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Fire assessment report

Fire rated foam Fulafoam FR and Fulafoam Pro FR in vertical linear joints

Sponsor: HB Fuller Australia Pty Ltd

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Quality management

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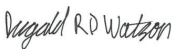
		Name	Dugald Watson	Mahmoud Akl	Yomal Dias
		Signature			

Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level of linear joints protected with polyurethane fire rated foam Fulafoam FR / Fulafoam Pro FR and galvanized steel flashings in lightweight concrete block walls if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

The analysis in section 5 of this report found that the proposed linear seals, together with the described variations, are expected to achieve the fire resistance levels as shown in Table 1, if tested in accordance with AS 1530.4:2014.

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: Fulafoam FR / Fulafoam Pro FR 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 sections 2, 3 and 6 of this report. The results of this report are valid until 31 August 2025.

Contents

1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of linear joints protected with polyurethane fire rated foam Fulafoam FR / Fulafoam Pro FR and galvanized steel flashings in lightweight concrete block walls if tested 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 HB Fuller Australia Pty Ltd.

The sponsor details are included in Table 2.

Table 2 Sponsor details

Sponsor	Address
HB Fuller Australia Pty Ltd	16-22 Redgum Drive Dandenong South 3175 Vic 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 2019[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 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 (Reconfirmed 2016), AS 4072.1:2005 (R2016), Standards Australia, NSW.
[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 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 14 September 2021, HB Fuller 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 and assessed in accordance with AS 4072.1:2005.
- This assessment is applicable to wall systems exposed to fire from each 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 systems 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 Accredited Testing Laboratory (ATL).
- The documentation that forms the basis for this report is listed in Appendix A.

[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

- 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.
- 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 the 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 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 polyurethane fire rated foam Fulafoam FR / Fulafoam Pro FR and galvanized steel flashings.

4.2 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 included in Appendix A.

Table 3 Referenced test data

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

4.3 Variations to the tested system

An identical system has not been subject to a standard fire test in accordance with AS 1530.4:2014. We have therefore 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 4.

Table 4 Variation to tested systems

Item	Reference test	Description	Variations
1	770-18TV	The referenced test was conducted in accordance with BS EN 1366-4:2006[7] and BS EN 1363-1:2012[8].	The proposed variation is to assess the likely fire resistance performance of linear seals if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005.

4.4 Test and assessment standards

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

[7] European Committee for Standardization, 2006, Fire resistance tests for service installations – Linear joint seals, BS EN 1366-4:2006, European Committee for Standardization, Brussels, Belgium.
[8] European Committee for Standardization, 2012, Fire resistance tests – General requirements, BS EN 1363-1:2012, European Committee for Standardization, Brussels, Belgium.

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).

4.5 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 ± 100 kg/m^3; thickness: 100 mm and 200 mm)
Foam sealant	Fulafoam FR / Fulafoam Pro FR fire rated sealant made of polyurethane foam. Applied to the joints from both sides of the wall Foam density of hardened material is declared by the manufacturer in limits between 20-25 kg/m^3.
Flashing	All joints were covered with galvanized steel flashings of 0.5 mm thickness from both sides and were fixed with steel screws.

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

5.1 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 polyurethane fire rated foam Fulafoam FR / Fulafoam Pro FR and galvanized steel flashings.

This test was conducted in accordance with BS EN 1366.4:2006+AI:2010 and EN 1363.1:2012 and it has been proposed to assess the likely fire resistance performance of the linear seals if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005. The likely differences in fire resistance performance of the linear seals if tested in in accordance with AS 1530.4:2014 and AS 4072.1:2005 are discussed below.

5.2 Methodology

The method of assessment used is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Comparative

5.3 Assessment

5.3.1 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 of 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 plates that face 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 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 mm ± 10 mm in AS 1530.4:2014 and 100 mm ± 50 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.

5.3.2 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 must be established at the top of the separating element and all the penetration services must have a pressure greater than 10 Pa. Similarly, as per BS EN 1366.4:2006, a vertical furnace must 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 maintain 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.

5.3.3 Specimen size

BS EN 1366.4:2006 states that a linear joint seal must 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 must 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.

5.3.4 Integrity performance criteria

In accordance with AS 1530.4:2014, while a specimen maintains its insulation performance, the specimen must 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 must 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.

Gap gauges are not required to be used in accordance with section 10 of AS 1530.4:2014 and BS EN 1366-4:2006 +A1:2010..

5.3.5 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 m^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)
- 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 must 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 must 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 show 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.

5.3.6 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 the AS 1530.4:2014, the insulation performance is expected to be similar or better than the test results.

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 if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005.

5.4 Assessment outcome

This assessment demonstrates that the linear joints protected with fire rated foam Fulafoam FR / Fulafoam Pro FR and galvanized steel flashings in lightweight concrete block walls are expected to achieve the FRLs shown in Table 7 if they were tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

Table 7 Assessment outcome for Fulafoam FR / Fulafoam Pro FR 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: Fulafoam FR / Fulafoam Pro FR is applied from both sides of the wall (symmetric application).			

6. 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 of the proposed systems 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 HB Fuller Australia Pty Ltd for their own specific purposes. This report may be used as Evidence of Suitability in accordance 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 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 done on 26 November 2018.
Test standards	The test was done in accordance with EN 1366.4:2006+AI: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 ± 10% and temperature was 20 ± 2°C
General description of tested specimen	The tested product is fire rated foam identical to Fulafoam FR / Fulafoam Pro FR linear joint sealant consisting of polyurethane foam. 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 × 3200 mm. The joint seals consisted of sealant and covering material. A foam identical to Fulafoam FR / Fulafoam Pro FR 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 in the limits of 20-25 kg/m^3.
Instrumentation	The test report states that the instrumentation was in accordance with EN 1366.4:2006+AI:2010 and EN 1363.1:2012.

The test specimen achieved the following results – see 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, °C	ΔT ≤ 180°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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