Fire assessment report

Performance of FulaFlex FR Hybrid sealant in wall control joints in accordance with AS 1530.4:2014 and AS 4072.1-2005.

Client: H B Fuller Australia Pty Ltd

Product: FulaFlex FR Hybrid sealant

Report number: FAS190359 Revision: R1.0

Amendment schedule

Version	Date	Information relating to report			
R1.0	Issue: 12/12/2019	Reason for issue	Report issued to H B Fuller Australia Pty Ltd for review and comment.		
			Prepared by	Reviewed by	Approved by
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Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance performance of H B Fuller FulaFlex FR Hybrid sealant protecting control joints in walls if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1-2005.

The analysis conducted in section 5 of this report found that the proposed variations are likely to achieve the fire resistance performance as shown in Table 1, if tested in accordance with AS 1530.4:2014 and AS 4072.1-2005.

Table 1 Variations and assessment outcome

Referenced Test report	Product	Concrete wall thickness (mm)	Maximum control joint width (mm)	Minimum sealant depth (mm)	Sealant location	Tested and assessed FRL for heat exposure from either side
FRT 190354.1	H B Fuller FulaFlex FR Hybrid sealant	120 (as tested in FRT 190354.1)	10	10	On both sides	-/240/120
			20	10		-/240/120
			30	15		-/240/120
			40	20		-/240/120
			50	25		-/240/120
		150	10	10		-/240/180
			20	10		-/240/180
			30	15		-/240/180
			40	20		-/240/180
			50	25		-/240/180
		170	10	10		-/240/240
			20	10		-/240/240
			30	15		-/240/240
			40	20		-/240/240
			50	25		-/240/240
Note that the above results are assessed as being applicable for the corresponding wall in concrete masonry blocks of equivalent FRL and 120mm minimum thickness. The assessed FRL would apply to all five control joint widths listed above with the performance matching the corresponding concrete masonry block's established integrity and insulation fire resistance level ie. FRL of -/120/120, -/180/180 and -/240/240.						

The variations and outcome of this assessment are subject to the limitations and requirements described in section 2, 4 and 6 of this report. The results of this report are valid until 31 December 2024.

Contents

1. Introduction

This report documents the findings of the assessment undertaken to determine the likely fire resistance performance of H B Fuller FulaFlex FR Hybrid sealant protecting control joints in walls if tested in accordance with AS1530.4:2014 and assessed in accordance with AS 4072.1-2005.This assessment was carried out at the request of H B Fuller Australia Pty Ltd. The sponsor details are included in Table 2.

Table 2 Sponsor details

Client	Address
H B Fuller Australia Pty Ltd	16~22 Red Gum Drive Dandenong South VIC 3175 Australia

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[1].

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 Limitations of assessment

The results of this assessment are applicable to control joints in concrete or concrete masonry block walls protected by H B Fuller FulaFlex FR Hybrid sealants applied with the minimum specified sealant depths on both sides for the corresponding maximum specified joint widths and with exposure from either side.

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 dated 4 December 2019, H B 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.

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

- 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 system and variations

3.1 Tested system description

This assessment is based on reference tests FRT190354.1, being a test on control joints in a concrete wall protected by H B Fuller FulaFlex FR Hybrid sealant in accordance with AS 1530.4:2014. The tests were sponsored by HB Fuller Australia and was conducted by Warringtonfire Australia Pty Ltd.

Refer to Appendix A for a full summary of the test data.

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 test FRT 190354 conducted at Warringtonfire Australia Pty Ltd's test laboratory located at Unit 2, 409~411 Hammond Road, Dandenong South, Victoria. The test sponsor was H B Fuller Australia Pty Ltd. Details of the test report are available in Appendix A.

3.3 Variations to tested system

The proposed construction shall be as tested in FRT 190354.1 with control joints in a 120mm thickness concrete wall of a series of widths protected by H B Fuller FulaFlex FR Hybrid sealant. Consideration is given for varying the concrete thickness to 150mm and 170mm and the inclusion of a 30mm control joints protected by sealant on both sides to a depth of 15mm as tabled below:

Table 3 Schedule of control joints protected by H B Fuller FulaFlex FR Hybrid sealant as tested and variation in wall thickness and joint width

Separating element concrete wall thickness (mm)	Maximum joint width (mm)	Minimum sealant depth (mm)	Sealant location
120 (as tested)	10	10	Both exposed and unexposed sides
	20	10	
	30	15	
	40	20	
	50	25	
150	10	10	
	20	10	
	30	15	
	40	20	
	50	25	
170	10	10	
	20	10	
	30	15	
	40	20	
	50	25	

3.4 Purpose of the test

AS 4072.1-2005 prescribes the requirements for the testing of control joints in accordance with the test method in AS 1530.4:2014. The results from the test in accordance with AS 1530.4:2014 provide the fire resistance performance of the specimen sealant in protecting the control joints and maintaining the fire resistance levels of the separating wall.

3.5 Schedule of components

Table 4 outlines the schedule of components for the assessed systems subject to a fire test, as referenced in 0.

Table 4 Schedule of components for control joints tested in FRT 190354.1

Item	Description	
Separating element		
1	Item name	Concrete wall strips
	Product name	120 mm thick concrete
	Density	2400 kg/m^3 (measured)
	Installation	The concrete strips were precast and stored at Warringtonfire Australia (WFA). The concrete strips were aligned as per the varying control joint sizes. The concrete strips were supported at both edges by parallel flange channel (PFC). Masonry anchors were used to fix the concrete strips to the PFCs.
Fire-stopping protections		
Sealant		
2	Item name	Sealant
	Product name	HB Fuller – Fulaflex FR hybrid
	Density	1822 kg/m^3 (measured)
	Installation	The sealant was installed in the control joints as detailed in various control joint descriptions below.
Backing Rod		
3	Item name	Open cell backing rod
	Product name	Polyethylene
	Size	20 × 20 mm and 28 × 20 mm
	Installation	The backing rods were installed in all the control joints as detailed in various control joint descriptions below.
Control joint A		
A	Control joint detail	Control Joint - nominally 1000 mm long × 10 mm wide, 10 mm deep protection on both sides.
	Local fire-stopping protection	
	Protection	The sealant (item 2) was applied into the control joint to the depth of 10 mm and finished flush on both exposed and unexposed sides. 20 mm × 20 mm backing rod was installed into the control joint behind the sealant as support. See Figure 1 to Figure 3 for more details.
Control joint B		
B	Control joint detail	Control Joint - nominally 1000 mm long × 20 mm wide, 10 mm deep protection on both sides.
	Local fire-stopping protection	

Item	Description	
	Protection	The sealant (item 2) was applied into the control joint to the depth of 10 mm and finished flush on both exposed and unexposed sides. 28 mm × 20 mm backing rod was installed into the control joint behind the sealant as support. See Figure 1 to Figure 3 for more details.
Control joint C		
C	Control joint detail	Control Joint - nominally 1000 mm long × 40 mm wide, 20 mm deep protection on both sides.
	Local fire-stopping protection	
	Protection	The sealant (item 2) was applied into the control joint to the depth of 10 mm and finished flush on both exposed and unexposed sides. 28 mm × 20 mm and 20 mm × 20 mm backing rods were installed into the control joint behind the sealant as support. See Figure 1 to Figure 3 for more details.
Control joint D		
D	Control joint detail	Control Joint - nominally 1000 mm long × 50 mm wide, 25 mm deep protection on both sides.
	Local fire-stopping protection	
	Protection	The sealant (item 2) was applied into the control joint to the depth of 10 mm and finished flush on both exposed and unexposed sides. 2 × 28 mm × 20 mm backing rods were installed into the control joint behind the sealant as support. See Figure 1 to Figure 3 for more details.

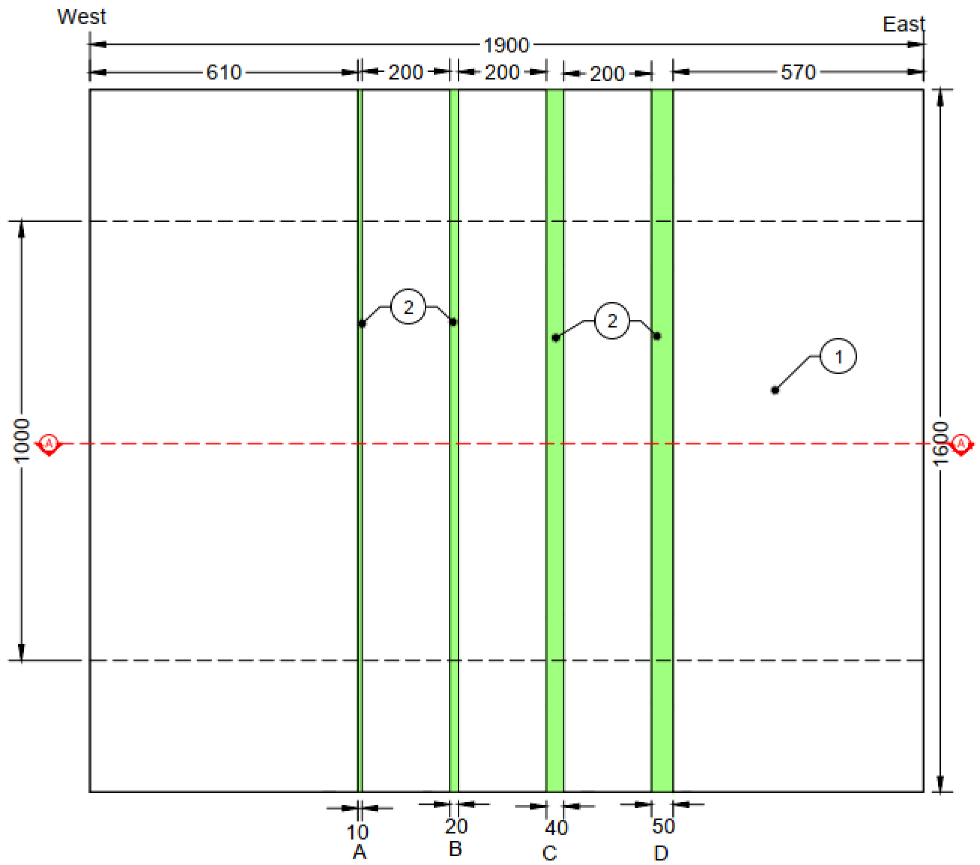

Figure 1 Elevation view of test specimen from the unexposed side

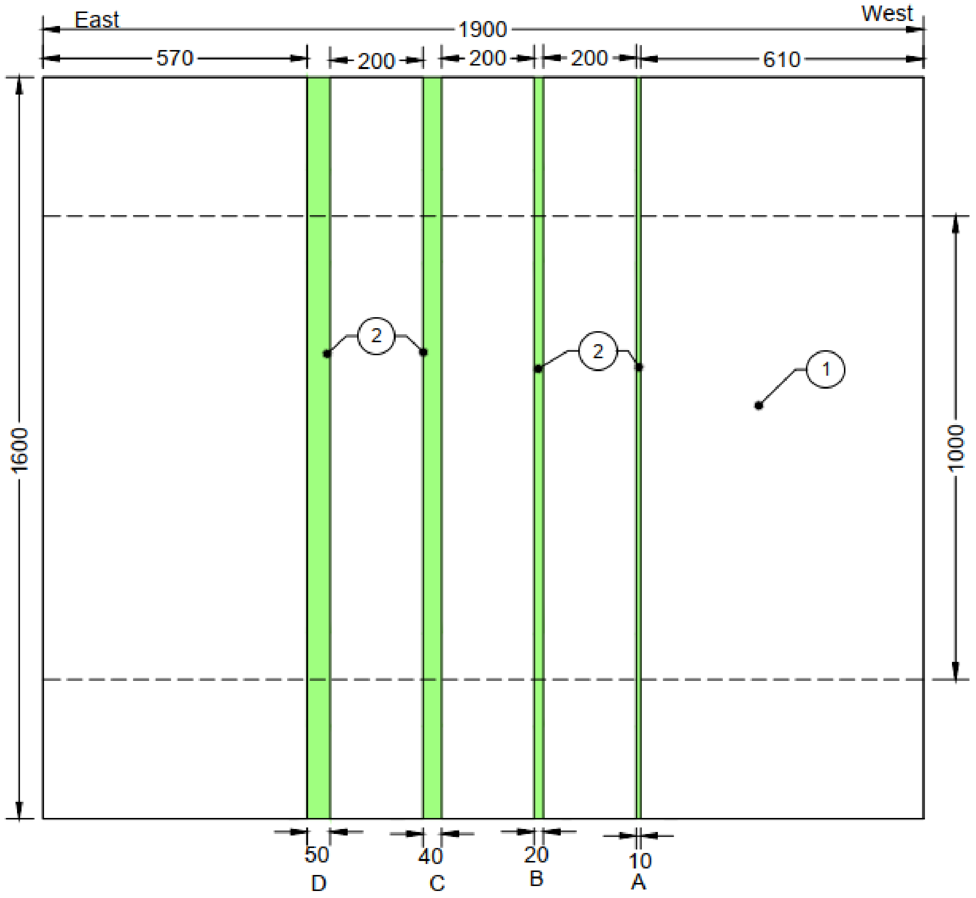

Figure 2 Elevation view of test specimen from the exposed side

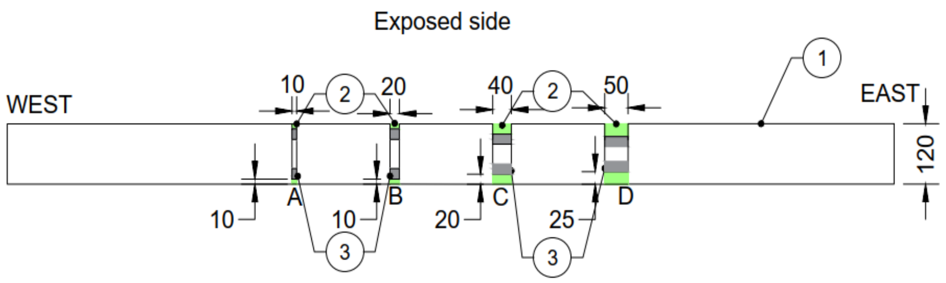

Figure 3 Cross section A-A

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 AS1530.4:2014 and AS4072.1-2005.
- The results of this assessment are applicable to control joints in concrete or solid concrete masonry block walls.
- This report is only valid for the assessed system/s. 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 system/s 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 of variations to control joints protected by H B Fuller FulaFlex FR Hybrid sealant

5.1 Description of variations

The proposed construction shall be as tested in FRT 190354.1 in accordance with AS 1530.4:2014 with control joints in 120mm thickness concrete wall of a series of widths protected by H B Fuller FulaFlex FR Hybrid sealant with consideration for the following variations:

- Varying the concrete wall thickness from 120mm as tested to 150mm
- Varying the concrete wall thickness from 120mm as tested to 170mm
- Replacing the 120mm, 150mm and 170mm thick concrete walls with equivalent concrete masonry block walls of equivalent established FRL’s to those of the corresponding concrete walls
- Adding a 30mm wide control joint with sealant applied to both sides each to a depth of 15mm

This assessment was undertaken to determine the likely performance of the system if tested in accordance with AS 1530.4:2014 and AS 4072.1-2005.

5.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 5.

Table 5 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Quantitative – interpolation and comparative

5.3 Assessment of variations

The control joints incorporating the H B Fuller FulaFlex FR Hybrid sealant in test FRT 190354.1 was tested with a 120mm thick concrete wall for an exposure duration of 241 minutes. The concrete wall held integrity for the full duration but apparently tended towards heat saturation after 135 minutes exposure. The wall temperature had a steeper temperature and failed insulation performance after about 165 minutes into the test. It is evident that the 120mm concrete will not hold its insulation performance beyond 165 minutes. The following discussion will address the insulation performance and review the results to form an opinion on the expected performance of sealant in the control joints.

Varying the concrete wall thickness to 150mm.

Test specimen control joint A did not have a thermocouple installed in the sealant within the joint gap as it could not be physically fitted. The temperatures recorded were therefore only those on the concrete wall surface adjacent to the control joint.

The temperatures recorded in Control joints B, C and D (refer to Figure 5 to Figure 7 and Table 9) showed the temperatures in the sealant on the unexposed side were all below 200°C (or within the insulation performance for 180 minutes exposure) after 180 minutes of exposure. The temperatures on the concrete surface adjacent to the joints, however, exceeded 200°C. This is due to the fact that the 120mm concrete wall has an established FRL of -/120/120. It is evident that the sealant continued to perform to at least 180 minutes in insulation uninfluenced by the higher surrounding temperature of the concrete.

Temperatures recorded for control joint A were only those for the concrete wall surface adjacent to the joint. From observations of the temperatures for control joints B, C and D, the temperatures recorded in the sealant on the unexposed side were all below the concrete surface temperatures. It is fair to deduce that the temperature in the sealant on the unexposed side of control joint A will be either equal or lower than the temperature on the wall surface adjacent to the joint.

If the concrete wall were to be increased in thickness to at least 150mm, the expected temperature of the concrete would be within the limits for insulation performance for 180 minutes. The reason is that the 150mm thick concrete wall is expected to perform to its established FRL or -/180/180.

From the above discussion, it is considered that the control joints A, B, C and D will perform to at least 180 minutes in integrity and insulation or an FRL of -/180/180.

Varying the concrete wall thickness to 180mm.

Figure 5 to Figure 7 show that the sealant temperature in control joint C after 240 minutes exposure was less than 200°C but increased to more than 200°C as the joint gap decreased in control joint C and B. It appears that as the control joint is reduced in width from 50mm in control joint D to 20mm in control joint B, the influence of the higher concrete temperature along the sides walls within the joint gap becomes more dominant as the gap narrows. The effects are shown with the narrowing of the temperature difference between temperature graph for the sealant and that for the concrete surface reduces as the control joint width decreases.

It is therefore reasonable to deduce that if the concrete temperature were held to within 200°C, there will be reduced heat transfer from the concrete to the sealant as the temperature of the sealant will be only slightly lower than that of the concrete. Increasing the concrete wall thickness to 170mm would result in having a concrete temperature (on the unexposed side) to no more than 200°C, i.e. the concrete will maintain its insulation performance for up to 240 minutes as 170mm thick concrete has an established FRL of -/240/240.

Control joints B, C and D would therefore have an insulation performance of at least that of the 170mm thick concrete and adding to the tested integrity performance of 240 minutes, the control joints would have an FRL of -/240/240.

Similarly, as the sealant temperatures are likely to be no more than the concrete surface temperature, the control joint A will likely have a sealant temperature on the unexposed side after 240 minutes of exposure of less than 200°C in a 170mm thick wall system. It is therefore considered that control joint A will perform up to an FRL of -/240/240 in a 170mm thick concrete wall system.

Replacing each of the concrete wall system with a solid concrete masonry block wall of equivalent FRL

The test conducted on control joints in concrete walls may be applied to solid concrete masonry block walls provided that the wall system has an equivalent FRL to the concrete wall and that the wall thickness is equal or thicker.

The test data indicates that the FulaFlex FR Hybrid sealant achieved an integrity performance up to 240 minutes when applied to both sides of the control joints in a 120mm thick concrete wall. The insulation performance of the sealant appears to track that of the wall system, The sealant is therefore expected to perform equally in a similar type of construction such as solid concrete masonry block walls provided the walls are not less than 120mm thick and that the walls would perform to the required FRL ie. -/120/120, -/180/180 and -/240/240.

Adding a 30mm control joint protected by the FulaFlex FR Hybrid sealant applied on both sides

From an analysis of the overall performance of the sealants in the control joints tested in FRT 190354.1, it is evident that the minimum required sealant depth in order to maintain the required FRL is half the joint width, i.e. a depth of 25mm for a 50mm width joint and 10mm for a 20mm width joint. The minimum sealant depth is held at 10mm as there is insufficient test data to interpolate for joint widths less than 20mm.

The addition of a 30mm wide control joint protected by the FulaFlex FR Hybrid sealant applied to both sides to a depth of 15mm would therefore perform similarly to the control joints tested in FRT 190354.1 and assessed positively in the above discussion.

5.4 Conclusion

This assessment demonstrates that the control joints as tabled below are likely to achieve the established FRL of the concrete or concrete solid masonry block wall system if tested in accordance with AS 1530.4:2014 and AS 4072.1-2005. Since the application of the sealant for the control joints are to equal depths on both sides, the system is symmetrical and therefore would be applicable for heat exposure from either side.

Table 6 Summary of assessment

Product	Concrete wall thickness (mm) or concrete masonry block wall of equal FRLand 120mm minimum thickness	Maximum control joint width (mm)	Minimum sealant depth (mm)	Sealant location	Tested and assessed FRL for heat exposure from either side
H B Fuller FulaFlex FR Hybrid sealant	120 (as tested in FRT 190354.1)	10	10	On both sides	-/240/120
		20	10		-/240/120
		30	15		-/240/120
		40	20		-/240/120
		50	25		-/240/120
	150	10	10		-/240/180
		20	10		-/240/180
		30	15		-/240/180
		40	20		-/240/180
		50	25		-/240/180
	170	10	10		-/240/240
		20	10		-/240/240
		30	15		-/240/240
		40	20		-/240/240
		50	25		-/240/240

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 likely to be demonstrated on a test in accordance with AS1530.4:2014 and AS4072.1-2005, based on the evidence referred to in this report.

This assessment is provided to the H B Fuller 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 Test report – FRT 190354.1

Table 7 Information about test report

Item	Information about test report
Report sponsor	H B Fuller Australia Pty Ltd
Test laboratory	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.
Test date	The fire resistance test was completed on 18/11/2019.
Test standards	The test was done in accordance with AS1530.4-2014.
Ambient temperature	20°C at the start of the test.
Test Duration	241 minutes
Variation to test standards	The pressure varied up to 23 Pa from the prescribed test standard limits during the first 90 minutes of the test but was within the limits for the remainder of the test. Due to the nature of the specimen and the fact that no significant events occurred during these time periods, the variances in pressure are unlikely to have invalidated the test result. The temperature was up to 25 °C above the limits prescribed in the standard during the 45-46 minute period. The temperature was within the limits for the rest of the test. This over temperature resulted in the test conditions being more onerous and would not have invalidated the test result.
General description of tested specimen	The test specimen control joints were constructed from five concrete strips of 1600mm long and 120mm thick. Three of the strips were 200mm wide mounted centrally and the remaining two were 600mm and 570mm place on each side. The central strips were spaced at 10mm, 20mm, 40mm and 50mm apart forming the four specimen control joints. The strips were held together in a 1900mm wide by 1600mm frame.
Instrumentation	The test report states that the instrumentation was in accordance with AS1530.4:2014.

The test specimen achieved the following result:

Table 8 Results summary for this test report

Control joint	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	Not applicable	**-/240/120**
	Integrity	No failure at 241 minutes	
	Insulation	Failure at 171 minutes	
B	Structural adequacy	Not applicable	**-/240/120**
	Integrity	No failure at 241 minutes	
	Insulation	Failure at 165 minutes	
C	Structural adequacy	Not applicable	**-/240/120**
	Integrity	No failure at 241 minutes	
	Insulation	Failure at 166 minutes	
D	Structural adequacy	Not applicable	**-/240/120**
	Integrity	No failure at 241 minutes	
	Insulation	Failure at 173 minutes	

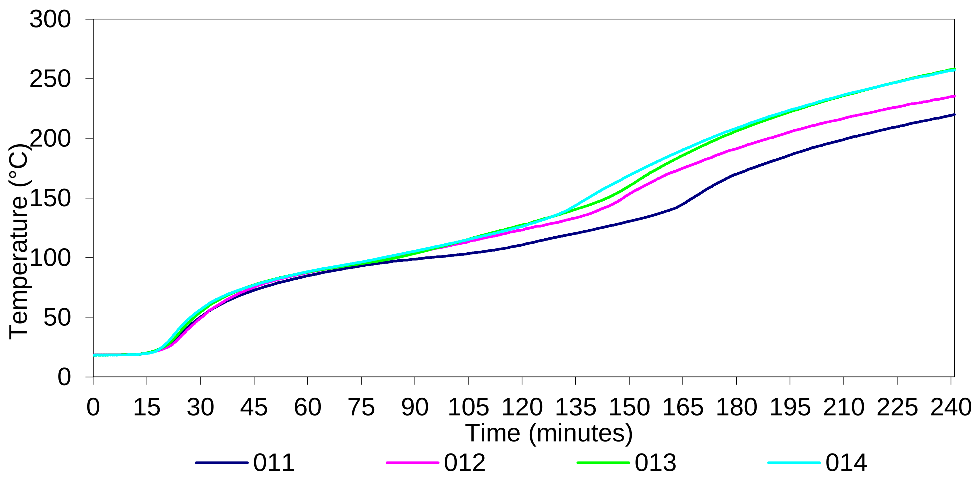

Figure 4 Control joint A – temperature vs time graph

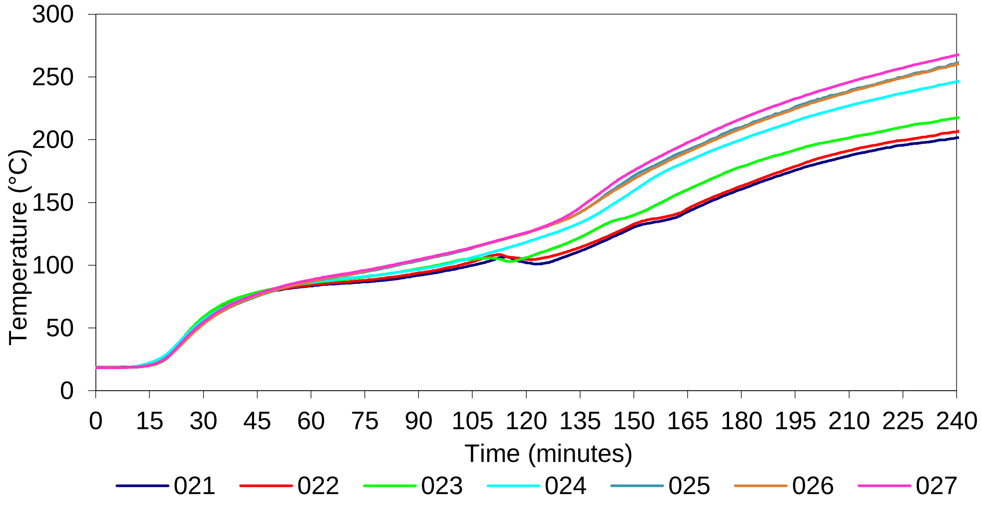

Figure 5 Control join B – temperature vs time graph

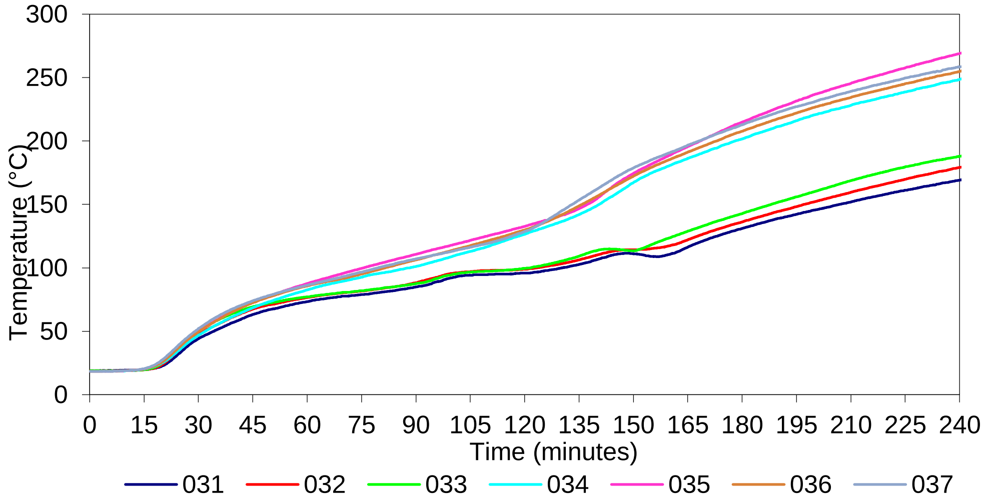

Figure 6 Control joint C – temperature vs time graph

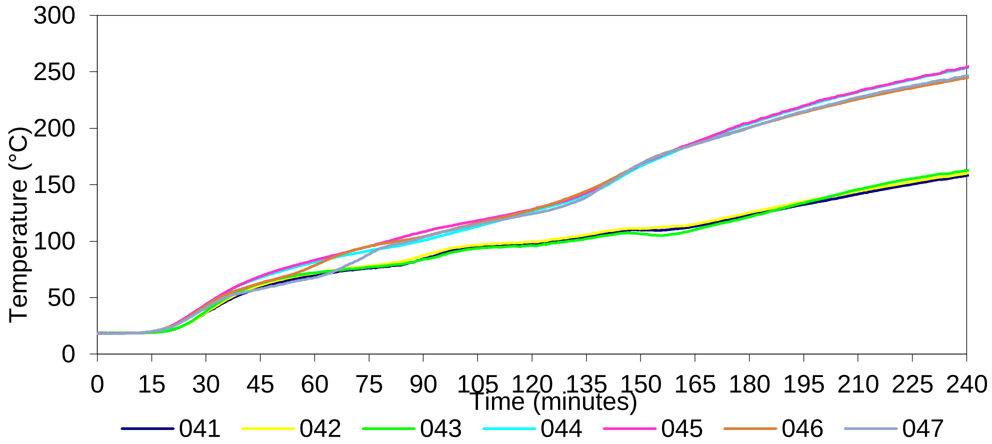

Figure 7 Control joint D – temperature vs time graph

Table 9 Test Specimen temperatures

Control joints	T/C no.	Description[2]	Temp (°C) at t (minutes)					Limit[1] (minutes)
			t=0	t=60	t=120	t=180	t=240	
A	011	On the separating element	18	84	111	170	219	209
	012	On the separating element	18	87	123	191	235	187
	013	On the separating element	18	88	127	206	257	173
	014	On the separating element	18	88	126	208	257	171
B	021	On control joint	19	83	102	160	201	232
	022	On control joint	19	84	105	163	206	222
	023	On control joint	18	86	106	178	217	204
	024	On the separating element	18	86	118	200	246	178
	025	On the separating element	18	87	126	210	260	170
	026	On the separating element	18	87	125	209	259	171
	027	On the separating element	18	88	126	217	267	165
C	031	On control joint	19	73	96	131	169	-
	032	On control joint	19	76	99	136	179	-
	033	On control joint	19	77	100	143	188	-
	034	On the separating element	19	82	126	202	248	176
	035	On the separating element	19	87	133	215	269	167
	036	On the separating element	19	85	130	208	254	171
	037	On the separating element	19	86	129	213	258	166
D	041	On control joint	19	69	98	123	158	-
	042	On control joint	19	71	99	125	160	-
	043	On control joint	19	72	96	121	162	-
	044	On the separating element	18	81	126	204	253	174
	045	On the separating element	18	83	128	205	254	173
	046	On the separating element	18	78	127	201	244	177
	047	On the separating element	18	67	124	200	246	178