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Fire assessment report

Assessment of various linear gaps protected by Boss FireSilicone EMA sealant

Client: Boss Products (Australia) Pty Ltd

Job number: FAS190037 Revision: R1.3

Issue date: 11 November 2019 Expiry date: 30 September 2024

Amendment schedule

Version	Date	Information relating to report			
R1.0	Issue: 20/09/2019	Reason for issue	Report issued to Boss Products (Australia) Pty Ltd for review and comment.		
			Prepared by	Reviewed by	Approved by
	Expiry: 30/09/2024	Name	Yomal Dias	Omar Saad	Omar Saad
		Signature			
R1.1	Issue: 24/09/2019	Reason for issue	Minor typographical amendments		
			Prepared by	Reviewed by	Approved by
	Expiry: 30/09/2024	Name	Yomal Dias	Omar Saad	Omar Saad
		Signature			
R1.2	Issue: 11/10/2019	Reason for issue	Tables 1 and 2 in Executive Summary section were reformatted.		
			Prepared by	Reviewed by	Approved by
	Expiry: 30/09/2024	Name	Yomal Dias	Omar Saad	Omar Saad
		Signature			
R1.3	Issue: 11/11/2019	Reason for issue	Test sponsor revised as Boss Products (Australia) Pty Ltd		
			Prepared by	Reviewed by	Approved by
	Expiry: 30/09/2024	Name	Yomal Dias	Omar Saad	Omar Saad
		Signature			

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General conditions of use

Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) and/or performance of various linear gaps protected with BOSS FireSilicone EMA sealant if tested in accordance with AS 1530.4:2014[1] and assessed in general accordance with AS 4072.1:2005[2].

Assessment 1 described in Section 5 of this report found that the proposed variations are likely to achieve the FRLs shown in Table 1, if tested in accordance with AS 1530.4:2014 and assessed in general accordance with AS 4072.1:2005.

Table 1 Assessment 1 variations and outcomes

Joint	Ref. test	Max. gap width (mm)	Floor/ wall separating element details			Backing material	Local fire protection	FRL
			Type	Min. Density (kg/m³)	Min. thickness (mm)			
A	WF 187564	12	AAC or normal weight concrete floor	670	150	1 × Ø13 PEF backing rod on the unexposed side	BOSS FireSilicone sealant, minimum depth of 6mm, on the unexposed side	-/240/120
B		30				1 × Ø30 PEF backing rod on the unexposed side	BOSS FireSilicone sealant, minimum depth of 15mm, on the unexposed side	-/240/180
C		50				2 × Ø25 PEF backing rods on the unexposed side	BOSS FireSilicone sealant, minimum depth of 25mm, on the unexposed side	-/240/60
D	WF 372207	60				3 × Ø20 PEF backing rods on the unexposed side	BOSS FireSilicone sealant, minimum depth of 30mm, on the unexposed side	-/240/120
E		60				Stone wool insulation, minimum depth of 50mm, on unexposed side	BOSS FireSilicone sealant, minimum depth of 6mm, on the unexposed side	-/240/180
F		60				Stone wool insulation, minimum depth of 50mm, on exposed side	BOSS FireSilicone sealant, minimum depth of 6mm, on the exposed side	-/90/60

[1] Methods for fire tests on building materials, components and structures Fire-resistance tests for elements of construction
[2] Components for the protection of openings in fire-resistant separating elements Service penetrations and control joints

G	WF 187564	12	AAC, normal weight concrete or solid masonry block floor	760	150	1 × Ø13 PEF backing rod on both sides	BOSS FireSilicone sealant, minimum depth of 6mm, on both sides	-/300/300
H		30				1 × Ø30 PEF backing rod on both sides	BOSS FireSilicone sealant, minimum depth of 15mm, on both sides	-/300/300
I	WF 372207	50				3 × Ø13 PEF backing rods on both sides	BOSS FireSilicone sealant, minimum depth of 25mm, on both sides	-/240/180
J		60				Stone wool insulation, minimum depth of 50mm, on both sides	BOSS FireSilicone sealant, minimum depth of 5mm, on both sides	-/240/240

Assessment 2 described in Section 6 of this report found that the proposed variations are likely to achieve the outcomes shown in Table 2, if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005.

Table 2 Assessment 2 variations and outcomes

Joint	Joint configuration	Separating element	Reference test	Variations	Outcome
K L M N	Identical to the tested configuration	Floor or wall separating elements either similar or superior to the tested floor separating element in terms of thickness and density.	Supplement to LPC TE82045[3]	Assessment of the applicability of test results in general accordance with AS 1530.4:2014 and AS 4072.1:2005 **For floor elements (K to N):** The assessment outcomes are applicable to identical linear gaps in wall separating elements. However, the proposed wall separating elements shall be either similar or superior to the tested floor separating element in terms of thickness and density.[4]	If tested in accordance with AS 1530.4:2014 and AS 4072.1:2005, the results of the proposed systems are likely not to change significantly from the referenced tests. However, FRLs are not applicable due to the test results not being in strict accordance with AS 1530.4: 2014

[3] The referenced test report is not considered to be in strict accordance with AS 1530.4:2014

[4] The assessment outcome holds no validity if knowledge on the fire resistance performance of the proposed systems becomes available through testing.

Limitations of assessment

The fire resistance period for insulation for 150mm thick concrete slabs is specified as 180min in Table 5.5.1 in AS 3600:2018. For 175mm thick concrete slabs, the standard specifies a fire resistance period for insulation of 240min.

The referenced test reports WF 187564 and WF 372207 comprised of 150mm thick aerated concrete wall and floor separating elements. Some of the reference tests with the 150mm thick separating element achieved insulation performance ratings of 240min and 300min (Wall systems G, H and J).

The reference supplement to LPC 82045 contained a 215mm thick concrete floor separating element. The test results show that the tested linear gap systems achieved an insulation performance rating of 300min.

The outcomes of this assessment, which are based on these test results, shall not be interpreted as universally applicable for the assessed products in all practical applications. It is acknowledged that with reduced safety margins arising from thinner concrete floor separating elements, the influence of other factors such as defects in products, faults in installation and workmanship bear greater influence on the performance of the systems.

Furthermore, when used in practical applications, the FRL of the proposed linear gaps are limited by the insulation performance rating of the separating element. The separating element shall have been either tested or assessed to achieve the required FRL in accordance with AS 1530.4:2014.

The variations and outcome of this assessment are subject to the additional limitations and requirements described in Sections 2, 4 and 7 of this report. The results of this report are valid until 30 September 2024.

Contents

1. Introduction

This report documents the findings of the assessments undertaken to determine the likely fire resistance level (FRL) of various linear gaps protected with BOSS FireSilicone EMA sealant if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005. This assessment was carried out at the request of Boss Products (Australia) Pty Ltd. The sponsor details are included in Table 3.

It has been confirmed by FSi Limited that the chemical composition and manufacturing process of the products with different trade names in the referenced reports (Pyro-plus and Pyrolastic Silicone Sealant) are the same. The same sealant is identified as BOSS FireSilicone EMA in Australia.

Furthermore, it has been confirmed that Boss Products (Australia) Pty Ltd has obtained the approval from other test sponsors to use their report in this assessment.

Table 3 Sponsor details

Client	Address
Boss Products (Australia) Pty Ltd	Unit 8, 15-23 Kumulla Rd, Caringbah NSW 2229

2. Framework for the assessment

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

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. Therefore, we have followed the Guide to Undertaking Assessments In Lieu of Fire Tests prepared by the Passive Fire Protection Federation (PFPF) in the UK[5].

This guide provides a framework to undertake 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*
- *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.

2.1 Declaration

The guide to undertaking assessments in lieu of fire tests prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal dated 23/07/2019, 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.

[5] Guide to Undertaking Assessments In Lieu of Fire Test - The Passive Fire Protection Federation (PFPF), June 2000, UK.

3. Description of the specimen and variations

3.1 System description

Fire test reports WF 187564 and WF 372207 comprise of various linear gaps within 150mm thick autoclaved aerated concrete floor slabs/ lintels and aerated concrete block walls.

The supplement to report LPC TE 82045 comprises of various linear gaps within a 215mm thick dense concrete floor slab.

3.2 Referenced test data

The assessment of the variation to the tested system and the determination of the likely performance is based on the results of the fire tests documented in the reports summarised in Table 4. Further details of the tested systems are described in Appendix A.

Table 4 Referenced test data

Report number	Test sponsor	Test date	Testing authority
WF 187564	Firestopit Limited	24/04/2009	Warringtonfire UK (formerly Bodycote Warringtonfire)
WF 372207	FSi Limited	29/09/2016	Warringtonfire UK (Formerly Exova Warringtonfire)
Supplement to LPC TE82045	Trade Fireseal Systems Ltd	Report issued on 22/04/1994	LPC Testing (Known as BRE Global)

3.3 Variations to tested systems

Identical linear gap sealing systems have not been subject to a standard fire test. We have therefore assessed the different systems using baseline test information for similar systems. The variations to the tested systems, together with the referenced baseline standard fire tests, are described in Table 5.

Table 5 Variation to tested systems

Assessment no	Item	Reference test	Description	Variations
1	Linear gaps	1. WF 187564 (BS EN 1363-1:1999[6] and EN 1366-4:2006[7]) 2. WF 372207 (EN 1366-4:2006+A1:2010)	The separating elements were: 1. A 150mm thick aerated concrete block wall 2. A 150mm thick autoclaved aerated concrete lintel floor	Assessment of the applicability of test results in accordance with AS 1530.4:2014 and AS 4072.1:2005 **For floor elements (A to F):** Concrete with a density not less than 670kg/m^3, and a thickness not less than 150mm may be used instead of autoclaved aerated concrete to form the floor separating element **For wall elements (G to J):** Concrete or masonry blocks with a density not less than 760kg/m^3, and a thickness not less than 150mm may be used instead of autoclaved aerated concrete to form the wall separating element
2	Linear gaps	Supplement to LPC TE82045	The separating element was made up of 215mm thick	Assessment of the applicability of test results in general accordance

[6] British Standards Institute (1999) *Fire resistance tests*, General requirements, BS EN 1363.1:1999
[7] British Standards Institute (2006) *Fire resistance tests for service installations*, Linear joint seals, BS EN 1366.4:2006

Assessment no	Item	Reference test	Description	Variations
		(BS476:Part 20:1987[8])	horizontal concrete floor lintels.	with AS 1530.4:2014 and AS 4072.1:2005 **For floor elements (K to N):** The assessment outcomes are applicable to identical linear gaps in wall separating elements. The proposed wall separating elements shall be similar to the tested floor separating element in terms of thickness and density.[9]

The assessments presented in this report do not address any variations with respect to the linear gap width, and sealant and backing material depth of the proposed systems. As described in Table 6, only the applicability of the test results in accordance with AS 1530.4:2014 and AS4072.1:2005 and the specified variations in the separating element are addressed.

3.4 Purpose of the test method

Section 2 of AS 1530.4:2014 specify the general requirements for conducting fire resistance tests. Section 10 of AS 1530.4:2014 give guidelines for determining the fire resistance of elements of construction penetrated by services such as linear gaps. AS 4072.1:2005 sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems. These include linear gaps between building elements that are required to have a fire resistance level (FRL).

3.5 Schedule of components

Table 6 outlines the schedule of components for the assessed systems subject to a fire test, as referenced in Sections 5 and 6.

Table 6 Schedule of components for proposed linear gaps in Assessment 1 and 2

Item		Description
1	**Name**	Separating floor lintels/slabs
	Material	Autoclaved aerated concrete or normal-weight concrete
	Density	Minimum 670kg/m^3
	Thickness	Minimum 150mm
2	**Name**	Separating wall blockwork
	Material	Autoclaved aerated concrete, normal-weight concrete or masonry blocks
	Density	Minimum 760kg/m^3
	Thickness	Minimum 150mm
3	**Name**	Separating floor/wall construction
	Material	Normal-weight concrete
	Density	Minimum 2400kg/m^3
	Thickness	Minimum 215mm
Floor linear gap system A (See Figure 1 for more details)		

[8] British Standards Institute (1987) *Fire tests on building materials and structures,* Method for determination of the fire resistance of elements of construction (general principles), BS 476:Part 20:1987

[9] The assessment outcome holds no validity if knowledge on the fire resistance performance of the proposed systems becomes available through testing.

Item		Description
A	**Joint width**	12mm
	Details of backing rod	
	Material	Polyethylene
	Size	Single 13mm diameter rod
	Fixing method	Friction fit within the cavity at the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	6mm
	Application method	Cartridge gunned at the unexposed face of the cavity
Floor linear gap system B (See Figure 2 for more details)		
B	**Joint width**	30mm
	Details of backing rod	
	Material	Polyethylene
	Size	Single 30mm diameter rod
	Fixing method	Friction fit within the cavity at the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	15mm
	Application method	Cartridge gunned at the unexposed face of the cavity
Floor linear gap system C (See Figure 3 for more details)		
C	**Joint width**	50mm
	Details of backing rod	
	Material	Polyethylene
	Size	Two 25mm diameter rods
	Fixing method	Friction fit within the cavity at the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	25mm
	Application method	Cartridge gunned at the unexposed face of the cavity
Floor linear gap system D (See Figure 4 for more details)		
D	**Joint width**	60mm
	Details of backing rod	
	Material	Polyethylene
	Thickness	Three 20mm diameter rods
	Fixing method	Friction fit within the cavity at the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	30mm
	Application method	Cartridge gunned at the unexposed face of the cavity
Floor linear gap system E (See Figure 5 for more details)		

Item		Description
E	**Joint width**	60mm
	Details of backing material	
	Material	Stone wool insulation
	Density	45.2 kg/m^3
	Thickness	50mm
	Fixing method	Friction fit within the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	5mm
	Application method	Cartridge gunned at the unexposed face of the cavity
Floor linear gap system F (See Figure 6 for more details)		
F	**Joint width**	60mm
	Details of backing material	
	Material	Stone wool insulation
	Density	45.2 kg/m^3
	Thickness	50mm
	Fixing method	Friction fit within the cavity at the exposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	5mm
	Application method	Cartridge gunned at the exposed face of the cavity
Wall linear gap system G (See Figure 7 for more details)		
G	**Joint width**	12mm
	Details of backing rod	
	Material	Polyethylene
	Size	Single 13mm diameter rod
	Fixing method	Friction fit within the cavity on both exposed and unexposed sides
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	6mm
	Application method	Cartridge gunned at both exposed and unexposed faces of the cavity
Wall linear gap system H (See Figure 8 for more details)		
H	**Joint width**	30mm
	Details of backing rod	
	Material	Polyethylene
	Size	Single 30mm diameter rod
	Fixing method	Friction fit within the cavity on both exposed and unexposed sides
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant

Item		Description
	Thickness	15mm
	Application method	Cartridge gunned at both exposed and unexposed faces of the cavity
Wall linear gap system I (See Figure 9 for more details)		
I	**Joint width**	50mm
	Details of backing rod	
	Material	Polyethylene
	Thickness	Three 20mm diameter rods
	Fixing method	Friction fit within the cavity on both exposed and unexposed sides
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	25mm
	Application method	Cartridge gunned at both exposed and unexposed faces of the cavity
Wall linear gap system J (See Figure 10 for more details)		
J	**Joint width**	60mm
	Details of backing material	
	Material	Stone wool insulation
	Density	45.2 kg/m^3
	Thickness	50mm
	Fixing method	Friction fit within the cavity on both exposed and unexposed sides
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	5mm
	Application method	Cartridge gunned at both exposed and unexposed faces of the cavity
Floor linear gap system K (See Figure 11 for more details)		
K	**Joint width**	150mm
	Details of backing material	
	Material	Stone wool insulation
	Density	110 kg/m^3
	Thickness	25mm
	Fixing method	Friction fit within the cavity at both exposed and unexposed faces of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness	10mm
	Application method	At the unexposed face of the cavity
Floor linear gap system L (See Figure 12 for more details)		
L	**Joint width**	100mm
	Details of backing materials	

Item		Description
	Material 1	Ceramic fibre insulation
	Density	96 kg/m^3
	Thickness	12.5mm
	Fixing method	Two layers friction fit within the cavity near the exposed face of the cavity
	Material 2	Polyethylene foam
	Density	34 kg/m^3
	Thickness	15mm
	Fixing method	Single layer friction fit within the cavity near the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness and application method	• 10mm, Mastic gunned at the unexposed face of the cavity • 15mm, Mastic gunned at the exposed face of the cavity
Floor linear gap system M (See Figure 13 for more details)		
M	**Joint width**	50mm
	Details of backing materials	
	Material 1	Ceramic fibre insulation
	Density	96 kg/m^3
	Thickness	12.5mm
	Fixing method	Two layers friction fit within the cavity near the exposed face of the cavity
	Material 2	Polyethylene foam
	Density	34 kg/m^3
	Thickness	15mm
	Fixing method	Single layer friction fit within the cavity near the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness and application method	• 10mm, Mastic gunned at the unexposed face of the cavity • 15mm, Mastic gunned at the exposed face of the cavity
Floor linear gap system N (See Figure 14 for more details)		
N	**Joint width**	100mm
	Details of backing materials	
	Material 1	Ceramic fibre insulation
	Density	96 kg/m^3
	Thickness	12.5mm
	Fixing method	Two layers friction fit within the cavity near the exposed face of the cavity
	Material 2	Polyethylene foam
	Density	34 kg/m^3

Item		Description
	Thickness	15mm
	Fixing method	Single layer friction fit within the cavity near the unexposed face of the cavity
	Details of sealant	
	Material	BOSS FireSilicone EMA sealant
	Thickness and application method	• 10mm, Mastic gunned at the unexposed face of the cavity • 15mm, Mastic gunned at the exposed face of the cavity

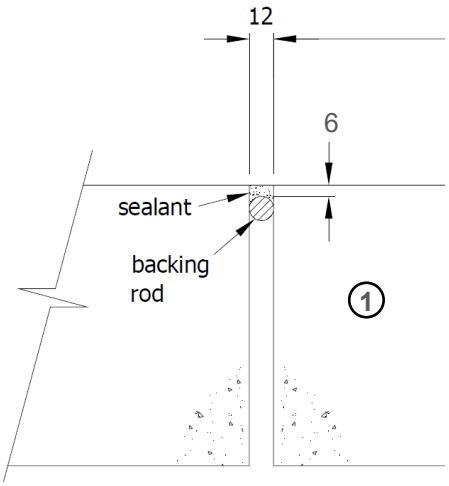

Figure 1 **Floor linear gap system A – Assessment 1 (As shown in WF 187564 and WF 372207) - dimensions in mm**

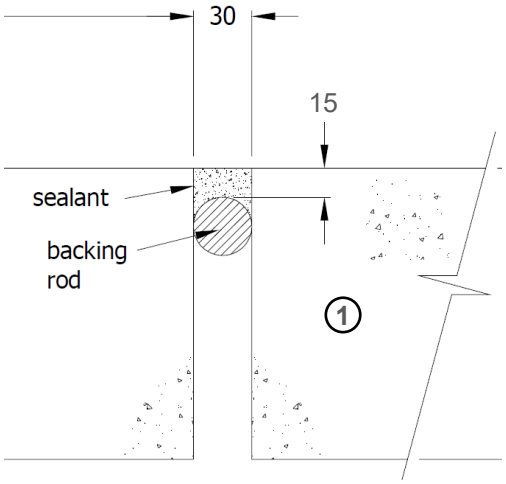

Figure 2 **Floor linear gap system B – Assessment 1 (As shown in WF 187564) - dimensions in mm**

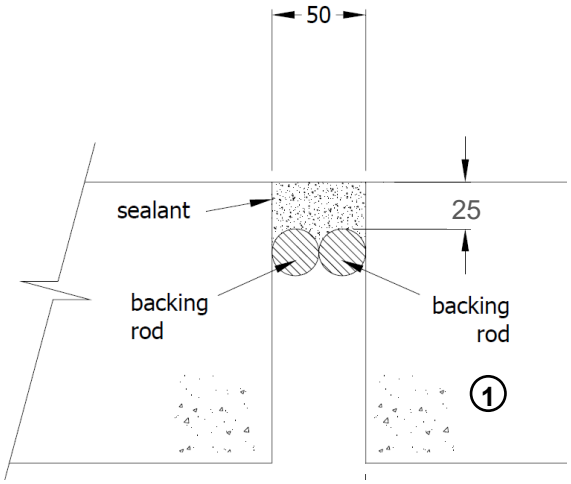

Figure 3 Floor linear gap system C – Assessment 1 (As shown in WF 187564) - dimensions in mm

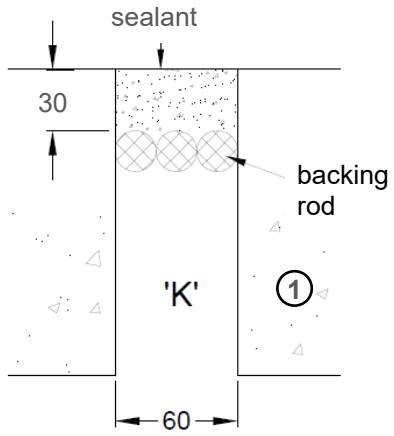

Figure 4 Floor linear gap system D – Assessment 1 (As shown in WF 372207) - dimensions in mm

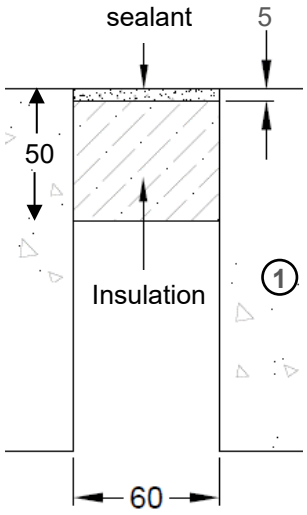

Figure 5 Floor linear gap system E – Assessment 1 (As shown in WF 372207) - dimensions in mm

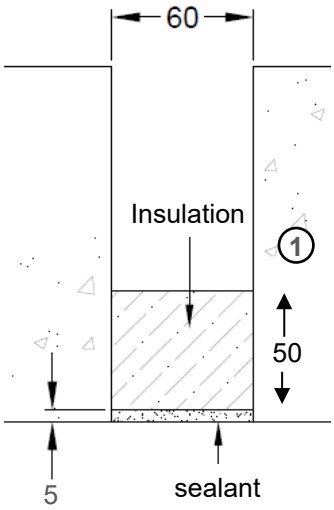

Figure 6 Floor linear gap system F – Assessment 1 (As shown in WF 372207) - dimensions in mm

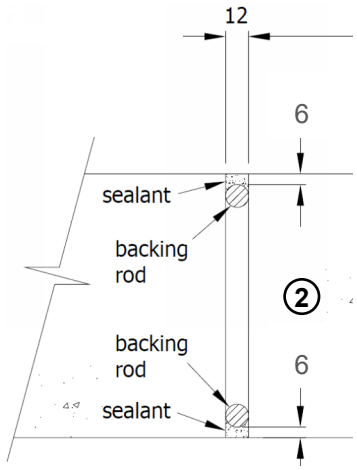

Figure 7 Wall linear gap system G – Assessment 1 (As shown in WF 187564) - dimensions in mm

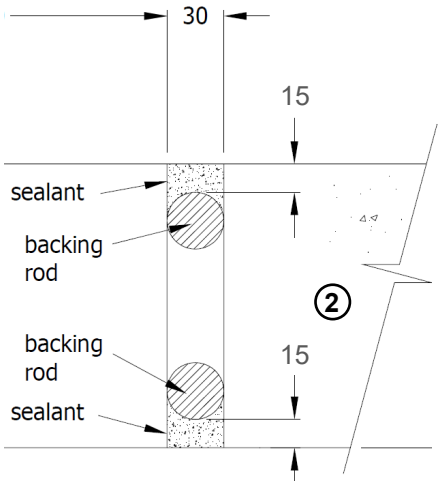

Figure 8 Wall linear gap system H – Assessment 1 (As shown in WF 187564) - dimensions in mm

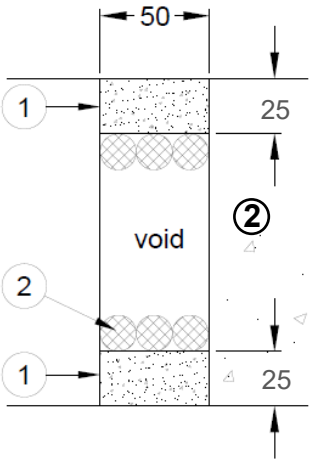

Figure 9 Wall linear gap system I – Assessment 1 (As shown in WF 372207) - dimensions in mm

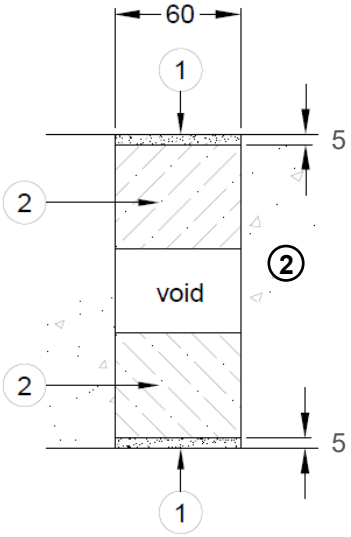

Figure 10 Wall linear gap system J – Assessment 1 (As shown in WF 372207) - dimensions in mm

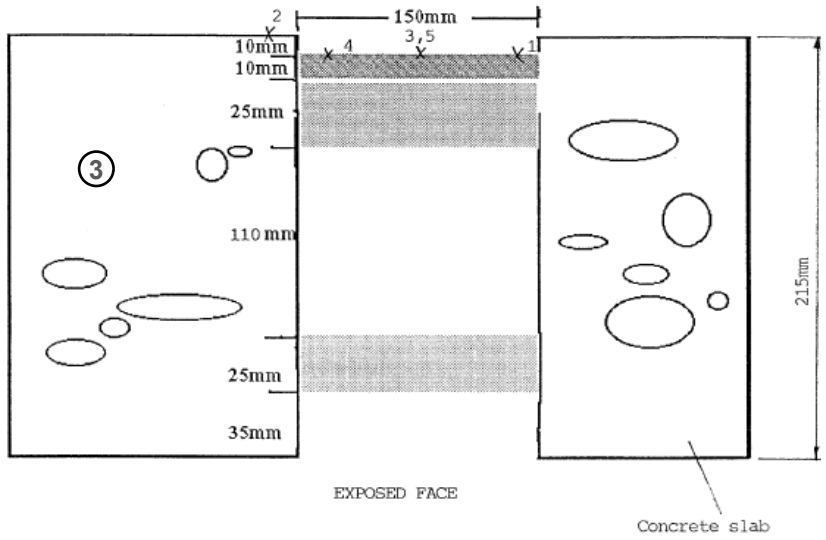

Figure 11 Floor linear gap system K – Assessment 2 (As shown in supplement to LPC TE82045)

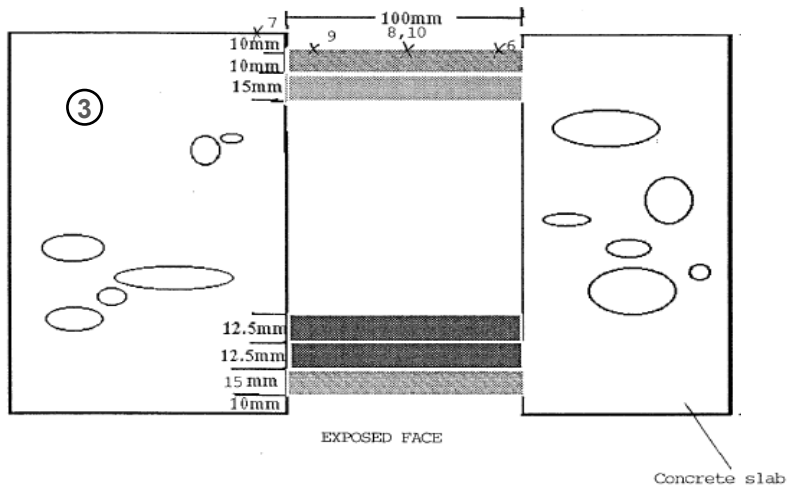

Figure 12 Floor linear gap system L– Assessment 2 (As shown in supplement to LPC TE82045)

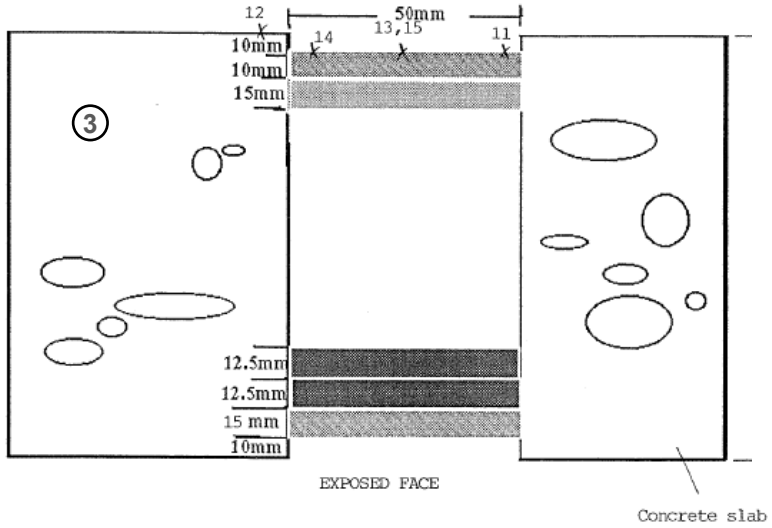

Figure 13 Floor linear gap system M – Assessment 2 (As shown in supplement to LPC TE82045)

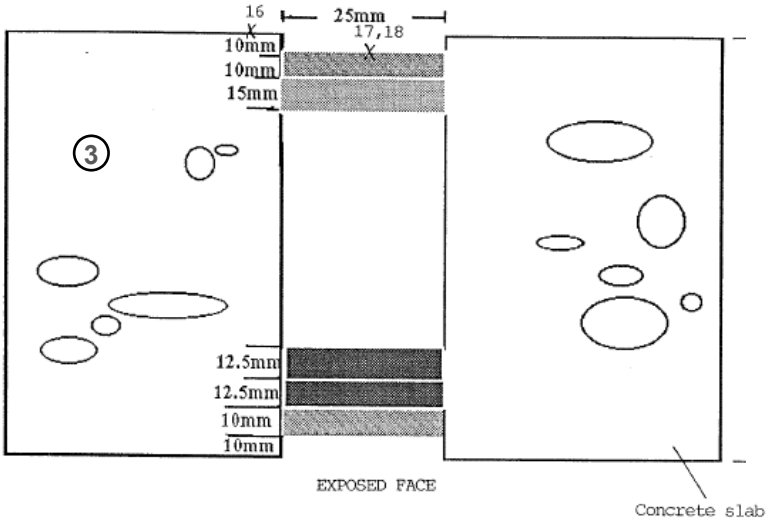

Figure 14 Floor linear gap system N – Assessment 2 (As shown in supplement to LPC TE82045)

4. Scope, objective and assumptions

4.1 Scope and objective

- The scope of this report is limited to an assessment of the variations to the tested systems described in Section 3.3.
- This report details the methods of construction, test conditions and assessed results that would have been expected if the specific elements of construction described here had been tested in accordance with AS 1530.4:2014 and AS 4072.1:2005.
- The results of this assessment are applicable to linear gaps exposed to fire from the side exposed to fire during testing only.
- This report is only valid for the assessed systems. 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 be needed to verify consistency with the assessment in this report.
- The data, methodologies, calculations and conclusions documented in this report specifically relate to the assessed systems and must not be used for any other purpose.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.

5. Assessment 1

5.1 Description of variation

Assessment 1 refers the test reports WF 187564 and WF 372207 only. These reports comprise of fire tests of linear gaps within floor and wall separating elements (Systems A to J in Table 6). The proposed variations are as follows.

For all systems:

- Assessment of the applicability of test results in accordance with AS 1530.4:2014 and AS 4072.1:2005

For Systems A to F (Floor separating elements)

- The separating element may be made of aerated concrete or normal-weight concrete with a density greater than 670kg/m^3, and a thickness not less than 150mm

For Systems G to J (Wall separating elements)

- The separating element may be made of autoclaved aerated concrete, normal-weight concrete or masonry blockwork with a density greater than 760kg/m^3, and a thickness not less than 150mm

5.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 7.

Table 7 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative

5.3 Assessment

5.3.1 Linear gaps through floor separating elements (Systems A to F)

WF 187564 and WF 372207 comprised of various horizontal linear gaps with widths varying between 12mm to 60mm (Figure 1 to Figure 6). The floor separating element was made of 150mm thick autoclaved aerated concrete slabs/ lintels with a density of 670kg/m^3.

The tests were conducted in accordance with BS EN 1366-4:2006 and BS EN 1363-1:1999. A comparison of the guidelines between these and the Australian standards AS 1530.4:2014 and AS 4072.1:2005 is provided in Section B.1. As per the discussion presented in Section B.1.6, the tests are considered to be in accordance with AS 1530.4:2014 and AS 4072.1:2005.

The proposed variation is to use autoclaved aerated concrete or normal-weight concrete with a density not less than 670kg/m^3 for the floor separating element, provided that their thickness is not less than 150mm. As per AS 3600:2018, the density of normal-weight concrete can be taken as 2400kg/m^3.

Compared to autoclaved aerated concrete, a normal-weight concrete separating element of the same size has a higher mass and a greater moisture content in its finished state. Consequently, normal-weight concrete possesses a greater thermal mass than aerated concrete. When exposed to fire, normal-weight concrete results in more steaming, releasing its internally trapped moisture. It also absorbs more heat to elevate the temperature of its mass.

The surface finish characteristics of autoclaved aerated concrete are different from normal-weight concrete. However, the difference in the interaction characteristics between the linear gap elements (backing rods, stone wool insulation backing and sealant) and the separating element surface are unlikely to affect the performance of the proposed systems significantly. This is partly because the backing materials are mostly friction fit within the linear gap.

Due to these reasons, if the separating elements of floor linear gap systems A to F were changed to aerated concrete or normal-weight concrete with a density not less than 670kg/m^3, while maintaining the minimum 150mm thickness, the results of the referenced tests are unlikely to be changed significantly.

5.3.2 Linear gaps through wall separating elements (Systems G to J)

WF 187564 and WF 372207 comprised of various vertical linear gaps with widths varying between 12mm to 60mm (Figure 7 to Figure 10). The floor separating element was made of 150mm thick autoclaved aerated concrete blocks.

It was previously established that the tests described in these referenced reports are in accordance with AS 1530.4:2014 and AS 4072.1:2005.

The proposed variation is to use either aerated concrete, normal-weight concrete or masonry blocks with a density not less than 760kg/m^3 as the wall separating element, provided that their thickness is not less than 150mm.

It was previously established that the variation in the surface interaction characteristics with the use of normal-weight concrete is unlikely to affect the friction fit backing materials and sealant. The variation in the surface interaction characteristics with the use of masonry blocks is also unlikely to considerably affect the behaviour of the friction fitted backing materials and the sealant. Due to these reasons, if the separating elements of wall linear gap systems G to J were changed to masonry blocks, the results of the referenced tests are unlikely to be changed significantly.

5.4 Conclusion

This assessment demonstrates that the linear gaps assessed are likely to achieve the FRLs shown in Table 8, if tested.

Table 8 Summary of Assessment 1 conclusions

Product	Reference test	FRL
Floor linear gap system A	WF 187564	-/240/120
Floor linear gap system B	WF 187564	-/240/180
Floor linear gap system C	WF 187564	-/240/60
Floor linear gap system D	WF 372207	-/240/120
Floor linear gap system E	WF 372207	-/240/180
Floor linear gap system F	WF 372207	-/90/60
Wall linear gap system G	WF 187564	-/300/300
Wall linear gap system H	WF 187564	-/300/300
Wall linear gap system I	WF 372207	-/240/180
Wall linear gap system J	WF 372207	-/240/240

Some of the reference tests with the 150mm thick separating element achieved insulation performance ratings of 240min and 300min (Wall systems G, H and J).

When used in practical applications, the FRL of the proposed linear gaps are limited by the insulation performance rating of the separating element. The separating element shall have been either tested or assessed to achieve the required FRL in accordance with AS 1530.4:2014.

6. Assessment 2

6.1 Description of variation

Assessment 2 refers the supplement to LPC 82045. This report comprises of fire tests of linear gaps within a floor separating element (Systems K to N in Table 6). The proposed variations are as follows.

- Assessment of the applicability of test results in accordance with AS 1530.4:2014 and AS 4072.1:2005
- Assessment of likely fire resistance performance of similar linear gap systems in vertical concrete separating elements
- The separating element shall not be less than 215mm in thickness
- The density of the separating element shall be not less than 2400kg/m^3

6.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 9.

Table 9 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Qualitative

6.3 Assessment

LPC TE82045 comprised of various horizontal linear gaps with widths varying between 25mm to 150mm (Figure 11 to Figure 14). The floor separating element was made of 215mm thick normal-weight concrete. However, test report does not specify the density of the concrete slab elements. AS per AS 3600:2018, the density of normal-weight concrete can be taken as 2400 kg/m^3.

The tests were conducted in accordance with BS 476:Part 20:1987. A comparison between the guidelines between this and the Australian standards AS 1530.4:2014 and AS 4072.1:2005 is provided in Section B.2. As per the discussion presented in Section B.2.8, the results are considered to be only in general accordance with AS 1530.4:2014 and AS 4072.1:2005.

The proposed variation addresses the applicability of the test results to identical linear gaps in concrete wall (vertical) separating elements. The thickness and the density of the separating element of the proposed systems shall not be less than those specified earlier.

The test report states that the furnace controller maintained a pressure of approximately 19Pa±1Pa above that of the laboratory at a position nominally 100mm below the underside of the concrete slabs. If tested vertically in accordance with the relevant Australian standards, the pressure conditions are likely to be less onerous than these test conditions.

Due to these reasons, if the linear gap systems K to N were installed vertically, in a concrete wall separating element with a thickness not less than 215mm, and tested in accordance with AS 1530.4:2014 and AS 4072.1: 2005, the results obtained are unlikely to vary considerably from the referenced test results.

However, due to the referenced test results reported in supplement to LPC TE 82045 not being in strict accordance with AS 1530.4:2014 and AS 4072.1:2005, FRLs are not assigned with reasonable confidence.

6.4 Conclusion

This assessment demonstrates that the proposed linear gaps are likely to achieve similar results to the tested system described in the referenced report, if tested in general accordance with AS 1530.4:2014 and AS 4072.1: 2005. However, specific FRLs are not assigned to the systems.

The reference supplement to LPC 82045 contained a 215mm thick concrete floor separating element. The test results show that the tested linear gap systems achieved an insulation performance rating of 300min.

When used in practical applications, the FRL of the proposed linear gaps are limited by the insulation performance rating of the separating element. The separating element shall have been either tested or assessed to achieve the required FRL in accordance with AS 1530.4:2014.

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 hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard 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 information and experience available at the time of preparation. 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 likely to be demonstrated on a test in accordance with AS 1530.4:2014 and AS 4072.1:2005, based on the evidence referred to in this report.

This assessment is provided to the Boss Products (Australia) Pty Ltd for its own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.

Appendix A Summary of supporting test data

A.1 Additional Test report – WF187564

Table 10 Information about test report

Item	Information about test report
Report sponsor	Firestopit Limited
Test laboratory	Warringtonfire UK (formerly Bodycote Warringtonfire)
Test date	The fire resistance test was completed on 24/04/2009
Test standards	The test was done in accordance with BS EN 1366-4:2006 and BS EN 1363-1:1999.
Variation to test standards	Variations to relevant Australian standards addressed in Section B.1
General description of tested specimen	The test comprised of wall and floor separating elements incorporating various gap sealing systems. The blockwork wall comprised of 150mm thick autoclaved aerated concrete blocks with a density of 760kg/m^3. The concrete floor comprised of 150mm thick autoclaved aerated concrete lintels with a density of 670kg/m^3. The separating floor element had the overall dimensions of 2240mm (L) × 1730mm (W) × 150mm (T) and was made up of autoclaved aerated concrete lintels arranged to provide 2-off 12mm (W) × 1000mm (L), 2-off 30mm (W) × 1000mm (L) and 2-off 50mm (W) × 1000mm (L) linear gaps. The separating wall element had the overall dimensions of 1500mm (H) × 1500mm (W) × 150mm (T) and was made up of autoclaved aerated blockwork arranged to provide 4-off 12mm (W) × 1000mm (L) and 2-off 30mm (W) × 1000mm (L) linear gaps. Each gap was sealed with silicone based intumescent sealant referenced “Pyrolastic Fire Rated Silicone” (known as BOSS FireSilicone EMA sealant in Australia). Each seal was cartridge gunned into the gaps. A description of each gap seal is given in Table 11.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1363-1:1999.

Table 11 Test specimen description for WF187564

System	Gap width (mm)	Gap facing	Description
A	12	Masonry to masonry	6mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 13mm diameter polyethylene backing rod
B	30	Masonry to masonry	15mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 30mm diameter polyethylene backing rod
C	50	Masonry to masonry	25mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 2-off 25mm diameter polyethylene backing rods
D	12	Steel to masonry	6mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 13mm diameter polyethylene backing rod
E	30	Steel to masonry	15mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 30mm diameter polyethylene backing rod
F	50	Steel to masonry	25mm deep, cartridge gunned then trowelled flush with the unexposed face and faced on the exposed side with 2-off 25mm diameter polyethylene backing rods

System	Gap width (mm)	Gap facing	Description
G	12	Masonry to masonry	6mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 13mm diameter polyethylene backing rods
H	30	Masonry to masonry	15mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 30mm diameter polyethylene backing rods
I	12	Timber to masonry	6mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 13mm diameter polyethylene backing rods
J	30	Timber to masonry	15mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 30mm diameter polyethylene backing rods
K	12	Timber to masonry	6mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 13mm diameter polyethylene backing rods
L	12	Steel to masonry	6mm deep, cartridge gunned then trowelled flush with both faces of the cavity. Both unexposed and exposed gap seals were faced internally with 13mm diameter polyethylene backing rods

Only systems A, B, C, G and H were referenced in the current assessment.

The test specimen achieved the results shown in Table 12.

Table 12 Summary of test results for WF187564

Reference	Integrity (min)		Insulation (min)
	Cotton pad	Sustained flaming	
A	244	300*	122
B	300*	300*	186
C	246	300*	65
D	300*	300*	48
E	300*	300*	43
F	229	300*	33
G	300*	300*	300*
H	300*	300*	300*
I	199	199	145
J	143	143	143
K	208	208	208
L	300*	300*	69

*Test duration. The test was discontinued after a period of 300 minutes.

A.2 Test report – WF372207

Table 13 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Warringtonfire UK (Formerly Exova Warringtonfire)
Test date	The fire resistance test was completed on 29/09/2016
Test standards	The test was done in accordance with BS EN 1366-4:2006 and BS EN 1363-1:1999.
Variation to test standards	Variations to relevant Australian standards addressed in Section B.1
General description of tested specimen	The test comprised of wall and floor separating elements incorporating various gap sealing systems. The blockwork wall comprised of 150mm thick autoclaved aerated concrete blocks with a density of 760kg/m^3. The concrete floor comprised of 150mm thick steel reinforced autoclaved aerated concrete slabs with a density of 670kg/m^3. The separating floor element had the overall dimensions of 2240mm (L) × 1730mm (W) × 150mm (T) and was made up of autoclaved aerated concrete lintels arranged to provide 6-off linear gaps of varying widths which were all 1000mm long. Two of the gaps were fitted with steel substrates. The separating wall element had the overall dimensions of 1500mm (H) × 1500mm (W) × 150mm (T) and was made up of autoclaved aerated blockwork arranged to provide 5-off linear gaps of varying widths which were all 1000mm long. Two of the gaps were fitted with timber substrates and one fitted with a steel substrate.
Instrumentation	The test report states that the instrumentation was in accordance with the requirements of BS EN 1366-4:2006+A1:2010.

Table 14 Test specimen description for WF187564

System	Gap width (mm)	Gap facing	Description
A	60	Concrete to concrete	60mm wide linear gap, sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to both faces of the wall and backed with a 50mm deep Rockwool stone wool insulation
B	60	Concrete to steel	60mm wide linear gap with one face of the gap opening fitted with 8mm thick steel plate substrate. The gap was sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to both faces of the wall and backed with a 50mm deep Rockwool stone wool insulation friction fit into the void.
C	50	Concrete to hardwood	60mm wide linear gap with one face of the gap opening fitted with 15mm thick hardwood timber substrate with a measured density of 638kg/m^3. The gap was sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to both faces of the wall and backed with a 50mm deep Rockwool stone wool insulation friction fit into the void.
D	12	Concrete to softwood	60mm wide linear gap with one face of the gap opening fitted with 15mm thick softwood timber substrate with a measured density of 544kg/m^3. The gap was sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to both faces of the wall and backed with a 50mm deep Rockwool stone wool insulation friction fit into the void.
E	30	Concrete to concrete	50mm wide linear gap, sealed with a 25mm depth of Pyrolastic silicone sealant, cartridge gunned to both faces of the wall and backed with three 20mm diameter closed cell PE backing rods.

System	Gap width (mm)	Gap facing	Description
F	50	Concrete to steel	60mm wide linear gap with one face of the gap opening fitted with 8mm thick steel plate substrate. The gap was sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to the unexposed face of the floor and backed with a 50mm deep Rockwool stone wool insulation friction fit into the void.
G	12	Concrete to steel	60mm wide linear gap with one face of the gap opening fitted with 8mm thick steel plate substrate. The gap was sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to the unexposed face of the floor and backed with a 50mm deep Rockwool stone wool insulation friction fit into the void.
H	30	Concrete to concrete	60mm wide linear gap, sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to the unexposed face of the floor and backed a 50mm deep Rockwool stone wool insulation friction fit into the void.
I	12	Concrete to concrete	60mm wide linear gap, sealed with a 5mm depth of Pyrolastic silicone sealant, cartridge gunned to the exposed face of the floor and backed a 50mm deep Rockwool stone wool insulation friction fit into the void.
J	30	Concrete to concrete	12mm wide linear gap, sealed with a 6mm depth of Pyrolastic silicone sealant, cartridge gunned to the unexposed face of the floor and backed with a single 20mm diameter closed cell PE backing rod.
K	12	Concrete to concrete	60mm wide linear gap, sealed with a 30mm depth of Pyrolastic silicone sealant, cartridge gunned to the unexposed face of the floor and backed with three 20mm diameter closed cell PE backing rods.

Only systems A, E, H, I, J and K were referenced in the current assessment.

The test specimen achieved the results shown in Table 15.

Table 15 Summary of test results for WF372207

Reference	Integrity (min)		Insulation (min)
	Cotton pad	Sustained flaming	
A	264*	264*	264*
B	248	248#	74
C	224	224#	224
D	218	218#	218
E	264*	264*	214
F	97	97	29
G	150	150	64
H	264*	264*	190
I	112	112	61
J	264*	264*	152
K	264*	264*	128

*Test duration. The test was discontinued after a period of 264 minutes.

#The specimen blanked off after failure to allow the test to continue.

A.3 Test report – Supplement to LPC TE82045

Table 16 Information about test report

Item	Information about test report
Report sponsor	Trade Fireseal Systems Ltd
Test laboratory	LPC Testing (Known as BRE Global)
Report issue date	The supplement to report TE 82045 was issued on 22/04/1994
Test standards	The test was done in accordance with BS EN 1366-4:2006 and BS EN 1363-1:1999.
Variation to test standards	Variations to relevant Australian standards addressed in Section B.2
General description of tested specimen	Slabs were installed in horizontal linear gaps, 25, 50, 100 and 150 mm (W) × 10mm (L), between dense concrete lintels, 215mm (W) × 215mm (T). For seals up to 100mm wide, the gap was sealed with 10mm thick Pyro-plus silicone sealant over 15mm thick polyethylene foam in the top of the gap and 15mm thick Pyro plus silicone sealant covering two layers of 125 mm thick Kaowool ceramic blanket in the bottom of the gap. For the 150 mm wide gap, the seal comprised of 10mm thick Pyro plus silicone sealant (known as BOSS FireSilicone EMA sealant in Australia) over 25mm thick Rockwool firebatt 825 in the top of the gap and 25 mm thick Rockwool Fire batt 825 in the bottom of the gap.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1363-1:1999.

The test specimen achieved the results shown in Table 17.

Table 17 Summary of test results for LPC TE 82045

Description	Integrity (min)	Insulation (min)
150mm wide gap sealed with 10mm thick Pyro plus silicone over 25mm thick Rockwool Firebatt 825 in the top of the gap, and 25mm thick Rockwool Firebatt 825 in the bottom of the gap.	250	250
100mm wide gap sealed with 10mm thick Pyro plus silicone over 15mm thick polyethylene foam in the top of the gap, and 15mm thick Pyroplus silicone covering two layers of 12.5mm thick Kaowool ceramic fibre blanket in the bottom of the gap.	250	244
50mm wide gap sealed with 10mm thick Pyro plus silicone over 15mm thick polyethylene foam in the top of the gap, and 15mm thick Pyroplus silicone covering two layers of 12.5mm thick Kaowool ceramic fibre blanket in the bottom of the gap.	250	250
25mm wide gap sealed with 10mm thick Pyro plus silicone over 15mm thick polyethylene foam in the top of the gap, and 15mm thick Pyroplus silicone covering two layers of 12.5mm thick Kaowool ceramic fibre blanket in the bottom of the gap.	250	250

Specific information on the use of a cotton pad are not available. The guidelines of AS 1530.4:2014 on the use of cotton pads are more stringent than those of BS 476:Part 20:1987.

Appendix B Summary of supporting test data

B.1 Relevance of BS EN 1363-1:1999 and BS EN 1366-4:2006 test data with respect to AS 1530.4:2014 and AS 4072.1:2005

B.1.1 Furnace Temperature Measurement

- 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 of diameter of less than 1.0mm and an overall diameter of 3mm. The measuring junction protrudes at least 25mm from the supporting heat resistant tube.
- The furnace thermocouple specified in BS EN 1363-1:1999 is made from 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[10], contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter 1 mm, the hot junctions being 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 ±1 mm by 97 ±1 mm by 10 ±1 mm thick with a density of 280 ±30 kg/m^3.
- The relative location of the furnace thermocouples for the exposed face of the specimen, for AS 1530.4:2014 and BS EN 1363.1:1999, is 100mm +10mm and 100mm +50mm respectively.
- The furnace control thermocouples required by BS EN 1363.1:1999 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 BS EN 1363.1:1999, particularly when the furnace temperature is changing quickly in the early stages of the test.

B.1.2 Furnace Pressure Regime

- It is a requirement of AS 1530.4:2014 that for a single horizontal penetration tested in a vertical separation element that has a height of more than 1m, it shall be tested with a pressure of 20±3 Pa at the top of the separation element and in such cases the horizontal penetrating service shall be included in the zone where the positive pressure exceeds 10Pa.
- Furthermore, if more than one penetration sealing system is tested in a vertical separation element, the pressure conditions specified above shall apply to the lowest penetration.
- Similarly, as per BS EN 1366-4:2006, a vertical furnace shall be operated so that a minimum pressure of 15Pa exists in the centre of the test specimen mounted in the lowest position.
- It is a requirement of AS 1530.4:2014 and BS EN 1363-1:1999 that for horizontal elements, a furnace gauge pressure of 20Pa is established at a height 100mm below the floor soffit level.
- The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and BS EN 1363-1:1999 are also not appreciably different.

[10] Thermocouples - Part 1: EMF specifications and tolerances

B.1.3 Specimen Size

- BS EN 1366-4:2006 states that a linear joint seal shall be of uniform design cross sectional area and for non-movement joints, a shorter length of not less than 900mm can be used.
- AS 1530.4:2014 states that the length of the linear gap exposed to the furnace chamber shall not be less than 1m. The linear gaps tested in the reference test reports all have a length of 1m. Therefore, they are in agreement with the Australian Standards' requirements.

B.1.4 Integrity Performance Criteria

- The integrity criteria differ slightly between AS 1530.4:2014 and BS EN 1363.1:1999
- While a specimen maintains its insulation performance, the specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 if it collapses or sustains flaming or other conditions on the unexposed face, which ignite the cotton pad when applied for up to 30 seconds. Gap gauges are not used to evaluate integrity.
- Except for minor technical variations, the integrity criteria in BN EN 1363.1:1999 are generally applied in a comparable manner.

B.1.5 Specimen Temperature Measurement and insulation performance criteria

- For linear gaps, AS 1530.4:2014 specifies the following requirements when placing thermocouples on the unexposed face in Clause 10.5.1 (f).
    a. At least three on the surface of the seal, with one thermocouple for each 0.3m^2 of surface area, up to a maximum of five, uniformly distributed over the area (one thermocouple being located at the centre of the seal)
    b. On the surface of the seal, 25mm from the edge of the opening, with one thermocouple for each 500mm of the perimeter.
    c. On the surface of the separating element, 25mm from the edge of the opening, with one thermocouple for each 500mm of the perimeter.
- Furthermore, Clause 10.5.3 of AS 1530.4:2014 specifies that thermocouples used for the evaluation of the insulation performance of linear gaps shall be positioned on the unexposed face of the sealing system and the separating element, except where the unexposed face of the seal is recessed within the separating element. Where this occurs, thermocouples shall only be fitted to the seal when the joint width is greater than or equal to 12mm. Under such circumstances, the size of the pad may be reduced to facilitate the fitting of the thermocouple.
- A review of Figures 5 to 11 of BS EN 1366-4:2006 show that while the unexposed surface thermocouple locations specified are in agreement with those specified in AS 1530.4:2014, the BS EN standard is more onerous in certain aspects.

B.1.6 Application of Test Data to 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 significant effect on the outcome of the referenced fire resistance test.
- It is noted that test report WF 187564, a thermocouple on the unexposed surface sealant was not placed at the bottom end of the tested wall joint specimens. Hence, it is not in strict accordance with AS 1530.4: 2014 which stipulates that at least 3 thermocouples should be placed on the surface of the seal. The bottom end of the vertical seal is subjected to a lower pressure from the exposed side. Therefore, the outcome of the test is unlikely to have significantly been altered due to the presence of these thermocouples.
- Based on the above discussion it is considered that the results relating to the integrity and insulation performance of the referenced tests can be used as a basis to assess the FRL of the specimens if tested in accordance with AS 1530.4:2014.

B.2 Relevance of BS 476:Part 20:1987 test data with respect to AS 1530.4:2014 and AS 4072.1:2005

B.2.1 General

- The fire resistance test LPC TE82045 was conducted utilising the heating conditions of BS 476:Part 20:1987, which differs from AS 1530.4 2014. The effects these differences have on the fire resistance performance of test specimens are discussed below.

B.2.2 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:Part 20:1987.
- The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and BS 476:Part 20:1987 are not appreciably different.

B.2.3 Furnace Thermocouples

- For furnace thermocouples specified in AS 1530.4:2014 are Type K, mineral insulated metal sheathed (MIMS) with a stainless steel sheath having a wire of diameter of less than 1.0mm and an overall diameter of 3mm. The measuring junction protrudes at least 25mm from the supporting heat resistant tube.
- The furnace thermocouple types in BS 476:Part 20:1987 shall be one of the following two types:
    a. Bare Nickel Chromium/Nickel Aluminium wires, 0.75mm to 1.5mm in diameter, welded or crimped together at their ends and supported and insulated from each other in a twin bore porcelain insulator. However, for 25mm approximately from the weld/crimp, the wires shall be exposed and be separated from each other by at least 5mm. (To be replaced or recalibrated after 6hrs of usage).
    b. Nickel Chromium/Nickel Aluminium wire contained within mineral insulation in a heat resisting steel sheath of diameter 1.5mm, the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall project 25mm from a porcelain insulator. The assembly shall have a response time on cooling in air of 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:Part 20:1987, is 100mm +10mm.

B.2.4 Furnace Pressure

- It is a requirement of AS 1530.4:2014 that for horizontal elements, a furnace pressure of 20Pa is established at 100mm below the underside of the floor assembly.
- Similar conditions are required by BS 476:Part 20:1987 for horizontal elements

B.2.5 Performance Criteria

- AS 1530.4:2014 specifies the following performance criteria for building materials and structures:
    a. Structural Adequacy – (Not relevant to the referenced test)
    b. Integrity
    c. Insulation

B.2.6 Integrity

- The integrity criteria differ slightly between AS 1530.4:2014 and BS 476:Part 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, or if the ignition of the cotton pad occurs.
- The integrity criteria for BS 476:Part 20: 1987 are similar to the above. However, the use of cotton pad is not as strictly regulated in the BS standard. Therefore, the AS standard is considered more onerous in measuring the integrity performance of linear gaps.

B.2.7 Insulation

- The thermocouple locations for measuring insulation in AS 1530.4:2014 and BS 476:Part 20:1987 are different. AS 1530.4:2014 specifically nominates positions for thermocouples for maximum temperature rise and allows the application of a roving thermocouple anywhere on the specimen. In BS 476:Part 20:1987 there is a requirement to measure temperatures at specified minimum number 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:Part 20:1987 are relatively different in terms of the positioning of thermocouples as noted above.

B.2.8 Application of referenced test data to AS 1530.4:2014 and AS 4072.1:2005.

- The variations in furnace heating regimes, furnace pressure conditions, 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.
- However, the BS 476:Part20:1987 is known to be less onerous than AS 1530.4:2014 with respect to the application of cotton pads to determine integrity failure.
- The requirement for having at least two thermocouples on the separating element was not strictly followed as described in the supplement to report TE 82045.
- Based on the above, it is considered that the results of the referenced report (supplement to LPC TE 82045) cannot be used to conduct an assessment in strict accordance with AS 1530.4:2014 and AS 4072.1:2005. Therefore, the likely fire resistance performance of the systems is assessed only in general accordance with these standards. FRLs are not prescribed for the proposed systems.