



Fire assessment report

Fire rated foam Sabre Fix FRF in vertical linear joints

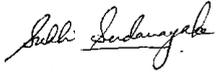
Sponsor: Sabre Adhesives

Product: Sabre Fix FRF

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Quality management

Version	Date	Information about the report			
R1.0	Issue: 30 Jun 2022	Reason for issue	Initial issue.		
	Expiry: 31 Aug 2025	Name Signature	Prepared by	Reviewed by	Authorised by
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Executive summary

This report documents the assessment undertaken to determine the expected fire resistance level (FRL) of linear joints protected with polyurethane fire rated foam Sabre Fix FRF and galvanized steel flashings in lightweight concrete block walls – accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

The analysis conducted in section 4 of this report found that the proposed linear seals are expected to achieve the FRLs shown in Table 1, in accordance with AS 1530.4:2014 and AS 4072.1:2005.

Table 1 Variations and assessment outcome

No.	Joint width (mm)	Joint depth (mm)	Fire Resistance Level (FRL)
A	40	100	-/90/30
B	30		-/90/30
C	20		-/90/45
D	15		-/240/45
E	10		-/240/60
F	60	200	-/120/90
G	40		-/180/90
H	30		-/240/120
I	20		-/240/180
J	10		-/240/240

Note: Sabre Fix FRF is applied from both sides of the wall (symmetric application).

The variations and outcome of this assessment are subject to the limitations and requirements described in section 2 and 5 of this report. The results of this report are valid until 31 August 2025.

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1. Introduction

This report documents the assessment undertaken to determine the expected fire resistance level (FRL) of linear joints protected with polyurethane fire rated foam Sabre Fix FRF and galvanized steel flashings in lightweight concrete block walls – in accordance with AS 1530.4:2014¹ and assessed in accordance with AS 4072.1:2005².

This assessment was carried out at the request of Sabre Adhesives. The sponsor details are included in Table 2.

Table 2 Sponsor details

Sponsor	Address
Sabre Adhesives	40-42 Cambridge Street South Lenin 5510 New Zealand

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. We have therefore followed the Guide to Undertaking Assessments In Lieu of Fire Tests prepared by the Passive Fire Protection Federation (PFPF) in the UK³.

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.

2.1 Limitations of assessment

- 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 assessed in accordance with AS 4072.1:2005.
- The results of this assessment are applicable to fire exposure from either direction for walls but not simultaneously.

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.

² Standards Australia (2005) *Components for the protection of openings in fire-resistant separating elements Part 1: Service penetrations and control joints*, AS 4072.1:2005

³ Passive Fire Protection Forum (PFPF) 2019, *Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence*, Passive Fire Protection Forum (PFPF), UK

- This report is only valid for the assessed system. 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.
- 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.

2.2 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 on 16 May 2022, Sabre Adhesives 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. Description of the specimen and variations

3.1 System description

The assessment report references fire test report 770-18TV, which details the fire resistance performance – in terms of insulation and integrity – of ten vertical 1000 mm long linear joints with varying widths in rigid lightweight concrete block walls of 100 mm and 200 mm thicknesses. The linear joints were protected with a sealant identical to Sabre Fix FRF and galvanized steel flashings.

3.2 Referenced test data

The assessment of the variation to the tested system and the determination of the expected performance is based on the results of the fire test documented in the reports summarised in Table 3. Further details of the tested system are described in Appendix A.

Table 3 Referenced test data

Report number	Test sponsor	Test date	Testing authority
770-18TV	Sponsor known to Warringtonfire	26 November 2018	TÜV Eesti OÜ

3.3 Variations to the tested system

An identical linear sealing system has not been subjected to a standard fire test in accordance with AS 1530.4:2014. We have therefore assessed the different systems using baseline test information for similar systems tested in accordance with EN 1366-4:2006⁴ and EN 1363-1:2012⁵. The variations to the tested systems, together with the referenced standard fire tests, are described in Table 4.

Table 4 Variation to tested systems

Item	Reference test	Description	Variations
1	770-18TV	The referenced tests were conducted in accordance with BS EN 1366-4:2006 and EN 1363-1:2012.	The proposed variation is to assess the expected fire resistance performance of linear seals in accordance with AS 1530.4:2014 and AS 4072.1:2005.

3.4 Purpose of the test

Section 2 of AS 1530.4:2014 specifies the general requirements for conducting fire resistance tests. Section 10 of AS 1530.4:2014 gives guidelines for determining the fire resistance of elements of construction penetrated by services such as control joints. As per section 10.3 of AS 1530.4:2014, the purpose of the test covering service penetrations and control joints is to assess-

- (a) The effect of the penetration or control joint on the integrity and insulation of the element
- (b) Insulation or integrity failure of the penetrating service or control joint

AS 4072.1:2005 sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems. These include control joints between building elements that are required to have a fire resistance level (FRL).

3.5 Schedule of components

Table 5 outlines the schedule of components for the assessed system subject to a fire test, as referenced in Appendix A.

Table 5 Schedule of components of assessed system

Item	Description
Substrate	Lightweight concrete block walls (density: $650 \pm 100 \text{ kg/m}^3$; thickness: 100 mm and 200 mm) built according to European Standard EN 1363-1 and conditioned for 28 days.
Foam sealant	Sabre Fix FRF fire rated sealant made of polyurethane foam. Applied to the joints from both sides of the wall and excessive foam cut as required a day after application. Foam density of hardened material is declared by the manufacturer to be within limits of 20-25 kg/m^3 .
Flashing	All joints were covered with galvanized steel flashings of 0.5 mm thickness on both sides and were fixed with steel screws.

⁴ BS EN 1366-4:2006: European Committee for Standardization 2006, *Fire resistance tests for service installations, Part 4: Linear joint seals*, BS EN 1366-4:2006, European Committee for Standardization, Brussels, Belgium.

⁵ BS EN 1363-1:2012: European Committee for Standardization 2012, *Fire resistance tests: General requirements*, BS EN 1363-1:2012, European Committee for Standardization, Brussels, Belgium.

4. Assessment of expected fire performance with respect to AS 1530.4:2014 and AS 4072.1:2005

4.1 Description of variation

This assessment refers to fire test report 770-18TV, which details the testing of ten linear joint seals in rigid lightweight concrete block walls protected with a foam sealant identical to Sabre Fix FRF and galvanized steel flashings.

This test was conducted in accordance with BS EN 1366-4:2006+A1:2010 and EN 1363-1:2012 and it has been proposed to assess the expected fire resistance performance of the linear seals in accordance with AS 1530.4:2014 and AS 4072.1:2005. The likely differences in fire resistance performance of the linear seals in accordance with AS 1530.4:2014 and AS 4072.1:2005 are discussed below.

4.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Comparative

4.3 Assessment

4.3.1 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 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 thermocouples specified in EN 1363-1:2012 are 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, contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter of 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/m³.

The relative location of the furnace thermocouples to the exposed face of the specimen is $100 \text{ mm} \pm 10 \text{ mm}$ in AS 1530.4:2014 and $100 \text{ mm} \pm 50 \text{ mm}$ in EN 1363-1:2012.

The furnace control thermocouples required by EN 1363-1:2012 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 1363-1:2012, particularly when the furnace temperature is changing quickly in the early stages of the test.

4.3.2 Furnace pressure regime

It is a requirement of AS 1530.4:2014 that for vertical elements with more than 1 m height, a furnace pressure of 20 ± 3 Pa shall be established at the top of the separating element and all the penetration services shall have a pressure greater than 10 Pa. Similarly, as per BS EN 1366-4:2006, a vertical furnace shall be operated so that a minimum pressure of 15 Pa exists in the centre of the test specimen mounted in the lowest position. In test 770-18TV, the minimum furnace pressure at the centre of the lowermost test specimen was maintained at 15 ± 2 Pa.

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.

4.3.3 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 900 mm can be used.

AS 1530.4:2014 states that the length of the control joint exposed to the furnace chamber shall not be less than 1 m.

The linear seals tested in the referenced test report all have a length of 1 m. Therefore, they are compliant with the requirements of AS 1530.4:2014.

4.3.4 Integrity performance criteria

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 or other conditions on the unexposed face which ignite the cotton pad when applied for up to 30 seconds.

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

- 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 technical variations, the integrity criteria in EN 1363-1:2012 can generally be applied in a comparable manner. However, it must be noted that EN 1366-4:2006+A1:2010 stipulate that gap gauges shall not be used.

4.3.5 Specimen temperature measurement and insulation performance criteria

For linear seals, AS 1530.4:2014 specifies the following requirements when placing thermocouples on the unexposed face in clause 10.5.1 (f).

- At least three on the surface of the seal, with one thermocouple for each 0.3 m² of surface area, up to a maximum of five, uniformly distributed over the area (one thermocouple being located at the centre of the seal)
- On the surface of the seal, 25 mm from the edge of the opening, with one thermocouple for each 500 mm of the perimeter.
- On the surface of the separating element, 25 mm from the edge of the opening, with one thermocouple for each 500 mm 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 seals 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 12 mm. Under such circumstances, the size of the pad may be reduced to facilitate the fitting of the thermocouple.

A review of BS EN 1366-4:2006 thermocouple requirements shows that it is recommended for the unexposed side thermocouples to be placed on the separating element at a distance of not more than 15 mm from the joint seal. However, apart from this slight variation in the thermocouple location, the general insulation criteria of AS 1530.4:2014 and BS EN 1366-4:2006 are not appreciably different.

4.3.6 Application of test data to AS 1530.4:2014

The variations in furnace pressure, 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.

It is noted that in test report 770-18TV, three thermocouples were placed on the surface of the seal, with one thermocouple being located at the centre of the seal. Therefore, it fulfills the requirements of AS 1530.4:2014, which stipulates that at least 3 thermocouples should be placed on the surface of the seal.

However, the unexposed surface thermocouples were placed 15 mm away from the edge of the opening in the separating element. In contrast, AS 1530.4:2014 requires thermocouples to be placed 25 mm from the edge of the opening. Therefore, as BS EN 1366-4:2006 locations are more onerous, if these thermocouples were to be placed as per AS 1530.4:2014, the insulation performance is expected to be similar or better than the test results.

Furthermore, even though AS 1530.4:2014 requires a gap gauge to be used to determine integrity failure, test report 770-18TV details no observations that warrant the use of a gap gauge.

Based on the above discussion, it is considered that the results relating to the integrity and insulation performance of the referenced test can be used as a basis to assess the FRL of the specimens in accordance with AS 1530.4:2014 and AS 4072.1:2005.

4.4 Conclusion

This assessment demonstrates that the linear joints protected with fire rated foam Sabre Fix FRF and galvanized steel flashings in lightweight concrete block walls are expected to achieve the FRLs shown in Table 7 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

Table 7 Assessment outcome for Sabre Fix FRF foam sealant in linear joints in walls

No.	Joint width (mm)	Joint depth (mm)	Fire Resistance Level (FRL)
A	40	100	-/90/30
B	30		-/90/30
C	20		-/90/45
D	15		-/240/45
E	10		-/240/60
F	60	200	-/120/90
G	40		-/180/90
H	30		-/240/120
I	20		-/240/180
J	10		-/240/240

Note: Sabre Fix FRF is applied from both sides of the wall (symmetric application).

5. 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 expected 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 Sabre Adhesives 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 Test report – 770-18TV

Table 8 Information about test report

Item	Information about test report
Report sponsor	Report sponsor known to Warringtonfire Australia.
Test laboratory	TÜV Eesti OÜ, Vana-Narva mnt. 24B
Test date	The fire resistance test was completed on 26 November 2018.
Test standards	The test was done in accordance with EN 1366-4:2006+A1:2010 and EN 1363-1:2012.
Variation to test standards	Specimen was stored in the test hall from 2 November 2018 to 26 November 2018 where the relative humidity was $20 \pm 10\%$ and temperature was $20 \pm 2^\circ\text{C}$
General description of tested specimen	<p>The tested product is a polyurethane fire rated foam sealant identical to Sabre Fix FRF.</p> <p>The specimens (labelled A-J) comprised of ten vertical 1000 mm long linear joints with varying widths in rigid lightweight concrete block walls of 100 mm and 200 mm thicknesses. The internal dimensions of the furnace were 3200 mm x 3200 mm.</p> <p>The joint seals consisted of sealant and covering material. The foam was applied to the joints from both sides of the wall and excessive foam was cut away a day after application. All joints were covered with steel flashings (galvanized steel, 0.5 mm thickness) from both sides and were fixed with screws. The density of the foam in its hardened state is declared by the manufacturer to be within the limits of 20-25 kg/m³.</p>
Instrumentation	The test report states that the instrumentation was in accordance with EN 1366-4:2006+A1:2010 and EN 1363-1:2012.

The test specimen achieved the following result in Table 9:

Table 9 Results summary for this test report

No.	Joint width (mm)	Joint depth (mm)	Maximum temperature rise at the end of the test ΔT , $^\circ\text{C}$	$\Delta T \leq 180^\circ\text{C}$, Test time (min)	Ignition of the cotton pad (min:sec)	Sustained flaming on the unexposed side
A	40	100	-	39	98:15	No
B	30		-	44		No
C	20		-	54	100:27	No
D	15		-	53	No	No
E	10		-	81	No	No
F	60	200	-	102	173:30	No
G	40		-	117	209:27	No
H	30		-	147	No	No
I	20		-	202	No	No
J	10		81	Did not exceed	No	No

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