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Fire assessment report

Service penetrations through Boss FireMortar-360

Sponsor: Boss Products Australia Pty Ltd

Report number: FAS220105 Revision: R1.1

Issued date: 13 October 2022 Expiry date: 31 August 2027

Quality management

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<tr><td rowspan="3">R1.0</td><td rowspan="3">Issue:
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Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various services penetrating Boss FireMortar-360 installed in floor and wall separating elements in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

The penetration services assessed are electrical busbars, mechanical dampers, steel pipes, combustible pipes, electric cables, and cable carriers.

The primary sealing system, BOSS FireMortar-360 is a fire-resistant Gypsum based mortar material used to reinstate the fire resistance performance of floor and wall constructions.

The analysis in sections 5 to 6 of this report found that the proposed systems, together with the described variations, are expected to achieve the fire resistance level (FRL) as shown in Table 1 to Table 7 in accordance with AS 1530.4:2014.

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 7 of this report. The results of this report are valid until 31 August 2027.

Table 1 Assessment outcome for electrical busbars penetrating floors

Specimen	Dimensions (mm)	Separating element	Fire stopping system	FRL	Reference test report
Zucchini LB Plus electrical busbar	45 mm× 35 mm	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 400 mm long × 40 mm thick BOSS P40 MAK-Wrap on the unexposed face of the floor	-/180/30	WF 398296
Zucchini MS electrical busbar	92 mm × 40 mm				

Table 2 Assessment outcome for fire dampers penetrating floors

Specimen	Maximum dimensions (mm)	Separating element	Fire stopping system	FRL	Reference test report
Curtain blade fire damper	479 mm long × 452 mm wide	Minimum 200 mm thick concrete slab	105 mm thick Boss FireMortar-360	-/240/30	WARRES No. 65526

Table 3 Assessment outcome for steel pipes penetrating floors

Specimen	Maximum pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
Steel pipes	75	3.2	Minimum 150 mm thick aerated concrete or solid concrete slab	50 mm thick Boss FireMortar-360 and BOSS P40 MAK-Wrap for a length of 600 mm on the unexposed face	-/240/120	TE 911613

Table 4 Assessment outcome for plastic pipes protected with Boss UniWrap penetrating floors

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PP	50	2.0 – 6.9	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 2 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689
PP	200	4.9 – 18.2	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep	-/120/120 U/C	WF 361932 and WF 367689

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
				BOSS FireMastic-300™ on the exposed face		
PVC	50	2.4 – 3.7	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 2 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689
PVC	200	7.7 – 9.6	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar	-/90/90 U/C	WF 367689
PVC	200	9.6	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689

Table 5 Assessment outcome for plastic pipes protected with Boss MaxiCollar penetrating floors

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PE	110	4.2	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 110 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PE	110	2.7	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 110 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PE	125	3.1	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 125 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PE	160	9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 160 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PVC	50	1.8	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 50 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350177 and WF 367689
PVC	110	4.2 – 7.3	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 110 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PVC	125	6.0	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 125 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PVC	160	9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 160 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PVC	160	6.2 – 9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 50 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350177 and WF 367689

Table 6 Assessment outcome for cables and cable carriers penetrating floors

Specimen	Separating element	Fire stopping system	FRL	Reference test report
250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 400 mm long × 40 mm thick BOSS P40 MAK-Wrap on the unexposed face of the floor	-/120/120	WF 367689
450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray			-/120/120	

Specimen	Separating element	Fire stopping system	FRL	Reference test report
350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder			-/90/90	
450 mm wide × 25 mm high × 1.0 mm thick unperforated steel cable tray			-/90/90	
1 × 3-core 185 mm^2 and earth PVC or XLPE insulated, PVC sheathed cable			-/120/90	
3 × 3-core 6 mm^2 and earth PVC insulated, PVC sheathed cables			-/120/120	
8× 3-core 1.6 mm^2 plus earth PVC insulated, PVC sheathed cables			-/120/120	

Table 7 Assessment outcome for plastic pipes penetrating walls

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
HDPE	125	3.1	Minimum 100 mm thick drywall with two layers of 12.5 mm thick Gypsum plasterboard on each side or minimum 100 mm thick rigid walls	4 layers of 2 mm thick Boss UniWrap fitted around the service at each face and Boss FireMortar-360 applied into the annular gap around the services at each face	-/120/120 U/C	WF 427180-BR
PVC	125	4.8				
PVC	125	7.4				
PP	50	3.1				

Contents

1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various services penetrating Boss FireMortar-360 installed in floor and wall separating elements in accordance with AS 1530.4:2014[1] and assessed in accordance with AS 4072.1:2005[2].

This report may be used as evidence of suitability in accordance with the requirements of the relevant National Construction Code (NCC) to support the use of the material, product, form of construction or design as given within the scope of this assessment report. It also references test evidence for meeting deemed to satisfy (DTS) provisions of the NCC as applicable to the assessed systems.

This assessment was carried out at the request of Boss Products Australia Pty Ltd.

The sponsor details are included in Table 8.

Table 8 Sponsor details

Sponsor	Address
Boss Products (Australia) Pty Ltd	Unit 1 16 Atkins Road Taren Point NSW 2229 Australia

2. Framework for the assessment

2.1 Assessment approach

An assessment is an opinion about the expected performance of a component or element of structure if it was subject to a fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2021[3].

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

This assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance properties if the elements were to be tested in accordance with AS 1530.4:2014.

[1] Standards Australia, 2014, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2014, Standards Australia, NSW.
[2] Standards Australia, 2005, Components for the protection of openings in fire-resistant separating elements: Service penetrations and control joints, AS 4072.1:2005, Standards Australia, NSW.
[3] Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

This assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the Evidence of Suitability requirements of the NCC 2019, including amendments[4] under A5.2 (1) (d).

This assessment has been written in accordance with the general principles outlined in EN 15725:2010[5] for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provision of the NCC under A5.4 for fire resistance levels as applicable to the assessed systems.

This assessment report may also be used to demonstrate compliance with the requirements for Evidence of Suitability under NCC 2016, including amendments[6].

2.3 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 19 April 2022, Boss Products Australia Pty Ltd confirmed that:

- To their knowledge, the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

3. Limitations of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results that are expected if the systems were tested in accordance with AS 1530.4:2014.
- This assessment is applicable to floor systems exposed to fire from below in accordance with the requirements of AS 1530.4:2014 where horizontal elements must be exposed to heat from the underside only.
- This assessment is applicable to wall systems exposed to fire from either side in accordance with the requirements of AS 1530.4:2014 where vertical elements must be exposed to heat from the direction required to resist fire exposure.
- This report is only valid for the assessed system/s and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an

[4] National Construction Code Volumes One and Two - Building Code of Australia 2019 including Amendments, Australian Building Codes Board, Australia
[5] European Committee for Standardization, 2010, Extended application reports on the fire performance of construction products and building elements, EN 15725:2010, European Committee for Standardization, Brussels, Belgium.
[6] National Construction Code Volumes One and Two - Building Code of Australia 2016 including Amendments, Australian Building Codes Board, Australia

Accredited Testing Laboratory (ATL) that is accredited to the same nominated standards of this report.

- The documentation that forms the basis for this report is listed in Appendix A and Appendix B.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

4. Description of the specimen and variations

4.1 System description

The services considered in this assessment include combustible pipes, steel pipes, electric cables, cable trays and mechanical dampers (including sleeve).

The primary sealing system, BOSS FireMortar-360 is a fire-resistant Gypsum based mortar material used to reinstate the fire resistance performance of floor and wall constructions.

Secondary sealing systems that have been assessed with BOSS FireMortar-360 are:

- BOSS P40 MAK-Wrap is an insulation wrap for protecting metallic services penetrating various separating elements.
- BOSS MaxiCollar is a pipe closure device used to form penetration seals where combustible pipes, cables and metal pipes with insulation penetrate walls and floors. Unless where specified, BOSS Maxi Collars must be installed on both the exposed and unexposed faces of vertical separating elements and on the underside of horizontal separating elements. Exceptions are specified as applicable.
- BOSS UniWrap (nominally 40 mm width × 2 mm thick with a density of 1.3 kg/m^3) has an intumescent composition and is developed to provide a high-volume expansion and pressure seal at the aperture during a fire. BOSS UniWrap must be wrapped around the pipe flush with the surface of the separating element on both the exposed and unexposed sides in walls and mid-depth in floors.
- BOSS Pipe Wraps are intumescent composition based elastomeric thermoplastic polymers designed to provide high volume expansion and pressure sealing around PVC pipes and insulated metal pipes.
- The sealant, BOSS FireMastic-300, is also used as a local fire protection system.

4.2 Referenced test data

The assessment of the variations to the tested systems and the determination of the expected performance is based on the results of the fire tests documented in the reports summarised in Table 9. Further details of the tested systems are included in Appendix B.

Table 9 Referenced test data

Report number	Test sponsor	Test date	Testing authority
427180-BR	FSi Limited	21 August 2020	Warringtonfire, UK
398296 Issue 2	FSi Limited	30 October 2018	Warringtonfire, UK
WF 367689	FSi Limited	27 July 2016	Exova Warringtonfire
WF 361932	FSi Limited	11 March 2016	Exova Warringtonfire
WF 350704	FSi Limited	31 March 2015	Exova Warringtonfire
WF 350177	FSi Limited	11 March 2015	Exova Warringtonfire
TE 91163	CAFCO Europe Sarl	26 August 1998	LPC Laboratories

Report number	Test sponsor	Test date	Testing authority
WARRES No. 65526	BTR Silvertown	25 August 1995	Warringtonfire Fire Research Centre

4.3 Variations to the tested systems

We have assessed the systems using baseline test information for similar systems. The variations to the tested systems – together with the referenced standard fire tests – are described in Table 10.

Table 10 Variations to tested systems

Reference test	Description	Variations
WARRES No. 65526, TE 91163, WF 367689, 398296 Issue 2 and 427180-BR	Various penetration services are protected with BOSS FireMortar-360 and other secondary sealing systems tested in accordance with BS EN 1366-3:2009[7], BS 476.20:1987[8] and AS 1530.4:2014.	It is proposed to assess: • The systems tested in accordance with BS EN 1366-3:2009 and BS 476.20:1987 to AS 1530.4:2014 • All tested penetrations to determine their expected FRL • Applicability of the services in solid concrete slabs of at least the same thickness as tested, provided the solid concrete slab achieves the required FRL
WF 350704, WF 350177, WF 361932	Various combustible pipe penetrations protected with local fire protection systems penetrating a 150 mm thick aerated concrete floor.	It is proposed to assess the fire resistance performance of the combustible pipes penetrating Boss FireMortar-360 in accordance with AS 1530.4:2014.

4.4 Assessment standard

AS 1530.4:2014 sets out the procedure for conducting fire resistance tests on building materials, components and structures. Section 2 of this standard contains general requirements for these tests. Section 10 addresses the fire resistance of service penetrations.

AS 4072.1:2005 sets out minimum requirements for the construction, installation, and application of fire resistance tests to sealing systems.

4.5 Schedule of components

Table 11 outlines the schedule of components for the assessed systems.

Table 11 Schedule of components of assessed systems

Item	Description	
Separating element (SE)		
1.	Item name	Aerated concrete or solid concrete slab
	Thickness	Minimum 100 mm
2.	Item name	Solid concrete slab
	Thickness	Minimum 200 mm
3.	Item name	Plasterboard wall
	Material	Gypsum plasterboard
	Thickness	Minimum 100 mm (2 layers of 12.5 mm thick plasterboard at both faces of the framework)

[7] European Committee for Standardization, 2009, Fire resistance tests for service installations. Penetration seals, BS EN 1366-3:2009, European Committee for Standardization, Brussels, Belgium.
[8] British Standards, 1987, Fire tests on building materials and structures – Part 20: Method for determination of the fire resistance of elements of construction (general principles), BS 472.20:1987, British Standards Institution, London, UK.

Item	Description	
Shuttering		
4.	Item name	Boss Batt
	Thickness	Single layer, 50 mm thick
	Material	Rock fibre insulation with ablative coating to both faces
	Density	140 kg/m^3
Fire Damper		
5.	Item name	Damper case
	Material	Stainless steel
	Dimensions	Maximum 479 mm long × 452 mm wide × 155 mm high
6.	Item name	Duct
	Material	Galvanized mild steel
	Size	482 mm long × 455 mm wide × 500 mm high
Services		
7.	Item name	Zucchini LB Plus electrical busbar
	Dimensions	45 mm× 35 mm
8.	Item name	Zucchini MS electrical busbar
	Dimensions	92 mm × 40 mm
9.	Item name	PP, PVC, PE or HDPE pipes
10.	Item name	250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder
11.	Item name	350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder
12.	Item name	450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray
13.	Item name	450 mm wide × 25 mm high × 1.0 mm thick unperforated steel cable tray
Fire stopping protections		
14.	Item name	Boss FireMortar-360
	Material	Gypsum based mortar
15.	Item name	BOSS P40 MAK-Wrap
	Material	Rock fibre insulation
	Thickness	40 mm
16.	Item name	BOSS UniWrap™
	Material	Intumescent pipe wrap
	Thickness	2 mm
17.	Item name	Boss MaxiCollar
	Material	Steel pipe collar with internal intumescent
Sealant		
18.	Item name	BOSS FireMastic-300™
	Nominal density	1560 kg/m^3

Figure 1 to Figure 6 show the assessed systems.

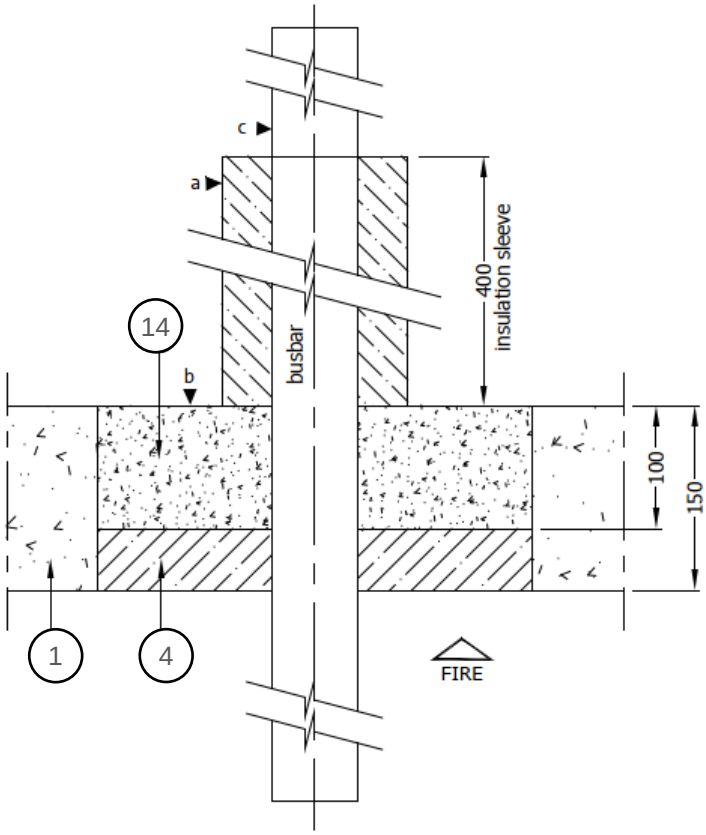

Figure 1 Electrical busbars penetrating BOSS FireMortar-360 in floors

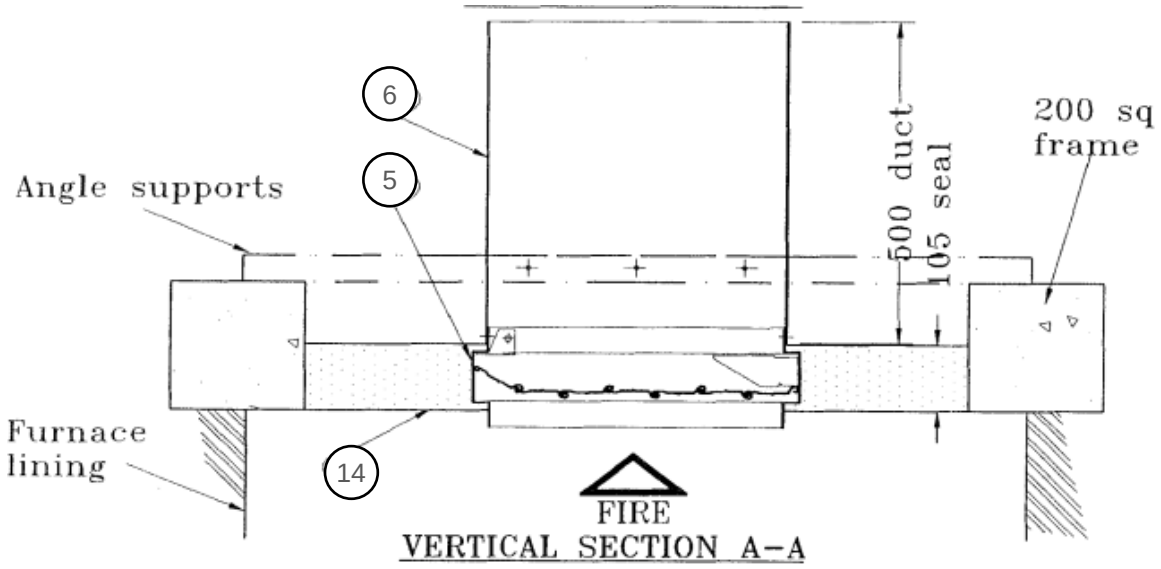

Figure 2 **Fire dampers penetrating BOSS FireMortar-360 in floors**

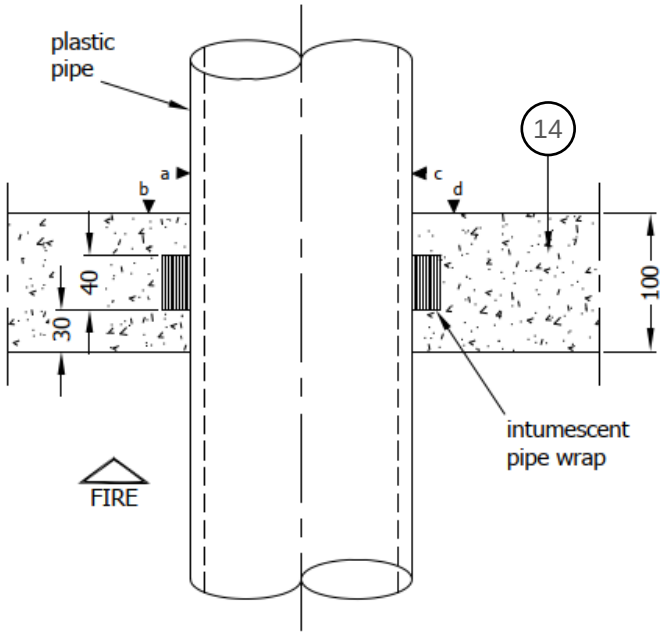

Figure 3 **Combustible pipes protected with Boss UniWrap penetrating BOSS FireMortar-360 in floors**

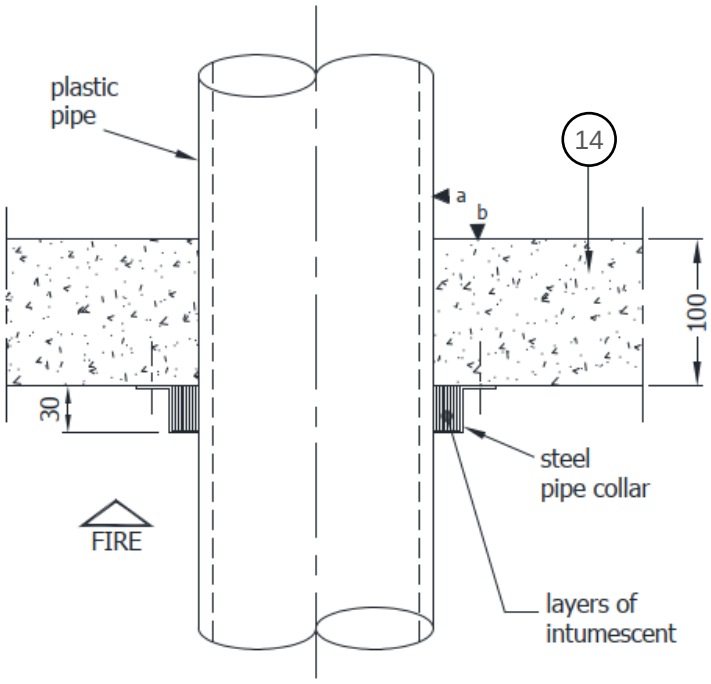

Figure 4 **Combustible pipes protected with Boss MaxiCollar penetrating BOSS FireMortar-360 in floors**

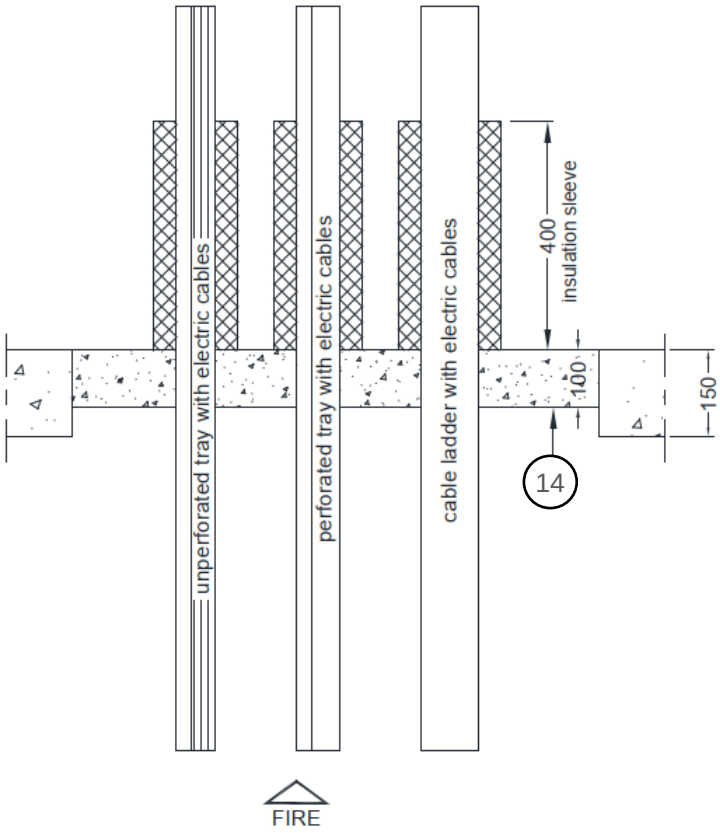

Figure 5 **Cables and cable carriers protected with Boss UniWrap penetrating BOSS FireMortar-360**

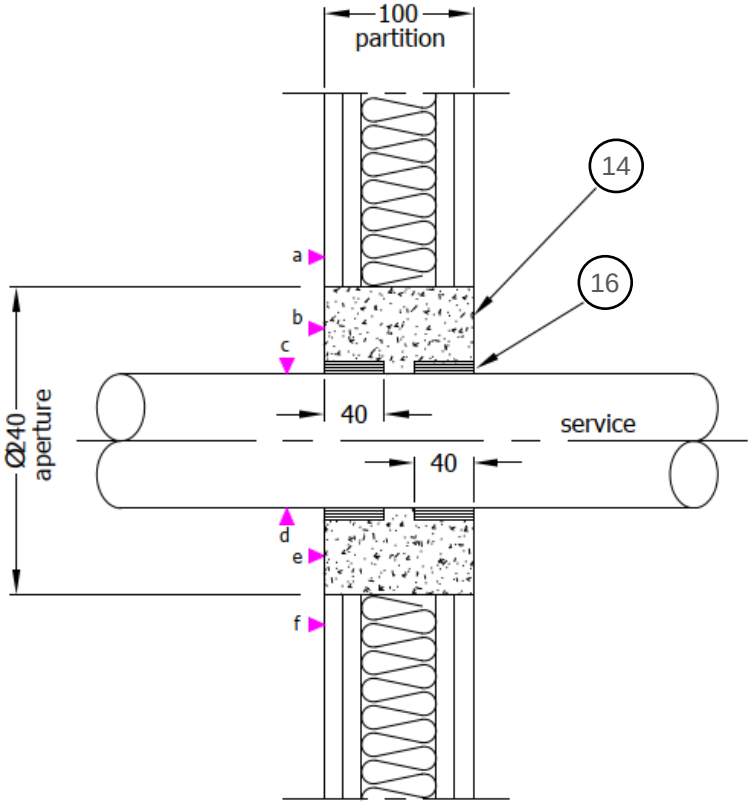

Figure 6 **Combustible pipes protected with Boss UniWrap penetrating Boss FireMortar-360 in walls**

5. Relevance of BS 476:20:1987 and EN 1366-3:2009 with respect to AS 1530.4:2014

5.1 Description of variation

The tested systems included a series of services penetrating Boss FireMortar-360 mortar installed in floor and wall separating elements. The tests were conducted in accordance with BS 476:20:1987, EN 1366-3:1998 and EN 1366-3:2009. It has been proposed to assess the expected fire resistance performance of the services in accordance with AS 1530.4:2014.

5.2 Methodology

The method of assessment used is summarised in Table 12.

Table 12 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative and comparative

5.3 Relevance of BS 476:20:1987 with respect to AS 1530.4:2014

The referenced tests TE 91163, WARRES No. 65526 and WARRES No. 60183 were performed in accordance with BS 476:20:1987, which differs from AS 1530.4:2014. The effect these differences have on the fire resistance performance of test specimens is discussed below.

5.3.1 Furnace conditions

Furnace temperature regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4:2014 follows a similar trend to BS 476.20:1987.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and BS 476.20:1987 are not appreciably different.

Furnace thermocouples

The furnace thermocouples specified in AS 1530.4:2014 are Type K, mineral insulated metal sheathed (MIMS), with a stainless-steel sheath having a wire diameter of less than 1.0 mm and an overall diameter of 3 mm. The measuring junction protrudes at least 25 mm from the supporting heat resistant tube.

The furnace thermocouple types in BS 476.20:1987 shall be one of the following two types:

- Bare nickel chromium/nickel aluminium wires – 0.75 mm to 1.5 mm in diameter – welded or crimped together at their ends and supported and insulated from each other in a twin bore porcelain insulator. However, for 25 mm approximately from the weld/crimp, the wires shall be exposed and separated from each other by at least 5 mm (to be replaced or recalibrated after six hours of usage).
- Nickel chromium/nickel aluminium wire contained within mineral insulation in a heat resisting steel sheath of diameter 1.5 mm; the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall project 25 mm from a porcelain insulator. The assembly shall have a response time on cooling in air not greater than 30 seconds.

The relative distance of the furnace thermocouples from the exposed face of the specimen – for both AS 1530.4:2014 and BS 476.20:1987 – is 100 mm + 10 mm.

Furnace pressure

It is a requirement of AS 1530.4:2014 that for horizontal elements a furnace pressure of 20 Pa is established at 100 mm below the underside of the concrete slab.

For BS 476.20:1987 – for horizontal elements – the pressure is 20 Pa at a point 100 mm below the soffit of the floor assembly.

5.3.2 Performance criteria

AS 1530.4:2014 specifies the following performance criteria for building materials and structures:

- structural adequacy (not relevant to the referenced test).
- integrity.
- insulation.

Integrity

The integrity criteria differ slightly between AS 1530.4:2014 and BS 476.20:1987.

For uninsulated specimens – or for specimens that have exceeded their insulation criteria performance – the specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 if it sustains flaming for 10 seconds, if a gap forms that allows the penetration of a 25 mm diameter gap gauge anywhere on the specimen, or if a gap forms that allows a 6 mm × 150 mm gap gauge to penetrate the specimen anywhere on the specimen.

The integrity criteria for BS 476.20:1987 are similar except that the 150 mm by 6 mm gap criterion is not applied at the threshold of doorsets, which is not applicable to this assessment.

Insulation

The thermocouple locations for measuring insulation in AS 1530.4:2014 and BS 476.20:1987 are different. AS 1530.4:2014 specifically nominates positions for the maximum temperature rise of the thermocouple, though this allows the application of a roving thermocouple anywhere on the specimen. In BS 476.20:1987, there is a requirement to measure temperatures at a specified minimum number of locations, with additional thermocouples fitted at the discretion of the laboratory. Similarly, a roving thermocouple can be applied at any location.

The failure criteria for insulation in AS 1530.4:2014 and BS 476.20:1987 are not appreciably different except for the positioning of thermocouples as noted above.

5.3.3 Applicability of test data in accordance with AS 1530.4:2014

The variations in furnace heating regimes, furnace thermocouples, and the responses of the different thermocouple types to the furnace conditions are not expected to have an overall significant effect on the outcome of the referenced fire resistance test.

Based on the above and in the absence of any foreseeable detrimental effects, it is considered that the results of the referenced test can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

5.4 Relevance of EN 1366-3:2009 with respect to AS 1530.4:2014

The fire resistance test 119060B is performed in accordance with EN 1366-3:1998, whereas tests 398296 Issue 2, 427180-BR and WF 367689 are performed in accordance with EN 1366-3:2009. These standards differ from AS 1530.4:2014 and the significance of these differences is discussed below.

5.4.1 Furnace conditions

Furnace temperature regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4:2014 follows the same trend as EN 1363-1.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and EN 1363-1 are not appreciably different.

Furnace thermocouples

The furnace thermocouples specified in AS 1530.4:2014 are type K, mineral insulated metal sheathed (MIMS), with a stainless-steel sheath having a wire diameter of less than 1.0 mm and an overall diameter of 3 mm. The measuring junction protrudes at least 25 mm from the supporting heat resistant tube.

The furnace thermocouple specified in EN 1363-1 is made from a folded steel plate that faces the furnace chamber. A thermocouple is fixed to the side of the plate facing the specimen, with the thermocouple hot junction protected by a pad of insulating material.

The plate part is to be constructed from 150 ±1 mm long by 100 ±1 mm wide by 0.7 ±0.1 mm thick nickel alloy sheet strips.

The measuring junction is to consist of nickel chromium/nickel aluminium (Type K) wire as defined in IEC 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter of 1 mm, with the hot junctions electrically insulated from the sheath.

The thermocouple hot junction is to be fixed to the geometric centre of the plate by a small steel strip made from the same material as the plate. The steel strip can be welded to the plate – or may be screwed to it – to facilitate replacement of the thermocouple. The strip should be approximately 18 mm by 6 mm if it is spot-welded to the plate, and nominally 25 mm by 6 mm if it is to be screwed to the plate. The screw is to be 2 mm in diameter.

The assembly of plate and thermocouple should be fitted with a pad of inorganic insulation material 97 ±1mm by 97 ±1 mm by 10 ±1 mm thick with a density of 280 ±30 kg/m^3.

The relative locations of the furnace thermocouples for the exposed face of the specimen – for AS 1530.4:2014 and EN 1363-1 – are 100 mm + 10 mm and 100 mm + 50 mm, respectively.

The furnace control thermocouples required by EN 1363-1 are less responsive than those specified by AS 1530.4:2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to EN 1363-1, particularly when the furnace temperature is changing quickly in the early stages of the test.

Furnace pressure

It is a requirement of AS 1530.4:2014 and EN 1363-1 that for vertical elements, a furnace gauge pressure of 0 Pa is established at a height of 500 mm above the notional floor level.

For wall penetrations, AS 1530.4:2014 requires that – if the separating element has a height greater than 1 m – it shall be tested with a pressure of 20 $\pm$ 3 Pa at the top of the separating element and that the horizontal penetrating services shall be included in the zone where positive pressure exceeds 10 Pa.

EN 1366-3:2009 specifies that a minimum pressure of 20 Pa shall be maintained at the top of the uppermost penetration seal in a vertical supporting construction and that services shall only be included in the zone where the positive pressure exceeds 10 Pa.

Therefore, both standards require that a minimum pressure of 10 Pa be maintained at the lowest point of the lowest service.

It is a requirement of both AS 1530.4:2014 and EN 1363-1:2012 that for horizontal elements, a furnace gauge pressure of 20 Pa is established at a height of 100 mm below the floor soffit level.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and EN 1363-1:2012 are also not appreciably different.

5.4.2 Specimen thermocouples

For penetration sealing systems, thermocouples are fixed in generally similar locations on the unexposed face in both EN 1363-1 and AS 1530.4:2014. These locations are on the supporting construction, the sealing system, the penetrating service adjacent to the plane of penetration, and on the penetrating service some distance from the plane of penetration.

5.4.3 Performance criteria

The performance criteria discussed – as pertaining to the current assessment – are integrity and insulation.

Integrity

In accordance with AS 1530.4:2014, while a specimen maintains its insulation performance, the specimen shall be deemed to have failed the integrity criterion if it collapses or sustains flaming on the unexposed face, which can ignite a cotton pad when applied for up to 30 seconds.

A specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 when any of the following occurs:

- Sustained flaming for 10 seconds.
- A gap forms that allows the passage of hot gases to the unexposed face and ignites the cotton pad when applied for up to 30 seconds.
- A gap forms that allows the penetration of a 25 mm gap gauge anywhere on the specimen.
- A gap forms that allows a 6 mm × 150 mm gap gauge to penetrate the specimen anywhere on the specimen.

Except for minor variations, the integrity criteria in EN 1363-1:1999 are generally applied in a comparable manner.

Insulation

The general insulation criteria of AS 1530.4:2014 and EN 1363-1:2012 are not appreciably different.

5.4.4 Specimen configuration

AS 1530.4:2014 specifies that the service(s) shall be installed so that it projects a minimum 500 mm on each side of the supporting construction, of which at least 200 mm shall extend beyond the extremities of the penetration sealing system. The penetration sealing system shall include any coating, wrapping or other protection to the services. The length of unprotected service on the unexposed face shall not be greater than 500 mm. For plastic pipes, the external projection away from the furnace shall be increased to a minimum of 2000 mm. The measurements shall not include any part of the plug or cap used to seal a pipe within the furnace. With respect to the pipe end configurations, AS 1530.4:2014 stipulates that service end conditions shall be representative of those intended to be used in practice.

EN 1366-3:2009 requires that the pipes extend on the fire side and non-fire side by a minimum of 500 mm, of which at least 150 mm shall extend beyond the extremities of the penetration seal. In the case of plastic pipes, the length of the pipe on the unexposed side may be extended to allow for the collection of the effluent gases.

When pipes are to be tested, the pipe end configurations are chosen depending on the nature of the pipe material and the required field of application.

5.4.5 Applicability of test data in accordance with AS 1530.4:2014

The variations in furnace heating regimes, furnace thermocouples and the responses of the different thermocouple types to the furnace conditions are not expected to have a significant effect on the outcome of the referenced fire resistance test.

The following field of application is applicable based on the tested pipe and configurations as given in Table 13 for combustible pipes and in Table 14 for metal pipes in accordance with BS EN 1366-3:2021[9].

[9] European Committee for Standardization, 2021, Fire resistance tests for service installations. Penetration seals, BS EN 1366-3:2021, European Committee for Standardization, Brussels, Belgium.

Table 13 Field of application for pipe end configurations for combustible pipes

		Tested			
		U/U	C/U	U/C	C/C
Covered	U/U	Y	N	N	N
	C/U	Y	Y	N	N
	U/C	Y	Y	Y	N
	C/C	Y	Y	Y	Y
Y=acceptable, N=not acceptable					

Table 14 Field of application for pipe end configurations for metal pipes

		Tested			
		U/U	C/U	U/C	C/C
Covered	U/U	Y	N	N	N
	C/U	Y	Y	Y	N
	U/C	Y	N	Y	N
	C/C	Y	Y	Y	Y
Y=acceptable, N=not acceptable					

Based on the review of the test data and the allowable field of application stipulated in the EN standard, the services tested with an open/open (U/U) end fire configuration are considered to be the worst-case scenario as the hot gases will have a clear path to the unexposed side. As a result, the thermocouple placed on the service will likely record the highest temperature when compared to other pipe end configurations. Therefore, FRL achieved in the U/U configuration can be extended to services tested in any of the pipe end configurations.

With respect to the services tested in an open/closed configuration or a closed/closed configuration, it is considered that both configurations are not in line with the general requirements of AS 1530.4:2014. However, AS 1530.4:2014 stipulates that “service end conditions shall be representative of those intended to be used in practice”. Therefore, it is reasonable to extend the FRL achieved in both configurations, provided that they are representative of the system used in practice.

With respect to the difference in the length of pipe projection from the wall separating element, it is considered that this difference will not likely introduce any detrimental effects to the wall system as the plastic pipe is expected to melt and closed off with the collar. Once the fire collar is activated, this difference can be negligible.

In the case of a floor system, it is argued that having a 2000 mm projection out of the floor slab at the unexposed side may have a detrimental effect due to stack effect. However, it is also argued that a 500 mm projection as stipulated in the EN standard presents a more onerous case as more hot gases are expected to pass from the exposed to the unexposed side at a faster rate, hence increasing the temperature recorded by the thermocouple placed on the service before the activation and closure of the fire collar. In conclusion, a considerable amount of research and test history has shown that the extension of the pipe from the unexposed side will not likely have an impact on the performance of the plastic pipes, hence it can be positively assessed.

6. Assessment of variations to the systems

6.1 Description of variation

The proposed system shall be as tested in the referenced test reports and subject to the following variations.

- Assess all tested penetrations to determine their expected FRL
- Applicability of the services in solid concrete slabs of at least the same thickness as tested, provided the solid concrete slab achieves the required FRL
- Use of Boss FireMortar-360 as a fire barrier to protect plastic pipes in conjunction with other local fire protection systems.

6.2 Methodology

The method of assessment used is summarised in Table 15.

Table 15 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative and comparative

6.3 Assessment

6.3.1 Electric busbars penetrating floors

In test report WF 398296, 45 mm × 35 mm Zucchini LB Plus and 92 mm × 40 mm Zucchini MS electrical busbars penetrated a 150 mm thick aerated concrete slab. The opening of the slab was protected with a 100 mm thick gypsum-based mortar identical to Boss FireMortar-360 and a 50 mm thick stone wool insulation shuttering identical to Boss batt. The 400 mm long × 40 mm thick rock fibre insulation – identical to BOSS P40 MAK-Wrap – was fitted around each busbar at the unexposed face of the mortar fire barrier and the sleeve was held in position using steel wire ties. Both Zucchini LB Plus and Zucchini MS busbars maintained their integrity performance for the entire test duration of 198 minutes; however, the insulation failure occurred on the busbar at 41 and 35 minutes, respectively.

On the basis of the discussion in section 5.4.5, it is expected that Zucchini LB Plus and Zucchini MS busbars penetrating a 150 mm thick aerated concrete slab is expected achieve an FRL of -/180/30 in accordance with AS 1530.4:2014.

It is considered that the above FRL can be applied to solid concrete slabs of at least the same thickness as the slab in test WF 398296, provided the solid concrete slab achieves the required FRL.

6.3.2 Dampers penetrating floors

In test report WARRES No. 65526, the fire resistance performance of a 479 mm long × 452 mm wide stainless steel curtain blade fire damper installed in a 200 mm thick concrete slab was tested in accordance with BS 476: Part 20:1987. The damper with the duct was fixed to mild steel angles which were fixed on the floor. The aperture in the concrete floor, around the damper was sealed with a 105 mm thick layer of gypsum-based cement mortar identical to Boss FireMortar-360. When tested, the damper maintained integrity performance for the entire test duration of 240 minutes but failed the insulation criteria after 39 minutes.

It is proposed to determine the FRL of the fire damper when it is installed as an air transfer grille in accordance with section 10 of AS 1530.4:2014. On the basis of the discussion in section 5.3.3, it is expected that a stainless steel curtain blade fire damper (up to 479 mm long × 452 mm) is expected to achieve an FRL of -/240/30 when installed as an air transfer grille in minimum 200 mm thick concrete slabs in accordance with section 10 of AS 1530.4:2014.

6.3.3 Steel pipes penetrating floors

In test report TE 911613, a steel pipe with a diameter of 75 mm and a wall thickness of 3.2 mm penetrating a 150 mm thick aerated concrete slab was tested in accordance with BS 476: Part 20:1987. The opening of the slab was sealed with a 50 mm thick gypsum-based cement mortar identical to Boss FireMortar-360. The steel pipe maintained integrity performance for the entire test duration of 240 minutes but failed the insulation criteria after 23 minutes. In the proposed construction, the P40 MAK-Wrap is to be wrapped around the pipe, flush with the unexposed face, and extended up to a length of 600 mm from the separating element on the unexposed face. The additional length of insulation is expected to provide a longer distance for the heat to conduct down the pipe before emanating at the uninsulated end. It is therefore expected that 75 mm steel pipe penetrating a 150 mm thick aerated concrete slab – protected by P40 MAK-Wrap for a length of 600 mm on the exposed side –will achieve an FRL of -/240/120 in accordance with AS 1530.4:2014.

It is proposed to determine the FRL of steel pipes with a maximum diameter of 75 mm penetrating Boss FireMortar-360. The vulnerability of a steel pipe with a diameter less than 75 mm to integrity and insulation failure is lower compared to that of a 75 mm diameter pipe. It is therefore expected that steel pipes with a maximum diameter of 75 mm penetrating a 150 mm thick aerated concrete slab – protected by P40 MAK-Wrap for a length of 600 mm on the exposed side – will achieve an FRL of -/240/120 in accordance with AS 1530.4:2014.

It is considered that the above FRL can be applied to solid concrete slabs of at least the same thickness as the slab in test WF 398296, provided the solid concrete slab achieves the required FRL.

6.3.4 Combustible pipes penetrating floors

WF 367689 consisted of various plastic pipes installed in a 150 mm thick aerated concrete slab where the aperture was sealed with 100 mm thick gypsum-based mortar identical to Boss FireMortar-360. The aperture was shuttered off and the mortar compound was poured in around the service penetrations flush with the unexposed face of the floor. The fire resistance was performed in accordance with EN 1366-3:2009.

The specimens C and D were 200 mm PVC pipes with a thickness of 7.7 mm and 9.6 mm, protected with 10 layers of 2 mm thick intumescent pipe wrap identical to Boss UniWrap fitted centrally to the mortar. The two pipes failed integrity criteria after 114 minutes due to sustained flaming at both the specimen and point of penetration. It is therefore expected that a 200 mm diameter and minimum 7.7 mm thick PVC pipe protected with 10 layers 2 mm thick of Boss UniWrap penetrating a 150 mm thick concrete slab is expected to achieve an FRL of -/90/90 in accordance with AS 1530.4:2014.

The specimens E and F were 160 mm in diameter and 9.5 mm thick PVC and PE pipes, protected with a collar to Boss MaxiCollar fitted around the pipe on the exposed face of the mortar barrier. The specimen E failed integrity criteria after 153 minutes due to sustained flaming at both the specimen and point of penetration. The specimen F maintained integrity performance for the entire 159 minutes of the test but failed insulation after 156 minutes. It is therefore expected that a 160 mm diameter and 9.5 mm thick PVC or PE pipe protected with Boss MaxiCollar penetrating a 150 mm thick concrete slab is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

The specimen G was a 110 mm diameter and 4.2 mm thick PE pipe protected with a collar identical to the Boss MaxiCollar fitted around the pipe on the exposed face of the mortar barrier. The PE pipe maintained integrity and insulation for the entire 159 minutes of the test. It is therefore expected that a 110 mm diameter and 4.2 mm thick PE pipe protected with Boss MaxiCollar penetrating a 150 mm thick concrete slab is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

In test reports WF 350704 and WF 350177, the test specimen consisted of a 150 mm thick aerated concrete floor construction. The floor was penetrated by a range of PVC and PE pipes protected by a collar identical to the Boss MaxiCollar fitted to the underside of the concrete floor assembly. Each specimen was positioned within an aperture which was cut to give a nominal 10 mm annular gap. The annular gap was filled to a depth of 5 mm with fire resistant sealant identical to BOSS FireMastic-300™ – to both sides of the floor assembly. All services maintained integrity and insulation performance for the entire 240 minutes of the test. The plastic pipes were plugged (or capped) on the unexposed side, which is not consistent with the stipulations for pipe end configurations in AS 1530.4:2014. Therefore, the applicability of the assessment made with this test data will be for uncapped/capped pipe end configurations.

It is proposed to assess the fire resistance performance of these plastic pipes penetrating Boss FireMortar-360. In the reference test WF 367689, the PVC and PE pipes were protected by a collar identical to the Boss MaxiCollar. During the test, as the plastic pipes melted, the MaxiCollar was able to close off the resulting gap and maintain integrity for at least 120 minutes. This proves that the integrity performance at the interface between the pipe and FireMortar-360 can be maintained for 120 minutes without failure. It is therefore expected that PVC and PE pipes protected with Boss MaxiCollar penetrating 150 mm thick aerated concrete floors is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014 – provided that the annular space is filled with a fire-rated sealant such as FireMastic-300™. The Boss MaxiCollar must be fitted to the underside of the floor assembly. It is considered that the above FRL can be applied to solid concrete slabs of at least the same thickness as the slab in test WF 398296, provided the solid concrete slab achieves the required FRL.

In test report WF 361932, the test specimen consisted of a 150 mm thick aerated concrete floor construction. The floor was penetrated by a range of PVC and PP pipes protected by 2 mm thick pipe wrap identical to Boss UniWrap. Each 50 mm pipe was fitted with two pipe wraps, and each 200 mm pipe was fitted with ten layers. The pipe wrap was self adhered to the service and fitted to mid depth of the aperture. Each annular gap was sealed with a single bead of 10 mm deep fire resistant sealant identical to BOSS FireMastic-300™ – to the unexposed face of the floor assembly. All the services maintained integrity and insulation performance for at least 120 minutes, except specimen L, which is not considered in this assessment. The plastic pipes were plugged (or capped) on the unexposed side, which is not consistent with the stipulations for pipe end configurations in AS 1530.4:2014. Therefore, the applicability of the assessment made with this test data will be for uncapped/capped pipe end configurations.

It is proposed to assess the fire resistance performance of these plastic pipes penetrating Boss FireMortar-360. In the reference test WF 367689, the PVC and PP pipes were protected by a pipe wrap identical to Boss UniWrap. During the test, as the plastic pipes melted, the UniWrap was able to close off the resulting gap and maintain integrity for at least 120 minutes. This proves that the integrity performance at the interface between the pipe and FireMortar-360 can be maintained for 120 minutes without failure. It is therefore expected that PVC and PP pipes protected with 2 mm thick Boss UniWrap penetrating a 150 mm thick aerated concrete floor are expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014 – provided that the annular space is filled with 10 mm deep FireMastic-300™ on the unexposed face. The 50 mm and 200 mm pipes must be wrapped with 2 layers and 10 layers, respectively, of 2 mm thick Boss UniWrap.

It is considered that the above FRL can be applied to solid concrete slabs of at least the same thickness as the slab in test WF 398296, provided the solid concrete slab achieves the required FRL.

6.3.5 Cables and cable carriers penetrating floors

The referenced test WF 367689 has been conducted using the standard cable configurations specified in BS EN 1366-3:2009. These include PVC and XLPE insulated and PVC sheathed cables with copper conductors and telecommunication cable bundles with PE sheathing and insulation installed in a 150 mm thick concrete slab where the aperture was sealed with 100 mm thick gypsum-based mortar identical to Boss FireMortar-360. The aperture was shuttered off and the mortar compound was poured in around the service penetrations flush with the unexposed face of the floor. All the services were wrapped on the unexposed side with a single layer of 400 mm wide × 40 mm thick Rockwool rock fibre insulation, which is identical to BOSS P40 MAK-Wrap.

It is proposed to determine the FRLs of cables penetrating Boss FireMortar-360 in accordance with AS 1530.4:2014. As D1 and D2 cable configurations have not been tested in accordance with AS 1530.4, the applicability of these configurations in accordance with Appendix D cannot be assessed. However, each cable type and size in the D1 and D2 configurations can be compared to the tested cables as per Annex A of EN 1366-3 and assessed individually for corresponding FRLs. One of the main factors that affect the fire performance in cables is the conductor area as it affects the amount of heat that is conducted from fire side to non-fire side, leading to an insulation failure on the non-fire side. Therefore, the total conductor area of the cables is identified as a critical factor.

D1 group cable in EN 1366-3 is a PVC sheathed and PVC insulated 1 × 4-core 185 mm^2 cable with a total conductor area of 740 mm^2 per cable. This can be considered more onerous compared to 1 × 3-core 185 mm^2 and earth PVC or XLPE insulated, PVC sheathed cable with a total conductor area of 555 mm^2. When tested, the D1 cable achieved integrity and insulation performance of 159 and 103

minutes, respectively. Therefore, it is expected that 1 × 3-core 185 mm^2 and earth PVC or XLPE insulated, PVC sheathed cable in D1 group of AS 1530.4:2014 wrapped with a single layer of 400 mm high × 40 mm thick BOSS P40 MAK-Wrap penetrating a 150 mm thick concrete slab is expected to achieve an FRL of -/120/90 in accordance with AS 1530.4:2014.

The B cables in EN 1366-3 are PVC sheathed and PVC insulated 2 × 1-core 95 mm^2 cables with a total conductor area of 95 mm^2 per cable. This can be considered more onerous compared to 3 × 3-core 6 mm^2 and earth PVC insulated, PVC sheathed cables with a total conductor area of 18 mm^2 and 8 × 3-core 1.6 mm^2 plus earth PVC insulated, PVC sheathed cables with a total conductor area of 4.8 mm^2. When tested, the D1 cable achieved integrity and insulation performance of 135 minutes. Therefore, it is expected that up to 3 × 3-core 6 mm^2 and earth PVC insulated, PVC sheathed cables or up to 8× 3-core 1.6 mm^2 plus earth PVC insulated, PVC sheathed cables in D1 group of AS 1530.4:2014 wrapped with a single layer of 400 mm high × 40 mm thick BOSS P40 MAK-Wrap penetrating a 150 mm thick concrete slab is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

Based on the above, it is identified that cables in AS 1530.4:2014 Appendix D1 configuration have been positively assessed except the single-core 630 mm^2 PVC or XLPE insulated, PVC sheathed cable.

In WF 367689, the fire resistance performance of steel cable ladders, perforated and unperforated steel cable trays penetrating a 150 mm thick concrete slab was tested in accordance with BS EN 1366-3:2009. The aperture was sealed with 100 mm thick gypsum-based mortar identical to Boss FireMortar-360. The aperture was shuttered off and the mortar compound was poured in around the service penetrations flush with the unexposed face of the floor. All the services were wrapped on the unexposed side with a single layer of 400 mm wide × 40 mm thick Rockwool rock fibre insulation, which is identical to BOSS P40 MAK-Wrap. The 20 mm diameter steel cross bars were welded to the arms of the support frame on the unexposed face of the barrier to support the cable ladders and cable trays. The 350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder and 450 mm wide × 25 mm high × 1.0 mm thick unperforated steel cable tray maintained the integrity and insulation performance for over 90 minutes. The 450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray did not fail integrity and insulation criteria for 135 minutes. The 250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder maintained its integrity and insulation performance for the entire 159 minutes of the test.

It is proposed to determine the FRLs of cable carriers penetrating Boss FireMortar-360 in accordance with AS 1530.4:2014. It is expected that a 350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder and 450 mm wide × 25 mm high × 1.0 mm thick unperforated steel cable tray is expected to achieve an FRL of -/90/90 in accordance with AS 1530.4:2014. Furthermore, it is expected that a 450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray and a 250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014. It should be noted that all the cable carriers must be wrapped on the unexposed side with a single layer of 400 mm wide × 40 mm thick BOSS P40 MAK-Wrap.

It is considered that above FRL can be applied to solid concrete slabs of at least the same thickness as the slab in test WF 398296 provided the solid concrete slab achieves the required FRL.

6.3.6 Combustible pipes penetrating walls

The WF 427180-BR consisted of various plastic pipes installed in a 100 mm thick drywall with two layers on 12.5 mm thick Gypsum plasterboard on each side, into which a mortar compound identical to Boss FireMortar-360 was applied into the annular gap around the services on each face. The fire resistance test was performed in accordance with EN 1366-3:2009.

The specimen 12 was a 125 mm in diameter and 3.1 mm thick HDPE pipe protected with 4 layers of 2 mm thick pipe wrap identical to Boss UniWrap fitted around the service at each face. The HDPE pipe maintained integrity and insulation for the entire 132 minutes of the test. It is therefore expected that a 125 mm diameter and 3.1 mm thick HDPE pipe protected with 4 layers of 2 mm thick Boss UniWrap penetrating a 100 mm thick drywall with two layers of 12.5 mm thick Gypsum plasterboard on each side is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

The specimens 13 and 14 were 125 mm in diameter PVC pipes with a thickness of 4.8 mm and 7.4 mm, respectively, protected with 4 layers of 2 mm thick pipe wrap identical to Boss UniWrap fitted

around the service at each face. The two pipes maintained integrity and insulation for the entire 132 minutes of the test. It is therefore expected that a 125 mm diameter and minimum 4.8 mm thick HDPE pipe protected with 4 layers of 2 mm thick Boss UniWrap penetrating a 100 mm thick drywall with two layers of 12.5 mm thick Gypsum plasterboard on each side is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

The specimens 19A and 19C were 125 mm in diameter and 3.1 mm thick HDPE and 50 mm diameter and 2 mm thick PP pipe, respectively, protected with 4 layers of 2 mm thick pipe wrap identical to Boss UniWrap fitted around the service at each face. The services maintained integrity and insulation for the entire 132 minutes of the test. It is therefore expected that 125 mm in diameter and 3.1 mm thick HDPE pipe or 50 mm in diameter and 2 mm thick PP pipe protected with 4 layers of 2 mm thick Boss UniWrap penetrating a 100 mm thick drywall with two layers of 12.5 mm thick Gypsum plasterboard on each side is expected to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014.

Furthermore, as a part of the direct field of applicability, the above FRLs can be applied to minimum 100 mm thick rigid walls provided that the rigid walls achieve a minimum FRL of -/120/120.

6.4 Conclusion

This assessment demonstrates that the proposed systems penetrating Boss FireMortar-360 are expected to achieve the fire resistance levels given in Table 16 to Table 22 in accordance with AS 1530.4:2014.

Table 16 Assessment outcome for electrical busbars penetrating floors

Specimen	Dimensions (mm)	Separating element	Fire stopping system	FRL	Reference test report
Zucchini LB Plus electrical busbar	45 mm× 35 mm	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 400 mm long × 40 mm thick BOSS P40 MAK-Wrap on the unexposed face of the floor	-/180/30	WF 398296
Zucchini MS electrical busbar	92 mm × 40 mm				

Table 17 Assessment outcome for fire dampers penetrating floors

Specimen	Maximum dimensions (mm)	Separating element	Fire stopping system	FRL	Reference test report
Curtain blade fire damper	479 mm long × 452 mm wide	Minimum 200 mm thick concrete slab	105 mm thick Boss FireMortar-360	-/240/30	WARRES No. 65526

Table 18 Assessment outcome for steel pipes penetrating floors

Specimen	Maximum pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
Steel pipes	75	3.2	Minimum 150 mm thick aerated concrete or solid concrete slab	50 mm thick Boss FireMortar-360 and BOSS P40 MAK-Wrap for a length of 600 mm on the unexposed face	-/240/120	TE 911613

Table 19 Assessment outcome for plastic pipes protected with Boss UniWrap penetrating floors

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PP	50	2.0 – 6.9	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 2 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689
PP	200	4.9 – 18.2	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS	-/120/120 U/C	WF 361932 and WF 367689

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
				FireMastic-300™ on the exposed face		
PVC	50	2.4 – 3.7	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 2 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689
PVC	200	7.7 – 9.6	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar	-/90/90 U/C	WF 367689
PVC	200	9.6	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 10 layers of 2 mm thick Boss UniWrap fitted centrally to the mortar and 10 mm deep BOSS FireMastic-300™ on the exposed face	-/120/120 U/C	WF 361932 and WF 367689

Table 20 Assessment outcome for plastic pipes protected with Boss MaxiCollar penetrating floors

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PE	110	4.2	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 110 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PE	110	2.7	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 110 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PE	125	3.1	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 125 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
PE	160	9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 160 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PVC	50	1.8	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 50 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350177 and WF 367689
PVC	110	4.2 – 7.3	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 110 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PVC	125	6.0	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 125 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350704 and WF 367689
PVC	160	9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 160 mm Boss MaxiCollar fitted on the exposed face	-/120/120 U/C	WF 367689
PVC	160	6.2 – 9.5	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360, 50 mm Boss MaxiCollar fitted on the exposed face and 5 mm deep BOSS FireMastic-300™ on both sides	-/120/120 U/C	WF 350177 and WF 367689

Table 21 Assessment outcome for cables and cable carriers penetrating floors

Specimen	Separating element	Fire stopping system	FRL	Reference test report
250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder	Minimum 150 mm thick aerated concrete or solid concrete slab	100 mm thick Boss FireMortar-360 and 400 mm long × 40 mm thick BOSS P40 MAK-Wrap on the unexposed face of the floor	-/120/120	WF 367689
450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray			-/120/120	

Specimen	Separating element	Fire stopping system	FRL	Reference test report
350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder			-/90/90	
450 mm wide × 25 mm high × 1.0 mm thick unperforated steel cable tray			-/90/90	
1 × 3-core 185 mm^2 and earth PVC or XLPE insulated, PVC sheathed cable			-/120/90	
3 × 3-core 6 mm^2 and earth PVC insulated, PVC sheathed cables			-/120/120	
8× 3-core 1.6 mm^2 plus earth PVC insulated, PVC sheathed cables			-/120/120	

Table 22 Assessment outcome for plastic pipes penetrating walls

Specimen	Pipe diameter (mm)	Pipe thickness (mm)	Separating element	Fire stopping system	FRL	Reference test report
HDPE	125	3.1	Minimum 100 mm thick drywall with two layers of 12.5 mm thick Gypsum plasterboard on each side or minimum 100 mm thick rigid walls	4 layers of 2 mm thick Boss UniWrap fitted around the service at each face and Boss FireMortar-360 applied into the annular gap around the services at each face	-/120/120 U/C	WF 427180-BR
PVC	125	4.8				
PVC	125	7.4				
PP	50	3.1				

7. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire resistance, but it should be recognised that a single test method will not provide a full assessment of fire resistance under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment is based on test data, information and experience available at the time of preparation. If contradictory evidence becomes available to the assessing authority, the assessment will be unconditionally withdrawn and the report sponsor will be notified in writing. Similarly, the assessment should be re-evaluated, if the assessed construction is subsequently tested since actual test data is deemed to take precedence.

The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on, or before, the stated expiry date.

This assessment represents our opinion about the performance of the proposed systems expected to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

This assessment is provided to Boss Products Australia Pty Ltd for their own specific purposes. This report may be used as Evidence of Suitability in accordance with the requirements of the relevant National Construction Code. Building certifiers and other third parties must determine the suitability of the systems described in this report for a specific installation.

Appendix A Drawings and additional information

Table 23 Details of figures

Figure No	Source
Figure 1	Extracted from WF 398296
Figure 2	Extracted from WARRES No. 65526
Figure 3 to Figure 5	Extracted from WF 367689
Figure 6	Extracted from WF 427180-BR

Appendix B Summary of supporting test data

B.1 Test report – WARRES No. 65526

Table 24 Information about test report

Item	Information about test report
Report sponsor	BTR Silvertown
Test laboratory	Warringtonfire Fire Research Centre, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.
Test date	The fire resistance test was done on 25 August 1995.
Test standards	The test was done in accordance with BS 476:20:1987.
Variation to test standards	None
General description of tested specimen	The test construction consisted of a 200 mm thick concrete floor containing an aperture which was penetrated by a fire damper. The penetration consisted of a stainless-steel curtain blade fire damper referenced as 'Ozonair Fire/Shield' containing a duct section above the floor. The damper with the duct was fixed to mild steel angles, which were fixed to the floor. The damper case was 1.22 mm thick and penetrated through an aperture of size 452 mm × 479 mm. A 105 mm thick gypsum based mortar seal referenced 'Silverseal Mortar' was cast in-situ into the aperture.
Instrumentation	The test report states that the instrumentation was in accordance with BS 476:20:1987.

The test specimen achieved the following results – see Table 25.

Table 25 Results summary for this test report

Specimen	Integrity	Insulation
479 mm long × 452 mm wide stainless steel fire damper	240 minutes	39 minutes

B.2 Test report – TE 91163

Table 26 Information about test report

Item	Information about test report
Report sponsor	CAFCO Europe Sarl
Test laboratory	LPC Laboratories, Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ, UK.
Test date	The fire resistance test was done 26 August 1998.
Test standards	The test was done in accordance with BS 476:20:1987.
Variation to test standards	None
General description of tested specimen	The main separating element is a 150 mm thick aerated concrete floor slab sealed with a 600 mm × 1100 mm aperture sealed with 50 mm thick Cafco MD1 mortar.
Instrumentation	The test report states that the instrumentation was in accordance with BS 476:20:1987.

The test specimen achieved the following results – see Table 27.

Table 27 Results summary for this test report

Specimen	Integrity	Insulation
75 mm diameter 3.2 mm thick steel pipe	240 minutes	23 minutes

B.3 Test report – WF 367689

Table 28 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 27 July 2016.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The supporting construction had an overall dimension of 2230 mm long × 1740 mm wide × 150 mm thick, and it was provided with a single aperture measuring 1400 mm long × 700 mm wide. The aperture was sealed with a 100 mm thick mortar fire barrier referenced 'SilverSeal HS Compound'. The aperture was shuttered off and the mortar compound was poured in around the service penetrations flush with the unexposed face of the floor.
Instrumentation	The test report states that the instrumentation was in accordance with BS 476:20:1987.

The test specimen achieved the following results – see Table 29.

Table 29 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
350 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder	All services were wrapped with a single layer of 400 mm wide × 40 mm thick Rockwool rock fibre insulation, referenced RWA45 with a measured density of 47.5 kg/m^3.	159*	159*	159*	105
D1 cable		159*	159*	159*	103
2 × E cables		159*	159*	159*	89
D2 cable		159*	159*	159*	159*
250 mm wide × 125 mm deep × 1.5 mm thick steel cable ladder		159*	159*	159*	159*
D3 cable		159*	159*	159*	114
450 mm wide × 25 mm high × 1.0 mm thick perforated steel cable tray		135##	135##	135##	135##
10 × A1 cables		135##	135##	135##	125
10 × A2 cables		135##	135##	135##	126
10 × A3 cables		135##	135##	135##	135
B cable		135##	135##	135##	135
C1 cable		135##	135##	135##	126
C2 cable		135##	135##	135##	135
C3 cable		135##	135##	135##	135
450 mm wide × 25 mm high × 1.0 mm thick steel cable tray		104#	104#	104#	104#
G1 cable		104#	104#	104#	104#

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
G2 cable		104#	104#	104#	104#
3 × 17 mm diameter 3.6 mm thick “H” steel conduits		104#	104#	104#	104#
3 × 16 mm diameter 1.0 mm thick “I” PVC conduits		104#	104#	104#	104#
Bundle of F telecommunication cables		104#	104#	104#	104#
200 mm diameter 4.9 mm thick PP pipe	10 × 2 mm thick layers of PipeBloc EL fitted centrally within the mortar compound.	21##	21	21	19
200 mm diameter 7.7 mm thick PVC pipe		114##	114	114	114
200 mm diameter 9.6 mm thick PVC pipe		114##	114	114	114
160 mm diameter 9.5 mm thick PVC pipe	Pipe collars referenced ‘PipeBloc PCP’ were fitted around the pipes on the exposed face of the mortar barrier.	153##	153	153##	153
160 mm diameter 9.5 mm thick PE pipe		159*	159*	159*	156
110 mm diameter 4.2 mm thick PE pipe		159*	159*	159*	159*

*The test duration. The test was discontinued after a period of 159 minutes.
#This position of Specimen A was extinguished to allow the test to continue
##Specimen blanked off to allow the test to continue.

B.4 Test report – 398296 Issue 2

Table 30 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Warringtonfire UK, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 30 October 2018.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The floor construction had overall dimensions 1720 mm wide × 2215 mm long × 150 mm thick. Th e floor was constructed out of aerated concrete slabs. The aperture was sealed with a 100 mm thick mortar fire barrier referenced 'SilverSeal HS Compound' with 50 mm of 140 kg/m^3 stone wool insulation shuttering.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009.

The test specimen achieved the following results – see Table 31.

Table 31 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
Zucchini LB Plus busbar	400 mm rock fibre insulation was wrapped around the unexposed face of the busbar from the point of penetration.	198*	198*	198*	41
Zucchini MS busbar		198*	198*	198*	35
*The test duration. The test was discontinued after a period of 198 minutes.					

B.5 Test report – 427180-BR

Table 32 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Warringtonfire UK, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 21 August 2020.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The drywall construction was of overall dimensions of 3000 mm wide × 3000 mm high × 100 mm thick. The framing comprised 50 mm wide galvanized steel studs, at maximum 600 mm centres, friction fitted into 52 mm wide galvanized steel C-section head and base track. Each side of the stud frame was faced with two layers of 12.5 mm thick Gypsum Type F plasterboard.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009.

The test specimen achieved the following results – see Table 33.

Table 33 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
125 mm diameter 3.1 mm thick HDPE pipe	4 layers, each 2 mm thick × 40 mm wide PipeBloc EL fit around the service at each face, SilverSeal HS Compound' trowel applied into the annular gap around the service at each face.	132*	132*	132*	132*
125 mm diameter 4.8 mm thick PVC pipe		132*	132*	132*	132*
125 mm diameter 7.4 mm thick PVC pipe		132*	132*	132*	132*
125 mm diameter 3.1 mm thick HDPE pipe, 125 mm diameter 7.4 mm thick PVC pipe, 50 mm diameter 2 mm thick PP pipe	4 layers, each 2 mm thick × 40 mm wide PipeBloc EL fit around the service at each face, SilverSeal HS Compound' trowel applied into the annular gap around the service at each face.	132*	132*	132*	132*
*The test duration. The test was discontinued after a period of 132 minutes.					

B.6 Test report – WF 350704

Table 34 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 31 March 2015.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The section of floor had overall dimensions of 2230 mm long × 1740 mm wide × 150 mm thick and was provided with nine circular apertures, each penetrated by a range of plastic pipes which were plugged on the unexposed side. Each specimen was protected with a single pipe collar referenced 'PipeBloc PCP', fitted to the underside of the concrete floor assembly. Each specimen was positioned with an aperture which was cut to give a nominal 10 mm annular gap. The annular gap was filled to a depth of 5 mm with 'Pyrocoustic sealant' to both sides of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009.

The test specimen achieved the following results – see Table 35.

Table 35 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
110 mm diameter 7.3 mm thick PVC pipe	The penetration was provided with a single 110 mm PipeBloc PCP series pipe collar fixed to the underside of floor.	264*	264*	264*	264*
110 mm diameter 4.2 mm thick PVC pipe		264*	264*	264*	264*
110 mm diameter 2.7 mm thick PE pipe		264*	264*	264*	264*
125 mm diameter 6.0 mm thick PVC pipe	The penetration was provided with a single 125 mm PipeBloc PCP series pipe collar fixed to the underside of floor.	264*	264*	264*	264*
125 mm diameter 3.1 mm thick PE pipe		264*	264*	264*	264*
*The test duration. The test was discontinued after a period of 264 minutes.					

B.7 Test report – WF 350177

Table 36 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 11 March 2015.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The section of floor had overall dimensions of 2230 mm long × 1740 mm wide × 150 mm thick and was provided with nine circular apertures, each penetrated by a range of plastic pipes which were plugged on the unexposed side. Each specimen was protected with a single pipe collar referenced 'PipeBloc PCP', fitted to the underside of the concrete floor assembly. Each specimen was positioned with an aperture which was cut to give a nominal 10 mm annular gap. The annular gap was filled to a depth of 5 mm with 'Pyrocoustic sealant' to both sides of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009.

The test specimen achieved the following results – see Table 37.

Table 37 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
50 mm diameter 1.8 mm thick PVC pipe	The penetration was provided with a single 50 mm PipeBloc PCP series pipe collar fixed to the underside of floor.	250*	250*	250*	250*
160 mm diameter 6.2 mm thick PVC pipe	The penetration was provided with a single 160 mm PipeBloc PCP series pipe collar fixed to the underside of floor.	250*	250*	250*	250*
160 mm diameter 9.5 mm thick PVC pipe		250*	250*	250*	250*
*The test duration. The test was discontinued after a period of 250 minutes.					

B.8 Test report – WF 361932

Table 38 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was done 11 March 2016.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The section of floor had overall dimensions of 2240 mm long × 1735 mm wide × 150 mm thick and was provided with twelve circular apertures, each penetrated by a range of plastic pipes which were plugged on the unexposed side. Each 50 mm diameter service was fitted with two pipe wraps referenced 'PipeBloc EL' and each 200 mm diameter service was fitted with ten layers. The pipe wrap was self adhered to the service and fitted to mid depth of the aperture. Each annular gap was sealed with a single bead of 'Pyrocoustic sealant' to the unexposed face of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009.

The test specimen achieved the following results – see Table 39.

Table 39 Results summary for this test report

Service	Seal type	Integrity (mins)			Insulation (mins)
		Cotton pad	Sustained flaming	Gap gauge	
50 mm diameter 6.9 mm thick PP pipe	The penetration was provided with a PipeBloc EL series pipe wrap self adhered and fitted centrally in the aperture. A bead of FSi Pyrocoustic sealant was used to seal the aperture on the unexposed face of the floor.	264*	264*	264*	264*
50 mm diameter 2 mm thick PP pipe		264*	264*	264*	264*
50 mm diameter 3.7 mm thick PVC pipe		264*	264*	264*	172
50 mm diameter 2.4 mm thick PVC pipe		264*	264*	264*	264*
200 mm diameter 18.2 mm thick PP pipe	The penetration was provided with a PipeBloc EL series pipe wrap self adhered and fitted centrally in the aperture. A bead of FSi Pyrocoustic sealant was used to seal the aperture on the unexposed face of the floor.	120#	120	120	120
200 mm diameter 4.9 mm thick PP pipe		264*	264*	264*	264*
200 mm diameter 9.6 mm thick PVC pipe		242	245#	245	185
*The test duration. The test was discontinued after a period of 264 minutes. #Specimen blanked off to allow the test to continue.					

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