end of the pipe had stopped
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
33	15	TC 105 on the pipe recorded a temperature of 202°C. Failure of insulation in accordance with AS 1530.4:2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 105 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
90	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
120	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system G		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 22°C.
05	15	Deformation appeared at the base of the pipe.
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
70	15	The sealant had expanded and lifted above the slab.
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
104	40	TC 108 on the separating element recorded a temperature of 202°C. Failure of insulation in accordance with AS 1530.4:2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 108 exceeded the initial temperature by more than 180°C.
120	00	The specimen had continued to maintain integrity in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system H		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 22°C.
02	39	Smoke venting appeared from the end of the pipe.
14	01	The smoke venting from the end of the pipe had stopped
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014

Time		Observation
Min	Sec	
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
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.
Penetration system I		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 22°C.
02	10	Smoke venting appeared from the end of the pipe.
14	01	The smoke venting from the end of the pipe had stopped
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
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4:2014
121	00	The test stopped at the request of the sponsor.

Appendix C Direct field of application

The text, figures and tables in this appendix have been taken from section 10 of AS 1530.4:2014.

C.1 General

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 set out in clauses 10.12.2 to 10.12.6 of AS 1530.4:2014 have been made.

C.2 Separating elements

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

- for elements manufactured from similar types of concrete or masonry, the results of the prototype test may be applied to materials of density within $\pm 15\%$ of the tested specimen. For greater variations, the opinion of a registered testing authority shall be obtained.
- 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.
- 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.
- 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.
- 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.

C.3 Metal pipes

C.3.1 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 of AS 1530.4:2014, 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 of AS 1530.4:2014.

TABLE 10.12.3.1
METAL PIPE DEEMED TO HAVE EQUIVALENT
FIRE RESISTANCE LEVELS

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

C.3.2 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 of AS 1530.4:2014.

C.3.3 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.

C.3.4 Insulated – lagged – metal pipes

Where fire test data on the insulation system is 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 10.12.3.2 of AS 1530.4:2014 are satisfied and the following procedures are followed:

- 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.
- 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.

C.3.5 Alternative pipe materials

If an element is penetrated by —

- a pipe other than brass, copper or ferrous alloys
- a pipe of cross-section other than circular
- 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 —
 - melting point of the material is equal to or greater than the tested specimen;
 - surface area to mass ratio of a cross-section of the pipe is equal to or less than the tested specimen
 - thermal conductivity is equal to or less than the tested specimen diffusivity of the material.

C.4 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 Appendix D.

C.5 Plastic pipes

C.5.1 General

In addition to the requirements of clause 10.12.2 of AS 1530.4:2014, 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 of AS 1530.4:2014.

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 plastic 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.

C.5.2 Services not perpendicular to the fire separation

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

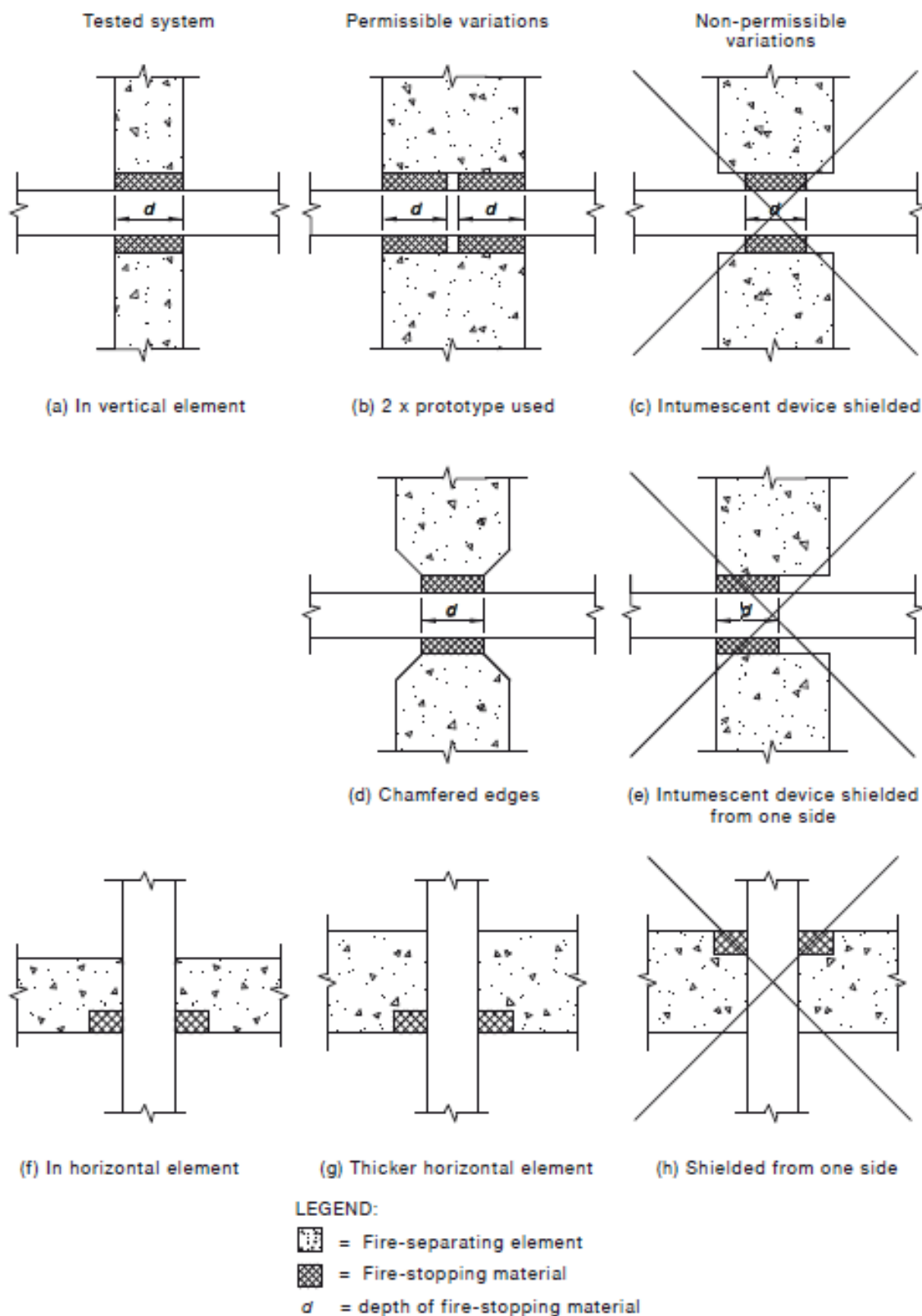


FIGURE 10.12.5.1 EQUIVALENT EXPOSURE OF UPVC PIPE FIRE-STOPPING SYSTEMS

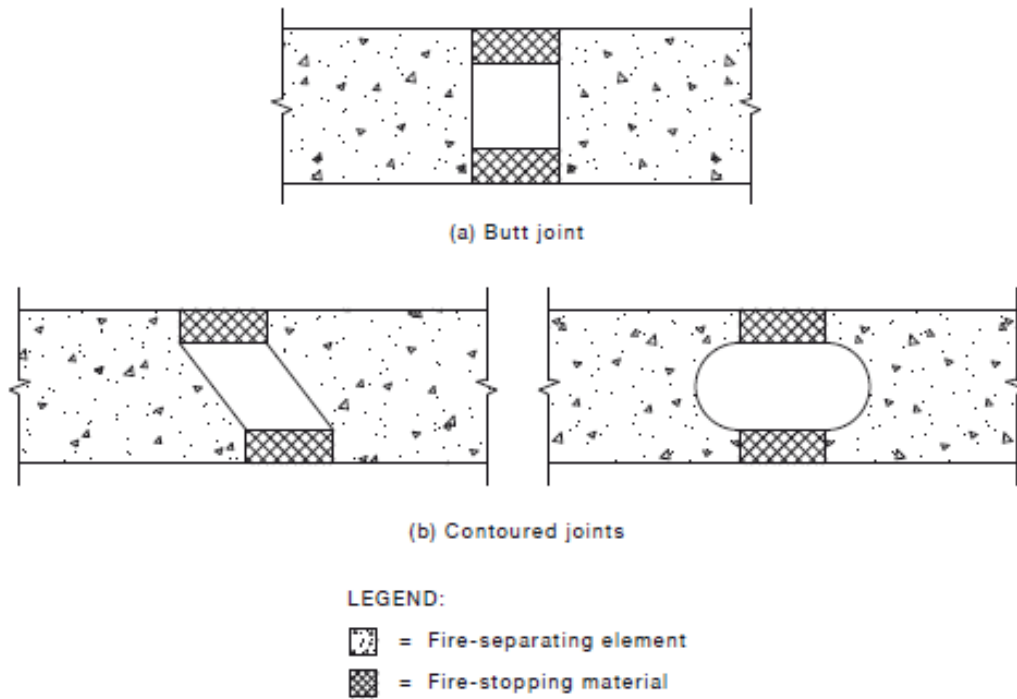


FIGURE 10.12.6 CONTOURED CONTROL JOINTS