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Regulatory information report

Various pipes, cables and paircoils services protected by BOSS Fire & Safety protection systems in a ceiling system

Test sponsor: BOSS Fire & Safety

Job number: RIR FRT180474

Test date: 17 January 2020 Revision: R1.0

Amendment schedule

Version	Date	Information about the report			
R1.0	20 February 2020	Description	Original issue		
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The data, methodologies, calculations and results documented in this report specifically relate to the tested specimen/s and must not be used for any other purpose.

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Executive summary

This report documents the findings of fire resistance test report of penetration systems undertaken on 17 January 2020 in accordance with sections 2 and 10 of AS 1530.4:2014.

The test specimen consisted of 235 mm thick ceiling system penetrated by ten varying penetration systems.

A summary of the penetration systems is provided in Table 1.

Table 1 Test summary

Penetration system	Service	Local fire-stopping protection	Aperture size (mm)	RISF Limit	Fire resistance rating (FRL)
A	• 4 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300 and BOSS FireMastic HPE	Ø44	Failure at 55 minutes	**-/90/90**
B	• 2 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300	Ø16	Failure at 36 minutes	**-/90/90**
C	• 7 × Cat 6 cables	BOSS FireMastic 300	Ø44	Failure at 60 minutes	**-/90/90**
D	• 1 × 32 mm steel sprinkler pipe	Thermal defence wrap, BOSS UniWrap and BOSS FireMastic 300	Ø51	Failure at 35 minutes	**-/90/90**
E	• 3 × Main power cable 2C+E cables	BOSS FireMastic 300	Ø51	Failure at 54 minutes	**-/90/90**
F	• 10 × TPS - 2.5mm^2 2C+E cables • 10 × Cat 6 cables • 1 × Paircoil FR • 2 × Paircoils • 1 × Copper pipe with Insulation • 1 × 25 mm uPVC conduit	BOSS Fire Transit Box BFB 150 and BOSS FireMastic 300	170 mm wide × 170 mm long	Failure at 40 minutes	**-/90/60**
G	• 1 × 25 mm uPVC conduit	BOSS FireMastic 300 and BOSS FireMastic HPE	Ø63	Failure at 55 minutes	**-/90/90**
H	• 1 × 32 mm uPVC conduit	BOSS FireMastic 300 and BOSS MaxiCollar 40 collar	Ø42	Failure at 48 minutes	**-/90/90**
I	• 1 × TPS - 2.5mm^2 2C+E cable • 1 × Cat 6 cable • 1 × Paircoil FR • 1 × 25 mm uPVC conduit	BOSS FireMastic 300, BOSS MaxiCollar 80 collar and BOSS FireMastic - HPE	Ø72	Failure at 53 minutes	**-/90/90**
J	• 2 × 25 mm uPVC conduits • 2 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300, BOSS MaxiCollar 65 collar and BOSS FireMastic - HPE	Ø51	Failure at 24 minutes	**-/90/90**

The specimen was tested against the performance criteria for the service penetrations specified in AS 1530.4:2014 section 2 and 10.

Date of test

17 January 2020

Contents

1. Introduction

This report documents the findings of fire resistance test of penetration systems undertaken on 17 January 2020 in accordance with Sections 2 and 10 of AS 1530.4:2014.

Warringtonfire Australia did the test at the request of BOSS Fire & Safety.

Table 2 Test sponsor details

Test sponsor	Address
BOSS Fire & Safety	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 Section 3.

Table 5 shows the installation method and orientation of the test specimen.

Table 3 Test assembly

Item	Detail	
Separating element	Ceiling system	
Nominal separating element size	Width (w):	1760 mm
	Height (h):	1760 mm
	Thickness (t):	235 mm
Number of penetration systems	Ten	
Restraint conditions	Not restrained at all	

Table 4 Test specimen

Penetration system	Service	Local fire-stopping protection	Aperture size (mm)
A	• 4 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300 and BOSS FireMastic HPE	Ø44
B	• 2 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300	Ø16
C	• 7 × Cat 6 cables	BOSS FireMastic 300	Ø44
D	• 1 × 32 mm steel sprinkler pipe	Thermal defence wrap, BOSS UniWrap and BOSS FireMastic 300	Ø51
E	• 3 × Main power cable 2C+E cables	BOSS FireMastic 300	Ø51
F	• 10 × TPS - 2.5mm^2 2C+E cables • 10 × Cat 6 cables • 1 × Paircoil FR • 2 × Paircoils • 1 × Copper pipe with Insulation • 1 × 25 mm uPVC conduit	BOSS Fire Transit Box BFB 150 and BOSS FireMastic 300	170 mm wide × 170 mm long

Penetration system	Service	Local fire-stopping protection	Aperture size (mm)
G	• 1 × 25 mm uPVC conduit	BOSS FireMastic 300 and BOSS FireMastic HPE	Ø63
H	• 1 × 32 mm uPVC conduit	BOSS FireMastic 300 and BOSS MaxiCollar 40 collar	Ø42
I	• 1 × TPS - 2.5mm^2 2C+E cable • 1 × Cat 6 cable • 1 × Paircoil FR • 1 × 25 mm uPVC conduit	BOSS FireMastic 300, BOSS MaxiCollar 80 collar and BOSS FireMastic - HPE	Ø72
J	• 2 × 25 mm uPVC conduits • 2 × TPS - 2.5mm^2 2C+E cables	BOSS FireMastic 300, BOSS MaxiCollar 65 collar and BOSS FireMastic - HPE	Ø51

Table 5 Installation details

Item	Detail
Start date of separating element construction	29 November 2019
Start date of penetration systems installation	13 December 2019
Completion date of test specimen construction and installation	19 December 2019
Separating element constructed by	Representatives of the test sponsor
Penetration system installed by	Representatives of the test sponsor
Orientation	Asymmetrical due to the protection was installed on the exposed side and the supports for the penetration system installed on the unexposed side. The pipes capped on the exposed side only.

3. Schedule of components

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

Table 6 Schedule of components

Item	Description		
Separating element			
1	Item name	13 mm fire-rated plasterboard	
	Product name	GIB Fyreline	
	Density	747 kg/m^3 (measured)	
2	Item name	Particleboard Flooring	
	Product name	Structaflor Yellow Tongue Particleboard Flooring	
	Thickness	19 mm (measured)	
	Density	661 kg/m^3 (measured)	
3	Item name	Timber framing	
	Product name	MGP10, 190 × 45 mm	
SE	Size	1760 mm long × 1760 mm wide × 235 mm deep	
	Specification	2 layers of 13 mm fire-rated plasterboard (item 1) was fixed directly onto the timber framing (item 3) on the exposed side using plasterboard screws (item 24) at nominal 150 mm centres on the joists and 100 mm centres on the perimeter framing. The particleboard Flooring (item 2) was fixed directly onto the timber framing (item 3) on the unexposed side using plasterboard screws (item 24) at nominal 300 mm centres on the joists and on the perimeter framing.	
Fire-stopping protections			
Sealant			
4	Product name	BOSS FireMastic - 300	
	Density	1558 kg/m^3 (measured)	
	Installation	The sealant was installed as detailed in various penetration system descriptions below.	
5	Product name	BOSS FireMastic - HPE	
	Density	1303 kg/m^3 (measured)	
	Installation	The sealant was installed as detailed in various penetration system descriptions below.	
Fire collar			
6	Item name	Fire collar 40	
	Product name	BOSS MaxiCollar 40	
	Collar shell material	Galvanised steel	
	Collar details	Outer diameter (OD)	55 mm (measured)
		Inner diameter (ID)	43 mm (measured)
		Height (h)	31 mm (measured)

Item	Description		
	Intumescent details	Number of layers	2
		Deep (d)	30 mm (measured)
		Thickness (t)	2.25 mm (measured)
		Density	1181 kg/m^3 (measured)
	Installation	The fire collar was secured on the exposed side of the plasterboard using Hollow wall anchors (item 25).	
7	Item name	Fire collar 65	
	Product name	BOSS MaxiCollar 65	
	Collar shell material	Galvanised steel	
	Collar details	Outer diameter (OD)	80 mm (measured)
		Inner diameter (ID)	65 mm (measured)
		Height (h)	31 mm (measured)
	Intumescent details	Number of layers	3
		Deep (d)	30 mm (measured)
		Thickness (t)	2.25 mm (measured)
		Density	1114 kg/m^3 (measured)
	Installation	The fire collar was secured on the exposed side of the plasterboard using Hollow wall anchors (item 25).	
8	Item name	Fire collar 80	
	Product name	BOSS MaxiCollar 80	
	Collar shell material	Galvanised steel	
	Collar details	Outer diameter (OD)	103 mm (measured)
		Inner diameter (ID)	84 mm (measured)
		Height (h)	31 mm (measured)
	Intumescent details	Number of layers	4
		Deep (d)	30 mm (measured)
		Thickness (t)	2.25 mm (measured)
		Density	1146 kg/m^3 (measured)
	Installation	The fire collar was secured on the exposed side of the plasterboard using Hollow wall anchors (item 25).	
Fire box			
9	Item name	Fire transit box	
	Product name	BOSS Fire Transit Box BFB 150	
	Size	150 mm wide × 150 mm long × 270 mm deep	
	Nylon brush detail	Height (h)	100 mm (measured)
		Outer diameter of individual brush	1.3 mm (measured)
	No. of intumescent bags in the box	8	
	Size of intumescent bags	120 mm deep × 80 mm wide × 11 mm thick (measured)	

Item	Description		
	Intumescent density	Nominal: 1354 kg/m^3 (measured)	
	Installation	The box was secured at the bottom of the ceiling cavity through 4 × L angles. The L angles were located 15 mm in from the bottom vertical edge on each side. Each angle was fixed to the box with three Button head screws (item 26) and fixed to the plasterboard with Hollow wall anchors (item 25).	
Wrap			
10	Item name	Insulation wrap 40 mm thick	
	Product name	BOSS P40-MAK Wrap	
	Overall size	300 mm wide × 40 mm thick (measured)	
	Mineral fibre wool density	40 kg/m^3 (measured)	
	Installation	The wrap was wrapped on the service F and extended to nominal 300 mm on the unexposed side. The wraps were approximately 40 mm overlapped and silver tape was used to bind the edges of the wraps. Stainless steel cable ties (item 28) were used to secure the wraps at nominal 150 mm on unexposed sides.	
11	Item name	Insulation wrap 6 mm thick	
	Product name	Thermal defence wrap	
	Overall size	105 mm wide × 6 mm thick (measured)	
	Density	1.4 kg/m^2 (measured)	
	Installation	The wrap was installed inside the ceiling cavity of the service D and secured with the steel wire.	
12	Item name	Insulation wrap 2 mm thick	
	Product name	BOSS UniWrap	
	Overall size	40 mm wide × 2 mm thick (measured)	
	Density	2.6 kg/m^2 (measured)	
	Installation	The wrap was installed inside the ceiling cavity of the service D and secured with the steel wire.	
Services			
13	Item name	TPS - 2.5mm^2 2C+E cable	
	Product name	L connect 2019 V-90 electrical cable 450/750V	
	Size	Width (w)	11.9 mm (measured)
		Height (h)	5.3 mm (measured)
14	Item name	TPS - 2.5mm^2 2C+E cable	
	Product name	Prysmian L electrical cable 450/750 V V-90	
	Size	Width (w)	12 mm (measured)
		Height (h)	5.4 mm (measured)
15	Item name	Cat 6 cable	
	Product name	N402 EZYDATA Cat 6 4 pair UTP PVC communication cable	
	Size	Outer diameter (OD)	5.5 mm (measured)

Item	Description		
16	Item name	NB 32 medium steel sprinkler pipe	
	Size	Outer diameter (OD) Inner diameter (ID) Thickness (t)	42.5 mm (measured) 36.5 mm (measured) 3 mm (measured)
17	Item name	Main power cable 2C+E cable	
	Product name	L NEXANS OLEX 2019 V-90 ELECTRICAL CABLE 450/750V	
	Size	Outer diameter (OD)	10.6 mm (measured)
18	Item name	Paircoil FR	
	Product name	KEMBLA Paircoil MAX AS1571 3/8 × 5/8	
	Size (Large pipe)	Outer diameter (OD)	15.88 mm
		Thickness (t)	1.02 mm
	Size (Large pipe lagging)	Outer diameter (OD)	48 mm (measured)
		Thickness (t)	12.3 mm (measured)
	Size (Small pipe)	Outer diameter (OD)	9.52 mm
		Thickness (t)	0.81 mm
	Size (Small pipe lagging)	Outer diameter (OD)	39.5 mm (measured)
		Thickness (t)	12.3 mm (measured)
19	Item name	Paircoil	
	Product name	Ardent 3/8 × 3/4	
	Size (Large pipe)	Outer diameter (OD)	19.05 mm
		Thickness (t)	1.14 mm
	Size (Large pipe lagging)	Outer diameter (OD)	47 mm (measured)
		Thickness (t)	13 mm (measured)
	Size (Small pipe)	Outer diameter (OD)	9.52 mm
		Thickness (t)	0.81 mm
	Size (Small pipe lagging)	Outer diameter (OD)	37 mm (measured)
		Thickness (t)	13 mm (measured)
20	Item name	DN 25 copper pipe	
	Product name	KEMBLA T79834 25.40 × 1.22 HD STR 1.5M	
	Size	Outer diameter (OD)	25.4 mm (measured)
		Thickness (t)	1.22 mm (measured)
	Product name	K-FLEX classi 09025 (1''ID × 3/8'' TK) M292819	
	Lagging size	Outer diameter (OD)	44.5 mm (measured)
		Thickness (t)	9.4 mm (measured)
21	Item name	25 mm uPVC conduit	
	Product name	DETA Electrical 25MD 10/60 AS/NZS2053	
	Size	Outer diameter (OD)	24.8 mm (measured)
		Thickness (t)	2 mm (measured)

Item	Description		
22	Item name	32 mm uPVC conduit	
	Product name	Holman PVP 3212-3 PVC -U 32 PN12	
	Size	Outer diameter (OD)	41.8 mm (measured)
		Thickness (t)	2.3 mm (measured)
Fixings			
23	Item name	Spring	
	Material	Steel	
	Size	Outer diameter (OD)	28 mm (measured)
		Thickness (t)	1.6 mm (measured)
		Deep (d)	180 mm (measured)
24	Item name	Plasterboard screws	
	Product name	GYPROCK 6g × 32 mm needle point screws	
	Installation	Used to secure the plasterboard (item 1) to the timber framing (item 3) at nominal 150 mm centres on the joists and 100 mm centres on the perimeter frame. Used to secure particleboard (item 2) to the timber framing (item 3) at nominal 300 mm centres on the joists and on the perimeter frame.	
25	Item name	Wall anchor	
	Product name	Hollow wall anchor HW13M4	
	Installation	Used to secure the fire collars and the fire transit box to the plasterboard.	
26	Item name	Button head screws	
	Product name	KOALA 8g × 12 mm button head needle point screws	
	Installation	Used to secure the L angle (item 27) to the Fire transit box (item 9)	
27	Item name	Steel L angle	
	Size	40 mm wide × 20 mm deep × 1 mm thick (measured)	
	Installation	Used to secure the Fire transit box to the plasterboard (item 9)	
28	Item name	Stainless steel cable ties	
	Size	5 mm wide × 0.5 mm thick (measured)	
	Installation	Used to secure the various services bundled together.	
Penetration system A			
A	Service	TPS - 2.5mm^2 2C+E cable (item 13)	
	Service detail	4 × TPS - 2.5mm^2 2C+E cable (item 13) were installed in the aperture and protruded nominally 500 mm on the exposed side and 570 mm on the unexposed side.	
	Service support	The service was supported on the unexposed side at nominal 500 mm with steel clamps.	
	Aperture size	Ø44 mm (measured)	
	Local fire-stopping protection		
	Protection	BOSS FireMastic HPE (item 5) was applied: • On the interface between the service and fire-rated plasterboard (item 1) to the depth of the 26mm on the exposed side and finished flush with the surface.	

Item	Description	
		BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface.
Penetration system B		
B	Service	TPS - 2.5mm^2 2C+E cable (item 14)
	Service detail	2 × TPS - 2.5mm^2 2C+E cable (item 14) were installed in the aperture and protruded nominally 500 mm on the exposed side and 570 mm on the unexposed side.
	Service support	The service was supported on the unexposed side at nominal 500 mm with stainless steel cable ties (item 28).
	Aperture size	Ø16 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface. • On the interface between the service and fire-rated plasterboard (item 1) to the depth of 26 mm on the exposed side and finished flush with the surface.
Penetration system C		
C	Service	Cat 6 cable (item 15)
	Service detail	7 × Cat 6 cables (item 15) were installed in the aperture through the spring (item 23) in the floor ceiling cavity and protruded nominally 500 mm on the exposed side and 570 mm on the unexposed side. The spring finished flush with exposed side plasterboard.
	Service support	The service was supported on the unexposed side at nominal 500 mm with steel clamps.
	Aperture size	Ø44 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface. • On the interface between the service with the spring and fire-rated plasterboard (item 1) to the depth of 26 mm on the exposed side and finished flush with the surface.
Penetration system D		
D	Service	NB 32 medium steel sprinkler pipe (item 16)
	Service detail	1 × 32 mm steel sprinkler pipe (item 16) was installed in the aperture and protruded nominally 500 mm on the exposed side and 540 mm on the unexposed side. The pipe end was capped by welding with steel plate on the exposed side.
	Service support	The service was supported on the unexposed side at nominal 500 mm with pipe clamp.
	Aperture size	Ø51 mm (measured)
	Local fire-stopping protection	

Item	Description	
	Protection	1 × layer of Thermal defence wrap (item 11) was wrapped with 50 mm overlap on top of the service and 1 × layer of BOSS UniWrap (item 12) was wrapped with 50 mm overlap on top of the Thermal defence wrap. These wraps were placed inside the separating element cavity and the wraps edges were flush with an outer layer of the exposed side plasterboard. BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the depth of the particleboard flooring on the unexposed side and finished flush with the surface. • On the exposed side between the plasterboard and the protection wrapping as a smoke seal.
Penetration system E		
E	Service	Main power cable 2C+E cable (item 17)
	Service detail	3 × Main power cable 2C+E cable (item 17) was installed in the aperture and protruded nominally 500 mm on the exposed side and 550 mm on the unexposed side.
	Service support	The service was supported on the unexposed side at nominal 500 mm with cable ties (item 28).
	Aperture size	Ø51 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS FireMastic HPE (item 5) was applied: • On the interface between the service and fire-rated plasterboard (item 1) to the depth of 26 mm on the exposed side and finished flush with the surface. BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface.
Penetration system F		
F	Service	• 10 × TPS - 2.5mm^2 2C+E cables (item 13) • 10 × Cat 6 cables (item 15) • 1 × Paircoil FR (item 18) • 2 × Paircoils (item 19) • 1 × Copper pipe with insulation (item 20) • 1 × 25 mm uPVC conduit (item 21)
	Service detail	The services were installed in the fire transit box and protruded 500 mm from the exposed and the unexposed side of the fire transit box except uPVC conduit (item 21). The 25 mm uPVC conduit (item 21) was installed in the fire transit box and protruded nominally 500 mm on the exposed side and 2000 mm on the unexposed side of the fire transit box. The Paircoil pipes exposed side ends were filled with mastic at nominal 10 mm deep and crimped. The copper pipe was capped with copper cap on the exposed side. The uPVC pipe exposed side end was filled with mastic at nominal 10 mm deep.
	Service support	The service were supported on the unexposed side at nominal 500 mm with cable ties (item 28) and uPVC conduit (item 21) was supported at nominal 500mm with the cable tie and 1500 mm with pipe clamp.
	Aperture size	170 mm wide × 170 mm long (measured)
	Local fire-stopping protection	

Item	Description	
	Protection	BOSS Fire Transit Box BFB 150 (item 9) was installed into the cavity of the separating element. BOSS FireMastic 300 (item 4) was applied: • On the interface between the plasterboard and the fire transit box on both the exposed side and the unexposed side. On the exposed side the mastic was finished with 15 mm × 25 mm fillet and finished flush with the surface on the unexposed side. BOSS P40-MAK wrap (item 10) was wrapped and extended to nominal 300 mm on the unexposed side.
Penetration system G		
G	Service	25 mm uPVC conduit (item 21)
	Service detail	1 × 25 mm uPVC conduit (item 21) was installed on the aperture and protruded nominally 500 mm on the exposed side and 2000 mm on the unexposed side. The uPVC pipe exposed side end was filled with mastic at nominal 10 mm deep.
	Service support	The service was supported on the unexposed side at nominal 500 mm and 1500 mm with pipe clamps.
	Aperture size	Ø63 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS FireMastic HPE (item 5) was applied: • On the interface between the service and fire-rated plasterboard (item 1) to the depth of 26 mm on the exposed side and finished flush with the surface. BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the depth of the particleboard flooring on the unexposed side and finished flush with the surface.
Penetration system H		
H	Service	32 mm uPVC conduit (item 22)
	Service detail	32 mm uPVC conduit (item 22) was installed on the aperture and protruded nominally 500 mm on the exposed side and 2000 mm on the unexposed side. The pipe was capped with the mineral wool and sealant to the depth of 20 mm on the exposed side.
	Service support	The service was supported on the unexposed side at nominal 500 mm and 1500 mm with pipe clamps.
	Aperture size	Ø42 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS MaxiCollar 40 collar (item 6) was installed and secured with Hollow wall anchor (item 25) on the exposed side. BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the depth of the particleboard flooring on the unexposed side and finished flush with the surface.
Penetration system I		
I	Service	• 1 × TPS - 2.5mm^2 2C+E cable (item 13) • 1 × Cat 6 cable (item 15) • 1 × Paircoil FR (item 18)

Item	Description	
		• 1 × 25 mm uPVC conduit (item 21)
	Service detail	The service protruded 500 mm from the exposed and the unexposed side. The 25 mm uPVC conduit (item 21) was protruded nominally 500 mm on the exposed side and 2000 mm on the unexposed side. The uPVC pipe exposed side end was filled with mastic at nominal 10 mm deep.
	Service support	The service was supported on the unexposed side at nominal 500 mm and 1500 mm with pipe clamps.
	Aperture size	Ø72 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS MaxiCollar 80 collar (item 8) was installed and secured with Hollow wall anchors (item 25) on the exposed side. BOSS FireMastic - HPE (item 5) was applied: • On the interface between the fire collar (item 8) and the service to the depth of the fire collar and finished flush with the fire collar. BOSS FireMastic 300 (item 4) was applied: • On the interface between the service and particleboard flooring (item 2) to the depth of particleboard flooring on the unexposed side and finished flush with the surface.
Penetration system J		
J	Service	• 2 × 25 mm uPVC conduits (item 21) • 2 × TPS - 2.5mm^2 2C+E cables (item 13)
	Service detail	2 × 25 mm uPVC conduits (item 21) protruded nominally 500 mm on the exposed side and 2000 mm on the unexposed side. Single TPS - 2.5mm^2 2C+E cable (item 13) was installed in each 25 mm uPVC conduit to 500 mm each side of the separating element. The uPVC pipes exposed side end was filled with mastic at nominal 10 mm deep.
	Service support	The service was supported on the unexposed side at nominal 500 mm and 1500 mm with pipe clamps.
	Aperture size	Ø51 mm (measured)
	Local fire-stopping protection	
	Protection	BOSS MaxiCollar 65 collar (item 7) was installed and secured with Hollow wall anchor (item 25) on the exposed side. BOSS FireMastic - HPE (item 5) was applied on the interface between the fire collar (item 7) and the service to the depth of the fire collar and finished flush with the fire collar. BOSS FireMastic 300 (item 4) was applied on the interface between the service and particleboard flooring (item 2) to the depth of the particleboard flooring on the unexposed side and finished flush with the surface.

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 Sections 2 and 10 of AS 1530.4:2014 appropriate for penetration systems	
Variations	None	
Pre-test conditioning	The construction and installation of the test specimen was completed on 18 December 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 fire resistance test report.	
Ambient laboratory temperature	Start of the test	25 °C
	Minimum temperature	25 °C
	Maximum temperature	27 °C
Test duration	91 minutes	
Instrumentation and equipment	The instrumentation was provided in accordance with AS 1530.4:2014 as follows: • The furnace temperature was measured by four mineral insulated metal sheathed (MIMS) Type K thermocouples – with wire diameters not greater than 1 mm, an overall diameter of 3 mm, and the measuring junction insulated from the sheath. The thermocouples protruded a minimum of 25 mm from steel supporting tubes. • The unexposed side specimen temperatures were measured by Type K thermocouples with wire diameters less than 0.5 mm soldered to 12 mm diameter × 0.2 mm thick copper discs covered by 30 mm × 30 mm × 2.0 mm thick inorganic insulating pads. • The resistance to incipient spread of fire (RISF) temperatures were measured by Type K thermocouples with wire diameters less than 0.5 mm soldered to 12 mm diameter × 0.2 mm thick copper discs covered by 30 mm × 30 mm × 2.0 mm thick inorganic insulating pads. • A roving thermocouple was available to measure temperatures at positions that appeared hotter than the positions monitored by the fixed thermocouples • Cotton pads were available during the test to assess the performance of the specimen under the criteria for integrity. • The furnace pressure was measured at approximately 100 mm below the ceiling	

5. Test measurements and results

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

Table 9 in Appendix A 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 Test results

Penetration system	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 55 minutes	
B	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 36 minutes	
C	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 60 minutes	
D	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 35 minutes	
E	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 54 minutes	
F	Structural adequacy	Not applicable	-/90/60
	Integrity	No failure at 91 minutes	
	Insulation	Failure at 75 minutes	
	RISF	Failure at 40 minutes	
G	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 55 minutes	
H	Structural adequacy	Not applicable	-/90/90
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 48 minutes	

Penetration system	Criteria	Results	Fire resistance level (FRL)
I	Structural adequacy	Not applicable	**-/90/90**
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 53 minutes	
J	Structural adequacy	Not applicable	**-/90/90**
	Integrity	No failure at 91 minutes	
	Insulation	No failure at 91 minutes	
	RISF	Failure at 24 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 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 B – 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

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.

7. Conclusions

Ten various penetration services comprise of pipes, cables and paircoils protected by BOSS Fire & safety protection system protruded from a 235 mm thick ceiling system has been subjected to a fire resistance test in accordance with AS 1530.4:2014 section 2 and 10.

The test specimen satisfied the performance requirements specified in AS 1530.4:2014 for the periods below.

- Penetration system A

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 55 minutes
- Penetration system B

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 36 minutes
- Penetration system C

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 60 minutes
- Penetration system D

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 35 minutes
- Penetration system E

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 54 minutes
- Penetration system F

  FRL (Fire Resistance Level): -/90/60

  RISF Failure at 40 minutes
- Penetration system G

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 55 minutes
- Penetration system H

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 48 minutes
- Penetration system I

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 53 minutes
- Penetration system J

  FRL (Fire Resistance Level): -/90/90

  RISF Failure at 24 minutes

Appendix A 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 started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
55	**00**	**TC 001 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 001 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
62	20	Cables had discoloured near the separating element.
62	20	Smoke emitting from the aperture.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system B		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
36	**05**	**TC 014 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 014 exceeded 250°C.**
45	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system C		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.

Time		Observation
Min	Sec	
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
60	**00**	**TC 022 on the service, 25 mm from the aperture recorded a temperature of 251°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 022 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
64	30	Cables had discoloured near the separating element.
64	30	Smoke emitting from the aperture.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system D		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
35	**15**	**TC 035 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 035 exceeded 250°C.**
45	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system E		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
54	**25**	**TC 041 on the service, 25 mm from the aperture recorded a temperature of 251°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 041 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.

Time		Observation
Min	Sec	
Penetration system F		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
03	50	Smoke emitting from the interface between the wrap and service.
04	40	Smoke emitting from the end of the pipe.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
16	10	Smoke emitting had decreased from the pipe.
29	30	Smoke emitting from the pipe had stopped.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
40	**55**	**TC 052 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 052 exceeded 250°C.**
45	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
75	**55**	**TC 162, on service, 25 mm from the wrap on the TPS cable, recorded a temperature of 204°C.** **Failure of insulation in accordance with Clause 2.13.3(b) of AS 1530.4:2014, where the maximum temperature of thermocouple TC 162 exceeded the initial temperature by more than 180 K.**
90	00	Specimen continued to maintain integrity in accordance with AS 1530.4:2014.
91	00	Test stopped
Penetration system G		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
04	40	Smoke emitting from the end of the pipe.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
16	10	Smoke emitting had decreased from the end of the pipe.
18	30	Smoke emitting from the end of the pipe had stopped.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
55	**50**	**TC 062 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 062 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.

Time		Observation
Min	Sec	
Penetration system H		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
43	00	Smoke emitting from the end of the pipe.
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
48	**05**	**TC 071 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 071 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system I		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
04	15	Smoke emitting from the end of the pipe.
06	25	Intumescent had blown out from the end of the pipe.
10	50	Smoke emitting from the pipe had stopped.
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
17	50	Lagging on the paircoil had started to expand.
30	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
45	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
53	**30**	**TC 082 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 082 exceeded 250°C.**
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.
Penetration system J		
00	00	Fire resistance test started. The initial temperature of the test specimen was approximately 25°C.
04	15	Smoke emitting from the pipe.
07	10	Smoke emitting from the pipe had stopped.

Time		Observation
Min	Sec	
15	00	The test specimen continued to maintain integrity, insulation and RISF temperature in accordance with AS 1530.4:2014.
24	**00**	**TC 095 on the service, 25 mm from the aperture recorded a temperature of 250°C.** **Failure of RISF temperature in accordance with AS 1530.4:2014 clause 4.9.2, where the maximum temperature of Thermocouple TC 095 exceeded 250°C.**
30	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
45	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
60	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
90	00	Specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
91	00	Test stopped.

Appendix B Direct field of application

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

B.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.

B.2 Separating elements

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

- 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.

B.3 Metal pipes

B.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 mm	Actual OD (outside diameter) mm	Actual wall thickness 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

B.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.

B.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.

B.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.

B.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.

B.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.

B.5 Plastic pipes

B.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.

B.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.

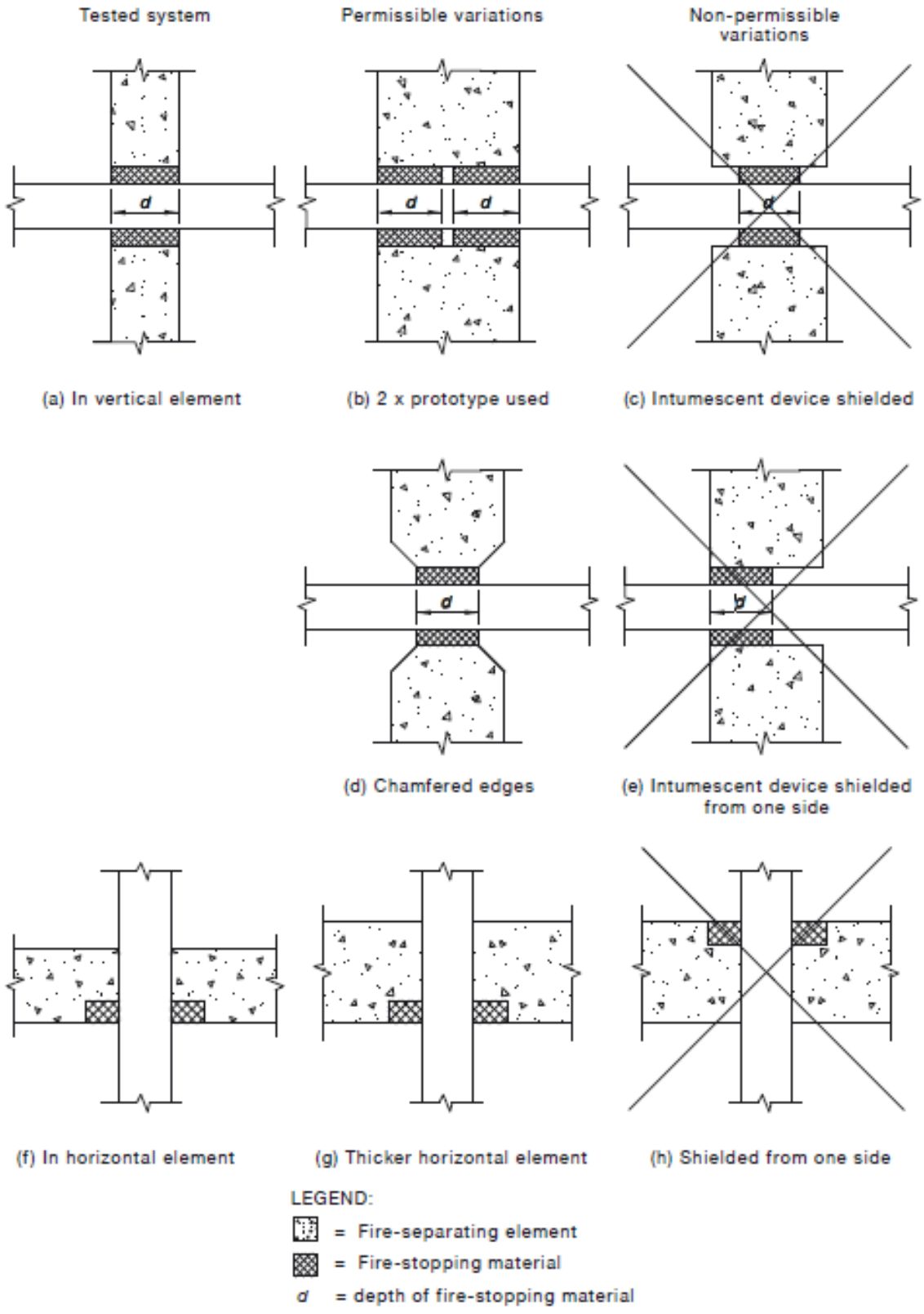

FIGURE 10.12.5.1 EQUIVALENT EXPOSURE OF UPVC PIPE FIRE-STOPPING SYSTEMS