

FIRE TEST REPORT

FP19882-01-1

THE FIRE RESISTANCE IN ACCORDANCE WITH AS 1530.4:2014 OF SIX DOUBLE LAYER CONTROL JOINTS INSTALLED IN A 120 MM THICK CONCRETE FLOOR SLAB

CLIENT
H.B. Fuller Company Australia Pty. Ltd
16-22 Red Gum Drive
Dandenong
South VIC 3175
Australia

All tests and procedures reported herein, unless indicated, have been performed in accordance with the laboratory's scope of accreditation

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TEST SUMMARY

Objective

To determine the fire resistance of control joint sealing systems in accordance with AS 1530.4:2014, *Fire-resistance tests for elements of construction: Section 10, Service penetrations and control joints*, with reference to AS 4072.1-2005.

Test Sponsor

H.B. Fuller Company Australia Pty. Ltd
16-22 Red Gum Drive
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Description of Test Specimen

The test specimen consisted of a nominally 2,400 mm long by 1,200 mm wide by 120 mm thick segmented concrete floor slab. The floor slab was provided with six nominally 1,000 mm long apertures which were sealed with various control joint sealing systems. The control joints were refenced A-F.

Date of Test

31 October 2024

Test Results

The fire resistance in minutes, in accordance with AS 1530.4:2014, of six double layer control joint systems installed in a 120 mm thick concrete floor slab, was as follows:

Specimen Ref	Control Joint Details Width x Depth	Integrity (min)	Insulation (min)	FRL*
A	1st - 25 mm x 25 mm FulaFlex™ FR 2nd - 25 mm x 15 mm FulaFlex™ FR	245 NF	139	-/120/120
B	1st - 25 mm x 25 mm FulaFlex™ FR 2nd - 25 mm x 15 mm FulaFlex™ FR	245 NF	172	-/120/120
C	1st - 35 mm x 30 mm FulaFlex™ FR 2nd - 35 mm x 20 mm FulaFlex™ FR	245 NF	173	-/120/120
D	1st - 35 mm x 30 mm FulaFlex™ FR 2nd - 35 mm x 20 mm FulaFlex™ FR	245 NF	182	-/120/120
E	UXF - 50 mm x 25 mm FulaFlex™ FR EXF - 50 mm x 25 mm FulaFlex™ FR	245 NF	202	-/120/120
F	UXF - 30 mm x 20 mm FulaFlex™ 620 EXF - 30 mm x 20 mm FulaFlex™ FR	245 NF	199	-/120/120

For Specimen A and Specimen C, the installation of the joints was from the exposed face (EXF) with the 2nd layer of FulaFlex™ FR located on the exposed face of the slab. For Specimen B and Specimen D, the installation of the joints was from the unexposed face (UXF) with the 2nd layer of FulaFlex™ FR located on the unexposed face of the slab.

NF = No Failure. The test was terminated after 245 minutes.

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*The test was conducted on a floor system with an established FRL of -/120/120. The maximum FRL of any test specimen cannot exceed the FRL achieved by the floor system in which it is installed.

The test standard requires the following statement to be included:

"The results of these fire tests may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions."

"This report details methods of construction, the test conditions and results obtained when the specific element of construction described herein was tested following the procedure outlined in this standard. Any significant variations with respect to size, constructional details, loads, stresses, edge or end conditions, other than those allowed under the field of direct application in the relevant test method, is not covered by this report."

"Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result."

LIMITATION

The results reported here relate only to the item/s tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

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DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	DESCRIPTION
01	12 November 2024	Initial Issue

1. TEST PROCEDURE

The control joint test was conducted in accordance with AS 1530.4:2014, “Methods for fire tests on building materials, components and structures, Part 4 *Fire-resistance tests for elements of construction: Section 10, Service penetrations and control joints,* with reference to AS 4072.1-2005 for which the fire resistance of the specimen is the time, expressed in minutes, to Integrity and Insulation failure under one or more of the following criteria.

1.1 Integrity Failure Criteria

Failure shall be deemed to occur if;

a) there is sustained flaming for a period greater than 10 seconds on the unexposed face; or

b) flames and/or hot gases cause flaming or glowing of the cotton fibre pad.

1.2 Insulation Failure Criteria

Failure shall be deemed to occur if;

a) the maximum temperature at any point on the unexposed surface of the control joint exceeds the initial temperature by 180 K; or

b) the maximum temperature on the unexposed surface of the surround element, 25 mm from control joint edge exceeds the initial temperature by 180 K.

2. DESCRIPTION OF THE TEST SPECIMEN

2.1 General

The test specimen consisted of a nominally 2,400 mm long by 1,200 mm wide by 120 mm thick segmented concrete floor slab. The floor slab was provided with six nominally 1,000 mm long apertures which were sealed with various control joint sealing systems. The control joints were refenced A-F.

2.1.1 Conditioning

The concrete blocks were cast on 19 December 2023. The control joint specimens were installed into their apertures on 25 September 2024. The specimens were kept under ambient laboratory conditions until testing on 31 October 2024.

2.1.2 Specimen Selection

BRANZ was responsible for the construction of the concrete floor slab, the client was responsible for the selection, supply and installation of the six control joint specimens.

2.1.3 Drawings and Specification

A client supplied drawing of the control joint specimens is shown in Figure 1.

Where discrepancies between the dimensions in the report text and those shown in the attached drawings exist, the text takes precedence.

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2.2 Control Joint Details

2.2.1 Control Joints A to D

Control Joints A to D were of an asymmetric-double caulked configuration comprising a 1st layer seal (internal) and 2nd layer seal (external). In all cases, the 1st layer seal is applied first. The application description that follows is based on application from the exposed face for Control Joint A and Control Joint C and from the unexposed face for Control Joint B and Control Joint D.

Nominally 20 mm thick backing rod was inserted into the aperture at a depth to suit the overall control joint configuration (1st and 2nd layers). The width of the backing rod was nominally 20% larger than the width of the aperture to allow for a compression fit. For Control Joint A and Control Joint B, the distance from the backing rod to the non-insertion face of the slab was nominally 40 mm, for Control Joint C and Control Joint D this was nominally 5 mm.

The 1st layer of FulaFlex™ FR sealant was applied directly onto the backing rod to the desired depth. The 2nd layer of backing rod was then inserted into the aperture to a depth corresponding to the desired depth of the 2nd layer of FulaFlex ™ FR sealant which was then applied and trowel finished flush to the insertion face of the slab.

An assumed nominal 25 mm air gap was provided between the 1st layer sealant and the 2nd layer backing rod for Control Joint C and Control Joint D.

2.2.2 Control Joints E and F

Control Joint E and Control F were of a symmetric-caulked both sides configuration. The apertures for Control Joint E and Control Joint F were filled from both faces with a nominally 20 mm thick foam backing rod. The width of the backing rod was nominally 20% larger than the width of the aperture to allow for a compression fit. The backing rod was recessed within the aperture to allow for the application of the sealant at its intended depth.

FulaFlex™ FR sealant was applied directly onto the backing rod on both faces of Control Joint E and the exposed face of Control Joint F. FulaFlex™ 620 sealant was applied directly onto the backing rod on the unexposed face of Control Joint F. The sealant was trowel finished flush to the surface of the slab on both faces.

The positioning of the backing rods provided an assumed nominal 30 mm air gap for Control Joint E and a nominal 40 mm air gap for Control Joint F.

Table 1 lists the measured dimensions of the control joint system components.

Table 1: Joint Details

Specimen Ref	Control Joint System	2nd Layer Location	Sealant Dimensions as Measured (mm)		
			Width	Depth	Length
A	FulaFlex™ FR - 1st Layer	EXF	25	25	1,065
	FulaFlex™ FR - 2nd Layer		25	15	
B	FulaFlex™ FR - 1st Layer	UXF	25	25	1,063
	FulaFlex™ FR - 2nd Layer		25	15	
C	FulaFlex™ FR - 1st Layer	EXF	35	30	1,066
	FulaFlex™ FR - 2nd Layer		35	20	
D	FulaFlex™ FR - 1st Layer	UXF	35	30	1,072
	FulaFlex™ FR - 2nd Layer		35	20	
E	FulaFlex™ FR - UXF Layer	N/A	50	25	1,042
	FulaFlex™ FR - EXF Layer		50	25	
F	FulaFlex™ 620 - UXF Layer	N/A	30	20	1,060
	FulaFlex™ FR - EXF Layer		30	20	

2.3 Floor Slab

The floor slab consisted of seven individual normal weight 120 mm thick concrete slabs. The slabs were positioned on top of a concrete lined specimen holder to provide six gaps each at least 1,000 mm long. The measured density of the concrete was 2,241 kg/m^3 and the measured moisture content at the time of the test was 3.6%.

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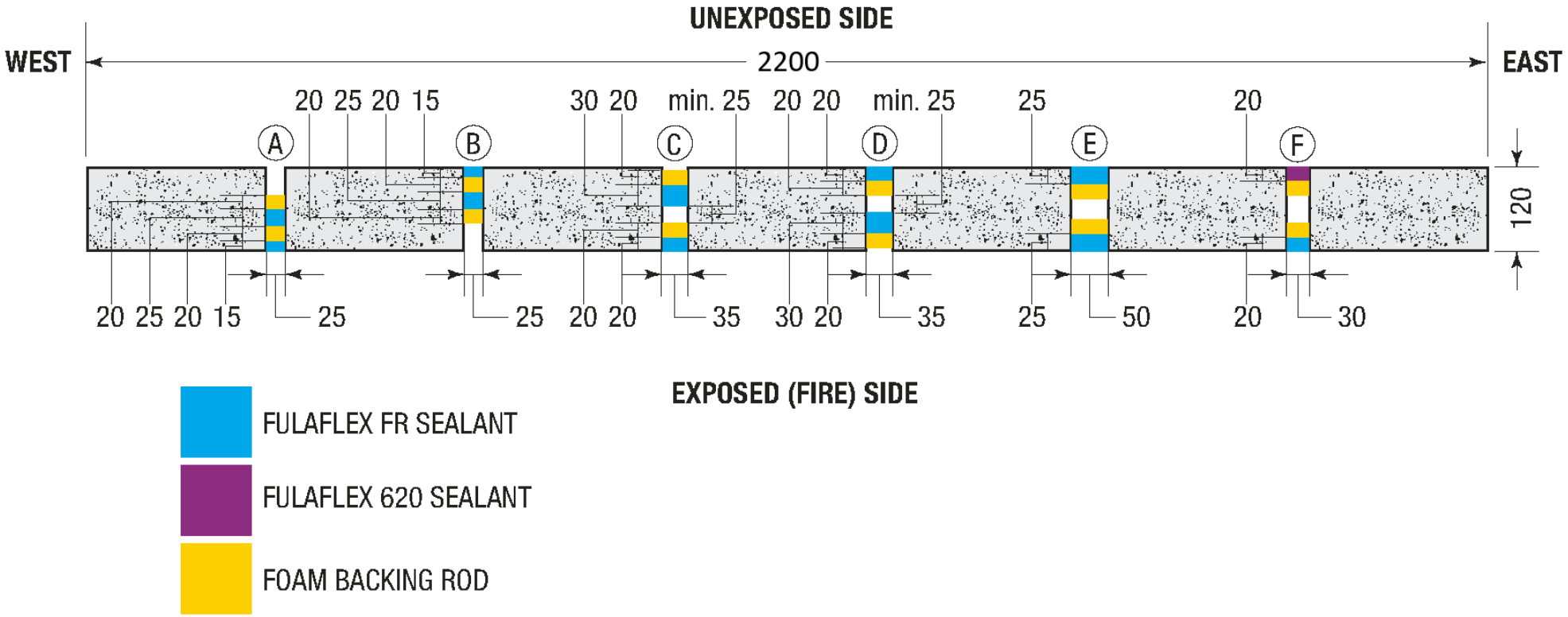
Figure 1: Client Supplied Drawing - Control Joint Configuration - Section View



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3. TEST CONDITIONS AND RESULTS

3.1 General

The specimen was tested on 31 October 2024, at the BRANZ laboratories at Judgeford, New Zealand, representatives of the client witnessed the test.

The ambient temperature at the beginning of the test was 14°C.

The floor slab specimen was placed on top of the Pilot Furnace in the horizontal orientation and the temperature and pressure conditions were controlled to the limits defined in AS 1530.4:2014.

The test was terminated after the specimen had been exposed to the standard fire resistance conditions for 245 minutes.

3.2 Furnace Conditions

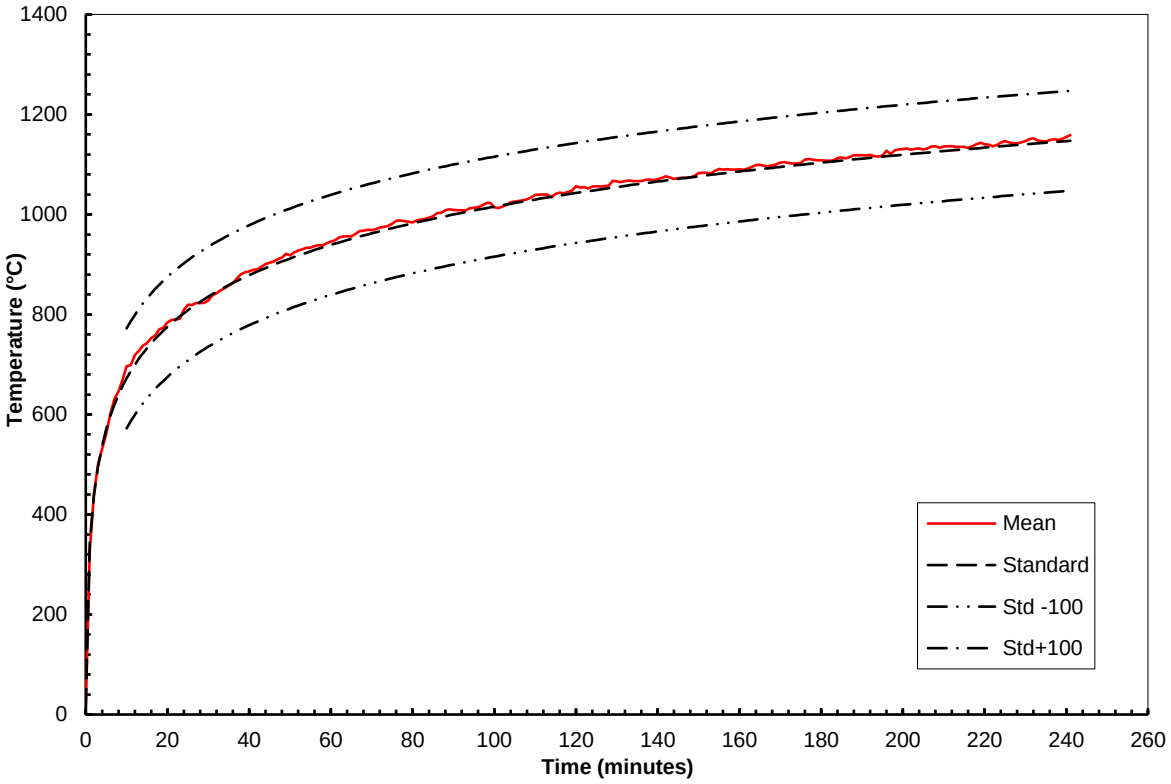
3.2.1 Furnace Temperature Measurement

Temperature measurement within the furnace was made using four mineral insulated metal sheathed (MIMS) chromel-alumel thermocouples uniformly distributed in a horizontal plane approximately 100 mm below the exposed face of the specimen.

The furnace thermocouples were connected to a computer-controlled data logging system which recorded the temperatures at 15 second intervals.

Figure 2 shows the furnace temperature curve and the permitted upper and lower limits in accordance with AS 1530.4:2014.

Figure 2: Furnace Temperature

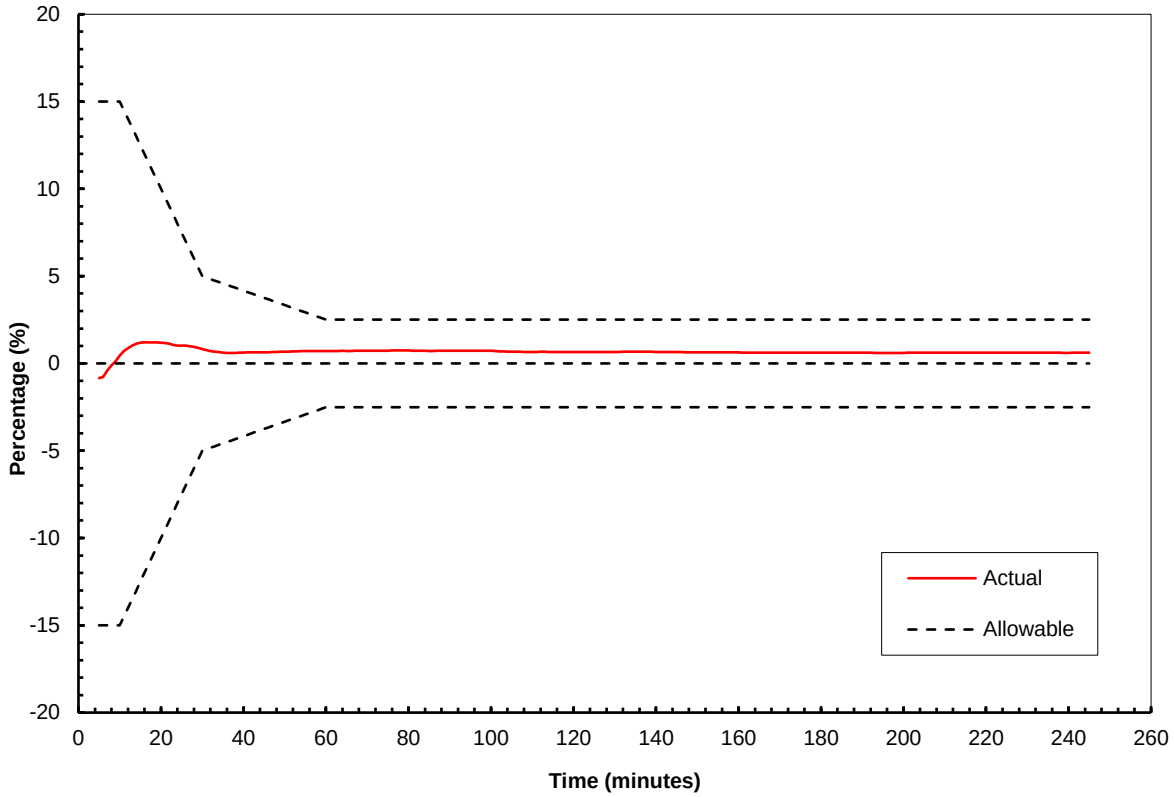


3.2.2 Furnace Control

The percentage deviation of the area under the curve of the furnace mean temperature from the standard temperature/time curve was within the standard requirements.

Figure 3 shows the percentage deviation of the mean furnace temperature from the Standard curve.

Figure 3: Percentage Deviation from Standard Curve



3.2.3 Pressure Measurements

The furnace pressure was controlled to be 20 Pa at 100 mm below the soffit of the specimen as defined in the test standard. This corresponds to a pressure of 15.9 Pa at the pressure probe. The differential pressure was monitored using a micromanometer connected to a computer-controlled data acquisition system which recorded the pressure at 15 second intervals.

Figure 4 shows the pressure measured at the probe during the test.

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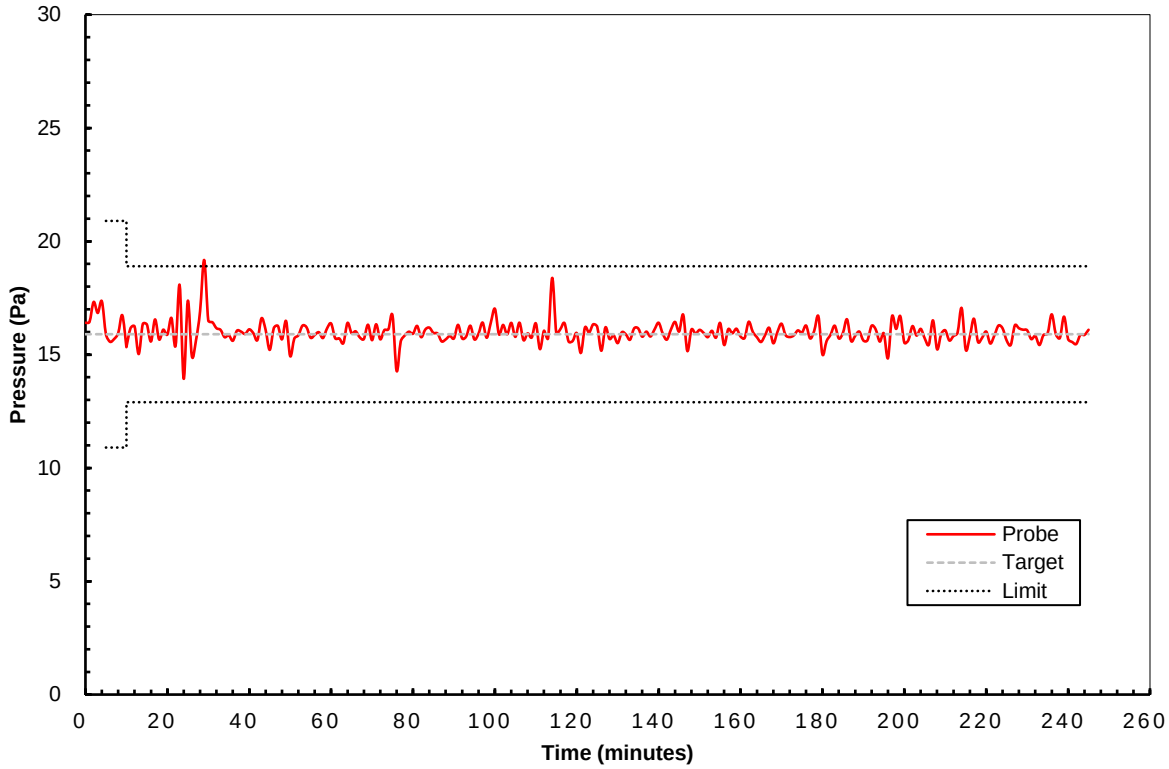
Figure 4: Mean Furnace Pressure



In summary the furnace conditions complied with the test standard for the majority of the 245 minute test duration except for a brief period where the furnace pressure was outside the upper limit. It is considered that this minor deviation would not have influenced the tested results.

3.3 Specimen Temperature Measurement

The temperature on the unexposed face of the control joint specimens and the floor slab were measured with chromel-alumel thermocouples attached to the specimens. The arrangement consisted of thermocouples placed as specified in clause 10.5 of the test standard AS 1530.4:2014.

The locations of the thermocouples are shown in Figure 5.

Figure 6 to Figure 11 show the temperature rise of each specimen.

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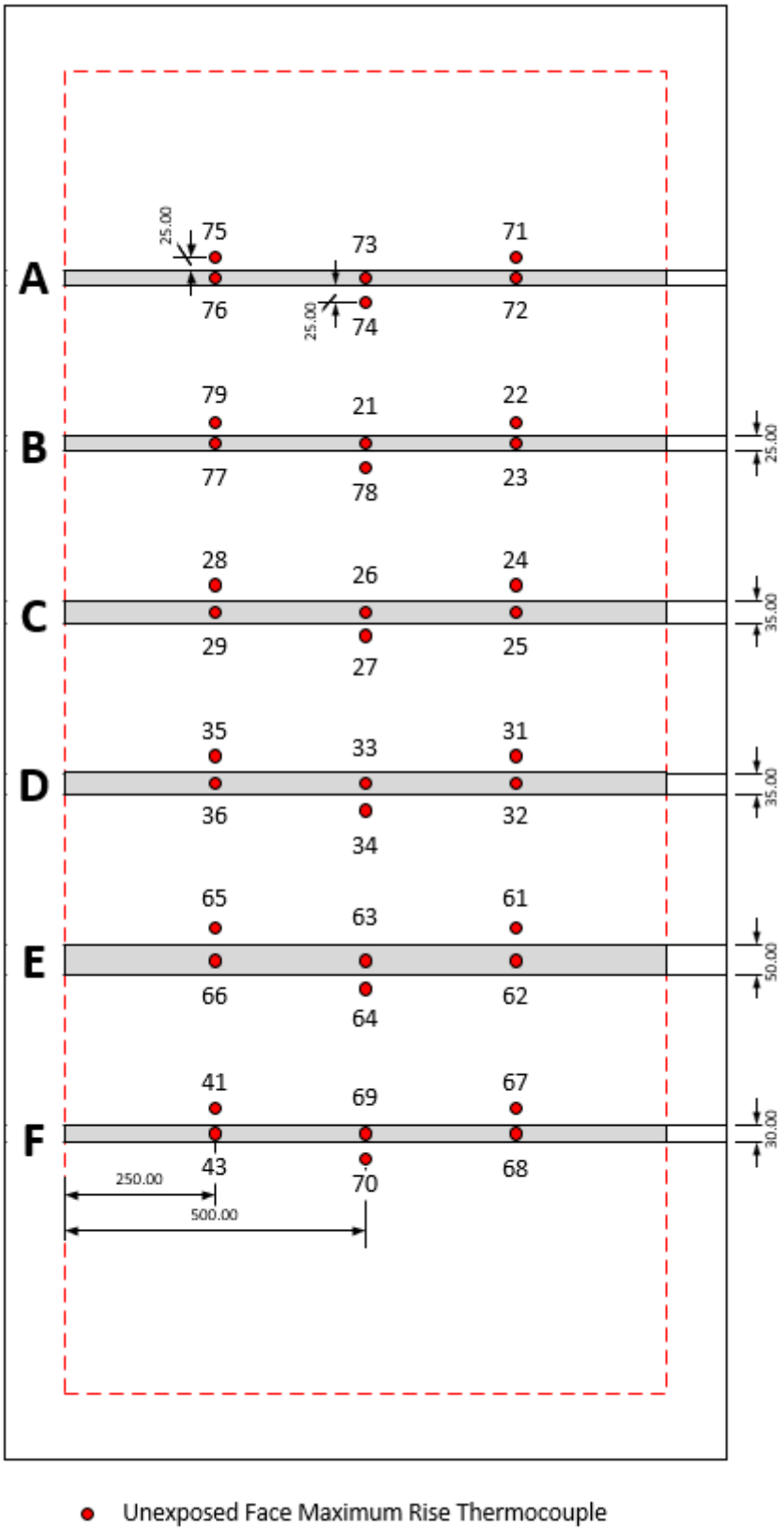
Figure 5: Unexposed Face Thermocouple Positions



● Unexposed Face Maximum Rise Thermocouple

Figure 6: Specimen A - Temperature Rise

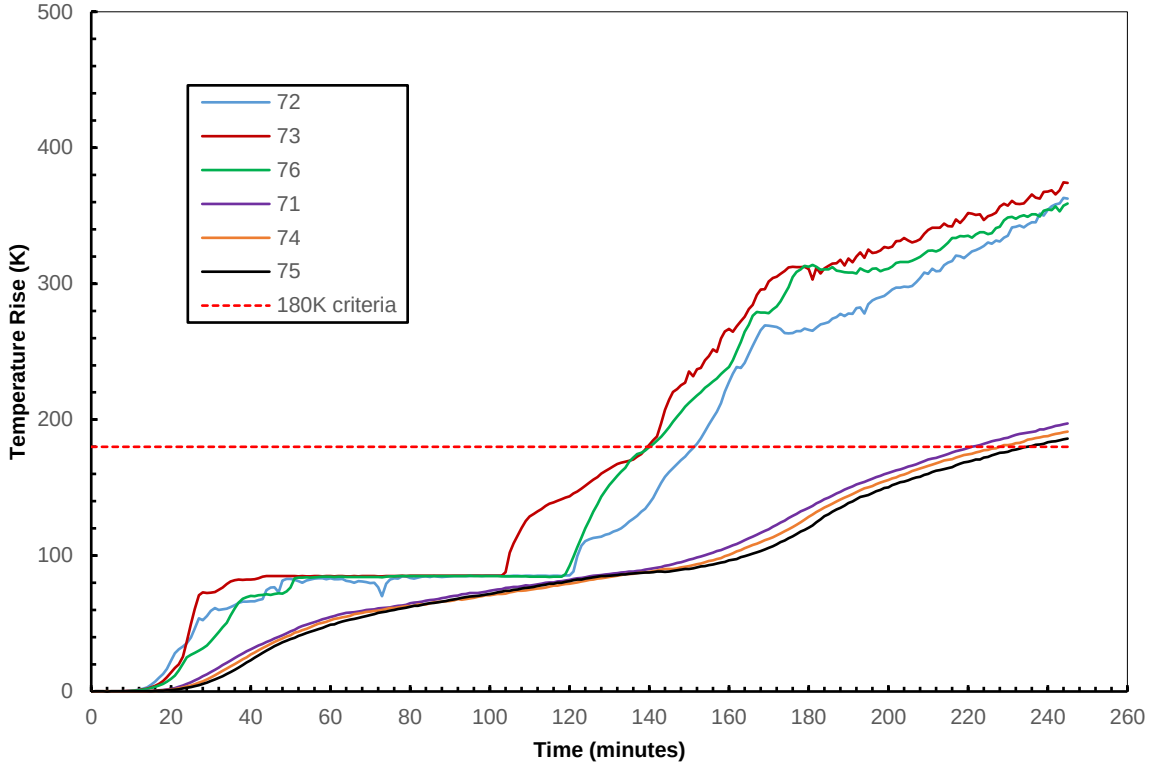


Figure 7: Specimen B - Temperature Rise

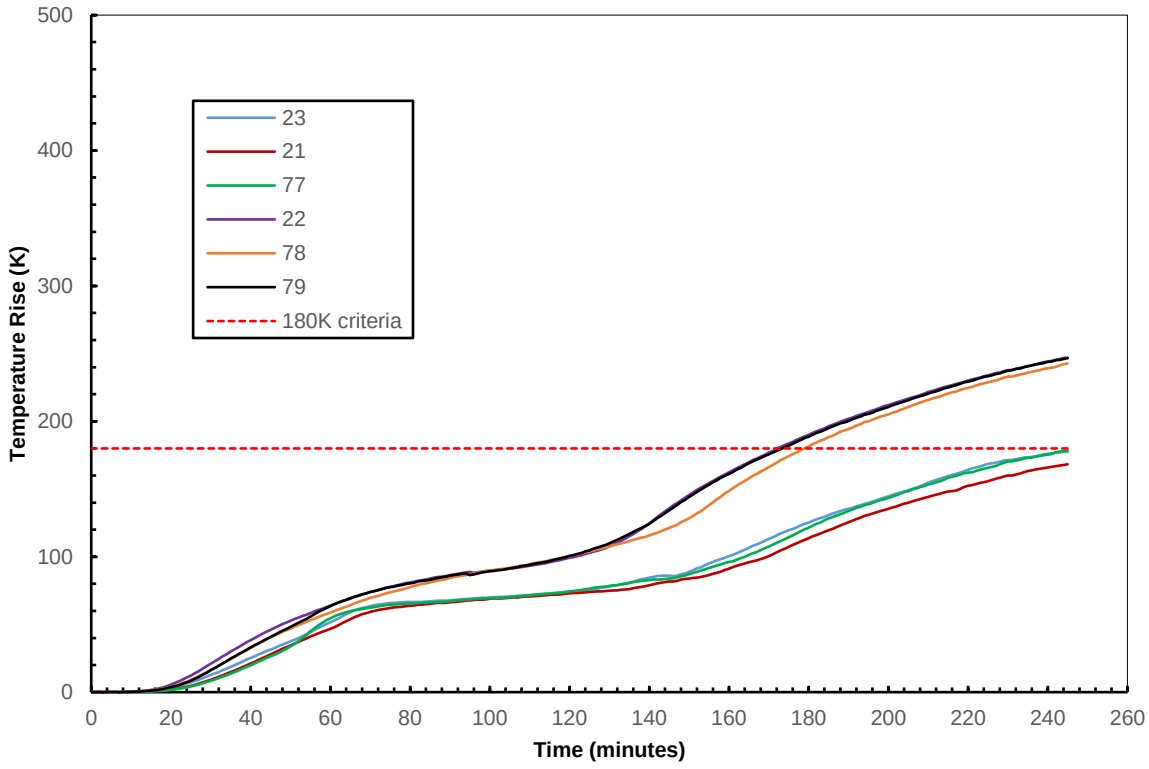


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Figure 8: Specimen C - Temperature Rise

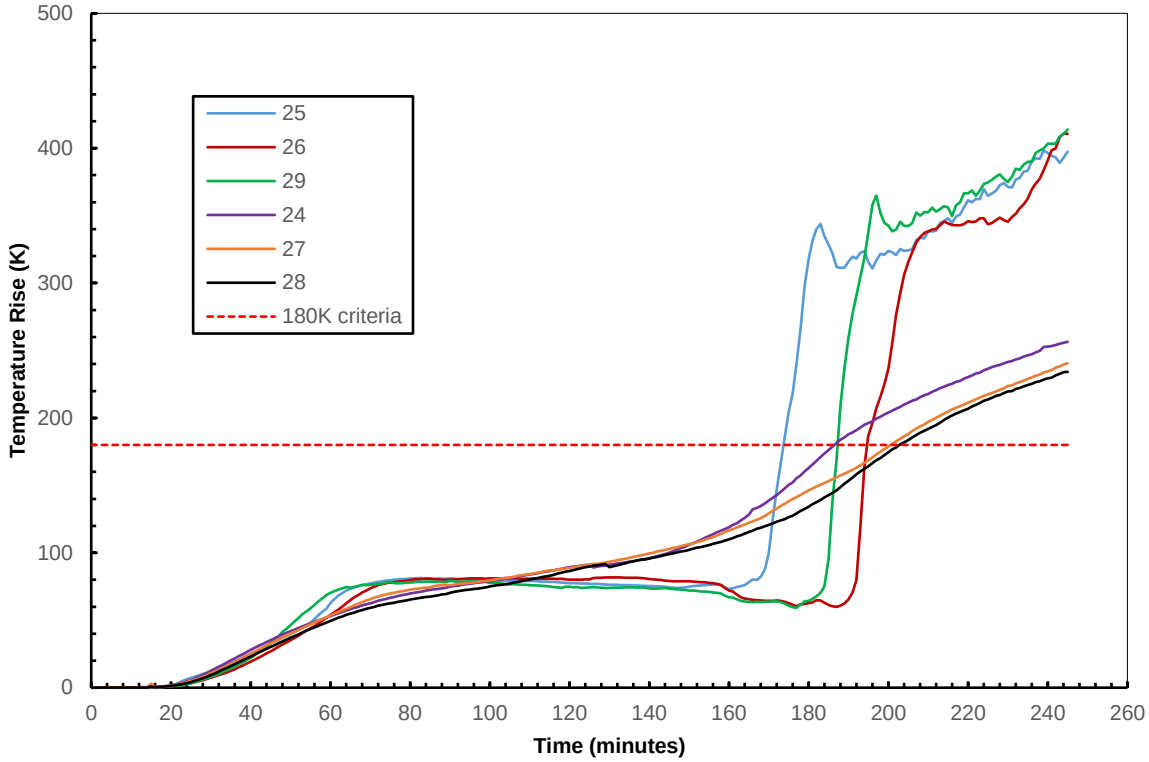

Figure 9: Specimen D - Temperature Rise

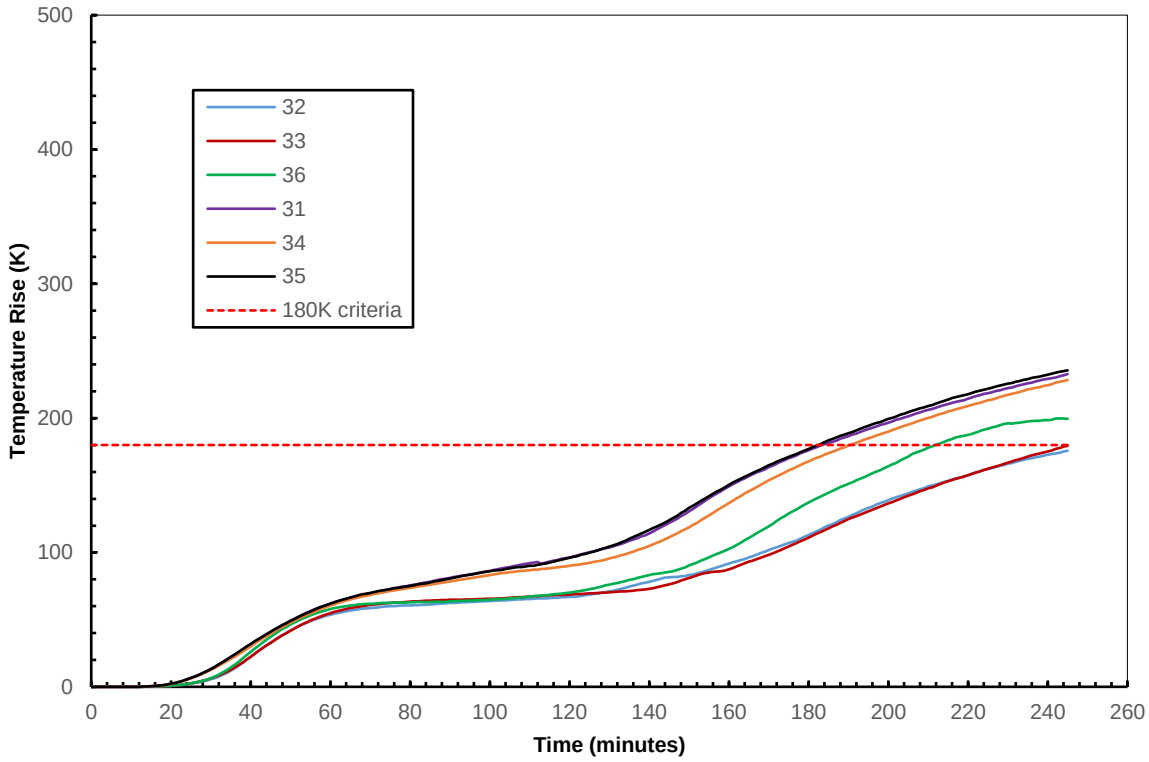

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Figure 10: Specimen E - Temperature Rise

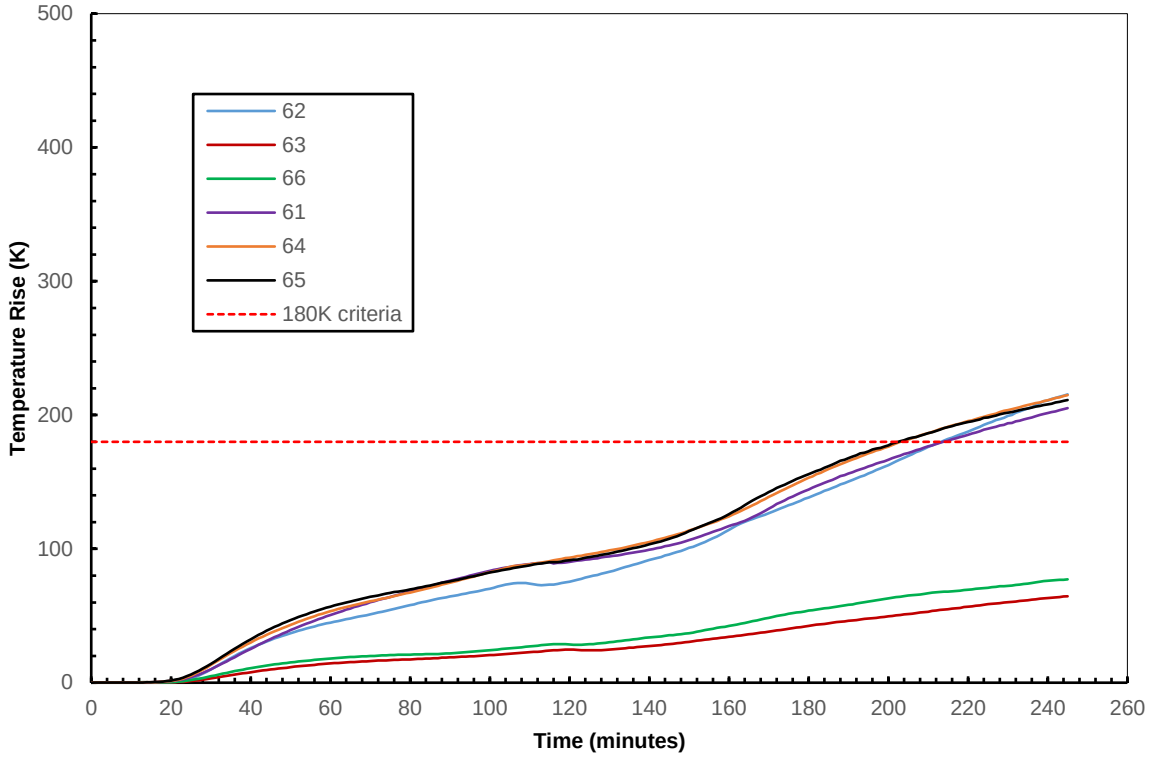
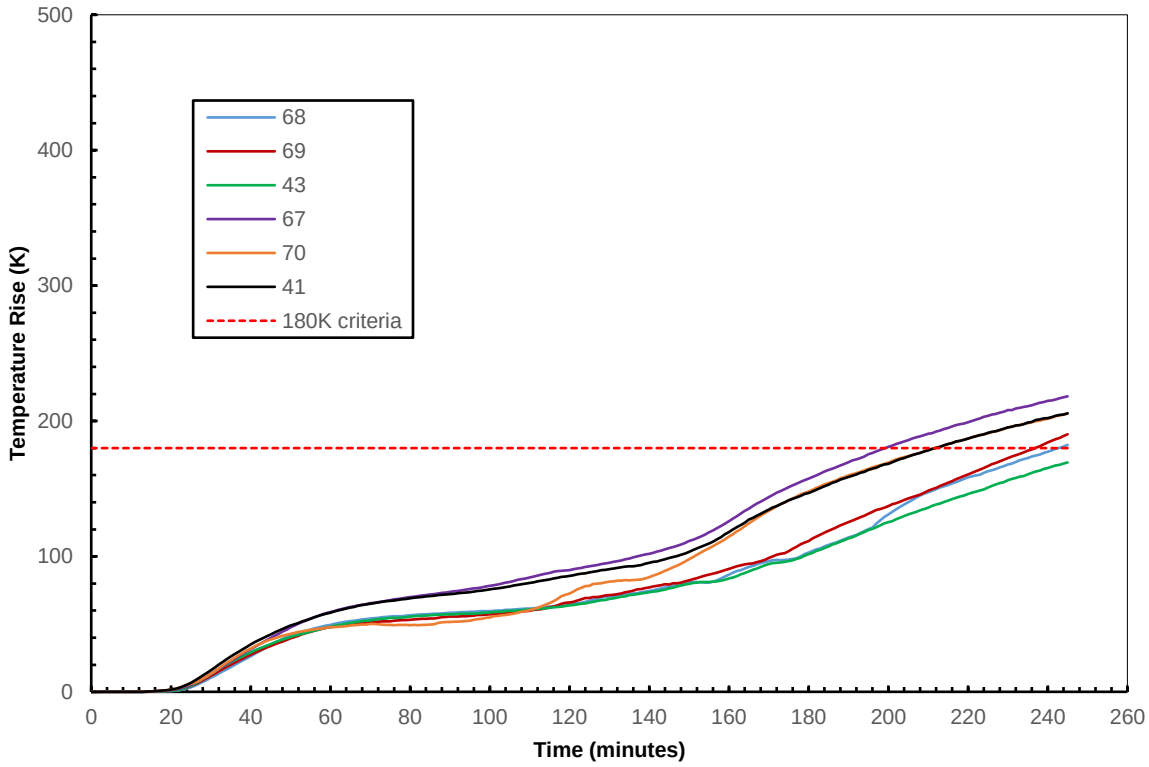


Figure 11: Specimen F - Temperature Rise



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3.4 Specimen Integrity

Integrity failures were recorded as follows in Table 2

Table 2: Specimen Integrity

Specimen Ref	Time (minutes) Until Integrity Failure Occurred
A	245 - No failure
B	245 - No failure
C	245 - No failure
D	245 - No failure
E	245 - No failure
F	245 - No failure

3.5 Specimen Insulation

Insulation failures were recorded as follows in Table 3

Table 3: Specimen Insulation

Specimen Ref	Time (minutes) Until Failure Occurred (T>180K)
A	139 - TC 73
B	172 - TC 22
C	173 - TC 25
D	182 -TC 35
E	202 - TC 65
F	199 - TC 67

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3.6 Observations

Observations related to the Integrity performance of the specimens were at the times stated in minutes and seconds as shown in Table 4.

U = Observations from the unexposed face.

E = Observations from the exposed face.

Table 4: Observations

Time (Min:Sec)	Test Face	Observations
00:00	-	The test commences.
05:00	U	Smoke issue commences from Control Joint A.
19:00	U	Smoke issue commences from Control Joint C.
20:00	U	Water from the slab begins to pool within Control Joint A, between TC 72 & TC 73.
40:00	U	The area of Control Joint A between TC 72 & TC 75 is filled with water, the water appears to be boiling.
70:00	U	The quantity of water within Control Joint A has reduced.
74:00	U	The sealant begins to bulge near TC 23 on Control Joint B.
76:00	U	The sealant begins to bulge near TC 36 on Control Joint D.
83:00	U	Bulging of the sealant in Control Joint B & D continues. Bulging is visible over the whole lengths of the control joints.
100:00	U	The sealant begins to sag/slump down in Control Joint E.
120:00	-	All of the control joints continue to maintain Integrity.
130:00	U	The backing rod in Control Joint A begins to discolour in three separate locations.
155:00	U	The backing rod in Control Joint C begins to discolour near to TC 25.
160:00	U	The backing rod in Control Joint C begins to form large holes.
162:30	U	Cotton wool pad applied to Control Joint C but does not ignite.
176.30	U	Cotton wool pad applied to Control Joint C but does not ignite.
180:00	-	All of the control joints continue to maintain Integrity.
185:00	U	The sealant that is now visible due to the loss of the backing rod in Control Joint C is cracked and glowing.
238:10	U	Cotton wool pad applied to Control Joint C but does not ignite.
240:00	-	All of the control joints continue to maintain Integrity.
245:45	-	The test is discontinued

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4. SUMMARY

The fire resistance in minutes, in accordance with AS 1530.4:2014, of six double layer control joint systems installed in a 120 mm thick concrete floor slab, was as follows:

Specimen Ref	Control Joint Details Width x Depth	Integrity (min)	Insulation (min)	FRL*
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D	1st - 35 mm x 30 mm FulaFlex™ FR 2nd - 35 mm x 20 mm FulaFlex™ FR	245 NF	182	-/120/120
E	UXF - 50 mm x 25 mm FulaFlex™ FR EXF - 50 mm x 25 mm FulaFlex™ FR	245 NF	202	-/120/120
F	UXF - 30 mm x 20 mm FulaFlex™ 620 EXF - 30 mm x 20 mm FulaFlex™ FR	245 NF	199	-/120/120

NF = No Failure.

The test was terminated after 245 minutes.

For Specimen A and Specimen C, the installation of the joints was from the exposed face (EXF) with the 2nd layer of FulaFlex™ FR located on the exposed face of the slab. For Specimen B and Specimen D, the installation of the joints was from the unexposed face (UXF) with the 2nd layer of FulaFlex™ FR located on the unexposed face of the slab.

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"Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result."

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5. PERMISSIBLE VARIATIONS

In accordance with AS 1530.4:2014 clause 10.12, the permissible variations that are relevant to the tested penetration systems reported in test report FP19882-01 are as follows.

5.1 General

The results of the fire test contained in the test report are directly applicable, without reference to the testing authority, to similar constructions where the following changes have been made.

5.1.1 Separating Elements

Results obtained may be applied to the performance of a system in concrete, masonry or solid gypsum blocks of greater or equal thickness to that of the tested prototype.

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PHOTOS

Photo 1: The Unexposed Face of the Assembly Prior to Testing

Photo 2: The Unexposed Face of the Test Assembly After a Duration of 30 Minutes

Photo 3: The Unexposed Face of the Test Assembly After a Duration of 60 Minutes

Photo 4: The Unexposed Face of the Test Assembly After a Duration of 120 Minutes

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Photo 5: The Unexposed Face of the Test Assembly After a Duration of 180 Minutes

Photo 6: The Unexposed Face of the Test Assembly After a Duration of 240 Minutes

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Photo 7: The Exposed Face of the Test Assembly Immediately After Testing

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