

FIRE TEST REPORT

FP18279-01-1

THE FIRE RESISTANCE IN ACCORDANCE WITH AS 1530.4:2014 OF SIX CONTROL JOINTS INSTALLED IN A 240 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
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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 240 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

20 June 2024

Test Results

The fire resistance in minutes, in accordance with AS 1530.4:2014, of six control joint systems installed in a 240 mm thick concrete floor slab, was as follows:

Specimen Ref	Control Joint Details Width x Depth	Integrity (min)	Insulation (min)	FRL
A	100 mm x 50 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240
B	20 mm x 10 mm FulaFlex™ FR Backing Rod	264 NF	236	-/240/180
C	60 mm x 40 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240
D	60 mm x 40 mm FulaFlex™ FR Backing Rod	264 NF	103	-/240/90
E	40 mm x 25 mm FulaFlex™ FR Backing Rod	264 NF	119	-/240/90
F	80 mm x 40 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240

NF = No Failure.

The test was terminated after 264 minutes.

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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	23 July 2024	Initial Issue

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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 240 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 9 April 2024. The specimens were kept under ambient laboratory conditions until testing on 20 June 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, C and F

The apertures for control joints A, C and F were filled with a nominally 75 mm thick, foil faced (one side only) mineral fibre identified as PAROC Pro Mat 80 AluCoat. The width of the mineral wool was nominally 20% larger than the width of the aperture to allow for a compression fit. The mineral fibre was inserted with the foil face facing the exposed face and was recessed below the unexposed face of the concrete blocks to allow for the application of the FulaFlex™ FR sealant at its intended depth. A splice joint was provided in the mineral wool nominally 400 mm from the south edge of the floor slab.

FulaFlex™ FR sealant was applied directly onto the mineral fibre and trowel finished to the surface of the unexposed face of the concrete blocks.

The 75 mm thick PAROC Pro Mat 80 had the following measured properties:

Measured weight per unit area	6.13	kg/m^2
Measured density	76.6	kg/m^3
Measured moisture content by weight	0.42	%

2.2.2 Control Joints B, D and E

The apertures for control joints B, D and E were filled with a nominally 20 mm thick (B) or 40 mm thick (D and E) 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 inserted from the unexposed face and was recessed below the unexposed face of the concrete blocks to allow for the application of the FulaFlex™ FR sealant at its intended depth.

FulaFlex™ FR sealant was applied directly onto the backing rod and trowel finished to the surface of the unexposed face of the concrete blocks.

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

Table 1: Joint Details

Specimen Ref	Control Joint System	Sealant Dimensions as Measured (mm)		
		Width	Depth	Length
A	PAROC Pro Mat 80	100	50	1,035
B	Backing Rod	20	10	1,030
C	PAROC Pro Mat 80	60	40	1,030
D	Backing Rod	60	40	1,030
E	Backing Rod	40	25	1,018
F	PAROC Pro Mat 80	80	40	1,030

2.3 Floor Slab

The floor slab consisted of seven individual normal weight 240 mm thick concrete blocks. The blocks 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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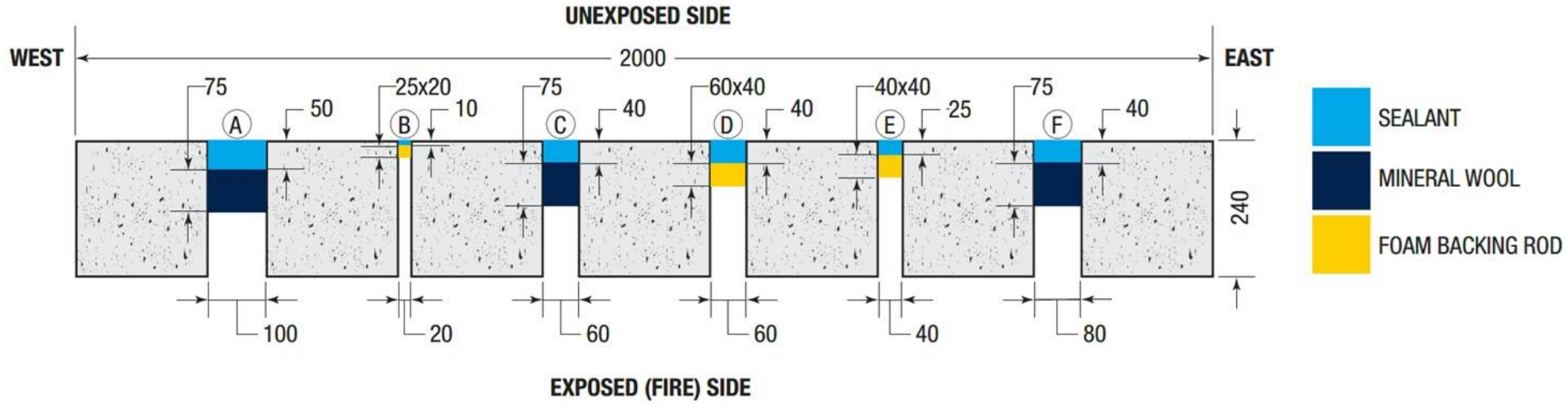
Figure 1: Client Supplied Drawing - Control Joint Configuration - Section View



3. TEST CONDITIONS AND RESULTS

3.1 General

The specimen was tested on 20 June 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 11°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 264 minutes.

3.2 Furnace Conditions

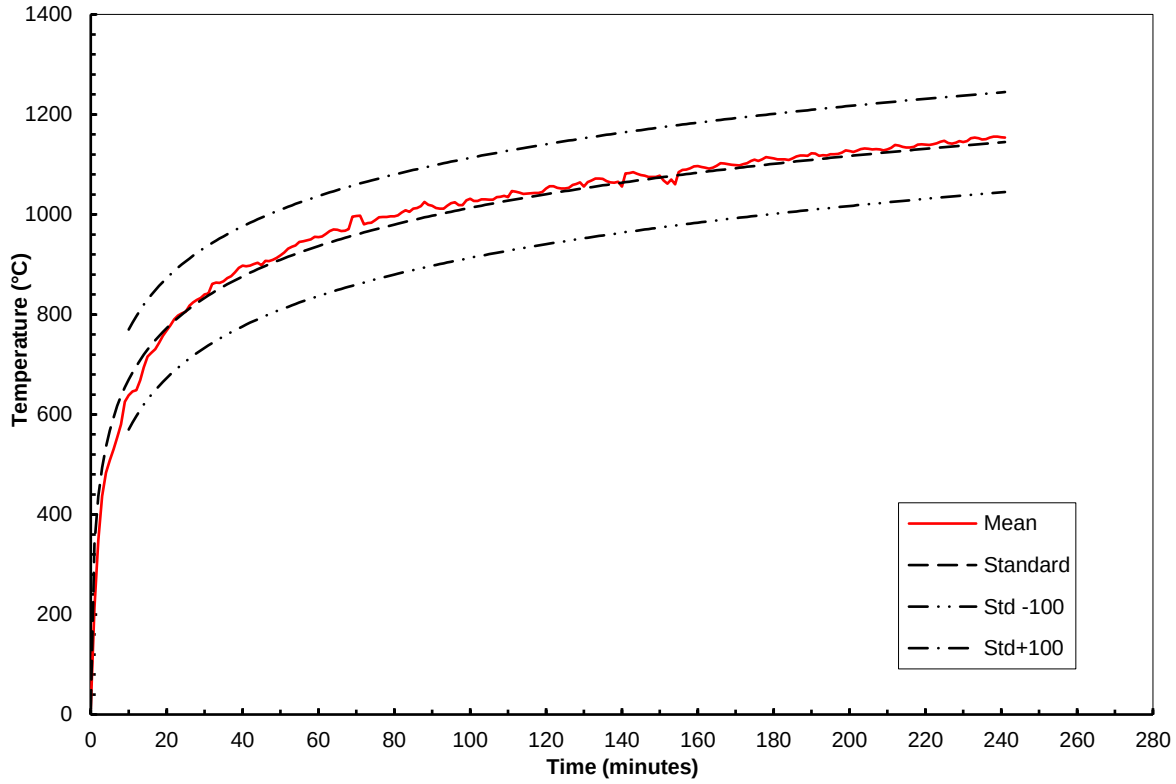
3.2.1 Furnace Temperature Measurement

Temperature measurement within the furnace was made using four plate thermometers 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

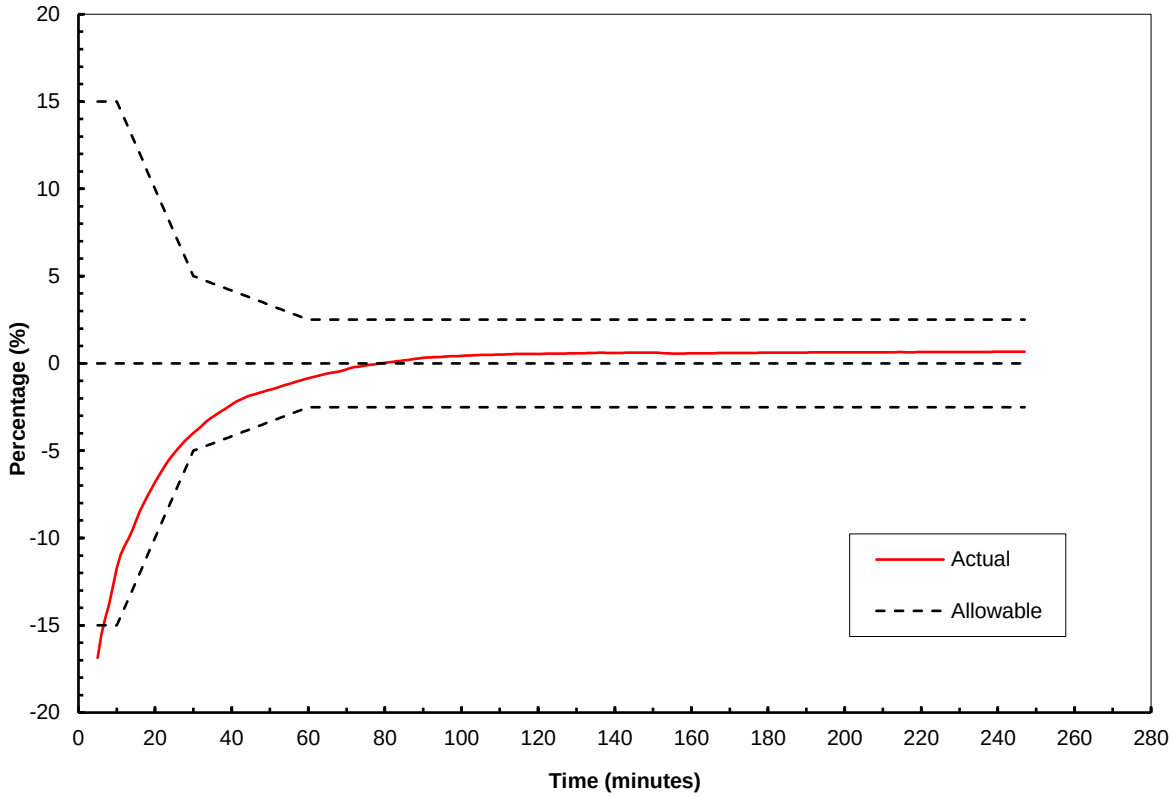


3.2.2 Furnace Control

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 15.7 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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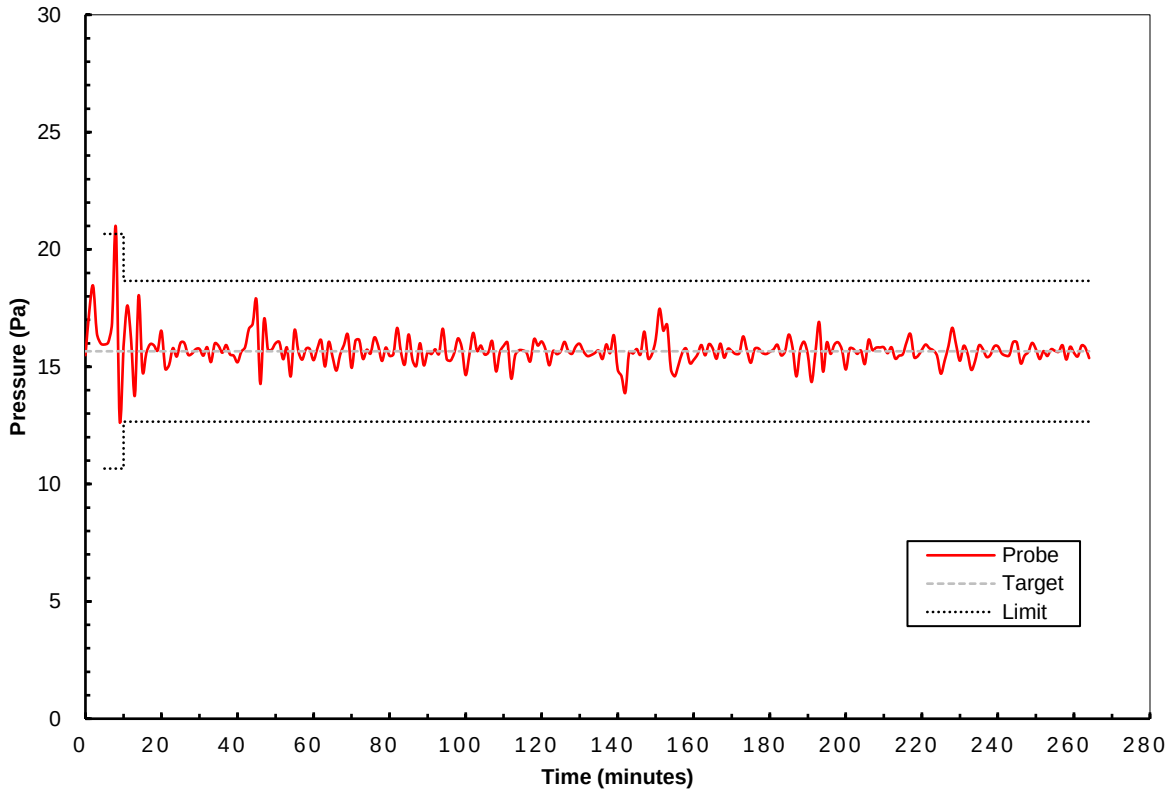
Figure 4: Mean Furnace Pressure



In summary the furnace conditions complied with the test standard for the majority of the 264 minute test duration except for a brief period between 8 and 13 minutes where the deviation from the standard curve was outside the lower limit and the furnace pressure was outside the upper limit. It is considered that these minor deviations 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

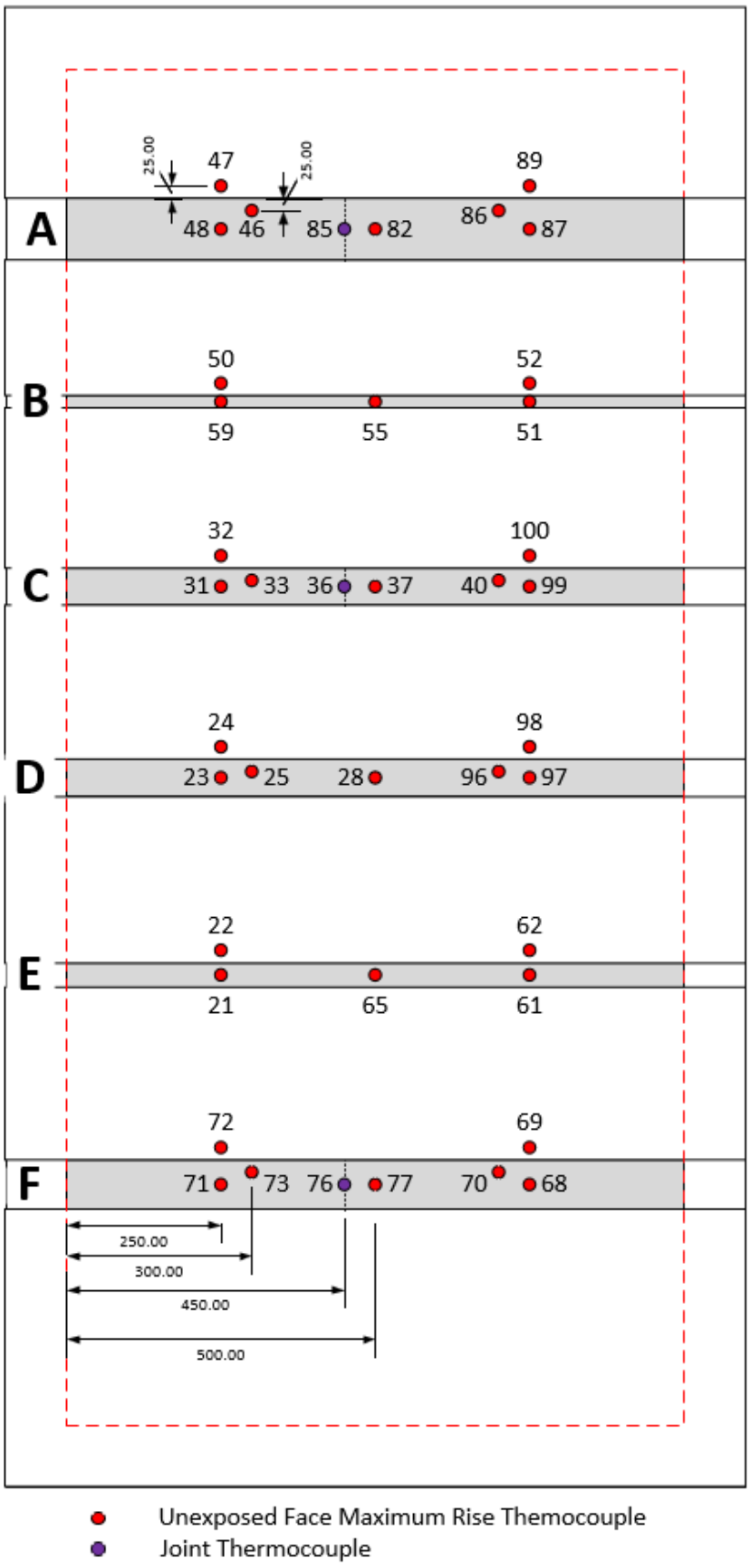

Figure 6: Specimen A - Temperature Rise

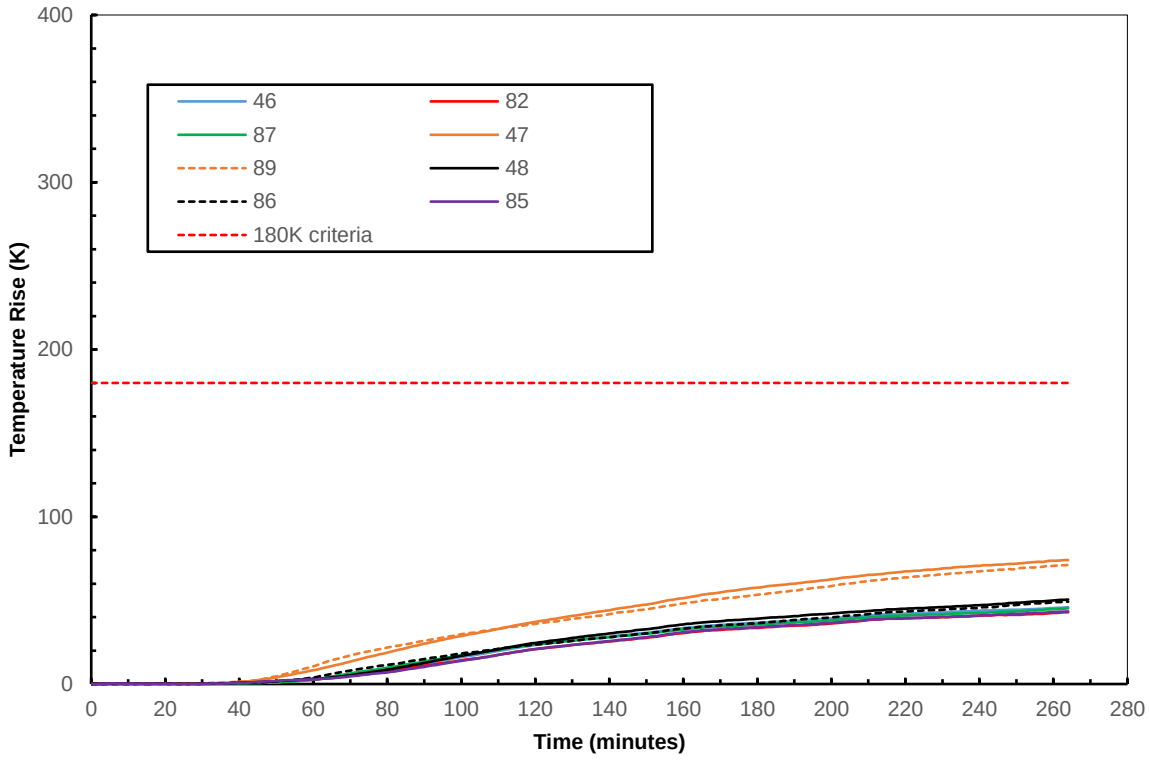

Figure 7: Specimen B - Temperature Rise

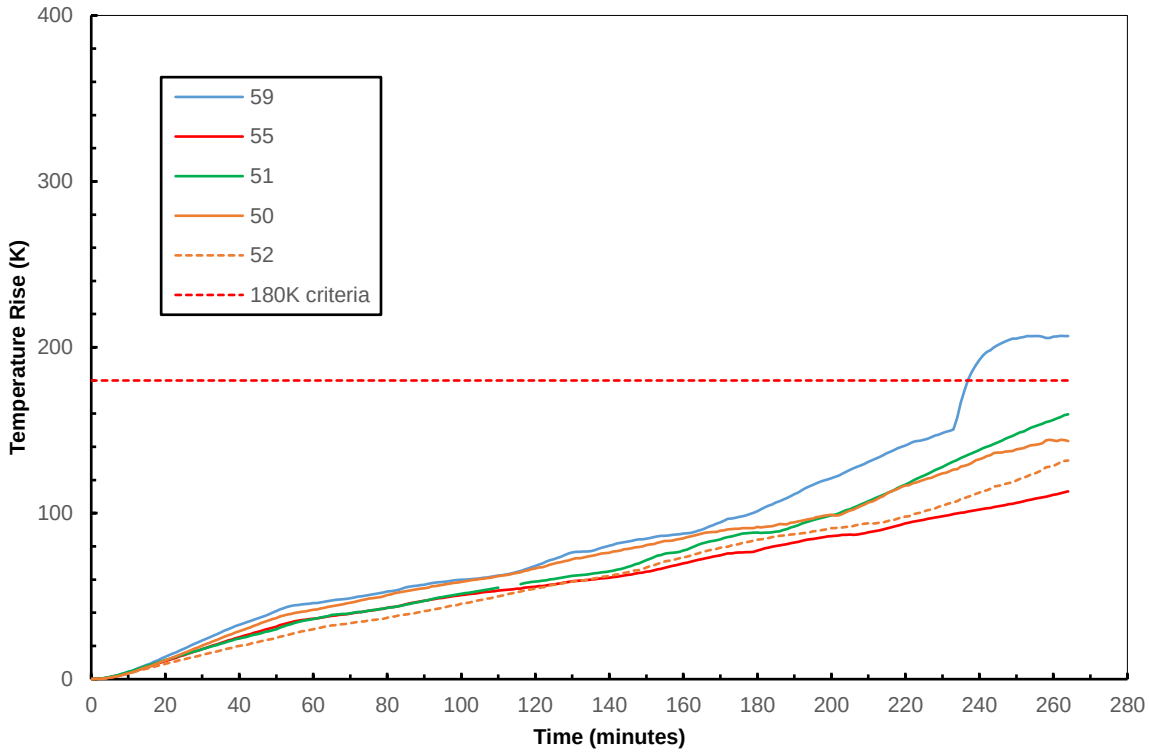

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Figure 8: Specimen C - Temperature Rise

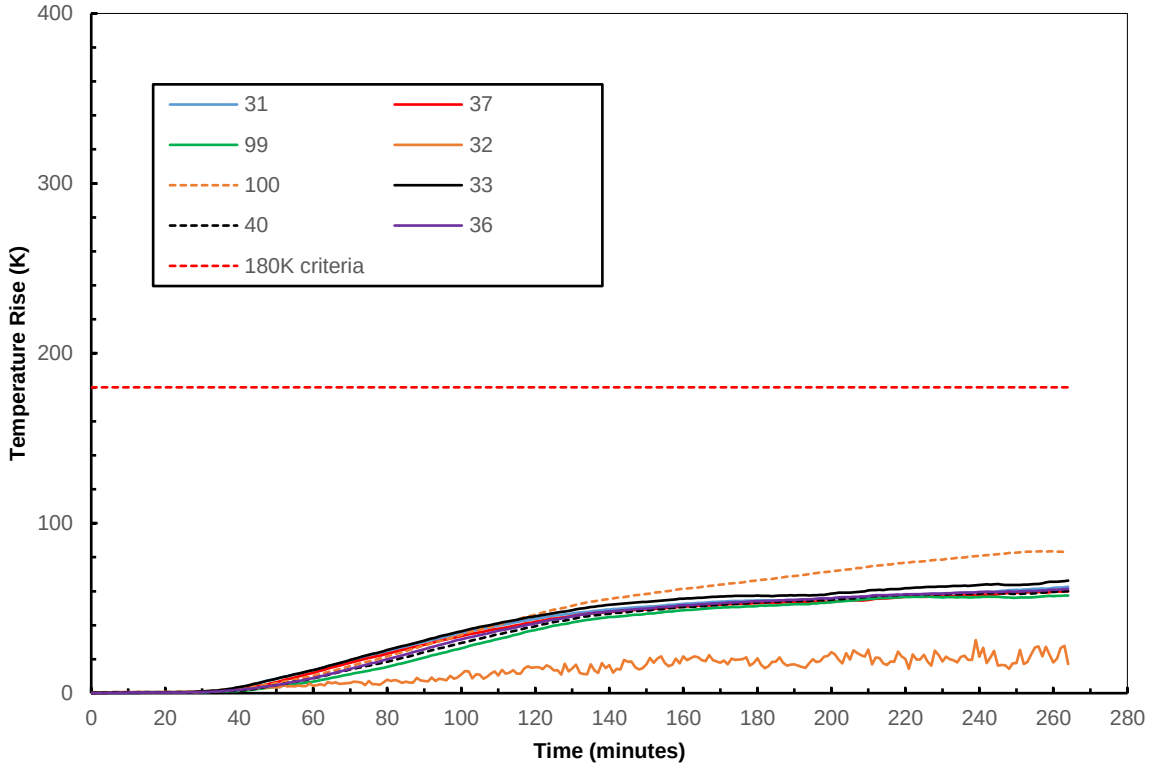

Figure 9: Specimen D - Temperature Rise

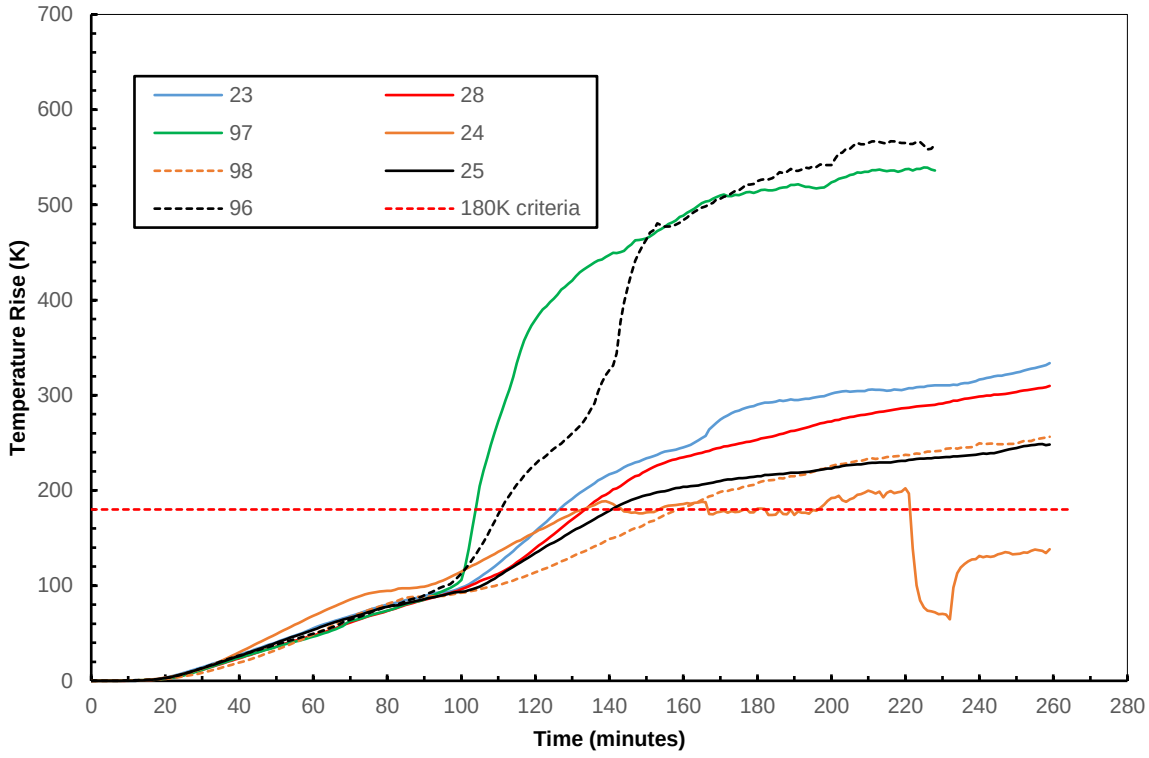

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Figure 10: Specimen E - Temperature Rise

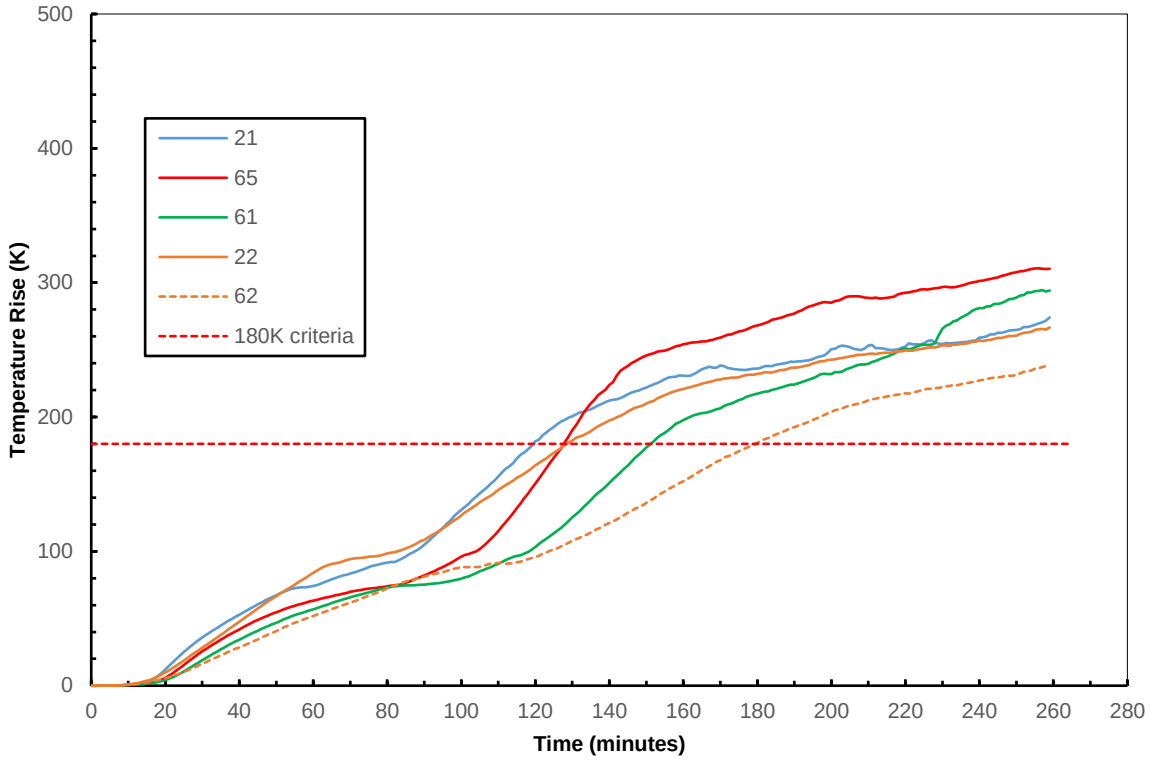
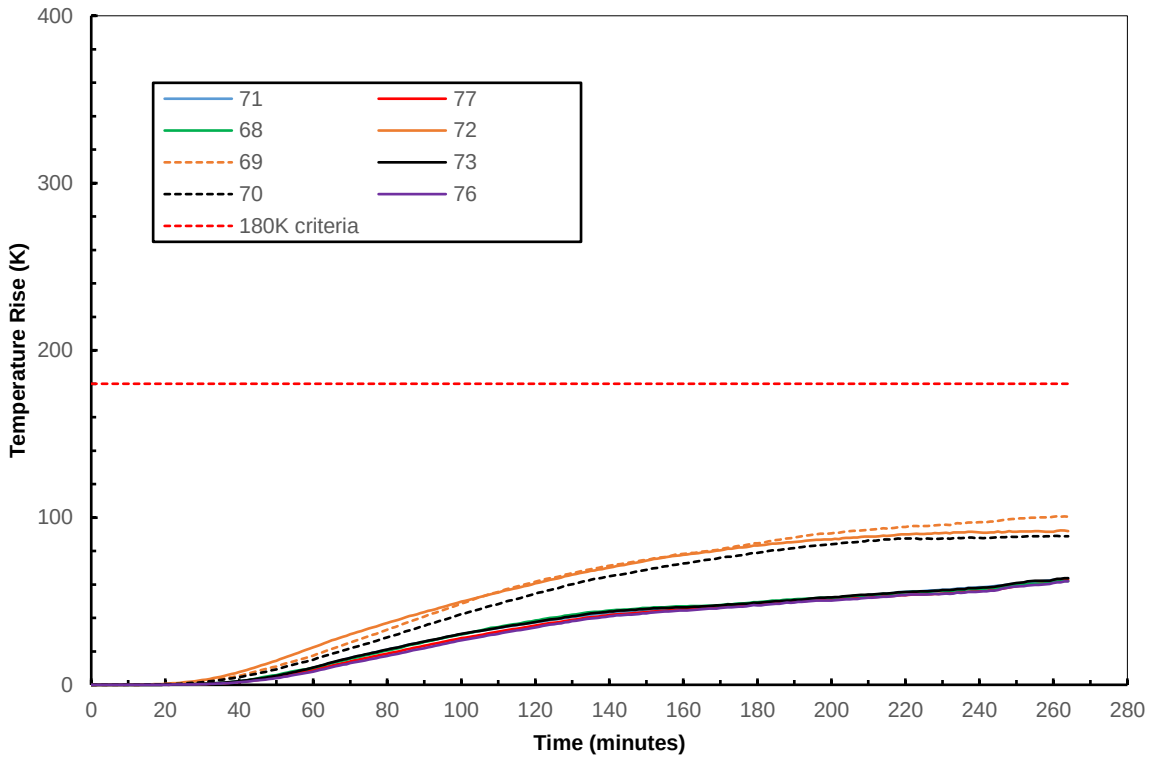


Figure 11: Specimen F - Temperature Rise



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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	264 - No failure
B	264 - No failure
C	264 - No failure
D	264 - No failure
E	264 - No failure
F	264 - 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	264 - No failure
B	236 - TC 59
C	264 - No failure
D	103 -TC 97
E	119 - TC 21
F	264 - No failure

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.
30:00	U & E	No significant visible change observed.
45:00	U	Water pooling at the West edge of Control Joint A.
60:00	U	The sealant at TC 21 position on Control Joint E is beginning to swell up, the sealant at the South end of Control Joint D is slumping down.
80:00	U	Some of the areas of Control Joint D which had slumped down at 60 minutes have now begun to swell upwards.
100:00	U	Discolouration of the sealant of Control Joint D near to TC 96/97 is occurring.
110:00	U	Smoke issue is increasing from Control Joint D near to TC 96/97.
120:00	U	Swelling of sealant is occurring on Control Joint B and Control Joint F.
190:00	U	A section of the sealant of Control Joint D near to TC 96/97 is visibly 'flapping' and has started to discolour.
229:00	U	Cotton pad applied to Control Joint D near to TC 96/97 but did not ignite.
239:00	U	Cotton pad applied to Control Joint D near to TC 96/97 but did not ignite.
264:15		The test is discontinued.

4. SUMMARY

The fire resistance in minutes, in accordance with AS 1530.4:2014, of six control joint systems installed in a 240 mm thick concrete floor slab, was as follows:

Specimen Ref	Control Joint Details Width x Depth	Integrity (min)	Insulation (min)	FRL
A	100 mm x 50 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240
B	20 mm x 10 mm FulaFlex™ FR Backing Rod	264 NF	236	-/240/180
C	60 mm x 40 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240
D	60 mm x 40 mm FulaFlex™ FR Backing Rod	264 NF	103	-/240/90
E	40 mm x 25 mm FulaFlex™ FR Backing Rod	264 NF	119	-/240/90
F	80 mm x 40 mm FulaFlex™ FR PAROC Pro Mat 80 AluCoat	264 NF	264 NF	-/240/240

NF = No Failure.

The test was terminated after 264 minutes.

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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."

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 FP18279-01 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

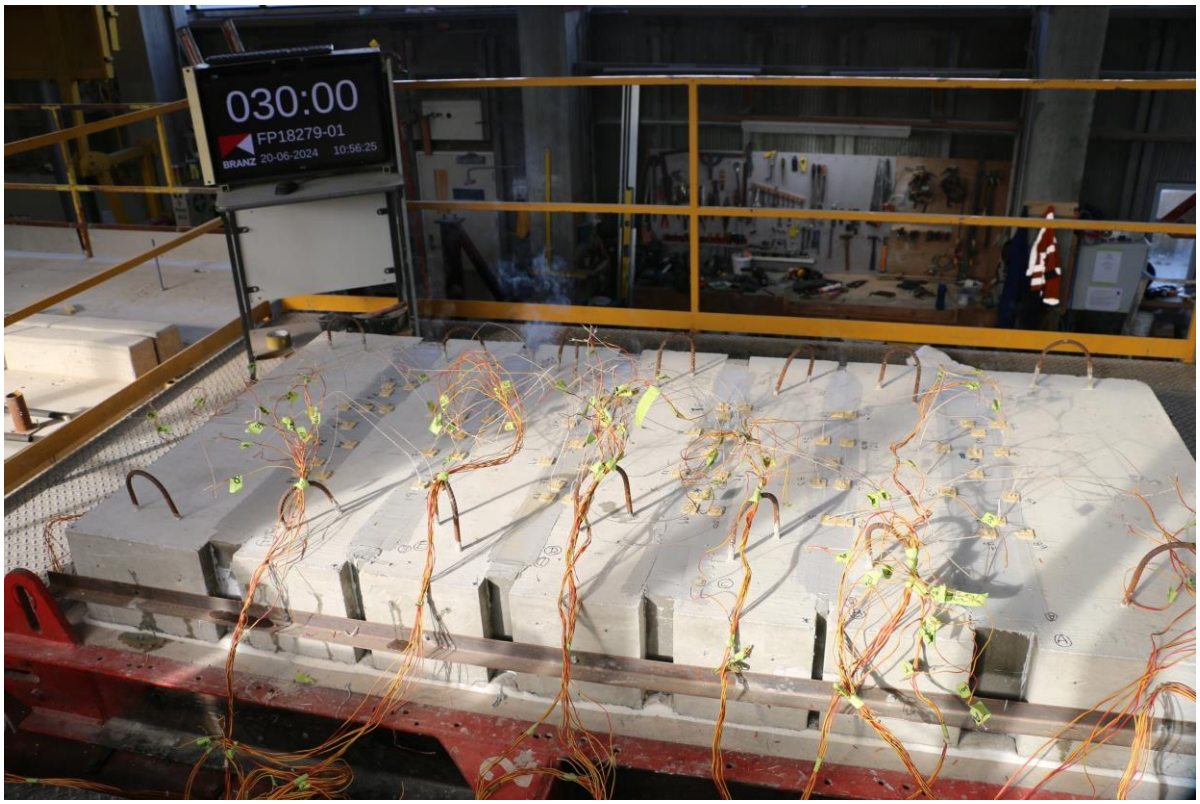

Photo 3: The Unexposed Face of the Test Assembly After a Duration of 60 Minutes

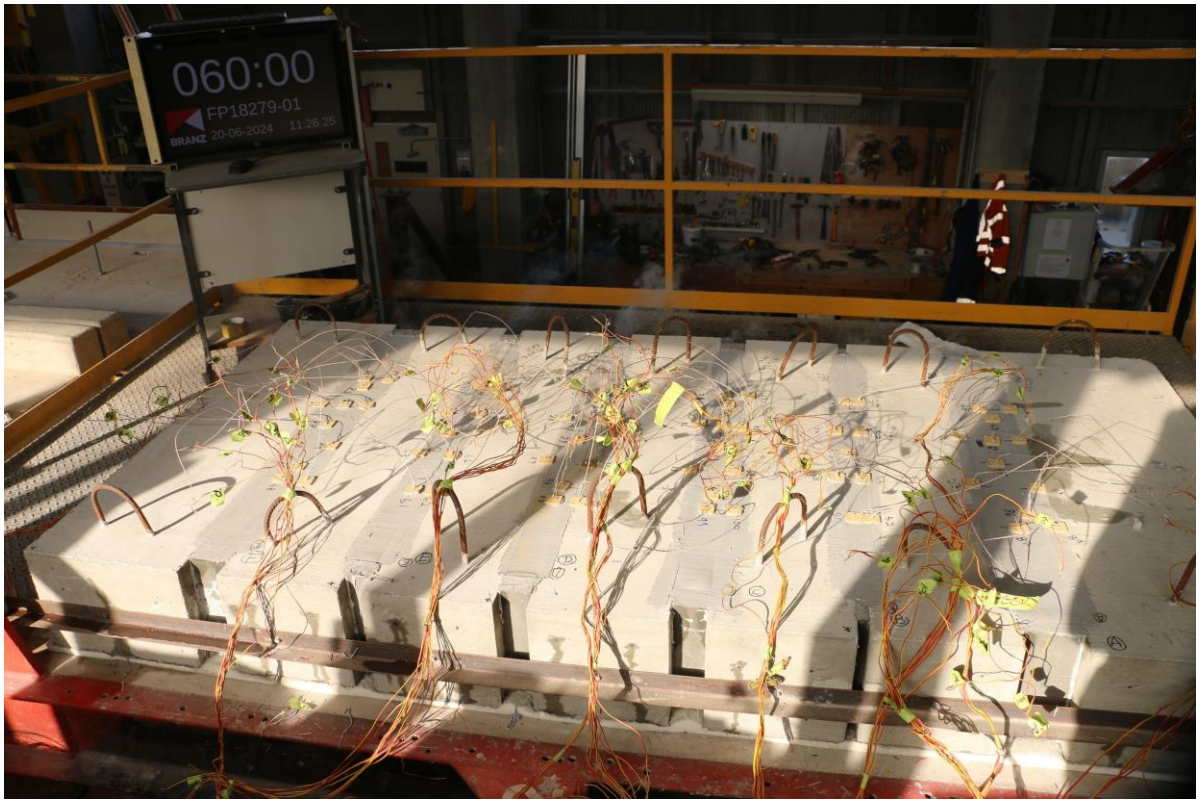

Photo 4: The Unexposed Face of the Test Assembly After a Duration of 120 Minutes

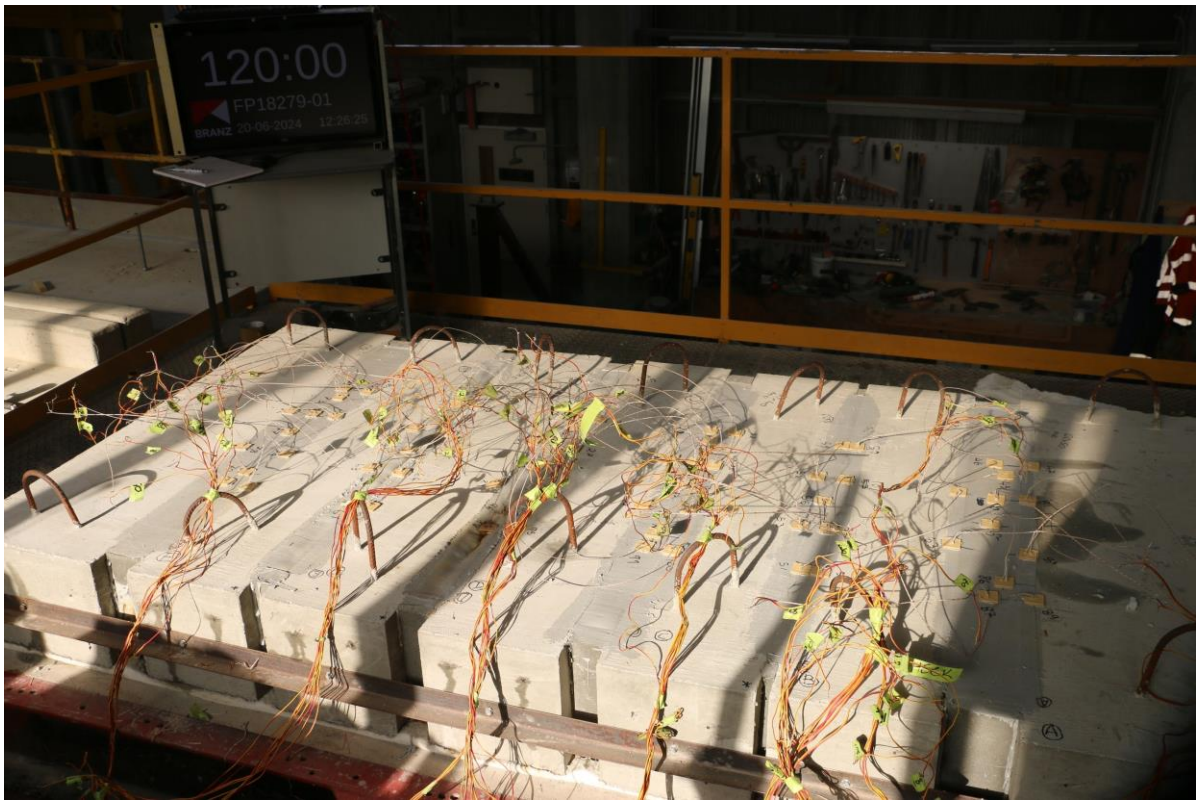

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Photo 5: The Unexposed Face of the Test Assembly After a Duration of 180 Minutes

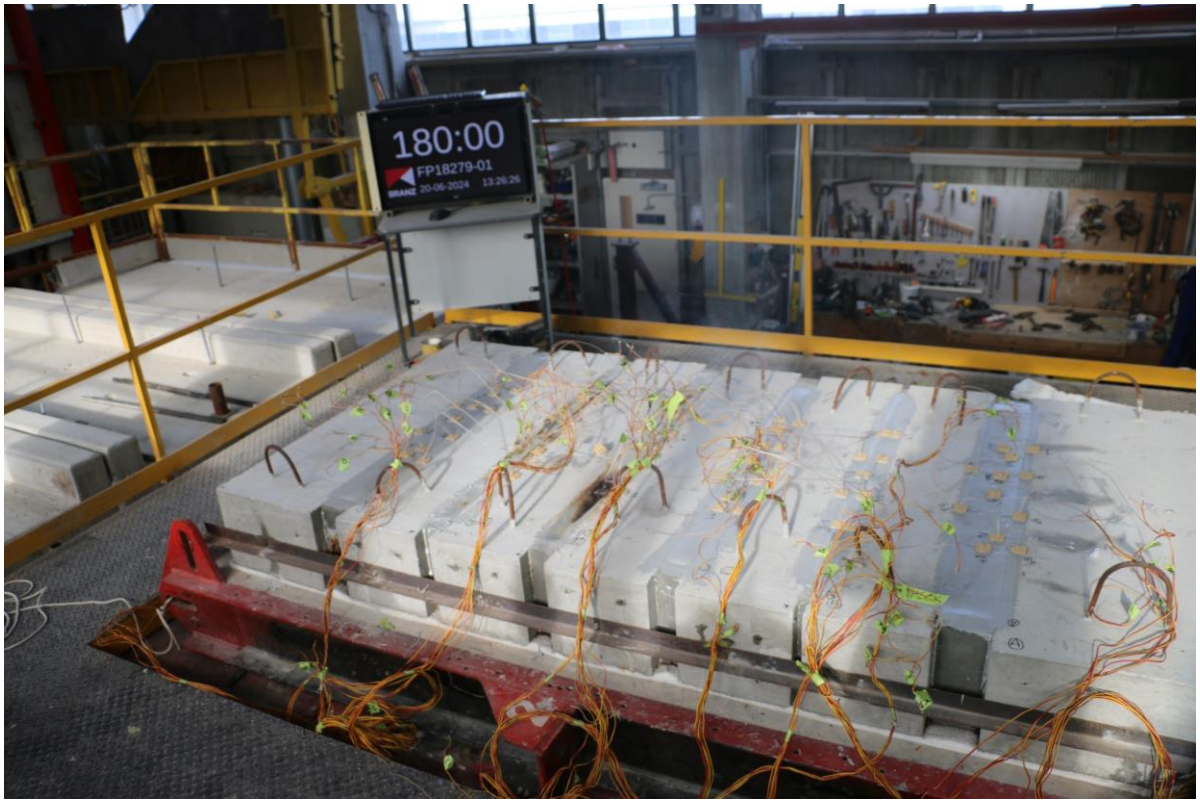


Photo 6: The Unexposed Face of the Test Assembly After a Duration of 240 Minutes

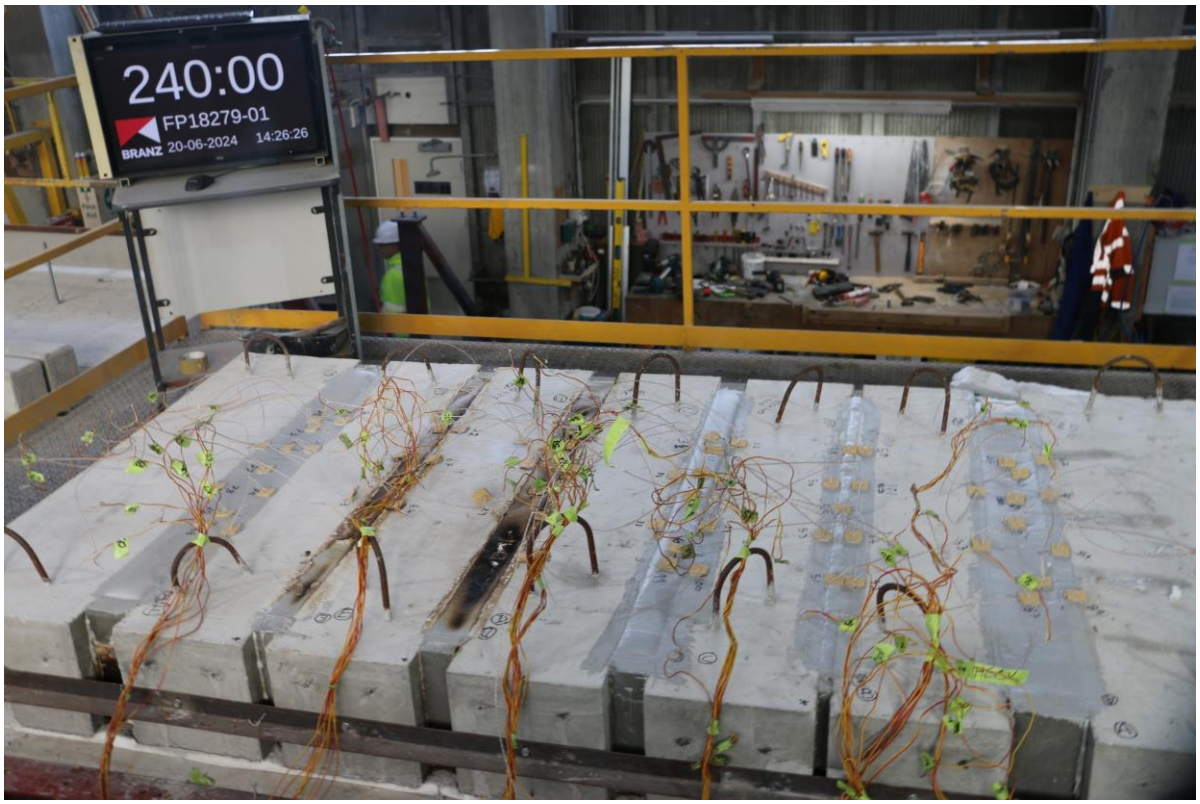
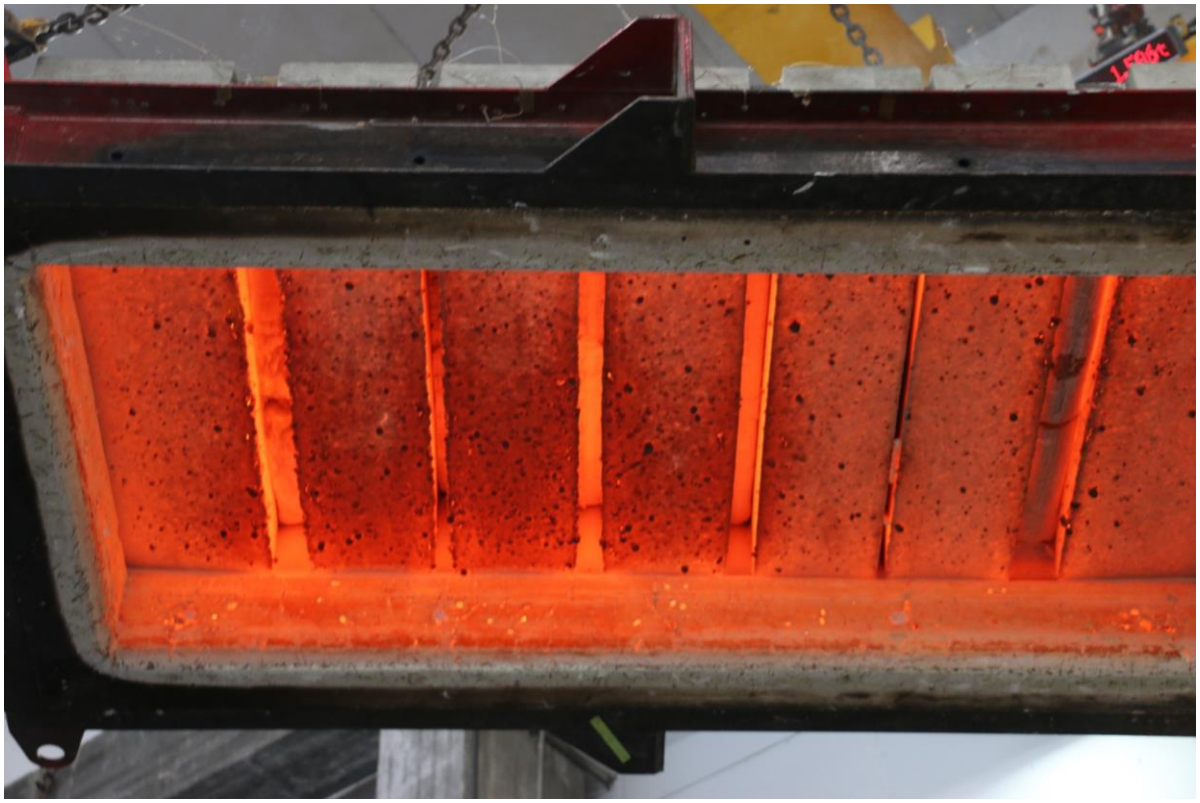


Photo 7: The Unexposed Face of the Test Assembly After a Duration of 264 Minutes

Photo 8: The Exposed Face of the Test Assembly Immediately After Testing



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